VCS Methodology

VM0052

ACCELERATED RETIREMENT OF COAL-FIRED POWER PLANTS USING A JUST TRANSITION

Version 1.0

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Sectoral Scope 1: Energy (renewable/non-renewable)

This methodology was developed by the Coal to Clean Credit Initiative, led by the Rockefeller Foundation, supported by South Pole and in collaboration with Verra.

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1 SUMMARY DESCRIPTION

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

This methodology determines net greenhouse gas (GHG) emission reductions resulting from the accelerated retirement of grid-connected coal-fired power plants (CFPPs) paired with the addition of renewable electricity to partially or fully replace the lost electricity capacity.

Project proponents must use this methodology in conjunction with *VMD0061 Just Transition Requirements for Accelerated Retirement of Coal-fired Power Plants* to ensure that projects are accompanied by a comprehensive just transition plan and implementation. The just transition mitigates negative impacts of accelerated retirement of CFPPs such as loss of livelihoods of workers, their households, contractors, and communities.

2 SOURCES

This methodology uses the most recent version of the following methodologies, tools and modules:

- *VMD0060 Combined Baseline and Additionality Assessment for Accelerated Retirement of Coal-fired Power Plants*
- *VMD0061 Just Transition Requirements for Accelerated Retirement of Coal-fired Power Plants*
- *VT0010 Emissions From Electricity Consumption and Generation*
- *VT0011 Electricity System Emission Factors*
- CDM *ACM0001 Flaring or Use of Landfill Gas*
- CDM *ACM0002 Grid-connected Electricity Generation from Renewable Sources*
- CDM *ACM0006 Electricity and Heat Generation from Biomass*
- CDM *ACM0014 Treatment of Wastewater*
- CDM *ACM0022 Alternative Waste Treatment Processes*

- CDM *TOOL15 Upstream Leakage Emissions Associated With Fossil Fuel Use*

This methodology is based on the following sources:

- CDM *AM0019 Renewable Energy Projects Replacing Part of the Electricity Production of One Single Fossil Fuel Fired Power Plant That Stands Alone or Supplies to a Grid, Excluding Biomass Projects, Version 2.0*
- RMI. 2022. *Guidelines for Financing a Credible Coal Transition*

3 DEFINITIONS

In addition to the definitions set out in the *VCS Program Definitions*, the following definitions apply to this methodology.

Accelerated retirement
The ceasing of operations, decommissioning of equipment, and remediation of a coal fired power plant earlier than would have occurred in the absence of the project activity.

Accelerated retirement date
The date on which the coal-fired power plant relevant to the project ceases operation because of the project activities. Accelerated retirement date is the start date of the project activity and crediting period.

Baseline retirement date
The date on which the coal-fired power plant relevant to the project would have been retired due to technical, regulatory, or economic drivers, in the absence of the project activity.

Coal-fired power plant (CFPP)
An installation that generates electric power from coal combustion. Several power units at one site may comprise one power plant, whereas a power unit is characterized by the fact that it can operate independently from other power units at the same site. A single unit of the power plant may also be referred to as a coal-fired power plant (CFPP). Plants operating as combined heat and power plants and plants with mixed fuels (e.g., biomass, waste) are not included.

Commitment date
The date on which the project proponent commits to retire the coal-fired power plant that is relevant to the project. Listed in descending order of preference, this is based on the date on which the project proponent terminates:

- long-term power purchase agreements (PPAs) or electricity supply agreements with the utility,
- long-term coal supply contracts, or
- operating agreements with the plant operator.

Deregulated electricity market
An electricity market in which market participants (independent power producers) other than the system operator own power plants. In a deregulated market, the independent power producers sell electricity to the wholesale market, typically to an off-taker or retail energy supplier that provides electricity to end customers. Such markets allow for price competition and choice of electricity supplier.

Grid
In this methodology, the electricity system that connects the project coal-fired power plant to other power plants and consumers through transmission and distribution lines in the host country. The grid extent is limited to the smaller of that which is managed by a single balancing pool operator, system operator, or the national jurisdictional border within which the project activity occurs.

Independent power producer (IPP)
A legal entity or instrumentality that owns facilities for the generation of electricity and sells electricity to an electric utility under a power purchase agreement. In this methodology, an IPP is understood to include all members of an IPP consortium, including their parent or holding companies, and when an IPP is, or when an IPP consortium has among its members, a state-owned company such as in a Public Private Partnership, the host country.

Just transition (JT)
A set of principles, processes and practices that aim to ensure that no people, workers, places, sectors, countries or regions are left behind in the transition from a high-carbon to a low-carbon economy.[1]

Just transition plan
A set of criteria and procedures developed using *VMD0061* that ensure stakeholder inclusion, fair representation, transparency, and mitigation of negative impacts on livelihoods and the environment, in the implementation of accelerated retirement of coal-fired power plants.

Mine-mouth power plant
A coal-fired power plant that is constructed and operates near a coal mine, where the coal-fired power plant is the anchor buyer of the coal from the mine and the coal is transported directly to the coal-fired power plant (e.g., via a conveyor belt)

Mothballed power plant
A coal-fired power plant that has been deactivated or put into an inactive state and could return to operation

[1] Taken from Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate Change 2022: Mitigation of Climate Change*. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. https://www.ipcc.ch/report/ar6/wg3/

Off-taker
An entity that has a power purchase agreement with the independent power producer for all or part of the electricity produced, for self-consumption or sale to another consumer. In the case of a regulated market, only the system operator acts as the off-taker.

Paired renewable electricity
Electricity generated by grid-connected renewable energy that is constructed after the commitment date to accelerated retirement. Pairing of renewable electricity is demonstrated in a pairing plan through one of the following pairing pathways:

- Contractual pairing: A new or revised coal-fired power plant (CFPP) power purchase agreement (PPA) covers new renewable electricity generation capacity.
- Financial pairing: The conditions for refinancing a CFPP for retirement require new renewable electricity generation capacity.
- On-site pairing: New renewable electricity generation capacity is developed at the CFPP site and uses existing grid connection or balance of plant components.
- Regulatory pairing: A regulator approves new renewable electricity generation capacity as an explicit replacement for retired CFPP generation capacity.
- Counterfactual plans pairing: New renewable electricity generation comes online earlier or at a greater capacity than projected in the current approved regulatory resource plan of the system operators.

Power purchase agreement (PPA)
A contract between an independent power producer and an off-taker. In this methodology, power purchase agreements:

- refer to agreements in which the off-taker is a utility or electricity system operator or a distribution company or power trader.
- are considered long-term where the term of the PPA is at least 20 years.

Regulatory-determined reserve margin target
The minimum reserve margin (expressed as a percent) mandated by the regulatory authority responsible for the grid, to meet a specific grid reliability target or simply to ensure grid reliability.

Regulated electricity market
An electricity market with an integrated utility company that is the system operator, owns the power system transmission and distribution (including all associated infrastructure), and generates and/or purchases wholesale electricity from independent power producers to sell to customers. The market is overseen by a public regulator with the authority and mandate to ensure consumers have access to reliable electricity at a reasonable cost.

Regulated utility
An integrated utility company that is the system operator, owns the power system transmission and distribution (including all associated infrastructure), and may generate or purchase wholesale electricity from independent power producers to sell to customers. A regulated utility is overseen by a public regulator with rate-making authority, mandated to provide consumers with access to reliable electricity at a reasonable cost.

Reserve Margin
The unused and available generation capacity of an electric power system at peak load as a percentage of the electric power system's total supply capacity[2]. When availability of capacity varies or some generation capacity is not available during hours of expected peak load, a weighted average may be used.

System operator
Entity responsible for day-to-day electricity grid management and operations, including scheduling and dispatching electricity from power plants while coordinating use of the transmission system. Irrespective of the nature and structure of the electricity market, the system operator typically remains independent. In a regulated market, the system operator acts as the single buyer (off-taker) of electricity from independent power producers and provides electricity to different consumers. In a deregulated market, the system operator ensures non-discriminatory access to the transmission system for independent power producers to provide electricity to their respective off-takers and consumers.

4 APPLICABILITY CONDITIONS

This methodology is applicable to project activities that reduce GHG emissions through the accelerated retirement of grid-connected CFPPs paired with renewable electricity.

4.1 Just Transition

This methodology is applicable under the following conditions related to just transition:

1) A just transition plan developed in accordance with *VMD0061* is available at the time of validation of the project description.

2) The plan in Section 4.1(1) is fully funded through sources other than the revenues generated from the sale of Verified Carbon Units (VCUs).

[2] Adapted from US Energy Information Administration: https://www.eia.gov/tools/glossary/index.php?id=reserve_margin#:~:text=Reserve%20margin%20(operating)%3A%20The,a%20percentage%20of%20total%20capability.

4.2 CFPP Retirement

This methodology is applicable under the following conditions related to CFPP retirement:

3) CFPP construction began prior to 31 December 2021.[3]

4) The CFPP is connected to the grid.

5) Where in a regulated electricity market, the CFPP is owned by either a regulated utility or an independent power producer (IPP).

6) The CFPP has a single long-term (at least 20 years) power purchase agreement (PPA) fully executed prior to 31 December 2023:

   a) in a regulated electricity market, with a system operator or a regulated utility off-taker.

   b) in a deregulated electricity market, with an eligible counterparty with obligations as a load-serving entity, such as a distribution company, power trader, government agency, or power retailer.

7) At validation and at the accelerated retirement date, the CFPP has positive annual net income after tax over the three most recent years and positive fair value, determined using a methodology that meets International Financial Reporting Standards for accounting (e.g., *IFRS 13 Fair Value Measurement*).

8) At validation, where the CFPP is owned by a state-owned utility company, both the utility and the host country have a publicly available commitment to not build new CFPPs and to not increase existing CFPP capacity in their jurisdiction.

9) At validation, where the CFPP is owned by an IPP, the IPP has a publicly available commitment to not build new CFPPs, and to not increase existing CFPP capacity under their control.

10) The system operator, utility, distribution company, or other government entity (as applicable) has issued a letter that confirms the accelerated retirement will not have a material negative effect on consumer prices, access to electricity, grid stability, and energy supply security, based on a reliability assessment and rate impact analysis.

11) At validation, the host country's most recent Nationally Determined Contribution (NDC) includes one or more of the following commitments:[4]

[3]This date coincides with the adoption of the Glasgow Climate Pact at the 26th United Nations Framework Convention on Climate Change Conference of the Parties (UNFCCC COP 26), which includes the phase-out and phase-down of fossil fuel. This threshold is set to prevent the eligibility of new CFPPs that were developed with the expectation that carbon finance would be available in the future to enable their retirement (i.e., preventing perverse incentives). The COP26 outcome is available here: https://unfccc.int/sites/default/files/resource/cma2021_10_add1_adv.pdf

a) Power sector-wide decarbonization targets, either as absolute targets or intensity-based, or

b) Increased share of renewable energy in total electricity mix, either as an absolute increase in renewable energy capacity or percentage of renewable energy in the grid.

12) At validation, the host country must have either:

c) Submitted a Long-Term Low Greenhouse Gas Emission Development Strategy (LT-LEDS)[5] to the UNFCCC, or

d) Published a power sector, energy transition, or economy wide decarbonization strategy or policy that supports the transition towards a less carbon intensive economy.

This methodology is not applicable under the following conditions:

13) The CFPP is deactivated or repurposed to continue to combust fossil fuels, including co-firing biomass with coal or gas.

14) The CFPP is a mine-mouth power plant.

15) The CFPP is a captive power plant.

4.3 Paired Renewable Electricity

This methodology is applicable under the following conditions related to paired renewable electricity:

16) The project proponent has a plan, available at validation, for pairing the retired CFPP generation capacity fully or partially with new renewable electricity generation that:

a) exports electricity to the grid.

b) covers at least 10% of the retired CFPP generation capacity on an annual basis at the project start date.

c) covers at least 40% of the retired CFPP generation capacity by the end of the initial crediting period.

17) The renewable electricity pairing plan includes a list of renewable electricity plants that are paired to accelerated CFPP retirement including:

a) name, type, capacity, and location of each renewable electricity power plant, and

b) planned commercial operations start date.

[5] LT LEDS can be accessed here: https://unfccc.int/process/the-paris-agreement/long-term-strategies

18) The paired renewable electricity is generated by one or a combination of the following sources:

a) Solar power plant with or without battery energy storage systems (BESS)

b) On-shore and/or offshore wind power plant with or without BESS

c) Hydropower plant (run-of-river or individual plant net output capacity limited to 15 MW)

d) Geothermal power plant

e) Tidal/wave power plant

f) Landfill gas power plant

g) Biogas power plant, including biogas from wastewater treatment

h) Waste-to-energy (WtE) power plant, including waste incineration

i) Biomass-fired power plant that complies with requirements and procedures established for biomass in the most recent version of CDM *ACM0006*[6]

Note – Only renewable electricity power plants included in the pairing plan available at validation are eligible (i.e., no new paired renewable electricity plants can be added through revisions or PD deviations, etc.) . Any design changes to renewable electricity power plants included in the pairing plan (e.g., modification to installed capacity) during project execution require a project description deviation and reassessment of additionality and the baseline retirement date. This does not permit changes of technology (e.g., solar PV instead of wind).

Note – This methodology aligns with net zero transition and avoids lock-in of fossil fuel combustion or other GHG-intensive systems. Projects are not required to conduct further assessments regarding compatibility with net zero transition for eligibility.

5 PROJECT BOUNDARY

The spatial extent of the project boundary encompasses the CFPP to be retired and, where applicable, the emissions from the operation of paired renewable electricity sources.

Sources of leakage that must be quantified are all the power plants/units connected to the grid that would compensate for electricity generation that is not produced by the retired CFPP and is not covered by paired renewable electricity capacity. Other leakage emissions are associated with certain paired renewable electricity sources.

The GHG sources included in or excluded from the project boundary are shown in Table 1.

[6] Verra is consulting on program-level rules for the use of biomass that will apply to this methodology once implemented.

Table 1. GHG sources associated with baseline, project and leakage emissions

Source		Gas	Included?	Justification/Explanation
Baseline	CFPP electricity generation	CO_2	Yes	Major source
		CH_4	No	Conservative to exclude
		N_2O	No	Conservative to exclude
		Other	No	N/A
Project	Electricity production by new renewable sources	CO_2	Yes	To be considered for landfill gas, geothermal, hydro, biomass thermal, wastewater, and waste-to-energy plants. Not to be considered for other eligible renewable electricity sources.
		CH_4	Yes/No	Depending on the renewable electricity technology and the relevant CDM methodology referenced in Section 8.2.
		N_2O	No	De minimis
		Other	No	N/A
Leakage	Electricity sourced from the grid	CO_2	Yes	Major source
		CH_4	Yes	Upstream methane emissions considered for gas-fired power plants where incremental gas is burned to compensate for retired CFPP electricity generation
		N_2O	No	De minimis
		Other	No	De minimis
	Paired renewable electricity sources	CO_2	Yes/No	Depending on the renewable electricity technology and the relevant CDM methodology referenced in Section 8.3.3.
		CH_4	Yes/No	Depending on the renewable electricity technology and the relevant CDM methodology referenced in Section 8.3.3.
		N_2O	No	De minimis
		Other	No	De minimis

6 BASELINE SCENARIO

This methodology uses the project method to determine the baseline scenario. Projects must apply *VMD0060 Combined Baseline and Additionality Assessment for Accelerated Retirement of Coal-fired Power Plants* to determine the baseline scenario and baseline retirement date of the CFPP.

The total project crediting period ends at the earliest of the following:

1) The maximum crediting period length permissible in the most recent version of the *VCS Standard*, measured from the project start date
2) The baseline retirement date, as determined by the most recent version of *VMD0060*
3) Where the CFPP is owned by a utility, the date on which the jurisdiction reneges on its no new coal commitment, either explicitly through an announcement or implicitly through the permitting of a new CFPP
4) Where the CFPP is owned by an IPP, the date on which the IPP reneges on its no new coal commitment, either explicitly through an announcement or implicitly through application for permits for a new CFPP anywhere globally

7 ADDITIONALITY

Additionality is demonstrated using the project method outlined in the most recent version of *VMD0060*.

8 QUANTIFICATION OF REDUCTIONS AND REMOVALS

8.1 Baseline Emissions

The baseline emissions are the GHG emissions from the operation of the CFPP between the accelerated retirement date and the baseline retirement date. They are calculated for each year *y* of the crediting period (see Appendix 1 for information on start date and crediting period) as follows:

$$BE_y = EG_{BL\,CFPP_y} \times EF_{BL_y} \quad (1)$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2)
$EG_{BL\,CFPP\_y}$	=	Baseline net electricity generated by the CFPP and supplied to the grid in year *y* (MWh)
EF_{BL_y}	=	Baseline emission factor for the CFPP in year *y* (t CO_2/MWh)

Baseline net electricity generated and supplied ($EG_{BL\,CFPP\_y}$) in year *y* must be determined as follows:

$$EG_{BL\,CFPP_y} = CAP_{CFPP} \times CUF_{BL,y} \times 8760 \quad (2)$$

Where:

CAP_{CFPP}	=	Net installed generation capacity of the CFPP being retired (MW)
CUF_{BL}	=	Historical capacity utilization factor of the CFPP (dimensionless)
8760	=	Number of hours in one year

The capacity utilization factor is determined using as follows:

$$CUF_{BL,y} = MIN\left(\frac{MIN(EG_{3y\,Val}, EG_{3y\,AR}, EG_{5y\,Val}, EG_{5y\,AR})}{CAP_{CFPP} \times T}, CUF_{ref}\right) \quad (3)$$

Where:

$EG_{3y\,Val}$	=	Net electricity delivered to the grid by the CFPP in the 3-year period preceding validation (MWh)
$EG_{3y\,AR}$	=	Net electricity delivered to the grid by the CFPP in the 3-year period preceding the accelerated retirement date (MWh)
$EG_{5y\,Val}$	=	Net electricity delivered to the grid by the CFPP in the 5-year period preceding validation (MWh)
$EG_{5y\,AR}$	=	Net electricity delivered to the grid by the CFPP in the 5-year period preceding the accelerated retirement date (MWh)
CUF_{ref}	=	Average capacity utilization factor of at least two reference CFPPs (-)
T	=	Hours in the period selected in the numerator (net electricity generated period), 3-years: 26,280, 5-years: 43,800

The average capacity utilization factor must be determined using the following equation:

$$CUF_{ref,y} = \frac{EG_{ref}}{CAP_{ref} \times 8760} \quad (4)$$

Where:

$EG_{ref,y}$	=	Average net electricity generation of at least two reference CFFPs in year y (MWh)
CAP_{ref}	=	Net installed generation capacity at the interconnection point of the reference plants (MW)

The baseline emission factor (EF_{BL_y}) is determined using the equation below:

$$EF_{BL_y} = (FC_c \times NCV_c \times EF_{CO2,C}) / EG_{CFPP} \quad (5)$$

Where:

FC_c	=	Quantity of coal fired in the CFPP (mass unit)
NCV_c	=	Weighted average net calorific value of coal used in the CFPP (GJ/mass unit)
$EF_{CO2,C}$	=	CO_2 emission factor of coal used in the CFPP (t CO_2/GJ)
EG_{CFPP}	=	Historical quantity of electricity generated and supplied to the grid by the CFPP (MWh)

8.2 Project Emissions

Project emissions are those that are emitted from renewable electricity capacity that is demonstrated to be paired with the accelerated retirement of the CFPP. Project emissions are calculated as follows:

$$PE_y = \sum_i PE_{RE_{i,y}} \quad (6)$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2e)
$PE_{RE\ i,y}$	=	Project emissions from operation of paired renewable electricity power plant *i* in year *y* (t CO_2e)

Generation of electricity from solar photovoltaic, wind (on-shore/offshore), tidal, and wave do not emit during the project. Other renewable electricity types emit GHGs and these must be quantified as applicable, using the most recent version of the following CDM methodologies:

- Project emissions from electricity generation from landfill gas: *ACM0001 Flaring or Use of Landfill Gas*
- Project emissions from geothermal and hydropower: *ACM0002 Grid-connected Electricity Generation From Renewable Sources*

- Project emissions from biomass-fired power plant: *ACM0006 Electricity and Heat Generation From Biomass*
- Project emissions from wastewater treatment: *ACM0014 Treatment of Wastewater*
- Project emissions from waste-to-energy power plant: *ACM0022 Alternative Waste Treatment Processes*

8.3 Leakage Emissions

Leakage emissions are calculated as follows:

$$LE_y = MAX\left[0\ ,\ (EG_{BL\,CFPP_y} - \sum_i EG_{RE_{i,y}}) \times EF_{CM,y}\right] + LE_{RE_{i,y}} \quad (7)$$

Where:

LE_y	=	Leakage emissions in year *y* (t CO_2e)
$EG_{RE\_i,y}$	=	Net electricity generated and supplied to the grid by paired renewable electricity power plant *i* in year *y* (MWh)
$EF_{CM,y}$	=	Combined margin emission factor associated with the production of EG_{Grid_y} in year *y* (t CO_2e/MWh)
$LE_{RE\_i,y}$	=	Leakage emissions from paired renewable electricity power plant *i* in year *y* (t CO_2e)

8.3.1 Paired Renewable Electricity Generation ($EG_{RE\_i,y}$)

For renewable electricity power plants that are paired through a counterfactual pairing pathway (see Section 4.3), the renewable electricity generation must only be accounted in EG_{RE} (i.e., counting towards replacing retired coal generation) between the actual operational start date of the renewable electricity project in the project scenario and the baseline scenario operational start date (as demonstrated in *VMD0060*). From the baseline scenario operational start date and onward, the renewable electricity generation must not be accounted in EG_{RE}.

8.3.2 Grid Emission Factor ($EF_{CM,y}$)

Where the paired renewable electricity is not able to fully replace the electricity that would have been supplied by the CFPP in year *y*, determine the emission factor of the grid supplying the remainder of the electricity. The grid emission factor to be applied is the combined margin, which incorporates the operating margin ($EF_{OM,y}$) and build margin ($EF_{BM,y}$) emission factors.

$$EF_{CM,y} = (0.4 \times EF_{OM,y}) + (0.6 \times EF_{BM,y}) \quad (8)$$

Where:

$EF_{OM,y}$	=	Operating margin emission factor in year *y* (t CO_2e/MWh)

$EF_{BM,y}$ = Build margin emission factor in year *y* (t CO_2e/MWh)

8.3.2.1 Operating Margin Emission Factor ($EF_{OM,y}$)

For the operating margin emission factor, determine whether a mothballed CFPP could replace the grid capacity of the retired CFPP. Where a mothballed plant has sufficient capacity, it represents the baseline scenario and impacts the operating margin calculation. The operating margin emission factor is determined using either of the following:

1) A default emission factor for subcritical coal where either of the following conditions are met in the monitoring period:
    a) The mothballed CFPP generating capacity connected to the grid is greater than or equal to the retired CFPP generation capacity.
    b) The reserve margin is greater than or equal to the regulatory-determined reserve margin target plus 10%, and more than half of the capacity that makes up the reserve margin is coal.
2) The simple operating margin, calculated as the generation-weighted average of all power plants connected to the grid, excluding low-cost/must-run (LCMR) electricity sources, using the most recent version of *VT0011*. LCMR electricity sources include renewables and nuclear. All fossil fuel power plants, including CFPPs, must be included in the simple operating margin calculation.

8.3.2.2 Build Margin Emission Factor ($EF_{BM,y}$)

The build margin is determined using the most recent version of *VT0011*, excluding all other renewable electricity in the jurisdiction that is paired with other accelerated retirement projects registered or seeking registration under VCS and/or Paris Agreement Crediting Mechanism.

8.3.2.3 Inclusion of Upstream Methane Leakage in Gas-Fired Power Plants

The grid emission factor ($EF_{CM,y}$) must account for upstream methane leakage emissions associated with power generation, which must be determined using the most recent version of CDM *TOOL15 Upstream Leakage Emissions Associated With Fossil Fuel Use*. The upstream methane leakage emissions must be added to the CO_2-equivalent emission factor applied when determining $EF_{OM,y}$ (Section 8.3.2.1, where applicable) and $EF_{BM,y}$ (Section 8.3.2.2) and based on a per GJ of gas consumption basis at the relevant gas fired power plants.

8.3.3 Leakage Emissions from Paired Renewable Electricity ($LE_{RE\_i,y}$)

Emissions must be quantified as applicable, for the following renewable electricity sources using the most recent version of the following CDM methodologies:

- Leakage emissions from biomass-fired power plant: *ACM0006 Electricity and Heat Generation From Biomass*
- Leakage emissions from wastewater treatment: *ACM0014 Treatment of Wastewater*

- Leakage emissions from waste-to-energy power plant: *ACM0022 Alternative Waste Treatment Processes*

Leakage emissions from the following renewable electricity sources are considered de minimis:

- Solar power plant with or without battery energy storage systems (BESS)
- On-shore and/or offshore wind power plant with or without BESS
- Hydro power plant
- Geothermal power plant
- Tidal/wave power plant
- Landfill gas power plant

8.4 Net Reductions and Removals

The net GHG emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad (9)$$

Where:

ER_y = GHG emission reductions in year y (t CO_2e)

8.5 Uncertainty Assessment

The primary sources of uncertainty arise from the quantification of the electricity that would have been supplied to the grid by the CFPP and the emission factors of electricity production, both from the CFPP and the incremental output from grid-connected power plants.

The baseline electricity production uncertainty is addressed through conservative underestimation. This is done by incorporating two reference CFPPs that dynamically represent comparable coal operations in the country and set the value as the minimum between dynamic CFPPs and the historical generation of the retired power plant.

The emission factor of the CFPP is based on historical data on fuel consumption and electricity generation. Both have very low uncertainty given the typical measurement methods in industry and because they serve commercial transactions. The NCV and fuel EF have also low uncertainty. The effective heat rate (fuel consumed per MWh produced) of the CFPP is determined at validation (set through FC_c) and remains constant, which is conservative given the expected decrease in efficiency as the plant would have aged.

The emission factor of the incremental output from grid-connected power plants is conservative given the inclusion of potential mothballed coal fired power plants, the requirement to apply

simple operating margin (which is always higher than simple adjusted or average), and the requirement to account for upstream methane leakage emissions associated with power generation.

Uncertainty associated with the paired renewable electricity power plants is estimated to be less than 1% given the accuracy of the meters and commercial transactions involved.

Project and leakage emissions are expected to be zero or low depending on the technology. While some of the parameters may have individual uncertainty (e.g., those related to methane emissions), the overall impact in absolute terms would be minor.

The overall uncertainty is estimated to be less than 10% and no discount for quantification uncertainty is necessary. An assessment of uncertainty in the baseline retirement date is included in *VMD0060*.

9 MONITORING

In addition to the parameters in Sections 9.1 and 9.2, all relevant parameters from the applicable methodologies, modules and tools used in conjunction with this methodology must be included.

9.1 Data and Parameters Available at Validation

Data/Parameter	CAP_{CFPP}, CAP_{ref}
Data unit	MW
Description	Net installed generation capacity at the interconnection point of the CFPP being retired, and the reference plants respectively
Equations	(2), (4)
Source of data	Project proponent records or those of the grid administrator or operation if different than the project proponent
Value applied	As per project proponent and CFPP records
Justification of choice of data or description of measurement methods and procedures applied	Project proponent (IPP or utility) will have the relevant data.
Purpose of data	Calculation of baseline emissions
Comments	This is the maximum electrical output capacity available for grid supply at the plant's connection to the transmission system, excluding any losses or reductions from turbines, plant output, or other stages. Other

	factors that limit the CFPP's capacity, such as regulatory caps, must also be considered.

Data/Parameter	$EG_{3y\ Val}$, $EG_{5y\ Val}$, $EG_{3y\ AR}$, $EG_{5y\ AR}$
Data unit	MWh
Description	Net electricity delivered to the grid by the CFPP in the 3-year period preceding validation Net electricity delivered to the grid by the CFPP in the 5-year period preceding validation Net electricity delivered to the grid by the CFPP in the 3-year period preceding the accelerated retirement date Net electricity delivered to the grid by the CFPP in the 5-year period preceding the accelerated retirement date
Equations	(3)
Source of data	Direct measurements using electricity meter at the grid interface, project proponent records
Value applied	Net annual average generation supplied to the grid over the monitoring period
Justification of choice of data or description of measurement methods and procedures applied	Use electricity meters installed at the grid interface for electricity exported to the grid. The electricity meter must have been subject to regular maintenance and testing in accordance with the stipulation of the meter supplier and/or as per the requirements set by the system operators or national requirements. Meters must be calibrated in accordance with national standards or requirements set by the meter supplier or requirements set by the system operator. Meter accuracy class must be in accordance with requirements set by the grid operator or national bodies.
Purpose of data	Calculation of baseline emissions
Comments	None

Data/Parameter	FC_C
Data unit	mass unit (e.g., tonne, kg)
Description	Quantity of coal fired in the CFPP
Equations	(5)
Source of data	Onsite records

Value applied	Combined five years of coal usage during the 5-year period preceding validation or the 5-year period preceding the accelerated retirement date, whichever occurs earlier
Justification of choice of data or description of measurement methods and procedures applied	Onsite records are the most appropriate source of data. The values must be cross-checked with coal purchase invoices for the same period.
Purpose of data	Calculation of baseline emissions
Comments	None

Data/Parameter	$EF_{CO2,c}$
Data unit	t CO_2/GJ
Description	CO_2 emission factor of coal used in the CFPP
Equations	(5)
Source of data	The following data sources must be used, if available, in priority order: (i) Values provided by coal supplier (ii) Measurement by project proponent (iii) Regional or national default values (iv) IPCC default values as provided in Table 1.2 and Table 1.4 of Chapter 1, Vol. 2, 2006 IPCC Guidelines on National Greenhouse Gas Inventories, or any more recent refinements as published from time to time by IPCC (no refinement in 2019 applies to these values)
Value applied	As per source of data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	None

Data/Parameter	NCV_c
Data unit	GJ/mass unit
Description	Weighted average net calorific value of coal used in the CFPP

Equations	(5)
Source of data	The following data sources must be used, if available, in priority order: (i) Values provided by coal supplier (ii) Measurement by project proponent (iii) Regional or national default values (iv) IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 and Table 1.4 of Chapter 1, Vol. 2, 2006 IPCC Guidelines on National Greenhouse Gas Inventories, or any more recent refinements as published from time to time by IPCC (no refinement in 2019 applies to these values)
Value applied	As per source of data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	For (i) and (ii), the value of NCV_c must be obtained for each fuel delivery over the five year period, from which weighted average values must be calculated. Verify if the NCV values under (i), (ii) and (iii) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards

Data/Parameter	EG_{CFPP}
Data unit	MWh
Description	Historical quantity of electricity generated and supplied to the grid by the CFPP
Equations	(5)
Source of data	Use the net electricity delivered to the grid by the CFPP in the 5-year period preceding validation ($EG_{5yr\ Val}$) or preceding the accelerated retirement date ($EG_{5yr\ AR}$), whichever occurs earlier
Value applied	As per source of data
Justification of choice of data or description of	N/A

measurement methods and procedures applied	
Purpose of data	Calculation of baseline emissions
Comments	None

9.2 Data and Parameters Monitored

Data/Parameter	$EG_{ref,y}$
Data unit	MWh
Description	Average net electricity generation of at least two reference CFFPs in year *y*
Equations	(3)
Source of data	System administrator or operator records
Description of measurement methods and procedures to be applied	Reference CFPPs used to determine average value must meet all of the following criteria: 1) Unabated CFPP combusting at least 90% coal on a thermal input basis 2) Not a combined heat and power plant 3) No contracted power offtake outside of the system operator 4) Equal or greater nameplate capacity than the CFPP being retired 5) Equal or greater long-run marginal cost than the CFPP being retired, defined as the sum of fuel costs, fixed and variable operating and maintenance costs, and carbon costs (where applicable) per unit of electricity produced. A reference plant may be selected based on the following criteria where the data needed to determine the long-run marginal cost are not available: a) The reference CFPP has a similar or lower efficiency technology than the CFPP being retired (technologies are subcritical, supercritical, and ultra-supercritical, listed from least to most efficient). Where no other suitable CFPPs are connected to the grid, a subcritical CFPP must be used as the reference CFPP. b) The reference CFPP uses a similar or lower grade of coal as the CFPP being retired (lignite, subbituminous, bituminous, anthracite, listed from lowest to highest grade). Where there are no CFPPs that meet the above criteria, $CUF_{ref,y}$ is assumed to decline linearly to 30% at the end of the technical life of the CFPP.
Frequency of monitoring/recording	Annual.

QA/QC procedures to be applied	Average of values from the selected reference CFPPs considered, to ensure appropriateness and conservativeness
Purpose of data	Calculation of baseline and leakage emissions
Calculation method	The average is calculated via adding the EG of all the reference CFPPs (n) in the year y, divided by the number of CFPPs selected as the reference CFPPs.
Comments	None

Data/Parameter	$EG_{RE\_i,y}$
Data unit	MWh
Description	Net electricity generated and supplied to the grid by paired renewable electricity capacity *i* in year *y*
Equations	(7)
Source of data	Measurements using electricity meters at the grid interface of the paired renewable electricity generating plant
Description of measurement methods and procedures to be applied	Use calibrated electricity meters from the grid supplier.
Frequency of monitoring/recording	Data must be monitored continuously and recorded at least monthly or with the frequency applicable according to the grid supplier.
QA/QC procedures to be applied	The consistency of metered electricity generation must be cross-checked with receipts from grid operator/utility where applicable. The meters must be calibrated as per manufacturer specifications or industrial specifications. Check contracts or other legally binding agreements such as PPAs to ensure that renewable electricity is paired and generated earlier than it would have been in the baseline scenario.
Purpose of data	Calculation of leakage emissions
Calculation method	For each paired renewable electricity source, this parameter must be either monitored using a bi-directional energy meter or calculated as the difference between: 1) the quantity of electricity supplied by the project plant/unit to the grid; and 2) the quantity of electricity used by the project plant/unit from the grid. Where calculated, the following parameters must be measured: a) Quantity of electricity supplied by the project plant/unit to the grid b) Quantity of electricity delivered to the project plant/unit from the grid

Comments	To be reported from the date on which the CFPP is retired until the earliest of the following dates: i) The baseline scenario CFPP retirement date ii) Date on which the renewable electricity generated would no longer be considered to be paired with the CFPP retirement (i.e., date from which it is assumed that the renewable electricity would have been generated even in the absence of the project)

Data/Parameter	$EF_{OM,y}$
Data unit	t CO_2e/MWh
Description	Operating margin emission factor in year *y*
Equations	(8)
Source of data	Where a subcritical coal default emission factor is applied, use the following sources: **Data source** / **Condition** 1) Regional or national default values — Preferred option where values are well documented and available from reputable sources 2) Global average default — Use where (1) is not available. Use reputable sources such as International Energy Agency (IEA), IPCC, UNFCCC. Where simple operating margin is applied, it must be calculated as per the most recent version of VT0011.
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Where simple operating margin is applied, it must be estimated ex ante and thereafter calculated annually.
QA/QC procedures to be applied	N/A
Purpose of data	Calculation of leakage emissions
Calculation method	Simple operating margin is calculated as per the most recent version of *VT0011* Where the simple operating margin is applied, the value for crediting year *y* is the greater value between the ex-ante simple operating margin and the simple operating margin in year *y*.

	Where there are other coal-to-clean/power sector crediting projects, the operating margin calculation must include those CFPPs, assuming the same generation projected in the baseline retirement case
Comments	Upstream methane leakage from gas-fired power plants to be determined where simple operating margin is applied as per criteria and procedures established under Section 8.3.2.3 Separate upstream methane leakage from gas-fired power plants is not considered where the operating margin value applied is the subcritical coal default emission factor, as this is already conservative.

Data/Parameter	$EF_{BM,y}$
Data unit	t CO_2e/MWh
Description	Build margin emission factor in year *y*
Equations	(8)
Source of data	Calculated as per the most recent version of *VT0011*
Description of measurement methods and procedures to be applied	N/A
Frequency of monitoring/recording	Estimated ex ante and subsequently annually
QA/QC procedures to be applied	Renewable electricity sources paired with other coal-to-clean/power sector crediting projects must be excluded from build margin calculations.
Purpose of data	Calculation of leakage emissions
Calculation method	For any given crediting year *y*, the greater of the ex-ante simple build margin and simple build margin in year *y* must be used.
Comments	Upstream methane leakage from gas-fired power plants must be considered as per criteria and procedures established under Section 8.3.2.3

9.3 Description of the Monitoring Plan

The project proponent must design and implement a comprehensive and robust monitoring plan. The monitoring plan must contain the following information:

1) Types of data and information to be reported
2) Units of measurement
3) Source of data
4) Monitoring methods (e.g., estimation, modeling, measurement, calculation)

5) Type of equipment used

6) Monitoring times and frequencies

7) Procedures related to the just transition plan developed using *VMD0061*, including at least:

    a) continual updates to:

        i) communication pertaining to the just transition

        ii) consensus building among identified stakeholders and project proponents

        iii) identified policies, programs, and grants relevant to the just transition plan and their use

    b) implementation of and updates to provisions to mitigate loss of work and ensure continued livelihood

    c) continual updates for financial transactions associated with just transition plan implementation

    d) updates and changes to the operational and management system

8) Quality assurance and quality control (QA/QC) procedures

9) Monitoring roles and responsibilities, including experience and training requirements

10) GHG information management systems, including the location, backup, and retention of stored data

11) Roles and responsibilities of the team and whether parts of monitoring are being outsourced

12) Mechanism to ensure compliance with criteria and procedures of monitoring

Where measurement and monitoring equipment is used, the project proponent must ensure that the equipment is calibrated according to current good practice (e.g., relevant industry standards, manufacturer specifications).

The QA/QC procedures must include, but are not limited to, the following:

1) Data gathering, input, and handling measures

2) Input data checked for typical errors, including inconsistent physical units, unit conversion errors

3) Typographical errors caused by data transcription from one document to another, and missing data for specific time periods or physical units

4) Input time series data checked for unexpected variations (e.g., orders of magnitude) that could indicate input errors

5) Use of version control for all electronic files to ensure consistency

6) Physical protection of monitoring equipment

7) Physical protection of records of monitored data (e.g., hard copy and electronic records)

8) Input data units checked and documented

9) All sources of data, assumptions, and emission factors documented

All necessary documents must be collected and centrally stored by the project proponent and be available for verification at any time. Documents and records must be stored in a secure and retrievable manner for at least two years after the end of the project crediting period. The monitoring plan must include procedures to ensure competence of teams and team members engaged in technical tasks such as monitoring of data, transmission of renewable electricity, and implementation of the just transition plan. This may be via appropriate and adequate education, demonstrated experience, trainings, or other measures.

9.3.1 No New Coal Commitments

The monitoring plan must include monitoring of the following commitments that are included as applicability conditions (see Section 4), and must be maintained throughout the total project crediting period:

1) Where the CFPP is owned by a state-owned utility company both the utility and the host country have not built new CFPPs, not increased existing CFPP capacity, and have no new CFPPs or CFPP capacity expansions under development or construction.

2) Where the CFPP is owned by an IPP, the owners have not built new CFPPs, not increased existing CFPP capacity, and have no new CFPPs or CFPP capacity expansions under development or construction that are under their control.

If any of these criteria are not fulfilled, the project activity is not eligible for crediting in the current monitoring period and for the remainder of the crediting period.

9.3.2 Decommissioning

The monitoring plan must include procedures to monitor and demonstrate by the first verification that major equipment at the CFPP has undergone adequate disposal. Adequate disposal of major equipment prevents its reuse to build a new CFPP, or extend the life of existing CFPPs. Major equipment includes, for example, coal pulverizers and other equipment specifically designed for CFPP operations.

At the first verification, site reclamation and remediation must have started, including evaluating for any toxic chemicals like asbestos, or heavy metals, and the cleanup and proper disposal of coal ash. Proper disposal of coal ash includes its removal from the site and disposal

in designated landfills that adhere to relevant host country standards or to relevant available technical standards, such as the US EPA under Subtitle D of the Resource Conservation and Recovery Act (RCRA)

9.3.3 Paired Renewable Electricity

The monitoring plan must include monitoring of renewable electricity capacity directly paired to the accelerated CFPP retirement. This must include but is not limited to the following:

1) Details of each renewable electricity power plant capacity being directly paired
2) Status of each directly paired renewable electricity source (e.g., whether renewable electricity power plant has started construction)
3) Update on the date of commissioning and any material change in the date of commissioning compared to the proposed date given at the start of validation, including whether the 10% threshold (see Section 4.3) was met by the accelerated retirement date, and whether the 40% threshold (see Section 4.3) has been met by the end of the first crediting period.
4) Where there is a material change in the date of commissioning, the reasons for the change and procedures to mitigate any negative impacts associated with delayed commissioning

10 REFERENCES

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APPENDIX 1: GUIDANCE ON VCS REQUIREMENTS

This section provides guidance on requirements of the *VCS Standard* in the context of projects developed using this methodology.

1) **Start date**: As per the *VCS Standard*, the start date for non-AFOLU projects corresponds to the date on which the project starts to generate GHG emission reductions and/or carbon dioxide removals. For this methodology, the start date corresponds to the date on which the CFPP completely ceases electricity production. This may also be considered the accelerated retirement date.

2) **Crediting period**: The crediting period is the shorter of the period in accordance with the most recent version of the *VCS Standard* and the period between the CFPP's accelerated retirement date (i.e., date by which the CFPP has been decommissioned) and the baseline retirement date.

   Example 1: The first crediting period is seven years, and the difference between the accelerated retirement date and the baseline retirement date is three years. In such a scenario, the project is eligible to be issued VCUs for three years and not seven years.

   Example 2: The total crediting period is 21 years (seven years twice renewable), and the difference between the accelerated retirement date and the baseline retirement date is 25 years. In such a scenario, the project is eligible to be issued VCUs for 21 years provided it complies with all rules and requirements applicable at each renewal of the project crediting period.

3) **Crediting period renewal and updated baseline retirement date**: Project proponents must follow the procedures for renewal of the project crediting period in accordance with the most recent version of the VCS Program rules and requirements.

   When demonstrating the validity of the original baseline scenario or updating the baseline scenario, the baseline retirement date must be reassessed in accordance with the criteria and procedures of the most recent version of *VMD0060.* Only the scenarios related to regulations and commitments must be reassessed during the crediting period renewal process, as listed below. The dates of the other scenarios remain the same and do not require reassessment.

   The baseline retirement date for the CFPP is the earliest date of the following scenarios:

   a) Scenarios that must be reassessed and updated at crediting period renewal:

      i) Regulatory CFPP phaseout date

      ii) Committed coal transition mechanism (CTM)

   b) Scenarios that are determined at validation and not reassessed at crediting period renewal:

i) End of technical life

ii) End of long-term PPA

iii) Financially attractive retirement[7]

The updated baseline retirement date for the CFPP applicable for the next crediting period will depend on the results of the reassessment of the applicable scenarios:

- Where the baseline retirement date reassessment does not result in a different date, the baseline retirement date remains the same as in the previous crediting period.
- Where the baseline retirement date reassessment results in a later date (e.g., due to a delay in regulatory phaseout or CTM commitments), the baseline retirement date remains the same as in the previous crediting period.
- Where the baseline retirement date reassessment results in an earlier date (e.g., because the regulatory commitment has advanced), the baseline retirement date for the next crediting period is the earlier date. In this case, the duration of the crediting period must be updated and will terminate at the new baseline retirement date or the maximum length of the crediting period outlined in the most recent version of the VCS Standard, whichever is earlier.

4) **Sustainable development contributions**: The impacts of just transition implementation in the context of accelerated CFPP retirement as per *VMD0061* (e.g., voluntary retirement benefits given to CFPP employees nearing the age of retirement, or training provided to existing employees) must not be reported as sustainable development contributions. These activities represent minimizing the impacts of accelerated CFPP retirement on livelihoods under the principle of no net harm. Additional benefits generated for the environment and community through paired renewable electricity or using revenue from sales of VCUs may be claimed as sustainable development contributions (e.g., additional jobs created due to renewable electricity deployment or setting up a new local healthcare facility for neighboring communities using revenue from sales of VCUs).

5) **Stakeholder engagement:** The project proponent must demonstrate compliance with the requirements of stakeholder engagement in the most recent version of the *VCS Standard*, for CFPP sites and paired renewable electricity sites. Where the location of paired renewable electricity is yet to be finalized, stakeholder consultation must include at least one paired renewable electricity location. The requirements for just transition as established in *VMD0061* are additional to the stakeholder engagement requirements of the *VCS Standard* and are limited to the context of the CFPP.

6) **Safeguards**: The project proponent must demonstrate compliance with the requirements of safeguards in the most recent version of the *VCS Standard*, for the CFPP sites and paired

[7] The financially attractive retirement date only needs to be assessed during monitoring or crediting period renewal if a project design change is made that impacts this date.

renewable electricity sites. The requirements for just transition as established in *VMD0061 a*re additional to the safeguards requirements of the *VCS Standard* and are limited to the context of the CFPP.

7) **No double claiming with other forms of environmental credit**: The renewable electricity paired with the accelerated CFPP retirement is ineligible to claim other forms of environmental credits or certificates such as Renewable Energy Certificates (RECs) for the duration of the crediting period. Off-takers from the paired renewable electricity plants should account for the power as having the emission factor of the retired coal plant in their inventory reporting during the crediting period.

DOCUMENT HISTORY

Version	Date	Comment
v1.0	6 May 2025	Initial version