

VCS Methodology

VMR0017

GRID-CONNECTED ELECTRICITY GENERATION FROM RENEWABLE SOURCES (ACM0002 REVISION)

Version 1.0

23 April 2026

Sectoral Scope 1: Energy supply

Version 1.0 of this methodology revision was developed by Verra, based on *ACM0002 Grid-connected Electricity Generation from Renewable Sources, v22.0*. VMR0017 must be used with *ACM0002, v22.0*.



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1 SUMMARY DESCRIPTION

Additionality, Crediting Method, and Mitigation Outcome	
Additionality	Project Method
Crediting Baseline	Project Method
Mitigation Outcome	Reductions

The Clean Development Mechanism (CDM) methodology *ACM0002 Grid-connected Electricity Generation from Renewable Sources*, v22.0 applies to grid-connected renewable energy generation project activities.

This methodology revision primarily expands the geographic eligibility of project activities, introduces provisions to determine project emissions due to battery energy storage system (BESS) fire suppression systems, considers leakage due to embodied emissions, and replaces key CDM tools with Verified Carbon Standard (VCS) tools.

This methodology revision must be used with *ACM0002*. The procedures and requirements of *ACM0002* must be applied unless indicated otherwise in this document.

2 SOURCES

This methodology revision applies to CDM methodology *ACM0002 Grid-connected Electricity Generation from Renewable Sources*, v22.0. Project proponents must use this methodology revision in conjunction with *ACM0002*, v22.0.

Project proponents using this methodology revision must make the following tool replacements throughout *ACM0002*:

- *TOOL01 Tool for the Demonstration and Assessment of Additionality* is replaced with VCS tool *VT0008 Additionality Assessment*
- *TOOL02 Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality* is replaced with VCS tool *VT0009 Combined Baseline and Additionality Assessment*
- *TOOL05 Baseline, Project and/or Leakage Emissions from Electricity Consumption and Monitoring of Electricity Generation* is replaced with VCS tool *VT0010 Emissions from Electricity Consumption and Generation*
- *TOOL07 Tool to Calculate the Emission Factor for an Electricity System* is replaced with VCS tool *VT0011 Electricity System Emission Factors*

Note – CDM TOOL32 Positive Lists of Technologies was inactivated under the VCS Program on 1 October 2025 and is not eligible under VMR0017.

3 DEFINITIONS

The definitions of the applicable versions of the *VCS Program Definitions* and *ACM0002* apply.

4 APPLICABILITY CONDITIONS

All applicability conditions in Section 2.2 of *ACM0002* must be met, taking into account the following replacements and additional applicability conditions.

Applicability condition 8(a) of *ACM0002* is replaced as follows:

2.2 Applicability

...

8. The methodology is applicable under the following conditions:

(a) Project activities correspond to one or more rows in Table 1.

Table 1. Applicable technology, capacity, and geographies

Technology	Capacity	Geographies
- Wind (onshore and offshore) - Geothermal - Terrestrial solar PV	Any	Low-, lower middle-, upper middle-income countries only ¹
- Floating solar - Wave - Tidal	Any	Globally applicable
Hydroelectric	15 MW or less, determined by the rated capacity or authorized capacity (as indicated in the activity approval from the regulator, government, or similar entity), whichever is higher	LDC countries only ²

¹ Income classifications based on World Bank Country and Lending Groups, available at: <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

² UN list of Least Developed Countries, available at: <https://www.un.org/ohrls/content/list-ldcs>

Notes:³

- *Registered projects and instances that have already been included in registered grouped projects using ACM0002 or AMS-I.D. Grid-connected Renewable Electricity Generation retain their original maximum crediting period. All new project activity instances must correspond to one or more rows in Table 1.*
- *This applicability condition supersedes the default eligibility for project activities given in the VCS Standard.*

The following applicability condition 8(f) is added and must be met by projects involving a BESS:

- 8(f) Where activities involve the integration of a renewable energy power plant with a BESS, the BESS and the power plant are located on the same site, directly connected to each other, and share a common connection to the grid.⁴ Both facilities are owned and operated by the same entity and are part of the same investment (financial) decisions.

Applicability condition 14 of ACM0002 is replaced as follows:

14. In addition, the applicability conditions included in the tools listed in Section 2 in VMR0017 apply.

5 PROJECT BOUNDARY

No changes or additions to ACM0002.

6 BASELINE SCENARIO

The following paragraphs replace the corresponding paragraphs in ACM0002:

5.2.3 Baseline scenario for retrofit or rehabilitation or replacement of an existing power plant

...

5.2.3.1 Step 1: Identify realistic and credible alternative baseline scenarios for power generation

30. Apply Step 1 of VT0009. The alternatives must include:

³ Further guidance is available on the Verra webpage for VMR0017.

⁴ The renewable energy power plant and the BESS are linked to the same grid interconnection point (i.e., they both feed electricity into (or draw from) the grid through a single grid connection or metering point).

- (a) P1: The project activity is undertaken without being registered under a GHG program;
- (b) P2: The continuation of the current situation, that is to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system; and
- (c) P3: All other plausible and credible alternatives to the project activity that provide an increase in the power generated at the site, which are technically feasible to implement. This includes, inter alia, different levels of replacement, retrofit, and/or rehabilitation at the power plants/units. Only alternatives available to project proponents should be taken into account.

...

5.2.3.3. Step 3: Investment analysis⁵

32. Project proponents must apply:

- (a) an investment comparison analysis, as per Step 3 of VT0009, if more than one alternative is remaining after Step 2 and if the remaining alternatives include scenarios P1 and P3;
- (b) a benchmark analysis, as per Step 3 (Option 2) of VT0008, if more than one alternative is remaining after Step 2 and if the remaining alternatives include scenarios P1 and P2.

7 ADDITIONALITY

The following paragraph is removed from ACM0002:

~~5.3.1. Simplified procedure to demonstrate additionality~~

~~35. For the simplified procedure to demonstrate additionality the project participants shall refer to the methodological tool TOOL32.~~

The following paragraph replaces the corresponding paragraph in ACM0002:

⁵ This step is only applicable to projects involving retrofit, rehabilitation, or replacement of an existing power plant.

5.3.2. Procedure to demonstrate additionality based on VT0008

36. The additionality of the project activity must be demonstrated and assessed using VT0008 and applying the following three steps:
 - a) Regulatory surplus must be demonstrated in accordance with the rules and requirements regarding regulatory surplus set out in the applicable version of the VCS Standard.
 - b) Project proponents must follow the procedures and requirements of Step 3 of VT0008 to conduct an investment analysis. For projects applying benchmark analysis, the project documents must record whether the project proponent carried out the additionality demonstration in accordance with Sections 5.4.2(2)(b) and (c) of VT0008.
 - c) Project proponents must assess whether the project activity is common practice, following the procedures and requirements of Step 4 of VT0008.

Note — Barrier analysis (Step 2 of VT0008) is not applicable under VMR0017.

8 QUANTIFICATION OF REDUCTIONS AND REMOVALS

8.1 Baseline Emissions

No changes or additions to ACM0002.

8.2 Project Emissions

The following paragraph replaces the corresponding paragraph in ACM0002, in line with changes to Section 5.4.6 of ACM0002 below:

40. For most renewable energy power generation project activities, $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions must be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} + PE_{BESS,y} + PE_{PSP,y} + PE_{FSS,y} \quad (1)$$

Where:

PE_y = Project emissions in year y (t CO₂e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (t CO₂/yr)

$PE_{GP,y}$	= Project emissions from the operation of dry, flash steam, or binary geothermal power plants in year y (t CO ₂ e/yr)
$PE_{HP,y}$	= Project emissions from water reservoirs of hydropower plants and pumped storage plants in year y (t CO ₂ e/yr)
$PE_{BESS,y}$	= Project emissions from charging of a BESS using electricity from the grid or from fossil fuel electricity generators (t CO ₂ e/yr)
$PE_{PSP,y}$	= Project emissions from utilizing electricity from the grid for pumping operation of PSP in excess to the production of the renewable power plant operating in coordination with the PSP (t CO ₂ e/yr)
$PE_{FSS,y}$	= Project emissions due to the release of agents from BESS fire suppression systems (t CO ₂ e/yr)

8.2.1 Emissions due to Release of Agents from BESS Fire Suppression Systems

The following paragraphs replace the corresponding paragraphs in ACM0002:

5.4.4. Emissions from charging of a BESS using electricity from the grid or from fossil fuel electricity generators ($PE_{BESS,y}$)

...

49. In cases where BESS is charged using grid electricity, the corresponding project emissions ($PE_{BESS,y}$) must be calculated according to the procedure described in Scenario A: Grid Electricity System (Section 5.1) of VT0010.

...

5.4.5. Emissions from utilizing grid electricity by pumped hydro plants ($PE_{PSP,y}$)

...

53. In cases where PSP utilizes grid electricity in excess to the production of the renewable power plant, the corresponding project emissions ($PE_{PSP,y}$) must be calculated according to the procedure described in Scenario A: Grid Electricity System (Section 5.1) of VT0010.

...

In addition to the requirements of Section 5.4 in ACM0002, the following paragraphs apply:

5.4.6 Emissions due to the release of agents from BESS fire suppression systems ($PE_{FSS,y}$)

Project activities should employ low⁶ or zero GWP agents (e.g., Novec 1230) in BESS fire suppression systems, thereby ensuring fire safety without potentially contributing to global warming. However, where agents with GWP > 1 (e.g., HFC-

⁶ This refers to GWP < 1.

227ea) are used, emissions due to the release of such agents must be determined using the following equation:

$$PE_{FSS,y} = \sum_e (M_{e,released,y}) \times GWP_{agent} \quad (18)$$

Where:

$PE_{FSS,y}$	= Project emissions due to release of agents from BESS fire suppression systems (t CO ₂ e)
$M_{e,released,y}$	= Mass of fire suppression agent released to the atmosphere due to event e in year y (tonnes)
GWP_{agent}	= Global warming potential of the fire suppression agent, calculated based on 100-year time horizon (t CO ₂ e/tonnes of agent)

8.3 Leakage Emissions

This section replaces Section 5.6 in ACM0002:

Leakage entails all emissions from the life cycle of the renewable energy generation power plant, which includes emissions related to construction, operation, and decommissioning of the power plant. Studies have shown these emissions most prominently relate to transport of equipment, people, and expendables to the project site or to upstream manufacturing facilities. These emissions are spread over the construction, operating life, and decommissioning phases of the renewable power plant, and can be parameterized using net generation output of a renewable plant as an estimation technique.

Embodied emissions are determined using the following equations, as applicable:

For greenfield power plants:

$$LE_y = LE_{embodied} = EG_{facility,y} \times EF_{embodied} \times 10^{-3} \quad (19)$$

For power plants involving capacity addition:

$$LE_y = LE_{embodied} = EG_{PJ_Add,y} \times EF_{embodied} \times 10^{-3} \quad (20)$$

Where:

LE_y	= Leakage emissions in year y (t CO ₂ e/yr)
$LE_{embodied}$	= Leakage due to annualized embodied emissions of the renewable energy generation plant (t CO ₂ e/yr)
$EG_{facility,y}$	= Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

$EG_{PJ_Add,y}$	= Quantity of net electricity generation supplied to the grid in year y by the project plant/unit that has been added under the project activity (MWh/yr)
$EF_{embodied}$	= Emission factor of the embodied emissions of the renewable energy generation plant (g CO ₂ e/kWh)

8.4 Net Reductions and Removals

The following section replaces the corresponding paragraph (and Equation (17)) of ACM0002:

5.7. Emission reductions

72. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (17)$$

Where:

ER_y	= Emission reductions in year y (t CO ₂ e/yr)
BE_y	= Baseline emissions in year y (t CO ₂ e/yr)
PE_y	= Project emissions in year y (t CO ₂ e/yr)
LE_y	= Leakage emissions in year y (t CO ₂ e/yr)

9 MONITORING

9.1 Data and Parameters Available at Validation

The following table replaces the corresponding Data/Parameter table (Data/Parameter table 6, Section 5.10) in ACM0002:

Data/Parameter	EF_{Res}
Data unit	kg CO ₂ e/MWh
Description	Default emission factor for emissions from reservoirs
Equations	(9)
Source of data	<i>Hydropower Sustainability Standard and the Hydropower Sustainability Guidelines on Good International Industry Practice</i> ⁷
Value applied	100 kg CO ₂ e/MWh

⁷ Available at: <https://www.hydropower.org/publications/hydropower-sustainability-guidelines>

Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of project emissions
Comments	None

The following tables are in addition to the Data/Parameter tables provided in Section 5.10:

Data/Parameter	GWP_{agent}
Data unit	t CO ₂ e/tonnes of agent
Description	Global warming potential of the fire suppression agent, calculated based on 100-year time horizon
Equations	(18)
Source of data	IPCC Global Warming Potential values (AR5) ⁸
Value applied	As per the relevant value for the agent, provided in the “Source of data” above
Justification of choice of data or description of measurement methods and procedures applied	Where commercial blends are used as an agent, the GWP must be determined based on manufacturer specifications or, where these are unavailable, calculated based on a weighted average of the various constituents used.
Purpose of data	Calculation of project emissions
Comments	Where the source of data mentioned above does not list the agents used by the project, the GWP must be determined based on manufacturer specifications or, where these are unavailable, sourced from relevant national, regional, or international regulatory authorities (e.g., the US Environmental Protection Agency), or where these are also unavailable, from peer-reviewed scientific literature.

Data/Parameter	$EF_{embodied}$
Data unit	g CO ₂ e/kWh
Description	Emission factor of the embodied emissions of the renewable energy generation plant
Equations	(19), (20)

⁸ Available at: <https://ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values%28August%2024%29.pdf>

Source of data	Life Cycle Greenhouse Gas Emissions from Electricity Generation: Update (September 2021) published by NREL ⁹																
Value applied	The value is based on the renewable energy technology type and must be determined as follows: <table> <tr> <th>Renewable energy generation technology</th><th>Emission factor for embodied emissions (g CO₂e/kWh)</th></tr> <tr> <td>Solar photovoltaic</td><td>43</td></tr> <tr> <td>Wind (onshore and offshore)</td><td>13</td></tr> <tr> <td>Biomass</td><td>52</td></tr> <tr> <td>Geothermal</td><td>37</td></tr> <tr> <td>Hydropower</td><td>21</td></tr> <tr> <td>Ocean energy</td><td>8</td></tr> <tr> <td>Concentration solar power (tower and trough)</td><td>28</td></tr> </table>	Renewable energy generation technology	Emission factor for embodied emissions (g CO ₂ e/kWh)	Solar photovoltaic	43	Wind (onshore and offshore)	13	Biomass	52	Geothermal	37	Hydropower	21	Ocean energy	8	Concentration solar power (tower and trough)	28
Renewable energy generation technology	Emission factor for embodied emissions (g CO ₂ e/kWh)																
Solar photovoltaic	43																
Wind (onshore and offshore)	13																
Biomass	52																
Geothermal	37																
Hydropower	21																
Ocean energy	8																
Concentration solar power (tower and trough)	28																
Justification of choice of data or description of measurement methods and procedures applied	N/A																
Purpose of data	Calculation of leakage emissions																
Comments	For renewable energy generation technologies not included in the table above, the project proponent may use values for credible and reputable sources/literature. The project proponent must justify the chosen value and clearly document its source in the project documents.																

⁹ Available at: <https://perma.cc/BQ23-EDVB>

9.2 Data and Parameters Monitored

The following table is in addition to the Data/Parameter tables provided in Section 6.1 of ACM0002:

Data/Parameter	$EG_{facility,y}$ $EG_{PJ_Add,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y Quantity of net electricity generation supplied to the grid in year y by the project plant/unit that has been added under the project activity
Equations	(12), (14), (19) (13), (20)
Source of data	Direct measurement
Description of measurement methods and procedures to be applied	Direct measurement is required, which involves the use of electricity meters installed at the grid interface for electricity export to the grid.
Frequency of monitoring/recording	Monitor continuously, aggregate data at least monthly.
QA/QC procedures to be applied	Regularly test and calibrate the meters as per utility or national requirements and manufacturer specifications. Cross-check with receipts/invoices from utilities or suppliers where applicable. Propagate uncertainty according to instructions specified in ACM0002 and VMR0017. For uncertainty of direct measurement, use the actual metering uncertainty specified by the error from the last calibration event or by the meter manufacturer where information from a previous calibration event is not available. For uncertainty of estimates, use zero for conservative estimates and a project-specific uncertainty for statistically significant estimates.
Purpose of data	Calculation of baseline emissions
Calculation method	For cumulative electricity meters, use the difference between initial and final readings and record the dates of each reading. Use linear interpolation where meter reading dates do not align with the monitoring period. Where historical data are used in the baseline, do one of the following: 1) Use at least three years of the most recent records. 2) Justify why older data are more appropriate. 3) Justify why a shorter data period is appropriate.

Comments	Where direct measurement is required but is temporarily not feasible due to technical or logistical constraints (e.g., lack of access to monitoring equipment, maintenance, remote or hazardous project locations), the project proponent may use estimation methods in line with VT0010. This must be accompanied by justification and a demonstration that the constraint is temporary and the chosen estimation method is conservative.
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Data/Parameter	$M_{e, released, y}$
Data unit	tonnes
Description	Mass of fire suppression agent released to the atmosphere due to event e in year y
Equations	(18)
Source of data	Fire suppression system activation logs that must be capable of recording all agent release events
Description of measurement methods and procedures to be applied	Project proponents must identify and record each release event e in the activation log regularly maintained on-site. This must include at least the following: • Fire events (e.g., thermal runaway, electrical faults) • Accidental discharge during maintenance or repair • Leakage due to equipment failure • False alarms or system malfunction • Emergency drills or testing For each identified release event e, the project proponent must determine the quantity of fire suppression agent released by direct measurement through weighing of fire suppression cylinders or containers before and after the event using calibrated equipment. Any agent recovered after the event may be deducted only where supported by certified documentation. Where the quantity of agent released during an event cannot be reliably determined, the full charged mass of the affected fire suppression system must be conservatively assumed to be released.
Frequency of monitoring/recording	Monitor continuously to capture all events and aggregate data at least monthly.
QA/QC procedures to be applied	Project proponents must use weighing equipment calibrated according to national or international standards. The event records must be cross-checked with BESS control system alarms and maintenance logs and other release events.
Purpose of data	Calculation of project emissions
Calculation method	Refer to “Description of measurement methods and procedures to be applied” above.
Comments	None

9.3 Description of the Monitoring Plan

The following paragraph replaces the corresponding paragraph in *ACM0002*:

6. Monitoring methodology

...

83. In addition, the monitoring provisions in the tools referred to in this methodology apply. Accordingly, $EG_{facility,y}$ and $EG_{PJ_Add,y}$ must be determined as per the monitored parameter table in Section 9.2 in *VMR0017* and $EC_{BESS,y}$ and $EC_{PSP,y}$ must be determined as per paragraphs 49 and 53 respectively in Section 8.2 of *VMR0017*. $EF_{grid,CM,y}$ and $PE_{FF,y}$ must be determined as per *VT0011* and *TOOL03* respectively.

In addition to the requirements of Section 6 in *ACM0002*, the following paragraphs apply:

- Project proponents may select the ex-ante or ex-post option in accordance with *VT0011* when calculating $EF_{grid,CM,y}$.
- The project documents must record whether the project proponent selected and applied the ex-post emission factor in accordance with paragraph 72(b) of *VT0011* and paragraph 42(b) of *TOOL07*.

10 REFERENCES

Not applicable.

DOCUMENT HISTORY

Version	Date	Comment
1.0	23 Apr 2026	Initial version The following updates to ACM0002 are included: • Expansion of geographic eligibility • Inclusion of project emissions from BESS fire suppression systems • Inclusion of embodied emissions of the renewable energy power plant • Replacement of CDM tools with VCS tools • Introduction of new requirements related to ownership and siting for projects integrating BESS with a power plant • Data source and value applied for the default emission factor for emissions from reservoirs (EF_{RES}) in accordance with the latest available information and science • Editorial improvements and corrections