

The GHG emission avoidance calculation in practice

Carbon capture and storage

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Carbon Capture and Storage (CCS)

- Capturing and compressing CO₂ from point sources or the air for injection in a storage site.
- Applications can be submitted by any players in the CCS supply chain (demonstrating the provision of the remaining services).
- EII and RES projects with CCS component: CCS part is calculated according to this section and introduced in EII/RES GHG calculations.
- No difference between CO₂ captured from fossil and biogenic sources. Biogenic CO₂ credit given to the emitting facility.

$$\Delta\text{GHG}_{\text{abs/CCS}} = \sum_{y=1}^{10} \left(\text{Ref}_{\text{release},y} - (\text{Proj}_{\text{capture},y} + \text{Proj}_{\text{pipeline},y} + \text{Proj}_{\text{transport},y} + \text{Proj}_{\text{injection},y}) \right) \text{Proj}_y$$

The diagram illustrates the components of the GHG calculation for CCS. The equation shows the difference between reference emissions and project emissions. Reference emissions are CO₂ that would be released in the absence of the project. Project emissions include capture, pipeline, transport, and injection. Transport emissions are further broken down into road, rail, and maritime.

CO₂ that would be released or available in the atmosphere in the absence of the project activity

emissions from the CO₂ capture activities

emissions from transport of CO₂ by pipelines

emissions from injection at the geological storage site

= Proj_{transport,road,y} + Proj_{transport,rail,y} + Proj_{transport,maritime,y}

Proj_{transport,y} calculation

Parameter	=	Equation
Proj _{transport,y}	=	Proj _{transport,road,y} + Proj _{transport,rail,y} + Proj _{transport,maritime,y}
Proj _{transport,road,y}	=	$\sum_{L=1}^T (K_{road,L} * CO_{2road,L} * EF_{road} * 10^{-3})$
Proj _{transport,rail,y}	=	$\sum_{L=1}^T (K_{rail,L} * CO_{2rail,L} * EF_{rail} * 10^{-3})$
Proj _{transport,maritime,y}	=	$\sum_{L=1}^T (K_{maritime,L} * CO_{2maritime,L} * EF_{maritime} * 10^{-3})$

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Example: transport and storage

Potential manifest error: omission of project emissions (e.g.: transportation components), poor methodology to estimate leakages, etc.

1. **Description:** Project intends to build a special transport system to transport large volumes of CO₂ by pipeline to the storage site
2. **Sector classification:** EII /other / CO2 transport&storage
3. **GHG calculation:** CCS, Section 3 of Methodology
4. **Reference:** CO₂ released to the atmosphere

$$\Delta\text{GHG}_{\text{abs}} = \sum_{y=1}^{10} \left(\text{Ref}_{\text{release},y} - \text{Proj}_{\text{capt},y} - \text{Proj}_{\text{pipe},y} - \text{Proj}_{\text{inject},y} - \text{Proj}_{\text{transport},y} \right)$$

- Proj_{capt,y}** is linked to a box: "Fuel and material use + fugitives+venting pre-injection"
- Proj_{pipe,y}** is linked to a box: "Emissions at support installations + fugitives + venting + leakage"
- Proj_{inject,y}** is linked to a box: "Emissions from fuel use at booster station + venting + leakage"
- Proj_{transport,y}** is linked to a box: "Emissions at each transportation modal"

5. **Data:** CO₂ transferred to capture facility; quantity of fossil fuel consumed; for fugitives (unintentional), leakage events and venting (planned) it will depend on the monitoring plan to be proposed by the applicant, and method of quantification selected.

Note that...

- The applicant shall secure a buyer of their technology and cover the whole cycle from capture to storage in their submission, which shall be part of the boundaries of GHG emission avoidance calculation. Companies will be required to monitor and report on emissions across all stages.
- Applications can be submitted with or without a Consortium. It is up to the applicants and players to organise themselves and split the revenues and liabilities.

Carbon Capture and Storage (CCS)

Example: cement plant with CO₂ capture and storage

1. **Description:** Project intends to produce cement in an innovative way and capture and store some of the CO₂ released
2. **Sector classification:** EII / cement & lime / cement
3. **GHG calculation:** EII, Section 2 of Methodology with CCS (Section 3) integrated.
4. **Reference:** cement EU ETS benchmark

$$\Delta\text{GHG}_{\text{abs}} = \underbrace{\sum_{y=1}^{10} (\text{Ref}_y - \text{Proj}_y)}_{\text{EII}}$$

$$= \sum_{y=1}^{10} \left(\text{Ref}_y - (\text{Proj}_{\text{inputs},y} + \text{Proj}_{\text{processes},y} + \text{Proj}_{\text{eol},y} + \text{Proj}_{\text{combustion},y} + \text{Proj}_{\text{changeuse},y} + \text{Proj}_{\text{non-principal},y}) \right)$$

Aside from all the EII processes involved in the production of cement, introduce also:

- The full amount of CO₂ generated by the project as a **positive term** (even though some of this CO₂ is to be captured)
- The CCS credit calculated according to section 3 of Methodology (CCS) as a **negative term** (i.e.: $\text{Ref}_{\text{release},y} - \text{Proj}_y$, where $\text{Ref}_{\text{release},y}$ is the CO₂ that would be released in the absence of the project and Proj_y the emissions due to the CO₂ capture, transport and storage)

Carbon Capture and Storage (CCS)

Example: waste to energy plant with CO₂ capture and storage

1. **Description:** Project intends to produce bio-electricity from a waste to energy plant and capture and store some of the CO₂ released
2. **Sector classification:** EII / other / electricity
3. **GHG calculation:** RES, Section 4 of Methodology with CCS (Section 3) integrated.
4. **Reference:** expected 2030 electricity mix

$$\Delta\text{GHG}_{\text{abs}} = \underbrace{\sum_{y=1}^{10} (\text{Ref}_y - \text{Proj}_y)}_{\text{RES}} = \sum_{y=1}^{10} \left(\text{Ref}_{\text{electricity}} - \text{Proj}_y \right)$$

Possibility to claim net carbon removals credit if the project emissions are negative

Aside from the RES project emissions involved in the production of bio-electricity, introduce also:

- The amount of **biogenic CO₂** generated by the project **with an emission factor of zero** and the **fossil CO₂** generated as a **positive term** (even though some of this CO₂ is to be captured).
- The CCS credit calculated according to section 3 of Methodology (CCS) as a **negative term** (i.e.: $\text{Ref}_{\text{release},y} - \text{Proj}_y$, where $\text{Ref}_{\text{release},y}$ is the CO₂ that would be released in the absence of the project (fossil and biogenic) and Proj_y the emissions due to the CO₂ capture transport and storage)

Potential clerical or manifest error: double-counting biogenic emissions.

Carbon Capture and Storage (CCS)

Example: Direct air capture and storage (DACCS)

1. **Description:** Project intends to remove CO₂ from ambient air and store it
2. **Sector classification:** EII / Other / CO₂ storage
3. **GHG calculation:** CCS, Section 3 of Methodology
4. **Reference:** CO₂ removed from the atmosphere

Possibility to claim net carbon removals credit if the overall project emissions are negative

$$\Delta\text{GHG}_{\text{abs}} = \sum_{y=1}^{10} \left(\underbrace{\text{Ref}_{\text{release},y}}_{\substack{\text{Amount of CO}_2 \\ \text{removed from} \\ \text{atmosphere}}} - \underbrace{\text{Proj}_{\text{capt},y} - \text{Proj}_{\text{pipe},y} - \text{Proj}_{\text{inject},y} - \text{Proj}_{\text{transport},y}}_{\substack{\text{Fuel and material use} \\ \text{+ fugitives + venting +} \\ \text{leakage}}} \right)$$

Relative GHG emission avoidance will be set at 100% to grant DACCS with an advantage over conventional CCS

Net carbon removals

Without permanent geological storage: relative GHG emission avoidance (e.g.: CCU)

With permanent geological storage:

- Total project emissions (should be negative) $\left\{ \begin{array}{l} \text{DACCS: } -\Delta\text{GHG}_{\text{abs,CCS}} \\ \text{BECCS: total project emissions with the CCS term integrated} \end{array} \right.$
- Relative net carbon removals: $\frac{\Delta\text{GHG}_{\text{abs,CCS}}}{\sum\text{Ref}_{\text{release}}}$ (**NOT necessarily** the same value as the “relative GHG emission avoidance” explained in 1.1.2. of the GHG methodology) where:

- DACCS: for the purpose of crediting carbon removals, the exact value should be calculated following the formula (note that for the main GHG calculation, this value was set as 100%)
- BECCS:
 - $\Delta\text{GHG}_{\text{abs,CCS}}$: calculated based **ONLY** on the **BIOGENIC** fraction of the CO_2 emitted by the plant (i.e.: $\sum\text{Ref}_{\text{release}}$ in equation 3.1 the Methodology considering only the biogenic fraction of CO_2) and that will be captured by the CCS facility (credit cannot be claimed for the fossil fraction of the CO_2 emitted (e.g.: WtE plant using waste from fossil and biogenic sources)).
 - $\sum\text{Ref}_{\text{release}}$: calculated as the sum of the **TOTAL CO_2** emissions by the plant (i.e.: biomass and fossil, if applicable) and that will be captured by the CCS facility

GENERAL RULES

- Total project emissions should be **negative**.
- Negative emissions can only be claimed excluding any credit for **timed operation**.
- **Non-principal products** are not allowed to be the only source of negative emissions in the project.

Q&A Session

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