Draft VCS Module

VMD00XX

COMBINED BASELINE AND ADDITIONALITY ASSESSMENT FOR THE ACCELERATED RETIREMENT OF COAL-FIRED POWER PLANTS

Draft Version 1.0

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

This draft module was developed by the Rockefeller Foundation led Coal to Clean Credit Initiative.

CONTENTS

1 SUMMARY DESCRIPTION

This module establishes criteria and procedures to determine the baseline retirement date and baseline scenario, and to demonstrate the additionality of projects activities that accelerate the retirement of a coal fired power plant (CFPP).

2 SOURCES

This module is used in combination with the most recent versions of *VM00XX: Accelerated Retirement of Coal-fired Power Plants Using a Just Transition*[1] and the following VCS Program module and tool:

- *VT0010 Emissions from Electricity Consumption (under development)*
- *VT0011 Emission factors for Electricity Systems (under development)*

This methodology is based on the following Clean Development Mechanism (CDM) methodologies:

- *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*
- *ACM0002: Grid-connected electricity generation from renewable sources, Version 21.0*

This methodology uses the most recent versions of the following CDM methodologies and tools:

- *Tool 02: Tool to identify the baseline scenario and demonstrate additionality*
- *Tool 07: Tool to calculate the emission factor for an electricity system.*
- *Tool 23: Additionality of first-of-its-kind project activities*
- *Tool 24: Common practice*
- *Tool 27: Investment Analysis Tool*

The following have also informed the development of the methodology:

- *Proposed guidance on addressing bias uncertainty, CDM – Meth Panel, Thirty-second meeting, Report Annex 14*

[1] Methodologies labelled as "VM00XX" and Tools labelled as "*VT00XX*" are under development

3 DEFINITIONS

In addition to the definitions in the latest version of the *VCS Program Definitions* and as established in the latest version of *VM00XX,* the following definitions apply in context of this module.

Accelerated depreciation
A utility finance tool that accelerates the depreciation schedule of the CFPP, and therefore accelerating the return on and recovery of capital invested on its rate base, over a shorter period.

Asset level phase-out plan
A documented and approved plan to retire CFPPs (and other fossil fuel power plants) in a jurisdiction (national or subnational) where the plan specifies the retirement date of each CFPP. Both the jurisdictional government and Independent Power Producer (IPP) can have an asset level phase-out plan. However, only a plan by a government is considered legally binding.

Coal Transition Mechanism (CTM)
Financial products and services designed to facilitate a managed transition of a CFPP that has remaining fair value to their owners. This is done by changing the underlying cost of capital of a CFPP or its revenues to deliver necessary returns.
Any carbon market mechanism leveraging the revenue generated from carbon credits, including compliance market, voluntary carbon market (VCM) and Article 6, is excluded from the definition of a coal transition mechanism.

Jurisdictional level phase-out plan
A documented and approved commitment by the jurisdictional (national or subnational) government that specifies the phaseout date for all CFPPs in the jurisdiction, without specifying the individual retirement dates This phaseout date is considered legally binding for all the CFPP within the jurisdiction.

Regulatory asset
A finance tool that allows a utility to continue to include an asset in its rate base, and therefore continue to realize a return on and recovery of capital on the asset, even after it has ceased operation.

Required revenues
The annual revenue that a regulated utility needs to earn to provide adequate service to its customers and the allowed return for its shareholders.

4 APPLICABILITY CONDITIONS

This module applies to the project activities related to an accelerated retirement of a CFPP using the most recent version of *VM00XX*.

5 DETERMINING THE BASELINE RETIREMENT DATE

The Baseline Retirement Date for the CFPP is the earliest date identified in the scenarios that follow in sections 5.1 through 5.5.

5.1 Regulatory CFPP phaseout date

The retirement date is imposed at the jurisdictional level or asset level by existing regulations, plans or commitments at the national or sub-national level, through any of the following:

1) A coal phaseout date specified in a country's Nationally Determined Contribution (NDC). The project proponent must refer to the latest version of the country's NDC communication[2] at the time of submitting the project for registration.
2) A coal phaseout date stipulated in the electricity system's most recent integrated resource or electricity sector plan, which has been approved by the electricity regulator or electricity sector governing body.
3) A coal phaseout date set in a national or subnational legislation, law, or executive mandate.

5.2 End of technical life

The date is determined to be the end of the technical life of the CFPP using the most recent version of CDM Tool 10: *Tool to determine remaining technical life of equipment.*

5.3 End of a long-term power purchase agreement (PPA)

The end date for the existing long-term PPA. PPA extensions executed after December 31, 2023, are not eligible and the original end date of the agreement must be used.

5.4 Committed CTM

The announced retirement date of the CFPP under a CTM, where either of the following conditions have been met:

1) The financial close of a transaction. Financial closure can be demonstrated through:
    a. transfer of ownership of the CFPP, or equity investment, or full/partial buyout of equity shares of the CFPP; OR
    b. development of a special purpose vehicle or fund to invest in the CFPP, refinancing, or new financing agreement, that would lower the existing cost of capital, for example by lowering the cost of equity, cost of debt, or leverage ratio, or required returns of the CFPP.

[2] The latest version of the NDC can be referenced from the UNFCCC NDC registry. Available at: https://unfccc.int/NDCREG

2) The signing of an electricity contract for a defined early retirement, such as a PPA, PPA renegotiation, or other contractual agreement detailing retirement ahead of the CFPP's current PPA term or technical life.

5.5 Financially attractive retirement

Retiring a CFPP earlier than the end of its technical life, regulatory-determined phaseout date, committed CTM retirement date, or the end of its PPA term, may be financially attractive to a regulated utility/IPP with a long term PPA or a long term PPA off-taker.

Early retirement of a CFPP is deemed financially attractive if replacing the coal generated electricity with renewable energy electricity results in net savings after accounting for any additional contract termination costs (e.g., early PPA termination fees).

The earliest date at which retirement is financially attractive is determined through an evaluation of the following scenarios appropriate to the ownership of the CFPP, using the financial analysis outlined in section 5.5.1.

1) CFPPs owned by a regulated utility:

    a) Accelerated depreciation - In this retirement scenario, the utility achieves capital recovery and earns return on capital for the CFPP over an accelerated depreciation period. The utility then retires the CFPP after capital recovery has been achieved and replaces its generation with alternative resources.

    b) Regulatory asset - Where appropriate regulation exists, an early retirement enabled through the creation of a regulatory asset must be evaluated if a precedent for such a practice exists in the jurisdiction. The utility then retires the CFPP and replaces it with alternative resources but is allowed to continue to realize return of capital and return on capital for the CFPP after its retirement.

    c) Securitization - Where appropriate regulation exists, early retirement enabled through mechanisms to refinance the CFPP's value in the utility's rate base (e.g., through ratepayer-backed bond securitization) must be assessed if a precedent for such a practice exists in the jurisdiction. In this case, the utility is provided capital recovery, the CFPP's underlying cost of capital (or regulated return) is replaced with a lower rate, and the utility retires and replaces the CFPP with alternative resources.

    d) Refinancing – In cases where the operating costs of the CFPP are subsidized by the government, an early retirement through sovereign debt must be evaluated if a precedent exists for government intervention to aid in refinancing the CFPP's fair value in the jurisdiction.

2) CFPPs owned by an IPP:

    a) Where a long-term PPA is in place, the project proponent must evaluate the financial feasibility of early retirement due to the early termination of its PPA by the off taker. This evaluation must consider that the off taker would pay early termination fees to the IPP, retire the CFPP, and need to pay for alternative sources of generation. PPA termination fees negotiated in contracts would typically enable the IPP to meet its financial and contractual obligations and achieve a fair return of its capital.

5.5.1 Determination of the financially attractive retirement date

The financially attractive retirement date is the earliest of the retirement dates determined for each of the above sub-scenarios, that are applicable to the CFPP being retired.

The financially feasible retirement date must be determined through a financial analysis that assesses whether retiring the CFPP early and replacing its generation with renewable energy (RE) and other grid-connected electricity is more financially attractive than continuing to operate it. This is done by calculating the Net Present Value of Required Revenues (NPVRR) over a number of years during which it is assumed the coal plant would have operated continuously to provide the CFPP owners with the desired returns. These years are referred to as the continued operating (CO) years.

The total number of continued operating years constitutes the period over which the financial assessment is to be carried out, i.e. the financial assessment period.

The financial analysis is carried out annually over the continued operation years until a year is reached when retiring the CFPP and replacing it with RE and grid electricity becomes more financially attractive than continuing its operation.

The financially attractive retirement date is defined as the first year when the NPVRR for continuing to run the CFPP is equal to or greater than the sum of the NPVRR for continued operation until that year and the NPVRR required to replace the electricity generated by the CFPP with a mix of paired renewable energy (RE) and grid-connected power sources. This is determined using Equation (1) below.

$$NPVRRC_{S,CO} \geq (CC_{S,AR} * NPVRRC_{S,AR}) + (CG_{S,AR} * NPVRRRG_{S,AR}) \quad (1)$$

Where:

$NPVRRC_{S,CO,}$	=	Net present value of required revenues associated with the CFPP for the relevant stakeholder, S (utility or IPP , 'U' or offtaker 'O') in the CFPP continued operation case (currency unit)
$NPVRRC_{s,AR}$	=	Net present value of required revenues associated with the CFPP for the relevant stakeholder, S (utility 'U' or offtaker 'O') in a retirement case (where (currency unit)- Where AR is the retirement year for which the NPV is carried out.
$NPVRRRG_{S,AR}$	=	Net present value of required revenues for replacement generation for the relevant stakeholder, S (utility or offtaker) following the retirement of the CFPP in year AR and until the last year of the assessment period
$CC_{s,AR}$	=	conservative correction factor for Net present value of required revenues associated with the CFPP for the relevant stakeholder, S (utility 'U' or offtaker 'O') in a retirement case Value to be set, if applicable, as stipulated in Section 7
$CG_{S,AR}$	=	conservative correction factor for Net present value of required revenues for replacement generation for the relevant stakeholder, S (utility or

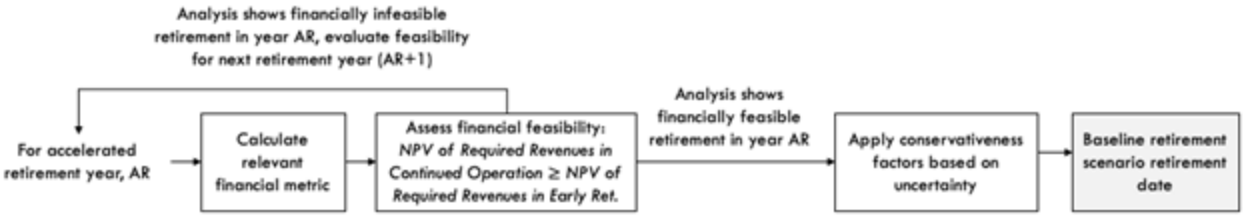
offtaker). Value to be set, if applicable, if applicable, as stipulated in Section 7.

The financial assessment period starts with the year in which the baseline scenario analysis is carried out (referred to as RO). The last year of the financial assessment period must be the year when the CFPP is assumed to stop operating and be retired i.e. the retirement year (RY). RY is established based on the financial period assessment options above.

The first CO year for which the financial analysis is undertaken is the year in which the project proponent undertakes the baseline retirement scenario analysis described in this module. Subsequent CO years are subjected to the same analysis until a year is reached when the condition in Equation 1 is met, i.e. when it is considered the retirement of the CFPP is financially attractive, as shown in Figure 1.

Each CO year that is assessed as a possible CFPP retirement year is termed the AR year. The CO year in which the condition in equation 1 is satisfied must be taken as the financially attractive retirement year for that sub-scenario

This process is illustrated in Figure 1.



The financial analysis only considers the value of the electricity generated throughout the financial assessment period and excludes the value of any additional grid services that the CFPP may provide (e.g., capacity, ancillary services). This approach ensures conservativeness by identifying a financially attractive retirement date that is earlier than one that considered the value of additional grid services.

The assessment of financial feasibility in Equation (1) must include uncertainty propagation or default uncertainty factors, which correspond to default conservativeness factors (see section 5.5.4 for details). The resulting conservativeness factor must be applied to the financially feasible retirement year to determine a conservative baseline scenario retirement date in each sub-scenario.

Financial analyses should be done in real terms. If nominal terms are used, inflation must be accounted for following the guidance provided in the latest version of the CDM TOOL 27: *Methodological Tool: Investment Analysis.*

5.5.2 Required revenues associated with the CFPP

In the case of a regulated-utility-owned CFPP or an IPP with a long term PPA, the NPVRR must be calculated based on CFPP costs as shown in Equation (2).

$$NPVRR_{C,U,AR} = \sum_{y=RO}^{y=RY} \frac{CAPEX_y + PDEBT_y + (IDEBT_y + VOM_y + FOM_y + FUEL_y + CONTRACT_y - CTMREV_y) \times (1-T) - DEP_y \times T + CARBON_y}{(1-T) \times (1+WACC_U)^{y-RO}} \quad (2)$$

Where:

$NPVRRC_{U,AR}$	=	Net present value of required revenues associated with the CFPP for the utility/ IPP owner for any retirement year AR (currency unit)
y	=	Year of CFPP operation (dimensionless)
RY	=	Financial assessment period assumed retirement year (dimensionless)
RO	=	Year of the baseline scenario analysis (dimensionless)
$CAPEX_y$	=	Capital expenditure including equity return of capital and equity return on capital (currency unit)
$PDEBT_y$	=	Principal payment for asset-level debt (currency unit)
$IDEBT_y$	=	Interest payment for asset-level debt (currency unit)
VOM_y	=	Variable operations and maintenance (O&M) costs (currency unit)
FOM_y	=	Fixed O&M costs (currency unit)
$FUEL_y$	=	Fuel costs (currency unit)
$CARBON_y$	=	Cost of carbon (currency unit)
$CONTRACT_y$	=	Contract termination costs (currency unit)
$CTMREV_y$	=	Revenues due to a coal transition mechanism, as relevant (currency unit)
T	=	Tax rate (%)
DEP_y	=	Depreciation for tax purposes (currency unit)
$WACC_U$	=	WACC of the Utility (%)

In the case of an off taker of a CFPP PPA, the NPVRR must be calculated based on the terms of the PPA as shown in Equation 3:

$$NPVRR_{O,AR} = \sum_{y=RO}^{y=RY} \frac{\left(PPAE_y \times G_y + PPAC_y \times A_y + PPAOS_y \times OS_y + CONTRACT_y\right) \times (1-T) + CARBON_y}{(1-T) \times (1+WACC_O)^{y-RO}} \quad (3)$$

Where:

$NPVRRC_O$	=	Net present value of required revenues associated with the CFPP for the offtaker for retirement year RY (currency unit)
y	=	Year of CFPP operation (dimensionless)
RY	=	Financial assessment period assumed retirement year (dimensionless)
RO	=	Year of the baseline scenario analysis (dimensionless)
$PPAE_y$	=	Remuneration for electricity generation under PPA contract (currency unit per unit of generation, e.g., $/MWh)
G_y	=	CFPP electricity generation in year y (MWh)

$PPAC_y$	=	Remuneration for available capacity under PPA contract (currency unit per unit of available capacity)
A_y	=	Availability (available capacity unit)
$PPAOS_y$	=	Remuneration for other electricity services, as relevant (currency unit per unit of service)
OS_y	=	Other yearly services provided by the CFPP, as relevant (service unit)
T	=	Tax rate (%)
$CARBON_y$	=	Cost of carbon, included if carbon costs are passed through to offtaker (currency unit)
$WACC_o$	=	WACC of the offtaker (%)

5.5.3 Required revenues for replacement electricity generation

Replacement electricity generation costs prior to the CFPP retirement year, AR, must equal zero. For all the remaining financial assessment period years after the AR year, the replacement electricity will be obtained from sources connected to the grid, including paired RE. The replacement generation cost is determined based on the unit cost of generation multiplied by the amount of electricity that has to be generated to replace the CFPP's expected generation.

The net present value of required revenues from replacement generation is calculated as shown in Equation 4:

$$NPVRRR_{G,AR} = \sum_{y=RO}^{y=RyCO} \frac{UCRG \times G_y}{(1-T) \times (1+WACC)^{y-RO}} \quad (4)$$

Where:

$NPVRRRG_{AR}$	=	NPV of required revenues for replacement generation starting in CFPP retirement year AR (currency unit)
y	=	Year (dimensionless)
Ry	=	Financial assessment period assumed retirement year n year (dimensionless)
$UCRG$	=	Unit cost of replacement generation in the electricity system (currency unit per unit of generation, e.g., $/MWh)
G_y	=	Annual Coal plant generation (generation unit e.g., MWh)
T	=	Tax rate (%)
$WACC$	=	Weighted average cost of capital of the offtaker or utility (%)

The unit cost of replacement generation (UCRG) during the years between the AR year and the remaining years of the financial assessment period, must not increase in the financial analysis and should be assumed to be constant in real terms.

The CFPP generation, G_y, should be assumed to be constant and must be consistently applied across all required revenue calculations.

5.5.4 Unit cost of replacement generation

The unit cost of replacement generation (UCRG) must be estimated as the lower value between the average cost of generation in the electricity system (UCG_{AVG}) and the cost of replacement generation in the project scenario, as shown below:

$$UCRG = \min(UCG_{AVG}, UC_{PS}) \quad (5)$$

Where:

$UCRG$	=	Unit cost of replacement generation in the electricity system (currency unit per unit of generation, e.g., $/MWh
UCG_{AVG}	=	Average cost of generation in the electricity system (currency unit per generation unit, e.g., $/MWh)
UC_{PS}	=	Unit cost of replacement generation in the project scenario (currency unit per generation unit, e.g., $/MWh)

1) Equation 5 calculates the average cost of generation in the electricity system in the year of the baseline scenario assessment.

$$UCG_{AVG} = \frac{\sum_i (GU_i \times UCG_i)}{\sum_i GU_i} \quad (6)$$

Where:

UCG_{AVG}	=	Average cost of generation in the electricity system (currency unit per generation unit, e.g., $/MWh)
GU_i	=	Generation from unit i in the electricity system (generation unit, e.g., MWh)
UCG_i	=	Average unit cost of generation of unit i (currency unit per generation unit, e.g., $/MWh)

2) Equation 6 calculates the unit cost of replacement generation in the project scenario.

$$UC_{PS} = \frac{UCG_{AVG} \times (Gy - GR) + LCOE_{RE} \times GR}{G_y} \quad (7)$$

Where:

UC_{PS}	=	Unit cost of replacement generation in the project scenario (currency unit per generation unit, e.g., $/MWh)
UCG_{AVG}	=	Average cost of generation in the electricity system (currency unit per generation unit, e.g., $/MWh)
Gy	=	Annual CFPP generation (generation unit, e.g., MWh)
GR	=	Annual paired renewable energy generation (generation unit, e.g., MWh)
$LCOE_{RE}$	=	Levelized cost of paired RE energy generation (currency unit per generation unit, e.g., $/MWh)

5.5.5 Levelized cost of paired renewable energy generation

$$LCOE_{RE} = \frac{\sum_{t=0}^{t=L}\{CAPEX_t + PDEBT_t + (IDEBT_t + FOM_t + VOM_t + FUEL_t) \times (1-T) - DEPTAX_t \times T + CARBON_t\}/(1+K_e)^t}{\sum_{t=0}^{t=L}(GR_t \times (1-T)/(1+K_e)^t)} \quad (8)$$

Where:

$LCOE_{RE}$	=	Levelized cost of paired renewable electricity (currency unit per generation unit, e.g., $/MWh)
t	=	Project year since initial investment (years)
L	=	Project lifetime (years)
$CAPEX_t$	=	Capital expenditure, including the equity portion of upfront capex, maintenance capex, and decommissioning costs (currency unit)
$PDEBT_t$	=	Principal payment on debt (currency unit)
$IDEBT_t$	=	Interest payment on debt (currency unit)
FOM_t	=	Fixed operations and maintenances costs (currency unit)
VOM_t	=	Variable O&M (currency unit)
$FUEL_t$	=	Fuel costs (currency unit)
$DEPTAX_t$	=	Depreciation allowance for asset (currency unit)
T	=	Tax rate (%)
$CARBON_t$	=	Carbon cost in year t (currency unit)
K_e	=	Cost of equity of the renewable energy owner (%)
GR_t	=	Generation of renewable energy in year t (energy unit e.g., MWh)

The calculation of the LCOE of renewable electricity must follow the guidance on cost of capital stipulated in CDM TOOL 27: *Investment Analysis* along with the additional criteria below:

- The initial capital investment must be assumed to be financed with at least 70% debt unless the technology is the first of its kind in the host country.
- Investment costs (Capex and O&M per unit capacity, e.g., $/MW) should be benchmarked against national or regional values. References from the International Energy Agency, International Renewable Energy Agency, or Bloomberg New Energy Finance may be used to estimate initial capex costs. Investment costs should include any policy support (e.g., grants, investment credits) that exist for the replacement RE.
- Carbon costs must be excluded for technologies that would not generate direct emissions due to fossil fuels, i.e. all eligible RE under the VM00XX: Accelerated Retirement of Coal-Fired Power Plants Using a Just Transition.
- Depreciation for tax purposes should reflect existing policies or tax codes that would provide a tax benefit to renewable energy technologies. If no such policies exist, straight-line depreciation over the project lifetime may be assumed.

- Project lifetime should be taken as the length of a PPA contract for IPP-owned renewable energy assets, and the technical life of the asset for utility-owned assets.
- Renewable generation must be estimated using at least the P50 energy yield arising from an independently prepared resource assessment, prepared by a qualified firm with prior experience conducting such studies.

5.5.6 Guidance for determining specific parameters

The sections below provide general guidance for determining specific parameters used in the financial analysis, to ensure conservativeness in the baseline determination.

5.5.6.1 Cost of capital

The weighted average cost of capital (WACC) should be calculated based on the cost of equity, share of the initial CFPP investment financed through equity, share of the initial investment financed through asset-level debt, and the cost of asset-level debt.

$$WACC_s = K_{e,s} \times w_{e,s} + K_{d,s} \times w_{d,s} \quad (9)$$

Where:

$WACC_s$	=	Weighted average cost of capital for stakeholder S (%)
$K_{e,s}$	=	Cost of equity for stakeholder S (%)
$w_{e.s}$	=	Share of initial CFPP investment financed by equity (%)
$K_{d,s}$	=	Cost of asset-level debt on plant owned by stakeholder S (%)
$w_{d.s}$	=	Share of initial CFPP investment financed by asset-level debt (%)

For utilities and single-buyer PPA offtakers, the cost of equity should reflect their regulated return[3]. The shares of equity and debt, and cost of asset-level debt, should be based on historical audited data, given the investment in the CFPP will have already occurred.

5.5.6.2 Capex costs

Capital expenditure costs, including equity return of capital and equity return on capital, are amortized over the remaining lifetime of the asset. This approach is recommended as upfront investment costs will have been made prior to the start of project registration and the execution of the financial analysis.

$$CAPEX_y = \frac{EV \times K_e \times (1 + K_e)^L}{(1 + K_e)^L - 1} \quad (10)$$

Where:

$CAPEX_y$	=	Yearly capital expenditure cost (currency unit)
EV	=	Equity value of asset (currency unit)
K_e	=	Cost of equity of the CFPP owner (%)
L	=	Lifetime of the CFPP asset from commissioning until retirement (years)

[3] The methodology may be revised in the future to cater for merchant CFPPs that do not have regulated return.

Where L is the technical life for a utility-owned CFPP, and the end of the PPA term for an IPP-owned CFPP.

Where the equity value of the asset, EV, should be determined based on the share of equity in the upfront investment (i.e. the initial investment cost of the CFPP minus any project-level debt) plus any accumulated maintenance capex and future maintenance capex. This maintenance capex is assumed to occur at the time of initial CFPP investment. While this does not represent the timing of maintenance capital expenditure, assuming all maintenance capex happens at the time of initial investment both simplifies the methodology calculations and is conservative, as it would increase the cost of coal operation in the continued operation case, therefore making earlier retirement more attractive.

$$EV = E + AMC + FMC \quad (11)$$

Where:

EV	=	Equity value of asset (currency unit)
E	=	Equity portion of initial investment (currency unit)
AMC	=	Accumulated maintenance capex until registration year (currency unit)
FMC	=	Expected future maintenance capex until two years prior to retirement year (currency unit)

Future maintenance capex should be based on existing maintenance contracts and should assume no additional maintenance capex is spent in the two years prior to the CFPP's retirement. Where maintenance contracts are unavailable, future maintenance capex may be projected using historical maintenance capex spending.

5.5.6.3 Debt

Debt service costs include asset-level debt that was used to finance the initial investment in the CFPP, refinance asset-level debt, or new debt issuance (e.g., under a committed CTM). Debt service costs, including interest and principal payments, should be calculated according to the terms of the existing financing agreement. The after-tax cost of debt should be used in the analysis.

If a CFPP would be retired before the end of its existing loan tenor, it may be assumed that the remaining principal on unpaid debt needs to be fully repaid in the retirement year (RY).

5.5.6.4 Fixed and variable operations & maintenance (O&M) costs

Fixed and variable O&M costs should be based on historical data over the previous five years prior to registration of the project. If fewer than five years of operational data exist, then the average of the historical fixed and variable operations and maintenance costs over the entire lifetime of the CFPP must be used. These costs should be assumed to be fixed in real terms in the baseline assessment.

5.5.6.5 Depreciation costs for tax purposes

Depreciation costs should be estimated assuming straight-line depreciation of the net book value of the CFPP over the remaining technical life of the CFPP.

$$DEPTAX_y = \frac{NBV_{RO}}{RTL_{RO}} \quad (12)$$

Where:

$DEPTAX_y$	=	Depreciation for tax purposes (currency unit)
NBV_{RO}	=	Net book value of CFPP in the year of the analysis (currency unit)
RTL_{RO}	=	Remaining technical life in the year of the analysis (dimensionless)

Technical life must be determined according to the latest version of the CDM Tool 10*: Tool to Determine Remaining Technical Life of equipment.*

5.5.6.6 Fuel costs

Fuel costs should be based on historical data over the previous five years prior to the date the baseline scenario assessment is undertaken and must include transportation costs of fuel. If fewer than five years of operational data exist, then the average of the historical fuel costs over the entire lifetime of the CFPP must be used. Fuel costs should be fixed in real terms for the baseline scenario analysis.

5.5.6.7 Costs of carbon

Costs of carbon must be included where a carbon pricing scheme exists or is planned. The carbon price must be determined as follows:

- Where a regulator or government agency in the host country has published a schedule of expected carbon prices, this schedule must be used when projecting future carbon costs.
- Where several pricing scenarios are available, the carbon price data set to be applied must be the one with the most ambitious, i.e., highest carbon price.
- Where a regulator or government agency in the host country has only published a range of expected carbon costs for its carbon pricing scheme, the carbon cost must be assumed to increase linearly to the maximum value in the range over the period for which the range was forecasted.
- If the assessment period extends beyond the published schedule or range or prices, the carbon cost must be projected forward using a linear trendline based on the average rate of change of carbon prices over the last five years of available data.

The cost of carbon should be calculated based on the emissions factor of the CFPP, its generation, and the carbon price.

$$CARBON_{y,i} = CP_y \times G_{y,i} \times EF_i \quad (13$$

Where:

$CARBON_{y,i}$	=	Carbon cost in year y for plant or unit I (currency unit)
CP_y	=	Carbon price in year y (currency unit per emissions unit, e.g., $/tCO2e)
$G_{y,i}$	=	Generation of plant or unit i in year y (generation unit e.g., MWh)
EF_i	=	Emissions factor of plant or unit I (emissions per generation e.g., tCO2e/MWh)

The emissions factor of the plant should be calculated as the three-year average annual emissions factor. If asset-level emissions data is unavailable, default emissions factors based on plant specifications may be utilized.

$$EF_i = \frac{1}{3} \times \sum_{y=REG-3}^{y=REG} \frac{EM_{y,i}}{G_{y,i}} \quad (14)$$

Where:

$EF_{y,i}$	=	Emissions factor of plant or unit I (emissions per generation e.g., tCO2e/MWh)
$EM_{y,i}$	=	Plant or unit emissions in year y (emissions unit, e.g., tCO2e)
$G_{y,i}$	=	Generation of plant or unit i in year y (generation unit e.g., MWh)

5.5.6.8 Generation and availability

The future yearly generation (G_y) and availability (A_y):

- Calculated as historical averages of the CFPP over the last five years.
- If fewer than five years of operational data exists, then the average of the historical generation and availability over the entire lifetime of the CFPP must be used.
- If the CFPP has an existing PPA with a take-or-pay clause, the take-or-pay levels set in the PPA must be used as a minimum for yearly generation, G_y.
- Annual generation and availability are assumed to be constant throughout the analysis period.

5.5.6.9 Contract termination costs

In the baseline retirement scenario that involves PPA termination by the offtaker, PPA termination costs should be assumed to be borne by the offtaker in the CFPP retirement year. These termination costs should be determined based on the existing terms of the PPA between the CFPP and off-taker at the time of the project validation. If this information is unavailable, the PPA termination cost may be estimated as the net book value of the CFPP asset in a given retirement year, AR. This must be determined assuming a straight-line depreciation of the remaining book value of the CFPP over the remaining PPA term. Contract termination costs must not include additional costs to cover termination of the CFPP's fuel supply agreement (FSA) or O&M agreements.

$$CONTRACT_{AR} = NBV_{RO} - \{\left(\frac{NBV_{RO}}{PPA_{term} - PPA_{AR}}\right) \times (PPA_y - PPA_{RO})\} \quad (15)$$

Where:

$CONTRACT_{AR}$	=	PPA contract termination cost borne by the offtaker in retirement year AR (currency unit)
RO	=	Year the baseline assessment is undertaken (dimensionless)

NBV_{RO}	=	Net book value of the CFPP asset in the year the baseline assessment is undertaken (currency unit)
PPA_{term}	=	Total length of the PPA term (years)
PPA_{RO}	=	Number of years since the start of the PPA term and the year the baseline assessment is undertaken (years)
PPA_{AR}	=	Number of years since the start of the PPA and the retirement year (years)

For retirement scenarios in which a regulated utility retires its own CFPP, the following contract termination costs may be considered:

- Early FSA termination costs if the FSA existing at the time of the project would expire after the expected early retirement of the CFPP. These early termination costs must be based on the existing terms of the FSA.
- Early O&M agreement termination costs if the O&M agreements existing at the time of the project would expire after the expected early retirement of the CFPP. These early termination costs must be based on the existing terms of the O&M agreement.

6 ADDITIONALITY

This methodology uses a project method for the demonstration of additionality.

Projects are additional if all of the following tests are met.

6.1 Regulatory surplus

Projects using this module under *VM0XX: Accelerated Retirement of a Coal-Fired Power Plants* demonstrate regulatory surplus if either:

1) No coal phaseout date is established in either of the three sub-scenarios in section 5.1, or
2) If a coal phaseout date is established in one or more sub scenarios. (e.g., national legislation mandates jurisdictional coal phaseout by December 31, 2040), the CFPP accelerated retirement is considered regulatory surplus if it occurs before the established coal phaseout date.

6.2 Implementation Barrier – Investment Barrier

Projects that retire the CFPP before the baseline retirement date as per Section 5 have demonstrated they have an investment barrier.

6.3 Common Practice

This subsection establishes criteria and procedures to determine if the proposed early decommissioning of the CFPP without carbon revenue is common practice. To be deemed additional, the project activity must not be common practice in the geographical region. The

common practice analysis considers only the early decommissioning of the CFPP and not the paired RE.

The geographical region selected for conducting common practice analysis should be the national boundary of the host country. If a sub-national boundary is selected as the applicable geographical region (e.g., region, province/state), the project proponent must provide suitable justification, rationale and supporting evidence between the differentiating circumstances of the selected sub-national boundary and the rest of the country. These circumstances may be based on relevant power sector regulations, significant differences in set up of power sector stakeholders, among others.

6.3.1 Identification of similar project activities

1) Identify CFPPs retired in the applicable geographic region in a relevant time horizon at the time of making the decision to project CFPP ahead of the baseline retirement date. The relevant time horizon or the look back period may be based on either of the following:
    a) 10 years prior to the time of making the decision to retire the project CFPP ahead of its baseline retirement date, OR
    b) Cessation of relevant power sector regulation and/or policy. e.g., reduction or culmination of subsidy for coal, OR
    c) Implementation of relevant power sector regulation and/or policy. e.g., carbon tax or emission trading scheme (ETS) for the power sector.

    The project proponent must justify the choice on the length of the look back period, including rationale and logic. Where option b) and c) are not clear and/or distinguishable, the project proponent must select option a) as the look back period.

2) The CFPPs identified in the look back period:
    a) must not be registered (or seeking registration) in a GHG program
    b) must have retired CFPP or have committed to retire CFPP before the submission of project registration or before retirement of the CFPP, whichever is earlier.
    c) must not include those CFPP have retired due to regulation, end of technical life, end of PPA or due to committed CTM.
    d) must not include any biomass co-firing plant.

    Note this number as NER.

3) Identify CFPPs that have been retired due to regulation, end of technical life, end of PPA or due to committed CTM. Note this number as NALL.

If the value of NER = 0, then the project is considered first of its kind in the applicable geographic region and project activity and meets the common practice test.

If the value of NER is 1 or more than 1, proceed to the next step.

6.3.2 Calculation of penetration rate

The penetration rate for early retirement of CFPP is calculated as follows:

$$CFPP_{PR} = 1 - \left(\frac{N_{ALL}}{N_{ER}}\right) \quad (16)$$

Where:

$CFPP_{PR}$	=	Penetration rate for early retirement of CFPP (dimensionless)
N_{ALL}	=	Number of CFPP retired as identified based on the criteria established in 5.7.1.3)
N_{ER}	=	Number of CFPP retired early as identified based on the criteria established in 5.7.1 1) and 5.7.1. 2)

If the value of $CFPP_{PR}$ is ≤0.2, the project activity is not deemed to be common practice in the applicable geographic region.

If the value of $CFPP_{PR}$ is > 0.2, proceed to the next step.

6.3.3 Differentiating between proposed project and NER

Provide an analysis demonstrating the extent of differentiation between the proposed project and all of the early retired CFPP identified in NER.
The differentiation (if any) must be established based on regulatory environment, promotional policies, financial policies (such as subsidies, preferential tariff), etc. that allow project CFPP to continue its operation unlike the early retired CFPP identified in N_{ER} or that these policies, instruments, etc. were not available to each CFPPs identified in N_{ER}.

If there are significant distinctions observed and demonstrated between the project CFPP and CFPPs identified in N_{ER} , then the project is deemed not a common practice in the geographical region.

If the outcome is that no significant differentiation/distinctions are observed and/or demonstrated, then the project is regarded as common practice.

7 UNCERTAINITY ASSESSMENT

The project proponent must undertake an uncertainty analysis at the project level by applying error propagation, in line with guidance provided in the *CDM Meth Panel's Proposed Guidance on Addressing Bias Uncertainty* for each financially feasible sub-scenario. Uncertainties should be considered for the following parameters:

- Fuel price
- Carbon price
- CFPP generation
- Average cost of grid generation
- Utility or offtaker cost of equity
- Continued operation date
- Contract termination costs
- RE capex
- RE cost of equity

- RE cost of debt
- RE debt tenor
- RE generator output

If the overall level of uncertainty exceeds 15% (at a 95% confidence level), the project proponent must apply the default conservativeness factors, C, provided in the table below as per CDM Meth Panel's Proposed Guidance on Addressing Bias Uncertainty.

Table 1: Conservativeness Factors

Estimated Uncertainty range at 95% confidence level	Conservativeness factor, C
> +/- 15%, ≤ +/- 30%	0.943
> +/- 30%, ≤ +/- 50%	0.893
> +/- 50%, ≤ +/- 100%	0.836

If a project proponent is unable to undertake an uncertainty analysis, the following default uncertainties and conservativeness factors must be applied, in line with the *CDM Meth Panel's Proposed Guidance on Addressing Bias Uncertainty*:

- The remaining technical life of the CFPP is less than 10 years: Conservativeness factor of 0.943.
- The remaining technical life of the CFPP is greater than 10 years: Conservativeness factor of 0.893.

The resulting conservativeness factor must be applied to the values of $NPVRRC_{S,AR}$ and $NPVRRRG_{S,AR}$ in Equation (1) to establish the year when it is assumed retiring the CFPP becomes financially attractive

8 DATA AND PARAMETERES

8.1 Data and Parameters Available at Validation

Data / Parameter	PDEBTy
Data unit	Currency unit
Description	Principal payment for asset-level debt
Equations	Equations 2,8
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of	N/A

measurement methods and procedures applied	
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	IDEBTy
Data unit	Currency unit
Description	Interest payment for asset-level debt
Equations	Equations 2,8
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	VOMy
Data unit	Currency unit
Description	Variable operations and maintenance (O&M) costs
Equations	Equations 2,8
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	FOMy
Data unit	Currency unit
Description	Fixed O&M costs
Equations	Equations 2,8

Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	FUELy
Data unit	Currency unit
Description	Fuel costs
Equations	Equation 2
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	CTMREVy
Data unit	Currency unit
Description	Revenues due to a coal transition mechanism
Equations	Equation 2
Source of data	CTM financial documentation
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	T
Data unit	Percentage (%)
Description	Total blended tax rate
Equations	Equations 2,3,4,8
Source of data	Local tax documentation
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	DEPy
Data unit	Currency unit
Description	Depreciation for tax purposes
Equations	Equations 2,12
Source of data	CFPP financial records, calculated as per equation 11
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	WACCU
Data unit	%
Description	WACC of the Utility
Equations	Equations 2,4
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of	N/A

measurement methods and procedures applied	
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	PPAEy
Data unit	Currency unit per unit of generation (e.g., $/MWh)
Description	Remuneration for electricity generation under PPA contract
Equations	Equations 3
Source of data	CFPP PPA terms
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	Gy
Data unit	Generation unit (e.g., MWh)
Description	CFPP electricity generation in year yt
Equations	Equations 3,4,7,13,14
Source of data	CFPP utilization/generation records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	PPACy
Data unit	Currency unit per unit of available capacity
Description	Remuneration for available capacity under PPA contract
Equations	Equation 3

Source of data	CFPP PPA terms
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	Ay
Data unit	Available Capacity Unit
Description	Availability
Equations	Equation 3
Source of data	CFPP PPA terms
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	PPAOSy
Data unit	Currency unit
Description	Remuneration for other electricity services, as relevant
Equations	Equation 3
Source of data	CFPP PPA terms
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	OSy
Data unit	Services unit
Description	Other yearly services provided by the CFPP
Equations	Equation 3
Source of data	CFPP PPA terms
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	WACCo
Data unit	%
Description	WACC of the off-taker
Equations	Equation 3
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	GUi
Data unit	Generation unit (e.g., MWh)
Description	Generation of unit i in the electricity system
Equations	Equation 6
Source of data	Grid system operator data
Value applied	N/A
Justification of choice of data or description of	N/A

measurement methods and procedures applied	
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	UCGi
Data unit	Currency unit per generation unit (e.g., $/MWh)
Description	Average unit cost of generation of unit i
Equations	Equation 6
Source of data	Grid system operator data
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	Ke,s
Data unit	%
Description	Cost of equity for stakeholder S
Equations	Equations 8, 9, 10
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	GRt
Data unit	Generation unit (e.g., MWh)

Description	Generation of renewable energy in year t
Equations	Equation 8
Source of data	Paired RE operating data
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	we.s
Data unit	%
Description	Share of initial CFPP investment financed by equity
Equations	Equation 9
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	Kd,s
Data unit	%
Description	Cost of asset-level debt on plant owned by stakeholder S
Equations	Equation 9
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions

Comments	-

Data / Parameter	wd.s
Data unit	%
Description	Share of initial CFPP investment financed by asset-level debt
Equations	Equation 9
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	E
Data unit	Currency unit
Description	Equity portion of initial investment
Equations	Equation 11
Source of data	CFPP financial records
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/a
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	AMC
Data unit	Currency unit
Description	Accumulated maintenance capex until registration year
Equations	Equation 11
Source of data	CFPP financial records
Value applied	As determined from the source data

Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	FMC
Data unit	Currency unit
Description	Expected future maintenance capex until two years prior to retirement year
Equations	Equation 11
Source of data	CFPP records, estimated as per the comments
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions
Comments	Future maintenance capex should be based on existing maintenance contracts and should assume no additional maintenance capex is spent in the two years prior to the CFPP's retirement. Where maintenance contracts are unavailable, future maintenance capex may be projected using historical maintenance capex spending.

Data / Parameter	NBVRO
Data unit	Currency unit
Description	Net book value of CFPP in the year of the analysis
Equations	Equation 12, 15
Source of data	CFPP financial accounts
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	RTLRO
Data unit	Dimensionless
Description	Remaining technical life in the year of the analysis
Equations	Equation 12
Source of data	CFPP records, determined according to CDM Tool to Determine Remaining Technical Life
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	CPy
Data unit	Currency unit per emissions unit (e.g., $/tCO2e)
Description	Carbon price in year y
Equations	Equation 13
Source of data	Regulatory documentation on carbon price/price pathway
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	Carbon price values for each year over the life of the plant shall be determined by assuming a carbon price (carbon tax, ETS allowance price, etc.) annual growth in accordance to host country plans or policy scenarios at the time of validation. If the length of the assessment period exceeds the period over which a carbon price target is set or forecasted, the carbon price to be applied to the remaining years shall be the CO2 price corresponding to the last year for which an official target or forecast price exists, projected forward using a linear trendline based on the average rate of change of carbon prices over the last five years of available data, or forecasted according to government sources. Where several pricing scenarios are available, the carbon price data set to be applied shall be the one with the most ambitious, i.e. highest carbon price.
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	EFi
Data unit	Emissions per generation (e.g., tCO2e/MWh)

Description	Emissions factor of plant or unit
Equations	Equation 13
Source of data	CFPP technical reporting, calculated as per methodology
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	The emissions factor of the plant should be calculated as the three-year average annual emissions factor. If asset-level emissions data is unavailable, default emissions factors based on plant specifications may be utilized
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	EMy,i
Data unit	Emissions unit (e.g., tCO2e)
Description	Plant or unit emissions in year y
Equations	Equation 14
Source of data	CFPP emissions reporting
Value applied	As determined from the source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	PPAterm
Data unit	Years
Description	Total length of the PPA term
Equations	Equation 15
Source of data	PPA terms
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions

Comments	-

Data / Parameter	PPARO
Data unit	Dimensionless
Description	Number of years since the start of the PPA term and the year the baseline assessment is undertaken
Equations	Equation 15
Source of data	PPA terms
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	PPAAR
Data unit	Dimensionless
Description	Number of years since the start of the PPA and the retirement year
Equations	Equation 15
Source of data	PPA terms
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

Data / Parameter	Cj
Data unit	Dimensionless
Description	Conservativeness factor for baseline retirement sub-scenario j
Equations	Equation 16
Source of data	Project proponent uncertainty analysis, or UNFCCC CDM conservativeness factor (below)

Value applied	If a project proponent is unable to undertake an uncertainty analysis, the following default uncertainties and conservativeness factors must be applied, in line with the CDM Meth Panel's Proposed Guidance on Addressing Bias Uncertainty: The remaining technical life of the CFPP is less than 10 years: Conservativeness factor of 0.943. The remaining technical life of the CFPP is greater than 10 years: Conservativeness factor of 0.893.
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Comments	-

DOCUMENT HISTORY

Version	Date	Comment
v1.0 (draft)	17 Oct 2024	Draft version of new module for public consultation