المجلس العالمي للبصمة الكربونية
GLOBAL CARBON COUNCIL

Methodology for Renewable Energy Generation Projects Supplying Electricity to Grid or Captive Consumers

GCCM001

V4.0 - 2022

CONTENTS

1. Baseline and Monitoring Methodologies of GCC

1. Global Carbon Council (GCC) is MENA region's first and only voluntary carbon offsetting program that aims to contribute to a vision of sustainable and low carbon economy of the region and help to catalyse climate actions on the ground. Refer www.globalcarboncouncil.com for details.

2. GCC methodologies facilitate the project owners of eligible greenhouse gas (GHG) reduction projects to calculate emission reduction of their projects, monitor the emission reductions, and develop the project submission in accordance with the methodologies.

3. This methodology for renewable power generation projects, which either supply power to the connected grid or to recipient captive user for captive consumption (here onwards referred to as "the project activity") facilitates the projects that displace the electricity which would be provided to the grid by a more emission-intensive mix of power sources, than that established under project activity. The power generated from Renewable sources can be either directly sold to the grid or used for captive consumption or can be stored in a Battery storage solution (BESS) attached to renewable energy generation plant and then delivered to the grid or used for captive consumption.

2. Source/s of this Baseline and Monitoring Methodology

4. For the development of GCC methodologies, the requirements of the 'GCC Program Manual' (paragraphs 43-46) and 'Standard for Development of Methodologies' are applied. The determination of baseline scenario and baseline emissions are consistent with UNFCCC's Clean Development Mechanism (CDM) guideline "Guideline for determining baseline for measure/s" (Baseline Guideline) referred in the above standard.

5. This methodology is based on the following baseline and monitoring methodologies of CDM.

   - ACM0002: Grid connected electricity generation from renewable sources; and
   - AMS-I-D: Grid connected renewable electricity generation.
   - AMS I F: Renewable energy generation for Captive use and mini-grid

6. This methodology also refers to the latest approved versions of the following tools and guidelines of CDM:

   (a) "Tool to calculate the emission factor for an electricity system"

   (b) "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation";

   (c) "Tool for Demonstration and Assessment of Additionality"

7. This methodology is developed by GCC in collaboration with Qatar General Electricity & Water Corporation (KAHRAMAA).

3. Description of Key Terms

8. The following description of key terms apply to the projects using this methodology:

Sr. No.	Key Term	Description
1	Utility scale power plant (USPP)	USPPs are those power plants which are implemented only for the purpose of producing electricity (using renewable energy types applicable in this methodology) and supplying it to regional or national electricity grid, with or without use of electricity for any domestic, commercial or industrial captive purposes. The power plant can be comprised of multiple power units based on single site or multiple sites. The example of USPP is a large-scale solar PV plant connected to grid.
2	Distributed Power Plants (DPPs)	DPPs are those distributed type of power plants which are implemented only for the purpose of producing electricity (using renewable energy types applicable in this methodology) and supplying it to the regional or national electricity grid, with or without the use of electricity for any domestic,commercial, or industrial captive purposes. The DPPs may be comprisedof multiple power units, at one or single site or distributed in multiple sites with a maximum capacity of an individual unit of 100 kW[1]. An example of DPPs is residential rooftop solar PVs, which supply electricity to the grid in addition to meeting the domestic electricity demand.
3	Installed capacity or nameplate capacity	The installed or nameplate capacity of a power unit is the capacity of power generation, expressed in Kilowatts or one of its multiples, for which the power unit has been designed to operate at nominal conditions. The installed capacity of USPP or DPPs is the sum of the installed capacities of its power units.
4	BESS	Battery storage, or battery energy storage systems (BESS), are devices that enable energy from renewables, like solar and wind, to be stored and then released as per grid availability or when customers need power most. BESS qualifying under this methodology should be located near the RE based USPP or DPPs.
5	Recipient captive user	The existing user of electricity, other than the grid, which receives electricity from renewable energy project activity and demonstrates that it is connected to the grid with or without project activity

[1] Refer 25(a) of in section 3.2 of 'Standard for Development of Methodologies'.at Standard for Development of Methodologies V3 (globalcarboncouncil.com)

4. Applicable Project Activities and their Eligibility Conditions

9. The project activities eligible under this methodology aim to build and operate a new USPP or new DPPs, which are subject to the following eligibility conditions:

   (a) The renewable energy generation projects shall supply electricity to user(s), either grid or a specific identified user[2]. The project activity will displace electricity from an electricity distribution system that is or would have been supplied by from a national or a regional grid (grid hereafter); the following renewable energy generation technologies qualify under this methodology:

      (i) Solar Photovoltaic;

      (ii) On-shore or Off-shore Wind;

      (iii) Tidal;

      (iv) Wave.

   (b) The project activities can also involve setting up and implementation of a BESS along with the renewable energy generation plant.

   (c) The project activity wherein a BESS has been deployed, can either be a greenfield installation wherein the BESS had been conceptualized along with the renewable energy generation unit or may be retrofitted into an existing setup of a renewable energy project, whether or not registered with GCC.

   (d) In case the Project Owners want to claim carbon credits due to the retrofit of BESS into an existing renewable energy generation unit, they would need to demonstrate that historically the renewable energy unit was subject to curtailed output due to low grid stability or capacity limitation[3] in the grid infrastructure for handling the increased generation. This must be through evidence of the existence of technical andregulatory/commercial constraints

   (e) The project activities shall not involve combined heat and power (co-generation) systems.

   (f) The project activities shall not involve co-firing of fossil fuel of any kind.

   (g) The project activities may have consumption of electricity (grid on on-site generation) for site offices.

   (h) DPPs that supply electricity also for domestic, commercial, or industrial captive purposes either wholly or in addition to supply to grid, shall demonstrate that grid connection was available on the site before the implementation of project activity.

   (i) Under no condition would the battery storage system (BESS) be charged from the grid except in case of emergency situations like deep discharge or exceptional

[2] The methodology does not apply if the electricity is supplied by the project plant to captive recipient via grid wheelingor banking mechanism.

[3] BESS helps storing the excess energy that can be supplied at other period of time when the grid is capable to absorb the excess renewable energy without facing infrastructure constraint or grid instability issues.

operational situations due to requirements from regulatory authorities in order to safeguard the safety and operational integrity of the connected grid system. In such exceptional cases, the corresponding GHG emissions shall be accounted as project emissions. The charging using the grid or using fossil fuel-based electricity generators should not amount to more than 2 percent of the electricity generated by the project's renewable energy plant during a monitoring period[4]. In cases, where the project BESS consumes more than 2 percent of the electricity for charging the Project Owner/s shall not be entitled to the issuance of the emission reductions for the corresponding monitoring period. BESS which consumes grid power or fossil fuel-based captive power for auxiliary load associated with BESS setup and employs cooling and/or fire suppression systems based on refrigerants or clean agents with the global warming potential (e.g. Hydrofluorocarbon (HFC) or Chlorofluorocarbon (CFC) are not included under this methodology.

5. Sectoral Scope Applicable to GCC verifier

10. The sectoral scopes eligible under GCC have been defined in section 3.2 of 'Standard for Development of Methodologies'.

11. Only a third-party verifier approved under GCC for the sectoral scope 1: Energy Industries (renewable/non-renewable sources) can conduct Project Verification or Emission Reduction Verification of GCC project that applies this methodology.

6. Project Boundary

12. The spatial extent of the project boundary includes the project power plant, BESS (where deployed), and all power plants connected physically to the electricity system that the GCC project power plant or distributed type power generation devices or the recipient captive users are physically connected to.

The GHGs included in or excluded from the project boundary are listed in Table 1

[4] The calculation of the 2 per cent limit for charging of the battery using the grid or using fossil fuel-based electricity generator shall exclude the time period/s during which the renewable energy plant is shut-down due to reasonably justifiable situations e.g. natural accidents, equipment failures, etc.

Table 1: Emission sources included in or excluded from the Project Boundary

Source		GHG	Included	Justification/explanation	Determination of Emissions
Baseline	CO_2 emissions from electricity generation in fossil fuel-fired power plants are displaced due tothe project activity	CO_2	Yes	The major source of emissions in the baseline	CDM Tool: "Tool to calculate the emission factor for an electricity system"
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small	-
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small	-
	Co2 emission from incremental electricity delivery to the grid by BESS installation in case of retrofit	CO_2	Yes	The major source of emissions in the baseline	CDM Tool: "Tool to calculate the emission factor for an electricity system"
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small	-
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small	-

Project Activity	Emissions from on-site electricity use in the project activity Or emergency charging of BESS (e.g. in case of deep discharge or exceptional operational situations due to requirements from regulatory authorities)	CO_2	Yes	May be an important emission source.	CDM Tool: "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and Monitoring of electricity generation"
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small	-
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small	-

7. Baseline Scenario

13. The rationale as per Baseline Guideline for determination of baseline scenario is that the electricity delivered to the grid by the project activity would be generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

14. Hypothetically it means that a power plant with emission factor equivalent to grid mix would have supplied electricity in absence of new project plant or added capacity. A grid emission factor is a reasonable benchmark that provides the proxy performance of the baseline power plant.

15. In case of deployment of a BESS along with the greenfield or existing renewable energy generation units, the baseline scenario is that the amount of electricity delivered to the grid or supplied to recipient captive user by power plant (including renewable energy generation unit/s and BESS) would have been generated by the grid connected power plants.

16. For retrofitting of BESS into existing renewable energy generation unit/s historical daily generation data for a period of 3 years prior to installation of the BESS solution should be available. If the renewable energy generation unit is not 3 years old, historical daily energy generation data for a period of at least 1 years should be available.

8. Additionality

8.1 Project Specific Additionality

17. Under the project-specific additionality approach, the additionality of GCC projects shall be determined by Project Owner using the CDM Tool: "Tool for Demonstration and Assessment of Additionality".

18. The Project Owner/s can demonstrate that the project activity qualifies as "automatically additional" following the latest applicable CDM Methodological tool: Positive list of technologies.

19. For project activities installing DPPs which fall under the micro-scale category of CDM, the GCC Project Standard requires Project Owners to demonstrate the additionality using "CDM Methodological tool: Demonstration of additionality of microscale project activities".

20. For the projects on installation of BESS deployment where the Project Owner choses the route of demonstration of financial additionality following guidelines apply. In cases wherein Project Owner has the flexibility of generation and charging/storage in BESS during off-peak period and generation / sale of power to the national grid during peak period and thus getting a favorable tariff, the highest tariff received by Project Owner for the additional electricity supplied due to BESS will be conservatively used in the cashflow for demonstration of economic attractiveness of the project. In case the objectively demonstratable estimate of additional quantity of electricity to be potentially supplied to the grid during peak period/s is available, the tariff/s of respective peak period/s can be applied only to the quantity of electricity that will be potentially supplied during the peak period. Rest of the electricity quantity, which would be supplied without BESS, shall be applied with the respective off-peak tariff/s. This shall be transparently presented in the investment analysis for demonstration of additionality.

21. For renewable energy power plant, with or without installation of BESS, and where the generated power is consumed by a related[5] recipient captive user that replaces grid power and is in the jurisdictions where differentiated time-of-the-day tariff is applied by grid authorities, the economic attractiveness of the project shall be demonstrated using the highest tariff at which the recipient captive user would have received power from the grid.

22. For renewable energy power plant, with or without installation of BESS, and where the generated power is consumed by an unrelated or third-party recipient captive user that replaces grid power, the economic attractiveness of the project shall be demonstrated using the higher tariff among that paid to project owner by captive user based on the power purchase agreement signed; and that would have been paid by grid authorities, based on publicly available tariff, had the power been supplied to the grid.

23. For renewable energy power plant, with or without installation of BESS, supplied power to both, the grid and recipient captive user, combination of above approaches shall be used appropriately for the demonstration of additionality.

9. Baseline Emissions

24. Baseline emissions are calculated using the guidance provided in Baseline Guidelines.

    Baseline emissions include only CO_2 emissions from electricity generation in power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-

[5] A related captive user means user is either the same company that generates renewable energy or belongs to the same group of companies.

connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

Case-1: For greenfield renewable energy generation project activities with or without BESS

$$BE_{y1} = EG_{PJ,y} \times EF_{grid,y} \qquad \textit{Equation (1)}$$

Case-2: For project activities where BESS is installed as retrofit to an existing renewable energy generation project activity

$$BE_{y2} = EG_{PJretrofit,y} \times EF_{grid,y} \qquad \textit{Equation (2)}$$

Where:

BE_y = Baseline emissions in year *y* (t CO_2)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid or supplied to recipient captive user replacing grid power as a result of the implementation of the GCC project activity in project year *y* in a greenfield project activity (MWh) or

$EG_{Pj,y,retrofit}$ = Incremental amount of net electricity generation that is produced due to installation of BESS and fed into the grid or supplied to recepient captive user that replaces grid power during year *y*(MWh)

$EF_{grid,y}$ = CO_2 emission factor for grid connected power generation in year *y* (t CO_2/MWh) determined as per one of the five options below:

(i) Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh) of the CDM;

Or

(ii) Latest available emission factor of the Grid in a country as approved by CDM standardized baseline

Or

(iii) Latest available emission factor of the Grid in a country as approved by its relevant National Authority or Designated National Authority (DNA) under CDM or UNFCCC focal point, in case DNA doesn't exist.

Or

(iv) Latest IFI combined margin emission factors published on UNFCCC website.[6]

Or

(v) Latest published Emission factor derived by International Energy Agency (IEA)[7] (This option can be used only if it is objectively demonstrated that options (i), (ii), (iii) and (iv) above are not available).

$$EG_{Pj,y,retrofit} = EG_{Pj,y} - EG_{historical,y} \quad \textit{Equation (3)}$$

Where:

$EG_{Pj,y}$ = Quantity of net electricity generation that is produced and fed into the grid or consumed captive thus replacing grid power as a result of the retrofit of BESS into the existing renewable energy generation unit in project year *y* (MWh)

$EG_{historical,y}$ = Annual average amount of electricity generation from the renewable energy generation unit in the 3 years prior to implementation of BESS project activity (MWh)
or
Annual average amount of electricity generation from the renewable energy generation unit in at least 1 year prior to implementation of BESS project activity, if the existing renewable energy generation unit is less than 3 years old (MWh)

[6] Harmonized IFI Default Grid Factors 2021 v3.1

[7] http://data.iea.org/payment/products/122-emissions-factors.aspx

25. The grid emission factor calculations shall be based on data from an official source (where available)[8] and made publicly available.

10. Project Emissions

26. For most renewable energy project activities, project emissions are equal to zero. However, CO_2 emissions from on-site consumption of electricity by project activity shall be calculated using the latest version of the CDM methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".

27. In addition to the parameters mentioned in the monitoring section of this methodology, the parameters referred in the tool above shall be monitored.

28. In case of use of Grid power for charging of BESS, in emergency situation (such as deep charging), the project emissions associated with consumption of grid power would be calculated using the latest version of the CDM methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".

11. Leakage Emissions

29. No leakage emissions are anticipated under this methodology.

12. Emission Reductions

30. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \qquad \textit{Equation (4)}$$

[8] For determining 'Combined margin CO_2 emission factor for grid connected power generation' using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh) of the CDM, the plant emission factors used for the calculation of emission factors should be obtained in the following priority: *I suggest using different bullets e.g. a), b) or i),ii) etc.*

1. *Acquired directly* from the dispatch center or power producers, if available;
2. *Calculated*, if data on fuel type, fuel Emission Factor, fuel input, and power output can be obtained for each plant. If confidential data available from the relevant host-country authority are used, the calculation carried out by the project owner shall be verified by the independent verifier and the project submission document may only show the resultant carbon emission factor and the corresponding list of plants;
3. *Calculated*, as above, but using estimates such as: default IPCC values from the 2006 IPCC Guidelines for *National* GHG Inventories for net calorific values and carbon emission factors for fuels instead of plant-specific values technology provider's nameplate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than nameplate performance would imply; conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date;
4. *Calculated*, for the simple operating margin (OM) and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.

Where:

ER_y = Emission reductions in project year *y* (t CO_2)

BE_y = Baseline Emissions in project year *y* (t CO_2)

PE_y = Project emissions in project year *y* (t CO_2)

LE_y = Leakage emissions in project year *y* (t CO_2)

13. Monitoring Methodology

31. All the assumptions made related to monitoring parameters should be explained and documented transparently in the project submission to GCC.

13.1 Parameters for monitoring during the crediting period

Table 1. Data / Parameter

Data / Parameter:	$EF_{grid,,y}$
Data unit:	t CO_2e/MWh
Description:	CO_2 emission factor of the grid electricity in year *y*
Source of data	-
Measurement procedures (if any):	CO_2 emission factor for grid connected power generation in year *y* (t CO_2/MWh) determined as per one of the four options below: (i) Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh) of the CDM; Or (ii) Latest available emission factor of the Grid in a country as approvedby CDM standardized baseline Or (iii) Latest available emission factor of the Grid in a country as approvedby its relevant National Authority or Designated National Authority (DNA) under CDM or UNFCCC focal point, in case DNA doesn't exist. Or (iv) Latest IFI combined margin emission factors published on UNFCCCwebsite. Or (v) Latest published Emission factor derived by International Energy Agency (IEA) (This option can be used only if it is objectively demonstrated that options (i), (ii), (iii) and (iv) above are not available).

Monitoring frequency:	Once determined, the emission factor will remain fixed for the entire crediting period, unless option (i) is used, and other specifications areprovided in the "Tool to calculate the emission factor for an electricitysystem" of CDM.
Quality Procedures, if any.	
Any comment:	

Table 2. Data / Parameter

Data / Parameter:	$EG_{historical,y}$
Data unit:	MWh
Description:	Annual average amount of electricity generation from the renewable energy generation unit in the 3 years prior to implementation of BESS project activity (MWh) or Annual average amount of electricity generation from the renewable energy generation unit in at least 1 year prior to implementation of BESS project activity, if the existing renewable energy generation unit is less than 3 years old (MWh)
Source of data	Electricity meter(s)
Measurement procedures (if any):	This parameter should be either measured and monitored using a bi-directional energy meter or calculated as the difference between (a) the quantity of net electricity supplied by the project plant/unit to the grid, and (b) the quantity of electricity delivered to the project plant/unit from the grid during historical years (as above) prior to implementation of the BESS retrofit in the plant. In case it is calculated, then the following parameters shall be measured: (b) The quantity of electricity supplied by the project plant/unit to the grid; and (c) The quantity of electricity delivered to the project plant/unit from the grid
Quality Procedures, if any.	Monitored data should have been measured using calibrated meters that had been calibrated as per national standards or requirements set by the meter supplier or requirements set by the grid operators. The accuracy class of the meters should be in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements. If these standards are not available, and the meter supplier does not specify, calibrate the meters every 3 years and use the meters with at least 0.5 accuracy class (e.g. a meter with 0.2 accuracy class is more accurate and thus it is accepted).
Monitoring frequency:	Monthly or yearly recording frequency.

Table 3. Data / Parameter

Data / Parameter:	$EG_{PJ,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid or consumed by recipient captive user thus replacing grid power in year *y*
Source of data	Electricity meter(s)
Measurement procedures (if any):	This parameter should be either measured and monitored using a bi-directional energy meter or calculated as the difference between (a) the quantity of net electricity supplied by the project plant/unit to the grid or recipient captive user, and (b) the quantity of electricity delivered to the project plant/unit from the grid, or the total amount of power delivered to the internal grid for replacement of grid power from project plant in case of captive consumption. When the project involves the implementation of several DPPs that require sample-based monitoring, the CDM's "Standard: Sampling and surveys for CDM project activities and programme of activities" shall be applied by the Project Owner. In case it is calculated, then the following parameters shall be measured: (d) The quantity of electricity supplied by the project plant/unit to the grid; and (e) The quantity of electricity delivered to the project plant/unit from the grid
Quality Procedures, if any.	The electricity meter measuring net electricity export to grid (and domestic consumption in case DPP or projects delivering power for recipient captive user including internal use of Project Owner e.g. Rooftop PV unit supplying part electricity to the house) will be subject to regular maintenance and testing in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements. The calibration of meters, including the frequency of calibration, should be done in accordance with national standards or requirements set by the meter supplier or requirements set by the grid operators. The accuracy class of the meters should be in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements. If these standards are not available, and the meter supplier does not specify, calibrate the meters every 3 years anduse the meters with at least 0.5 accuracy class (e.g. a meter with 0.2 accuracy class is more accurate and thus it is accepted).
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording.

DOCUMENT HISTORY

Version	Date	Comment
V 4.0	02/11/2022	Revision to: • Provide consistency with latest applicable version of CDM Tool 32: Positive list of technologies; • Align with provisions of ACM0002 on additionality demonstration applying favorable tariff for BESS supplying electricity to the grid during peak time.
V 3.0	22/02/2022	Revision to i. Add applicability of methodologies applying BESS to renewable energy generation units. ii. Allow for captive consumption of part of power generated within the project activity. iii. Remove standardized additionality approach using positive list of various countries.
V 2.0	09/12/2020	Revision to: i Correct the error in the text on demonstration of 2% penetration of RE project activity to claim automatic additionality. ii Incorporate the timeline for A2 type project activity to demonstrate 2% penetration to claim automatic additionality. iii Replace name of "Standard for Key Project Requirements and Methodological Development" with the updated document "Standard for Development of Methodology".
V 1.0	13/01/2020	Initial adoption by GCC Steering Committee based on following: i. Consideration by individual steering committee member, followed by evaluation of entire steering committee ii. 15-day global stakeholder consultation taken place between 25/11/2019 to 10/12/2019

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