Verified Carbon Standard

Draft VCS Module

VMD0060

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

Version 1.~~0~~1 (draft)

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

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1 SUMMARY DESCRIPTION

This module establishes criteria and procedures to determine the baseline scenario and baseline retirement date and to demonstrate the additionality of project activities that accelerate the retirement of a coal-fired power plant (CFPP) using *VM0052 Accelerated Retirement of Coal-fired Power Plants Using a Just Transition*.

2 SOURCES

This module is used in combination with the most recent version of *VM0052* and the following tooltools:

- *Paris Agreement Crediting Mechanism Tool A6.4-AMT-006: Determination of the technical lifetime of equipment*
- *VT0009 Combined Baseline and Additionality Assessment*

3 DEFINITIONS

In addition to the definitions in the *VCS Program Definitions* and *VM0052,* the following definitions apply to this module.

Accelerated depreciation
A utility finance tool that accelerates the depreciation schedule of a coal-fired power plant, and therefore accelerates the return on and recovery of capital invested on its rate base over a shorter period

Asset-level phaseout plan
A documented and approved plan to retire coal-fired power plants (and other fossil fuel power plants) in a jurisdiction (national or subnational) where the plan specifies the retirement date of each power plant. Both the jurisdictional government and independent power producer (IPP) can have an asset-level phaseout plan. However, only government plans are considered legally binding.

Coal transition mechanism (CTM)
Financial products and services designed to facilitate the managed transition of a coal-fired power plant that has remaining fair value to its owners, by changing the underlying cost of capital of the plant or its revenues to deliver necessary returns. Carbon market mechanisms leveraging revenue

generated from carbon credits, including compliance markets, voluntary carbon markets, and Article 6 are excluded.

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

Regulatory asset
A financial 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 the asset has ceased operation

Required revenues
Annual revenue that a regulated utility must earn to provide adequate service to its customers and the allowed return for its shareholders

4 APPLICABILITY CONDITIONS

This module applies to project activities related to the accelerated retirement of a CFPP using the most recent version of *VM0052*.

5 BASELINE SCENARIO

Project proponents must determine the most plausible scenario that would have occurred in the absence of the project activity. The baseline scenario identified through the process outlined below is used to inform the assessment of project additionality in Section 7.

5.1 Baseline scenario for the CFPP

Project proponents must ~~assess the following alternative scenarios:~~accurately determine the activities and GHG emissions that would have occurred in the absence of the project activity.

~~Baseline~~When conducting the following steps, the applicable geographic area is determined in accordance with *VT0009 Combined Baseline and Additionality Assessment.*

5.1.1 Step 1: Identify Alternative Scenarios

Project proponents must identify and assess all credible alternative baseline scenarios to the proposed project activity. At a minimum, this assessment must include the alternative baseline scenarios listed below. Project proponents must also consider other plausible alternatives that deliver a similar output and have been previously implemented or are currently under development in the applicable geographic area.

Baseline scenario **B1:** The CFPP continues to operate until the baseline retirement date determined in Section 6.

Baseline scenario **B2:** The CFPP is retired ahead of the technical end of life, end of long~~-~~-term PPA, the date of regulatory phase out, or as specified in a transition mechanism~~,~~ (i.e., accelerated retirement) and without being registered under a GHG program.

Baseline scenario **B3:** The CFPP is repurposed for firing natural gas, co-firing biomass and coal, or firing exclusively biomass. This alternative must only be considered if there are other CFPPs that have been ~~refurbished~~converted to co-fire biomass and coal or use solely natural gas or biomass in the applicable geographic region (determined per Section 5.1 of *VT0009*) over the last 10 years before validation.

~~To identify the baseline~~Baseline scenario ~~from~~B4: The retirement of the CFPP is accelerated and the ~~alternative scenarios, project~~salvage value of major components is recovered through their transfer and reuse at other plants.

5.1.2 Step 2: Check Consistency with Mandatory Applicable Laws and Regulations

Project proponents must~~:~~

remove alternative scenarios that do not comply with mandatory laws and regulations ~~in~~as well as the ~~jurisdiction~~NDC in the applicable geographic region where ~~it~~the project is located, following Step 1b of *VT0009* ~~*Combined Baseline and Additionality Assessment*~~.

~~1) demonstrate that alternative scenario B3 is prevented by barriers and/or is not financially attractive applying *VT0009*. This step is only applicable if B3 was not removed in 1). Such barriers are limited to:~~

~~a) The barriers listed in *VT0009*; and~~

5.1.3 ~~Supply~~Step 3: Barrier Analysis

Project proponents must use Steps 2a and 2c of *VT0009*[1] to identify and assess potential barriers to the implementation of the alternative baseline scenarios remaining after Step 2. In addition to

[1] Step 2b: Demonstrate That Barriers Would Prevent Project Activity Implementation
Step 2c: Demonstrate That Barriers Would Not Prevent Implementation of at Least One Alternative

the barriers listed in Step 2a of *VT0009*, the following barrier may prevent the alternative scenarios from occurring:

1) Systemic, logistic, or supply chain barriers~~: e.g. - limited access to~~ , for example:

    a) Inadequate or outdated infrastructure and/or high cost of developing natural gas infrastructure

    b) Lack of access to or high cost of sourcing a reliable supply of natural gas, other fossil-fuels, or biomass feedstocks ~~within an economically feasible transport distance from the CFPP, or higher cost of~~

    ~~b)~~c) Risk of unreliable long-term fuel supply of natural gas, other fossil fuels, or biomass ~~per unit of electricity generated (e.g., per MWh) compared to coal.~~feedstocks

    d) Risk of unmanageable fuel price volatility of natural gas, other fossil fuels, or biomass feedstocks, increasing operational and financial uncertainty for investment in re-purposing

Eliminate the alternative scenarios that are prevented by at least one barrier from further consideration.

5.1.4 Step 4: Identifying the Baseline Scenario

If only baseline scenario B2 remains after applying Step 3, the project is not eligible under the methodology as the project activities happen in the baseline.

If baseline scenarios B3 and/or B4 remain, the project is not eligible under the methodology.

If only baseline scenarios B1 and B2 remain, demonstrate that alternative scenario B2 is not financially attractive ~~following~~using Section ~~7.2.~~ 7.2.

The project proponent must demonstrate that the ~~remaining~~most plausible alternative without carbon revenues (i.e., the baseline scenario) is scenario B1.

5.2 Baseline scenario for Paired Renewable Electricity

The baseline scenario for the renewable electricity power plants paired with the project is that they would not have been built or commissioned before their baseline scenario operational start date or the baseline retirement date of the CFPP determined in Section 6.

Using this common baseline, all renewable electricity plants, regardless of pairing pathway, are included in the financial assessment in Section 6.5 until the date when they would have been operational in the baseline scenario.

The rationale for this baseline for each type of pairing pathway follows.

1) Contractual pairing: The baseline retirement date serves as the point in time when there is ~~a gap in~~demand for capacity that the contractual paired RE meets. Project proponents

with contractual pairing seeks to fill. As such, there is no need for must demonstrate the renewable electricity plant beforebaseline operational date using previous submissions to regulators, or agreements with 3rd parties that date.are obsolete or amended because of the advancement the operational date as a result of the project activity.

2) Financial pairing: Financing for the construction of the paired renewable electricity power plant is dependent on the retirement of the CFPP. Financial pairing includes cases in which the cost of debt for clean energy is tied to CFPP retirement or emissions reduction, or where the lending terms are dependent on clean replacement being provided when retiring the CFPP.

3) On-site pairing: The new renewable electricity plant is built on the site of the existing CFPP and its construction cannot take place until the CFPP is retired.

4) Regulatory pairing: The approval for the construction of the renewable electricity plant by the regulator is dependent on the retirement of the CFPP.

5) Counterfactual pairing: Commissioning of the renewable electricity plant would not have taken place until the date specified as the operational start date in the current approved regulatory resource plan of the system operators. Project proponents with contractual pairing must demonstrate the baseline operational date in the resource plan is conservative by comparing previous resource plans to actual operational dates of plants.

Note - Using this common baseline, all renewable electricity plants, regardless of pairing pathway, are included in the financial assessment in Section 6.5 until the date when they would have been operational in the baseline scenario.

6 DETERMINING THE BASELINE RETIREMENT DATE

The baseline retirement date for the CFPP is the earliest date of the following scenarios, explained in more detail in Sections 6.1–6.5:

1) Regulatory CFPP phaseout date
2) End of technical life
3) End of long-term power purchase agreement (PPA)
4) Committed coal transition mechanism (CTM)
5) Financially attractive retirement

6.1 Regulatory CFPP Phaseout Date

The retirement date is imposed at the jurisdictional or asset level by existing regulations, plans, strategies, or commitments at the national or subnational 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 most recent 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 grid's most recent integrated resource or electricity sector plan, which has been approved by the public regulator, electricity regulator, or electricity sector governing body
3) A coal phaseout date set in national or subnational legislation, law, or executive mandate
4) For a jurisdictional level phaseout plan, such as a commitment to phase out all CFPPs by 2040, the commitment date is considered the regulatory CFPP phaseout date. For asset-level phaseout plans, the CFPP retirement date under this plan is considered the regulatory CFPP phaseout date.

6.2 End of Technical Life

~~The end of the CFPP's technical life is equal to the technical life of the key equipment and components of the CFPP (e.g., boilers, steam turbines, generators) with the shortest remaining technical life determined using any one of the three options in the most recent version of CDM *TOOL10 Tool to Determine the Remaining Technical Life of Equipment*.~~Project proponents must use the most recent version of *A6.4-AMT-006: Determination of the technical lifetime of equipment* to determine the remaining technical life of the CFPP.

6.3 End of Long-term Power Purchase Agreement (PPA)

The end date is determined to be the end of the existing long-term PPA. PPAs or PPA extensions executed after 31 December 2023 are not eligible and the original end date of the agreement must be used.

6.4 Committed Coal Transition Mechanism (CTM)

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

1) The financial closure of a transaction, demonstrated through one of the following:
    a) Transfer of ownership of the CFPP or equity investment, or full/partial buyout of equity shares of the CFPP

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

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, leverage ratio, or required returns of the CFPP

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

6.5 Financially Attractive Retirement

The accelerated retirement of a CFPP is considered financially attractive when retiring the CFPP and replacing the coal-generated electricity with renewable electricity results in a financial gain compared to continued operation.

The earliest date at which retirement can be considered financially attractive is determined using the financial analysis outlined in the following sections.

~~6.5.1 Identifying the enabling scenario~~

~~Project proponents must identify the financial scenario(s) relevant to their project, that could make accelerated retirement financially attractive. The financial details for each of the relevant scenario(s) are used to determine the financially attractive retirement date in Section 6.5.2.~~

~~1) CFPP 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, early retirement enabled through the creation of a regulatory asset must be evaluated where 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 where 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 the CFPP and replaces it with alternative resources.~~

~~d) Refinancing: In cases where the operating costs of the CFPP are subsidized by the government, early retirement through sovereign debt must be evaluated where a~~

precedent exists for government intervention to aid in refinancing the CFPP's fair value in the jurisdiction.

The evaluation of the above scenarios is done using Approach 1 in Section 6.5.3.1.

2) CFPP owned by an IPP with a long term PPA in place:

   a) IPP led retirement: In this case, the IPP terminates the PPA ahead of the contracted end date. This evaluation must consider that the IPP would be responsible for the costs associated with early termination, retiring the CFPP, and acquiring alternative sources of generation.

   b) Off-taker led retirement: In this case, the off-taker terminates the PPA ahead of the contracted end-date. This evaluation must consider the off-taker responsible for the costs associated with early termination, retiring the CFPP, and acquiring 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 on its capital.

The evaluation of these scenarios is done using Approach 2 in Section 6.5.3.1.

6.5.26.5.1 Determining Financially Attractive Retirement Date

The financially attractive retirement date represents the earliest year when retiring the CFPP with paired RE according to the pairing plan is more financially attractive than continuing to operate the CFPP.

To identify this date, proponents must first compare the net present value of required revenues (*NPVRRC*) of the following scenarios related to the operation of the CFPP:

- Continued operation (*CO*) of the CFPP, and
- Accelerated retirement (*AR*) of the CFPP paired with renewable electricity and grid-connected power sources

The comparison is done using Equation 1:

$$NPVRRC_{S,CO} \leq NPVRRG_{S,AR} \geq NPVRRG_{S,AR} + NPVRRC_{S,AR} \quad (1)$$

Where:

$NPVRRC_{S,CO}$	=	Net present value of required revenues associated with the CFPP for stakeholder *S* under continued CFPP operation (currency unit)
$NPVRRC_{S,AR}$	=	Net present value of required revenues associated with the CFPP for stakeholder *S* under CFPP retirement in year *AR* (currency unit)
$NPVRRG_{S,AR}$	=	Net present value of required revenues for replacement generation for stakeholder *S* following CFPP retirement in year *AR* and until *RY*

S = Stakeholder (Regulated utility = utility, independent power producer = IPP, independent power producer from the point of view of the Off-taker = 'IPP-F')

Project proponents must perform this comparison for each year of the assessment period until the year in which Equation 1 is true is identified (i.e., - where the net present value of required revenues for the *AR* scenario are at least equal to those of the *CO* scenario). The assessment period is the period between the year in which the baseline scenario analysis is carried out (referred to as *R0*) and the retirement year (*RY*).

RY is determined as the end year of the shortest period represented by one of the following:

1) 20 years (standard period for required revenue calculations)
2) For a CFPP owned by a regulated utility, the remaining technical life determined as per Section 6.2
3) For a CFPP owned by an IPP with a long-term PPA, the remaining number of years under the existing PPA

In the *CO* scenario, it is assumed that the CFPP would continue to operate for the entire assessment period.

To conservatively account for uncertainty, Section 8 requires that projectsproponents must deduct one0.1 years for each year of the advancement period from the year where Equation 1 is true. The resulting year is the financially attractive retirement date. determined in Equation (1)(1), (e.g., for a seven year advancement period, proponents advance the retirement date 0.7 years earlier). Justification is provided in Section 8.

6.5.36.5.2 Calculating the net present value of the required revenues

The net present value (NPV) of the required revenues for the *CO* and *AR* scenarios used in Equation 1 must:

- Include the value of the electricity generated in the financial assessment period,
- Be determined in real terms, using values that were relevant at the time of investment decision for the project activity
- Exclude any expenditures that occurred prior to the decision to proceed to retire the CFPP

All assumptions, data, and conclusions in the calculation of NPV of the required revenues must be:

a) transparently documented in the project description,

b) appropriately justified and substantiated by verifiable evidence,

c) relevant and appropriate to the project circumstances, and

d) consistent with information presented to the company's decision-making management and to investors/lenders.

6.5.3.16.5.2.1 Required Revenues for the CFPP (NPVRRC)

Determining the required revenues associated with the CFPP for the continued operation ($NPVRRC_{S,CO}$) and accelerated retirement ($NPVRRC_{S,AR}$) must be done using one of the following approaches.

When using Equation (2) or (4) to determine $NPVRRC_{S,CO}$, the year AR = RY.

Approach 1: When the CFPP is owned by a regulated utility (stakeholder 'S' = Utility), use Equation (2)(2) to determine the required revenues ($NPVRRC_{S=Utility,\ CO}$ and $NPVRRC_{S\ =\ Utility,\ AR}$) for use in Equation (1)(1) to determine the financially attractive retirement date.

Approach 2: When the CFPP is owned by an IPP:, the following steps apply:

1) use Equation (2)(2) to determine the required revenues ($NPVRRC_{S=IPP,CO}$ and $NPVRRC_{S=IPP,AR}$) from the owner's perspective, and evaluate Equation (1)(1) to determine the financially attractive retirement date fromfor the owner's perspectiveIPP (stakeholder 'S' = IPP),
2) use Equation (4)(4) to determine the required revenues ($NPVRRC_{S=IPP\text{-}F,CO}$ and $NPVRRC_{S=IPP\text{-}F,AR}$) from the off-takers perspective, and evaluate Equation (1)(1) to determine the financially attractive retirement date fromfor the off-taker's perspective taker (stakeholder 'S' = Off-taker 'F'),
3) use the earlier of the two financially attractive retirement dates.

Equation (2)(2) evaluates the required revenues from the perspective of the CFPP plant owner and is given below:

$$NPVRRC_{S,AR\ or\ CO} = \sum_{y=R0}^{y=RY} \frac{EX_y + P_y + \left(AC_y + TERM_{AR} + DC_{S,RY} - CTM_y\right) \times (1-H) - (DEP_{CFPP,y} \times H) + CAR_y}{(1-H) \times (1+WACC_S)^{y-R0}} \qquad (2)$$

Where:

$NPVRRC_{S,AR\ or\ CO}$	=	Net present value of required revenues associated with the CFPP for the stakeholder (S = regulated utility or IPP), in retirement year *AR* or for continued operation (*CO*) (currency unit)
y	=	Year of CFPP operation (dimensionless)
$R0$	=	Year of baseline assessment (dimensionless)
RY	=	Retirement year (dimensionless). For accelerated retirement (*AR*), use *RY*=*AR*. For continued operation (CO) of a CFPP owned by a regulated utility, *RY* is the earliest of a 20-year assessment period

		and the remaining technical life as per Section 6.2. For continued operation (CO) of a CFPP owned by an IPP, *RY* is the earliest of a 20-year assessment period and the end of the existing PPA.
EX_y	=	Capital expenditure including equity return of capital and equity return on capital in year *y* (currency unit)
P_y	=	Principal payment for asset-level debt in year *y* (currency unit)
AC_y	=	Annual costs in year *y* (currency unit)
$TERM_{AR}$	=	Contract termination costs in accelerated retirement year *AR* (currency unit). Equal to zero for continued operation (*CO*) scenario.
$DC_{S,RY}$	=	Present value of decommissioning costs as of accelerated retirement year AR (currency unit) or the retirement year RY in the continued operation scenario
CTM_y	=	Revenue due to a coal transition mechanism in year *y*, where relevant (currency unit). Equal to zero for continued operation (*CO*) scenario.
H	=	Total blended tax rate (%)
$DEP_{CFPP,y}$	=	Tax depreciation of CFPP asset in year *y* (currency unit)
CAR_y	=	Cost of carbon in year *y* (currency unit)
$WACC_S$	=	Weighted average cost of capital of the stakeholder (%)

Annual costs in year *y* (AC_y) are calculated using Equation (3)(3).

$$AC_y = IDEBT_y + VOM_y + FOM_y + FUEL_y \tag{3}$$

Where:

$IDEBT_y$	=	Interest payment for asset-level debt in year *y* (currency unit)
VOM_y	=	Variable operations and maintenance costs in year *y* (currency unit)
FOM_y	=	Fixed operations and maintenance costs in year *y* (currency unit)
$FUEL_y$	=	Fuel costs in year *y* (currency unit)

Equation (4)(4) evaluates the required revenues from the perspective of the off-taker for CFPPs owned by IPPs, as described in Section 1.1.1 (2) (b), and is given below:

$$NPVRRC_{S,AR\ or\ CO} = \sum_{y=R0}^{y=RY} \frac{\left(PPAE_y \times G_y + PPAC_y \times A_y + PPAS_y \times OS_y + TERM_{AR} + DC_{S,RY}\right) \times (1-H) + CAR_y}{(1-H) \times (1+WACC_S)^{y-R0}} \tag{4}$$

Where:

$NPVRRC_{S,AR\ or\ CO}$	=	Net present value of required revenues associated with the CFPP for the stakeholder (S = *IPP-F*), in retirement year *AR* or for continued operation (*CO*) (currency unit)

$PPAE_y$	=	Remuneration for electricity supplied to the grid under PPA contract in year *y* (currency unit per unit of generation, e.g., USD/MWh)
G_y	=	CFPP electricity generated and supplied to the grid in year *y* (MWh)
$PPAC_y$	=	Remuneration for available capacity under PPA contract in year *y* (currency unit per unit of available capacity)
A_y	=	Availability of CFPP capacity as per PPA in year *y* (capacity unit)
$PPAS_y$	=	Remuneration for other electricity services in year *y*, where relevant (currency unit per unit of service)
OS_y	=	Other yearly services provided by the CFPP in year *y*, where relevant (service unit)
CAR_y	=	Cost of carbon in year *y*, included where carbon costs are passed to off-taker (currency unit)
$WACC_S$	=	Weighted average cost of capital of the stakeholder which must be the IPP from the point of view from the off-taker (*S=IPP-F*) (%)

6.5.3.26.5.2.2 Required Revenues for Replacement Electricity Generation ($NPVRRG_{AR}$)

Costs for replacement electricity generation (that was supplied to the grid) prior to CFPP retirement year *AR* are considered zero.

For all subsequent years in the financial assessment period, 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 must be generated and supplied to replace the CFPP's expected generation.

The net present value of required revenues from replacement generation (that is supplied to the grid) is calculated as shown in Equation (5)(5).

$$NPVRRG_{AR} = \sum_{y=AR}^{y=RY} \frac{UG \times G_y}{(1-H) \times (1+WACC_S)^{y-AR}} \quad (5)$$

Where:

$NPVRRG_{AR}$	=	Net present value of required revenues for replacement generation following CFPP retirement in year *AR* (currency unit)
UG	=	Unit cost of replacement generation that is supplied to the grid (currency unit per unit of generation, e.g., USD/MWh)
$WACC_S$	=	Weighted average cost of capital of the stakeholder (%)

The unit cost of replacement generation that is supplied to the grid (*UG*) must not increase throughout the financial assessment period and must be assumed to be constant in real terms.

CFPP generation (G_y) must be assumed to be constant and must be consistently applied across all required revenue calculations.

6.5.3.36.5.2.3 Unit Cost of Replacement Generation (*UG*)

The unit cost of replacement generation that is supplied to the grid (*UG*) must be estimated as the lower value of the average cost of generation in the grid (UG_{AVG}) and the cost of replacement generation in the project scenario (UC_{PS}).

$$UG = \mathrm{MIN}(UG_{AVG}, UC_{PS}) \quad (6)$$

Where:

UG_{AVG}	=	Average cost of generation in the grid (currency unit per unit of generation, e.g., USD/MWh)
UC_{PS}	=	Unit cost of replacement electricity generated and supplied to the grid in the project scenario (currency unit per unit of generation, e.g., USD/MWh)

Equation (7)(7) calculates the average cost of generation in the grid in the year of the baseline scenario assessment.

$$UG_{AVG} = \frac{\sum_i (GU_i \times UG_i)}{\sum_i GU_i} \quad (7)$$

Where:

GU_i	=	Generation that is supplied to the grid from unit *i* (generation unit, e.g., MWh)
UG_i	=	Average unit cost of generation supplied to the grid by unit *i* (currency unit per unit of generation, e.g., USD/MWh)

Equation (8)(8) calculates the unit cost of replacement generation in the project scenario (UC_{PS}).

$$UC_{PS} = \frac{\left(UG_{AVG} \times (G_y - GR)\right) + ((LCOE_{RE} - PLI) \times GR) + SA}{G_y} \quad (8)$$

Where:

GR	=	Annual paired RE generation that is supplied to the grid (generation unit, e.g., MWh)
$LCOE_{RE}$	=	Levelized cost of paired RE generation (currency unit per unit of generation, e.g., USD/MWh)
SA	=	Present value of the capital and fixed operating costs associated with supporting assets that provide energy storage and/or ancillary services
PLI	=	Production-Linked Incentives; output-based government subsidies paid to the generator

6.5.3.46.5.2.4 Levelized Cost of Paired Renewable Electricity Generation ($LCOE_{RE}$)

The levelized cost of paired renewable electricity generation is calculated as follows:

$$LCOE_{RE} = \frac{\sum_{t=0}^{t=L}\left((EX_t + P_t + AC_t \times (1-H)\right) - (DEP_{RE,t} \times H) + CAR_t)/(1+K_e)^t}{\sum_{t=0}^{t=L} GR \times (1-H)/(1+K_e)^t} \quad (9)$$

Where:

t	=	Project year since initial investment (years)
L	=	Renewable electricity plant lifetime (years)
K_e	=	Cost of equity to the facility owner (%)
$DEP_{RE,t}$	=	Tax depreciation of renewable electricity asset in year t (currency unit)
AC_t	=	Annual costs in year t (AC_t) calculated using Equation 3, with $FUEL_t$ equal to zero, and 'y' is substituted with 't' as the indicator of the year in question

To calculate $LCOE_{RE}$, project proponents must apply the relevant requirements in Appendix 2 of *VT0009 Combined Baseline and Additionality Assessment.* The following additional guidance must be taken into account:

1) The initial capital investment must be assumed to be financed with at least 70% debt.
2) Renewable electricity generation must be estimated using at least the P50 energy yield[3] arising from an independently prepared resource assessment, prepared by a qualified firm with prior experience conducting such studies.

~~6.5.3.5~~6.5.2.5 Capital Expenditure Costs (EX_y)

Capital expenditure costs, including equity return of capital and equity return on capital, are amortized over the remaining lifetime of the asset.[4]

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

Where:

EV	=	Equity value of asset (currency unit)
L_a	=	Lifetime of CFPP asset from commissioning until retirement (years)

L_a is the technical lifetime for a utility-owned CFPP or the end of the PPA term for an IPP-owned CFPP.

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 capital expenditure and future maintenance capital expenditure.

[3] Median energy yield, with 50% probability that this yield will be met or exceeded

[4] This approach is recommended as upfront investment costs will have been made prior to project registration and financial analysis.

For the purposes of calculation, maintenance capital expenditure is assumed to have occurred at the time of initial CFPP investment.[5]

$$EV = E + AMC + FMC \tag{11}$$

Where:

E	=	Equity portion of initial investment (currency unit)
AMC	=	Accumulated maintenance capital expenditure until project registration year (currency unit)
FMC	=	Expected future maintenance capital expenditure until two years prior to retirement year (currency unit)

~~6.5.3.6~~6.5.2.6 Costs of Carbon (CAR_y)

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

1) 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.
2) Where several pricing scenarios are available, the most ambitious (i.e., highest price) must be applied.
3) 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 is forecasted.
4) Where the assessment period extends beyond the published schedule or range of prices, the carbon cost must be projected forward using a linear trendline using the values determined above.

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

$$CAR_y = CP_y \times \sum_i (G_{i,y} \times EF_i) \tag{12}$$

Where:

CP_y	=	Carbon price in year y (currency unit per unit of emissions, e.g., USD/t CO_2e)
$G_{i,y}$	=	Generation of plant or unit i in year y (generation unit, e.g., MWh)
EF_i	=	Emission factor of plant or unit i (emissions per unit of generation, e.g., t CO_2e/MWh)

[5] This is conservative as it increases the costs in the continued operation scenario, making retirement financially attractive earlier.

The emission factor of the plant (EF_i) is calculated as the three-year average annual emission factor. Where asset-level emissions data are unavailable, an emission factor determined using Equation (13(13) must be used.

$$EF_i = \frac{1}{3} \times \sum_{y=REG-3}^{y=REG} \frac{EM_{i,y}}{G_{i,y}} \tag{13}$$

Where:

$EM_{i,y}$ = Emissions of plant or unit *i* in year *y* (emissions unit, e.g., t CO_2e)

REG = Year of project registration

6.5.3.76.5.2.7 Contract Termination Costs ($TERM_{AR}$)

In the baseline retirement scenario that involves PPA termination by the off-taker, PPA termination costs should be assumed to be borne by the off-taker 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 project validation. Where 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 termconsidered zero. Contract termination costs must not include additional costs to cover termination of the CFPP's fuel supply agreement or operations and maintenance agreements.

$$TERM_{AR} = NBV_{R0} - \left(\left(\frac{NBV_{R0}}{PPA_{term} - PPA_{AR}}\right) \times (PPA_y - PPA_{R0})\right) \tag{14}$$

Where:

NBV_{R0} = Net book value of CFPP asset in baseline assessment year *R0* (currency unit)

PPA_{term} = Total length of PPA term (years)

PPA_{AR} = Number of years from start of PPA term to retirement year *AR* (years)

PPA_y = Number of years left on the PPA at baseline assessment year *R0* (years)

PPA_{R0} = Number of years from start of PPA term to baseline assessment year *R0* (years)

For retirement scenarios in which a regulated utility retires its own CFPP:

- Early fuel supply agreement termination costs may be considered where the fuel supply agreement 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 fuel supply agreement.
- Early operations and maintenance agreement termination costs may be considered where the operations and maintenance agreements existing at project registration would expire after the expected early retirement of the CFPP. These early termination costs must be based on the existing terms of the operations and maintenance agreement.

6.5.2.8 Decommissioning Costs (DC_{RY})

Decommissioning Costs used in Equations (2)(2) and (4)(4) must reflect the costs borne by the stakeholder in question. Typically off-takers bear no cost associated with CFPP decommissioning, in which case the value of DC_{RY} is zero in that analysis. For CFPP owners, there may be a difference between the gross cost of decommissioning and the net cost they are liable to pay, arising from government or other third party financial assistance.

Where decommissioning cost estimates are available as an 'overnight' cost as at the time of CFPP retirement, that value may be used. Where more detailed schedules of decommissioning costs are available for a multi-year programme of activities, equation [15] must be used:

$$DC_{S,RY} = \sum_{Y=RY}^{Y=RY+D} \frac{(DC_{S,gross,y}) - (FA_{S,y})}{(1-H)/(1+K_e)^y} \quad (15)$$

Where:

$DC_{S,RY}$	=	Net present value of decommissioning costs borne by the stakeholder S in retirement year RY (currency unit)
y	=	Year of decommissioning analysis (e.g. 2030)
D	=	Year of decommissioning period (i.e. 1, 2, 3, etc.)
$DC_{S,gross,y}$	=	Gross decommissioning costs payable by stakeholder S in year y
$FA_{S,y}$	=	Financial assistance accruing to stakeholder S in year y
K_e	=	Cost of equity to stakeholder S
H	=	Total blended tax rate (%)

6.5.2.9 Supporting Assets

Intermittent renewable generation often benefits from complementary assets, including energy storage and assets specialized in providing ancillary services (e.g. voltage and frequency support). The capital costs and fixed maintenance costs associated with these complementary assets contribute to the cost structure of a paired renewable energy solution. To be conservative, the variable operating costs of these assets are excluded, as the uncertainty associated with forecasting the future operating regime of these assets is significant.

$$SA = \sum_{t=0}^{t=L} \frac{SAEX_t + ACSA_t}{(1-H)/(1+K_e)^t} \quad (16)$$

Where:

t	=	Project year since initial investment (years)
L	=	Supporting asset plant lifetime (years)
$SAEX$	=	Supporting asset capital expenditures
$ACSA$	=	Annual cost of supporting assets

Capital expenditures, including the return of and on equity capital for each supporting asset, are amortized over the lifetime of each asset.

$$SAEX_y = \frac{SAEV_a \times K_e \times (1 + K_e)^{L_a}}{(1 + K_e)^{L_a} - 1} \quad (17)$$

Where:

$SAEV_a$	=	Equity value of each asset 'a' (currency unit)
K_e	=	Cost of equity to the facility owner (%)
L_a	=	Lifetime of each asset 'a' from commissioning until retirement (years)

For the purposes of calculation, maintenance capital expenditure is assumed to have occurred at the time of initial CFPP investment.

$$SAEV = E + AMC + FMC \quad (18)$$

Where:

E	=	Equity portion of initial investment (currency unit)
AMC	=	Accumulated maintenance capital expenditure until project registration year (currency unit)
FMC	=	Expected future maintenance capital expenditure until two years prior to retirement year (currency unit)

The annual operating costs associated with all supporting assets should be calculated according to the following equation. This deliberately omits variable costs to be conservative in the overall estimate of SA in Equation 8.

$$ACSA_y = \sum_a IDEBT_{y,a} + FOM_{y,a} \quad (19)$$

Where:

$IDEBT_{y,a}$	=	Interest payment for asset-level debt in year y for each supporting asset 'a' (currency unit)
$FOM_{y,a}$	=	Fixed operations and maintenance costs in year y for each supporting asset 'a' (currency unit)

6.5.2.10 Production-Linked Incentives

Government subsidies for renewable energy are sometimes structured in the form of production-linked incentives. These programs augment revenues by paying generators as a function of energy produced. Where this revenue exists, the levelized cost of renewable generation (equation (8(8)) is offset.

$$PLI = \frac{\sum_{t=0}^{t=L} GR_t * PLIR_t}{\sum_{t=0}^{t=L} GR_t \times (1-H)/(1+K_e)^t} \quad (20)$$

Where:

t	=	Project year since initial investment (years)
L	=	Renewable electricity plant lifetime (years)
PLIR	=	Project linked incentive rate per MWh in year t

Where production-linked incentives take the form of non-refundable tax credits, the monetization of the incentives is delayed relative to the generation profile and

$$PLI = \frac{\sum_{t=0}^{t=L} MTC_t}{\sum_{t=0}^{t=L} GR_t \times (1-H)/(1+K_e)^t} \quad (21)$$

Where:

t	=	Project year since initial investment (years)
L	=	Renewable electricity plant lifetime (years)
MTC	=	Monetized production-linked tax credits in year t

7 ADDITIONALITY

This module uses a project method to demonstrate additionality.

Projects are additional where all of the following conditions in Sections 7.1–7.2.3 are met.

7.1 Regulatory Surplus

Projects using this moduleProject proponents must demonstrate regulatory surplus in accordance with *VM0052*the rules and requirements set out in the most recent versions of the VCS Standard-. Furthermore, project proponents demonstrate regulatory surplus through Section 6.1 in this module.

7.2 Financial Barrier

7.2.1 Financial Indicator

7.2 Investment Comparison Analysis

Net present value (NPV) is used as the financial indicator for investment comparison analysis in the process detailed in Section 6.5 of this module.

7.2.2 Investment Comparison Analysis. The

Section 6.5 compares the NPVs of two mutually exclusive scenarios (over the same period: the continued operation of the CFPP, and (the CO scenario), and the project activities, i.e. - the accelerated retirement of the CFPP while substituting electricity usingand replacing capacity with paired renewable electricity and grid electricity) (the AR scenario).

The NPV of the required revenues of the CO scenario serves as a financial benchmark against which the same metric of the AR scenario is compared. The output of Section 6.5 is the financially attractive retirement date which represents the earliest date that the NPV of the AR scenario meets the benchmark, and carbon credit revenues are calculated. not required to meet the benchmark. As such, the financially attractive retirement date serves as the threshold date, after which the project activities would be considered non-additional.

Where theTherefore, project activity retires the CFPPactivities that begin before the financially attractive baseline scenario retirement date and replacesdetermined in Section 6.5 are deemed to be additional.

7.2.3 Sensitivity Analysis

A sensitivity analysis must be performed to demonstrate that the conclusion regarding additionality is robust to reasonable variation (+/- 10%) in the critical assumptions. Specifically, to be valid, the electricity through a combination retirement date of paired renewable electricity and grid electricity, it leaves an NPV gap (i.e., retiring the CFPPplant must occur before the financially attractive baseline scenario retirement date is not an economically attractive scenario in the absence of carbon credit revenue). Thus, the project is deemed to be financially additional. retirement date determined in Section 6.5.

7.3 Common Practice

The steps in Sections 7.1 and 1.1 must be complemented with an analysis of the extent to which the proposed project type (i.e., accelerated retirement) has already diffused in the relevant sector and applicable geographic area.

The geographic region must be established in accordance with Step 5.1 of *VT0009 Combined Baseline and Additionality Assessment*. Relevant factors for limiting the applicable geographic area to a specific geographic area within the host country may include:

1) Differences in regional policies, regulations, or market mechanisms
2) Variations in electricity market conditions, power sector structure, ownership models, or contractual arrangements
3) Differences in grid infrastructure, transmission access, or renewable integration capacity
4) Differences in coal supply logistics or fuel costs

The common practice analysis must be conducted following the procedures and requirements in Step 4c of the most recent version of *VT0009 Combined Baseline and Additionality Assessment*, with the following additional guidance:

- The common practice analysis must only consider the early retirement of the CFPP and not the paired renewable electricity.
- Project proponents must provide an analysis of the extent to which similar activities to the proposed project activity for which commitments to bring forward the retirement date have been implementedmade over the last 10 years prior to the commitment date.
- of the project. N_{all} is the total number of CFPPs thatfor which operators have been retired overmade commitments to bring forward the retirement date in the last 10 years prior to the commitment date (excluding activities under the VCS Program and other GHG programs per VT0009).)
- N_{diff} is the the total number of CFPPs thatwith essential distinctions for which operators have been retired overmade commitments to bring forward the retirement date in the last 10 years prior to the commitment date with essential distinctions from the project activity.(excluding those CFPPs using one of the scenarios detailed in Sections 6.1– 6.5).

Where the outcome of this step based on the criteria in Step 4c of *VT0009* is that the proposed project activity is not considered common practice, and the previous steps in Sections 7.1 and 1.1 are met, the proposed project activity is additional.

Where the outcome of this step is that the proposed project activity is considered common practice, then it is not additional.

8 UNCERTAINTY ASSESSMENT

Uncertainty is assessed to ensure that the financially attractive retirement date is conservative. The uncertainty associated with the application of this module was assessed according to the 2006 IPCC Guidelines following the Monte Carlo simulation technique. More detail on the assessment process is provided in Appendix A.

This involves estimating uncertainty in cashflows for the different scenarios by identifying the key variables that contribute most significantly to the uncertainty of the NPV, using a 90% confidence interval.

For parameters determined by existing contracts (e.g., PPAs, loan agreements) or by laws or regulations (e.g., amortization schedules, tax laws), random uncertainty is assumed to be negligible.

The individual uncertainty of the following parameters is considered to materially contribute to the overall uncertainty:

1) Fuel prices and other variable operating costs
2) Carbon price
3) Cost of equity and cost of debt
4) Capital expenditure for paired renewable electricity

A Monte Carlo simulation was done to model the uncertainty of the NPVs based on the individual uncertainties of the key parameters. Normal probability density functions were assumed for all parameters, assigning the point of estimate as the mean and the standard deviation based on reasonable assumptions of the uncertainty ranges of the parameters.

The resulting uncertainty of the NPVs for each scenario was used to assess the uncertainty of the retirement date, i.e. the point in time when continued operation has a similar NPV as accelerated retirement.

The overall uncertainty in determining the financial retirement date is estimated to be 10%. In most cases, this translates into a range of approximately ± 2 years. The range depends on the slope of the function and is project specific, but different scenarios were modelled to stress-test the overall expected uncertainty.

A deduction was calculated as per section 2.4.4 of the Methodology Requirements v4.4 by applying a t-value for a one-sided 66.67% confidence interval to select a date contained in a range with a probability of 66.7%-100%.

As a result, and to be conservative, the project proponent must deduct ~~one~~0.1 years for each year of the advancement period from the financially attractive retirement date ~~determined in Section 6.5.2, i.~~e~~., assume that CFPP~~.g. - For a ten year period, the deduction would ~~have been retired one year earlier under this scenario.~~be 0.1 X 10 = 1 year, For a 15 year period, the deduction would be 0.1 X 15 = 1.5 years

9 DATA AND PARAMETERS

9.1 Data and Parameters Available at Validation

Data/Parameter	P_y P_t
Data unit	currency unit
Description	Principal payment for asset-level debt in year *y* Principal payment for asset-level debt in year *t*
Equations	(2)(2), (9)(9)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Debt service costs include asset-level debt that was used to finance the initial investment in the CFPP, refinancing asset-level debt, and new debt issuance (e.g., under a committed CTM). Debt service costs must be calculated according to the terms of the existing financing agreement. The after-tax cost of debt should be used in the analysis.
Purpose of data	Determination of baseline scenario
Comments	Where a CFPP would be retired before the end of its existing loan tenor, it may be assumed that the remaining principal on unpaid debt must be fully repaid in retirement year *RY*.

Data/Parameter	CTM_y
Data unit	currency unit
Description	Revenue due to a coal transition mechanism in year *y*
Equations	(2)(2)

Source of data	CTM financial documentation
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	CTM financial documentation will include information on additional revenue provided.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	*H*
Data unit	%
Description	Total blended tax rate
Equations	(2)~~(2)~~, (4)~~(4)~~, (5)~~(5)~~, (9)~~(9)~~
Source of data	Local tax documentation
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$DEP_{CFPP,y}$
Data unit	currency unit
Description	Tax depreciation of CFPP asset in year *y*
Equations	(2)~~(2)~~

Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Tax depreciation must reflect existing policies or tax codes. Where no such policies exist, 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; divide net book value of CFPP in year of analysis by remaining technical life to obtain DEP_y.
Purpose of data	Determination of baseline scenario
Comments	Technical life must be determined according to the most recent version of CDM *TOOL10*.

Data/Parameter	$TERM_{AR}$
Data unit	currency unit
Description	Contract termination costs in accelerated retirement year *AR*
Equations	(2)(2), (4)(4), (14)(14)
Source of data	PPAs or calculated as per Equation (14)(14)
Value applied	As determined from PPA or as calculated from Equation (14)(14)
Justification of choice of data or description of measurement methods and procedures applied	PPAs usually specify contract termination costs based on the year in which the contract is terminated.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$WACC_S$
Data unit	%
Description	Weighted average cost of capital of for stakeholder *S*.

Equations	(2)(2), (4)(4), (5)(5)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	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 cost of asset-level debt as follows: $WACC_S = (K_{e,S} \times w_{e,S}) + (K_{d,S} \times w_{d,S})$ Where: $K_{e,S}$ = 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 CFPP owned by stakeholder S (%) $w_{d,S}$ = Share of initial CFPP investment financed by asset-level debt (%)
Purpose of data	Determination of baseline scenario
Comments	For plants owned by a regulated utility, the WACC represents the owners cost of capital. For plants owned by an IPP, the WACC must represent the IPP cost of capital in Equation (2)(2), and the off-takers cost of capital in Equation (4)(4). For utilities and single-buyer PPA off-takers, the cost of equity must reflect regulated return.[6] The shares of equity and debt and cost of asset-level debt should be based on historical audited data, given investment in the CFPP will have already occurred.

Data/Parameter	$DC_{S,RY}$
Data unit	Currency unit
Description	Decommissioning costs attributable to a given stakeholder, net of any financial assistance provided by government or other third parties.
Equations	(2), (4), (15)
Source of data	Estimates developed for the project

[6] Future updates to this module may include considerations for merchant CFPPs that do not have regulated return.

Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Operating CFPPs may not have a detailed and current estimate for decommissioning costs available, and are even less likely to have one for a potential accelerated retirement. Thus, the development of such estimates for purposes of the project are likely required. CFPP decommissioning is a well-understood proposition, even if important details tend to be site-specific. Proponents should be readily able to procure an estimate from qualified third parties with prior experience in CFPP decommissioning.
Purpose of data	Determination of costs arising from CFPP decommissioning for purposes of determining the financially attractive retirement date.
Comments	This variable is stakeholder-specific, to align with equations 2 and 4. It refers to costs attributable to the stakeholder in question, net of financial assistance from government or other third parties. In most cases we expect the offtaker would bear no costs associated with decommissioning, in which case this variable can be marked at zero.

Data/Parameter	*SA*
Data unit	Currency unit
Description	Present value of the capital and fixed operating costs associated with supporting assets that provide energy storage and/or ancillary services to complement the paired renewable generation.
Equations	(8), (16)
Source of data	Estimates developed for the project
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Supporting assets (including, for illustrative purposes, battery energy storage systems and synchronizing condensers) can complement paired renewable energy by mitigating the intermittent nature of renewable energy production, and providing valuable ancillary services including voltage and frequency support that are not otherwise provided by the renewable generation itself. As the development of these assets will be, typically, linked with the paired renewable energy, it is logical that cost estimates associated with these assets would be developed as a part of normal project development.

Purpose of data	Determination of capital and fixed operating costs associated with one or more supporting assets developed to complement the paired renewable energy.
Comments	The scope of the costs included in variable SA is limited to capital and fixed operating costs to be conservative; consensus regarding the likely operating regime of such assets can be difficult to achieve (moreso even than for conventional generation), and any such forecast is inherently complex.

Data/Parameter	*PLIR*
Data unit	Currency unit per generation unit (e.g. $/MWh)
Description	Rate of the production linked incentive applicable to the renewable energy generator and year in question.
Equations	(20)
Source of data	Policy documentation describing the production-linked incentive
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Where production-linked incentives exist, they may be subject to escalation accounting for inflation, evolving policy goals, or other reasons. Public information about these policy tools should be used as the basis for establishing the rate applicable to the renewable energy generation involved in the project.
Purpose of data	To be used to determine the value of production-linked incentives in offsetting the unit cost of replacement generation.
Comments	

Data/Parameter	*MTC*
Data unit	Currency unit
Description	The monetizable value of production-linked incentives when structured as non-refundable tax credits.
Equations	(21)

Source of data	Project analysis based on structure of the tax credit and projected tax obligations arising over time.
Value applied	As determined from project analysis
Justification of choice of data or description of measurement methods and procedures applied	Non-refundable production tax credits are a specific implementation of production-linked incentives that result in a delay between when credits are earned (as a function of production) and when they can be monetized. Owing to this difference in time and relationship with forecast tax obligations, a project-specific analysis is required to determine the projected monetizable value over time.
Purpose of data	To be used to determine the value of production-linked incentives in offsetting the unit cost of replacement generation.
Comments	

Data/Parameter	$IDEBT_y$
Data unit	currency unit
Description	Interest payment for asset-level debt in year *y*
Equations	(3)(3)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Debt service costs include asset-level debt that was used to finance the initial investment in the CFPP, refinancing asset-level debt, and new debt issuance (e.g., under a committed CTM). Debt service costs must be calculated according to the terms of the existing financing agreement. The after-tax cost of debt should be used in the analysis.
Purpose of data	Determination of baseline scenario
Comments	Where a CFPP would be retired before the end of its existing loan tenor, it may be assumed that the remaining principal on unpaid debt must be fully repaid in retirement year *RY*.

Data/Parameter	VOM_y

	, FOM_y
Data unit	currency unit
Description	Variable operations and maintenance costs in year *y* Fixed operations and maintenance costs in year *y*
Equations	(3)(3)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Fixed and variable operations and maintenance costs should be based on historical data over the previous five years prior to project registration. Where fewer than five years of operational data exist, the average of historical fixed and variable operations and maintenance costs over the entire lifetime of the CFPP must be used. These costs must be assumed to be fixed in real terms in the baseline assessment.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$FUEL_y$
Data unit	currency unit
Description	Fuel costs in year *y*
Equations	(3)(3)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Fuel costs should be based on historical data over the previous five years prior to the date of baseline scenario assessment and must include fuel transportation costs. Where fewer than five years of operational data exist, the average of historical fuel costs over the entire lifetime of the CFPP must be used. Fuel costs must be fixed in real terms for baseline scenario analysis.

Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$PPAE_y$
Data unit	currency unit per unit of generation (e.g., USD/MWh)
Description	Remuneration for electricity supplied to the grid under PPA contract in year *y*
Equations	(4)(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	G_y
Data unit	generation unit (e.g., MWh)
Description	CFPP electricity generated and supplied to the grid in year *y*
Equations	(4)(4), (5)(5), (8)(8), (12)(12), (13)(13)
Source of data	CFPP use/generation records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Calculated as historical averages for the CFPP over the last five years. Where fewer than five years of operational data exist, the average of historical generation over the entire lifetime of the CFPP must be used.

	Where 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 G_y.
Purpose of data	Determination of baseline scenario
Comments	Annual generation is assumed to remain constant throughout the analysis period.

Data/Parameter	$PPAC_y$
Data unit	currency unit per unit of available capacity
Description	Remuneration for available capacity under PPA contract in year y
Equations	(4)(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	A_y
Data unit	capacity unit
Description	Availability of CFPP capacity as per PPA in year y
Equations	(4)(4)
Source of data	CFPP PPA terms
Value applied	Calculated as historical averages of the CFPP over the last five years. Where fewer than five years of operational data exist, the average of

	the historical availability over the entire lifetime of the CFPP must be used.
Justification of choice of data or description of measurement methods and procedures applied	Historical data is best representation of future performance.
Purpose of data	Determination of baseline scenario
Comments	A_y is the capacity of the CFPP that is available and used to determine the remuneration for available capacity under a PPA contract in year *y*. Availability is assumed to remain constant throughout the analysis period.

Data/Parameter	$PPAS_y$
Data unit	currency unit per unit of service
Description	Remuneration for other electricity services in year *y*
Equations	(4)(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	OS_y
Data unit	service unit
Description	Other yearly services provided by the CFPP in year *y*

Equations	(4)(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	GU_i
Data unit	generation unit (e.g., MWh)
Description	Generation that is supplied to the grid from unit *i*
Equations	(7)(7)
Source of data	Grid operator data
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	UG_i
Data unit	currency unit per unit of generation (e.g., USD/MWh)
Description	Average unit cost of generation supplied to the grid by unit *i*

Equations	(7)(7)
Source of data	Grid operator data
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	*GR*
Data unit	generation unit (e.g., MWh)
Description	Annual paired renewable electricity generation that is supplied to the grid
Equations	(8(8), (9)(9)
Source of data	Paired renewable electricity estimated to be exported to the grid.
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on the capacity of the renewable electricity generation unit prior to operation. Measured once generation unit is supplying to the grid. Use calibrated electricity meters from the grid supplier.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	K_e
Data unit	%

Description	Cost of equity to the facility owner
Equations	(9)~~(9)~~, (10)~~(10)~~
Source of data	Facility financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$DEP_{RE,t}$
Data unit	currency unit
Description	Tax depreciation of renewable electricity asset in year *t*
Equations	(9)~~(9)~~
Source of data	Local tax documentation
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Tax depreciation must reflect existing policies or tax codes that would provide a tax benefit to renewable energy technologies. Where no such policies exist, straight-line depreciation over the project lifetime may be assumed.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	L_a
Data unit	years

Description	Lifetime of CFPP asset from commissioning until retirement (years)
Equations	(10)(10)
Source of data	CFPP records
Value applied	Utility-owned CFPP: technical lifetime IPP-owned CFPP: end of PPA term
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	*E*
Data unit	currency unit
Description	Equity portion of initial investment
Equations	(11)(11)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	*AMC*

Data unit	currency unit
Description	Accumulated maintenance capital expenditure until project registration year
Equations	(11)(11)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	*FMC*
Data unit	currency unit
Description	Expected future maintenance capital expenditure until two years prior to retirement year
Equations	(11)(11)
Source of data	CFPP records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	Future maintenance capital expenditure should be based on existing maintenance contracts and should assume no additional maintenance capital expenditure in the two years prior to CFPP retirement. Where

	maintenance contracts are unavailable, future maintenance capital expenditure may be projected using historical spending.

Data/Parameter	CP_y
Data unit	currency unit per unit of emissions (e.g., USD/t CO_2e)
Description	Carbon price in year *y*
Equations	(12)~~(12)~~
Source of data	Regulatory documentation on carbon price/price pathway
Value applied	As determined from 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 CFPP must be determined by assuming annual growth of carbon prices (e.g., carbon tax, emissions trading scheme allowance price) in accordance with host country plans or policy scenarios at the time of validation. Where 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 is the carbon price corresponding to the final year for which an official target or forecast price exists, projected forward using a linear trendline based on the average rate of change in carbon prices over the last five years of available data, or forecasted according to government sources. Where several pricing scenarios are available, apply the most ambitious (i.e., highest) carbon price.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$EM_{i,y}$
Data unit	emissions unit (e.g., t CO_2e)
Description	Emissions of plant or unit *i* in year *y*
Equations	(13)~~(13)~~
Source of data	CFPP emissions reporting

Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	NBV_{R0}
Data unit	currency unit
Description	Net book value of CFPP asset in baseline assessment year *R0*
Equations	(14)(14)
Source of data	CFPP financial accounts
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	PPA_{term}, PPA_{R0}, PPA_{AR}, PPA_y
Data unit	years
Description	Total length of PPA term, Number of years from start of PPA term to baseline assessment year *R0*, Number of years from start of PPA term to retirement year *AR,* Number of years left on the PPA at baseline assessment year *R0*, respectively
Equations	(14)(14)

Source of data	PPA term
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

APPENDIX A: UNCERTAINTY ASSESSMENT

The uncertainty associated with the application of this module was assessed according to the 2019 refinement of 2006 IPCC Guidelines following the Monte Carlo simulation technique.

The assessment focused on understanding the overall uncertainty of the NPV resulting from cashflows of the different scenarios.

The first step involved an assessment of the sensitivity of the result to reasonable variations to the input parameters. The sensitivity analysis was used to identify the key variables that contribute most significantly to the uncertainty of the NPV.

For parameters determined by existing contracts (e.g., PPAs, loan agreements, ongoing depreciation) or by laws or regulations (e.g., amortization schedules, tax laws, etc.) random uncertainty was assumed to be negligible. Other variables not simulated may have an important role in the cashflows but are considered to have a minor impact on the overall uncertainty.

It is important to note that the objective of the uncertainty assessment is to quantify an uncertainty range of the result based on the current knowledge of the variables and context. Potential unknown changes in future regulations, taxation or interaction with other activities, or potential changes in the evolution of broader variables are outside the scope of the assessment.

The individual uncertainty of the following parameters is considered to contribute the most to the overall uncertainty: Further assessments expanding to new data or deeper granularity level may yield to different results. The current assessment is the result of balancing time, resources and outcomes given the resource intensive nature of the Monte Carlo simulation.

The individual uncertainty of the input data for the following parameters is considered to contribute the most to the overall uncertainty:

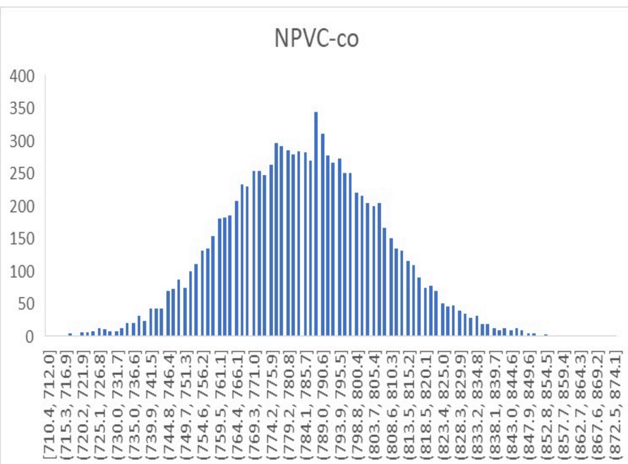
1) Fuel prices and other variable operating costs
2) Carbon price
3) Cost of equity and cost of debt
4) Capital expenditure for paired renewable electricity

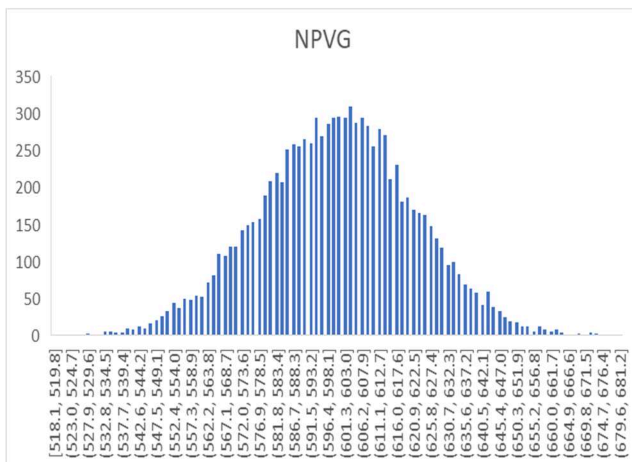
Each parameter identified was simulated to behave as a normal probability distribution function with the underlaying statistical parameters determined based on reasonable and conservative assumptions. The mean of the distribution was assigned as the point of estimate, and the standard deviation was determined based on the uncertainty ranges of each parameter representing the two-sided 90% confidence interval.

The main parameters simulated are described below:

Input data		Probability function	90% CI
VOMy	Variable O&M	Normal distribution	40%
FOMy	Fixed O&M	Normal distribution	20%
FUELy	Fuel cost	Normal distribution	30%
CPy	Carbon price	Normal distribution	50%
Gy	Generation	Normal distribution	20%
EF	Emission factor	Normal distribution	10%
Ke	Cost of equity	Normal distribution	20%
Kd	Cost of debt	Normal distribution	20%
La	Lifetime	Normal distribution	30%

The simulation was done for 10,000 runs over the NPV for the two main scenarios: continuous operation of the CFPP and the early retirement paired with renewable generation.





The resulting uncertainty of the NPVs for each scenario was used to assess the uncertainty of the retirement date, i.e. the point in time when continued operation has a similar NPV as accelerated retirement.

The overall uncertainty in determining the financial retirement date is estimated to be approximately 10%. In most cases, this translates into a range of approximately ± 2 years (rounding to integer year value, e.g. financial retirement date: year 12, ranging from year 10 to year 14). The range depends on the slope of the function and it is project specific, but different scenarios were modelled to stress-test the overall expected uncertainty.

A deduction was calculated as per section 2.4.4 of the Methodology Requirements v4.4 by applying a t-value for a one-sided 66.67% confidence interval to select a date contained in a range with a probability of 66.7%-100%. The deduction yields a discount of 0.5 years.

As a result, and to be conservative, the project proponent must deduct 0.1 years for each year of the advancement period from the financially attractive retirement date determined in Section 6.5.1, i.e., for a ten year long period, assume that CFPP would have been retired one year earlier under this scenario.

DOCUMENT HISTORY

Version	Date	Comment
v1.0	6 May 2025	Initial version
v1.1	27 Mar 2027	Draft revision for public stakeholder consultation