CLEAN DEVELOPMENT MECHANISM

CDM-MP89-A03

Draft Small-scale methodology

SSC-III.xx: Hydrogen fuel cell vehicles

Version 02.0

Sectoral scope(s): 07

DRAFT

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. A request for the new methodology "SSC-NM0107: Hydrogen fuel cell logistics truck project in Foshan City", was submitted by Climate Bridge (Shanghai) Ltd in December 2021.

2. Purpose

2. The proposal is for a new methodology applicable to project activities that aim to introduce hydrogen fuel cell vehicles replacing baseline fossil-fuel, electric or hybrid vehicles with the equivalent capacity of hydrogen fuel cell vehicles.

3. Key issues and proposed solutions

3. The proposed draft methodology is applicable to project activities that introduce hydrogen fuel cell vehicles for passenger and freight transportation. The methodology is applicable only to fleet vehicles such as buses, commuter vans, taxis for public transport and trucks for freight transport, waste collection or food delivery.

4. The hydrogen consumed by project vehicles shall be: (i) green hydrogen produced via the electrolysis of water using renewable electricity; or, (ii) hydrogen produced by electrolysis of water using grid electricity; or (iii) by-product hydrogen that was flared or vented in the absence of the project activity.

5. The use of by-product hydrogen in the project scenario is capped to the maximum quantity of the by-product hydrogen that was flared or vented over last three years prior to the start of the project activity.

6. The project activity shall provide the same level of service provided on comparable routes by the baseline vehicles.

3.1. Comments by the Board at its 115th meeting

7. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board) provided the following comments at its 115th meeting and requested the Methodologies Panel (MP) to further work on the draft revised methodology.

8. The Board raised concerns regarding the use of renewable energy from existing renewable energy plants to produce hydrogen. This may result in competing use of renewable electricity, leading to the existing users to shift to other options such as fossil fuel-based electricity to meet their demand. The methodology now requires the use of a dedicated greenfield renewable energy source that is built together with the hydrogen production facility (see paragraph 8 (a) of the draft methodology).

9. The Board observed that the approach as provided under TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation to estimate project emissions due to use of grid electricity may be more

appropriate to apply in the methodology. The concerned equations 10 and 11 (see paragraph 29 and 30 of the draft methodology) and data / parameter 11 (see section 6 Monitoring Methodology) were corrected to reflect that the project participant shall use an approach referred in TOOL05 to calculate project emissions due to the use of electricity, which is consistent with other methodologies.

10. Hydrogen transportation could be a significant emission source, and in that context, the Board requested the MP to review the condition to waive project emissions due to hydrogen transportation for distances less than 200 kilometers. In the latest draft, project emissions from transportation irrespective of the distance are included. Further, project emissions due to electricity consumption to operatge pipelines for hydrogen transportation to the hydrogen charging / fuel stations (see to section 5.5.3 of the draft methodology) are also included.

11. The Board requested the MP to analyse whether to consider emissions due to fugitive leakage of hydrogen. The MP made the following observations: (i) There is a lack of commercially available sensors that can detect hydrogen emissions at levels below the threshold for hydrogen flammability which would be needed for proper leakage quantification[1] and only limited research available on the global warming potential (GWP) of hydrogen which itself may be indirect; (ii) Hydrogen is not listed as one of the greenhouse gases under Kyoto Protocol; and (iii) At various points in time GWP numbers as provided by the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report and/or from the Fifth Assessment Report have been generally used under the CDM. A cursory review of the IPCC's assessment reports by the MP did not reveal a discussion on the GWP of hydrogen.

4. Impacts

12. The draft methodology if approved will be the first methodology that will allow for the development of CDM projects using hydrogen fuel cell technology for transport purposes; such projects have strong relevance for reducing GHG emissions in this sector.

5. Subsequent work and timelines

13. The draft version of the methodology is recommended by the MP for consideration by the Board at its 116th meeting. No further work is envisaged.

6. Recommendations to the Board

14. The MP recommends that the Board adopt this new methodology, to be made effective at the time of the Board's approval.

[1] Ocko and Hamburg, "Climate consequences of hydrogen emissions, 2022

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1. Introduction

1. The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical project(s)	Operation of hydrogen fuel cell vehicles for providing transportation services
Type of GHG emissions mitigation action	Fuel switch: • Displacement of more GHG-intensive vehicles

2. Scope, applicability and entry into force

2.1. Scope

2. This methodology applies to project activities introducing hydrogen fuel cell vehicles for passenger and freight transportation.

2.2. Applicability

3. Only fleet vehicles are eligible under this methodology. The category of fleet vehicles covered by the methodology include, but are not limited to:

(a) Buses, commuter vans or taxis used for public transport;

(b) Trucks for freight transport, food delivery or waste collection.

4. For replacement of existing baseline vehicles, the project participants shall demonstrate that the project activity vehicles would have provided the same level of service on comparable routes in the baseline scenario. The project participants shall demonstrate that the project and baseline vehicles are comparable using the following means:

(a) Project and baseline vehicles belong to the same vehicle category;

(b) The frequency of operations is not decreased by the project activity; the characteristics of the travel route such as distance, start and end points and the route itself are sufficient to service the level of passenger/freight transport previously provided;

(c) Project and baseline vehicle categories have comparable passenger or load-carrying capacity with a variation of no more than 20 per cent.

5. The baseline category of the fleet vehicles to be replaced can be classified per fuel used for their operation, including but not limited to:

(a) Fossil fuel-based vehicles;

(b) Electric vehicles;

(c) Hybrid vehicles with electrical and internal combustion motive systems.

6. The methodology does not cover baseline scenario where baseline electric vehicles are charged using renewable electricity as there will be no baseline emissions in such cases.

7. The project participant shall demonstrate that double-counting of emission reductions will not occur, e.g. via a contractual agreement with hydrogen fuel cell vehicle manufacturer(s), hydrogen fuel cell vehicle owner(s), hydrogen fueling station(s), hydrogen producer(s) and/or renewable energy power plant(s). The project participants shall maintain a comprehensive inventory of project vehicles, including the unique identification of the vehicles. The steps undertaken to avoid double-counting shall be documented in the project design document.

8. Hydrogen consumed by project vehicles shall be one of the following:

   (a) Green hydrogen produced by electrolysis of water using renewable electricity, where the renewable electricity would not have been generated in the baseline scenario, i.e. a dedicated greenfield renewable energy generation plant is built together with the hydrogen production facility to supply electricity to the hydrogen production facility;

   (b) Hydrogen produced by electrolysis of water using grid electricity;

   (c) By-product hydrogen that was generated by by-product hydrogen facilities (e.g. chlor-alkali plant), which would have been flared or vented in the absence of the project activity. Historical measurements of hydrogen flared or vented from the facility which produces by-product hydrogen shall be used to demonstrate that this condition is met.

9. Where by-product hydrogen is used, the quantity of hydrogen permitted for crediting under the project is capped at the quantity of by-product hydrogen that was flared or vented by the by-product hydrogen production facility in the baseline over last three years prior to the start of the project activity.

2.3. Entry into force

10. The date of entry into force is the date of the publication of the EB XX meeting report on dd Month YYYY.

2.4. Applicability of sectoral scopes

11. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, the application of sectoral scope 07 is mandatory.

3. Normative references

12. This methodology is based on the proposed small-scale methodology “SSC-NM107: Emission reduction by hydrogen fuel cell vehicles” submitted by Climate Bridge (Shanghai) Ltd.

13. Project participants shall apply the "General guidelines for SSC CDM methodologies” and the “TOOL21 Demonstration of additionality of small-scale project activities” (hereinafter referred to as TOOL21) mutatis mutandis.

14. This methodology refers to the latest approved versions of the following methodology and tools:

    (a) "ACM0002: Grid-connected electricity generation from renewable sources" (hereinafter referred to as ACM0002);

    (b) "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (hereinafter referred to as TOOL05);

    (c) "TOOL12: Project and leakage emissions from transportation of freight" (hereinafter referred to as TOOL12);

    (d) "TOOL19: Demonstration of additionality of microscale project activities" (hereinafter referred to as TOOL19).

4. Definitions

15. The definitions contained in the Glossary of CDM terms shall apply.

16. The following definitions shall apply:

    (a) **By-product hydrogen production facility** – a facility which produces hydrogen as a by-product (e.g. chlor-alkali plants) that is used in the project activity;

    (b) **Electric vehicles** – a category of vehicles that is only powered by a battery that is charged externally using an electric plug;

    (c) **Fleet vehicles** – vehicles that are dedicated to transporting passengers or freight by a specific operator, such as logistic vehicles operated by a courier company or public transport buses operated by a transport company;

    (d) **Fossil fuel-based vehicles** – vehicles that use petroleum-based fuels such as petrol, diesel, compressed natural gas or liquified petroleum gas as a fuel for their internal combustion engine;

    (e) **Green hydrogen** – an energy carrier that is produced by renewable energy-powered electrolysis of water;

    (f) **Hydrogen fuel cell vehicles**[2] – a category of vehicles that uses a propulsion system similar to that of electric vehicles, where energy stored as hydrogen is converted into electricity by a fuel cell;

    (g) **Hydrogen production facility** – a facility that produces hydrogen through electrolysis of water using either electricity from a renewable energy source or from a grid;

    (h) **Hybrid vehicles** – a category of vehicles that combines an internal combustion engine and one or more electric motors. The vehicles may or may not have a facility for charging externally using an electric plug.

[2] Also known as fuel cell electric vehicles (FCEV).

5. Baseline methodology

5.1. Project boundary

17. The project boundary includes:

    (a) The hydrogen fuel cell vehicles that are introduced under the project activity (i.e. project vehicles);

    (b) The geographic boundaries in which the project vehicles are operated;

    (c) The hydrogen production facility, including the facilities where hydrogen is produced as a by-product or flared in absence of the project activity;

    (d) A dedicated greenfield renewable energy-based power plant(s) that supply(ies) renewable electricity to the hydrogen production facility for green hydrogen production;

    (e) The grid-connected power plants supplying electricity to the hydrogen production facility and to the charging station, including the hydrogen storage facility;

    (f) Auxiliary facilities, such as hydrogen fueling stations, that are used by the project vehicles.

5.2. Baseline

18. The baseline scenario is the operation of the comparable vehicles (the comparability of baseline and project vehicles to be demonstrated as per paragraph 4 above) that would have been used to provide the same transportation service.

19. In the case of application of hydrogen fuel cell vehicles to new route(s), the comparable vehicles refer to the category of vehicles that are used for the same transportation service in the applicable geographical region.

5.3. Additionality

20. For the specific case of this methodology, additionality is demonstrated using one of the options below:

5.3.1. Option 1

21. Demonstrate that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in TOOL21. The barrier(s) can be demonstrated for buyers/users and/or charging service providers for the hydrogen fuel cell vehicles even if the manufacturer or retailer of the hydrogen fuel cell vehicles is implementing the project.

5.3.2. Option 2

22. Demonstrate ex-ante that the market penetration of project hydrogen fuel cell vehicles is equal to or smaller than 2.5 per cent of annual sales of the vehicles of the same category (e.g. if project vehicles are hydrogen fuel cell buses, market penetration of hydrogen fuel cell buses is equal to or smaller than 2.5 per cent of all motorized buses, irrespective of the manufacturer) in the applicable geographical region. To determine the penetration of

hydrogen fuel cell vehicles, the "Appendix: Determination of penetration of proposed technology/measure" of TOOL19 shall be followed.

5.4. Baseline emissions

23. Baseline emissions should be calculated based on the unit of service provided by the project vehicles (distance travelled by the project vehicles) times the emission factor for the baseline vehicle to provide the same unit of service as per following equations:

$$BE_y = BE_{y,FF} + BE_{y,E} + BE_{y,H} \quad \text{Equation (1)}$$

Where:

$BE_{y,FF}$	=	Baseline emissions due to the operation of fossil fuel-based vehicles in year *y* (t CO_2)
$BE_{y,E}$	=	Baseline emissions due to the operation of electric vehicles in year *y* (t CO_2)
$BE_{y,H}$	=	Baseline emissions due to the operation of hybrid vehicles in year *y* (t CO_2)

24. The baseline emissions are calculated separately for each baseline vehicle category *i* depending on the fuel they used for their operation:

(a) In cases of fossil fuel-based vehicles:

$$BE_{y,FF} = \sum_{i,j} EF_{BL,km,i,j} \times TD_{i,j,y} \times 10^{-6} \quad \text{Equation (2)}$$

Where:

$EF_{BL,km,i,j}$	=	Emission factor for baseline vehicle category *i* consuming fossil fuel type *j* (g CO_2/km)
$TD_{i,j,y}$	=	Annual total distance travelled by project vehicles of category *i* that replaced vehicles consuming fossil fuel type *j* in the year *y* (km)

(b) In cases of electric vehicles:

$$BE_{y,EV} = \sum_{i} EF_{BL,km,i,EV} \times TD_{i,EV,y} \times 10^{-6} \quad \text{Equation (3)}$$

Where:

$EF_{BL,km,i,EV}$	=	Emission factor for baseline vehicle category *i* consuming electricity (g CO_2/km)
$TD_{i,EV,y}$	=	Annual total distance travelled by project vehicles of category *i* that replaced electric vehicles in the year *y* (km)

(c) In cases of hybrid vehicles:

$$BE_{y,H} = \sum_{i} EF_{BL,km,i,H} \times TD_{i,H,y} \times 10^{-6}$$ Equation (4)

Where:

$EF_{BL,km,i,H}$	=	Emission factor for baseline vehicle category *i* consuming electricity and /or fossil-fuel in hybrid mode (g CO_2/km)
$TD_{i,H,y}$	=	Annual total distance travelled by project vehicles of category *i* that replaced hybrid vehicles in the year *y* (km)

25. The emission factor for baseline vehicle category *i* shall be determined ex ante as follows:

(a) In cases of fossil fuel-based vehicles:

$$EF_{BL,km,i,j} = \sum \left(SFC_{i,j} \times NCV_{i,j} \times EF_{i,j}\right) \times IR^{t}$$ Equation (5)

Where:

$SFC_{i,j}$	=	Specific fuel consumption of baseline vehicle category *i* consuming fossil fuel type *j* (g/km)
$NCV_{i,j}$	=	Net calorific value of fossil fuel type *j* consumed by baseline vehicle category *i* (J/g)
$EF_{i,j}$	=	Emission factor of fossil fuel type *j* consumed by baseline vehicle category *i* (g CO_2/J)
IR^{t}	=	Technology improvement factor for baseline vehicle in year *t*
t	=	Year counter for the annual improvement (dependent on age of data per vehicle category)

(b) In cases of electric vehicles:

$$EF_{BL,km,i,EV} = \sum \left(SEC_{i,EV} \times EF_{CO2,ELEC,i}\right) \times IR^{t}$$ Equation (6)

$SEC_{i,EV}$	=	Specific electricity consumption of baseline vehicle category *i* consuming electricity (kWh/km)
$EF_{CO2,ELEC,i}$	=	Emission factor of electricity consumed by baseline vehicle category *i* (g CO_2/kWh)

(c) In cases of hybrid vehicles:

$$EF_{BL,km,i,H} = \sum \left[\left(SFC_{i,j} \times NCV_{i,j} \times EF_{i,j}\right) + \left(SEC_{i,EV} \times EF_{CO2,ELEC,i}\right)\right] \times IR^{t}$$ Equation (7)

26. The specific fuel consumption of baseline vehicle category *i* consuming fossil-fuel type *j* ($SFC_{i,j}$) and specific electricity consumption of baseline vehicle category *i* consuming electricity ($SEC_{i,EV}$) shall be determined as per the monitoring methodology section below.

5.5. Project emissions

27. Project emissions shall be calculated as follows.

$$PE_y = PE_{elec,y} + PE_{RE,y} + PE_{trans,y} \quad \text{Equation (8)}$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2)
$PE_{elec,y}$	=	Project emissions due electricity consumption in year *y* (t CO_2)
$PE_{RE,y}$	=	Project emissions due to operation of renewable energy plants supplying electricity to the hydrogen production facility (t CO_2)
$PE_{trans,y}$	=	Project emissions due to transportation and storage of hydrogen to be used in the project activity in year *y* (t CO_2)

5.5.1. Project emissions due to electricity consumption

28. Project emissions due to grid electricity consumption for hydrogen production and electricity consumption by the storage facility of hydrogen at the charging/fuel stations are calculated as follows:

$$PE_{elec,y} = PE_{p,y} + PE_{cs,y} \quad \text{Equation (9)}$$

Where:

$PE_{p,y}$	=	Project emissions due to grid electricity consumption for hydrogen production in year *y* (t CO_2)
$PE_{cs,y}$	=	Project emissions due to electricity consumption for compression and storage of hydrogen at the hydrogen production, charging/fuel stations in year *y* (t CO_2)

5.5.1.1. Project emissions due to grid electricity consumption for hydrogen production

29. The project emissions due to hydrogen production are calculated as follows:

$$PE_{p,y} = EC_{H2,p,y} \times EF_{grid,y} \quad \text{Equation (10)}$$

Where:

$EC_{H2,p,y}$	=	Electricity consumption by the green hydrogen production facility in year *y* (MWh)
$EF_{grid,y}$	=	Grid electricity emission factor in year *y* (t CO_2/MWh) determined as per TOOL05

5.5.1.2. Project emissions due to electricity consumption for hydrogen compression and storage

30. The project emissions due to electricity consumption by the hydrogen compression and storage at the hydrogen charging/fuel stations are calculated as follows:

$$PE_{cs,y} = EC_{H2,cs,y} \times EF_y \quad \text{Equation (11)}$$

Where:

$EC_{H2,cs,y}$ = Electricity consumption by the hydrogen compression and storage at the hydrogen charging / fuel stations in year *y* (MWh)

EF_y = Electricity emission factor in year *y* (t CO_2/MWh) determined as per TOOL05

31. In case the storage facility uses renewable electricity, the project emissions due to electricity consumption at the storage facility are considered as zero.

5.5.2. Project emissions due to the operation of renewable energy plants

32. In the case of a dedicated renewable energy supply from a renewable source such as a geothermal power plant and/or hydroelectric power plant, project emissions shall include emissions due to the operation of these plants. The project emissions shall be calculated as per the requirements provided under ACM0002.

5.5.3. Project emissions due to transportation of hydrogen

33. Project emissions due to road and pipeline transportation of green hydrogen shall be calculated as follows:

$$PE_{transport,y} = PE_{road,y} + PE_{pipeline,y} \quad \text{Equation (12)}$$

Where:

$PE_{transport,y}$ = Project emissions due to transportation of hydrogen (tCO_2)

$PE_{road,y}$ = Project emissions due to road transportation of hydrogen (tCO_2)

$PE_{pipeline,y}$ = Project emissions due to transportation of hydrogen via pipelines (tCO_2)

34. In case the hydrogen is transported via road, the project emissions shall be calculated as per the requirements provided under TOOL12.

35. In case the hydrogen is transported using pipelines, project emissions due to operation of pipelines to transport the hydrogen to the hydrogen charging / fuel stations should be calculated as follows.

$$PE_{pipeline,y} = EC_{H2,pipeline,y} \times EF_y \quad \text{Equation (13)}$$

Where:

$EC_{H2,pipeline,y}$ = Electricity consumption for operating pipelines that transport the hydrogen to the hydrogen charging/fuel stations in year *y* (MWh)

EF_y = Electricity emission factor in year *y* (t CO_2/MWh) determined as per TOOL05

5.6. Leakage

36. No leakage is considered under this methodology.

5.7. Data and parameters not monitored

37. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / Parameter table 1.

Data / Parameter:	***$EF_{BL,km,i,j}$* or *$EF_{BL,km,i,EV}$* or *$EF_{BL,km,i,H}$***
Data unit:	g CO_2/km
Description:	*$EF_{BL,km,i,j}$:* Emission factor for baseline vehicle category *i* consuming fossil fuel type *j* *$EF_{BL,km,i,EV}$:* Emission factor for baseline vehicle category *i* consuming electricity *$EF_{BL,km,i,H}$:* Emission factor for baseline vehicle category *i* consuming electricity and /or fossil-fuel in hybrid mode
Source of data:	Determined as per paragraph 2524(c)
Any comment:	Fixed ex-ante at the time of validation and updated once for every subsequent crediting period

Data / Parameter table 2.

Data / Parameter:	***$SFC_{i,j}$***
Data unit:	g/km
Description:	Specific fuel consumption of baseline vehicle category *i* consuming fossil fuel type *j*
Source of data:	(a) Option A: The most recent operational data of the vehicles under baseline operational conditions. The average of at least one year of operational data of the vehicle(s) under baseline operating conditions; or (b) Option B: Manufacturer's specification of the top 20 per cent of comparable vehicles operated for passenger/freight transportation in the project region; or (c) Option C: Most recent[3] publicly available statistics, such as host country statistics or reports (released by transportation department or other authorities), relevant industry association reports or peer-reviewed literature, values in relevant national standards, Intergovernmental Panel on Climate Change (IPCC), or other international data
Any comment:	-

[3] Data that was published no more than three years before the start of the validation of the project activity.

Data / Parameter table 3.

Data / Parameter:	$NCV_{i,j}$
Data unit:	J/g
Description:	Net calorific value of fossil fuel type *j* consumed by baseline vehicle category *i*
Source of data:	The following data sources' latest available data may be used, in order of priority: (a) Values provided by the fuel supplier; (b) Regional or national default values; (c) IPCC default values at the upper limits of the 95 per cent confidence intervals as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	$EF_{i,j}$
Data unit:	g CO_2/J
Description:	Emission factor of fossil fuel type *j* consumed by baseline vehicle category *i*
Source of data:	The following data sources' latest available data may be used, in order of priority: (a) Values provided by the fuel supplier; (b) Regional or national default values; (c) IPCC default values at the upper limits of the 95 per cent confidence intervals as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Any comment:	The case of baseline vehicles using fossil fuel blended with bio-diesel, the emission factor of the fossil fuel shall be a weighted average taking care of blending per centage of bio-diesel with the fossil fuel.

Data / Parameter table 5.

Data / Parameter:	$SEC_{i,EV}$
Data unit:	kWh/km
Description:	Specific electricity consumption of baseline vehicle category *i* consuming electricity

Source of data:	(a) Option A: The most recent operational data of the vehicles under baseline operational conditions. The average of at least one year of operational data of the vehicle(s) under baseline operating conditions; or (b) Option B: Manufacturer's specification of the top 20 per cent of comparable vehicles operated for passenger/freight transportation in the project region; or (c) Option C: Most recent[4] publicly available statistics, such as host country statistics or reports (released by transportation department or other authorities), relevant industry association reports or peer-reviewed literature values in relevant national standards, IPCC, or other international data
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	$EF_{CO2,ELEC,i}$
Data unit:	g CO_2/kWh
Description:	Emission factor of electricity consumed by baseline vehicle category *i*
Source of data:	Emission factor of electricity consumed by baseline vehicle is determined using one of the following options: (a) If the electricity for charging the baseline vehicle is supplied by renewable power plant, the emission factor is 0; (b) If grid electricity is used, the emission factor can be calculated as per requirements under TOOL05
Any comment:	-

Data / Parameter table 7.

Data / Parameter:	IR^t
Data unit:	-
Description:	Technology improvement factor for baseline vehicle in year *t*
Source of data:	The improvement rate is applied to each calendar year. The default value of the technology improvement factor for all baseline vehicle categories is 0.99
Any comment:	-

Data / Parameter table 8.

Data / Parameter:	**By-product hydrogen vented or flared in the baseline scenario**
Data unit:	Volume or mass unit
Description:	Maximum value of the by-product hydrogen that was vented or flared in the baseline scenario

[4] Data that was published no more than three years before the start of the validation of the project activity.

Source of data:	Historical measurements from the by-product hydrogen production facility
Any comment:	The value is fixed at the time of validation and is based on the last three years of value prior to the start of the project activity. The quantity of the by-product hydrogen that will be used in the project scenario shall not be more than this value

6. Monitoring methodology

38. Relevant parameters shall be monitored and recorded during the crediting period as indicated in the section below. The applicable requirements specified in the "General guidelines for SSC CDM methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be followed by the project participants.

6.1. Data and parameters monitored

Data / Parameter table 9.

Data / Parameter:	**By-product hydrogen used in the project scenario**
Data unit:	Volume or mass unit
Description:	The by-product hydrogen that is used in the project vehicles
Source of data:	Measurements from the hydrogen charging station
Measurement procedures (if any):	Measured using a flow meter
Monitoring frequency:	Continuous monitoring and at least monthly recording
QA/QC procedures:	Cross checked with the quantity of the by-product hydrogen that was purchased from the project industrial facility
Any comment:	The quantity of the by-product hydrogen that will be used in the project scenario shall not be more than this value

Data / Parameter table 10.

Data / Parameter:	$TD_{i,j,y}$ **or** $TD_{i,EV,y}$ **or** $TD_{i,H,y}$
Data unit:	km
Description:	$TD_{i,j,y}$ – Annual total distance travelled by project vehicles of category *i* that replaced vehicles consuming fossil fuel type *j* in the year *y* $TD_{i,EV,y}$ – Annual total distance travelled by project vehicles of category *i* that replaced electric vehicles in the year *y* $TD_{i,hybrid,y}$ – Annual total distance travelled by project vehicles of category *i* that replaced hybrid vehicles in the year *y*
Source of data:	Measurement
Measurement procedures (if any):	Monitor travel distance of every vehicle through vehicle odometer or any other appropriate sources (e.g. on-line sources)
Monitoring frequency:	Continuous monitoring and at least monthly recording
QA/QC procedures:	Cross-checked with GPS data if available
Any comment:	-

Data / Parameter table 11.

Data / Parameter:	$EF_{grid,y}$ **or** EF_y
Data unit:	t CO_2/MWh
Description:	$EF_{grid,y}$ – Grid electricity emission factor in year y EF_y – Electricity emission factor in year y
Source of data:	Determined as per requirements of TOOL05
Measurement procedures (if any):	As per requirements under TOOL05
Monitoring frequency:	As per requirements under TOOL05
QA/QC procedures:	As per requirements under TOOL05
Any comment:	-

Data / Parameter table 12.

Data / Parameter:	$EC_{H2,p,y}$
Data unit:	MWh
Description:	Electricity consumption by the hydrogen production facility in year *y*
Source of data:	Measurement
Measurement procedures (if any):	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
Monitoring frequency:	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
QA/QC procedures:	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
Any comment:	-

Data / Parameter table 13.

Data / Parameter:	$EC_{H2,cs,y}$
Data unit:	MWh
Description:	Electricity consumption by the hydrogen compression and storage facility at the hydrogen charging / fuel stations in year *y*
Source of data:	Measurement
Measurement procedures (if any):	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
Monitoring frequency:	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
QA/QC procedures:	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
Any comment:	-

Data / Parameter table 14.

Data / Parameter:	$EC_{H2,pipeline,y}$
Data unit:	MWh
Description:	Electricity consumption by the pipelines that transport the hydrogen to the hydrogen charging / fuel stations in year *y*
Source of data:	Measurement

Measurement procedures (if any):	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
Monitoring frequency:	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
QA/QC procedures:	As per requirements under TOOL05 for parameter $EC_{PJ,j,y}$
Any comment:	-

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Document information

Version	*Date*	*Description*
02.0	11 October 2022	MP 89, Annex 3 To be considered by the Board at EB 116. This version takes into account the comments from the Board at EB 115 meeting (EB115 meeting report, para.39).
01.0	13 July 2022	MP 88, Annex 5 To be considered by the Board at EB 115.

Decision Class: Regulatory
Document Type: Standard
Business Function: Methodology
Keywords: Hydrogen fuel cell vehicles