ASSESSMENT REPORT ON METHODOLOGY FOR IMPROVED EFFICIENCY OF FLEET VEHICLES AND COMBUSTION ENGINES

Document Prepared by Earthood Services Private Limited

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Summary

Verra has contracted Earthood Services Private Limited (hereby referred as ESPL), a VVB, to conduct the validation assessment for the proposed Methodology revision entitled "Methodology for Improved Efficiency of Fleet Vehicles and Combustion Engines ", revision to AMS- III. BC. to include Mobile Machinery (Version 1.0). This Methodology Revision provides the procedures to

- Improve the combustion efficiency.
- Include telematics system for monitoring fuel usage, odometer distance and operational time of the engine, to record changes in engine performance in real time.

The proposed Methodology Element belongs to Sectoral scope 07 (Transport).

ESPL assessed the Methodology Revision against VCS program requirements found in the VCS Methodology Approval Process document, the VCS Program Guide, and the VCS Standard. An internal assessment document was used to conduct the assessment.

Purpose

The purpose of the methodology validation was to conduct an independent assessment of the proposed methodology revision entitled "Methodology for Improved Efficiency of Fleet Vehicles and Combustion Engines "against the requirements of the VCS/16/ and identify any non-conformances and the appropriateness of the claims and the plans for monitoring,

Method and Criteria

The assessment was undertaken by a competent team of Earthood and involved the following:

- Independent desk review of the documents and evidence submitted by the client in context of the reference standard, methodology and other evidence.
- Interactions with the client
- Reporting the assessment findings with respect to clarifications and non-conformities and the closure of findings, as appropriate.
- Preparation of a draft assessment opinion based on the raised findings and conclusions.
- Technical review of the draft assessment opinion along with other documents as appropriate by an independent competent technical review team.
- Finalization of the methodology assessment report (this report).

Findings raised during the assessment:

The findings are raised when issues are identified that require further elaboration, research or expansion and modification in the document or if information is insufficient or not clear enough to form an opinion. The validation team verified the methodology by conducting a document review and analysis of the Methodology document shared by the project proponent against the requirements given in the VCS methodology Approval Process/25/, VCS Methodology requirements/16/ and other related documents mentioned in section 2.1 and 2.2 of this report. A total of 04 CLs and 03 CARs were raised during the validation process of the methodology and successfully closed.

There were no uncertainties identified during the assessment of methodology.

Summary of the assessment conclusion

The proposed methodology assessed in this report is based on the methodologies titled "AMS-III.BC.: Emission reductions through improved efficiency of vehicle fleets (version 3.0)"and VCS approved methodology VMR0004 entitled "Revision to AMS-III.BC to include Mobile Machinery (version 1.0)". The VVB can confirm that:

- The proposed methodology revision complies with the Verra's requirements/16/;
- The methodology form for its applicable version has been appropriately filled for all relevant sections;
- The application of tools, guidelines and other applicable document/1/(as mentioned in the methodology) is not altered.
- All relevant information has been consistently applied within the applicable sections in the methodology document.

CONTENTS

1 INTRODUCTION

1.1 Objective

Verra contracted Earthood Services Private Limited to conduct an independent assessment of the proposed methodology revision "Methodology for Improved Efficiency of Fleet Vehicles and Combustion Engines". The objective of the Methodology assessment is to compare the methodology revision against the requirements of the criteria documents listed below in section 2.2 and identify any non-conformances. The findings of this assessment are described in the report presented herein.

1.2 Summary Description of the Methodology

The proposed Methodology is a revision of a CDM approved methodology AMS-III.BC. entitled "Emissions reductions through improved efficiency of vehicle fleets (version 2.0)" and VCS approved methodology VMR0004: Revision to AMS-III.BC to include Mobile machinery v1.03". The methodology applies to those project activities which reduce the amount of fuel used and thereby reducing greenhouse gas emissions. Hence, the project activities may lead to reduction of emissions released by different vehicle fleets and mobile machinery. The types of vehicle fleet covered under this methodology include fleets of trucks, buses, cars, taxis or motorized tricycles, excavators and cranes. The methodology falls within the sectoral scope 07: Transport.

The globally applicable methodology includes project activities that are improving the efficiency of vehicle fleets and mobile machinery. The methodology includes revisions to the CDM methodology AMS-III.BC. "Emission reductions through improved efficiency of vehicle fleets and approved VCS Methodology Revision VMR0004 that included mobile machinery. The following inclusions have been made in the methodology:

- Inclusion of activities that improve combustion efficiency.
- Inclusion of a telematics system for monitoring fuel usage, odometer distance and operational time of engine, to keep a record of real time changes in the engine performance.

2 ASSESSMENT APPROACH

2.1 Method and Criteria

Method:

The methodology Validation, from Contract Review to Assessment Report, was conducted using VVB's internal procedures. The proposed methodology was checked against the requirements of the VCS Program/15/16/.

The methodology Validation process is conducted as per Earthood Services Private Limited's internal CDM Quality Manual and in accordance with criteria laid down by Verra. It includes the following steps:

- contract with methodology developer for the scope and appointment of validation team and technical review team;
- completeness check of Verra methodology form;
- desk review of methodology in accordance with the tools & requirements and mentioned references/statistics wherever applicable;
- reporting and closure of findings (CARs/CLs/FARs) and preparation of draft validation report;
- independent technical review of the draft report and final/revised documentation (e.g., VCS methodology form and VCS validation assessment report);
- issuance of the final assessment report to contracted methodology developer (or authorized representatives).

No sampling was required during the methodology validation.

Criteria:

The Methodology was compared to the requirements described in the following documents:

- VCS Methodology Development and Review Process (Version 4.3, dated: 29 August 2023)/25/
- VCS Methodology Template (Version 4.3)/17/
- VCS Standard (Version 4.5, dated: 29 August 2023)/15/; and
- VCS Program Guide (Version 4.4, dated: 29 August 2023)/23/
- VCS Methodology Requirements (Version 4.4, dated: 29 August 2023)/16/.

The methodology was also assessed for clarity, completeness, structure and logic in the context of the VCS program and industry practice.

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2.2 Document Review

Earthood Services Private Limited also referred to as ESPL's assessment team reviewed the VCS requirements by studying the documents listed in Section 2.1 of the of this report. The proposed methodology assessment is performed primarily as a document review of the documents submitted at various stages of assessments. The review is performed by the assessment team using dedicated protocols. The assessment team cross checks the information provided in the documents (filled-in methodology form) and information from sources other than those used, if available, and also conducts independent background investigations. VVB has conducted a desk review as under;

- A review of the data and information presented to verify their completeness;
- A review of the revisions made to the methodology, including referenced tool(s), referenced sources and, where applicable, the quality assurance and quality control procedures.

An evaluation of revisions made in terms of their influence on the quantification of time savings calculations.

2.3 Interviews

No site visit was conducted for this assessment. However, the validation team held teleconferences with the following individuals throughout the course of the methodology assessment:

- Jim Payne (dynaCERT Inc.)
- Ruston Hoffman (dynaCERT Inc.)
- Ranny Dhillon (dynaCERT Inc,)

2.4 Assessment Team

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Team Leader	IR	Garg	Shreya	Central Office

2.	Technical Expert (7.1)	IR	Badu	Pratik	Outsourced entity
3.	Validator	IR	Koul	Abhishek	Central Office
4.	Technical Reviewer	IR	Kumar Gautam	Ashok	Central Office
5.	Technical Expert to Technical Reviewer (7.1)	IR	Cruz	Sergio	Outsourced entity

2.5 Resolution of Findings

As an outcome of the validation & verification process, the team can raise different types of findings:

A Clarification Request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable VCS requirements have been met.

Where a non-conformance arises the team leader shall raise a Corrective Action Request (CAR). A CAR is issued, where:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions.
- The VCS requirements have not been met.
- There is a risk that emission reductions cannot be monitored or calculated.

The validation process may be halted until this information has been made available to the team leader's satisfaction. Failure to address a CL may result in a CAR. Information or clarifications provided as a result of a CL may also lead to a CAR.

During the validation process, a total of 03 CARs and 04 CL were raised and resolved satisfactorily. All the findings that are raised during validation are included under appendix 4. The section also includes the response, if provided, by the project proponent and an assessment by the validation team if it was closed out or otherwise.

3 ASSESSMENT FINDINGS

3.1 Relationship to Approved or Pending Methodologies

Following is the list of similar methodologies that have been identified:

Methodology	Title	GHG Program	Comments

AM0031	Bus Rapid Transit Projects	CDM	The methodology comprises measures for the construction and operation of a new bus rapid transit system (BRT) for urban road transport of passengers or the construction and operation of the extensions of bus lanes of existing BRT systems or expansions of existing BRT systems. The emission reductions are by displacing more GHG-intensive transportation models with less-GHG intensive models. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
ACM0016	Mass Rapid Transit Projects	CDM	The methodology applies to segregated BRT bus lanes, or the rail based MRTS replaces existing bus routes operating under mixed traffic conditions. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
AM0090	Modal shift in transportation of cargo from road transportation to water or rail transportation	CDM	The methodology applies to switching from fossil to electric or hybrid vehicles and not for efficiency gains. Thus, the procedure for baseline determination is completely different. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
AMS-III.S.	Introduction of low-emission vehicles/technologies to commercial vehicle fleets	CDM	The methodology includes the introduction of low greenhouse gas emitting vehicles for commercial passengers (including public transportation), material and freight transport, operating in

			comparable traffic conditions and on similar terrain. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
AMS-III.T	Plant oil production and use for transport applications	CDM	The methodology comprises measures for the production of biofuel and thus, cannot be revised to meet the objective of the proposed methodology revision. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
AMS-III.U	Cable cars for Mass Transit System (MRTS)	CDM	This methodology comprises measures for the construction and operation of new cable cars for passenger transport substituting traditional road-based transport trips. It substitutes traditional road-based transport trips with cable car transport. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
AMS-III.AA	Transportation energy efficiencyactivities using retrofit technologies	CDM	The methodology is for passenger vehicles and single type measures. The determination of the baseline procedure and emissions calculations are different. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
AMS-III.AP	Transport energy efficiency activities using post-fit idling stop device	CDM	The methodology comprises measure for the installation of Idling stop devices and does not describe approach for vehicles powered by LPG or CNG, hybrid vehicles combining electric and internal combustion systems, electric vehicles, or vehicles

			utilizing biofuel or blended biofuel and does not encompass provisions for estimating emissions reduction in these specific cases. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
AMS-III.AQ	Introduction of Bio-CNG in transportation applications	CDM	The methodology is for the introduction of Bio-CNG in transportation applications and thus a different area from this methodology.
AMS-III.BC	Emissions reductions through improved efficiency of vehicle fleets	CDM	This methodology is the basis of the current methodology but does not include the revision to include technology improvements that improve combustion efficiency in engines with or without improving efficiency of engines and does not include mobile machinery. Hence, the methodology is being revised to meet the objective of the proposed methodology revision.
AMS-III.AT	Transport energy efficiency activities installing digital tachograph systems to commercial freight transport fleets	CDM	The methodology comprises measures for installation of digital tachograph systems or another device that monitors vehicles and driver performance and provides real time feedback to drivers in freight vehicles and/or commercial passenger vehicles. The methodology does not include provisions to improve the efficiency of the engine operation. Thus, the methodology cannot be revised to meet the objective of the proposed methodology revision.
VM0019	Fuel switch from gasoline to ethanol in flex-fuel vehicles.	VCS	This methodology calculates the GHG emissions reductions from substituting ethanol in place of

			gasoline or gasoline blends in commercial fleets of flex-fuel vehicles. The proposed methodology does not include ethanol fuel switch. Therefore, the methodology cannot be revised to meet the objective of the proposed methodology revision.
VMR0004	Revision to AMS-III.BC to includeMobile Machinery v1.03	VCS	The methodology is for project activitiesthat improve the efficiency of vehicle fleets resulting in reduced fuel usage and greenhouse gas emissions. This revision is to include mobile machinery but does not incorporate revisions proposed in the proposed methodology.

The VVB has checked the following registries on similar methodologies:

Registry
Climate Action Reserve /18/
UNFCCC Clean Development mechanism/19/
Gold Standard for Global Goals (GS4GG) /20/
Global Carbon Council (GCC) /21/
Verified Carbon Standard (VCS) /15/

As per VVB's assessment, no further similar methodologies have been identified and the list of all similar methodologies as per provided new methodology is considered complete and no further similar methodologies could have been reasonably revised to meet the objective of the methodology revision, and thus, the methodology revision is justified.

3.2 Stakeholder Comments

The project has been published by Verra for public commenting from 14 October 2021 to 13 November 2021. A total of 3 comments were received from the public stakeholder consultation to the methodology/14/. Very detailed and specific comments have been provided by the

stakeholders. Based on the comments received the methodology has been updated as applicable. All comments have been listed in appendix 1 and all comments have been considered and provided with a response. During the assessment of methodology, all the comments were checked, and responses were found satisfactory in the assessment. Overall, all comments have been considered and a due account has been taken. Hence, the stakeholder comments have been adequately considered or addressed.

3.3 Structure and Clarity of Methodology

The methodology is drafted with a clear, concise and logical approach, bearing all the relevant sections applicable as per the methodology form template/17/. It was assessed that:

• The methodology template instructions/17/ have been adhered to, and methodology form also fulfils requirements and criteria laid in the appropriate sections within the form.

• The terminologies used in the methodology follow Verra program requirements and GHG accounting generally.

• The applicable keywords have been used appropriately and consistently, denoting requirements, recommendations and permissible or allowable options, wherever applicable.

• The criteria and procedures are drafted in an easy-to-understand manner and can be applied readily and consistently by project proponents.

• The revisions do not introduce any ambiguity which may lead to lack of clarity in undertaking audits by the project activity(ies).

The clarity of content, its applicability and continuity in terms of use with other similar tools is observed in the methodology. The structure of methodology is well defined, maintaining consistency with the methodology form.

3.4 Definitions

Some of the definitions used in the proposed methodology revisions are mentioned below;

Activity level: It is defined as the rate or level of output of the vehicle/ machinery that can be produced by the machine over certain period of time. (e.g., machine hour or gross ton hour of the machine)

Gross vehicle weight (GVW): Gross vehicle weight is the maximum permissible weight of a vehicle, including its own weight and the freight weight. It is measured in tons.

Heavy duty vehicles: Vehicles with gross vehicle weight more than or equal to 3.5 t are classified as heavy-duty vehicles.

Light duty vehicles: Vehicles with gross vehicle weight less than 3.5 t are classified as light duty vehicles.

Mobile machinery: Mobile machinery are self-propelled vehicles that are designed and used for a wide range of applications, such as construction, mining, agriculture and transportation. They are not fixed at a specific site but can be moved around either under its own power or with assistance when engineering specifications or logistics dictate (e.g., moving a loader using a lo-bed rather than driving the loader to the destination). The are self-propelled, except where a self-propelled unit has its drive carriage removed to secure the unit to a structure during operation and may include but not be limited to: excavators, log harvesting bunchers, log readers, cranes, timer processors, fork-lifters, road building machines and/or bulldozers. Generators used for power generation do not qualify as mobile machinery under this methodology.

Telematics System: A telematics system is a technology that employs the method of monitoring cars, trucks, equipment and other assets with the help of GPS technology and on-board diagnostics (OBD) to plot the asset's movements on a computerized map. The On-board diagnostics is connected, and telematics devices retrieve data generated by the vehicle, like GPS position, speed, fuel usage, engine light information and faults.

Tons (t): Metric tons is a unit used to measure the weight of the vehicles.

The Methodology applies all the generic terms and definitions. The definitions were found to be consistently included in the methodology text, along with the reference. The definitions are concise and would aid in providing context of the methodology and enhance the readability.

3.5 Applicability Conditions

During the methodology assessment process, the assessment team ensured the applicability conditions were appropriate for the activities targeted by the methodology. Quantification procedures required by the methodology adequately target the relevant applicability conditions. The applicability conditions appropriately specify relevant requirements to individual projects. The assessment determined the applicability conditions contained within the methodology are appropriate, adequate and in compliance with the VCS standards and rules.

Further, the assessment team determined the applicability conditions provide sufficient clarity to projects determining if their activities are or are not eligible under the methodology. The applicability conditions address environmental integrity and practical considerations, where relevant.

The following summarizes applicability conditions as written, changes made during the revision of the methodology, and the final evaluation of those changes during the assessment:

S.No.	Applicability Criteria	Assessment

1.	The methodology applies to project activities that implement one or more of the following measures: a) Idling stop device b) Eco-drive systems c) Tire-rolling resistance improvements d) Air-conditioning system improvements e) Use of low viscosity oils f) Aerodynamic drag reduction measures g) Transmission improvements h) Retrofits that improve the engine and combustion efficiency i) Other energy efficiency improvement measures identified by the project description. Such other measures must have been described in independent third-party studies as leading to fuel savings.	The criteria define the project activities that can be applicable under the methodology. Further revisions have been included in this methodology revision; those are: • Inclusion of activities that improve combustion efficiency; and • Inclusion of a telematics system for monitoring fuel usage, odometer distance and operational time of the engine, to record changes in engine performance in real time. The applicability condition is written in clear and concise manner to ensure the methodology is applicable to project activities that are improving the efficiency of vehicle fleets and mobile machinery.
2.	More than one energy efficiency measure covered by the methodology may be implemented in the project vehicle fleet(s) and the measures implemented may vary across vehicles in the fleet(s).	The condition is written to ensure that measures implemented may vary across vehicles in the fleet(s) and that the project vehicle fleet(s) may implement more than one energy efficiency measure.
3.	Where the project proponent is not the owner of the vehicle fleets (eg, the project proponent is a fleet manager with many clients, each client being the owner of its respective vehicle fleets), there must exist a contract between the project proponent and each fleet owner to establish clear ownership of the emission reductions.	The applicability condition is written in clear and concise manner to ensure that the ownership of the emission reductions is made clear between the project proponent and the owner of the vehicle fleets.

4.	The project proponent must provide ex-ante estimation of the percentage of baseline emissions avoided per each energy efficiency measure. The ex-ante estimations must be based on literature, official reports or statistics published by an independent third party or studies carried out by the project proponent, and validated by the validation/ verification body. This is applied for any measure identified in the project description. The ex-ante estimations will also serve as a cap of on the specific emission reductions (using the specific emission reduction percentage per activity unit as the metric). In other words, the reduction in the project emission factor compared to the baseline emission factor may not exceed the ex-ante estimation.	The applicability condition is written in clear and concise manner that outline the procedure for ensuring accuracy in estimating emission reductions for energy efficiency measures. Additionally, these estimations serve as an upper limit for emission reductions, preventing overstatement of benefits. Overall, the approach is well structured, and the applicability criteria is well defined.
5.	This methodology is not applicable under the following conditions: a) Measures that improve the system efficiency of the fleet, for example a change of operational procedures to improve the occupancy rate of vehicles and modal shift in transportation. b) A switch from fossil fuels to biofuels in transportation applications. The usage of fixed biofuel blend is, however, admissible if project vehicles use the same blend of biofuel as used by baseline vehicles. In the case of using biofuel blends, the biofuel share is accounted for as zero emitting. c) A fuel-switch, for example from liquid to gaseous fuels.	The applicability criteria clearly mention the conditions which outline the scenarios for which the methodology is not applicable. The applicability condition is found to be written in a clear and concise manner.

6.	Project fleets may use various fuel types. The composition of the fleet with regard to fuel types used may also change over time. The introduction of hybrid vehicles is allowed. Hybrid fuel vehicles are classified according to their fossil fuel engine type and compared with the same baseline fossil fuel type (e.g., compressed natural gas, diesel, gasoline hybrids are compared with diesel, gasoline or compressed natural gas engines).	The applicability condition is written in clear and concise manner that outlines that the projects allow for diverse fuel types in its fleet and accommodates potential changes over time. It also permits the inclusion of hybrid vehicles, which are evaluated based on their fossil fuel engine type and compared to corresponding baseline engines (e.g., CNG, diesel, gasoline). This approach ensures accurate assessment of emission reductions.
7.	Only vehicles in which at least one of the ex-ante identified project activity measures has been implemented shall be included in the project fleet.	The applicability condition is written clearly and concise manner that outlines the measures that ensures only vehicles that have implemented at least one of the identifies project activity measures prior to inclusion in the project fleet will be considered.
8.	Each fleet included in the project activity shall include only one vehicle category. In each vehicle category, vehicles are classified according to the fuel types used. Baseline and project emissions are calculated for each fuel type of each vehicle category. A project activity may, however, encompass various fleets. Vehicle categories in the context of this methodology are: a) Trucks with a gross vehicle weight (GVW) > 3.5 t; b) Trucks with a GVW <3.5 t; c) Buses with a GVW >3.5 t; d) Taxis: In the case of significantly different taxi types such as conventional cars, minibuses, jeepneys, etc., these shall also be	The applicability condition is written clearly and concise manner that outlines the approach to fleet categorization within the project activity. The methodology allows for the inclusion of various fleets under one project activity. The defined vehicle categories are comprehensive and encompass a range of vehicle types, ensuring a thorough evaluation of emissions across different modes of transportation.

	considered as separate vehicle categories; e) Passenger cars (e.g., company cars, rental cars); f) Motorized tricycles (e.g., used as taxis or for deliveries); and g) Mobile machinery.	

Additionally, the project activities must comply with all applicable conditions set out in the original CDM methodology AMS-III.BC*:* Small-scale Methodology: Emission Reductions through Improved Efficiency of Vehicle Fleets version 3.0/10/ and Approved VCS Methodology Revision VMR0004 version 1.0/13/ as stated under section 4 of the proposed methodology revision.

3.6 Project Boundary

The methodology defines the project boundary as the spatial extent of the project boundary encompasses the geographical area(s) of the trips of the vehicles under the baseline scenario, as well as the geographical area(s) of the trips of the vehicles in the project scenario.

Further the methodology provides a table of corresponding GHG sources, sinks and reservoirs, whether they are included or not and a corresponding justification:

Source		Gas	Included?	Justification/Explanation
Baseline	Fleet vehicle exhaust gas	CO_2	Yes	Major source of GHG emissions in the exhaust gas.
		CH_4	No	Negligible in the exhaust gas.
		N_2O	No	Negligible in the exhaust gas.
		Other	No	Negligible in the exhaust gas.
Project	Fleet vehicle exhaust gas	CO_2	Yes	Major source of GHG emissions in the exhaust gas.
		CH_4	No	Negligible in the exhaust gas.
		N_2O	No	Negligible in the exhaust gas.
		Other	No	Negligible in the exhaust gas.

3.7 Baseline Scenario

The baseline scenario is where in the absence of project activity the group of vehicles of same fleet or mobile machinery consume increased amount of fossil fuel due to inefficient operation of the vehicle fleets. Hence, the baseline emissions are the GHG emissions related to high fossil fuel consumption due to inefficient operation of the vehicle fleets in pre-project conditions, which have been avoided by the project activity.

For vehicles of any type that are fitted with a telematics system capable of monitoring fuel consumption, the determination of baseline emissions should rely on the vehicle's internal data collected prior to the implementation of the project measure. To establish baseline emissions, the project vehicle must accrue a minimum of 5,000 kilometers or 200 hours of operation. The methodology also defines the calibration of equipment's to be carried out according to the relevant industry standard and provides credible evidence of the baseline scenario of project vehicle fleets and provides examples of those such as Local Utilities (electrical) Authority records of electrical transmission and distribution losses, fuel consumption records, engine operational time, records of odometer data, control group data among others. The baseline scenario is hence predefined, and any project activity must provide evidence complying with the baseline scenario. A related applicability criterion is established in section 4 of the methodology. This ensures that project activities that are not applicable to the related cannot apply the methodology.

3.8 Additionality

The Methodology uses the project method to establish a procedure for the demonstration of additionality. As per section 3.5 of the Methodology requirements/16/, the project proponent must apply the following steps to demonstrate additionality:

Step 1: Demonstrate Regulatory Surplus

The project proponent must demonstrate regulatory surplus in accordance with the rules and requirements regarding regulatory surplus set out in the latest version of the VCS Standard and VCS Methodology Requirements/15/16/.

Step 2: Implementation Barriers

The project proponent must identify barriers that would prevent the implementation of the project activity. The methodology has also described some of the barriers that can be faced based on three types: Investment Barriers, Institutional Barriers etc. the description was found to be in line with the VCS standard requirement and Methodology requirement and hence found to be appropriately described.

The identified barriers must be demonstrated with the documentary evidence sourced from an independent third party. The types of evidence that may include has been identified in section 7 of the methodology/1/.

Step 3: Common Practice

The project proponent must determine the project is not a common practice based on the requirements set out in VCS Standard and Methodology requirements/15/16/. The methodology clearly sets out the procedure to demonstrate the project activity is not a common practice. The steps have been assessed and found to be appropriately outlined. The Assessment team reviewed the procedure for providing additionality and was found to be appropriate. The final methodology document/1/ contained an additionality procedure appropriate for the project activities, and the assessment team concludes the criteria for determining.

3.9 Quantification of GHG Emission Reductions and Carbon Dioxide Removals

3.9.1 Baseline Emissions

The methodology identifies that the continuation of pre-project activities such as the group of vehicles of same fleet or mobile machinery consuming more amount of fossil fuel due to the inefficient operation of the vehicle fleets as a baseline scenario. To quantify the baseline, the methodology has defined some of the steps to help the project proponent. The steps defined for calculating baseline emissions and removals have been assessed and found to be appropriate.

The formulas, algorithms and equations used in the methodology are found to be appropriately identified. Two options have been identified to apply the GHG emission factors to characterize the baseline emissions for the relevant vehicle category/ fuel type. The emission factors taken for each vehicle category i and fuel type x (BEFkm,I,x,y) derived from:

- Option 1 will make use of the vehicles own data prior to the project measure's implementation, for all vehicle types equipped with a telematics system capable of tracking fuel consumption; or,
- Option 2 will make use of the monitored specific fuel consumption of a control group of vehicles and the monitored project activity level, for all vehicle types not equipped with a telematics system capable of tracking fuel consumption.

Calculating baseline emissions utilizing telematics systems

For all vehicle types equipped with a telematics system capable of tracking fuel consumption, the baseline emissions shall be calculated using the vehicle's own data prior to the project measure's implementation. The project vehicle shall allow for a minimum of 5,000 km or 200 hours of vehicle operation to obtain baseline emissions. The project vehicle's usage must be similar or less than the regular usage during the baseline period.

The emission factor is monitored within the control group of vehicles and multiplied by the activity level of the project:

$$BE_y = \sum_{i,x} BEF_{i,x,y} \times AL_{i,x,y} \times 10^{-6} \quad (1)$$

Where:

BEy = Baseline emissions in the year y (gCO2)

BEFi,x,y = Baseline emission factor per activity level metric of project group vehicles i during using fuel type x in the year y (gCO2/activity level metric)

ALi,x,y = Activity level of project per activity level metric of project group vehicles i using fuel type x in the year y (activity level metric)

$$BEF_{i,x,y} = SFC_{BL,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y} \quad (2)$$

Where:

BEFi,x,y = Baseline emission factor per activity level metric of project group vehicles i using fuel type x in the year y (gCO2/activity level metric)

SFCBL,i,x,y = Specific baseline fuel consumption of control group vehicle category i using fuel type x in year y (fuel metric/activity level metric)

NCVx,y = Net calorific value of fuel type x in year y (MJ/fuel metric)

EFCO2,x,y = CO2 emission factor for fuel type x in year y (gCO2/MJ)

The activity level metric AL (eg, hours) is defined by the project description. See Section 9.2 for definitions and calculation method of AL.

For electric or hybrid vehicles, BEF is determined using equation 10 below. The parameters SEC, EF_{elec} and TDL are determined in accordance with the latest version of CDM methodology AMS-III.C.

$$BEF_{i,elec,y} = \sum_{i} \frac{SEC_{i,y} \times EF_{elec,y}}{(1 - TDL_y) \times 10^{-3}} \quad (3)$$

Where:

BEFi,elec,y = Baseline emission factor per activity level metric of control group mobile machinery i using electricity in year y (gCO2/activity level metric)

SECi,y = Specific electricity consumption by control group mobile machinery i per activity level in year y (kWh/activity level metric)

EFelec,y = CO2 emission factor of electricity in year y (gCO2/kWh)

TDLy = Average technical transmission and distribution losses for providing electricity in the year y (no unit)

If mobile machinery uses both electricity and fossil fuels, then the emissions from both sources must be summed up.

Calculating baseline emissions not utilizing telematics systems (control group method)

BEFkm,l,x,y is monitored annually. The metric used for the baseline emissions is:

- Emissions per tonne-km (tkm) for heavy duty vehicles; or
- Emissions per km for all other vehicle categories.

To avoid crediting emission reductions to the project for external factors, the baseline emission factor shall be based on comparable vehicles driving in a comparable situation. This can be based either on a Randomized Control Trial (RCT) as described below or with a control group that complies with the following conditions to ensure that the control group is comparable to or more conservative than the project group:

- For buses, passenger cars, taxis and jeepneys, the following criteria shall be comparable for the control and the project group: average vehicle age, area of usage of the vehicle (e.g., urban or inter-urban routes), average passenger capacity and average share of vehicles with air conditioning:
    - The control group vehicles must have an on average, the same age or less than the project group vehicles.
    - The control group vehicles must be used on average in the same area of usage as the project vehicles.
    - The control group vehicles must have an on average, the same or a lower passenger capacity than the project vehicles.
    - The share of vehicles with air conditioning in the control group must be the same or lower than that of the project group.

- For trucks the criteria are: average GVW, average annual distance driven and main area of usage of the vehicles (urban vs. inter-urban trips).

    - The average GVW of vehicles in the control group must be the same or greater than that of the vehicles in the project group.
    - The average annual distance driven of the vehicles in the control group must be the same or greater than that of the vehicles in the project group.
    - The share of inter-urban trips of vehicles in the control group must be on average equal to or higher than the share of the project vehicles.

- For mobile machinery the criteria are:

    - Mobile machinery in both groups must have a comparable power rating with variations of not more than ±20%;
    - Mobile machinery of the control group must have, on average, the same or lesser age than the project group mobile machinery;
    - The mobile machinery of the control group can be used to produce the same product or perform the same activity as the mobile machinery of the project group.

Control group vehicles shall be selected from the vehicle fleets of the project proponent or from third party fleets (preferred option). For the RCT, the population of interest is randomly assigned to either a project (where energy efficiency measures are implemented) or a control group. Each vehicle in the population of all eligible vehicles is randomly assigned to either the control or project group based on a random probability, as opposed to being assigned to one group or the other based on some characteristic of the vehicle (e.g. vehicle age or willingness of a driver to sign up for the project activity).

Calculating baseline emissions for trucks and buses

Baseline emissions for trucks and buses are calculated based on the baseline emission factor per tkm per fuel type determined based on the monitoring of the control group vehicles. The baseline emission factor is multiplied by the actual tkm transported by the project activity level per fuel type.

$$BE_y = \sum_{i,x} BEF_{tkm,i,x,y} \times AL_{tkm,i,x,y} \times 10^{-6} \quad (4)$$

Where:

BEy = Baseline emissions in the year y (gCO2)

BEFtkm,i,x,y = Baseline emission factor per tkm of vehicle category i using fuel type x in the year y (gCO2/tkm)

ALtkm,i,x,y = Activity Level of project in tkm of vehicle category i using fuel type x in the year y (tkm)

$$BEF_{tkm,i,x,y} = \frac{SFC_{BL,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y}}{AW_{BL,i,x,y}} \quad (5)$$

Where:

$BEFtkm,i,x,y$ = Baseline emission factor per tkm of vehicle category i using fuel type x in the year y (gCO2/tkm)

SFCBL,i,x,y = Specific baseline fuel consumption of control group vehicle category i using fuel type x in year y (g/km)

NCVx,y = Net calorific value of fuel type x in year y (MJ/g)

EFCO2,x,y = CO2 emission factor for fuel type x in year y (gCO2/MJ). For electric or hybrid vehicles the emission factor is determined in accordance with the latest version of "AMS-II.C: Emissions reductions by electric and hybrid vehicles".

AWBL,i,x,y = Average GVW per vehicle unit of control group vehicle category i using fuel type x in the year y (tonnes).

The gross vehicle weight as per vehicle registration or the maximum technical weight specified by the manufacturer of the vehicle should be used for the calculations.

Vehicle categories are indicated in section 4 of the methodology. The project can include vehicle subcategories.

Baseline emissions for all other vehicle categories are calculated based on the baseline emission factor per km per fuel type determined for the control group vehicles. The baseline emission factor is multiplied by the actual distance travelled by the project activity fleet.

$$BE_y = \sum_{i,x} BEF_{km,i,x,y} \times AL_{km,i,x,y} \times 10^{-6} \quad (6)$$

Where:

BEy = Baseline emissions in the year y (t gCO2)

BEFkm,i,x,y = Baseline emission factor per km of vehicle category i using fuel type x in the year y (gCO2/km)

ALkm,i,x,y = Activity level of project in km of vehicle category i using fuel type x in the year y (tkm)

$$BEF_{km,i,x,y} = \left(SFC_{BL,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y}\right) \quad (7)$$

Calculating baseline emissions for mobile machinery

Baseline emissions for mobile machinery are calculated based on the baseline emission factor per activity level for the control group vehicles. The activity level metric must be defined and justified in the project description and must fulfill the following criteria:

- Higher activity levels must lead to higher fuel consumption. The relationship between fuel consumption and the activity level metric must be described in the project description based on measurements or independent third-party studies.
- The activity level metric must be measurable with an acceptable level of certainty (acceptable data accuracy is ±10%).
- Changes in the relationship between fuel usage and activity level must be related to efficiency or changes of fuel type used. In other words, such changes must not be random or due to external factors not under the influence of the project. To demonstrate this relationship, data from the sample to determine the baseline emission factor at the lower boundary of the 90% confidence interval must have a deviation of less than 20% from the average value. If this is not achieved, then more homogenous subgroups of mobile machinery must be made. At validation, the demonstration that changes in fuel

consumption is directly related to efficiency or changes in fuel type are based on qualitative arguments or ex-ante data. At verification, this demonstration is based on the 20% deviation check of the 90% confidence interval described above.

Activity level metrics may be related to the mobile machinery itself, or to the production output (eg, amount of processed material). This is not a requirement, but rather an indication of how activity level metrics may be defined. The project proponent must demonstrate at validation that the activity level metric is appropriate to the project.

The emission factor is monitored within the control group of vehicles and multiplied by the activity level of the project.

$$BE_y = \sum_{i,x} BEF_{i,x,y} \times AL_{i,x,y} \times 10^{-6} \quad (8)$$

Where:

BEy = Baseline emissions in the year y (tCO2)

BEFi,x,y = Baseline emission factor per activity level metric of control group mobile machinery i using fuel type x in the year y (gCO2/activity level metric)

ALi,x,y = Activity level of project per activity level metric of mobile machinery i using fuel type x in the year y (activity level metric)

Where:

$$BEF_{i,x,y} = SFC_{BL,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y} \quad (9)$$

Where:

BEFi,x,y = Baseline emission factor per activity level metric of control group mobile machinery i using fuel type x in the year y (gCO2/activity level metric)

SFCBL,i,x,y = Specific baseline fuel consumption of control group vehicle category i using fuel type x in year y (fuel metric/activity level metric)

NCVx,y = Net calorific value of fuel type x in year y (MJ/fuel metric)

EFCO2,x,y = CO2 emissions factor foe fuel type x in year y (gCO2/MJ)

The activity level metric AL (eg, hours) is defined by the project description. See Section 9.2 for definitions and calculation method of AL.

For electric or hybrid vehicles, BEF is determined using equation 10 below.

$$BEF_{i,elec,y} = \sum_{i} \frac{SEC_{i,y} \times EF_{elec,y}}{(1 - TDL_y) \times 10^{-3}} \quad (10)$$

Where:

BEFi,elec,y = Baseline emission factor per activity level metric of control group mobile machinery i using electricity in year y (gCO2/activity level metric)

SECi,y = Specific electricity consumption by control group mobile machinery i per activity level in year y (kWh/activity level metric)

EFelec,y = CO2 emission factor of electricity in year y (gCO2/kWh)

TDLy = Average technical transmission and distribution losses for providing electricity in the year y (no unit)

If mobile machinery uses both electricity and fossil fuels, then the emissions from both sources must be summed using equation 8.

3.9.2 Project Emissions

Calculating Project emissions utilizing telematics systems

The process to ascertain project emissions for all vehicle categories employing telematics systems is outlined below. In instances where telematics is not applicable for certain vehicle categories, project emissions must be evaluated using the method outlined below:

$$PE_y = \sum_{i,x} PEF_{i,x,y} \times AL_{i,x,y} \times 10^{-6} \quad (11)$$

Where:

PEy = Project emissions in the year y (tCO2)

PEFi,x,y = Project emission factor per activity level metric of vehicle category i using fuel type x in year y (gCO2/activity level metric)

ALi,x,y = Activity level of project per activity level metric of vehicle category i using fuel type x in the year y (activity level metric)

$$PEF_{i,x,y} = SFC_{PJ,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y} \quad (12)$$

Where:

PEFi,x,y = Project emission factor per activity level metric of vehicle category i using fuel type x in year y (gCO2/activity level metric)

SFCPJ,i,x,y = Specific project fuel consumption of project group vehicle category i using fuel type x in the year y (fuel metric/activity level metric)

NCVx,y = Net calorific value of fuel type x in year y (MJ/fuel metric) EFCO2,x,y = CO2 emission factor for fuel type x in year y (gCO2/MJ).

For electric or hybrid vehicles, PEF is determined in accordance with Equation 12 above, mutatis mutandis.

Calculating Project emissions not utilizing telematics systems

Project emission calculations for trucks and buses

$$PE_y = \sum_{i,x} PEF_{tkm,i,x,y} \times AL_{tkm,i,x,y} \times 10^{-6} \quad (13)$$

Where:

PEy = Project emissions in the year y (tCO2)

PEFtkm,i,x,y = Project emission factor per tkm of vehicle category i using fuel type x in year y (gCO2/tkm)

ALtkm,i,x,y = Activity level of project in tkm of vehicle category i using fuel type x in the year y (tkm)

$$PEF_{tkm,i,x,y} = \frac{SFC_{PJ,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y}}{AW_{PJ,i,x,y}} \quad (14)$$

Where:

PEFtkm,i,x,y = Project emission factor per tkm of vehicle category i using fuel type x in year y (gCO2/tkm)

SFCPJ,i,x,y = Specific project fuel consumption of project group vehicle category i using fuel type x in the year y (Fuel Metric/Activity Level Metric)

NCVx,y = Net calorific value of fuel type x in year y (MJ/Fuel metric)

EFCO2,x,y = CO2 emission factor for fuel type x in year y (gCO2/MJ).

AWPJ,i,x,y = Average GVW per vehicle unit of project group vehicle category i using fuel type x in year y (tonnes). The gross vehicle weight as per vehicle registration or the maximum technical specified by the manufacturer of the vehicle should be used for the calculations.

Calculating Project emissions for all other vehicle categories

$$PE_y = \sum_{i,x} PEF_{km,i,x,y} \times AL_{km,i,x,y} \times 10^{-6} \quad (15)$$

Where:

PEy = Project emissions in the year y (tCO2)

PEFkm,i,x,y = Project emission factor per kilometre of vehicle category i using fuel type x in year y

(gCO2/km)

ALkm,i,x,y = Activity level of project in km of vehicle category i using fuel type x in the year y

(km)

$$PEF_{km,i,x,y} = SFC_{PJ,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y} \quad (16)$$

Where:

PEFkm,i,x,y = Project emission factor per km of vehicle category i using fuel type x in year y (gCO2/km)

$SFC_{PJ,i,x,y}$ = Specific project fuel consumption of project group vehicle category i using fuel type x in the year y (Fuel Metric/Activity Level Metric)

$NCV_{x,y}$ = Net calorific value of fuel type x in year y (MJ/Fuel metric)

$EF_{CO2,x,y}$ = CO2 emission factor for fuel type x in year y (gCO2/MJ).

Calculating Project emissions for mobile machinery

Project emissions for mobile machinery must be determined following the procedure below:

$$PE_y = \sum_{i,x} PEF_{i,x,y} \times AL_{i,x,y} \times 10^{-6} \quad (17)$$

Where:

PEy = Project emissions in the year y (tCO2)

PEFi,x,y = Project emission factor per activity level metric of project group mobile machinery i using fuel type x in year y (gCO2/activity level metric)

ALi,x,y = Activity level of project per activity level metric of mobile machinery i using fuel type x in the year y (activity level metric)

$$PEF_{i,x,y} = SFC_{PJ,i,x,y} \times NCV_{x,y} \times EF_{CO2,x,y} \quad (18)$$

Where:

PEFi,x,y = Project emission factor per activity level metric of project group mobile machinery using fuel type x in year y (gCO2/activity level metric)

SFCPJ,i,x,y = Specific project fuel consumption of project group mobile machinery i using fuel type x in the year y (fuel metric/activity level metric)

NCVx,y = Net calorific value of fuel type x in year y (MJ/fuel metric

EFCO2,x,y = CO2 emission factor for fuel type x in year y (gCO2/MJ)

For electric or hybrid vehicles, PEF is determined in accordance with Equation 18 above, mutatis mutandis.

The formulas, algorithms and equations used in the methodology are found to be appropriately identified. The reference to the emission factors has been appropriately identified in the methodology. The procedures for estimating the parameters related to the quantification of project emissions and removals are found to be appropriate.

3.9.3 Leakage Emissions

Since the methodology revision pertains to the procedures in CDM methodology AMS-III.BC version 3.0, as outlined in paragraph 27 of the approved methodology, no leakage calculation is deemed necessary. Hence, no changes were made to the procedure in AMS-III.BC for leakage emissions. The validation team can confirm that the procedures given in AMS-III.BC are adequate for project activities applying the methodology revision.

3.9.4 GHG Emission Reductions and Carbon Dioxide Removals

As per methodology, the net GHG emission reductions and removals are calculated as:

$$ER_y = BE_y - PE_y - LE_y \quad (19)$$

Where:

ERY = Net GHG emissions reductions and removals in year y (tCO2e)

BEY = Baseline emissions in year y (tCO2e)

PEy = Project emissions in year y (tCO2e)

LEy = Leakage in year y (tCO2e)

Based on the documents checked as well as based on related VCS regulations the VVB confirms that the procedures for calculating net GHG emission reductions and removals are appropriate for the project activities covered by the methodology and provide an overall conclusion regarding procedures for calculating net GHG emission reductions and removals.

Hence, the VVB confirms that:

• All algorithms, equations and formulas used are appropriate and without error.

• Any uncertainties associated with the quantification of net GHG emission reductions and removals are addressed appropriately.

3.10 Monitoring, Data and Parameters

The methodology has described data and parameters available at validation that are fixed for the duration of the project crediting period and data and parameters monitored that must be monitored during the project crediting period for each verification. All parameters which have been defined in the corresponding baseline, project and leakage emission calculation sections have been considered either as a parameter available at validation or as a monitoring parameter or is given as a default value. The data and parameters available at validation in accordance with the original approved CDM methodology AMS-III.BC are being referred to in this methodology revision.

Data and parameters available at validation:

Data/Parameter	Definition	Justification
$EF_{CO2,x,y}$ gCO2/MJ	CO2 emission factor of fuel type x in the year y	The parameter is sourced from the latest version of the IPCC Guidelines for National GHG inventories. The applied values have been stated in the methodology and found to be appropriate. The datum will be used for calculation of baseline and project emissions in line with VCS rules.
EFelec,y gCO2/kWh	CO2 emission factor of electricity in year y	The parameter is sourced from the Local Utilities (Electrical) Authority or International Energy Agency (IEA). The applied values under certain conditions have been stated in the methodology and found to be appropriate. The datum will be used for calculation of baseline and project emissions in line with VCS rules.
NCVx,y MJ/g or MJ/L	Net calorific value of fuel type x in the year y	The parameter is sourced from the latest version of the IPCC Guidelines for National GHG inventories. The

		applied values have been stated in the methodology and found to be appropriate. The datum will be used for calculation of baseline and project emissions in line with VCS rules.
SFCBL,i,x,y g/activity level metric, or L/activity level metric	Specific baseline fuel consumption of control group vehicle category i in the trial period x in the year y	The parameter is calculated based on the following options: Option 1: Telematics System The monitoring process may be achieved through the utilization of a vehicle telematic recording system equipped with the capability for uninterrupted tracking and secure recording of precise engine data. This encompasses critical metrics such as odometer readings, fuel consumption records, and engine operational duration, sourced directly from the vehicle's engine control module. The telematics system is required to transmit these engine measurements wirelessly to the telematic service provider's secure database, facilitating subsequent analysis and review to verify compliance with established protocols. Option 2: Mobile machinery statistics or sample measurements. The sample size is taken based on a sample of pre-project vehicles chosen as per the standard for sampling and surveys for CDM project activities using a 90% confidence interval and a ±10% error margin to determine the sample size. The fuel consumed by the respective group of mobile machinery must be

		divided with the activity level of that group during the same time period over which fuel consumption was monitored. The purpose of data is for the calculation of baseline fuel consumption for the control group vehicle in a specific category and baseline emissions, and the QA/QC and calculation methods are appropriate for the datum.
AW,BL,i,x,y tonnes	Specific baseline gross vehicle weight (GVW) average of control group vehicle category i in the trial period x in the year y	The parameter is calculated based on an average Gross Vehicle Weight of baseline group fleet measures on an annual basis. The purpose of data is for the baseline calculation of the average weight used for the control group and baseline emissions, and the QA/QC and calculation methods are appropriate for the datum.
Be_y tCO2	Baseline emissions in the year y	The parameter is calculated based on the following options: Option 1: Telematics System data *T*he parameter is calculated based on data continuously monitored with a minimum of 5000km to determine the baseline emissions in case of utilizing a telematics system. Option 2: Control group method In case of not utilizing a telematic system, the data is monitored annually wherein the telematics device monitors data throughout the entire project length. The purpose of the data is to determine the baseline emissions and the QA/QC and calculation methods are appropriate for the datum.

BEFkm,i,x,y gCO2/km	Baseline emissions factor per activity level metric of project group vehicles i using the fuel type x in the year y	The parameter is calculated based on the following options: Option 1: Telematics System *T*he parameter is calculated based on data continuously monitored with a minimum of 5000km to determine the baseline emissions in case of utilizing a telematics system. Option 2: Control group method In case of not utilizing a telematic system, the data is monitored annually wherein the telematics device monitors data throughout the entire project length. The purpose of the data is to determine the baseline emissions factor per activity level metric of project group vehicles using fuel type and the QA/QC and calculation methods are appropriate for the datum.
BEFi,elec,y gCO2/activity level metric	Baseline emissions factor per activity level metric of control group mobile machinery i using electricity in the year y	The parameter is calculated based on the following options: Option 1: Telematics System *T*he parameter is calculated based on data continuously monitored with a minimum of 5000km to determine the baseline emissions in case of utilizing a telematics system. Option 2: Control group data In case of not utilizing a telematic system, the data is monitored annually wherein the telematics device monitors data throughout the entire project length. The purpose of the data is to determine the baseline emissions factor per activity level

		metric of control group vehicles using electricity and the QA/QC and calculation methods are appropriate for the datum.
SECi,y	Specific electrical consumption by control group mobile machinery i per activity level using electricity in the year y	The parameter is calculated based on the following options: Option 1: Telematics System The parameter is calculated based on data continuously monitored with a minimum of 5000km to determine the baseline emissions in case of utilizing a telematics system. Option 2: Control group method In case of not utilizing a telematic system, the data is monitored annually wherein the telematics device monitors data throughout the entire project length. The purpose of the data is to determine the average electricity consumption used for the control group vehicle in a specific category and the QA/QC and calculation methods are appropriate for the datum.
TDLy	Average technical transmission and distribution losses for providing electricity in the year in the year y.	*T*he parameter is calculated based on data sourced from Local Utilities (Electrical) Authority. The purpose of the data is to determine the average technical transmission and distribution losses for providing electricity, and the QA/QC and calculation methods are appropriate for the datum.

Data and parameters monitored:

Data/Parameter	Definition	Justification
ALi,x,y km, tkm, hours	Activity level of project vehicle category i using fuel type x in the trial period *y*	The parameter is calculated based on the following options: Option 1: Telematics System data The parameter is calculated based on telematic recording system which monitors continuously tracking engine data including odometer, fuel consumption, and engine operational time if telematics system is being utilized. Option 2: Used for mobile machinery. The parameter is calculated monthly or annually based on hour-monitoring devices installed at the mobile machinery and recorded by electronic or paper records. The purpose of data is for determining the metric by which engine fuel consumption is monitored, and the QA/QC and calculation methods are appropriate for the datum.
$SFC_{PJ,i,x,y}$ g/activity level metric, or L/activity level metric	Specific project fuel consumption of project group vehicle category i in the trial period x in the year y	The parameter is calculated based on the following options: Option 1: Telematics system The parameter is calculated based on telematic recording system which monitors continuously by tracking engine data including odometer, fuel consumption, and engine operational time if telematics system is being utilized. Option 2: Mobile machinery statistics or sample measurements.

		The sample size is taken based on a sample of pre-project vehicles chosen as per the standard for sampling and surveys for CDM project activities using a 90% confidence interval and a ±10% error margin to determine the sample size. The fuel consumed by the respective group of mobile machinery must be divided with the activity level of that group during the same time period over which fuel consumption was monitored. The purpose of data is for the calculation of project fuel consumption for the control group vehicle in a specific category and baseline emissions, and the QA/QC and calculation methods are appropriate for the datum
AWPJ,i,x,y tonnes	Average gross weight per vehicle unit of vehicle category i using fuel type x in year y	The parameter is calculated based on an average Gross Vehicle Weight of project group fleet measured on an annual basis. The purpose of data is for the calculation of the average weight used for the control group and project emissions, and the QA/QC and calculation methods are appropriate for the datum.

Findings were raised for the parameters, and a thorough assessment of the parameters and the monitoring & alternate choices available against each was conducted. The parameters selected and depicted a valid project activity scenario and for the quantification of GHG emissions.

The calculations and equations used for each parameter are well defined and are in conformity with the Verra's rules and requirements.

3.11 Uncertainty

ESPL have assessed the approach taken to address uncertainty and find it to be both appropriate and in conformance with VCS Program rules and requirements/16/. The evaluation encompasses an assessment of how the methodology effectively minimizes both systematic and random errors to the extent practicable, and appropriately deals with uncertainties. Hence, achieving a reasonable level of assurance.

3.12 Verifiable

ESPL critically assessed the methodology revision to ascertain its level of clarity and specificity and can confirm that the methodology revision effectively mandates project proponents to transparently report project results, thus ensuring compliance with requirements for validation and verification processes with a high degree of confidence. This aligns with established audit standards and best practices, reinforcing the reliability and integrity of the reported project outcomes. Furthermore, it is crucial to assess if the methodology encompasses clear guidelines and instructions that enable project proponents to accurately and comprehensively document project outcomes. This not only facilitates a transparent reporting process but also enhances the likelihood of successful validation and verification efforts, instilling a greater level of confidence in the overall assessment. Additionally, a well-defined methodology fosters consistency and reliability in project reporting, aligning with established VCS rules and requirements.

4 ASSESSMENT CONCLUSION

The VVB, Earthood Services Private Limited (Earthood) has performed a validation of the proposed methodology revision "Methodology for Improved Efficiency of Fleet Vehicles and Combustion Engines" /1/. The validation was performed based on rules and requirements defined by Verra Standard /15/16/25/.

The methodology revision is falling within Sectoral Scope 07 – Transport.

Earthood Services Private Limited has informed the methodology developers of the validation outcome through the draft validation report and final validation report. The final validation report contains the information regarding fulfilment of the requirements for validation, as appropriate.

Earthood Services Private Limited applied the following validation process and methodology using a competent validation team:

- The publication of draft version on VERRA for global stakeholder consultation process;
- The desk review of documents and evidence submitted by the methodology developers in context of the reference Verra's guidelines issued;
- Reporting audit findings with respect to clarifications and non-conformities and the closure of the findings, as appropriate and;

- Preparing a draft validation opinion based on the auditing findings and conclusions;
- Technical review of the draft validation opinion along with other documents as appropriate by an independent competent technical review;
- Finalization of the validation opinion (this report).

The review of the methodology report and, supporting documentation have provided Earthood Services Private Limited with sufficient evidence to determine the fulfilment of stated criteria.

Earthood Services Private Limited is of the opinion that the proposed methodology revision "Methodology for Improved Efficiency of Fleet Vehicles and Combustion Engines", does meet the stated criteria of Verra's requirements. Therefore, the proposed methodology is being recommended to VERRA Board for request for registration and approval.

5 EVIDENCE OF FULFILMENT OF VVB ELIGIBILITY REQUIREMENTS

Earthood Services Private Limited is accredited by Executive Board (EB) of Clean Development Mechanism (CDM) as a Designated Operational Entity (DOE). The accreditation has been granted for 11 different sectoral scopes including sectoral scope 7 i.e., Transport. The information about Earthood Services Private Limited's accreditation and sectoral scope is available at the following UNFCCC interface/28/. The competencies of the personnel involved as the assessment team members is provided in appendix 3 below.

6 SIGNATURE

Signed for and on behalf of:

Name of entity:	Earthood Services Private Limited (ESPL)
Signature:	
Name of signatory:	Dr. Kaviraj Singh
Date:	24-November-2023

APPENDIX 1: LIST OF STAKEHOLDER COMMENTS

All the comments raised during the public stakeholder comments period was reviewed by the VVB. The responses to all the comments were found to be satisfactory and where, applicable the necessary changes as per the public comments raised has been made in the methodology. The changes made has been reviewed and found to be appropriate.

Comment #	Methodology Section	Comment	Response to commenter	Summary of change made (internal)	Response & document change status
1	8.1.1	Allow baseline emissions utilizing telematics systems to be calculated with emissions factors for comparable vehicles. We are pleased to see that the methodology has included the option to utilize telematics systems to calculate baseline and project emissions. However, we recommend that the methodology use calculated emissions factors instead of quantifying baseline emissions on a per vehicle basis. Currently, the methodology requires that "For all vehicle types equipped with a telematics system capable of tracking fuel consumption, the baseline emissions shall be calculated using the vehicles own data prior to the project measure's implementation" (Section 8.1.1). We find the requirement to calculate baseline emissions based on each individual vehicle's	The first comment is not applicable to the Methodology under review which aims to provide fleets with reductions in Carbon Emissions. The most truthful way to prove that the emission reductions are true and accurate is to compare the vehicle against itself because all engines/vehicles perform differently regardless of being the same make and model. The commentator suggests that this comparison can lead to a perverse incentive to not maintain vehicles but this is not the case as the Methodology under review measures reductions in Carbon Emissions regardless of the maintenance performed on any particular vehicle.	No Change needed	-

		operation problematic as this presents an array of installation and deployment issues along with undesirable and unnecessary GHG emissions, specifically for new vehicles. The vast majority of Derive's VQ Efficiency products, which improve the efficiency of vehicles through mechanisms that are eligible with this methodology, are installed on new vehicles at a central location before delivery to the end user. These project activity measures are typically installed at the upfitting site and then distributed to various regions throughout the country for regular usage and operation. The need for each individual vehicle in a project fleet to operate for at least 5,000 km before implementing the project activity will pose onerous challenges as the installation site is often far away from where the vehicle operates for regular usage. Moreover, this requirement presents a perverse incentive to maintain inefficient vehicles, despite being of the same category with similar usage and emissions factors. For example, under the current draft methodology, if 500 new and similar vehicles are manufactured and upfitted in Florida with operations in Colorado, the project proponent would have to move the new vehicles (without	Secondly, if the entity does not do maintenance and applies technology that is applicable under this Methodology under review, the outcome would be the same as the maintenance would still not be done. The lack of maintenance would be considered the entity's "business as usual". If the maintenance was done during the project activity, it would not be credited as that is a change of operational procedure, which is not applicable in the methodology as stated in section 4, point 5. The installation issue for the project activities is on the manufacturer; the technology the methodology developer is using for the Methodology under review does not suffer this issue. The second comment is not applicable to the Methodology under review which aims to provide fleets with reductions in Carbon Emissions. 5000km used as a baseline of a trial period is acceptable statistically as an appropriate sample size for operations. The Methodology under review has been updated to include a comparable duration in hours. The third comment is not applicable to the Methodology under review which aims to provide fleets with reductions in Carbon		

		the project activity) from Florida to Colorado, operate the high GHG emitting vehicles for at least 5,000 km each (2,500,000 km total), and then either send the vehicles back to Florida for project activity installation or find an alternative installation method, which is difficult and limited. If unaddressed, these deployment challenges could ultimately result in limited installation of efficient technologies, increased GHG emissions, and reduced participation in the VCS program. For vehicles with similar usage and fuel economy, calculating baseline emissions on a per vehicle basis is unnecessary as the emissions factors for comparable vehicles should be equivalent throughout the fleet with minimal standard deviation. Alternatively, if the methodology is updated to allow for the use of calculated emissions factors, the project proponent could utilize data from existing comparable vehicles to determine appropriate baseline emissions factors and eliminate the need to operate similar vehicles without the project activity. This change would also allow the project proponent to complete most project activity installations at the upfitting site and avoid undesirable and unnecessary operational GHG emissions.	Emissions. Using comparable vehicles versus the individual vehicle does not necessarily give an accurate measurement of the emissions reduced by that vehicle or the project as a whole. Project developers that aim to avoid having to do baselines along with control vehicles and instead use data from a similar project run the risks that such statistics may not provide accurate reductions in Carbon Emissions. As well, the emissions during the baseline trial are necessary because in order to get a proper baseline without the improvement measures. Improvements of reductions in Carbon Emissions are necessary in the VCS program. The forth comment is not applicable to the Methodology under review which aims to provide fleets with reductions in Carbon Emissions. the commentator is suggesting using data from comparable vehicles to establish a “fleet-specific regional emissions factor for each vehicle category” which would be fine if there was a governing body that could establish what each “fleet-specific emissions factor” is and determine which “categories” apply to the project proponent and activity. Since each company or fleet operates differently, with different vehicle activities, with different vehicle types and		

		To remove this perverse incentive and increase usability of the methodology, we propose that the VCS remove the need to calculate baseline emissions on a per vehicle basis for new vehicles with telematics systems and instead utilize a sample of comparable vehicles to develop a fleet-specific regional emissions factor for each vehicle category. We recommend that baseline emissions factors be calculated based on the activity level and fuel usage of at least 10% of sample vehicles during or prior to the first crediting period, within a specific vehicle category with comparable fuel economy and usage. The baseline emissions for these sample vehicles may be derived from the methodology's stated threshold of at least 5,000 km of operation; however, we also suggest additional clarification regarding the development of this requirement and how it would be generally applicable to different fleets.	age, under different conditions which would make for specific categories to that entity, creating entity specific categories would lead to infinite categories and "fleet-specific regional emission factors". The Methodology under review compares Carbon Emissions of vehicles back to its own particular baseline derived from its own data to reflect the true savings of Carbon Emissions. The comment from the commentator that also suggests to use 10% of the sample vehicles prior or during the first credit period. Why use 10% of the sample vehicles when the Methodology under review uses 100% of the data that is available. As a result this suggestion of using only 10% of vehicles is not applicable to the Methodology under review which aims to measure entire fleets with actual and more certain and measured reductions in Carbon Emissions.		
2	8.1.2	Provide additional details for baseline emission calculations for vehicles using a control group. The methodology states, "Control group vehicles shall be selected from the vehicle fleets of the project proponent or from third party fleets (preferred option)" (Section 8.1.2). Currently, we believe that the definition of a "third-party fleet" is unclear, and we are unsure if a third-party	Control groups are specific to the comparable group. If a control group can be used for multiple comparisons, wouldn't that mean they are the same and therefore be in the same project? The equations in section 8.1.1 and 8.1.2 are for all vehicles if there is no specific set of equations for that particular vehicle or fleet. Equation 6 uses a different larger unit of	No change needed	-

		control group could be used for more than one project. To increase clarity, we recommend that the methodology developer expand on the definition and parameters for the control group. Additionally, we recommend that the methodology provide clarity on baseline emissions equations for vehicle categories not using the telematics systems by making the following changes: • Move equation 6 to section 8.1.2 • Add description of parameter ALtkm,i,x,y in equation 4 • Provide parameter descriptions for equation 7	measurement which is more practical to use for trucks and buses which is why it is in 8.1.3. A description for ALtkm,i,x,y has been added. A description for the equation has been added.		
3	8.2.2 and 8.2.3	Clarify missing and/or confusing information in quantification/monitoring sections. We believe the VCS should review and expand on the calculations for project emissions not utilizing telematics systems and project emissions for all other vehicle categories (Section 8.2.2 and 8.2.3) to ensure completeness and accuracy when quantifying emissions. We request that the methodology developer include descriptions for all parameters, specifically in equations 14, 15, and 16.	The equations in section 8.1.1 and 8.1.2 are for all vehicles if there is no specific set of equations for that particular vehicle or fleet. Equation 6 uses a larger unit of measurement which is more practical to use to trucks and buses which is why it is in 8.1.3. The tables have been added and updated. Options are options; pick the one that is best suited for the application.	No change needed	-

		Additionally, we suggest clarification for why different equations and parameters have the same description. For example, the calculation for baseline emissions utilizing telematics systems (equations 1, 2, and 3) appear to be identical to the calculations for baseline emissions for mobile machinery (equations 8, 9, and 10). An explanation of the difference between these two calculations would be useful. We also suggest that when describing parameters for calculating emissions from telematics systems, the methodology developer refrain from using the term "control group" to mitigate confusion with specified control group calculations (e.g., equations 2 and 3). Furthermore, in Section 9.2 Data and Parameters Monitored, we recommend that the tables be reviewed and completed for each parameter. For example, in the third table (ALi,x,y) there are multiple descriptions of measurement methods and procedures to be applied for both option 1 and option 2. We request clarification on which description is accurate. Thank you again for the opportunity to weigh in on the draft Methodology for Improved Efficiency of Fleet Vehicles and Combustion Engines (v3.0). We support this endeavor and believe			

		this methodology, if revised, has the potential to bring to market high-quality carbon offsets.			

APPENDIX 2: DOCUMENTS REVIEWED

S.No.	Title of document	Version	Provided by
1.	Methodology for Improved Efficiency of Fleet Vehicles and Combustion Engines	3.1	Developer
2.	AM0031	8.0	Others
3.	AM0090	1.1.0	Others
4.	AMS-III.S.	4.0	Others
5.	AMS-III.T.	2.0	Others
6.	AMS-III.U	2.0	Others
7.	AMS-III.AA.	1.0	Others
8.	AMS-III.AP	2.0	Others
9.	AMS-III.AQ	2.0	Others
10.	AMS-III.BC	3.0	Others
11.	AMS-III.AT	2.0	Others
12.	VM0019	1.0	Others
13.	VMR0004	1.0	Others
14.	Public Stakeholder Comments	-	Developer
15.	VCS Standard	4.5	Others
16.	VCS Methodology Requirements	4.4	Others
17.	VCS-Methodology Template	4.3	Others
18.	https://www.climateactionreserve.org/	-	Others
19.	https://cdm.unfccc.int/	-	Others
20.	https://www.goldstandard.org/	-	Others
21.	https://www.globalcarboncouncil.com/	-	Others
22.	https://verra.org/	-	Others
23.	VCS Program Guide	4.4	Others
24.	Latest version of IPCC Guidelines for National Greenhouse Gas Inventories	-	Others
25.	Methodology Development and Review Process	4.3	Others
26.	Methodology Assessment Report Template	4.2	Others
27.	VCS Program Definitions	4.4	Others
28.	https://cdm.unfccc.int/DOE/list/DOE.html?entityCode=E-0066/ .	-	Others
29	Guidelines for sampling and surveys for CDM project activities and programmes of activities	4.0	Others
30	Local Utilities (Electrical) Authority	-	Others

APPENDIX 3: COMPETENCE STATEMENT

Competence Statement			
Name	Shreya Garg		
Country	India		
Education	M.Sc. (Climate Science & Policy), TERI University		
Experience	9 Years +		
Field	Climate Change		
Approved Roles			
Team Leader	YES		
Validator	YES		
Verifier	YES		
Methodology Expert	AMS.I.A., AMS.I.C., AMS.I.D., AMS.I.F., AMS.II.D., AMS.II.G., AMS.II.J., AMS.III.AV., AMS.III.BL, ACM0002, ACM0012		
Local expert	YES (India)		
Financial Expert	NO		
Technical Reviewer	YES		
TA Expert	YES (TA 1.1, TA 1.2, TA 3.1, TA 13.1)		
Reviewed by	Shifali Guleria	**Date**	21/12/2022
Approved by	Deepika Mahala	**Date**	21/12/2022

Competence Statement	
Name	Abhishek Koul
Education	Bachelor of Technology in Mechanical Engineering
Experience	1 year
Field	Climate Change
Approved Roles	
Team Leader	Yes
Validator	Yes
Verifier	Yes
Methodology Expert	NO
Local expert	Yes (India)
Financial Expert	NO

Technical Reviewer	NO		
TA Expert (X.X)	TA 1.2		
Reviewed by	Shifali Guleria (Quality Manager)	**Date**	08/08/2023
Approved by	Deepika Mahala (Technical Manager)	**Date**	08/08/2023

Competence Statement			
Name	Pratik Kumar Badu		
Education	M.Tech. Embedded Systems		
Experience	6+ years		
Field	Electronics Engineering		
Approved Roles			
Team Leader	NO		
Validator	NO		
Verifier	NO		
Methodology Expert	NO		
Local expert	NO		
Financial Expert	NO		
Technical Reviewer	NO		
TA Expert (X.X)	YES (TA 7.1)		
Reviewed by	Shifali Guleria (Quality Manager)	**Date**	09/08/2023
Approved by	Deepika Mahala (Technical Manager)	**Date**	11/08/2023

Competence Statement	
Name	Sergio Bonanno Cruz
Country	Brazil
Education	Post Graduate Diploma in Environment
Experience	+25 Years
Field	Environmental Law, CDM, Energy, Climate Change
Approved Roles	
Team Leader	Yes
Validator	Yes
Verifier	Yes

Methodology Expert	Yes (ACM0001, ACM0002, AM0026, ACM0006, AMS ID)		
Local expert	Brazil, Chile, Colombia		
Financial Expert	Yes		
Technical Reviewer	No		
TA Expert	Yes (TA 1.1, 1.2, 13.1, 7.1, 3.1)		
Reviewed by	Shifali Guleria	**Date**	06/06/2023
Approved by	Deepika Mahala	**Date**	06/06/2023

Competence Statement			
Name	Ashok Gautam		
Country	India		
Education	M. Sc. (Environmental Sciences) M. Tech. (Energy & Environmental Management)		
Experience	16 Years +		
Field	Energy, Climate Change & Environment		
Approved Roles			
Team Leader	YES		
Validator	YES		
Verifier	YES		
Methodology Expert	AMS-I.D., AMS-I.A., AMS-I.C., AMS-I.E, AMS-II.D., AMS-II.G., AMS-III.E., AMS-III.H., AMS-III.Q, AMS-III.Z., AMS-III.AV., AMS III.AR, AM0029, AM0025, AM0056, ACM0001, ACM0002, ACM0004, ACM0012, ACM0006, AM0018, ACM0017, ACM0009, AM0034, AMS.I.B, ACM0016, AMS-III.BL, AMS-II.L, AMS-I.I., AMS-III.A.O., ACM0010, ACM0025		
Local expert	YES (India)		
Financial Expert	YES		
Technical Reviewer	YES		
TA Expert	YES (TA 1.1, TA 1.2, TA 3.1, TA 13.1)		
Reviewed by	Shifali Guleria	**Date**	06/03/2023
Approved by	Deepika Mahala	**Date**	06/03/2023

APPENDIX 4: FINDINGS OVERVIEW

Table 1. CL from this validation

CL ID	01	Section no.	9.1 & 4.0	Date : 02/11/2022
Description of CL				
In the VCS Methodology, 1. Under section 9.1, "Data and Parameters Available at Validation", Developer is requested to clarify why there are no input data or parameters available at validation for the given baseline scenario. 2. Under section 4.0, "Sources", Developer is requested to clarify whether the engine efficiency is improved with or without any improvements in combustion efficiency. 3. Under section 1.0, the latest version for the methodology to be revised i.e. "AMS-III.BC." available is version 3.0, Developer is requested to clarify why they have considered an older version (version 2.0) for the revision. 4. Under section 1.0, "Sources", VMR0004 version is mentioned as 1.03 which is not consistent with the available version for the methodology revision i.e. "VMR0004 version 1.0", Developer is requested to clarify the same.				
Methodology developer response				**Date :** DD/MM/YYYY
1. The data and parameters at validation have been added along with the procedures for regarding the data storage and collection. 2. The efficiency improvement, whether combustion or engine, will have the same outcome as the metrics for measuring the fuel reduction do not consider the thermodynamics of the engine. As well, I have added a statement that the conditions set out in CDM methodology AMS-III-BC still apply. 3. Revised and updated to the latest version. 4. This is a typo mistake: It would not make sense that the referenced version is a higher revision than the latest version unless this document is from the future. This should be corrected to VMR0004 version 1.0.				
Documentation provided by Methodology developer				
VVB assessment				**Date:** 31/08/2023

1. The validation team checked and found that methodology developer has now added a statement under section 9.1 titled 'Data and Parameters Available at Validation' which states that "*All data collected as part of the monitoring should be archived electronically and to be kept for at least two years after the last crediting period. All the data should be monitored unless indicated otherwise. All measurements should be conducted with calibrated equipment according to relevant industry standards. The data and parameters available at validation must be provided in accordance with CDM methodologies AMS-III.BC.*"

   The statement included by the developer in the methodology document indicates that the methodology revision will be applying the same data and parameters as applicable in the primary methodology i.e. AMS-III.BC. on which the revision is based. The information is found to be appropriate and satisfactory. Hence, the finding is closed.

2. The validation team checked section 4.0 titled 'Applicability conditions' of the methodology document It was observed that the methodology developer has made a revision to paragraph 1(h) of the applicability conditions, which now states, "*Retrofits that enhance engine or combustion efficiency, or both.*" The updated statement is deemed to provide comprehensive information and is considered sufficient. Therefore, this finding is now closed.

3. The validation team reviewed section 1.0 "Sources" of the revised Methodology document shared by the developer and can confirm that the version of the methodology to be revised i.e. CDM approved methodology AMS-III.BC. has been updated to version 3.0 which is the latest version available on the CDM webpage. The updated information is found to be appropriate and complete as per the VCS requirements. Hence, the finding is closed.

4. The validation team reviewed section 1.0 "Sources" of the revised Methodology document shared by the developer and can confirm that the version of the methodology titled 'VMR004' has been updated to reflect the correct version i.e. version 1.0. The correction made by the developer is found to appropriate and exact. Hence, the finding is closed.

CL# 01 is closed.

CL ID	02	**Section no.**	4.0	**Date :** 03/11/2022
Description of CL				
In the VCS Methodology, Under section 4.0, "Applicability Conditions", 1. The methodology describes the implementation measures, but it does not mention the measures to monitor the implementation, for example: how will the effect of the condition "Use of low viscosity oils" be measured with respect to the engine efficiency of the vehicle fleets and mobile machinery as low viscosity oil could cause more wear and friction, generating more heat and thus reducing the engine efficiency. Developer is requested to clarify the same. 2. Developer is requested to clarify how the literature used for ex-ante estimations will be applicable globally as mentioned under section 2, "Summary Description of the Methodology". 3. Developer is requested to clarify any provisions to monitor the maintenance and upkeep of vehicles, for example: for the condition "Tire-rolling resistance improvements", tyre pressure will have to be monitored, etc. 4. Developer is requested to clarify any provisions made to consider variables like emission norms, geographical conditions, temperature variations, vehicle age for the implementation of the applicability conditions.				
Methodology developer response				**Date :** DD/MM/YYYY

1. This methodology focuses activities that improve the efficiency of the vehicle fleets and mobile machinery. The fuel efficiency measurement metrics do not consider the thermodynamics of the engine. Engine and combustion efficiencies are part of an activity under this methodology to improve the efficiency of fleet vehicles and combustion engines, to which the fuel savings can be converted to a carbon credit. This methodology calculates the fuel savings.

   The type of oil can have affect on the power that an engine produces across the range of its output and should be selected based on the application. Whether thin oil or thick oil improves the engine efficiency should not matter as the methodology would consider this part of an activity and determines if that activity saves fuel or not. It does not calculate the engine or combustion efficiency directly, it considers the vehicle efficiency improvement for the activity. If an oil type change improves (or doesn't) the engine efficiency (or combustion), the vehicle efficiency should also improve (or not). The processes in the methodology calculate the fuel consumption based on the activity to see if there is an improvement or not. Combustion and engine efficiency improvements can be applied in this methodology.

2. The noticeable differences based on factors such as vehicle type, purpose, climate, and local driving conditions have been considered via the project activity and activity level; see section 9. The additionality and crediting method is a project based scenario and the changing factors are averaged across the fleet. Vehicle operations for heavy-duty trucks, passenger cars, buses, and off-road vehicles can vary significantly which is why the methodology has different baseline requirements for the different classes of vehicle along with the different vehicle operations. The baseline sections 8.1 and 8.2 cover this.

   The methodology looks at the vehicle fleet improvements. In section 4 "Applicability Conditions" it clearly states that fuel switching is not allowed; for example, going from diesel to bio-diesel for the same vehicle activity. It states that the project can use multiple types of fuel but the fuel is not allowed to be switched during the activity.

   The provisions taken to account for different types of project fleets with different fuel types is accounted for in sections 4 and 8. Furthermore, the different regions, driving habits, and traffic patterns are accounted for in section 8.1.2 using a randomized control trial and the conditions for the control group.

3. This has been done - see section 9.2 and 9.3.

   The individual implementations for fleet vehicle efficiency improvements are accounted for in the activity and activity level. The monitoring of this will be done through the activity level.

   Maintenance of improvement measures are on the fleet / vehicle owner. The methodology will not change whether maintenance is done or not. It the fleet / vehicle owner does not maintain the efficiency improvement, the methodology will show this as the fuel consumption will go back to baseline levels.

4. The methodology does not supersede or replace any law, local or federal. If a person decides to not follow the law, that is on them. Furthermore, any improvements made would improve the emission standard that the vehicle could meet. Therefore, if a vehicle is already operating legally under a lower standard, moving to a better standard should not be an issue.

Documentation provided by Methodology developer	
VVB assessment	**Date:** 31/08/2023

1. The validation team reviewed the revised methodology document and found that methodology developer has added a statement under section 4.0 titled 'Applicability Conditions' which states that "*This methodology applies to project activities that improve efficiency of vehicle fleets and mobile machinery (e.g. fleets of trucks, buses, cars, taxis or motorized tricycles, excavators, cranes), resulting in reduced fuel usage and GHG emissions. Projects must comply with all applicable conditions set out in CDM methodology AMS-III-BC: Small-scale Methodology: Emission Reductions through Improved Efficiency of Vehicle Fleets version 3.0 and Approved VCS Methodology Revision VMR0004 version 1.0 Sectoral Scope 7"*. The statement included by the developer in the methodology document indicates that the proposed methodology will be applying the same measures to monitor the implementation for the applicability conditions as applicable in the approved methodology i.e. AMS-III.BC. on which the revision is based. Hence, the finding is closed.

   1)
2. The validation team checked the revised methodology document and found that the methodology developer has included a statement under section 9 which states that "*All data collected as part of the monitoring should be archived electronically and to be kept for at least two years after the last crediting period. All the data should be monitored unless indicated otherwise. All measurements should be conducted with calibrated equipment according to relevant industry standards. The data and parameters available at validation must be provided in accordance with CDM methodologies AMS-III.B.C*". According to this statement, the literature used in the methodology will be based on the primary methodology i.e. AMS-III.BC. which is already approved. Therefore, the literature used for ex-ante estimations will be applicable as per the CDM approved methodology AMS-III.BC v1.3. Hence, the finding is closed.

   2)
3. The validation team checked the revised methodology document and found that the methodology developer has included a statement under section 9 which states that "*All data collected as part of the monitoring should be archived electronically and to be kept for at least two years after the last crediting period. All the data should be monitored unless indicated otherwise. All measurements should be conducted with calibrated equipment according to relevant industry standards. The data and parameters available at validation must be provided in accordance with CDM methodologies AMS-III.B.C*". According to this statement, the literature used in the methodology will be based on the primary methodology i.e. AMS-III.BC. which is already approved. Therefore, the provisions to monitor the maintenance and upkeep of vehicles will be applicable as per the CDM approved methodology AMS-III.BC v1.3. Hence, the finding is closed.

   3)
4. The validation team checked the revised methodology document and found that the methodology developer has included a statement under section 9 which states that "*All data collected as part of the monitoring should be archived electronically and to be kept for at least two years after the last crediting period. All the data should be monitored unless indicated otherwise. All measurements should be conducted with calibrated equipment according to relevant industry standards. The data and parameters available at validation must be provided in accordance with CDM methodologies AMS-III.B.C*". According to this statement, the literature used in the methodology will be based on the primary methodology i.e. AMS-III.BC. which is already approved. Therefore, the provisions established to account for variables such as emission standards, geographical factors, temperature fluctuations, and the age of the vehicle for determining the applicability criteria will remain unchanged, in accordance with the CDM-approved methodology AMS-III.BC v1.3. Hence, the finding is closed.

CL#02 is closed.

CL ID	03	Section no.	9.1 & 4.0	Date : 02/11/2022
Description of CL				

The proposed methodology under section 5 project boundary and applicable greenhouse gases has only indicated CO2 as eligible gas in the baseline and project scenario. The available measures for application includes change in the engine oil and/ combustion/engine efficiency. In order to burn the fuel more efficiently might result in the N2O and CH4 emissions, which could also be potential GHG, however have not been included. Please justify.
Methodology developer response **Date :** DD/MM/YYYY
N2O comes from the air being part of the combustion process. The fuel saved (unburnt fuel) does not contribute directly to N2O formation. The amount of N2O is dependant on the vehicle or engine operation leaving the amount of N2O reductions questionable with the reduction being based on the fuel savings. I have not found an accepted amount of N2O emission per liter of diesel or other fuels to account for the emission reduction of N2O. Burning diesel or other fuels is not a source of CH4 emissions according to the EPA. https://www.epa.gov/ghgemissions/overview-greenhouse-gases
Documentation provided by Methodology developer
VVB assessment **Date:** 31/08/2023
The assessment team has verified the GHG emission factors in accordance with the UK DEFRA guidelines, while also consulting other globally relevant databases such as the US EPA and IPCC. Based on these references, the assessment team has determined that the release of 1 kg each of N2O and CH4 from burning 1 litre of diesel can be considered negligible in the exhaust gas. Consequently, the project's scope focuses on CO2 emissions as the primary gas released, with other GHGs like N2O and CH4 being considered insignificant. The information presented in this section is deemed suitable and comprehensive. Therefore, the finding is considered resolved and closed. CL#03 is closed

CL ID	04	**Section no.**	Cover page of the VCS Methodology	**Date :** 02/05/2023
Description of CL				
In the VCS Methodology document, on the cover page of the methodology, the sectoral scope mentioned are “3. Energy Demand and 7. Transport”. However, the methodology being revised is AMS-III.BC. (Version 2.0) has only one applicable sectoral scope 07 (Transport). Also, on the web page of the methodology, only one sectoral scope is mentioned which is scope 07 (Transport). Developer is requested to kindly clarify why they have considered sectoral scope 03 (Energy demand) for this methodology revision.				
Methodology developer response				**Date :** DD/MM/YYYY
This was not to be included and how now been removed.				
Documentation provided by Methodology developer				
VVB assessment				**Date:** 31/08/2023
The validation team checked the revised VCS methodology document and after reviewing the cover page of the methodology document found that the methodology developer has removed sectoral scope 03 (Energy demand) from the methodology document. The proposed methodology now only indicates the applicable sectoral scope 07 (Transport) which is found consistent with the sectoral scope applied for the methodology being revised i.e. AMS-III.BC. v3.0. The updated information is found to be appropriate and complete. Hence, the finding is closed. CL#04 is closed.				

CL ID	05	Section no.	4.0	Date : 23/10/2023
Description of CL				
In the Methodology document, Under section 4 'Applicability Conditions', para 5 (b), it is stated that "*A switch from fossil fuels to biofuels in transportation applications. The usage of a fixed biofuel blend is, however, admissible if project vehicles use the same blend of biofuel as used by baseline vehicles.".* Methodology Developer is requested to clarify if there is a minimum percentage usage requirement outlined in the methodology for the usage of the same blend of the biofuel as used in the baseline.				
Project participant response				**Date :** 03/11/2023
No, there is no minimum.				
Documentation provided by project participant				
-				
VVB assessment				**Date:** 20/11/2023
The VVB can confirm that the methodology developer has clarified that while switching from the fossil fuels to biofuels in transportation applications, there no minimum usage requirement outlined in the methodology for the same blend of biofuel used in the baseline scenario. The clarification provided by the methodology developer is found to be satisfactory and hence the finding is closed. CL#05 is closed.				

CL ID	06	Section no.	-	Date : 23/10/2023
Description of CL				
1. In case of the electric vehicles, Methodology developer is requested to clarify how the electricity consumption will be calculated and what is the mechanism in place if the vehicle is not being charged from grid connected electricity source. How is the electricity consumption calculated if the vehicles are charged from battery swap or from a distributed energy source which are not connected to grid. 2. Methodology developer shall clarify that in the absence of the Telematics system how will the electricity consumption data be collected and monitored, what will be the frequency of the monitoring and the calibration requirements. 3. Under section 4 para 6, it is stated that "*Project fleets may use various fuel types. The composition of the fleet with regard to fuel types used may also change over time. The introduction of hybrid vehicles is allowed. Hybridfuel vehicles are classified according to their fossil fuel engine type and compared with the same baseline fossil fuel type (e.g., compressed natural gas, diesel, gasoline hybrids are compared with diesel, gasoline or compressed natural gas engines).*" Methodology Developer is requested to clarify if Hydrogen driven vehicle fleet is also considered here.				
Project participant response				**Date :** 03/11/2023
1. The activity level is the calculation of the electrical consumption. The methodology itself is the mechanism in place regardless of the source of electrical supply. *Swapping batteries is not practical but if this activity was used, it would still measure the electrical consumption the same way as if it was charging the battery in the vehicle.* *Charging from an off-grid supply would still be monitored as the emissions from the energy supping source would still be captured. The methodology has descriptions and parameters for what is applicable and what is not. Based on that, the equipment and vehicles participating in the project will have the correct measures and procedures in place and done in accordance with the latest version of CDM methodology AMS-III.C.*				

2. The electrical data collection is done using the same procedures as the non-electrical data via control group or RCT procedures. The electrical consumption data collection is done the same as if were a conventional fuel such as diesel.
Frequency is annual or based on the project description. Calibration depends on the equipment or tool being calibrated. This is done in accordance with the latest version of CDM methodology AMS-III.C. as stated in section 8.1.1

3. Yes, we considered it. Hydrogen fuel cells have little to zero emissions and therefore would not be able to generate emissions savings on a reasonable scale. Hydrogen combustion engines and the infrastructure to support them are still in development and are not widely available on the market or Tpractical use. Either way, the methodology still works if hydrogen is used as a fuel, as the methodology looks at the emissions savings. If a technology is invented in the future that removes harmful emissions from a hydrogen driven vehicle, this methodology will still be applicable.

Documentation provided by project participant

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VVB assessment	**Date:** 20/11/2023

1. The methodology developer has provided comprehensive clarification on how electricity consumption is calculated for electric vehicles, regardless of the source of electrical supply. The methodology ensures that charging from an off-grid supply is monitored, capturing emissions from the energy-supplying source. The methodology's descriptions and parameters specify what is applicable, ensuring that equipment and vehicles involved in the project adhere to correct measures and procedures as outlined in the latest version of CDM methodology AMS-III.C. Therefore, the finding is addressed and closed successfully.

2. The VVB can confirm that in the absence of the Telematics system, the electricity consumption data will be collected and monitored as per procedures in the section 8.1.1 and 8.1.2 of the methodology documents and in accordance with the methodology CDM AMS-III.C that is being revised. The information is found to be appropriate. Hence, the finding is closed.

3. The VVB confirms that the methodology developer has provided clarification regarding the consideration of Hydrogen-driven vehicles among the different fuel types covered by the methodology. The clarification provided is deemed appropriate. Therefore, the finding is closed.

CL#06 is closed.

CL ID	07	**Section no.**	TA to TR Comments	**Date :** 04/11/2023

Description of CL

In the Methodology document,

1. Under section 8.1 of the Methodology document, it is mentioned that "*Baseline emissions are calculated based on a baseline emission factor for each vehicle category I and fuel type x (BEFkm,I,x,y) derived from: The vehicles own data prior to the project measure's implementation, for all vehicle types equipped with a telematics system capable of tracking fuel consumption*".

Methodology developer shall clarify whether the vehicle idle duration (Engine is switched ON but the vehicle is not moving) is also captured via the telematics system, as this data plays a vital role in urban driving conditions. 2. Under section 9.1 of the Methodology document, for the data and parameter 'AW,BL,i,x,y' which is described as 'Specific baseline gross vehicle weight (GVW) average of control group vehicle category *i* in the trial period *x* in the year y'. The source of data for the parameter is mentioned as control group data. However, methodology developer shall clarify how is the GVW recorded? Is there a specific sensor in the vehicle or is it manually captured. 3. Under section 4.0 of the methodology document, para 5 which states that "*This methodology is not appliable under the following condition: b) A switch from fossil fuels to biofuels in transportation applications. The usage of a fixed biofuel blend is, however, admissible if project vehicles use the same blend of biofuel as used by baseline vehicles. In the case of using biofuel blends, the biofuel share is accounted for as zero emitting*." Methodology developer shall clarify if there is a separate calculation method if blended biofuel is used? Or this is covered under existing fuel change calculations.
Project participant response **Date :** *07/11/2023*
1. *Yes, the vehicle idle duration is captured.* 2. *Please see section 4.8a, footnote 11: The gross vehicle weight (GVW) is the maximum allowable total weight of a vehicle when loaded. This weight includes the vehicle as well as fuel, passengers and cargo. This is a fixed weight that is set and specified by the vehicle manufacturer. This is a manual capture.* 3. *Fuel switching is not allowed. The calculation method is the same when biofuel is used.*
Documentation provided by project participant
VVB assessment **Date:** 20/11/2023
1 The methodology developer has provided clarification that the vehicle idle duration is also captured via the telematics systems, addressing the urban driving condition concerns. The clarification provide by the methodology developer is found to be appropriate. Therefore, the finding is closed. 2 The validation team can confirm that under section 4 titled "Applicability conditions", para 8, the types of vehicle categories that the methodology covers have been specified. Additionally, under section 9.1 titled "Data and Parameters Available at Validation", the parameter namely "AW BL,i,x,y" which is described as 'Specific baseline gross vehicle weight (GVW) average of control group vehicle category i in the trial period x in the year y' will allow project activities using the methodology to capture the specified parameter. Therefore, the clarification provided by the methodology developer is found to be appropriate. Hence, the finding is closed. 3 The methodology developer has clarified that the calculation method will remain the same even when blended biofuel is used. This clarification is found to be appropriate. Therefore, the finding is closed. CL#07 is closed.

Table 2. CAR from this validation

CAR ID	01	Section no.		Date : 02/11/2022
Description of CAR				
Developer is requested to review and update the VCS Methodology template to the latest version of the VCS Methodology template v.4.3 as available on the VERRA website.				
Methodology developer response				**Date :** DD/MM/YYYY
It looks like version 4.1 was not active at the time of submission. Version 4.0 was uploaded 2019/09. Version 4.1 was uploaded 2019/02. It looks like version 4.1 was removed as version 4.2 is current on the main download page. The templates are not labeled with dates (other than the print-out shows the version, no date). Upon review of the differences, version 4.1 adds an additional note describing the requirements for the control data source using a dynamic performance benchmark. I believe we are not using a dynamic performance benchmark.				
Documentation provided by Methodology developer				
VVB assessment				**Date:** 20/11/2023
The VVB reviewed the revised methodology document and can confirm that the methodology developer has updated the methodology document to the latest template available on the VCS webpage which is Methodology Template v4.3. The updated information was found to be exact and appropriate. Hence, the finding is closed, CAR#01 is closed.				

CAR ID	02	Section no.	9.2	Date : 02/11/2022
Description of CAR				
In the VCS Methodology, 1. Under section 9.2, in the parameter description of "ALi,x,y", the year is denoted with z, however the parameter does not signify z. Developer is requested to correct the denotation. 2. Under section 9.2, in the parameter description of "SFCBL,i,x,y/SFCPJ,i,x,y", Developer is requested to add separate tables for "Specific project fuel consumption (PJ) and Specific baseline fuel consumption (BL)" of control group vehicle category *i* in the year y". 3. Under section 9.2, "Data and Parameters Monitored", Developer is requested to consider all the parameters mentioned in section 8, "Quantification of GHG Emission Reductions and Removals" like: TDLy, EFelec,y, $BEFi,elec,y$, SECi,y, BEFkm,I,x,y, PEFkm,i,x,y, etc and add tables for all the parameters.				
Methodology developer response				**Date :** DD/MM/YYYY
1. On page 21, last table description "trial period z" needed to be corrected to "trial period y". We have made the correction in new attached document. 2. I do not see any data regarding "SFCBL,i,x,y/SFCPJ,i,x,y". If we have sent them in any other document, it needs to be put in two separate tables. There is table for SFCBL,i,x,y/SFCPJ,i,x,y on page 23. But still, we made two separate table for two entities. 3. This has been corrected.				
Documentation provided by Methodology developer				
VVB assessment				**Date:** 19/07/2023
1. The VVB can confirm that under section 9.2 of the Methodology document, in the table, the parameter description has been updated. The trial period is now denoted to y, which is the correct denotation for the parameter. Hence, the finding is closed. 2. The VVB can confirm that under section 9.2 of the Methodology document, in the table, the parameters "SFCBL,i,x,y/SFCPJ,i,x,y" have been separately mentioned in two different tables. The correction made is found to be appropriate and complete. Hence, the finding is closed. 3. The VVB can confirm the Methodology developer has now included all the parameters under section 9.2 of the Methodology document titled "Data and Parameters Monitored" that are mentioned under section 8 "Quantification of GHG Emission Reductions and Removals" of the Methodology document. The updated information is found to be exact and complete. Hence, the finding is closed. CAR#02 is closed.				

CAR ID	03	Section no.	9.2	Date : 02/11/2022
Description of CAR				
As per para 4.4.2 of Methodology Approval Process "The developer shall take due account of such comments, which means it will need to either update the methodology or demonstrate the insignificance or irrelevance of the comment. It shall demonstrate to the validation/verification body what action it has taken." However, the information on the stakeholder comments and its resolution was not made available to the VVB				
Methodology developer response				**Date :** DD/MM/YYYY
We have the document and it will be sent with the latest updates of this file and the methodology. Aug 24 2023				
Documentation provided by Methodology developer				
VVB assessment				**Date:** 31/08/2023
The document shared by the methodology developer includes the comments that were received during the public stakeholder consultation. However, it does not include the response to these comments. As per para 3.4.2 of the Methodology Development and Review Process v4.3 state that "*At the end of the public comment period, Verra consolidates the comments and provides them to the developer. The developer shall take due account of such comments, which means it shall either update the methodology to address the comment, provide clarification, or demonstrate the insignificance or irrelevance of the comments. The developer shall include responses to all consolidated comments and submit them for validation/verification body assessment alongside the methodology documentation*" Methodology developer is requested to kindly provide their responses to the stakeholder comments for the VVB to assess. The finding remains open.				
Methodology developer response				**Date :** DD/MM/YYYY
Our responses to the comments have been added.				
Documentation provided by Methodology developer				
VVB assessment				**Date:** 01/10/2023
The methodology developer has now shared the complete document which now includes their responses to the stakeholder comments that were received during the public stakeholder consultation. This is in accordance with Methodology Development and Review Process v4.3 document. The responses were reviewed by the validation team and found to be satisfactorily addressed and therefore, the information is appropriate and complete. Hence, the finding is closed. CAR#03 is closed.				