Methodology for measuring net carbon dioxide removal through bioenergy with carbon capture and storage (BECCS)

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Contents

1 Methodology context

The purpose of this methodology is to show how a project proponent (defined in chapter 2) may quantify a project's net carbon removal contribution to climate change mitigation. Such proponents will be using power and/or heat bioenergy with carbon capture and storage (BECCS) as a tool for permanent carbon dioxide removal (CDR). This methodology is built on the principle of conservativeness, calculating the net volume of carbon dioxide (CO_2) removed from the atmosphere through BECCS, and containing measures to avoid overstating removals volumes. In addition, this methodology outlines robust quantification approaches and data sources that can be used to verify net removal volumes and in turn produce CDR credits. It also outlines strict eligibility criteria, such as detailed biomass sustainability requirements. The methodology is developed for the voluntary carbon market, but may be adapted for compliance purposes where appropriate or necessary.

BECCS technology performs the service of capturing and storing CO_2 in geological reservoirs while co-producing energy. Where the CO_2 stored is derived from sustainably sourced biomass, BECCS delivers permanent negative emissions. This methodology applies to BECCS projects using thermal combustion of solid biomass fuels, i.e. projects generating CDR credits from energy-generation BECCS plants. It does not apply to other BECCS approaches, such as ethanol-production or waste-to-energy plants – although many of the principles and the methodology may also be adapted for use with these technologies.

This methodology lays out criteria and approaches that project developers shall adhere to in each step of developing a credit-generating BECCS project. The authors anticipate that it will be updated periodically to reflect the latest approaches and evidence.

The following documents have informed the development of the methodology:

- Intergovernmental Panel on Climate Change (IPCC) Special Report on Carbon dioxide Capture and Storage
- Proposal for an EU Carbon Removals Certification Framework (EU CRC-F), COM (2022) 672 final
- The Integrity Council for Voluntary Carbon Markets – Core Carbon Principles / Assessment Framework (July 2023)
- ISO 14064-2:2019 – Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements
- ISO 27914:2017 – Carbon dioxide capture, transportation and geological storage
- Puro.Earth – Geologically Removed Carbon
- Gold Standard – Methodology for biomass fermentation with carbon capture and geologic storage – draft for public consultation (2023)

1.1 Version notes

This version of the methodology (v1.0) has been developed by Drax and Stockholm Exergi, with technical inputs from EcoEngineers. It has been validated by DNV, a third party validation and verification body.

The methodology may be revised in future iterations to, inter alia, reflect new best practices or accommodate other project types (e.g. BECCS from the pulp and paper industry), fuel sources or jurisdictions.

2 Project requirements

This chapter lays out the scope of this methodology, as well as the applicability conditions, safeguards and crediting periods that the project proponent is required to follow.

2.1 Methodology scope

The current version of this methodology applies to power and/or heat BECCS projects storing CO_2 in a defined set of jurisdictions. These are: the European Union (EU) and non-EU member states of the European Economic Area (EEA), the United States of America (USA), or the United Kingdom (UK). This jurisdictional limitation is based on said jurisdictions' robust regulations and high enforcement levels, in particular regarding permanent geological sequestration of carbon dioxide. This is not to say that other jurisdictions may not already have equally strong regulatory frameworks; in future iterations, the methodology's scope may be opened to more jurisdictions.

The methodology version only applies to forest biomass, although it may be extended to other forms of biomass in the future such as agricultural residues and waste treated through incineration. Projects may source biomass from any jurisdiction / source which meets the sustainable biomass criteria outlined in Appendix C.

2.2 Project proponent

The project proponent is defined as the party that has the overall contractual control over, and responsibility for, the BECCS project that generates CDR credits. Typically, this is the operator or owner of the carbon capture system. The project proponent is not required to directly operate all components of the BECCS value chain, and may choose to rely on contractual partnerships for delivery. For example, the project proponent need not be the entity which directly injects or stores the CO_2. The project proponent shall be awarded any carbon credits generated in relation to activities using this methodology.

2.3 Requirements

2.3.1 Applicability conditions

The project proponent shall demonstrate that their project:

a. Uses only sustainable biomass feedstocks, verified appropriately against the conditions laid out in Appendix C of this methodology.

b. Stores captured CO_2 in geological storage only with storage operators that meet local and international applicable regulatory standards for permanent sequestration. Storage sites are to be verified appropriately against the conditions regarding permanence laid out in chapter 8.

c. Generates electricity and/or heat that is available for external consumption.

d. Does not use CO_2 captured from BECCS facilities for enhanced hydrocarbon recovery (EHR).[1]

2.3.2 Safeguards

The aim of projects under this methodology is to deliver climate change mitigation through the delivery of CDR. While this delivers a climate benefit, it is important to also consider the social and environmental impact on communities where projects are located. Therefore, at project validation, the project proponent shall demonstrate that their project has:

a. Conducted all relevant stakeholder consultations following the requirements described in Appendix E.

b. Reviewed the full list of safeguards outlined in Appendix F and either i) confirmed they have not identified any project risk of breaching any of these, or ii) provided a mitigation plan for any identified risks. These assessments shall be made available on request to the validation/verification bodies (VVB) engaged to validate the project. If any issues arise against these safeguards during project operation, the project proponent must develop and publish a mitigation plan.

2.3.4 Crediting periods

The project crediting period runs for 15 years and is renewable twice. Each renewal period will require a full review and update of the Project Design Document (PDD – see chapter 9) to ensure continued compliance with all methodology requirements. Renewals will be validated against the latest version of the methodology document, noting that the methodology requirements may be updated over time

[1] In many cases, BECCS projects are likely to use shared infrastructure for CO_2 transport, injection, or storage with other CO_2 capture projects. Shared infrastructure may also be used for non-applicable activities such as enhanced hydrocarbon recovery (EHR). In the case that a BECCS project uses shared infrastructure where a part of the overall CO_2 is going to EHR, the project developer shall demonstrate that contractually their CO_2 is only intended for applicable non-EHR storage sites. Furthermore, the developer shall provide mass balance evidence from the infrastructure provider that the amount of CO_2 the developer is entitled to was injected in an applicable non-EHR storage site.

3 Baseline determination

3.1 Defining the baseline

A project baseline describes what would have happened in the absence of a carbon removal project. Defining a baseline facilitates the assessment of the additionality of a project and provides a counterfactual against which the emissions impact of the project can be quantified.

This methodology is primarily concerned with a non-incremental change to the baseline scenario where the outcome is net removal of CO_2 from the atmosphere.

Retrofit baseline

For a retrofit project, i.e. where the carbon removal activity is added to an existing bioenergy plant, the baseline is:

- The existing biomass power and/or heat facility without CCS

New-build baseline

For a new build BECCS plant, i.e. where the carbon removal activity and the bioenergy plant are installed simultaneously, determining the project baseline requires further consideration of the counterfactual outcome. In this consideration, it cannot be assumed that the counterfactual outcome would be a new energy plant without CCS for the production of biomass-based renewable electricity and/or heat.

Instead, it could be arrived at that for a new-build BECCS plant, there could potentially be two possible different baselines: (a) no BECCS plant would be built, or (b) a bioenergy plant of substantially the same size and at the same location would be built.

Considering (i) that the purpose of this methodology is primarily to promote the removal of CO_2 from the atmosphere, (ii) the inherent ambiguities in determining whether (a) or (b) above is the correct baseline as well as the benefits of having a standardized baseline, and (iii) that it is the removal credit revenue that is supposed to trigger and make the project additional, the baseline for a new-build BECCS plant under this Methodology shall be:

- No BECCS plant is developed

Scenario qualification criteria

To qualify as an *existing* biomass power and/or heat plant, the plant shall have been operating using biomass feedstock for more than 36 months prior to the commencement of the installation of carbon capture equipment.

To qualify as a new-build biomass power and/or heat plant under, the plant shall have been operating using biomass feedstock for less than 36 months prior to commencement of the installation of the carbon capture equipment.

3.2 Requirements

Any emissions not attributable to the project shall be categorized as baseline emissions (see description of applicable emissions in Appendix G). By default, these emissions shall not be included in the net removals quantification. However, in the interests of conservativeness, some emissions in the baseline may be included in the overall quantification of net removals (see chapter 6).

3.2.1 At point of project validation, the project proponent shall confirm whether the project shall be designated as a retrofit or new-build. They should use the definitions in section 5.1 of this methodology.

4 Additionality

Under this methodology, BECCS projects are developed for the purpose of delivering carbon dioxide removals. Removals are additional if they would not have taken place without the incentive created by CDR credit revenues. Note that the additionality assessment described in this methodology is designed to follow a 'standardized approach' as defined by the Integrity Council for the Voluntary Carbon Market (ICVCM).

4.1 Requirements

4.1.1 The project proponent shall demonstrate the additionality of their BECCS project by following the approach outlined in figure 1 below:

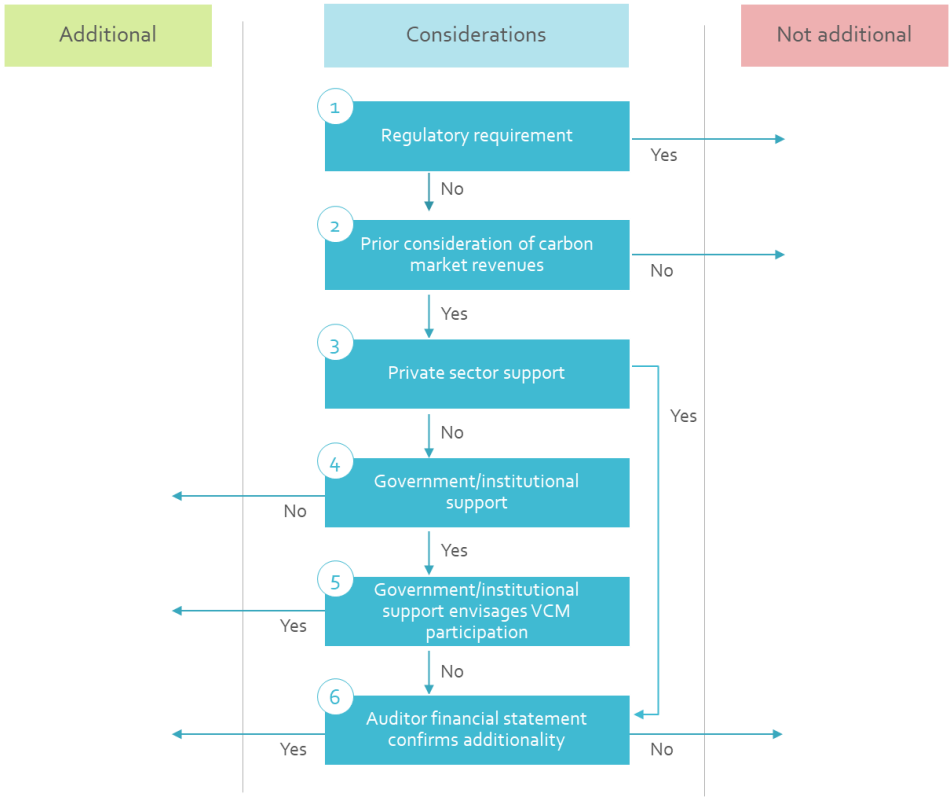


Figure 1 Additionality demonstration diagram

1. **Regulatory requirement:** The project proponent shall demonstrate that there are no existing regulations requiring the proponent to capture and store CO_2 on bioenergy plants within the jurisdiction of the capture unit. Should such a requirement exist as a condition for financial support this will not be taken to amount to a regulatory requirement for the deployment of the project, provided the project proponent demonstrates that the existence of such support does not preclude the closure of an existing bioenergy plant nor mandate the construction of a new plant. Where

successfully demonstrated, projects are considered to comply with this requirement for the duration of their crediting period upon validation. This will be revalidated at each crediting period renewal. If the project is able to demonstrate regulatory additionality, it must move to additionality step 2.

2. **Prior consideration of carbon market revenues:** The project proponent must provide documented evidence (e.g. public announcements, internal decision documents) of 'prior consideration'[2] of carbon market revenues in the decision to develop a project. 'Prior consideration' is defined as reasoning used to justify action or investment in advance of operational commencement. If the project proponent can prove prior consideration, it must move to step 3.

3. **Private sector support:** A project may receive funds from the private sector, including grants, prize money, and other non-CDR credit related contributions. These contributions are accrued outside the sales of CDR credits or equity funding. If private sector funding is used by the project proponent, additionality will need to be demonstrated using step 6. If the project has no such funds, it must move to step 4.

4. **Government/institutional support:** If a project proponent demonstrates that the project is not in receipt of sources of revenue from governments or public institutions, the project is additional. In cases where there is government / institutional support, the project must move to step 5.

5. **Government support envisages VCM participation:** Government or institutional support may take several forms. Often support is granted with the assumption that the project will participate in the voluntary carbon market (VCM) and therefore that some portion of the project funding will come from the market. In such instances, the project will be considered additional since the support received has been unlocked by carbon market revenues. Projects in receipt of government or institutional support that do not envisage VCM participation must move to step 6.

6. **Auditor Financial Statement:** To confirm that projects receiving private sector, government or institutional support would not have taken place absent the incentive of carbon market revenues, a third-party financial auditor will review the finances of activities within the project boundary. The auditor will determine whether said revenues were a necessary factor in the project proponent's decision to realize the project. If the auditor states that carbon market revenue is necessary, then the project is additional.

[2] ICVCM Core carbon principles, assessment framework and assessment procedure (2023)

5 Project boundaries

The projects boundary encompasses relevant project activities leading to GHG sources and sinks. The boundary is drawn to represent processes that are exclusively initiated by the anticipation of CDR credit revenue from the project. Therefore, there will be one project boundary within which additional processes relative to the baseline are included.

See Appendix G for a detailed breakdown of all emissions, including those included or excluded from the project boundary.

The overall calculation of net removals in this methodology also requires the quantification and deduction of operational supply chain emissions generated within the BECCS value chain, irrespective of whether those emissions sit in the baseline or the project boundary. These emissions are considered within the wider 'quantification boundary'. By subtracting emissions generated along the value chain, and by accounting for leakage where applicable, this approach ensures a conservative crediting of net removals (as elaborated in Chapter 6).

The operational supply chain emissions shall only consider activities insofar as they relate to the delivery of carbon removals through CCS (i.e. those activities within the quantification boundary that provide biogenic carbon to the CCS unit for permanent capture). This is to avoid the inclusion of activities within the quantification boundary that are unrelated to the delivery of carbon removals by the project. Relevant examples of such activities include:

- A BECCS plant that delivers CO_2 for carbon capture and utilisation in parallel to carbon capture and storage
- A situation where the T&S network is temporarily unable to accept CO_2 from the BECCS plant but the bioenergy plant remains running

Table 1 - Distinction between boundaries

Term	**Definition**
Project Boundary	The activities exclusively initiated by the anticipation of CDR credit revenue from the project relative to the additionality baseline
Quantification Boundary	Activities that fall within the overall quantification of net removals, irrespective of whether they are within the project boundary
Quantification Baseline	The counterfactual against which the emissions impact of the project can be assessed
Additionality Baseline	The counterfactual against which the additionality of the project can be assessed

5.1 Requirements

5.1.1 For retrofit BECCS and new-build BECCS: The project boundary shall include the CO_2 capture, processing, transport and storage components of the BECCS system (see figure 2-3).

5.1.2 The project proponent shall identify the overall quantification boundary, listing all attributable activities to be considered for quantification outside the project boundary (see figure 2-3). The quantification boundary may vary for different biomass sources.

5.1.3 The project proponent must provide the locations of each project site using global positioning system (GPS) coordinates. If pipelines are included in the CO_2 transport process, then the project proponent shall provide a map showing the GPS coordinates for locations along the pipeline.

A BECCS project's boundary encompasses all activities initiated by the anticipation of CDR credit revenues. For conservativeness, the quantification of net removals accounts for a broader range of activities beyond those strictly within project boundaries, regardless of the project type: namely operational supply chain emissions and leakages (i.e. indirect emissions), which are deducted alongside project emissions from gross CO_2 injected. Note that some market leakages may reduce emissions (e.g. through heat recovery processes on carbon capture units). These concepts are further discussed in chapters 6 and 7.

Figure 2 - Extent of retrofit BECCS project

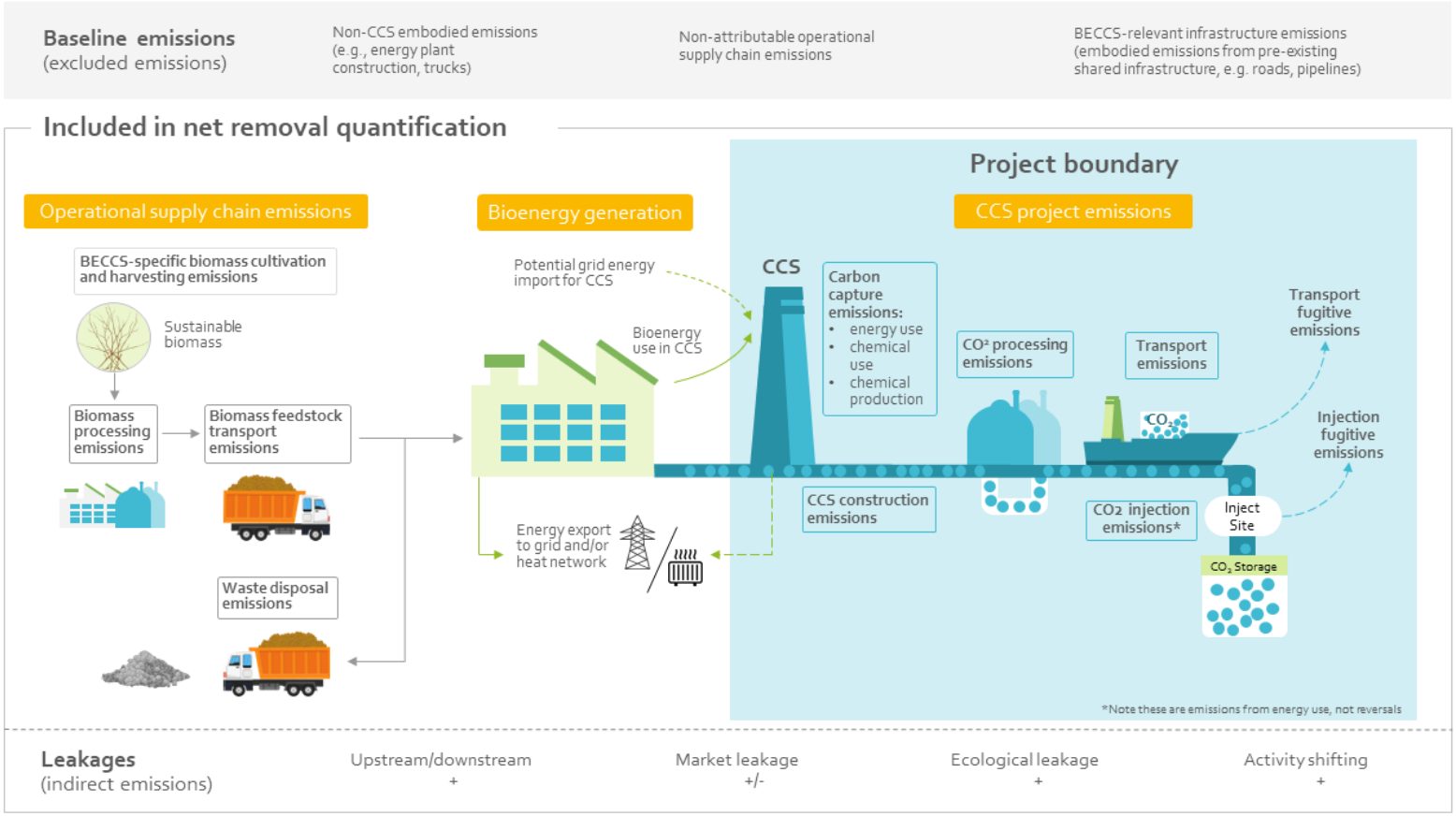
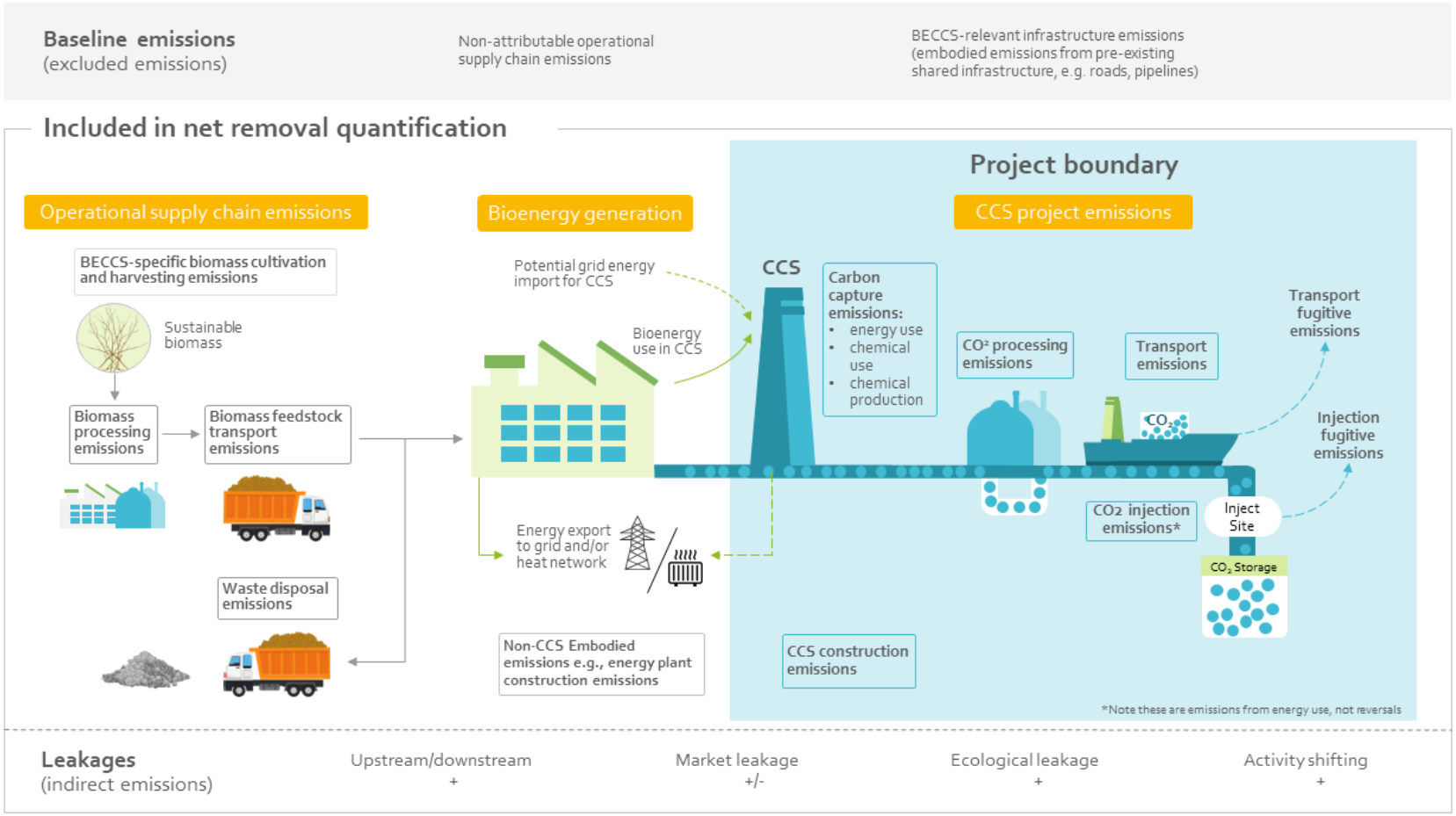


Figure 3 - Extent of New Build BECCS Project



6 GHG removal quantification

This chapter details the method that the project proponent must follow to quantify the number of CDR credits they can receive from removing greenhouse gases (GHGs) through BECCS activity. This number is determined by the amount of CO_2 that has been permanently removed and stored through the BECCS project, minus all direct emissions associated with CCS operation and supply chain emissions, and minus indirect emissions from leakage.

GHG emissions shall be converted to CO_2e using the most recently available global warming potentials (GWP) published by the IPCC.[3]

6.1 Conservative Measures

This methodology is guided by the principle of conservativeness. It is designed to avoid overstating net removals volumes where outcomes or measurements are uncertain, for greater assurance on climate benefit. In addition, there are several instances where a proactively conservative approach has been taken where less conservative, but justifiable, alternatives were available. These instances are outlined below.

Retrofit BECCS

- **Operational supply chain emissions may be included** in the overall quantification of net removals despite being in the baseline. An argument could be made that these emissions would have occurred without the project, for example with the biomass supply chain.
- **Energy leakage must be accounted for** in the overall quantification of net removals in accordance with Chapter 7 and Appendix D, despite the overall system being a net renewable energy generator.
- **Energy attribute certificates are not allowed** to be used against any energy consumption made by the plant. Instead it is required that associated project or leakage emissions be accounted for accordingly.
- In addition to the first item, **heat recovered from the carbon capture process is not included** in the calculation for allocating operational supply chain emissions to the different products of the BECCS facility (electricity, heat, carbon removal and carbon for usage)
- In a leakage calculation, the potential outcome that a CHP based BECCS plant may result in **lower heat emissions compared to the baseline does not generate any extra credits**

New build BECCS

- **Emissions reductions achieved from new renewable energy** displacing more GHG intensive forms of generation are not included in the overall quantification of net removals nor otherwise credited.

[3] See IPCC Sixth Assessment Report, 2021, Chapter 7. available at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material.pdf

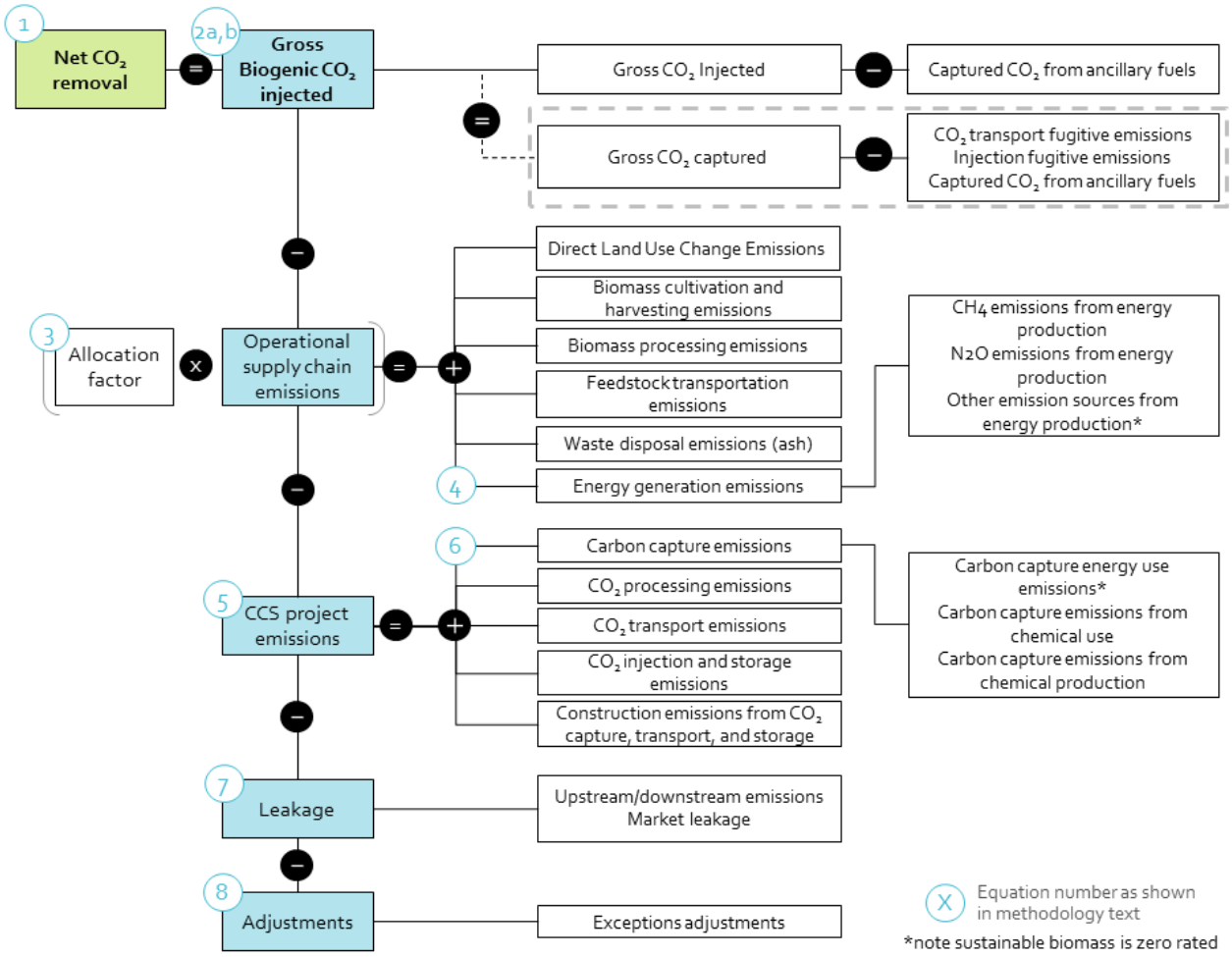
- **Embodied carbon emissions from energy plant construction must be subtracted** from the overall quantification of net removals, even though an argument could be made for allocating these emissions to the energy output.
- **Energy attribute certificates are not allowed** to be used against any energy consumption made by the plant. Instead it is required that associated project or leakage emissions be accounted for accordingly.

6.2 Requirements

The project proponent shall calculate total CDR credits generated by BECCS using the approach outlined in *Figure 4* and the subsections and equations in Chapter 6. These equations have been designed to capture a conservative estimate of the 'net' volume of removals produced by a BECCS project.

6.2.1 The full quantification shall be carried out at validation and applied at each subsequent verification and credit issuance. Not all variables need to be updated at each quantification - certain variables only need updating annually (with updates required for each calendar year after validation). Each data/parameter shall be monitored according to the frequency outlined in the sampling plan noted in the PDD (an example is shown in Appendix J).

Figure 4 - Removal quantification



6.3 Calculating net removals

6.3.1 Net CO2 Removal

Net CO_2 removals are calculated in accordance with the following equation:

(eq 1) $$NCR_y = GBCI_y - OSC_y - PE_y - L_y - A_y$$

Where:

NCR_y	Total net CO_2 removals in period Y	tonnes of CO_2e
$GBCI_y$	Gross Biogenic CO_2 injected in period Y (see equation 2a or 2b)	tonnes of CO_2
OSC_y	Operational supply chain emissions in period Y (see equation 3)	tonnes of CO_2e
PE_y	Total project emissions in period Y (see equation 5)	tonnes of CO_2e
L_y	Leakage emissions in period Y (see equation 7)	tonnes of CO_2e
A_y	Adjustments in period Y (see equation 8)	tonnes of CO_2e

6.3.2 Gross Biogenic CO2 Injected

The preferred approach for quantifying injected biogenic CO_2 volumes is through documentation from the storage operator that certifies the gross volumes of injected CO_2 attributed to the BECCS project. If certification showing injected CO_2 volumes directly attributable to the BECCS project is provided, this figure shall be used directly,[4] and fugitive emissions need not be estimated.

In certain instances[5] there may be a small portion of the gross volumes of injected CO_2 from fossil sources. Equation 2a describes how the gross biogenic CO_2 injected is calculated.

(eq 2a) $$GBCI_y = GICR_y - AFC_y$$

Where:

$GBCI_y$	Gross Biogenic CO_2 Injected in period Y	tonnes of CO_2
$GICR_y$	Gross CO_2 Injected in period Y (monitoring table 1[6])	tonnes of CO_2
AFC_y	Carbon captured and stored originating from ancillary fuels used in period Y (monitoring table 2)	tonnes of CO_2e

[4] Note: in some cases, the project proponent may wish to use a proportion of the gross injected removal volumes for other mitigation uses. Where this is the case, the project proponent shall provide evidence to the VVB of the volume of removals being used for these different purposes, and these volumes shall be subtracted from gross injected removals prior to the rest of the calculation.

[5] e.g. fuel used for biomass combustion start-up process or for use in regenerative thermal oxidisers

[6] See Appendix I for monitoring tables

Where for logistical or other reasons stored tonnes cannot be directly tied to the project proponent, then equation 2b shall be used to calculate gross injected removal volumes. Equation 2b relies on metering data from the capture facility for calculating carbon removals, not on data from the point of injection.

(eq 2b) $$GBCI_y = GCC_y - TFE_y - IFE_y - AFC_y$$

Where:

$GBCI_y$	Gross Biogenic CO_2 Injected in period Y	tonnes of CO_2
GCC_y	Gross captured CO_2 in period Y (monitoring table 3)	tonnes of CO_2
TFE_y	CO_2 transport fugitive emissions in period Y (monitoring table 4)	tonnes of CO_2
IFE_y	Injection fugitive emissions in period Y (monitoring table 5)	tonnes of CO_2
AFC_y	Carbon captured and stored originating from ancillary fuels used in period Y (monitoring table 2)	tonnes of CO_2

Project developers shall make transparent in their PDD an estimation of fugitive emissions from carbon transport and injection processes. They should also estimate the uncaptured emissions from the burning of ancillary fossil fuels (e.g. for starting up the biomass combustion process or use in regenerative thermal oxidisers) as detailed in section 6.3.3.1 Developers should review these estimates in their annual reporting to ensure fugitive emissions are not underestimated.

6.3.3 Operational supply chain emissions

Operational supply chain emissions include all emissions related to the supply of biogenic CO_2 used for BECCS, which is the sum of:

- Direct land use change emissions
- Cultivation and harvesting emissions
- Biomass processing emissions
- Transport & distribution of biomass emissions
- Energy generation and fuel in use emissions
- Waste disposal emissions

A non-exhaustive list of potential emissions sources for each stage is provided in the table below:

Stage	**Example**
Direct land use change	• Emissions associated with any applicable direct land use change activities
Cultivation & harvesting	• Embodied emissions of fertilisers, pesticides and other chemicals • Embodied emissions and combustion emissions of fossil fuels for operation of forestry and/or farm machinery • N2O emissions from soils due to application of N fertiliser

	• CH_4 emissions from decomposition of biomass during on-field storage
Biomass processing	• Embodied emissions and combustion emissions of fossil fuels for chipping or pelleting of biomass • N_2O and CH_4 emissions from combustion of sustainable biomass • Emissions related to electricity consumed from the grid or dedicated generation facility for pelleting and other processing of biomass
Transport & distribution of biomass	• Embodied emissions and combustion emissions of fossil fuels used for operation of biomass transport vehicles including ships, trains and trucks • Emissions related to electricity consumed from the grid or dedicated generation facility for storage of biomass • CH_4 emissions from any decomposition of biomass during storage
Waste disposal	• Embodied emissions and combustion emissions of fossil fuels used for disposing of wastes
Energy generation and fuel in use emissions	• Embodied emissions and combustion emissions of fossil fuels used for operating the bioenergy plant • N_2O and CH_4 emissions from combustion of sustainable biomass • Emissions related to electricity consumed from the grid or dedicated generation facility for operation of the bioenergy plant

The quantification boundary for wastes, residues and by-products shall begin at the point in which the material is generated from the wider value chain. For example, the quantification boundary for sawdust from sawmilling operations shall begin at the point at which the sawdust is produced and shall not consider upstream emissions associated with sawmilling etc. For residues and by-products from forestry and agriculture, the quantification boundary shall begin at the point of harvest and collection.

(eq 3) $$OSC_y = (El_y + Eec_y + Eep_y + Etd_y + Egu_y + Ewd_y) \times AF_y$$

Where:

OSC_y	Operational supply chain CO_2 emissions in period Y	tonnes of CO_2e
El_y	Direct land use change emissions in period Y	tonnes of CO_2e
Eec_y	Biomass cultivation and harvesting emissions in period Y (monitoring table 6)	tonnes of CO_2e

Eep_y	Biomass processing emissions in period Y (monitoring table 7)	tonnes of CO_2e
Etd_y	Biomass feedstock transportation & distribution emissions in period Y (monitoring table 8)	tonnes of CO_2e
Egu_y	Energy generation emissions in period Y (see equation 4)	tonnes of CO_2e
Ewd_y	Waste disposal emissions in period Y (monitoring table 9)	tonnes of CO_2e
AF_y	Proportion of emissions allocated to net CO_2 removed in period Y	%

Additional guidance will be provided in due course on how to fully account for operational supply chain emissions.

6.3.3.1 Emissions from energy generation

Emissions from energy generation will not include CO_2 emissions from the combustion of sustainable biomass due to their 'zero rated' nature (as detailed in Appendix A and Appendix C). However, combustion of biomass typically results in the production of CH_4 and N_2O, which shall be taken into account. This may also include emissions from managing any waste streams from the energy production activities.

(eq 4) $$Egu_y = TCH4_y + TN2O_y + OES_y$$

Where:

Egu_y	Emissions from energy generation in period Y	tonnes of CO_2e
$TCH4_y$	Total CH_4 emissions from energy production in period Y (monitoring table 10)	tonnes of CO_2e
$TN2O_y$	Total N_2O emissions from energy production in period Y (monitoring table 11)	tonnes of CO_2e
OES_y	Other emission sources from energy production in period Y (monitoring table 12)	tonnes of CO_2e

Any fossil fugitive emissions (e.g. from fuel oil used during the start-up process) not covered by the capture process are accounted for in equation 4.

Emissions from generation that are not associated with the capture and storage of biogenic carbon, per the requirements laid out in Section 5, may be excluded from quantification.

Allocation factor

Operational supply chain emissions can either be fully allocated to carbon removals or be partially allocated against different energy products that may be produced through the bioenergy generation process. The use of the allocation factor is left to the discretion of the project proponent, who may

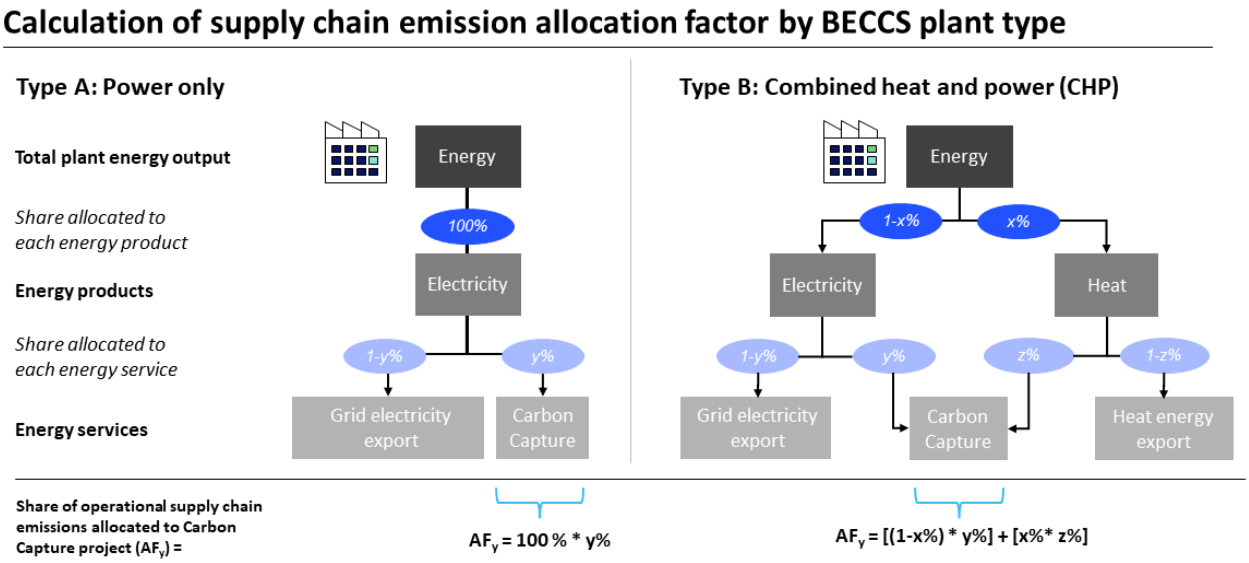
consider important factors such as pre-existing GHG reporting obligations in deciding whether to allocate emissions to co-products.

It is noted that any approach where supply chain emissions are allocated in full to the carbon removals infers that all energy co-products of the BECCS value chain are free of GHG emissions at the point of production, potentially conflicting with other GHG reporting obligations of the proponent.

Energy allocation

Where a project proponent decides to partially allocate operational supply chain emissions to other products (e.g. heat and electricity), the split of emissions between these products shall first be conducted in accordance with the GHGP standard[7] for the Allocation of GHG Emissions. For example, operational supply chain emissions can be allocated to all "products" indicated as arrows in the below diagram:

Figure 5 - Allocation of emissions to heat and electricity



Where:

x%	share of supply chain emissions allocated to heat
1-x%	share of supply chain emissions allocated to electricity
y%	share of supply chain emissions allocated to the carbon capture (from electricity)
1-y%	share of supply chain emissions allocated to electricity export
z%	share of supply chain emissions allocated to the carbon capture (from heat)
1-z%	share of the supply chain emissions allocated to heat export

[7] GHG Protocol - Allocation of GHG emissions from a combined heat and power (CHP) plant, Guide to calculation worksheets (2017)

y% + z%	Total share of supply chain emissions allocated to carbon capture

Project proponents shall calculate the allocation factor (AF_y), i.e. the share of operational supply chain emissions allocated to the CCS product, by multiplying the share of electricity production within the plant's total energy output (including electricity and heat) with the share of electricity used in CCS activities. Operational supply chain emissions may be 'allocated' to different products according to this ratio of energy output. For avoidance of doubt, all emissions associated with the electricity used for CO_2 capture and transportation preparation (i.e. electricity required for carbon capture, liquefaction and interim storage) shall be fully accounted for within the carbon removal. Operational supply chain emissions shall not be allocated to any potential heat product based on heat recovery from the carbon capture, the liquefaction or the interim storage. The allocation to the carbon capture process may be further divided into CCU and CCS, in case some of the CO_2 is applied towards the former.

6.3.4 CCS Project Emissions

Project emissions shall include all emissions associated with the installation and operation of carbon capture & storage processes, and includes:

- Emissions from the operation of the carbon capture process, including chemical use and production, and energy use.
- Emissions for processing captured carbon (including liquefaction).
- Emissions from transport of CO_2 to injection and storge sites following the capture process (the project proponent will need to acquire and hold data on all transportation methods, their emissions factors, and the distances travelled).
- Emissions generated from injection and storage processes (including from any energy used in pumping and maintaining the CO_2 in its storage location).
- Emissions from the construction or installation of the CCS units, and in the case of new-build BECCS, emissions from the construction of the bioenergy power and/or heat plant.[8]

Any construction emissions directly attributable to the project (e.g. production and installation of CCS equipment or bioenergy plant construction emissions for new-build) shall be identified, included and amortised over 15 years. This reflects the duration of one crediting period as described under clause 2.3.4 above. Once all embodied emissions have been amortized over the first crediting period, they shall not be included as project emissions in future periods.

(eq 5) $$PEy = PEC_y + PEP_y + PET_y + PES_y + EEI_y$$

[8] This will also include the embodied emissions from any construction activity for transport, injection, or storage directly caused as a result of the BECCS project, for example CO_2 pipelines or storage sites. Only construction activity for transport, injection, and storage infrastructure occurring as a direct result of the BECCS project shall be counted as embodied emissions in this calculation. Any indirect impacts, for example increased demand for shared CO_2 storage sites, will be accounted for under the upstream/downstream leakage calculations as described in chapter 7.

Where:

PE_y	Total CCS project emissions in period Y	tonnes of CO_2e
PEC_y	Project emissions from capture in period Y (see equation 6)	tonnes of CO_2e
PEP_y	Project emissions from CO_2 processing, compression and dehydration in period Y (monitoring table 13)	tonnes of CO2e
PET_y	Project emissions from CO_2 transport in period Y (monitoring table 14)	tonnes of CO_2e
PES_y	Project emissions from CO_2 injection and storage in period Y (monitoring table 15)	tonnes of CO_2e
EEI_y	Amortised embodied CO_2 emissions from construction and installation of CCS equipment in period Y (of carbon capture equipment embodied emissions in the case of retrofits, and including energy plant and BECCS-relevant infrastructure embodied emissions for new-builds) (monitoring table 16)	tonnes of CO_2e

6.3.4.1 Carbon Capture Emissions

In most cases, the energy required to operate CCS equipment will come through the biomass energy generation process. Any energy used for CCS from on-site biomass generation will not need to be subtracted from gross removals as all relevant emissions are factored into the supply chain emissions and project emissions from energy production calculations. Potential secondary effects on the grid – for example, energy leakage – are considered further in equation 7 and Appendix D.

In some cases, however, the carbon capture process may be powered by energy purchased from third party sources. Where electricity is sourced from the grid, the carbon emissions from energy can be determined by multiplying the energy used to operate the CCS equipment by the grid emissions factor. In cases where the CCS equipment is operated using a dedicated generation facility, with energy provided directly to the CCS facility (e.g. by direct wire, or PPAs fulfilling strict temporal and geographical constraints in addition to robust additionality requirements[9]), then an emission factor specific to the carbon intensity of the generation facility may be used. Energy attribute certificates (EACs) shall not be used for conferring the carbon intensity of energy used by the plant[10].

Chemicals produced for use in the carbon capture process shall also have their upstream emissions quantified using supply chain-relevant and chemical-specific emissions factors. Chemicals used in the

[9] Such as those proposed in the EU delegated act on renewable liquid fuels: https://energy.ec.europa.eu/system/files/2023-02/C_2023_1087_1_EN_ACT_part1_v8.pdf

[10] Note that regardless of the emissions associated with any energy 'drawn-down' from the grid, energy leakage risks shall continue to be assessed as described in equation 7 and Appendix D. In the case where renewable energy is drawn from the grid to power a CCS process, energy leakage remains. Energy has been removed from grid capacity, and so this capacity would need to be replaced to fill demand

carbon capture process may also release emissions that shall be taken into account. These emissions shall also be quantified using chemical-specific emissions factors (which shall be defined in the PDD and revised periodically during full verification). In addition, some methods may release other GHGs due to chemical use, and these shall also be quantified with chemical-specific emissions factors.

(eq 6) $$PEC_y = CCE_y + CCC_y$$

PEC_y	Project emissions from capture in period Y	tonnes of CO_2e
CCE_y	Carbon capture energy use emissions in period Y (monitoring table 17)	tonnes of CO_2e
CCC_y	Carbon capture emissions from chemicals used for capture processes in period Y (monitoring table 18)	tonnes of CO_2e

6.3.5 Leakage

As discussed above, all material leakages shall be considered in the calculation of net emissions removals. Leakage shall be assessed using the framework described in chapter 7 and summed up as in the equation below. Emissions from activity shifting and ecological leakage are considered immaterial based upon conformance with the biomass sustainability criteria. See Appendix D for further details on estimation approaches for energy leakages, considered as a sub-set of the market leakage category below.

(eq 7) $$L_y = UDE_y + MLE_y$$

Where:

L_y	Emissions from leakage in period Y	tonnes of CO_2e
UDE_y	Emissions from upstream/downstream leakages in period Y	tonnes of CO_2e
MLE_y	Emissions from market leakages in period Y	tonnes of CO_2e

6.3.6 Adjustments

Exception adjustments allow for reductions to the number of credits that may be issued in a given period. In the case where a project proponent fails to meet particular requirements within this methodology, (e.g. the failure of certain biomass consignments against the sustainability criteria in Appendix C), the project proponent, VVB, and registry may propose conservative compensation mechanisms. Exact agreement on these compensation adjustments will require adoption by the VVB and registry. Such exceptions shall be quantified and verified by the VVB against the terms of the methodology.

Additional subtraction adjustments to gross removals may be added at the discretion of the project proponent.

7 Leakage

BECCS projects may lead to indirect emissions or 'leakage' caused by activities within the BECCS value chain (including biomass production, processing, capture, transport and storage activities). This methodology accounts for all material leakage emissions by subtracting them from gross CO_2 removed.

7.1 Requirements

7.1.1 A project proponent must assess all sources of leakage across four categories of leakage[11], as outlined in table 2 below.

Table 2 - Categories of emissions leakage

Source of leakage	Materiality
Upstream/downstream emissions: removal projects can directly impact emissions that occur downstream or upstream, outside of net removals quantification boundaries.	To be assessed through direct quantification of key upstream/downstream emissions sources outside the project boundary and baseline scenario In most situations these emissions are likely to be immaterial on the basis that the full quantification (consisting of the quantification boundary and leakage) already covers the full removals value chain. Thus, any increase in emissions within the broader value chain will be directly reflected by an increase in the calculated supply chain emissions.
Activity-shifting: shifting emissions to locations not targeted, or emissions not monitored, by the project. An example is the increase in agricultural emissions from the displacement of agricultural activities from land converted to biomass production.	Assessed to be non-material due to the stringent biomass sustainability requirements of this methodology. In particular, due to the following protections against land sector leakage stemming from indirect land use change (ILUC): • Biomass feedstock shall not use feedstock suitable for use in long-lived wood products. These are of greatest value and therefore provide the main driver of land use and land management decisions in the forest sector • Biomass feedstock is only sourced from forest areas where the carbon stock is stable or increasing, or where biomass sourcing helps to reverse declines in forest carbon stock (e.g. to mitigate risk of natural disturbance). By assessing carbon

[11] Integrity Council for the Voluntary Carbon market (ICVCM) Core carbon principles, assessment framework and assessment procedure, (2024)

Source of leakage	Materiality
	stock changes at a jurisdictional or sourcing area level, the assessment captures both direct and indirect forest carbon stock changes associated with the boundary of assessment of the project. (See Appendix C)
Market leakage: removal projects can impact the supply and demand of emissions-intensive products or services. For example, energy leakage would occur if the operation of CCS equipment raises demand for carbon intensive energy without an equivalent increase in energy supply or reduced system demand.	To be assessed following approach outlined in Appendix D. Note that energy leakage emissions are distinct from direct CCS energy use emissions, which are accounted for in the net removals quantification under CCS project emissions. Energy leakage are indirect emissions that would be caused by changes to the overall grid's emissions resulting from CCS operations. In some cases a lowering of emissions can occur, for example through the recovery of process heat replacing other more carbon intensive heat production. This benefit may be specified but, due to conservativeness, will not be counted as an emission reduction credit. The net removals calculation will only be impacted when leakage occurs, i.e. when the project would result in a system level increase in emissions.
Ecological leakage: a removals project can have an indirect impact on emissions from hydrologically-connected areas. An example would be carbon dioxide emissions from soils in a wetland if the water level is lowered following increases in water demand from biomass feedstocks grown on land that is hydrologically- connected to the wetland.	Assessed to be non-material due to the stringent biomass sustainability requirements of this methodology.

7.1.2 For **upstream/downstream emissions leakage,** the project proponent shall include the following steps:

a) List sources of potentially relevant emissions and quantification estimates for these.

b) Identify those sources of emissions most likely to increase in response to BECCS deployment, with an estimated potential impact (expressed as the % increase of emissions from these sources, relative to baseline level).

c) Quantify any emissions sources estimated to potentially have material impact (greater than 2% of the gross removal, cumulative of all sources within the leakage category) and add the value to the leakage calculation in the quantification chapter.

7.1.3 To ensure no leakage in the land sector, either through activity-shifting or ecological leakage, the project proponent shall meet all sustainable biomass criteria laid out in Appendix C.

7.1.4 To quantify energy leakage, a component of market leakage, the project proponent shall follow the requirements outlined in Appendix D.

8 Storage and permanence

For CDR activities to have sustained impact on lowering atmospheric carbon, and so for carbon removal credits to be issued under this methodology, storage of captured CO_2 must be permanent with a risk of reversal scientifically determined to be negligible. This chapter outlines requirements for all storage operators used by a BECCS project, to ensure that CO_2 is stored permanently, and with transparent reporting in place.

8.1 Scientific and regulatory basis for permanent storage of carbon

Subject to the requirements contained in this methodology, CO_2 may be considered permanently stored from the point of injection into its geological reservoir given the negligible risk of reversal.[12] This level of permanence risk has been assessed based on robust scientific evidence and regulatory conditions.

Scientific risk of reversal

- The IPCC special report on carbon dioxide capture and storage[13] states that: 'For large-scale operational CO_2 storage projects, assuming that sites are well selected, designed, operated and appropriately monitored, the balance of available evidence suggests the following: It is very likely the fraction of stored CO_2 retained is more than 99% over the first 100 years; It is likely the fraction of stored CO_2 retained is more than 99% over the first 1000 years.'
- Similarly, the containment certainty study regarding 'Deep Geological Storage of CO_2 on the UK Continental Shelf'[14] confidently concluded that less than 0.01% of injected CO_2 is likely to escape into the atmosphere for typical UK offshore sites with permitted storage complexes after 25 years of injection and 100 years of storage[15]. The study was based on a review of close to 100 studies and analysis of failure data from a global database of well equipment reliability.

Regulatory conditions

- As per the applicability criteria, the methodology applies only to sequestration occurring in the Member States of the European Union, non-EU Member States of the European Economic Area (EEA), the UK, and the USA. These jurisdictions require having a permit that guarantees safe and permanent storage of carbon through appropriate site selection and characterization and the adoption of safe injection and storage methods. These regulations require storage operators to monitor stored carbon during and post injection, as well as after site closure, to ensure that reversals do not occur. In addition, storage operators must report monitoring results at least once a year in the EEA and UK, and semi-annually in the USA.

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[12] Reversal refers to any migration of carbon dioxide from its geological reservoirs post injection. This is also sometimes known as 'leakage', so to avoid confusion with the notion of indirect emissions, this document only uses the term 'reversal'.

[13] IPCC special report on carbon dioxide capture and storage – Chapter 5 Underground geological storage, p.246, 2005

[14] BEIS Deep Geological Storage of CO_2 on the UK Continental Shelf - Containment Certainty, p.9, 2023

[15] Probability across 125 years

- In these jurisdictions, permanence is further strengthened by the transfer of responsibilities to government following site closure. In the EEA and the UK, once all evidence demonstrates that stored carbon will be completely and permanently contained, operational and financial obligations pertaining to storage site maintenance, monitoring and implementation of corrective measures are transferred from the operator to the relevant competent authority. In the USA, transfer provisions are defined at the state level. As an example, in Louisiana[16], ownership of the storage facility is transferred to the state by default 50 years after the end of injection operations if carbon sequestration is shown to be safe and permanent.
- In the event of emissions released from the storage site, the storage operator will be required to take different mitigation measures depending on local regulations. These regulations, including the risk of having the license revoked, create strong incentives for the storage operator to operate the site in line with industry standards. For example:
    - If carbon dioxide stored migrates from its geological reservoir to the atmosphere, storage operators in the EEA must surrender ETS emissions allowances (EUA). A similar approach exists in the UK. In addition to the incentive effect, this ensures that net emissions in the system do not change as a result of a possible reversal.
    - In the USA, remediation mechanisms are defined at the federal and state levels. At the federal level, EPA Class VI rules do not target emissions from leaks specifically but require storage operators to have an emergency remediation plan and to take corrective action to prevent dangerous movements of carbon underground. Project proponents may also lose access to government subsidies if carbon is not stored permanently. For example, benefits from USA's tax credit on carbon sequestration 45Q[17] will be 'recaptured' if the carbon ceases to be 'disposed of in secure geological storage'.

In future, this methodology may be extended to jurisdictions other than the EU, non-EU member states of the EEA, UK and USA if the project proponent can provide evidence that relevant local regulations meet or exceed the requirements set out in the ISO 27914:2017 standard on Carbon Dioxide Capture, Transportation and Geological Storage.

8.2 Requirements

In addition to adhering to relevant local regulations on the storage of CO_2, the relevant party responsible for transport and storage of carbon shall provide evidence to the project proponent that they have carried out the below requirements:

8.2.1 Provide certificates of CO_2 injection attributable to the project proponent to inform the net removal quantification described in chapter 6.

8.2.2 Store CO_2 in geological storage sites within the list of jurisdictions detailed in Appendix B.

[16] Louisiana Geologic Sequestration of Carbon Dioxide act 2009

[17] US Code 45Q – credit for carbon oxide sequestration 2008

8.2.3 Conduct a risk assessment prior to project implementation and produce a plan for monitoring reversals.

8.2.4 Adhere to ISO 9001 or 14033 or equivalent standard of procedure in relation to the management of data.

Following these requirements, the carbon-crediting program will fulfil the permanence materiality assessment defined by criteria 9.1 c) in the ICVCM core carbon principles assessment framework.[18] ICVCM criteria 9.1 and 9.3 note that financial mechanisms to account for reversal risks, such as pooled buffer reserve or insurance, will not be required for projects with non-material risks of reversals. ICVCM notes that CCS projects with geological storage are likely to have non-material risk of reversal, and so unlikely to require financial mechanisms for mitigating reversal risks.

[18] ICVCM Core carbon principles, assessment framework and assessment procedure (2024)

9 Reporting, Validation & Verification

This chapter explains the measurement, reporting, validation and verification processes for BECCS projects. Reporting is defined as the submission of data and evidence to a third-party organisation (a VVB) for the purpose of independently assuring project outcomes. Validation is defined as the confirmation of a project's adherence to all requirements in this methodology. Project validation also signifies the beginning of the crediting period. Verification is defined as the assurance of claims of net CO_2 removal volumes that inform each credit issuance, following the quantification approach shown in chapter 6.

9.1 Outline of reporting, validation and verification processes

As described in 9.2, the project proponent is required to develop a Project Design Document (PDD) to describe all relevant technical components of a BECCS project. This PDD will be a 'living document' that will change over the life of the project.

The project proponent may choose to validate their PDD before commencing any further project activity, such as the construction or installation of any carbon capture assets. PDD validation can give confidence that, should BECCS projects be developed according to the specifications of the PDD, their operations will be compliant with the requirements of this methodology. The PDD validation also gives the project proponent an opportunity to confirm additionality before construction.[19]

A project proponent shall develop a monitoring plan within the PDD that describes how a project can provide evidence of compliance with all validation and verification requirements in this methodology. An independent VVB shall review this monitoring plan during PDD validation (or project validation, if PDD validation is not sought). The VVB may suggest edits to the reporting frequency of specific variables according to what is needed to determine high integrity BECCS removals. An indicative monitoring plan is shown in Annex J.

An illustrative project timeline is shown in the table below, with validation and verification requirements for each stage shown in the appropriate column. Cells highlighted in blue represent formal reporting requirements as part of this methodology. Cells in white are included for information only, to describe how the project reporting processes may align with a typical BECCS project. Note: unless specifically detailed in the table below, VVBs will be required to assess data that the project proponent shares with them. Where more stringent validation or verification approaches are required (e.g. VVB site visits), these are noted in the table.

[19] Even if additionality is confirmed before the start of the project crediting period, this confirmation of additionality will apply for the full duration of the first crediting period once it begins.

Table 3 - Illustrative Project Timeline

Stage	Event or process	Likely reporting frequency	Requirements
Project development	Front-end engineering design (FEED)	Once.	Technical concept for carbon capture, processing, transport and storage components of the BECCS system.
	Project Design Document (PDD)	Once, but updated periodically during project validation and full verification events.	The PDD compiles all relevant project data that reflects the project proponent's plan for adherence to the methodology as outlined in- 9.2.1. May take place after FID
	PDD validation (optional)	Once, before a project final investment decision (FID) is confirmed.	VVB to review PDD against all BECCS methodology requirements as set out in 9.2.3 – Validation.
	Final Investment Decision (FID)		Project proponent's commercial decision to move forward with execution of the project
	Commercial Operations Date ("Project start")		Target date in the PDD for commercial operation of the facility.
Crediting period 1 (15 years)	Project validation	Once, at point of first verification in connection with or after operational commencement. Note it is likely that project validation will coincide with first credit issuance.	VVB to validate that the completed and operational BECCS project meets all methodology criteria (as set out in 9.2.3) based on the most recently updated version of the PDD, thus beginning the project crediting period.
	Streamlined verifications for credit issuances	Submitted at each point of credit issuance. Frequency may be monthly, quarterly, or semi-annual – left to the discretion of each project.	VVBs shall verify the accuracy of data informing the net removals calculation as described in chapter 6, including documentation from the storage operator certifying the gross volumes of CO_2 injected. Data shall be updated as described in the PDD, and follow the quality assurance measures as defined in the monitoring tables in Appendix I.

Stage	Event or process	Likely reporting frequency	Requirements
	Full verification reports	Annual, at least once per calendar year after the year of project validation. The VVB may require a full verification where there have been significant changes to project approach or emissions.	As with streamlined verifications, VVBs shall verify the accuracy of data informing the net removals calculation as described in chapter 6. In the full verification report, the project proponent shall update all parameters required for the calculation, including those not measured constantly through the project's operation. VVBs shall assess these parameter updates for their likely accuracy over the 12-month period to the next full verification. VVBs shall also verify that the BECCS project continues to meet methodology criteria following the requirements set out under 9.2.6.
Crediting periods 2 and 3 (15 years each)	Validation renewal[20]	At end of 15-year crediting period (can renew up to 2 times).	Verify that project continues to meet all methodology criteria – with requirements as above for project validation.
	Streamlined verifications for credit issuances	As above for crediting period 1.	As above for crediting period 1.
	Full verification reports	As above for crediting period 1.	As above for crediting period 1.

[20] Validation for subsequent crediting periods likely to commence before the end of the preceding crediting period to ensure smooth transition.

9.2 Requirements

Project Design Document

9.2.1 All relevant project data shall be compiled in the form of a Project Design Document (PDD). The PDD will reflect the project proponent's plan for adherence to this methodology. As a minimum, the PDD shall include the following:

a. Key contacts responsible for the project operation and crediting, including names, titles, and contact information.

b. Name(s) of carbon capture, transport, and storage operator(s).

c. Name of project proponent.

d. A plan for project implementation including:

1) Project commercial operations date.

2) Timeline or chronology for the project.

3) Expected project duration.

e. Description of value chain and technologies applied in the value chain.

f. Description of project boundaries (e.g. shapefiles), process flows, and metering.

g. List of all GHG sources controlled and affected by, and related to, the project – with criteria for their inclusion in quantification.

h. A description of the projected aggregate GHG emissions and removals by GHG for the project and baseline (stated in units of CO_2e) for the relevant period (e.g. annual, cumulative to date, total), and reflecting the principle that removals are not overstated.

i. Application of criteria, procedures or guidance used in calculating GHG emissions and removals as outlined in Chapter 6 and Appendix I

j. Description of baseline (including allocation factor where appropriate).

k. Monitoring Plan (see Appendix J for further details): the project proponent shall develop a monitoring plan that will be used for all project validation and verification reports. This monitoring plan will outline the frequency for collecting, reporting on, and independently verifying data points. Monitoring plans shall show how the project proponent plans to provide data for all variables shown in the monitoring tables in Appendix I.

l. Disclosure of all likely areas of uncertainty. This may include any lapses in feedstock documentation, data irregularities, scientific uncertainty in land use, land-use change and forestry (LULUCF) modelling for applicable regions, geological uncertainty involving formations or CO_2 plume modelling, and LCA considerations where subjective decisions were made regarding boundaries and exclusions of GHG sources.

m. Quality control methods for each requirement (see row 'QA/QC procedures to be applied' in the monitoring tables in Appendix I on managing data).

n. Defined frequency of project monitoring and reporting (see Appendix J for further details about the monitoring plan).

o. Plan for sites visits to biomass sourcing, carbon capture, and injection and storage sites.

p. Timing/frequency of validation and verification activities.

q. Proof of additionality.

r. Biomass sourcing and verification plan, evidencing means to comply with sustainability criteria as described in Appendix C.

s. Confirmation of storage operator compliance with the storage and permanence requirements detailed in chapter 8 of this methodology.

t. Stakeholder consultation plan.

u. Sustainability safeguards and mitigation plan for identified risks in accordance with the requirements laid out in Appendix F

9.2.2 The monitoring plan shall be reviewed by the VVB during PDD validation (or project validation if no PDD validation is sought). The VVB shall appropriately tailor verification requirements for each project.

Project Validation

9.2.3 The project proponent shall submit the PDD for project validation by the VVB. The PDD shall contain sufficient information to demonstrate that the project's requirements adhere to the principles of this methodology, with respect to:

a. Project Requirements (see chapter 2): Assess project alignment with methodology requirements in chapter 2. The VVB will conduct site visits to the project as considered proportionate in the monitoring plan

b. Additionality (see chapter 4): Assess and confirm additionality – project validation will consider the PDD validation if one was performed prior to FID

c. Sustainable biomass (see Appendix C): Assess alignment of biomass sourcing areas with sustainable biomass sourcing requirements. The VVB will conduct visits to a sample of biomass sourcing sites within the sourcing area as considered proportionate in the monitoring plan.

d. Storage and permanence requirements (see chapter 8): Assess alignment of injection and storage sites with requirements. The VVB will conduct site visits to a sample of injection and storage sites, as considered proportionate in the monitoring plan. Where an injection and storage site is shared with other projects, the VVB may waive this requirement if the injection and storage site has separately undergone validation and verification that meets the requirements of this methodology

e. Monitoring plan (see Appendix I).

f. Project boundaries (see chapter 5): Confirm that project boundaries are accurate and relevant

g. Quantification (see chapter 6): Assess the accuracy of all parameters required to complete the net removal quantification. Assess that all parameters meet the quality assurance standards described in the monitoring tables in Appendix I. Assess that all metrics have been quantified within the reasonable materiality threshold (see clause 9.2.13).

h. Materiality assessments for leakages (see chapter 7): Review materiality assessments for leakages (see chapter 7) to ensure they are accurate, and review the accuracy of any leakage required to be quantified and subtracted from the net removal quantification.

i. Baseline (see chapter 3): Confirm baseline definition of retrofit or new build (see chapter 3).

j. Safeguards (see Appendix F): Validate that safeguard risks as detailed in Appendix F have been assessed and mitigation plans developed where necessary.

k. Confirm the applicability of VVB credentials against the requirements of clause 9.2.11.

The VVB shall assess the project's compliance with the principles of this methodology through a desk review of the information provided in the PDD (see Appendix J for indicative monitoring plan). If applicable, any deviations from the PDD should be listed. In addition, the VVB shall carry out site visits to the proponent's biomass sourcing areas, capture facilities and storage sites to assess compliance with the methodology's sustainable biomass and storage and permanence requirements. The VVB may define the frequency and nature of such site visits, as well as any additional checks that are deemed necessary as part of project validation in the project data sampling and verification plan.

9.2.4 The project proponent may submit their PDD to the VVB ahead of project validation, to gain confidence that their operations will be compliant with the requirements of this methodology.

Verification

9.2.5 At the point of project validation, full and streamlined verifications, and validation renewals, the project proponent shall provide the VVB with all data points necessary, as defined in the monitoring plan.

9.2.6 The project proponent shall submit a full verification report, as a minimum, once per year for each calendar year after the year of initial project validation. This full verification report shall provide updates to all quantification variables as described in the monitoring tables in Appendix I. VVBs shall conduct the following actions on the full verification report:

a. Assess alignment of biomass sourcing with sustainable biomass sourcing requirements in Appendix C.

b. Assess carbon capture site alignment with methodology requirements in chapter 2.

c. Assess alignment of injection and storage sites with requirements shown in chapter 8.

d. Confirm that project boundaries are accurate and relevant (as described in chapter 5).

e. Review materiality assessments for leakages (see chapter 7) to ensure they are accurate, and review the accuracy of any leakage required to be quantified and subtracted from the net removal quantification.

f. Validate that safeguard risks as detailed in Appendix F have been assessed, that risk assessments continue to be applicable, and that mitigation plans have been developed where necessary.

g. Disclosure of all areas of uncertainty. This may include any lapses in feedstock documentation, data irregularities, scientific uncertainty in carbon stock data for applicable regions, geological uncertainty involving formations or CO_2 plume modelling, and LCA considerations where subjective decisions were made regarding boundaries and exclusions of GHG Sources.

h. Confirm the applicability of VVB credentials against the requirements of clause 9.2.11.

9.2.7 The project proponent shall submit streamlined verifications to VVBs at each point of credit issuance. The frequency of streamlined verifications (and credit issuance) is at the discretion of the project proponent. Streamlined verifications shall include:

a. Data informing the net removals quantification in Chapter 6

b. Documentation from the storage operator certifying gross volumes of CO2 injected

9.2.8 Streamlined verifications will not be permitted if:

c. It has been more than 12 months since the last full verification.

d. A new VVB is used.

e. If the VVB cannot fulfil requirements of reasonable assurance given identified project risks.

f. The VVB concludes that significant risks or changes to project operations require more thorough review, such as changes to biomass sourcing policy or storage operator.

9.2.9 All reports may include additional elements from the monitoring plan, as requested by the VVB.

Validation/verification bodies

9.2.10 Verification bodies shall use professional judgment in tailoring a verification process appropriate for each validation and verification event.

9.2.11 All VVBs shall demonstrate accreditation from one of the following:

a. A domestic or international accreditation body pursuant to ISO 14064-3:2019, or to the most recent version of this standard.

b. The Clean Development Mechanism (CDM) Accreditation Standard for Designated Operational Entities.

c. A relevant governmental or intergovernmental regulatory body.

9.2.12 Any conflict of interest must be avoided according to ISO 14065:2020. This includes potential conflicts of interest between the project proponent, VVBs, and individuals involved with the project and verification teams.

9.2.13 The level of assurance for each verification is to be reasonable, with a materiality threshold of greater than 2% of the gross removal. All credits issued are to be ex-post after a positive project validation and subsequent positive verification reports.

Appendix A - Zero-rating of biomass and basis of removal

Biomass shall be treated in accordance with reporting conventions laid out in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

In accordance, CO_2 emissions from biomass shall be zero-rated at the point of use: "Carbon dioxide (CO_2) emissions from the combustion of biomass or biomass-based products are captured within the CO_2 emissions in the Agriculture, Forestry and Other Land Use (AFOLU) sector through the estimated changes in carbon stocks from biomass harvest, even in cases where the emissions physically take place in other sectors. This approach to estimate and report all CO_2 emissions from biomass or biomass-based products in the AFOLU sector was introduced in the first IPCC guidelines for national greenhouse gas emissions (IPCC 1995), reflecting close linkages with data on biomass harvesting, and for the pragmatic reason to avoid double counting."[21]

The capture and permanent storage of CO_2 from biomass may therefore deliver permanent negative emissions:

"If the [carbon capture and storage] plant is supplied with biofuels, the corresponding CO_2 emissions will be zero (these are already included in national totals due to their treatment in the AFOLU sector), so the subtraction of the amount of gas transferred to long-term storage may give negative emissions. This is correct since if the biomass carbon is permanently stored, it is being removed from the atmosphere."[22]

To ensure overall climate benefit, it is therefore imperative that biomass sourced for BECCS has a neutral or positive impact on carbon stocks in the land sector. The sustainability criteria laid out in Appendix C are to ensure that only sources of biomass delivering an overall net removal of carbon from the atmosphere are credited, while further ensuring that overall ecosystem health is protected.

[21] 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 2, 2.3.3.4

[22] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 2, 2.3.4

Appendix B – Countries initially assessed under storage and permanence requirements

The list below shows the jurisdictions against which the storage and permanence requirements in this methodology have been assessed. Only storage operators operating under these jurisdictions shall be considered compliant with the storage and permanence requirements expressed in chapter 8. Further countries will be added to the list over time as the methodology is expanded to more jurisdictions.

Applicable storage and permanence jurisdictions (as of October 2023) and local regulations on storage and permanence:

- European Economic Area (EEA):
    - The 2009/31/EC directive on the geological storage of carbon dioxide
- United States of America (USA)
    - At the federal level, the EPA's Class VI rules from 2010
    - Relevant state level regulations
- United Kingdom (UK)
    - The storage of carbon dioxide regulations of 2010 and 2011.

Appendix C – Sustainability criteria for forest biomass

This appendix outlines the criteria that a project proponent must follow to ensure that the forest biomass used for BECCS is sustainable. Projects that fulfil the requirements below, or meet the exemption requirements, will be applicable for issuing CDR credits. Where biomass is sourced from multiple regions, each sourcing region shall comply with the requirements and provide appropriate evidence against the criteria below. Note that sustainability criteria for alternative biomass sources are detailed in Appendix L.[23]

Stable or increasing forest carbon stock

The project proponent shall conduct a carbon stock assessment for all sourcing areas that provide biomass inputs for BECCS processes. Assessments shall review changes in carbon stocks and conclude if the stock is stable, increasing, or declining. A carbon stock assessment shall be completed at project validation, and at each subsequent verification, and the results shall be verified by the VVB.

For projects sourcing biomass from jurisdictional territories smaller than 5 million km^2, carbon stock assessments of the sourced biomass shall be conducted on the Jurisdictional level or forest sourcing area level. For projects sourcing biomass from territories larger than 5 million km^2, carbon stock assessments of the sourced biomass shall be conducted on forest sourcing area level.

Jurisdictional approach

For projects that assess carbon stock changes at the jurisdictional level, national statistics for forest land and harvested wood products submitted to UNFCCC are required to demonstrate compliance with this carbon stock principle. Carbon stock changes shall be assessed using an average of the annual changes in emissions of forest lands and harvested wood products, as reported within the LULUCF sector by the jurisdiction to the UNFCCC[24]. This 'rolling average' shall be calculated using the most recently available primary data to the jurisdiction at each point of verification for a period not exceeding 10 years. Carbon stocks will be considered stable or increasing where the rolling average of these emissions is zero or negative[25], noting that a negative value represents an increase in carbon stocks.

Forest sourcing area approach

For assessments completed at the forest sourcing area level, assessment shall be conducted based on changes in carbon stock on attributable managed lands within the sourcing region. For undertaking the assessment, the following requirements shall be adhered to:

[23] As of version 1.0, requirements for alternative biomass have not yet been developed.

[24] It is recognized that there is a delay in collecting LULUCF data submitted to UNFCCC, hence a 10 year rolling average is the preferred calculation approach.

[25] In UNFCCC inventories, an increase in land carbon stocks is reported as a negative value since this corresponds to negative emissions.

- Assessment shall, as a minimum, consider carbon stock change in above ground biomass. Below ground biomass, carbon in dead matter and carbon in soils may either be quantified, or evidence provided, that such carbon stocks are not negatively impacted.
- Assessments shall compare changes in carbon stocks using an average of the most recently available data. This 'rolling average' shall be calculated with the most recently available primary data for each sourcing area, and at each point of verification over a period not exceeding 10 years. Carbon stocks will be considered stable or increasing where the rolling average is zero or positive.
- Priority shall be given to data sources underlying the development of national LULUCF inventories. Use of alternative data sources (e.g. bespoke remote sensing) shall be duly justified, with particular consideration given to data accuracy and reliability.

In exceptional circumstances, the carbon stock principle may still be fulfilled for biomass sourced from areas with declining carbon stocks. This applies for both jurisdictional and forest sourcing area approaches. Such exceptions will only be allowed where a third party VVB concludes that:

- A reduction in carbon stock within the assessment area is beyond the reasonable control of the project proponent and is not a result of over-harvesting of forests. Relevant examples may include:
    - Excessive levels of natural disturbance such as fire, earthquake, or pests.
    - Reductions were planned to stabilize or reverse the decline of future forest carbon stock (e.g. thinning to reduce fire risk in regions prone to fire damage).
- A mitigation plan is in place to stabilize or reverse the decline of carbon stocks. The mitigation plan shall include the following:
    - A description of the measures that will be implemented to mitigate risk of future declines in carbon stocks
    - Identification of the parties that will implement the measures
    - An assessment of the predicted impact of the measures taken, including estimates of when carbon stocks are anticipated to recover
    - A plan to monitor the impact of measures to reduce future declines in carbon stock

Sustainable management of forests and maintenance of biodiversity

Biomass shall be sourced from sustainably managed forests demonstrating:

- Legality of harvesting operations
- Forest regeneration of harvested areas

- That areas designated by international or national law, or by the relevant competent authority for nature protection purposes, are protected with the aim of preserving biodiversity and preventing habitat destruction
- That harvesting maintains or improves the long-term production capacity of the forest
- That harvesting is carried out considering maintenance of soil quality and biodiversity according to sustainable forest management principles, with the aim of preventing negative impacts in a way that:
    - Avoids harvesting of stumps and roots.
    - Avoids harvesting on vulnerable soils.
    - Ensures harvesting of large clear-cuts is within maximum thresholds as defined in the country where the forest is located.
    - Ensures extraction of deadwood adheres to locally and ecologically appropriate retention thresholds.
    - Ensures logging systems minimize impacts on soil quality and biodiversity features and habitats.

From an EU perspective, the criteria of this section leverage the EU RED Article 29.6, as amended by REDIII.

Protection of primary forests and other highly biodiverse ecosystems

Biomass shall not be sourced from lands with high biodiversity value, namely:

a. Primary forest, defined as woodland of native species where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed; and old growth forest, as defined in the legislation of the country in which the forest is located.
b. Highly biodiverse forest, as identified by the relevant competent authority, unless evidence is provided that the harvesting of the biomass does not interfere with those nature protection purposes.
c. Highly biodiverse grassland.

From an EU perspective, the criteria of this section leverage the EU RED Article 29.3 and 29.6 as amended by REDIII.

Protection of high carbon stock lands

Biomass shall not be sourced from lands recently converted from a status with high carbon stock value, namely:

a. Wetlands
b. Peatland, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil

This applies to land converted 20 years prior to project commencement, with the exception of projects within the EU where land shall not have been converted after 2008 in accordance with the EU RED.

From an EU perspective, the criteria of this section leverage the EU RED Article 29.6, 29.4 & 29.5, as amended by REDIII.

Long-lived wood products

To protect harvested wood product-based carbon sinks and their climate benefit in substituting carbon intensive products, biomass shall not be sourced from material suitable for use in long-lived wood products such as sawtimber or veneer.

Sources of roundwood unsuitable for use in higher value markets when considering forest, market, and logistical conditions, are eligible. Sources may include thinning, pulpwood, or down-graded wood due to fire, storms, infestation, fungus or fiber that is logistically, economically, or otherwise unsuitable for use in long-lived products.

Corruption

Biomass shall not be sourced from any country with a Corruption Perception Index[26] <50, except where a supplier demonstrates adequate mitigation of the risk of corruption.

Exemptions

Post-consumer forms of biomass (e.g. construction and demolition timber waste) shall be exempt from the sustainability criteria on the basis that such forms of biomass are challenging to trace back to origin and because their use for BECCS is unlikely to have any impact on land management decisions. However, such forms require verification that the waste has not been deliberately produced for the purposes of providing biomass for BECCS.

Biomass residues from processing (e.g. sawmill residues) shall be exempt from the 'Stable or increasing forest carbon stock' criteria on the basis that demand for such biomass has little influence over land management decisions and consequently carbon stock changes. All other sustainability criteria shall apply. However, due regard shall be given to traceability challenges for such material when considering evidence necessary to demonstrate adherence.

Traceability and mass balance

Biomass shall be traceable throughout the value chain using either a physical segregation or mass balance approach. Where using a mass balance approach, the mass balance system shall:

a. Allow consignments of biomass with differing sustainability and GHG characteristics to be mixed.

[26] 2022 Corruption Perceptions Index: Explore the... - Transparency.org

b. Allow consignments of biomass with differing energy content to be mixed for the purposes of further processing, provided that the size of consignments is adjusted according to energy content.

c. Ensure sustainability and GHG characteristics remain assigned to the mixture through the chain of custody.

d. Provide for the sum of all consignments withdrawn from the mixture to be described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture and require that this balance be achieved over an appropriate period.

e. Ensure that sustainability and GHG characteristics are not double-counted across consignments.

f. Ensure that sustainable biomass is not mixed with illegally harvested sources.

Certification/Monitoring, reporting and verification (MRV)

Verification of biomass sources against biomass sustainability requirements in this methodology shall be demonstrated through one or more of three routes:

a. Certification – Biomass sources are verified against the relevant criteria through a biomass sustainability certification scheme, such as the Sustainable Biomass Programme (SBP), the Forestry Stewardship Council (FSC), the Programme for the Endorsement of Forest Certification (PEFC), the Sustainable Forestry Initiative (SFI) or Roundtable on Sustainable Biomaterials (RSB).

b. Regulatory compliance – Biomass sources' compliance with the sourcing principles are verified by a third party or by national authorities in accordance with sustainability criteria set out in national or jurisdictional regulation.

c. Independent assurance – Biomass is independently verified by a third party against the biomass sustainability requirements laid out in this methodology. Verification shall be conducted in accordance with ISAE 3000 limited assurance engagement or equivalent as a minimum. Verification shall be performed annually as a minimum.

Where verification of a biomass source may be partially demonstrated through certification or regulation, independent assurance (c) may be additionally used against those requirements not covered. Where using a combination of both certification/regulation and independent assurance, it shall be clearly demonstrated which requirements are met through certification and regulation and which are met through independent assurance.

Non-compliance

If any consignments of sourced biomass fail to fulfil the requirements in this section, and do not fulfil the exception criteria described, then the project proponent shall not be issued with CDR credits from CO_2 removal volumes derived from these consignments.

The project proponent shall decrease issuance of net removal certificates by the proportion of biomass feedstock sourced from consignments that fail to fulfil sustainability criteria, compared to the total

volume of biomass feedstock sourced for the BECCS process. Compliance with the criteria shall be assessed based on the best available evidence at the time of crediting.

Revisions

The sustainability criteria apply a risk averse approach to biomass sourcing. However, it is duly recognized that there can be substantial potential benefits of improved forest management within forests of high ecological value (including both carbon stocks and biodiversity), particularly in forests prone to natural disturbance events exacerbated by climate change.

These criteria will therefore be subject to continuous review to ensure that the principles remain aligned with the latest scientific consensus on biomass sourcing, with a view to delivering meaningful climate and nature benefit through improved forest management.

Appendix D – Leakage

Energy Leakage

Energy leakage is defined as the emissions impact from a rise in overall energy demand resulting from CCS operations (e.g. an increased grid emissions factor or changes in heat emissions intensity). It is distinct from direct emissions from CCS operation, which are accounted for within the project boundary. Energy leakage is considered a form of market leakage under the classification structure defined in chapter 7. The treatment of energy leakage in this methodology depends both on the type of BECCS project – retrofit or new-build – and on the policy environment in which the project proponent operates.

Project type

New-build BECCS power and/or heat plants (Scenario B) add new renewable energy capacity to the grid and accordingly, will have a neutral or beneficial impact on the grid carbon intensity (see chapter 3). Therefore, new-build BECCS projects do not require any energy leakage adjustments (as long as the BECCS project contribute more new electricity than it consumes).

A scenario in which an existing energy plant is transformed from using fossil fuels to sustainable biomass with CCS is treated similarly to Scenario B. While there are multiple counterfactuals that could arise without the conversion of the plant to BECCS (including continued unabated running of the fossil plant, decommissioning of the fossil plant, operation of the fossil plant on a merchant basis or conversion to fossil CCS), the energy grid carbon intensity will be positively affected by the conversion to BECCS due to the additional avoided emission benefit of conversion to sustainable biomass fuels. Assuming there is zero energy leakage, per Scenario B, is therefore an appropriate assumption for such projects.

Energy leakage only needs to be assessed, therefore, in the case of retrofit BECCS projects (Scenario A). Due to the addition of CCS installations, a BECCS plant may supply less net energy to the grid compared to the baseline, thereby potentially increasing energy emission intensity.[27] If a retrofit BECCS project supplies less energy to the grid than before the project commencement, then the project proponent shall make energy leakage adjustments as described below. However, if a project proponent can demonstrate that the CCS project has maintained or increased plant energy output, they do not need to make any adjustments for energy leakage as it can be seen to add to renewable capacity. Equally, if a retrofit project will operate under a substantially different operating regime with BECCS compared to continuation of unabated generation (e.g. operating at baseload with BECCS compared to on a merchant basis unabated), this shall be factored into the leakage calculation. In the case of retrofit BECCS, the VVB shall assess the evidence of changes in energy output based on official project documentation (e.g. planning statements) as provided by the project proponent.

[27] Note that for combined heat and power (CHP) plants, the effect on emissions intensity of heat may be the opposite. The project proponent shall assess this prior to each credit issuance.

Policy environment

In jurisdictions with cap-and-trade schemes in place covering the power and heat generation sectors, energy leakage from retrofit projects is non-material because any increase in energy emissions resulting from increased CCS energy use supplied by the existing bioenergy plant will necessitate reductions in emissions from other parts of the energy system due to the jurisdictional emissions cap. In this case, the CCS component of a retrofit BECCS project cannot be said to create energy leakage, as the emissions must be reduced from elsewhere in the energy system to keep emissions from the power and heat sector in line with the emissions cap.

In jurisdictions without cap-and-trade systems for the power and heat sectors and where a retrofit project leads to reduced renewable energy supply to the grid, the project proponent shall quantify net energy leakage emissions and subtract them from net removals.

Energy Grid Intensity

For retrofit BECCS projects reducing renewable energy supply to the grid in jurisdictions with no cap-and-trade schemes in place covering the heat and power generation sectors, the quantification of energy leakage shall not apply if either of the following local grid conditions are met:

- The regional electricity grid emission factor is less than 18g CO_2e/MJ[28] , or
- >90% of the available power on the regional electricity grid is renewable

The regional electricity grid is defined as the bidding zone and/or national grid where the CCS facilities are located.

Assessment

In cases where quantification of energy leakage is required, the project proponent shall estimate the additional emissions that are being generated through the impact on regional grid emissions intensity resulting from retrofit CCS energy using the following equation:

$$MLE = (PXB - PXP) \times PGI + (HXB - HXP) \times HGI$$

MLE	Emissions from market leakages	tonnes of CO_2e
PXB	Power delivered to the grid in baseline	MWh
PXP	Power delivered to the grid by the BECCS plant	MWh
PGI	Power grid carbon intensity	Tonnes of CO_2e/MWh
HXB	Heat delivered to the grid in baseline	MWh
HXP	Heat delivered to the grid by the BECCS plant	MWh
HGI	Heat grid carbon intensity	Tonnes of CO_2e/MWh

[28]This is based on the European Union's Delegated Act rules on hydrogen production, which allow for fuels produced using electricity from a grid with emissions intensity of less than 18g CO2e/MJ to be classified as renewable. Delegated Act available at: https://energy.ec.europa.eu/delegated-regulation-union-methodology-rnfbos_en

In case the change in power and heat production in the BECCS plant impacts the Project proponent's production system, including possible regional cooperation for heat, such impacts shall be included in the calculation above. For example, increased heat delivery from the BECCS plant may reduce the need for electricity in centralised heat pumps. Additional guidance will be provided in due course on how to account for change in carbon leakage over time, particularly for situations where energy delivered in the baseline and grid carbon intensities are anticipated to change over time.

Appendix E – Stakeholder consultation and grievance mechanism requirements

Stakeholder consultation requirements

For new-build BECCS facilities, the project proponent shall conduct a public consultation prior to breaking ground on the project. For retrofit projects, this is only necessary where the project will expand the physical footprint of the facility (e.g. additional pipelines, or expanded plant boundaries). This is to ensure that public feedback is considered, and any concerns are addressed appropriately by the time the project becomes operational.

To promote inclusivity, the project proponent shall identify and invite relevant stakeholders to engage with the project development process. Those invited, directly or through advertising, should include, as a minimum:

- Representatives from local governing bodies.
- Relevant non-governmental organizations (NGOs).
- Residents from surrounding areas where the project will be located.
- Stakeholders with land-tenure rights within or adjacent to the project

Stakeholders shall be given the opportunity to engage with the project proponent in the form of a meeting. Invites (including through public advertising) shall be sent out well in advance to allow time for participants to plan to attend. Invites shall include the date, time, venue, and reason for organizing the public consultation. Some consultations may be offered on a single stakeholder basis, as appropriate.

The project proponent shall prepare documentation with evidence and outcomes of the consultations, which shall include at least the following:

- List of invitees/target groups.
- List of attendees.
- Agenda of the meeting.
- Minutes of the meeting.
- Questions and feedback received from participants, including responses by the project proponent to those questions and any subsequent actions to be carried out.

At the point of validation, the project proponent shall demonstrate to the VVB what action, if any, they have taken as a result of local stakeholder consultation and the reasons for taking, or not taking, action.

Grievance mechanism

Simultaneous to planning and organizing public consultation, the project proponent shall create and adopt a grievance redressal mechanism or equivalent community engagement mechanism, unless open channels for communication are already available with the project proponents' ordinary line of business. The project proponent shall make all stakeholders aware of the mechanism and its uses. The grievance redressal mechanism will allow any parties affected by the project and acting in good faith to provide feedback or grievances directly to the project proponent. The grievance mechanism must be available through both the implementation and operation phases of the project, and have easily accessible points of contact such as:

- A dedicated email address.
- A help desk phoneline.
- An in-person help desk at a local office of the project.

The project proponent shall respond to grievances raised also in good faith and maintain a log of all grievances received, and their resolution, throughout the crediting period of the project. The project proponent may wish to publish grievance and resolution logs on relevant project websites to provide transparency to affected stakeholders, and to encourage public participation through the life of the project.

Appendix F – Safeguards

The BECCS project shall adhere to safeguards which ensure that any negative social and environmental impacts are considered and mitigated.

At the point of project validation, the project proponent must demonstrate that the project, including business partners, has obtained all required relevant environmental and business permits in the jurisdictions of sourcing, capture and storage operations[29]. These safeguards shall apply to all stages of the BECCS value chain, including biomass sourcing, carbon capture and processing sites, CO_2 transportation, injection, and storage. Furthermore, the project proponent shall review the full list of sustainable safeguards outlined below and confirm that they have considered each and, where requested, provide the VVB with copies of the assessments provided and mitigations to be implemented.

Assessment and management of environmental and social risks

- Abide by national and local laws, objectives, programs and regulations and, where relevant, international conventions and agreements; assess risks of negative environmental and social impacts with regard to the safeguards.
- Ensure free, prior and informed Consent (FPIC) processes for Indigenous Peoples (IPs) and Local Communities (LCs), where applicable, and conduct reasonable stakeholder consultations, including local stakeholders, as part of project design and implementation.

Labour rights and working conditions

- Provide safe and healthy working conditions for employees.
- Provide fair treatment of all employees, avoiding discrimination and ensuring equal opportunities.
- Prohibit the use of forced labour, child labour, or trafficked persons, and protect contracted workers employed by third parties.

Resource efficiency and pollution prevention

- Comply with regulatory-defined limits for:
    - Local air and water pollution
    - Noise and vibration generation
    - Waste generation or release of hazardous materials, chemical pesticides and fertilizers.

[29] Where permits cannot be issued until commercial operations have begun, the project proponent must be able to demonstrate that these permits can be met

Land acquisition and involuntary resettlement

- Avoid, or where this is not feasible, minimize physical and or economic displacement.

Biodiversity conservation and sustainable management of living natural resources

- Avoid, or where this is not feasible, minimize negative impacts on terrestrial and marine biodiversity and ecosystems.
- Protect the habitats of rare, threatened, and endangered species, including areas needed for habitat connectivity.
- Avoid conversion of primary or old growth forests, highly biodiverse grasslands, wetlands, peatlands or other high conservation value habitats.
- Comply with regulatory-defined limits for:
    - soil degradation and soil erosion.
    - water consumption and stress in the mitigation activity.

Indigenous peoples (IPs), local communities (LCs) and local heritage

Where applicable, recognize, respect and promote the protection of the rights of IPs and LCs in line with applicable international human rights law, and the United Nations Declaration on the Rights of Indigenous Peoples and ILO Convention 169 on Indigenous and Tribal Peoples[30].

- Identify the rights-holders possibly affected by the project (including customary rights of local rights holders).
- Apply, when relevant to circumstances, the Free Prior Informed Consent (FPIC) process.
- Not force eviction or any physical or economic displacement of IPs and LCs, including through access restrictions to lands, territories, or resources, unless agreed upon with IPs and LCs during the FPIC process.
- Preserve and protect cultural heritage consistent with IPs and LCs protocols/rules/plans on the management of cultural heritage or UNESCO Cultural Heritage conventions.

Respect for human rights, stakeholder engagement

- Avoid discrimination and respects human rights.
- Abide by the International Bill of Human Rights and universal instruments ratified by the host country.

[30] https://social.desa.un.org/issues/indigenous-peoples/united-nations-declaration-on-the-rights-of-indigenous-peoples; https://normlex.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C169

- Consider and respond to local stakeholders' views.

Gender equality

- Provide for equal opportunities in the context of gender.
- Protect against, and appropriately respond to, violence against women and girls.
- Provide equal pay for equal work.

Appendix G – Emissions included or excluded from the quantification

Table 4 - Emissions sources and sinks included in, or excluded from, the project boundary

Baseline or project and/or quantification	Source or sink category	Included or excluded from project boundary	Included or excluded from quantification	Justification/description
Baseline	Non-CCS supply chain energy emissions	Excluded	Excluded	Operational supply chain emissions that are allocated to the energy (power or heat) output of the system. Can be zero where emissions are fully allocated to the carbon removal.
Baseline	Non-CCS bioenergy plant construction	Excluded	Excluded for retrofit / **Included for new-build**	In the case where a bioenergy plant is retrofitted with CCS, bioenergy plant construction emissions would have occurred anyway in the absence of the CCS project. For new-build projects, construction emissions of the bioenergy facility must be accounted for.
Baseline	Emissions upstream of the point of collection for biomass wastes, residues & by-products	Excluded	Excluded	Emissions from the cultivation, harvesting, transport and/or processing of biomass for purposes other than BECCS would have occurred anyway in the absence of the CCS project and are attributable to the main products of the pathway e.g. sawtimber.
Baseline	BECCS-relevant infrastructure emissions	Excluded	Excluded	Embodied emissions from the construction of shared infrastructure that existed prior to the BECCS project that is used by BECCS operations (e.g. roads, pipelines) would likely have occurred anyway in the absence of the CCS project and are assumed to be immaterial when amortised over the lifetime of the infrastructure and allocated to all projects relying on its use.
Project boundary & quantification	Gross CO_2 captured	Included	**Included**	CO_2 would not have been captured absent the CCS project

Baseline or project and/or quantification	Source or sink category	Included or excluded from project boundary	Included or excluded from quantification	Justification/description
Project boundary & quantification	Fugitive emissions from carbon capture	Included	**Included**	Fugitive emissions are directly caused by the CCS project and would not have occurred without it. They must be included in the net removals quantification.
Project boundary & quantification	Fugitive emissions from CO_2 transport	Included	**Included**	Same as above.
Project boundary & quantification	Fugitive emissions from injection	Included	**Included**	Same as above.
Quantification	Biomass cultivation and harvesting emissions (operational supply chain emissions)	Excluded	**Included**	These are not always directly related to the project, particularly for retrofit plants. However they are included in the net removals quantification in accordance with the boundary requirements laid out in 6.3.3. for conservativeness and to ensure the full removals value chain is considered in the quantification of BECCS carbon removals. Projects may apply an allocation factor to attribute emissions between the carbon removal and other products of the BECCS plant (e.g. heat and electricity).
Quantification	Biomass processing emissions (operational supply chain emissions)	Excluded	**Included**	Same as above.
Quantification	Feedstock transportation emissions (operational supply chain emissions)	Excluded	**Included**	Same as above.
Quantification	Waste disposal emissions (ash) (operational supply chain emissions)	Excluded	**Included**	Same as above.

Baseline or project and/or quantification	Source or sink category	Included or excluded from project boundary	Included or excluded from quantification	Justification/description
Quantification	Energy production emissions	Excluded	**Included**	Emissions resulting from the burning of fossil fuels to start up the biomass incineration process are directly related to the project. They are included in the net removals quantification for conservativeness with an allocation factor if shared with energy products.
Project boundary & quantification	CO_2 capture emissions (CCS project emissions)	Included	**Included**	Emissions associated with the CO_2 capture emissions are directly related to the project and quantified in the net removals calculation
Project boundary & quantification	CO_2 processing emissions (CCS project emissions)	Included	**Included**	Emissions associated with the CO_2 processing emissions are directly related to the project and quantified in the net removals quantification
Project boundary & quantification	CO_2 storage emissions (CCS project emissions)	Included	**Included**	Emissions associated with the CO_2 storage emissions are directly related to the project and quantified in the net removals quantification
Project boundary & quantification	CO_2 CCS construction emissions (CCS project emissions)	Included	**Included**	Emissions associated with the installation of CCS equipment are directly related to the project and quantified in the net removals calculation.
Quantification	Upstream/downstream emissions (leakage emissions)	Excluded	**Included**	Upstream and downstream leakage emissions are included where the cumulative impact of all upstream/downstream leakage sources is deemed to be material (i.e. greater than 2% of the gross removal). In most situations these emissions are expected to be immaterial on the basis that the quantification boundary covers the full removals value chain.
Quantification	Activity-shifting (leakage emissions)	Excluded	Excluded	These emissions are assumed to be immaterial based on compliance with the biomass sustainability criteria.

Baseline or project and/or quantification	Source or sink category	Included or excluded from project boundary	Included or excluded from quantification	Justification/description
Quantification	Market leakage (leakage emissions)	Excluded	**Included**	Market leakage emissions are applicable only to retrofit projects and included where the cumulative impact of all market leakage sources is deemed to be material (i.e. greater than 2% of the gross removal).
Quantification	Ecological leakage (leakage emissions)	Excluded	Excluded	These emissions are assumed to be immaterial based on compliance with the biomass sustainability criteria.

Appendix H – Registry requirements

The application of the methodology must be compatible with a registry that follows the requirements detailed in this appendix. A registry is a standardized platform for the issuance, trading, and retirement of carbon credits that provides a system for verifying the validity and authenticity of the credits, and for ensuring they are not double-counted or sold more than once. The registry can be held by a certification body, a body appointed by national authorities, or by an international organization.

The registry shall operate a system that can uniquely identify each CDR credit, associated physical carbon removals, ownership of the credit, and any other relevant attributes. It shall have open interfaces to allow for cost-efficient integration with multiple CDR credit trading platforms and national or international registries for host nation positions.

The registry shall carry the following information for each CDR credit:

- Serial number
- Issuing organization
- Issue date
- Feedstock
- Capture company
- Capture plant
- Capture method
- Transportation method
- Storage location
- Storage method, with permanence classification ("Geological storage")
- Reversal mechanism e.g. ETS/CCS
- Transaction chain (date of sale, seller and purchaser)
- Retirement date
- Retirement party (holding corporation at the time of retirement)
- Volume (standardized to 1 tonne or appropriate multiple thereof)
- Amount of CO_2 subtracted from gross tonne injected to arrive at net tonne (for issuance as CDR credits)
- Tag for Voluntary Carbon Market or Compliance Market
- Host country
- Chain of national adjustments (c.f. CA)

It is noted that credits issued under this methodology are traded between corporations for voluntary purposes and corporate climate target claims. Consequently, it is possible that the underlying physical removal and storage of CO_2 may in parallel be claimed by host nations for the achievement of national climate targets. This is consistent with the VCMI Claims Code of Practice requirements for reporting high-quality carbon credits: "In the absence of a host country's authorization and subsequent corresponding adjustment, companies must publicly communicate that the mitigation underlying the carbon credit may also be counted towards the host country's NDC."[31]

[31] VCMI Claims Code – Background document (2023)

Appendix I – Managing data

This appendix details how the project proponent must monitor, document and report all metrics identified within this methodology. Following this guidance will ensure the project proponent measures and confirms carbon removed and long-term storage compliance, and will enable quantification of the emissions removal resulting from the project activity during the project crediting period.

This methodology utilizes a comprehensive monitoring and documentation framework that captures the GHG impact in each stage of a BECCS project. Monitoring and detailed accounting practices must be conducted throughout to ensure the continuous integrity of the carbon removals and crediting.

Requirements

- The project proponent must develop and apply a monitoring plan according to ISO 14064-2 principles of transparency and accuracy that allows the quantification and proof of GHG emissions removals.
- The project proponent must monitor all the parameters listed below to ensure proper operation under this methodology.

Monitoring table 1:

Data/Parameters	**Gross CO_2 injected**
Equation	Equation 2a (GICR)
Source of data	Measurements at injection sites
Description of measurement methods	CO2 metering at injection site
Frequency of monitoring/recording	Measured continuously at injection location
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.
Purpose of data	To quantify and provide proof of total CO_2 injected.
Calculation	n/a
Comments	n/a

Monitoring table 2:

Data/Parameters	**CO_2 captured and stored originating from ancillary fuels** [32]
Equation	Equation 2a and 2b (AFC)
Source of data	BECCS plant management data
Description of measurement methods	Measured volume of ancillary fossil fuels and fuel carbon content
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.
Purpose of data	To account for emissions from energy production through biomass combustion.
Calculation	Total sum of measured volume of ancillary fossil fuels burned (e.g. fuel used for biomass combustion start-up process or for use in regenerative thermal oxidisers) multiplied by fuel carbon content and multiplied by the % capture rate. The amount of carbon captured is converted to CO2 by dividing by 12 (atomic mass of carbon) and multiplying by 44 (molecular mass of CO2)
Comments	n/a

Monitoring table 3:

Data/Parameters	**Gross Captured CO_2**
Equation	Equation 2b (GCC)
Source of data	Measurements at capture sites
Description of measurement methods	CO2 metering at capture sites
Frequency of monitoring/recording	Measured continuously at capture location
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive)

[32] Ancillary fuel CO_2 adjustment emissions only need to be monitored if the project proponent must estimate gross volumes of CO_2 injected based on gross CO_2 captured, due to the unavailability of injected CO_2 volume certificates.

	require following certain published standards and have specific calibration requirements.
Purpose of Data	To quantify and provide proof of total CO2 captured.
Calculation	n/a
Comments	n/a

Monitoring table 4:

Data/Parameters	**CO_2 transport fugitive emissions (optional[33])**
Equation	Equation 2b (TFE)
Source of data	Metering points along transport network Or Network operator specification
Description of measurement methods	CO2 metering along transport network. May use network operator specification where metered values are not available or where deemed more reliable than metered values.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.
Purpose of data	To identify volume of fugitive emissions from CO_2 transportation.
Calculation	Difference between delivered and injected CO2
Comments	n/a

Monitoring table 5:

Data/Parameters	**Injection fugitive emissions (optional[34])**
Equation	Equation 2b (IFE)
Source of data	Meter at injection wellhead

33 Fugitive emissions only need to be monitored if the project proponent must estimate gross volumes of CO_2 injected based on gross CO_2 captured, due to the unavailability of injected CO_2 volume certificates.

34 Fugitive emissions only need to be monitored if the project proponent must estimate gross volumes of CO_2 injected based on gross CO_2 captured, due to the unavailability of injected CO_2 volume certificates.

	Or Network Operator Specification
Description of measurement methods	CO_2 metering at wellhead May use network operator specification where metered values are not available or where deemed more reliable than metered values.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.
Purpose of data	To calculate fugitive emissions upon injection.
Calculation	Difference between injected and stored CO_2
Comments	n/a

Monitoring table 6:

Data/Parameters	**Biomass cultivation and harvesting emissions**
Equation	Equation 3 (Eec)
Source of data	Data provided by biomass producer Project proponent may use disaggregated default values from EU RED Annex VI or standard input data from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 when direct measurement is not possible. Emission factors for fuels and chemicals shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed LCA. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used.

	Where applicable, N_2O emissions from soils and/or CH_4 emissions from biomass degradation during storage shall be estimated using scientifically justifiable approach e.g. as laid out in IPCC Guidelines for National Greenhouse Gas Inventories.
Description of measurement methods	Measurement of fuel, energy and chemical inputs undertaken by biomass producer. Approach to measurement may vary across sources.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year, applied per consignment.
QA/QC procedures to be applied	Review of factors and processing procedures.
Purpose of data	To quantify emissions directly attributable to the cultivation of biomass for BECCS purposes, e.g. collection of residues.
Calculation	Total sum of inputs (unit) multiplied by associated emission factors (tCO_2eq/unit) divided by tonnes of output produced. This provides the carbon intensity value in tCO_2eq/t output of the biomass cultivation and harvesting processes which shall be adjusted by accounting for any subsequent losses and multiplied by the tonnes of biomass used by the BECCS facility over the monitoring period as measured by the supplier (e.g. bill of lading, invoice) or by direct measurement at the BECCS plant (monitoring table 21). Where applicable, N_2O emissions from soils and/or CH_4 emissions from biomass degradation during storage shall be estimated using scientifically justifiable approach e.g. as laid out in IPCC Guidelines for National Greenhouse Gas Inventories
Comments	Further information on calculations and measurement methods will be provided in additional guidance.

Monitoring table 7:

Data/Parameters	**Biomass processing emissions**
Equation	Equation 3 (Eep)
Source of data	Data provided by operator of biomass processing facility.

	Project proponent may use disaggregated default values from EU RED Annex VI or standard input data from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 when direct measurement is not possible. Emission factors for fuels and chemicals shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed LCA. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used.
Description of measurement methods	Measurement of fuel, energy and chemical inputs undertaken by operator of biomass processing facility. Approach to measurement may vary across facilities.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year, applied per consignment.
QA/QC procedures to be applied	Review of factors and processing procedures.
Purpose of data	To quantify emissions from biomass processing for the BECCS plant. May include pelletizing, drying, etc.
Calculation	Total sum of inputs (unit) multiplied by associated emission factors (tCO_2eq/unit) divided by tonnes of output produced. This provides the carbon intensity value in tCO_2eq/t output of biomass processing which shall be adjusted by accounting for any subsequent losses and multiplied by the tonnes of biomass used by the BECCS facility over the monitoring period (as measured by the supplier (e.g. bill of lading, invoice) or by direct measurement at the BECCS plant (monitoring table 19).
Comments	Further information on calculations and measurement methods will be provided in additional guidance.

Monitoring table 8:

Data/Parameters	**Biomass feedstock transportation and distribution emissions**
Equation	Equation 3 (Etd)
Source of data	Data provided by supply chain logistics operator or other supply chain partners. Approach to measurement may vary across transport routes. Project proponent may use disaggregated default values from EU RED Annex VI or standard input data from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 when direct measurement is not possible. Emission factors for fuels and standard values for fuel consumption shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used.
Description of measurement methods	Measurement of transport distance and identification of fuel type, transport mode and transport mode's energy consumption.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year, applied per consignment.
QA/QC procedures to be applied	Review assumptions, parameters and measurement methods.
Purpose of data	To quantify emissions from feedstock transport.
Calculation	Total sum of measured fuel consumption and/or metered electricity use (based on transport distance, transportation mode and the transportation mode's fuel and/or electricity consumption) multiplied by an emissions factor for the fuel and/or energy type, divided by tonnes of biomass transported. This provides the

	carbon intensity value of the transportation process which shall be adjusted by accounting for any subsequent losses and multiplied by the tonnes of biomass transported to the BECCS facility over the monitoring period (as measured by the supplier (e.g. bill of lading, invoice) or by direct measurement at the BECCS plant (monitoring table 19)
Comments	Further information on calculations and measurement methods will be provided in additional guidance.

Monitoring table 9:

Data/Parameters	**Waste disposal emissions**
Equation	Equation 3 (Ewd)
Source of data	BECCS plant management data. Emission factors for fuels and standard values for fuel consumption shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used
Description of measurement methods	Measured volume of fuel, metered electricity use and/or waste disposal transport distances.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes require following certain published standards and have specific calibration requirements.
Purpose of data	To quantify emissions from the BECCS plant waste management process.

Calculation	Total sum of measured volume of fuel and/or metered electricity use multiplied by the relevant emissions factor. Fuel or energy use may alternatively be calculated based on measured transport distance, transportation type's fuel consumption and transportation type's fuel emission factor.
Comments	Must include all emissions from onsite machinery as well as vehicles removing waste to landfill or other disposal site.

Monitoring table 10:

Data/Parameters	**CH_4 emissions from energy production**
Equation	Equation 4 (TCH_4)
Source of data	Metered emissions of CH_4. Project proponent may use disaggregated default values for combined CH_4 and N_2O combustion emissions from EU RED Annex VI when direct measurement is not possible.
Description of measurement methods	Metered emissions of CH_4.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU RED Directive) require following certain published standards and have specific calibration requirements
Purpose of data	To account for CH_4 GHG emissions from energy production through biomass combustion.
Calculation	n/a
Comments	n/a

Monitoring table 11:

Data/Parameters	**N_2O emissions from energy production**
Equation	Equation 4 (TN_2O)
Source of data	Metered emissions of N_2O.

	Project proponent may use disaggregated default values for combined CH_4 and N_2O combustion emissions from EU RED Annex VI when direct measurement is not possible.
Description of measurement methods	Metered emissions.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU RED directive) require following certain published standards and have specific calibration requirements.
Purpose of data	To account for N_2O emissions from energy production through biomass combustion.
Calculation	n/a
Comments	n/a

Monitoring table 12:

Data/Parameters	**Other emissions sources from energy production**
Equation	Equation 4 (OES)
Source of data	BECCS plant management data Emission factors for fuels shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used
Description of measurement methods	Measured volume of fuel and/or metered electricity use.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive)

	require following certain published standards and have specific calibration requirements.
Purpose of data	To account for all emissions from energy production.
Calculation	Total sum of measured volume of fuel and/or metered electricity use multiplied by the relevant emissions factor.
Comments	This category will be used if energy sources outside of biomass are used to start up or maintain energy production facilities (e.g. grid electricity, natural gas) during capture. CO_2 emissions from biomass shall be zero-rated where the biomass meets the requirements of Appendix C

Monitoring table 13:

Data/Parameters	**CO_2 processing, compression and dehydration emissions (PEP)**
Equation	Equation 5
Source of data	BECCS plant management data and/or data from network operator Emission factors for fuels shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used
Description of measurement methods	Measured volume of fuel and/or metered electricity use consumption.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.

Purpose of data	To quantify emissions from captured CO_2 processing, compression and dehydration.
Calculation	Total sum of measured fuel consumption and/or metered electricity multiplied by the relevant emission factor, multiplied by the tonnes of CO2 transported (as measured in monitoring table 1). Where applicable, this shall be adjusted proportionally to represent the project proponents share of the transported volume and distance.
Comments	Not applicable to electricity from the BECCS plant, provided all biomass sources meet the requirements of Appendix C .

Monitoring table 14:

Data/Parameters	**CO_2 transport emissions**
Equation	Equation 5 (PET)
Source of data	Data from network operator, logistics operator or other relevant supply chain partner. Emission factors for fuels and standard values for fuel consumption shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used.
Description of measurement methods	Measurement of transport distance and identification of fuel type, transport mode and transport mode's energy consumption.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year, applied per consignment.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some

	regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.
Purpose of data	To quantify emissions from captured CO_2 transport.
Calculation	Total sum of measured fuel consumption and/or metered electricity use (based on transport distance, transport mode and the transportation mode's fuel and/or electricity consumption) multiplied by an emissions factor for the fuel and/or electricity. Where applicable, this shall be adjusted proportionally to represent the project proponents share of processing, compression and dehydration emissions.
Comments	n/a

Monitoring table 15:

Data/Parameters	**CO_2 injection and storage emissions**
Equation	Equation 5 (PES)
Source of data	Storage operator. Emission factors for fuels shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used
Description of measurement methods	Measured volume of fuel and/or metered electricity use.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year, applied per consignment.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.

Purpose of data	To determine emissions from storage.
Calculation	Total sum of measured fuel consumption and/or metered electricity multiplied by the relevant emission factor. Where applicable, this shall be adjusted proportionally to represent the project proponents share of injection and storage emissions.
Comments	If emissions factor is not in CO_{2e} factors must be collected for N_2O and CH_4.

Monitoring table 16:

Data/Parameters	**Embodied CO_2 emissions from construction and installation**
Equation	Equation 5 (EEI)
Source of data	Inventory of construction materials and fuel and/or energy consumption provided by construction contractor. Embodied emission factors for materials shall be provided by the supplier or taken from relevant peer-reviewed resource. Emission factors for fuels shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources.
Description of measurement methods	Measured mass of construction materials and measured volume of fuel use.
Frequency of monitoring/recording	Fixed over period of construction., ..
QA/QC procedures to be applied	Review assumptions, parameters and measurement methods.
Purpose of data	To quantify emissions associated with materials and fuels for construction of carbon capture, transport and storage equipment.
Calculation	Total sum of construction materials and fuels multiplied by the relevant emissions factor, amortized over first crediting period.
Comments	n/a

Monitoring table 17:

Data/Parameters	**CO_2 capture energy use emissions**
Equation	Equation 6 (CCE)
Source of data	BECCS plant management data. Emission factors for fuels shall be taken from JRC (2016); Solid and gaseous bioenergy pathways: input values and GHG emissions - Version 2 or relevant peer-reviewed resources. Emission factors for electricity shall be based on the average regional grid intensity as published by the relevant regional authority. Where electricity is sourced via a PPA under the conditions outlined in 6.3.4.1, an emission factor specific to the source facility shall be used.
Description of measurement methods	Measured volume of fuel and/or metered electricity use..
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q), EU CCS Directive require following certain published standards and have specific calibration requirements.
Purpose of data	To account for energy use emissions from carbon capture technology use.
Calculation	Total sum of measured volume of fuel and/or metered electricity use multiplied by the relevant emission factor.
Comments	Will vary depending upon energy source. Not applicable to electricity from the BECCS plant, provided all biomass sources meet the requirements of Appendix C. Any captured emissions related to ancillary fuels may be excluded.

Monitoring table 18:

Data/Parameters	**CO2 capture emissions from chemicals used for capture processes**
Equation	Equation 6 (CCC)

Source of data	Inventory of chemical use from BECCS plant management data Emission factors shall be provided by the supplier or taken from relevant peer-reviewed resource.
Description of measurement methods	Measured volume or mass of chemical usage.
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes (e.g. IRA 45Q, EU CCS Directive) require following certain published standards and have specific calibration requirements.
Purpose of data	Calculate direct and embodied emissions from carbon capture systems chemical use.
Calculation	Volume measurement multiplied by emission factor.
Comments	Some chemicals may release fossil CO_2 upon use that may be captured through CCS. These emissions shall be accounted for in full where included within metered capture volumes to ensure only net removals are ultimately credited.

Monitoring table 19:

Data/Parameters	**Biomass Used**
Equation	Used for data requirements (monitoring tables 5 to 11) underpinning Equation 3 & Equation 4.
Source of data	BECCS plant management data.
Description of measurement methods	Measured volume and net calorific value of fuel as delivered to the BECCS Facility
Frequency of monitoring/recording	Fixed over reporting period not exceeding 1 year, applied per consignment.
QA/QC procedures to be applied	Meters/scales must be calibrated as per local/national standards or as per manufacturer specifications. Some regulatory regimes require following certain published standards and have specific calibration requirements.

Purpose of data	To calculate amount of biomass delivered to the BECCS site, used for calculating operational supply chain emissions. To calculate amount of biomass subject to adjustments.
Calculation	n/a
Comments	n/a

Appendix J – Indicative monitoring plan

The tables provided below may be used to develop a project's monitoring plan as described in chapter 9. These are indicative templates that can be updated to reflect each project's specific requirements. Independent VVBs shall use their professional judgement to adapt reporting timelines and verification requirements to levels that are appropriate for each project, and their level of risk.

Table 5- Indicative Reporting Requirements

Reporting principle	PDD validation	Project validation	Streamlined verification	Full verification	Validation renewal
Additionality	**Demonstrate additionality**				**Re-confirm additionality**
Baseline	Define if project will be retrofit or new-build.	Confirm if built project is retrofit or new-build. Estimate allocation factor for non-CCS energy products for first quantification.		Re-assess allocation factor for non-CCS products.	
Sustainable biomass	Assess adherence to sustainable biomass principles of planned sourcing areas.	Confirm adherence of built project to all PDD validation requirements. Will require site visits.		Assess continued adherence to sustainable biomass principles, including carbon stock assessments.	Reassess adherence to sustainable biomass principles for all sourcing areas. May require site visits where not already undertaken as part of the verification process for underpinning certification schemes.
Storage and permanence requirements	Assess planned storage site adherence to storage principles.	Confirm adherence of built project to all PDD validation requirements. Will require site visits.		Assess continued adherence to storage site principles (including enhanced hydrocarbon recovery).	Re-confirm adherence to storage principles for all sites.
Consultation and safeguards	Develop stakeholder consultation plan. Review safeguards and develop mitigation plans.	Confirm adherence to stakeholder consultation plan. Review safeguards and adherence to mitigation plans; recommend development of other mitigation plans if new issues identified.		Review safeguards and adherence to mitigation plans; recommend development of other mitigation plans if new issues identified.	Review safeguards and adherence to mitigation plans; recommend development of other mitigation plans if new issues identified.
Leakage	Assess leakage sources for materiality.	Confirm materiality of leakage sources.		Re-assess leakage sources for materiality.	

Reporting principle	PDD validation	Project validation	Streamlined verification	Full verification	Validation renewal
Additionality	**Demonstrate additionality**				**Re-confirm additionality**
Quantification	Calculate embodied emissions from construction and installation, over 15 year amortization period. Provide first projections for all variables required for net removals calculation.	Calculate embodied emissions from construction and installation, over 15 year amortization period. Provide first projections for all variables required for net removals calculation.	Provide data on all continuously monitored (i.e. metered) variables. Likely to include: Gross injected CO_2 removal volumes. Energy use emissions. Energy generation emissions.	Provide data on all non-continuously monitored variables. Likely to include emissions from: Upstream biomass harvesting, processing, and transportation. Waste disposal. CO_2 processing, transport, injection, and storage. Energy leakage.	
Verification and reporting	Create project data sampling and verification plan. Provide confirmation of VVB credentials.	Confirm project data monitoring plan. Provide confirmation of VVB credentials.	Provide confirmation of VVB credentials to registry.	Provide confirmation of VVB credentials to registry.	Re-assess project monitoring plan. Provide confirmation of VVB credentials.

Table 6 -Indicative frequency of updates to quantification variables

Quantification variable requirement	Streamlined verifications	Full verifications
Gross CO_2 injected	x	
Biomass cultivation and harvesting emissions		x
Biomass processing emissions		x
Emissions from feedstock transportation		x
Emissions from waste disposal		x
Energy production emissions (CH_4, N_2O, CO_2, other emissions)	x	
Carbon capture emissions from energy use	x	
Carbon capture emissions from chemical use	x	
Emissions from CO_2 processing, compression and dehydration		x
Emissions from CO_2 transportation		x
Emissions from injection and storage		x
Emissions from construction and installation of carbon capture equipment[35]		
Allocation factor for operational supply chain emissions		x
Leakages (including energy leakage)		x
Other adjustments (as necessary)	x	

[35] Emissions from construction and installation of carbon capture equipment are only measured once, after construction, and are amortized over a 15-year period. Such emissions are reported in the PDD for project validation but not in the verification reports since they have occurred prior to the project and hence will not change over the course of the crediting period.

Appendix K – Land use considerations for developing robust biomass sourcing criteria for CDR

This section provides a more detailed overview of the potential land sector risks of BECCS, including carbon leakage, and an overview of how the relevant provisions in the methodology mitigate these risks.

Protecting global land carbon pools for BECCS

In its Special Report on Climate Change, the IPCC recognises that:

"Most scenarios, including two of the four [socioeconomic] pathways in the IPCC Special Report on 1.5°C, compatible with stabilisation at 2°C involve substantial areas devoted to land-based CDR, specifically afforestation/reforestation and BECCS. Even larger land areas are required in most scenarios aimed at keeping average global temperature increases to below 1.5°C, and scenarios that avoid BECCS also require large areas of energy crops in many cases, although some options with strict demand-side management avoid this need. Consequently, the addition of carbon capture and storage (CCS) systems to bioenergy facilities enhances mitigation benefits because it increases the carbon retention time and reduces emissions relative to bioenergy facilities without CCS."

While BECCS can provide an important contribution towards meeting Paris Agreement-aligned net greenhouse gas emissions targets, its scale-up is not without risk, particularly to the land sector. The IPCC recognises that when deployed at high levels, BECCS risks increasing competition for land, water resources and nutrients, potentially impacting land degradation, food security, water availability, biodiversity and other ecosystem services. These impacts will be proportionate to scale of deployment and will be context specific. For example, large areas of monoculture bioenergy crops that displace other land uses could exacerbate these impacts, while integration of biomass production into sustainably managed landscapes could ameliorate them. The overall climate mitigation of BECCS, and its wider impact on ecosystems and communities, is therefore highly dependent upon the source of biomass that the technology draws upon. In accordance, this methodology requires that only biomass that provide adequate protections to the land sector are used for BECCS.

Land use change, counterfactual analysis and carbon leakage

Land conversion is recognised by the IPCC as providing a significant risk to the overall climate mitigation potential of BECCS. Of greatest concern is where new demand for biomass poses a risk of natural ecosystems exhibiting high levels of carbon storage (e.g. wetlands, peatlands, primary forest) being converted to lower carbon forms of managed land in order to satisfy the new demand. This carries associated wider negative environmental or social impacts, such as depleting biodiversity or threatening food security.

Conversion may occur directly (e.g. where a natural ecosystem is converted to managed agricultural or forest land to provide feedstock for BECCS) or indirectly (e.g. where biomass previously used for another

market is diverted to BECCS, and land elsewhere is converted to fulfil the market deficit). The latter is referred to as indirect land use change (ILUC).

In addition to the risk of land conversion, there also exists a risk that land management changes could directly, or indirectly result in a reduction in land carbon stocks. This risk is typically more relevant to forestry, where demand for biomass could result in shortening of rotation lengths or transformation of natural forests with high carbon stock to lower carbon stock in managed forests.

ILUC has historically been modelled using a range of different economic models and typically predict that a wide range of counterfactuals will materialise to meet the new demand created including intensification (i.e. higher production on existing land), extensification (i.e. production on new land) and overall demand reduction (i.e. reduction in demand from competing markets). The risk of ILUC resulting in significant increase in emissions is typically greatest in the agriculture sector, where an increased demand for arable land or pasture could result in loss of global forest area.

Indirect land use or land management changes that arise as a result of an increase in biomass demand created by a BECCS facility is synonymous with 'carbon leakage', and reflects a system-wide counterfactual, considering the broad range of market responses that will arise as a result of increased biomass demand. This issue is addressed in this methodology through the implementation of robust provisions to mitigate the risk of biomass demand indirectly contributing to undesirable climate outcomes. For conservativeness, all biomass used for BECCS shall adhere to these conditions under this methodology, regardless of whether used in new build or retrofit installations. In particular, this is to address the risk of a change in sourcing practices and/or geography resulting in land sector leakage.

Methodology implementation

This Methodology has multiple safeguards to address the risk of negative climate, nature and social impacts arising as a direct or indirect result of the demand for biomass created by a BECCS facility. A summary and discussion of the sustainability provisions outlined in Appendix C, is provided below:

1. **Biomass shall not be sourced from the primary consumable product of food or feed crops.**
   Agriculture is the greatest global driver of deforestation and land conversion. By excluding the use of crops grown for food or feed suitable for human or animal consumption, the methodology serves to mitigate the risk of contributing to the largest global driver of deforestation, while also mitigating the risk of contributing to global food insecurity.
2. **Sourcing of forestry biomass is only allowed from jurisdictions or sourcing areas that have a stable or increasing carbon stock, and where laws or management systems are in place to ensure forest retention**
   Carbon removals from BECCS can only be considered eligible when forest biomass sourcing does not cause a decrease in forest carbon stocks. Requiring that biomass is sourced from forests where carbon stocks are stable or increasing provides a robust and quantifiable results-based criteria. Monitoring of carbon stocks at a landscape level (region, county, jurisdiction) ensures that direct and potential indirect impacts to surrounding forests (i.e. carbon leakage) are captured in forest carbon impact assessments.

3. **Sourcing from biomass from ecologically valuable forests, such as primary and old growth forests is not allowed**
   Requiring that biomass is not sourced from ecologically valuable forests applies a risk averse approach to sourcing, eliminating any possible risk that such forests could be degraded directly as a result of BECCS.
4. **Sourcing from lands recently converted from lands of higher carbon stock, such as wetlands and peatlands, is not allowed**
   Requiring that biomass is not sourced from land recently converted from wetlands or peatlands protects against the direct conversion of ecosystems that natural exhibit high levels of carbon storage.
5. **Sourcing must be from areas that comply with sustainable forest management principles**
   Requiring that sustainable management principles are adhered to ensures that the forests sourcing BECCS deliver a range of environmental benefits, including forest regeneration, retention of deadwood at ecologically appropriate levels and maintaining or improving soil quality and biodiversity.
6. **Sourcing must not displace long-lived wood products**.
   The most valuable forest products (high quality roundwood suitable for sawmills) typically serve as the principal driver of land use and land management decisions, and therefore demand for these primary products carry the greatest risk of carbon leakage from land use or management change. This risk is mitigated by excluding biomass that would otherwise be used for long-lived wood products (i.e. high quality roundwood). This exclusion also mitigates potential carbon leakage from non-wood production value-chain substitution e.g. increased concrete and steel production compensating for loss of structural timber production.

Appendix L - Sustainability Criteria for Additional biomass sources

Future iterations of the methodology may include sustainability criteria for additional biomass sources or to complement existing criteria. Additional sources may, e.g., include secondary agricultural biomass (e.g. straw), the biogenic part of waste incineration, energy crops on agricultural land (e.g. energy grasses and short rotation coppices such as willow) and bio-oils based on waste or residual products to replace fossil oils used in bioenergy plants for start-up or support purposes. Appropriate sustainability criteria will be developed, accounting for sustainability risks specific to each biomass type to ensure protection of ecosystems and in particular, adequate mitigation of land sector carbon leakage.

For reasons noted in Appendix K, future iterations will not cover biomass derived from the primary consumable product of food or feed crops.

References

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Glossary

Table 7 Definitions and abbreviations

Activity-Shifting Leakage	Increased/decreased emissions to locations not targeted, or emissions not monitored, by the project
Ancillary Fuels	Fossil Fuels fuel used for biomass combustion start-up process or for use in regenerative thermal oxidisers
Baseline	The conservative scenario that would exist in the absence of the project
Bioenergy with Carbon Capture Storage (BECCS)	Process in which sustainably sourced biomass is used in an industrial process that produces, for example, biofuels, electricity, heat or pulp; the resulting biogenic CO_2 emitted is captured and stored.
Carbon credit	Tradable instrument that represents the reduction or removal of one metric tonne of carbon dioxide or its equivalent in other greenhouse gases, which can be bought and sold on carbon markets to help individuals, organizations, and/or countries achieve their decarbonisation objectives.
Carbon Capture and Storage (CCS)	Process that captures carbon dioxide (CO_2) emissions from industrial processes, power plants, or the atmosphere, and stores them underground or in other long-term storage facilities.
Carbon Dioxide Removal (CDR)	Anthropogenic activities separating CO_2 from the atmosphere and storing it durably in geological, land or ocean reservoirs, or in products.
Combined Heat and Power (CHP)	An electricity generating plant combined with equipment to recover and use heat.
Carbon Dioxide Equivalent (CO_2e)	Amount of greenhouse gas, converted in terms of global warming potential over 100 years.
Disaggregated Default Values	The carbon intensity values for individual components of the biomass supply chain as laid out in Annex VI of Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources (recast)
Ecological Leakage	Changes in emissions from hydrologically connected areas as a result of the indirect impact of the project
European Economic Area (EEA)	An international agreement which extends the application of the European Union's single market to some member states of the European Free Trade Association (Norway, Iceland, Liechtenstein).
Enhanced Hydrocarbon Recovery (EHR)	Practice of recovering hydrocarbons additional to those produced naturally by injecting gas such as CO_2 or water.
Emissions trading	Market-based mechanism that allows entities to buy and sell permits that authorize them to emit a certain amount of greenhouse gases, such as carbon dioxide (CO_2), into the atmosphere.
Fugitive Emissions	The unintended release of GHGs due to not being captured or leaks in the system e.g. valves, pipe connections

Geological Storage	The storage of carbon dioxide in underground geologic formations.
Greenhouse Gas, (GHG)	Group of chemical compounds, including carbon dioxide, methane, and water vapor, that trap heat in the Earth's atmosphere and contribute to the warming of the planet.
Global Warming Potential (GWP)	A measure of how much energy the emission of 1 tonne of a gas will absorb over time compared to the emissions of 1 tonne of CO_2. It is used to estimate the potential future impact of different gases on the climate system.
Integrity Council for the Voluntary Carbon Market (ICVCM)	Independent organization that aims to promote the credibility and transparency of voluntary carbon markets by setting standards, verifying carbon credits, and providing guidance to market participants.
Intergovernmental Panel on Climate Change (IPCC)	Scientific body established by the United Nations to assess the science, risks, and impacts of climate change, and provide policymakers with recommendations for addressing the issue.
Issuance	Act of generating or producing new carbon credits and making them available for purchase in a carbon market.
Land Sector Leakage	the indirect impact that a targeted LULUCF activity in a certain place at a certain time has on carbon storage at another place or time
Leakage	Emissions sources outside of net removals quantification boundaries (see chapter 5 on project boundaries) that increase/decrease as a result of project operations. Four leakage categories are commonly recognised: upstream/downstream emissions, activity-shifting, market leakage and ecological leakage.
Life Cycle Analysis (LCA)	A method to quantify the environmental impacts of a product or service throughout its lifecycle.
Mitigation	Reduction, Removal or prevention of greenhouse gas emissions and other actions taken to minimize the extent or impact of climate change.
Monitoring, reporting and verification (MRV)	Process of accounting for all the emissions, energy use, environmental and public health impacts associated with a carbon removal project to determine its net climate impact, reporting said information to a relevant third party, and verification by said third party against external standards thus enabling the issuance of credits.
Operational Supply Chain Emissions	GHG emissions occurring outside of the project boundary which are included in the quantification of CDRs
Partner (business)	Any party involved in upstream and/or downstream BECCS value chain activities that is contracted by the Project proponent.
Project Boundary	The activities exclusively initiated by the anticipation of CDR credit revenue from the project e.g. Carbon Capture Unit
Project Design Document (PDD)	A document that compiles all relevant project data and reflects the project proponent's plan for adherence to the requirements of this methodology.

Project proponent	The project proponent is the party that has the overall control over and responsibility for the BECCS project that generates CDR credits, typically the operator or owner of the carbon capture system.
Primary forest	Naturally regenerated forests of native tree species where there are no clearly visible indications of human activity and the ecological processes are not significantly disturbed.
Project boundary	The project boundary covers all relevant activities leading to carbon sources and sinks that are exclusively initiated by the anticipation of CDR credit revenue from the project.
Quantification Boundary	Activities that fall within the quantification of net removals, irrespective of whether they are part of the project boundary or baseline e.g. supply chain emissions in retrofit projects
Registry	Standardized platform for the issuance, trading, and retirement of carbon credits, providing a system for verifying the validity and authenticity of the credits, and for ensuring that they are not double-counted or sold more than once.
Removal credit	Type of carbon credit that is generated by a project or activity that removes carbon dioxide or other greenhouse gases from the atmosphere and can, if it is stored geologically, be used to neutralise emissions.
Reporting	Submission of data and evidence to a third-party organisation (a VVB) for the purpose of independently assuring project outcomes.
Reversal	Any migration of carbon dioxide from its geological reservoirs post injection.
Sustainable Development Goal (SDG)	Set of 17 global goals established by the United Nations to promote sustainable development and address social, economic, and environmental challenges, including poverty, inequality, and climate change.
Sequestration	Process of capturing GHG from the atmosphere and storing it in a way that prevents it from contributing to global warming.
Transport and storage operators	Operators of the carbon dioxide transportation and/or storage facilities, which hold the appropriate licenses and permits to transport, drill and operate injection and monitoring wells.
Upstream/Downstream Leakage	Change in emissions that occur downstream or upstream of the project, outside of net removals quantification boundaries
Validation	Process whereby a validation/verification body (VVB) confirms a project's adherence to all requirements in this methodology. Project validation is a pre-requisite for CDR crediting.
Validation/verification bodies (VVB)	Independent third-party auditors that assess whether a project or program complies with a methodology.
Verification	Process whereby a validation/verification body (VVB) confirms that the quantification of net CO_2 removal volumes that inform each credit issuance

	aligns with the project documentation and requirements of the relevant standard.
Voluntary Carbon Market (VCM)	Market(s) where nations, organizations and individuals can purchase and sell carbon credits voluntarily to offset their greenhouse gas emissions, neutralize their emissions or support climate change mitigation and adaptation projects.
Zero-rated biomass	Combustion of biomass or biomass-based products in the energy sector is counted as generating zero emissions of carbon dioxide, because net carbon dioxide emissions resulting from changes in biomass carbon stocks are already accounted for by the Agriculture, Forestry and Land Use (AFOLU) sector. This accounting principle was introduced by the IPCC to avoid double counting of emissions.