



## **Innovation Fund (INNOVFUND)**

# Methodology for GHG Emission Avoidance Calculation

Version 5.0  
01 December 2025



<b>HISTORY OF CHANGES</b>		
<b>Version</b>	<b>Publication date</b>	<b>Changes</b>
1.0	15.03.2022	<ul style="list-style-type: none"> <li>Initial version</li> </ul>
2.0	01.11.2022	<ul style="list-style-type: none"> <li>Main table from previous Appendix 1 moved to the body of the GHG methodology, clarification for projects with multiple principal products and for hybrid projects, addition of subsection 1.1.2.1. for Net Carbon Removals, previous section 1.15 'GHG emissions from inputs' is now section 1.3.3., Clarifications in table 1.1 on sector classification, addition of a paragraph for principal products of a project replacing the function of a physically different conventional product (section 1.2), Clarifications for projects earning revenues from the sale of multiple products, clarification for manufacturing of components, adding specific data references for projects manufacturing electrolysers (load factor and CAPEX), restructuring of the section related to 'Calculation of GHG emission avoidance', added clarification to table 1.3, added paragraph 'Simplification for PILOT topic projects', Creation of a subsection 1.3.5. for combustion emissions, addition of 2 example cases for setting the reference scenario for a principal product, addition of elements for Case 3 in section 2.2.4.3., addition of elements for Case 4 in section 2.2.4.4., addition of elements for case 6 in section 2.2.4.6., addition of a reference for methane leakage in section 2.2.5., addition of examples for 'Other relevant inputs', addition of element in section 2.2.9.1., reformulation of section 3 'Carbon Credits', clarification of the scope of section 4 and 5, addition of an equation for manufacturing of components of renewable energy systems, addition of examples for auxiliary services, update of the table of contents to the new structure and annex numbering, reworking of sentences for clarity, spelling mistake correction</li> </ul>
3.0	01.11.2023	<ul style="list-style-type: none"> <li>General clarifications, editorial improvements and language streamlining in section 1, 2, 3, 4, and 5.</li> <li>Editorial improvements on transport emissions in section 1.1.4.</li> <li>Clarification in section 1.2 on the principal product, and on the selection of the correct sector and methodology. This includes clarifications for CCS projects and manufacturing projects.</li> <li>Clarifications in section 1.2.2, including clarifications on manufacturing of fuel cells and on manufacturing project duration.</li> <li>Added section 1.3.6 covering the changes in performance of certain technologies.</li> <li>Correction and clarifications in Table 2.1.</li> <li>The need to provide a detailed project diagram has been clarified in section 2.2.2.</li> <li>Clarifications in section 2.2.4, and changes in the simplifications for PILOTS projects.</li> <li>Clarifications in section 2.2.4.4, which relates to transport fuel substitutes, including reinstated text of the first three footnotes of section 2.2.4.4, and clarified examples.</li> <li>Clarifications in the provisions for CCS projects in section 2.2.5.2 and related sections for which cross-references have been provided.</li> </ul>

		<ul style="list-style-type: none"> <li>▪ Clarifications in the provisions for CCU projects in section 2.2.5.3, including general editorial improvements and clarifications regarding the system boundaries of CCU projects.</li> <li>▪ Clarification regarding the End-of-Life emissions of CCU products in section 2.2.5.3.2</li> <li>▪ Amended the provisions concerning heat input emissions in section 2.2.6, second paragraph.</li> <li>▪ Clarification on reference scenario for waste utilization in section 2.2.6.1, and expanded scope for certain rigid input waste in section 2.2.6.1.1.</li> <li>▪ Clarification of provisions on upstream emissions in the fossil fuel supply chain, and correction of a related example in section 2.2.6.3.3.</li> <li>▪ Clarifications in section 2.2.6.3.6 concerning the provisions on timed operations and virtual storage.</li> <li>▪ Section 3. Clarification and general editorial improvements, including cross-references to other relevant sections for CCS and CCU projects.</li> <li>▪ Section 3.1. Provisions on splitting the CC credit among multiple projects from the same CCS chain removed.</li> <li>▪ Section 4. Introduction and scope clarification on renewable sources and direct power connection projects - small scale simplification improved - language harmonisation.</li> <li>▪ Sections 4.2. and 4.2.1. Clarifications in equation terms.</li> <li>▪ Removed dedicated provisions for the calculation of the relative GHG emission avoidance for wind, solar and ocean projects in section 4.3.</li> <li>▪ Clarification on timing conditions for electrical energy storage included in section 5.1 projects</li> <li>▪ Improved framing of the reference scenario for EV batteries project in equation 5.3 and table 5.2</li> <li>▪ Clarification in Table 5.2. EF for hydrogen corrected for using LHV in consistency with other sections, amended description entry for electricity.</li> <li>▪ Section 2, section 4 and section 5. Several emission factor values updated for consistent application to include CH<sub>4</sub> and N<sub>2</sub>O contributions and to account for LHV and not HHV in H<sub>2</sub> in section 5.</li> <li>▪ Simplification of hierarchy of sources in Appendix 1.</li> <li>▪ Inclusion of sections 6 and 7 with the provisions for the calculation of GHG emissions avoidance for maritime and aviation projects, respectively. Review of section 1 to account for the inclusion of these new sections.</li> </ul>
<p>3.1</p>	<p>01.03.2024</p>	<ul style="list-style-type: none"> <li>▪ Inclusion of subsection 1.1.6 with guidance for the calculation of GHG emissions avoidance for sectors road transport and buildings. Review of Table 1.1 to include these new sectors.</li> <li>▪ Correction of the example in section 5.1.2 and of equation 5.4a (Energy Storage).</li> <li>▪ A leftover reference to footnote 14 has been removed.</li> </ul>

4.0	15.11.2024	<ul style="list-style-type: none"> <li>▪ The entire methodology has been edited for simplicity and clarity. This includes the renumbering and restructuring of existing sections.</li> <li>▪ Emission factors related to the combustion of fuels have been updated to ensure they are inclusive of CO<sub>2</sub> and non-CO<sub>2</sub> GHG emissions, are aligned across the project categories and use the adequate GWP.</li> <li>▪ Nomenclature reviewed for coherence across the methodology and with other Regulations.</li> <li>▪ List of main changes to section 1, introduction and general provisions: <ul style="list-style-type: none"> <li>○ A list of 'Key steps for the calculation of the GHG emissions avoidance' has been added in section 1.1.1.</li> <li>○ In section 1.1.3 Equation 1.1 an explicit term has been added for the carbon capture credit, which was previously integrated into the term Proj<sub>y</sub>.</li> <li>○ The list of sources generally excluded in section 1.1.7 has been clarified.</li> <li>○ It has been clarified in section 1.1.7 that the calculation of other GHG savings should be consistent with the principles of the methodology to the extent possible.</li> <li>○ A bioenergy sector has been created under the RES category, and bioenergy projects shall no longer apply under the EII category (section 1.2).</li> <li>○ Section 1.2.1 has been added, clarifying the choice of sectors when a principal product may replace more than one reference product.</li> <li>○ Section 1.2.3 has been added clarifying the choice of principal products and sector for CCU/S projects.</li> <li>○ In section 1.3 the rules for projects manufacturing innovative technologies and their components have been clarified, including clarifying that the cost share is 1 for projects manufacturing a whole consumer product.</li> <li>○ In section 1.4.3 guidance has been added relating to the emission factors to be used for heat and hydrogen as project inputs.</li> <li>○ The emission factor for electricity exported from an EII project has been changed from 0 to 48.8 tCO<sub>2</sub>e/TJ (section 1.4.3.1).</li> <li>○ Section 1.4.4 has been added, clarifying the treatment of biomass-derived fuels and materials.</li> <li>○ Section 1.5 and Appendix 4, including monitoring and reporting provisions, have been updated, expanded, and harmonised for clarity.</li> </ul> </li> <li>▪ List of main changes to section 2, energy intensive industries (EII): <ul style="list-style-type: none"> <li>○ Applicants are no longer permitted to bring within the system boundary input-related upstream processes that are not under their control (section 2.2.3).</li> <li>○ The rules relating to projects where an innovation applies to only part of the throughput have been clarified (section 2.2.3.1).</li> <li>○ The requirements in section 2.2.4 relating to the definition of a reference scenario have been clarified, particularly for cases in</li> </ul> </li> </ul>
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		<p>which a principal product may replace more than one reference products.</p> <ul style="list-style-type: none"> <li>○ The requirements in section 2.2.5 relating to carbon capture have been streamlined with the requirements in section 6.</li> <li>○ For CCU projects, the process in which CO<sub>2</sub> is used must now always be brought within the system boundary of the project (section 2.2.5.3.1).</li> <li>○ The 'minor' input category has been retired from the methodology; all inputs must be identified as major or de minimis (section 2.2.6.2). The section on inputs (2.2.6) has been reordered and simplified.</li> <li>○ The requirement to remove upstream emissions associated with the fossil fuel supply chain from the emission factors for inputs, including the simplified option to remove 15% from the supply emissions, has been retired from the methodology. Input emission factors should now be used without this adjustment.</li> <li>○ Rules for rigid inputs have been clarified in section 2.2.6.4, including provisions for waste inputs in section 2.2.6.4.2.</li> <li>○ The rules for principal products containing carbon have been clarified in section 2.2.9.1.</li> <li>○ An equation has been added in section 2.2.10 to clarify the treatment of non-principal products.</li> </ul> <ul style="list-style-type: none"> <li>▪ The section dedicated to renewable energy (RES) projects has been renumbered from section 4 to section 3, and streamlined for clarity and simplicity. Main changes include: <ul style="list-style-type: none"> <li>○ Equations have been updated for clarity, and to properly characterize emissions for bioenergy projects (section 3.1.2 and other sections).</li> <li>○ Provisions have been included for projects aiming to operate stationary fuel cells (section 3.1.2.1) and to manufacture stationary fuel cells and their components (section 3.1.3.1).</li> <li>○ Dedicated sections were created for projects aiming exclusively at consuming renewable energy for activities outside the scope of Annex I to the ETS directive (section 3.1.4 and 3.3.2)</li> <li>○ Dedicated sections were created for projects aiming at manufacturing components for renewable energy generation (section 3.1.3 and 3.3.3).</li> </ul> </li> <li>▪ The section dedicated to energy storage (ES) projects has been renumbered from section 5 to section 4, and streamlined for clarity and simplicity. Main changes include: <ul style="list-style-type: none"> <li>○ Auxiliary services are now considered within the boundaries of the GHG calculations also for small-scale projects.</li> <li>○ Energy storage technologies for mobility applications are now covered under the new category mobility (MOB) in section 5.</li> <li>○ Section 4.1 has been streamlined and aligned with the provisions in section 1. The text now clarifies that the exclusion of simultaneous charging and discharging only applies to the same type of energy.</li> <li>○ In section 4.3, the distinction between inputs to energy storage and on-site energy consumption has been clarified by introducing differing subscripts. Equation [4.1] and [4.2] have been adapted to the general provisions on absolute GHG emissions avoidance in section 1.</li> </ul> </li> </ul>
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		<ul style="list-style-type: none"> <li>○ The methodology for manufacturing of innovative energy storage systems and their components has been separated in the dedicated subsection 4.3.1.2 and aligned with the provisions for manufacturing projects in section 1.</li> <li>○ The majority of emission factors in section 4.5 has been revised in line with the changes in other sections. For electricity, heat and hydrogen, a link to the provisions in section 1 has been introduced. The grid losses have been updated based on the latest Eurostat data from 2022.</li> <li>▪ A dedicated section for mobility projects (MOB) was created as section 5, which replaces the former sections for aviation and maritime projects, and includes also road transport as a sector. The new category covers also manufacturing of innovative aircrafts, maritime vessels, road vehicles and their components, including fuel cells and energy storage components for mobility applications.</li> <li>▪ The section on CCU/S credit has been renumbered from section 3 to section 6 and has been streamlined and clarified. <ul style="list-style-type: none"> <li>○ Equation 6.1 has been reframed on a single year rather than over the sum of project years (section 6.5).</li> <li>○ Equations have been added in a footnote to section 6.5 to clarify the case that a CC credit must be included in the reference scenario.</li> </ul> </li> <li>▪ A dedicated section for proposals submitted under the INNOVFUND-2024-BATT call has been created as section 7.</li> </ul>
4.1	15.12.2024	<ul style="list-style-type: none"> <li>▪ Updated the emission factor for EV use phase (relevant for relative and total GHG avoidance) for the INNOVFUND-2024-BATT call.</li> </ul>
4.2	01.04.2025	<ul style="list-style-type: none"> <li>▪ In section 1.1.7, page 19, clarified the treatment of emissions due to the manufacturing process in the case of projects manufacturing innovative technologies and their components.</li> <li>▪ Corrected a typo in the unit of measure of term <math>P_{out,y}</math> in Section 3.3.1.1, page 93. The quantity <math>P_{out,y}</math> must be expressed in megawatt (MW) to ensure dimensional consistency in equations 3.3, 3.4, 3.5.</li> <li>▪ Clarified the units of measure to be used in equation 4.4a, page 104. The term <math>EF_{out, natural\ gas}</math> must be expressed in tonnes CO<sub>2</sub> equivalent per terajoule (tCO<sub>2</sub>e/TJ) and the conversion factor 0.0036 is introduced in equation 4.4a to ensure dimensional consistency. A related example in section 4.1.2, page 101, was also clarified accordingly.</li> </ul>
5.0	01.12.2025	<ul style="list-style-type: none"> <li>▪ Parts of the methodology have been edited for simplicity and clarity. This includes a limited renumbering and restructuring of existing sections.</li> <li>▪ List of main changes to Section 1, introduction and general provisions: <ul style="list-style-type: none"> <li>○ In section 1.1.5, simplified the provisions related to the calculation of net carbon removals.</li> <li>○ In section 1.1.7, removed the concept of 'other GHG savings' as no longer applicable, in line with the Call Text.</li> <li>○ In section 1.2, clarified that each project shall have only one principal product, and removed the designation of non-principal products, with limited impact on the provisions governing the selection of a sector for the purposes of GHG calculations.</li> </ul> </li> </ul>

		<ul style="list-style-type: none"> <li>○ In section 1.3, clarified that a manufacturing of components project cannot claim a carbon capture credit.</li> <li>○ In section 1.3.5, clarified the definition of the cost share of the component and related provisions.</li> <li>○ New section 1.4.5 introduced to clarify provisions for externally-produced RFNBOs and LCFs other than hydrogen used as inputs and/or feedstocks by a project.</li> <li>○ In section 1.4.6, provisions for transport emissions expanded to cover the case of biomass derived fuels and materials, RFNBOs, LCFs, and hydrogen where relevant.</li> <li>○ In section 1.5, clarified and expanded the monitoring and reporting provisions, with specific reference to biomass-derived fuels and materials, RFNBOs, LCFs, renewable and LCF hydrogen, and waste materials.</li> <li>▪ List of main changes to Section 2, energy intensive industries (EII):             <ul style="list-style-type: none"> <li>○ In section 2.2.3, diagram updated to remove the box dedicated to 'Non-principal products', which is no longer applicable, and to remove the box related to 'Combustion (principal products)', which is now included in the box 'End of life'.</li> <li>○ In section 2.2.4, clarified the need to provide a process diagram as part of the GHG calculations.</li> <li>○ In section 2.2.5.3, clarified the CAPEX requirement on projects proposing the modification of an existing plant, with or without a CCS component (Case 3), and clarified the provisions for a project proposing the modification of an existing plant involving an increase in production volumes.</li> <li>○ In section 2.2.5.9, clarified and standardised the provisions for Case 9 ('The applicant proposes a reference scenario').</li> <li>○ In section 2.2.6.3.3, clarified provisions for the calculation of end-of-life emissions for CCU products, and aligned to the provisions for externally-produced RFNBOs and LCFs.</li> <li>○ In section 2.2.7, simplified the treatment of inputs by removing the designation of inputs as elastic, rigid or semi-elastic. In addition, dedicated subsections have been provided covering the case of biomass-derived fuels and materials, externally-produced RFNBOs and LCFs, and waste materials used as inputs.</li> <li>○ In section 2.2.9, clarified the provisions for the calculation of end-of-life emissions, which now include emission previously labelled 'Emissions from combustion (principal products)'.</li> </ul> </li> <li>▪ List of main changes to Section 3, renewable energy (RES):             <ul style="list-style-type: none"> <li>○ In section 3.1.2, clarified the provisions for projects using hydrogen, RFNBOs and/or LCFs for energy generation.</li> <li>○ In section 3.1.3.1, clarified the provisions for projects manufacturing components for stationary fuel cells and other stationary technologies for the generation of electricity, heating or cooling using renewable or low-carbon fuels</li> </ul> </li> <li>▪ List of main changes to Section 4, energy storage (ES):             <ul style="list-style-type: none"> <li>○ In section 4.1.2, provisions related to the definition of emission factors have been grouped in one place, and the provisions for projects using biomass-derived fuels, RFNBOs and/or LCFs have been clarified and aligned with other sections of the Methodology.</li> </ul> </li> </ul>
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		<ul style="list-style-type: none"> <li>○ In section 4.1.3, provisions related to the definition of a reference scenario for the provision of auxiliary services to the grid have been clarified.</li> <li>▪ List of main changes to section 5, mobility (MOB):             <ul style="list-style-type: none"> <li>○ In section 5.1.2.2, the reference fuel to be used in maritime projects has been changed to Marine Diesel Oil (MDO) for simplicity.</li> <li>○ In section 5.1.3.3, provisions related to the calculation of additional non-CO<sub>2</sub> climate impacts for maritime activities have been clarified.</li> <li>○ In section 5.3.2.1, the possibility to use the Energy Efficiency Ratio (EER) to define a reference scenario for road transport projects has been removed, for simplicity and for alignment to other modes of transport.</li> </ul> </li> <li>▪ List of main changes to section 6, Credit for Carbon Capture and Storage or Utilisation:             <ul style="list-style-type: none"> <li>○ Clarified provisions for the unusual case that the reference scenario includes an element of carbon capture and utilisation.</li> <li>○ Clarified that a carbon capture credit cannot be claimed when submitting an application for a manufacturing of components project.</li> </ul> </li> <li>▪ Section 7, which was dedicated to proposals submitted under the INNOVFUND-2024-BATT call, has been removed as no longer applicable.</li> <li>▪ In Appendix 1, provisions related to the hierarchy of sources have been clarified.</li> <li>▪ Appendix 2, which covered provisions related to the definition of elastic, rigid, and semi-elastic inputs, has been removed as no longer applicable.</li> <li>▪ Appendix 3 has been renumbered as Appendix 2, and provisions related to the allocation of emissions to inputs have been streamlined and clarified.</li> <li>▪ Appendix 4 has been renumbered as Appendix 3, and provisions related to monitoring, reporting, and verification (MRV) have been further developed and clarified, particularly to better cover the case of manufacturing of components projects and to provide more guidance with respect to the definition of a monitoring plan.</li> <li>▪ Appendix 5 has been renumbered to Appendix 4 and definitions have been added for RFNBO and LCF.</li> <li>▪ A new appendix 5 has been added to list references used through the Methodology.</li> </ul>
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## 1 Introduction and general provisions

The methodology for the calculation of the GHG emission avoidance for projects submitted under the call 'Innovation Fund Call for proposals 2025 Net Zero Technologies' (INNOVFUND-2025-NZT) is described in the following sections and in the appendixes to this document:

Section 1: Introduction and general provisions.

Section 2: Energy intensive industries (EII), including substitute products, carbon capture and utilisation (CCU), and manufacturing of electrolysers and their components.

Section 3: Renewable energy (RES), including manufacturing of components for RES.

Section 4: Energy storage (ES), including manufacturing of components for ES.

Section 5: Mobility (MOB), including manufacturing of innovative ships, aircraft, road vehicles and their components.

Section 6: Credit for carbon capture and storage or utilisation.

Each methodology section provides the details to be used when:

- calculating the GHG emission avoidance potential of a project at the application stage;
- reporting performance for the purposes of disbursement of the portion of the grant that is linked to GHG emission avoidance verification; and
- reporting performance for the purposes of knowledge-sharing.<sup>1</sup>

Definitions of terms used within the methodology for the INNOVFUND-2025-NZT call are provided in Appendix 4. References are provided in Appendix 5.

### 1.1 GHG emission avoidance: principles and scope

For the purpose of the Innovation Fund, the GHG emission avoidance of a project is calculated in terms of absolute GHG emission avoidance (section 1.1.3), and relative GHG emission avoidance (section 1.1.4).

The InnovFund grant disbursement depends on verified emission reductions. Therefore, it is important that the emissions reductions described in the application can be delivered. For example, when forecasting operational data, applicants should consider any expected **ramping up period**, e.g. if reduced performance can be expected over the first years of operation due to necessary stops and starts of the production for technical adjustments, this should be reflected in the calculations.

The final split of products and expected functions for those products needs to be clearly identified. If the application claims that a product will be used for a specific purpose this should be credibly demonstrated, for example by providing draft contracts or other relevant supporting documents.

In the case that the share of products or their use during project implementation differs from the products and uses specified in the application, or that other assumptions made at the application stage cannot be demonstrated during project implementation, the project may not be able to reach the GHG emission avoidance claimed at the time of the

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<sup>1</sup> These parameters will be reported through a dedicated knowledge-sharing report template once projects enter into operation. The detailed knowledge-sharing requirements are specified in the Model Grant Agreement, Call Text and knowledge-sharing reporting template available on the Funding & Tenders portal.

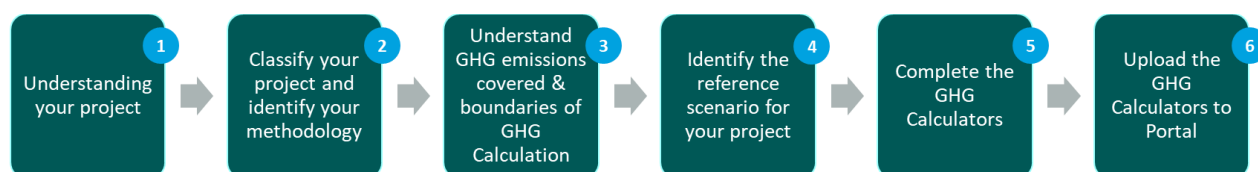
application, with potential implications on grant disbursement as specified in the Call Text (see also section 1.1.9 and section 1.5).

It is a fundamental principle of the Methodology for GHG Emission Avoidance Calculation that each GHG emission and each GHG saving shall only be counted once ('no double counting' principle). In any case in which the other provisions in this methodology may seem to call for a given emission or saving to be counted twice, the 'no double counting' principle prevails.

### 1.1.1 Key steps for the calculation of the GHG emissions avoidance

The following six steps approach outlines the key stages applicants must go through for calculating the GHG emissions avoidance of a project.

Figure 1.1. The step-by-step process of GHG calculations



#### 1.1.1.1 Step 1: Understanding your project

The first step for an applicant is to understand their project, what practice or product they intend to replace – does it refer to a change in the process, or a replacement of the final product? What are the parties involved in the implementation?

For instance, a project could propose to produce an innovative fuel for transport applications. Alternatively, a project may focus on the use of an alternative fuel in an innovative vessel or aircraft, or it can include both the production and the use of the fuel.

It is very important to have clarity on the scope of the project, and to thoroughly check the eligibility conditions established in the Call Text for each topic.

#### 1.1.1.2 Step 2: Classify your project and identify your methodology

Then, the applicant must identify the category and sector under which their project falls.

A project must be classified according to the **principal product that is the main aim of the project**, following the provisions in section 1.2. A correct definition of the principal product of the project is the key for a correct identification of the sector under which the application shall be submitted, as well as the category.

Once the project has been classified, the applicant can use Table 1.1 in section 1.2 to identify which section(s) of the GHG methodology they have to follow, in addition to the general guidance provided under section 1 of this document. Each section includes instructions, provisions, and/or readymade equations for applicants to use to calculate the GHG emission avoidance of their project.

Note that some projects may have more than one product (section 1.2.2) and some projects may have products associated to more than one category (hybrid projects, section 1.2.5).

Refer also to section 1.3.1 for projects aiming at manufacturing innovative technologies and their components and to section 5.1.1 for MOB projects.

### 1.1.1.3 Step 3: Understand GHG emissions covered & boundaries of GHG Calculation

Once the relevant methodology section(s) has been identified, the applicant must thoroughly review it to understand the provisions that apply to the category and sector of their project.

Then, the applicant must define the project boundaries for the purpose of GHG emission avoidance calculations, in line with the relevant provisions in the Methodology and as a function of the specificities of the proposed project.

The applicant shall take into consideration that the definition of the project boundaries is closely linked to the project classification and principal product definition, so applicants may need to review and confirm the previous steps accordingly, while going through step 3.

Refer to section 1.1.2 to define the time period considered for GHG emission avoidance calculations, to section 1.1.6, 1.1.7, 1.1.8 for GHG emissions and additional non-CO2 climate impacts that are generally included or excluded from the scope of this methodology, and to the relevant sub-sections of the methodology to understand the boundaries of the GHG emission avoidance calculations: section 2.2.3 for EII projects, section 3.2 for RES projects, section 4.2 for ES projects, and section 5.2 for MOB projects.

Refer also to section 1.3 for projects aiming at manufacturing innovative technologies and their components, and to section 6 for projects including a component of CCS or CCU.

### 1.1.1.4 Step 4: Reference Scenario identification

The emission avoidance of a project is calculated in terms of absolute GHG emission avoidance (section 1.1.3), and relative GHG emission avoidance (section 1.1.4) by comparing the emissions in the project scenario to the emissions in the reference scenario.

The reference scenario is a hypothetical scenario that represents what would have occurred in the absence of the project as further detailed in section 1.4.1.

The applicant must select the reference scenario in line with the provisions of the Methodology. Often, the choice of the reference scenario is mandated by the Methodology, and the applicant cannot further adapt the scenario prescribed.

The applicant must thoroughly review and apply the relevant provisions under each section of the methodology as applicable to the category and sector of your project. In particular: section 2.2.5 for EII projects, section 3.2.1 for RES projects, section 4 for ES projects, and section 5.1.2 for MOB projects.

### 1.1.1.5 Step 5: Complete the GHG Calculators

Once the reference scenario is defined, applicants shall perform their GHG calculations following the relevant section(s) of the methodology applicable for the category and sector of the project, as specified in Table 1.1 in section 1.2, in addition to the general provisions in section 1.

To perform their GHG calculations, the applicant must duly fill-in the relevant GHG calculator(s). GHG calculators are spreadsheet templates available on the Call application webpage, which the applicant must complete and submit as part of their application documents. The applicants must also complete the 'data traceability' section of the GHG calculator(s), as part of the Monitoring Reporting and Verification requirements for Innovation Fund projects, as detailed in section 1.5 and Appendix 3 to this document.

Since applicants are allowed to upload only one spreadsheet at the application stage, for the case of hybrid projects (section 1.2.5), the applicants need to combine two or more GHG calculators into one single file, following the instructions in section 1.2.5.1.

In addition to completing the GHG calculator, the applicant must complete the relevant application forms, and they must provide a detailed explanation of the calculations performed and a credible justification of the assumptions taken. This includes providing adequate justification and explanation as to how the proposed project meets the relevant minimum requirements as specified in the Call Text. The applicant should provide additional supporting documents where relevant and ensure that the information encoded across different application documents are consistent.

It is recommended that applicants review the relevant training materials, tutorials, and examples available on the Innovation Fund webpage.

#### 1.1.1.6 Step 6: Upload GHG calculator to the portal

Once the GHG calculator is completed, the applicant shall upload it on the application portal along with the other application documents.

#### 1.1.2 Time period considered for GHG calculations

The GHG emission avoidance of a project is calculated over a period of 10 years after the entry into operation of the project. **In case the project operates for less than 10 years**, operational data will be set to zero for those years in which the project does not operate. As such, both  $\Delta\text{GHG}_{\text{abs}}$  and  $\Delta\text{GHG}_{\text{rel}}$  shall reflect the reduced period of operation of the project.

The minimum duration of the monitoring and reporting period is specified in the Call Text and depends on the topic under which the project is submitted. Note that the duration of the monitoring and reporting period may be shorter with respect to the period of 10 years over which the GHG emission avoidance of a project is calculated at the application stage.

#### 1.1.3 Absolute GHG emission avoidance

The **absolute GHG emission avoidance** represents the difference, over a defined period, between **all** the emissions that would occur **in the reference scenario**, i.e. in the absence of the proposed project, and **all** the emissions that occur **in the project scenario**.

Note that, in the calculation of the absolute and relative GHG emission avoidance, it is necessary to include all the emissions both in the reference and project scenario. This includes common emissions that are the same in both scenarios. If common emissions were to be excluded from both scenarios, then the *relative* emission calculation (section 1.1.4) would be distorted.

The absolute GHG emission avoidance shall be calculated based on the expected emissions avoided in each year from the entry into operation over a 10-year period, as defined in section 1.1.2, using the equation below.

$$\Delta\text{GHG}_{\text{abs}} = \sum_{y=1}^{10} (\text{Ref}_y - \text{Proj}_y + \text{CC}_{\text{credit}_y}) \quad [1.1]$$

Where:

$\Delta\text{GHG}_{\text{abs}}$  = Net absolute GHG emissions avoided due to operation of the project during the first 10 years of operation, in tCO<sub>2</sub>e.

$\text{Ref}_y$  = GHG emissions that would occur in the absence of the project in year  $y$ , in tCO<sub>2</sub>e.

$\text{Proj}_y$  = GHG emissions in the project scenario in year  $y$ , in tCO<sub>2</sub>e.

$\text{CC}_{\text{credit}_y}$  = credit for storage or utilisation of captured CO<sub>2</sub> in year  $y$ , in tCO<sub>2</sub>e, calculated in accordance with section 6.

y = year of the operation of the project.

For projects with multiple products and for hybrid projects,  $Ref_y$  and  $Proj_y$  represent the sum of the reference emissions and project emissions across all products and categories, respectively. For the case of hybrid projects, this will require adding together reference emissions and project emissions calculated using different sections of this methodology (see section 1.2.5).

#### 1.1.4 Relative GHG emission avoidance

The **relative GHG emission avoidance** potential shall be calculated by dividing the absolute emission avoidance ( $\Delta GHG_{abs}$ ) by the reference emissions ( $Ref_y$ ) cumulated over a 10-year period, as defined in section 1.1.2, using the equation below, and subject to the additional conditions detailed in this sub-section.

$$\Delta GHG_{rel} = \frac{\Delta GHG_{abs}}{\sum_{y=1}^{10} (Ref_y)} \quad [1.2]$$

Where:

$\Delta GHG_{rel}$  = Relative GHG emissions avoided due to operation of the project over the first 10 years of operation, in percent.

$\Delta GHG_{abs}$  = Net absolute GHG emissions avoided due to operation of the project during the first 10 years of operation, in tCO<sub>2</sub>e.

$Ref_y$  = GHG emissions that would occur in the absence of the project in year y, in tCO<sub>2</sub>e.

The relative GHG emission avoidance of a project cannot be negative. In case the absolute GHG emission avoidance of a project is zero or negative, the relative GHG emission avoidance shall be set to zero. In the unusual case in which a project has zero or negative cumulated reference emissions, but the absolute GHG emission avoidance of the project is positive, equation [1.2] cannot be used, and the relative GHG emission avoidance shall be set equal to 200%. This includes projects that consist only of direct air capture of CO<sub>2</sub>, capture of naturally released CO<sub>2</sub>, or CO<sub>2</sub> capture at an existing bioenergy plant without expansion of the capacity of the plant, for the purpose of permanent storage.

Note that all the projects must meet the relevant minimum requirement in terms of relative GHG emission avoidance, as specified in the Call Text.

#### 1.1.5 Net carbon removals

To be considered a net carbon removals project, the project must deliver net negative emissions in the project scenario, i.e.  $\sum_{y=1}^{10} (Proj_y - CC_{credit_y}) < 0$ , and be characterised by a relative GHG emission avoidance higher than 100%.

#### 1.1.6 GHG considered and global warming potentials

The greenhouse gases that must be taken into account in emissions calculations shall be those listed in the EU Emissions Trading System (EU ETS) Directive 2003/87/EC, Annex II: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF<sub>6</sub>).

Emission factors for all greenhouse gases shall be expressed in terms of CO<sub>2</sub> equivalent emissions on the basis of 100-year global warming potentials. The global warming potentials (GWPs) to be used are those in the Annex to Delegated Regulation (EU) 2020/1044.

The methodology is structured with the intention of capturing the most common emission sources. However, some GHG emissions are generally excluded from the scope of this methodology (see section 1.1.7).

Examples of emissions that may occur in stages in the lifecycle, and are included within the scope of this methodology (non-exhaustive list):

- Emissions of non-CO<sub>2</sub> greenhouse gases (e.g. methane and nitrous oxide) due to fuel combustion (including from combustion of renewable fuels).
- Emissions of non-CO<sub>2</sub> greenhouse gases resulting from chemical processes such as refrigerant manufacture.

### 1.1.7 GHG emission sources that are generally excluded

Generally, the following emissions are excluded for all projects unless specified otherwise. **These shall not be considered in the calculation** of absolute and relative GHG emissions avoidance.

- Emissions from capital goods (e.g. manufacture of machinery and equipment) and emissions during construction.
- Emissions due to extraction, processing, refining, distribution and storage of fossil fuels are excluded from the calculation in both the reference and project scenario. This allows aligning to the methodology for calculating the EU ETS benchmarks, which considers only combustion emissions of fossil fuels. This exclusion does not apply to non-hydrocarbon fuels (e.g. hydrogen and ammonia) that are derived from fossil sources (hydrogen must be assigned an emission factor according to the rules in section 1.4.3.2, other non-hydrocarbon fuels must be treated in the same way as other inputs).
- Fugitive CO<sub>2</sub> and CH<sub>4</sub> emissions due to well testing and well bleeding in geothermal power plants.
- Avoidance of methane emissions from alternative disposal of biomass inputs (e.g. their diversion from landfill).
- Indirect land use change (ILUC) emissions from supply of crops, and consideration of carbon debt in forestry.
- Emissions related to decommissioning of the plants and machinery at the end of life.
- Emissions related to employee commuting, business travels and waste generation at the administrative offices.
- Emissions due to the manufacturing process in the case of projects manufacturing innovative technologies and their components, when they are classified in one of the sectors specified in section 1.3.1.
- Emissions associated with the transport of raw materials, inputs, intermediate products, process waste sent to treatment, and distribution of final products shall not be considered in neither the project or reference scenario, unless otherwise specified in section 1.4.5.
- Emissions due to additional fuel demand for heating and cooling purposes and leakage emissions of hydrofluorocarbons (HFCs) and other refrigerant gases used in Heating, Ventilation, and Air Conditioning (HVAC) systems in mobility projects.

### 1.1.8 Additional non-CO<sub>2</sub> climate impacts associated with maritime and aviation activities

Maritime and aviation activities are associated with significant non-CO<sub>2</sub> climate impacts in addition to the non-CO<sub>2</sub> greenhouse gases identified in section 1.1.6. These additional non-CO<sub>2</sub> climate impacts derive mostly from emissions by aircraft of water vapour, formation of contrails (condensation trails) and cloudiness in the wake of aircraft, nitrogen oxides (NO<sub>x</sub>), soot particles and oxidised sulphur species, and releases of black carbon from vessels.

The significance of these additional non-CO<sub>2</sub> climate impacts has been confirmed, and it shall be characterised in terms of GWP on a 100-year basis and counted towards absolute GHG emission avoidance for maritime and aviation projects following the provisions in section 5.

### 1.1.9 Assumptions and data sources

To support the calculation of reference and project emissions, and for those parameters that are not prescribed by this Methodology, applicants may need to adopt assumptions to predict operational performance. Applicants should select assumptions that lead to the most accurate possible estimate of activity data (e.g. energy production or consumption), operational performance and resulting GHG emissions. Every assumption adopted in the calculations shall be justified and underpinned with adequate references to verifiable sources of information. In addition, the operational assumptions adopted for the purposes of GHG calculations shall be consistent with those adopted in the rest of the proposals.

Failure to provide adequate justification, or the use of assumptions that deliberately give an unduly favourable result may adversely affect the quality of the GHG emission avoidance calculations, and the evaluation of the project. In addition, the applicants must propose adequate monitoring measures in their monitoring plan (see section 1.5 and Appendix 3) to ensure adequate monitoring and reporting of the assumptions made at the application stage. Failure to provide an adequate monitoring plan may negatively affect the quality of the GHG calculations, and the resulting evaluation.

During project implementation, failure to demonstrate that the assumptions made at the application stage are representative of the actual operation of the project, may affect the overall GHG emission avoidance that can be achieved, which may have consequences in terms of grant disbursement as specified in the Call Text.

The Methodology provides additional guidance on the selection of relevant assumptions in the following sections, where relevant and depending on the type of project. For example, section 1.3.6 provides specific guidance for projects manufacturing innovative technologies and their components, and section 1.4.4 provides specific guidance on biomass-derived fuels and materials. In addition, Appendix 1 provides specific guidance for the selection of GHG emissions intensities and combustion emissions, when those parameters are not specified in the relevant section of the methodology, and need to be sourced from the literature, which is particularly relevant for the case of Energy Intensive Industry (EII) projects (section 2).

## 1.2 Principal product and specification of a sector for the purpose of the GHG emission avoidance calculations

When submitting the application, the applicant must identify the principal product that the project will produce and choose the sector under which the project falls accordingly (see Table 1.1). The sector must be determined based on the function of the principal product or service following the provisions in sections 1.2.1 and 1.2.2.

Table 1.1 provides an overview of sector classification associated with possible principal products or services and provides an indication of the section of the methodology to follow for the GHG emission avoidance calculation of a given type of project. The sector **must** be

chosen from the list provided, but the principal product is not always explicitly listed. The applicant should therefore specify this principal product in the application. For example, a project in the sector 'glass, ceramics and construction material' may specify its principal product as 'shatterproof glass' rather than identifying one of the more generic products listed below.

Applicants should **thoroughly review the Call Text** to check whether the product(s) that they intend to produce is eligible under the specific topic under which they intend to apply. In addition, applicants should note that the choice of a sector may influence the outcome of the evaluation and the scoring of the GHG criterion, see the Call Text for details.

**Note for applicants familiar with previous versions of the methodology:** *in previous versions of the methodology the products of a project could be divided into 'principal' and 'non-principal' products, and one of the principal products was to be identified as the 'main aim of the project' and used to determine the sector. The use of this language has been changed in this version, so that only a single product is defined as the principal product and determines the sector, while the categorisation of non-principal products has been retired.*

Table 1.1. Sector classification and methodology section

CATEGORY <sup>2</sup>	SECTOR <sup>3</sup>	PRODUCTS/SERVICES <sup>4</sup>	SECTION
Energy Intensive Industries (EII)	Refineries	fuels (including e-fuels, bio-fuels)	Section 2
	Iron & steel	coke iron iron ore steel cast ferrous metal products other ferrous metal products or substitute products, please specify	Section 2
	Non-ferrous metals	aluminium, precious metals, copper, other non-ferrous metal, cast non-ferrous metal products, other non-ferrous metal products or substitute products, please specify	Section 2
	Cement & lime	cement cement clinker lime, dolime, sintered dolime other cement or lime products or substitute products, please specify	Section 2
	Glass, ceramics & construction material <sup>5</sup>	flat glass container glass glass fibres other glass products tiles, plates, refractory products	Section 2

<sup>2</sup> Categories are derived from the legal basis – Article 10(a) of the EU ETS Directive

<sup>3</sup> To fall in one of the energy intensive industry sectors, the principal product of the project must be or must substitute a product whose conventional production is covered by Annex I of the EU ETS Directive. Substituting a product may include substituting the function of a product.

<sup>4</sup> The lists of products given for each sector are non-exclusive and most give 'other products' as an option, where applicants are expected to specify the principal product and other product(s) in the GHG calculator.

<sup>5</sup> The sector 'Glass, ceramics & construction material' is a combination of the EU ETS activities 'Glass and ceramics', 'Mineral wool' and 'Gypsum'.

CATEGORY <sup>2</sup>	SECTOR <sup>3</sup>	PRODUCTS/SERVICES <sup>4</sup>	SECTION
		bricks houseware, sanitary ware other ceramic products mineral wool gypsum and gypsum products other construction materials or substitute products, please specify	
	Pulp & paper	chemical pulp mechanical pulp paper and paperboard sanitary and tissue paper other paper products or substitute products, please specify	Section 2
	Chemicals	organic basic chemicals inorganic basic chemicals nitrogen compounds plastics in primary forms synthetic rubber textiles other chemical products or substitute products, including bio-based products, please specify	Section 2
	Hydrogen	hydrogen	Section 2
	Manufacturing of components for energy intensive industries (in case of production of electrolyzers)	electrolysers and their components recycling of materials for production of electrolyzers and their components other, please specify	Section 2
	Other <sup>6</sup>	Electricity heat other, please specify	Section 2
Energy Intensive Industries (EII) where CCS or CCU is the main aim of the project <sup>7</sup>	Choose an EII sector	choose an EII product	Section 2 and section 6
	EII / Other	CO <sub>2</sub> Transport	Section 2 and section 6
	EII / Other	CO <sub>2</sub> Storage	Section 2 and section 6
Renewable energy (RES)	Wind energy	non-dispatchable electricity heating cooling	Section 3

<sup>6</sup> The sector 'Other' covers all other activities that fall under the EU ETS. This particularly covers combustion to generate heat and electricity. This could include projects that improve efficiency in conventional combustion plants for electricity generation or make use of CCS in the power sector.

<sup>7</sup> Projects capturing CO<sub>2</sub> for geological storage or use are assigned to the sector where they capture the CO<sub>2</sub> or to the sector corresponding to the CCU product they produce, as specified in section 1.2.3. Projects that transport and/or geologically store CO<sub>2</sub> captured outside the system boundary are assigned to sector 'EII/Other'.

CATEGORY <sup>2</sup>	SECTOR <sup>3</sup>	PRODUCTS/SERVICES <sup>4</sup>	SECTION
	Solar energy	non-dispatchable electricity heating cooling	Section 3
	Hydro/Ocean energy	non-dispatchable electricity dispatchable electricity heating cooling	Section 3
	Geothermal energy (including ambient energy through heat pumps)	dispatchable electricity heating cooling	Section 3
	Bioenergy (also indicated as 'bio-electricity' in Part C of the application form)	dispatchable electricity heating cooling	Section 3
	Use of renewable energy outside Annex I <sup>8</sup>	use of renewable energy in water desalination use of renewable energy in wastewater treatment other, please specify	Section 3
	Manufacturing of components for renewable energy	wind plants and their components solar plants and their components hydro/ocean plants and their components geothermal / ambient plants (including heat pumps) and their components recycling of materials for production of RES plants and their components stationary fuel cells using biofuels or RFNBOs, and their components other, please specify	Section 3
Energy storage (ES)	Intra-day electricity storage	electricity	Section 4
	Other energy storage	electricity heating cooling	Section 4
		hydrogen-based energy storage e-fuel-based energy storage	Section 4 (projects producing hydrogen or e-fuels shall only be considered under the Energy Storage

<sup>8</sup> The sector 'use of renewable energy outside Annex I' is aimed at projects whose main innovation is linked to the use rather than production of renewable electricity, heating and/or cooling and the final product or service falls outside Annex I activities.

CATEGORY <sup>2</sup>	SECTOR <sup>3</sup>	PRODUCTS/SERVICES <sup>4</sup>	SECTION
			category when storage of excess renewable energy is a primary aim of the project)
	Manufacturing of components for energy storage	batteries and their components recycling of materials for production of batteries and their components other, please specify	Section 4
Mobility (MOB)	Maritime	Transportation of goods Transportation of passengers Manufacturing of components for vessels other, please specify	Section 5
	Aviation	Transportation of goods Transportation of passengers Manufacturing of components for aircrafts other, please specify	Section 5
	Road transport	Transportation of goods Transportation of passengers Manufacturing of components for road vehicles other, please specify	Section 5
Buildings (BIL)	Buildings	Various, please specify	Various. Refer to section 1.2.4.

### 1.2.1 Choice of sector based on the principal product and corresponding reference product

In most cases, a project will produce a single principal product that will replace a similar reference product and will have a single possible use or function. In this situation, it is straightforward to choose the sector that corresponds to the principal product.

*Example: The sole product of the project is steel produced in an innovative way to substitute traditional steel production. The principal product is steel and the relevant sector to choose is the steel sector under EII/Iron and Steel.*

*Example: If a project intends to generate electricity through installation of photovoltaic panels, the relevant sector to choose is RES/Solar energy.*

In some cases, the principal product from a project could be used in more than one sector. For example, some products could be used either as chemicals under sector EII/Chemicals, or could be used as fuel under sector EII/Refineries. In such cases, the applicant must choose the sector associated with the most common use of the principal product unless the project includes specific actions and tasks related to the use of the principal product in less common application. Similarly, in calculating the emissions in the reference scenario for each product (see section 1.4.1), the applicant must determine the appropriate emission factor based on the most common use of the product, unless the project includes specific actions and tasks related to the use of the product in a less common application.

*Example: The sole product of a project is ethanol, and the project does not involve specific actions and tasks, nor investments, related to the use of ethanol as a chemical. The main market for ethanol in the EU is as transport fuel, and therefore the applicant must apply in the sector EII/refineries rather than EII/chemicals. The reference scenario emissions shall be determined in accordance with EII Case 4 (transport fuel substitutes).*

In some cases, a principal product from a project may be physically different (including having a different chemical composition) to the conventional product that it will replace (the reference product). In these cases, the relevant sector associated to **the substituted reference product** shall be chosen for the application. The applicant must clearly specify the principal product and the associated reference product. The reference emissions will be determined by the product that is being replaced. In such cases applicants must credibly demonstrate the claimed use of the product, for example by providing draft contracts, letters of intent from the buyers, or other relevant supporting documents.

*Example: A project produces a novel biomass-based packaging material and the applicant states that it will replace polystyrene in packaging applications. The category/sector/reference product for the application will be EII/chemicals/polystyrene with a reference scenario based on polystyrene production. The applicant must credibly demonstrate that the packaging product will replace polystyrene in practice.*

In cases where the principal product could potentially replace either a physically similar<sup>9</sup> conventional product or a physically different conventional product, the applicant must select the sector of the physically similar conventional product unless the project includes specific actions and tasks related to the use of the product to substitute a physically different product. Similarly, in calculating reference scenario emissions for each product (see section 1.4.1) the applicant must determine the appropriate emission factor based on production of the physically similar conventional product, unless the project includes specific actions and tasks related to the use of the product to substitute a physically different product.

*Example: A project produces a cardboard product, and the applicant states that it could be used to replace PVC products in a specified application. If the project includes specific actions and tasks and investments related to setting up and operating a manufacturing plant to use the cardboard product in that PVC application, then the application may be submitted in the category/sector EII/Chemicals with a reference scenario based on PVC production. If the project does not include specific actions, tasks, and investments of this sort, then the application must be submitted in the category/sector EII/Pulp & paper.*

During project implementation, copies of offtake contracts will have to be submitted to ensure that the claims made with respect to the intended use of the product and the related GHG emission avoidance are verified. If the project does not reach the expected GHG emissions avoidance due to a change in the use of the product, this may have implications on grant disbursement.

### 1.2.2 Choice of sector when a project produces more than one product

**The application may only be submitted for one sector.** However, some projects may produce multiple products associated to more than one sector, and potentially associated to multiple categories. For such projects, the applicant must select the appropriate sector

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<sup>9</sup> A physically similar conventional product is a conventional product with a similar or identical chemical composition and similar or identical physical properties.

for the application based on the principal product, as explained below. The other products produced by the project do not affect the choice of the sector. Note that projects that include products associated to more than one category are referred to as **hybrid projects** (see section 1.2.5).

In case a project will earn revenues from the sale of a single product, it is straightforward to identify the principal product as the only product produced by the project.

In case a project will earn revenues from the sale of **several products**, one principal product must be chosen that reflects the main aim and innovation of the project. This product will determine the sector for the application. The main aim should be identified primarily by considering the revenues from the products or services that the project will produce or deliver, but the applicant should also consider to which product the main innovation introduced by the project relates to. In some cases, the revenue and innovation in a project will be evenly distributed across products in more than one sector – in those cases, the applicant may discretionally choose which sector to apply in.

*Example: A steel producer proposes a project to modify its existing plant in order to produce ethanol from carbon monoxide in the flue gas in addition to steel products. Ethanol will be sold as an alternative transport fuel for blending in gasoline for road transport. Both steel and ethanol are identified as principal products. The applicant must therefore decide whether to apply in the sector 'EII/Iron and steel' or in the sector 'EII/Refineries'. In a project of this sort, the produced steel will normally represent a larger revenue stream than the produced ethanol. The main innovation introduced by the project, however, may lie in the conversion of flue gas carbon monoxide to ethanol. In this case, therefore, it may be appropriate for the applicant to identify the ethanol as the product that is the main aim of the project and apply in the sector EII/refineries, even though it does not represent the largest revenue stream for the modified facility. In any case, this choice must be well justified in the application documents.*

### 1.2.3 Choice of sector for CCU/S projects

In case of CCS projects that include the facility from which the CO<sub>2</sub> is captured within the system boundary of the project, the principal product must be set as the main output of the facility.

*Example: A carbon capture unit is added to an existing steel production plant. The principal product of the project is steel, and the relevant sector is EII/Iron and Steel.*

Projects for which the main aim is CCS based on direct air capture or capture of naturally released geological CO<sub>2</sub>, in which CO<sub>2</sub> is captured from the atmosphere or from a naturally occurring geological source, rather than from an industrial process, shall apply under category 'EII' and sector 'other' with the principal product identified as 'CO<sub>2</sub> storage' (see also section 2.2.5.7).

Projects that will transport and/or geologically store CO<sub>2</sub> captured outside the system boundary shall apply under category 'EII' and sector 'other' with the principal product identified as 'CO<sub>2</sub> transport' or 'CO<sub>2</sub> storage' (see also section 2.2.5.8, and section 6.2).

For projects including a CCU component, the sector shall be determined by consideration of the principal product of the project. If both the process from which the CO<sub>2</sub> is captured and the process in which the CO<sub>2</sub> is used are within the system boundary of the project, then both the product(s) from the process from which the CO<sub>2</sub> is captured and the CCU product(s) must be considered in the calculations, and the applicant must determine from these the principal product of the project following the guidance in section 1.2.2 above.

*Example: A carbon capture unit is added to an existing steel production plant and the captured CO<sub>2</sub> is used in plastic production. Both the steel plant and the plastic*

production plant are **within the system boundary** of the project. Both steel and plastic must be treated as products of the project. The principal product, and therefore the sector of the project, must be determined by considering the main innovation and sources of revenue for the project.

If the CO<sub>2</sub> capture occurs outside the boundaries of the project, and the CO<sub>2</sub> is brought in as an input, then one of the CCU products shall be identified as the principal product of the project. In case of multiple CCU products, the guidance in section 1.2.2 above applies.

*Example:* A project sources captured CO<sub>2</sub> from **outside the system boundaries** for it to be used in plastic production. The principal product of the project is plastic, and the relevant sector is EII/Chemicals.

Note that in the case that CO<sub>2</sub> is captured for utilisation from a project in the RES or MOB categories, then the CCU product(s) produced will normally fall under the EII category, and a hybrid RES + EII or MOB + EII application may be required (see section 1.2.5).

See section 6 for additional guidance on the calculation of the carbon capture credit. See section 2.2.6.2 for additional guidance on EII projects with a component of CCS, and section 2.2.6.3 for additional guidance on EII projects with a component of CCU.

Note that, as specified in section 6.1, a carbon capture credit cannot be claimed when submitting an application for a manufacturing of components project (section 1.3).

#### 1.2.4 Buildings projects

This sub-section applies to projects focusing on innovative solutions that reduce GHG emissions in Buildings (BIL). Such projects shall apply the general provisions outlined in section 1 and in the Annexes as relevant. In addition, such projects should refer to the chapters of the methodology that best correspond to their project activity, namely: EII (section 2), RES (section 3), or ES (section 4).

For example, a project that intends to produce electricity and/or heat for use in buildings should use section 3 of the Methodology if the heat or electricity produced or used is of renewable origin, including bio-origin. Conversely, the project should use section 2 of the methodology if the heat or electricity is of a different origin. In addition, a project that intends to produce innovative construction materials for use in buildings should apply section 2 of the methodology.

The list of examples in this section is not exhaustive.

#### 1.2.5 Hybrid projects

When a project combines activities related to more than one category, such as EII, RES, ES, MOB, this will be considered a hybrid project. In such cases, the applicant shall still choose a main sector and associated principal product that best corresponds to the main aim of the project (see 1.2.2).

*Example:* a hybrid project involves installation of a large wind power generation facility coupled to an electrolyser producing hydrogen. The export of electricity, in excess to the electricity used by the electrolyser, is anticipated to generate ten times as much revenue as the sale of hydrogen and the integration of the two installations is innovative in terms of process and technology. The applicant should choose RES/wind energy as the main sector.

*If, however, the project's innovation is related only to the electrolyser and it is not related to the wind farm, nor the integration between the two facilities, then it would NOT be appropriate to make a hybrid application. The applicant may instead consider making an application for the electrolyser only under EII/hydrogen (i.e.*

*considering hydrogen as the principal product and treating electricity production as out of scope).*

In cases where the expected revenues for products in different sectors under a potential hybrid project are comparable (i.e. cases where a lower-revenue product would generate at least 70% of the expected revenue of the highest-revenue product) and the innovation is associated with a lower revenue product, the applicant may choose the main sector based on the more innovative product rather than the product with the highest revenue share. The applicant shall then clearly identify the distinct parts in the project relating to the relevant categories so that the calculations follow the respective sections of the methodology.

#### 1.2.5.1 Calculation of GHG emission avoidance for hybrid projects

Hybrid projects may involve elements of any two or more of the categories EII, RES, ES and MOB. Such hybrid projects should combine the various components and clarify the system boundaries for each part. The GHG emissions from each component need to be then summed up while removing double counting. The following sub-sections 1.2.5.2 to 1.2.5.5 provide specific guidance on some more common combinations.

Hybrid projects shall calculate their reference emissions and their project emissions by summing up the single components calculated according to the relevant sections of the methodology (e.g. EII, RES, ES, MOB) while removing double counting of avoidance and/or emissions, if any. Then, the absolute GHG emission avoidance is calculated as the difference between the cumulated reference emissions, and the cumulated project emissions, while the relative GHG emission avoidance is calculated as the cumulated absolute GHG emission avoidance divided by the cumulated reference emissions.

Since applicants are allowed to upload only one spreadsheet at the application stage, for the case of hybrid projects, the applicant needs to combine two or more GHG calculators into one single file. For instance, for a hybrid EII + RES application the applicant shall add a copy of the tabs 'Reference emissions RES', 'Project emissions RES' and 'Conversion factors RES' from the RES GHG Calculator into the EII GHG Calculator. If the project involves other categories such as ES or MOB, then the file shall include a copy of the 'Reference emissions', 'Project emissions' and 'Conversion factors' tabs from the corresponding GHG Calculator as well. There is no need to duplicate the remaining tabs, e.g. for 'Assumptions', 'Net carbon removals', etc. Applicants can fill all the required information in one single version of the tab.

Note that, after filling-in the project data, calculating the GHG emissions in the reference and project scenario for each of the project categories and removing any double counted emissions, applicants shall adjust the links to other tabs in the 'Summary per year' sheet, to ensure they capture the total reference emissions and project emissions from all the relevant categories. The formulas in the 'Net carbon removals' sheet may also need to be adjusted, while the formulas in the 'Summary' sheet should not be modified.

#### 1.2.5.2 Energy intensive industries (EII) and renewable energy (RES) projects

For a project including EII and RES parts, the applicant should consider submitting a hybrid application. A typical case could be a project that proposes an innovative EII installation coupled with a RES generation plant, which will both supply power to the EII installation and export excess power to the grid. In this situation, only the portion of electricity exported to the grid can be claimed as part of the RES calculations, and result in additional emission savings.

Projects generating energy from partly renewable fuels (such as waste-to-energy plants where the consumed waste is partly biogenic) must make hybrid applications considering the renewable part under RES and the non-renewable part under EII. For projects involving carbon capture, refer also to the examples provided in section 6.4.

Applicants should pay particular attention to use in the calculation the correct emission factor for electricity for each part of the project. An applicant should use the appropriate RES EF value from Table 1.3 in section 1.4.3.1 for the net electricity (dispatchable or not) exported from the RES part of the project, even if the hybrid project application is submitted for an EII sector as its main sector. The emissions accounting of EII and RES parts follows the principle of 'adding up while removing double counting'.

*Example:* A project proposes a hydrogen electrolyser, with principal product hydrogen, combined with an on-site wind energy farm. During wind peaks, the project plans to export half of the power to the grid. The project can be submitted as a hybrid project with an EII part (EII/hydrogen) and a RES part (RES/wind energy). Only the portion of electricity exported to the grid can be included as part of the RES calculations.

*Conversely, in case all the renewable energy will be used in the production of hydrogen with no electricity export, then the calculation follows only the EII section, and the project does not need to be considered as hybrid.*

For a hybrid EII+RES project, the applicant shall demonstrate that the power from the RES part will be preferentially supplied to local use in the EII part, with only the remainder exported.

*Example:* A project intends building a RES facility that supplies 100% of its power to the grid and it is co-located in an EII facility. In such a case the applicant may consider submitting two separate funding applications for the RES and EII facilities, but cannot submit a hybrid application.

#### 1.2.5.3 Energy intensive industries (EII) and energy storage (ES) projects

A project that includes energy storage in combination with an EII plant should split the GHG calculation into two contributions based on section 2 and section 4 respectively. The EII emissions and the ES emissions need to be then summed up while removing double counting.

Energy intensive industry projects aiming to claim emissions savings from timed operation must apply as hybrid EII+ES projects following the provisions in section 2.2.7.4.

#### 1.2.5.4 Renewable energy (RES) and energy storage (ES) projects

Projects that include production of renewable energy and storage of energy should apply as hybrid projects combining a RES component and an ES component. The application should clarify the system boundaries for the two parts. The RES emissions and the ES emissions need to be then summed up while removing double counting.

The correct emission factors shall be used for the RES and ES component of the project. Refer to the provisions in this section and to section 1.4.3 for the relevant emission factors for dispatchable and non-dispatchable electricity for the RES and ES components.

*Example:* Projects that generate renewable electricity and include a storage component at times when there is an excess of electricity in the grid, e.g. smart grid applications, are an example of hybrid projects. The application should clarify the split for their feed-in of grid electricity into a storage component and the residual uncontrolled feed-in. The emission avoidance of the storage component shall be calculated as in section 4. The emission avoidance of the uncontrolled feed-in shall follow the calculation of section 3.

For a hybrid RES+ES project, the applicant must demonstrate that the power from the renewable energy facility will be supplied to the energy storage facility when the timing of power generation is consistent with the needs of the storage facility. These projects can

claim emission avoidance under the RES methodology for any excess power exported. This also means that the combined facility shall never be assumed to store power from the grid at the same time as it is discharging power to the grid.

*Example: Consider a hybrid project including a wind farm coupled with a battery storage facility. If the wind farm is generating power during a period during which the battery is being charged, the wind power should be used to charge the battery. Any excess power not required for battery charging may then be exported to the grid. To calculate the GHG emissions avoidance the equations described in sections 3 and 4 should be combined, and any double counted emissions removed.*

#### 1.2.5.5 Fuel production under energy intensive industries (EII) combined with fuel switch under mobility (MOB)

Projects aiming exclusively at producing fuels for transport applications shall apply under the EII category. However, projects that include both the production phase of the fuel and the use phase of that fuel in vessels, aircrafts, or road vehicles may apply as hybrid projects combining the EII category (for production of the fuel) with the MOB category.

In this way, MOB projects operating in the aviation and maritime sector may claim eventual benefits from using the novel fuel in terms of reduced additional non-CO<sub>2</sub> climate impacts (e.g. black carbon in maritime or contrails in aviation). In such hybrid projects, CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from fossil fuel combustion that the project avoids by fossil fuel substitution shall be included in the reference scenario for the EII part of the calculation, by using the relevant fossil fuel comparator. Therefore, those terms shall be excluded from the MOB part of the calculation to avoid double counting (i.e. from equation [5.1]).

### 1.3 Manufacturing of innovative technologies and their components

Some projects involve the **manufacturing of components** to be used in specific renewable energy generation systems, energy storage systems, electrolysers, fuel cells, or mobility systems, including the manufacturing of the entire systems (see Table 1.1, section 1.2). Such projects shall follow the rules in this section and calculate emissions reductions based on the intended use of the manufactured components rather than on the manufacturing process itself.

The applicants should carefully review the Call Text to check whether the component they intend to manufacture is eligible under the topic in which they intend to apply. Note that, as specified in section 6.1, a carbon capture credit cannot be claimed when submitting an application for a manufacturing of components project following the rules in this section.

#### 1.3.1 Choice of a sector for projects manufacturing innovative technologies and their components

Projects covered under this section shall select the dedicated manufacturing sector under the relevant category **based on the type of component manufactured and its intended use** (see section 1.2):

- electrolysers and their components (EII/Manufacturing of components for energy intensive industries);
- components for renewable energy generation, including heat pumps and fuel cells for stationary applications (RES/Manufacturing of components for renewable energy);
- components for energy storage systems, including batteries for stationary applications (ES/Manufacturing of components for energy storage);

- components for maritime vessels, including batteries and fuel cells for application in maritime vessels (MOB/Maritime).
- components for, aircrafts, including batteries and fuel cells for application in aircrafts (MOB/Aviation).
- components for road vehicles, including batteries and fuel cells for road transport applications (MOB/Road transport).

Eligible projects that manufacture components that are not listed above **may not use the rules in this section, may not apply in a 'manufacturing of components' sector** under category EII, RES, and ES, and may not apply the manufacturing methodology under category MOB, but may be permitted to apply in another sector following the relevant provisions as applicable.

### 1.3.2 Definition of component

Projects covered under this section must produce specialised components, which include some specialised materials. Projects producing bulk materials shall not apply as 'manufacturing of components' projects under category EII, RES and ES, nor apply the manufacturing methodology under category MOB, and they shall not use the provisions in this section. However, they may be permitted to apply in another sector, for example a relevant EII sector, following the relevant provisions as applicable.

For a manufactured product, including a recycled product, to be considered a component, it shall have all the following characteristics distinguishing it from bulk materials:

- It shall be either a part of the energy or mobility system or a specialized material used in the energy or mobility system and could be replaced with a spare part or with replacement material.
- When leaving the manufacturing facility, it already has the intended specialized function relevant to the final purpose of the energy or mobility system.
- It is innovative or produced/recycled in an innovative way.
- It is in a ready to use form, i.e. it can be directly assembled or integrated into the energy or mobility system. Specialised materials must be in their final chemical form for utilisation.

*Example: bulk materials that can be used for manufacturing of batteries, but also for other purposes, are not considered components. Instead, materials to be solely used in batteries can be considered components, e.g. specific battery-grade anode and cathode materials. Other examples of specialised materials are the cooling fluid for a heat pump, and electrolytes.*

The methodology for the manufacturing of a component may be applied to the manufacturing of a whole consumer product, with the component being the whole consumer product in this case (see section 1.3.3 and 1.3.5), and it may include the assembling of sub-components procured from a supplier external to the project.

*Example: the manufacturing of innovative electric vessels does not require the manufacturing of the electric engines as part of the project but may be limited to the assembly of the innovative vessels with the engines purchased from an external supplier.*

### 1.3.3 Definition of facility and consumer product

Components manufactured by projects covered under this section may be used in facilities which themselves produce product(s) within the scope of the Innovation Fund, or may be used in relevant consumer products:

- For projects manufacturing components for electrolyzers (EII/manufacturing of components for energy intensive industry), the component shall be considered to be used in a fully functioning electrolyser, which can operate as a facility or can be sold as a consumer product.

*Example: components for electrolyzers may be used in large-scale electrolyzers for the industrial production of hydrogen (facilities), or in small-scale electrolyzers for household or commercial use (consumer products).*

- For projects manufacturing components for renewable energy generation, including heat pumps (RES/manufacturing of components for renewable energy), the component may be used in a facility or in a consumer product.

*Example: components for solar panels may be used in solar farms (facilities) or in solar panels for household use (consumer products).*

- For projects manufacturing components for energy storage, including batteries for stationary applications (ES/Manufacturing of components for energy storage), the component may be used in a facility or in a consumer product.

*Example: component for batteries may be used in large-scale installations for intra-day electricity storage (facilities) or in batteries for household use (consumer products).*

- For projects manufacturing components for aircrafts, vessels, or road transport vehicles, including batteries and fuel cells for transport applications (MOB/Aviation, MOB/Maritime, MOB/Road Transport), the relevant consumer product is a functioning aircraft, vessel or road vehicle.

#### 1.3.4 Calculation of GHG emission avoidance for projects manufacturing innovative technologies and their components

For the purpose of the GHG calculations, applicants shall bring within the system boundary the operation of the facilities or consumer product that will be built using the components manufactured by the project and supplied to the market (subject to the requirements in section 1.3.5 regarding allocation of emissions savings proportionally to the cost share of the component produced with respect to the total cost of the facility or consumer product).

The manufacturing plant producing the components shall be outside the system boundary of the GHG calculation. Any additional GHG emission reduction compared to the traditional processes of components manufacturing is outside of the scope of the GHG emission avoidance methodology for manufacturing of components projects.

For manufacturing of component projects, the emissions in the project and reference scenarios are calculated considering that the components produced by the project (over the first 10 year of operation of the manufacturing plant) will be installed in relevant facilities and/or consumer products where they will be used for a use period (UP) of 5 years. Unless, the lifetime of the component is expected to be less than five years, in which case the emissions shall be calculated based on the expected lifetime of the component (i.e. the UP shall be set equal to the expected lifetime of the component).

*Example: A manufacturing plant produces wind turbine blades. The manufacturer expects the blades to remain in service for 20 years. The emission avoidance calculations will consider that the blades produced each year will be used over a period of 5 years, corresponding to the maximum allowed by the methodology.*

*Example: A manufacturing plant produces an innovative component for road vehicles with an expected lifetime of 3 years. The emission avoidance calculations*

*will consider that the components produced each year will be used over a period of 3 years, corresponding to its lifetime.*

### 1.3.5 Allocation of emissions avoidance based on the cost share of the component

Applicants can only claim a portion of the emission avoidance generated by the facility or consumer product in which the manufactured component is used. This portion shall be proportional to the cost of the single component as a share of the total capital cost of the relevant facility or of the total production cost of the relevant consumer product ( $CS_{\text{component}}$ ) as detailed below:

- For **components used in a facility**, the total capital cost of a facility is the sum of the cost of the manufactured component plus the cost(s) of the remaining components constituting a typical operational facility. Costs and expenses incurred in connection with design, engineering, procurement, construction, commissioning and testing of the project shall not be considered as part of the total capital cost of a facility for the purposes of this calculation.
- For **components used in consumer products**, the cost share ( $CS_{\text{component}}$ ) is defined as the ratio of the cost of the single component divided by the production cost of the relevant consumer product in which the component will be used. Alternatively, the cost share for components used in consumer products can be calculated using price assumptions as a proxy for cost assumptions. In this case, the cost share ( $CS_{\text{component}}$ ) is defined as the ratio of the price of the single component, excluding sales taxes, divided by the retail price of the consumer product in which the component will be used, excluding sales taxes. For projects manufacturing a whole consumer product as defined in section 1.3.3, the  $CS_{\text{component}}$  can be equal to 100%.

These calculations shall be based on a typical use case for the component and on assumptions coherent with the relevant cost and financial calculations, where relevant. Applicants must provide appropriate references to justify this cost assessment.

*Example: A manufacturing plant produces wind turbine blades to be used in a wind farm (the facility). The project shall consider only a share of the reference and project emissions proportional to the share of the capital cost of a wind farm facility spent on the blades. If the applicant presents evidence that the rotor blades represent 25% of the total capital cost of a wind turbine installation, then the project shall include only 25% of the associated reference and project scenario emissions in its GHG calculations.*

*Example: A manufacturing plant produces an innovative component for road vehicles (the consumer products). The project shall consider only a share of the reference and project emissions proportional to the ratio of the cost of the innovative component divided by the production cost of the relevant road vehicle. The applicant may choose to use price assumptions as a proxy for cost assumptions, in which case the sale price of the innovative component, excluding sales taxes, must be divided by the retail price of the relevant road vehicle, excluding sales taxes.*

The relevant facility or consumer product to be used for this purpose is the one in which the component is intended to be used. The same component use must be assumed when calculating the cost share of the component as when determining the sector and when calculating project and reference emissions.

If a manufacturing project will produce components with different possible uses, distinct products may be defined for each of the intended use, and a principal product may be selected among these, which need to be well justified.

*Example:* A project will manufacture fuel cells. The fuel cells are specifically designed to be used in road transport vehicles (i.e. the consumer product). The applicant must apply in the sector MOB/Road transport, and must calculate the cost share of the component as the ratio between the cost of the fuel cell and the production cost of a representative fuel cell vehicle. The applicant is not permitted to calculate the cost share based on the use of the fuel cell for stationary applications. The applicant should also justify the intended use of the fuel cells in road transport applications and the corresponding cost assumptions by providing technical specifications, letters of intent and/or other relevant supporting documents.

*Example:* A project will manufacture fuel cells. Some of the fuel cells are designed to be used in road transport vehicles, while others are designed for use in stationary applications. The applicant must make a hybrid application treating the different types of fuel cells as two different products, considering the stationary fuel cells following the RES category rules in section 3 and the fuel cells for vehicles following the mobility category rules in section 5. The sector for the application shall be chosen considering the revenue share and level of innovation for each of the fuel cell types, and selecting the principal product following the rules in section 1.2.2. A different cost share shall be calculated for each part of the hybrid application, one based on the production cost of a fuel cell vehicle as consumer product, and the other based on the capital cost of a representative stationary fuel cell facility. The applicant should justify the two intended uses of the fuel cells, the corresponding cost assumptions, and the volume of products allocated to each use, by providing technical specifications, letters of intent and/or other relevant supporting documents.

### 1.3.6 Assumptions for projects manufacturing innovative technologies and their components

The operating conditions of the facility or consumer product in which the component will be installed shall be estimated based on credible assumptions, and shall be well justified, for example by providing technical specifications, letters of intent and/or other relevant supporting documents. Applicants will have to justify the rationale for the projected performance of the component produced, as well as of other components that will be needed in the operational facility or consumer product, including performance degradation where relevant.

The applicant may not assume that the facility or consumer product equipped with a component manufactured by the project will have better performance or will be operated in a way which increases the resulting emission avoidance with respect to standard practice, unless these are a direct consequence of the installation of the innovative component manufactured by the project.

The intended use of the facility or consumer product equipped with the manufactured component may have an impact on the GHG emission avoidance calculations (see section 1.3.4). Therefore, the choice of the facility or consumer product in which the component will be used must be well justified, for example by providing technical specifications, letters of intent and/or other relevant supporting documents.

In case the actual user of the components produced during project implementation differs from, or is not compatible with, the intended use specified in the application, the project may not be able to reach the expected GHG emission avoidance, with potential implications on grant disbursement.

Applicants shall estimate the number of components manufactured by the project and supplied to the market based on the expected output of the manufacturing plant and the market potential, and in line with the assumptions made in the rest of the proposal

concerning the operation of the plant, including relevant cost calculations and financial calculations. The actual number of components manufactured and provided to the market must be monitored, reported, and demonstrated with relevant supporting documents during project operation.

Refer to sub-section 2 of Appendix 3 for relevant monitoring and reporting provisions.

#### 1.3.6.1 Default assumptions for projects manufacturing components for electrolyzers and hydrogen fuel cells for stationary applications

Applicants with projects manufacturing electrolyser components (EII/Manufacturing of components for energy intensive industries) may assume that the electrolyzers will operate for 5,000 hours a year (SWD(2022) 230) and may choose to use the following electrolyser capital cost assumptions (Annex to GB decision no. CleanHydrogen-GB-2022-02) or may provide their own project specific values:

Electrolyser technology	Alkaline	PEM	Solid oxide	Anion exchange
Capital cost	480 €/kW	700 €/kW	520 €/kW	550 €/kW

Applicants with projects to manufacture hydrogen fuel cell components for stationary applications (RES/Manufacturing of components for renewable energy) may use the following fuel cell capital cost assumptions, or may provide their own project specific values:

Fuel cell technology	< 5 kW	5-50 kW	51-500 kW
Stationary SOFC system (CHP)	8,000 €/kW	7,500 €/kW	7,500 €/kW
Stationary PEMFC system (power generation)	5,500 €/kW	2,150 €/kW	1,550 €/kW

## 1.4 Calculation of GHG emission avoidance

The calculations of GHG emission avoidance should comprehensively cover the emissions in the reference scenario and in the project scenario. In the following, some general guidance is provided. Detailed calculation guidance is provided by project category in section 2 (EII), section 3 (RES), section 4 (ES), and section 5 (MOB), and in section 6 concerning the calculation of a carbon capture credit.

### 1.4.1 The reference scenario

The reference scenario should reflect the production of a quantity of reference product(s) that provides an equivalent function to the product(s) produced by the project. The reference scenario should be based on the production of the reference product(s) in a way consistent with current practice in the relevant sectors. If a product produced by the project has more than one possible use, the applicant must determine the appropriate reference product based on the most common use of that product, unless the project includes specific actions and tasks related to the use of the product in a less common application.

Tables 1.2 and Table 1.3 provide examples of reference scenarios for a number of possible products. Typically, the corresponding default emission factors are also given in the spreadsheet-based GHG calculators.

Table 1.2. Examples of reference scenario emissions

Category / Sectors / products	Reference scenario emissions based on:
EII	EU ETS benchmark(s), IF fossil fuel comparators (see Table 2.2), or other cases as specified in section 2.2.5.
EII / Refineries / Biofuels	IF fossil fuel comparators (see Table 2.2)
EII / CCS	CO <sub>2</sub> is released (i.e. not captured) /available in atmosphere
RES / Non-dispatchable renewable electricity	2030 electricity mix
RES / Renewable heat	EU ETS benchmark for heat
RES / Renewable cooling	2030 electricity mix
RES / Dispatchable renewable electricity	Single-cycle natural gas turbine (used for peaking power)
ES / Energy storage	Single-cycle natural gas turbine (used for peaking power)
ES / Electricity grid auxiliary services	Combined-cycle natural gas turbine (partial load)
ES / Heat	EU ETS benchmark for heat production
ES / Hydrogen storage	EU ETS benchmark for hydrogen production
MOB/Maritime	A conventional vessel running on heavy fuel oil
MOB/Aviation	A conventional aircraft running on jet A1 Kerosene
MOB/Road transport	A conventional road vehicle running on conventional diesel

(<sup>1</sup>) Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (Recast), Annexes V and VI.

Source: European Commission internal elaboration.

*Example:* A project converts biogenic residues into heat and sells the heat for industrial and residential use. The reference scenario for renewable heating is pre-set as the EU ETS benchmark for heat (see Table 1.2).

*Example:* A project produces hydrogen. The reference scenario is the EU ETS benchmark for hydrogen.

#### 1.4.2 Relationship to the calculation of relevant costs

The GHG emission avoidance calculations and the relevant cost calculations should generally be aligned and based on coherent assumptions, where relevant. For example, in terms of yearly production volumes, plant operation, and quantity of components yearly

supplied to the market. However, applicants should be aware that the scope of the relevant cost methodology and the scope of the Methodology for GHG Emission Avoidance Calculation may differ in some cases.

*Example:* In a CCS project, in the GHG methodology, applicants must consider downstream emissions along the entire CCS chain, including emissions which may fall outside the scope of the project in terms of capital investment.

*Example:* In a manufacturing facility, the GHG methodology focuses on the emissions during the use of the components, while the relevant cost methodology considers the construction and operation of the manufacturing plant.

### 1.4.3 GHG emission factors for electricity, hydrogen, and heat

The calculation methodology requires the use of different emission factors for electricity, hydrogen and heat depending on whether they are inputs to, or outputs from a project, and on other contextual factors such as the project category. This section details which emission factors to use in each case.

#### 1.4.3.1 *Electricity*

The EU is expected to achieve full decarbonisation of grid electricity by 2050. In order to assess Innovation Fund applications based on their long-term potential in a decarbonised economy, the GHG emissions for Innovation Fund projects shall be calculated treating the **grid electricity consumed by a project as having zero associated GHG emissions, which corresponds to the projected average emissions of the 2050 grid electricity mix**. Applicants must still report expected electricity consumption by their projects for knowledge-sharing purposes.

The Innovation Fund also seeks to support projects that will make a contribution to **delivering a fully decarbonised grid**. The GHG emissions for projects that will supply non-dispatchable **renewable** energy shall be calculated treating the electricity replaced by the project as having the expected average emissions of the 2030 grid electricity mix (with an emission factor of 48.8 tCO<sub>2</sub>e/TJ [0.176 tCO<sub>2</sub>e/MWh], European Commission, 2021), while the GHG emissions for projects that provide dispatchable renewable electricity or energy storage shall be assessed treating electricity replaced as having the GHG emissions of dispatchable single cycle natural gas power generation (with an emission factor of 140 tCO<sub>2</sub>e/TJ [0.505 tCO<sub>2</sub>e/MWh], Commission Implementing Regulation (EU) 2018/2066, Annex VI).

*Example 1:* A project produces renewable electricity from an intermittent source, such as wind or solar power. The electricity replaced by the project shall be considered to be non-dispatchable, and the corresponding emission factor is the expected average emission factor of the 2030 grid electricity mix (0.176 tCO<sub>2</sub>e/MWh).

*Example 2:* A project produces renewable electricity from a source that can make the energy output available on demand, such as geothermal or biomass power. The electricity replaced by the project shall be considered to be dispatchable, and the corresponding emission factor is the one corresponding to single cycle natural gas power generation (0.505 tCO<sub>2</sub>e/MWh).

*Example 3:* A project produces renewable electricity from an intermittent source, such as wind or solar power, and is coupled with a battery storage system. The project can apply as a hybrid RES + ES project following the provisions in section 1.2.5.4. The amount of renewable electricity that is fed directly to the grid shall be considered non-dispatchable. In turn, the amount of renewable electricity that is used to charge the battery during periods of low demand from the grid, and that is

*then discharged to the grid during period of high demand, may be considered dispatchable.*

*The project cannot consider 'dispatchable' any amount of electricity that is discharged by the energy storage system while it is simultaneously charging. This means that, for the purposes of GHG calculations, the energy storage system cannot discharge electricity while it is charging at the same time. Also, the project cannot consider 'dispatchable' any amount of electricity that is discharged by the energy storage system, while the renewable energy system could have provided the same amount at the same time. This means that the project cannot artificially lower the output of the renewable energy system during period of high demand, to prioritise energy discharge from the battery storage system.*

In the energy intensive industries category (EII, section 2), emission avoidance associated with electricity use or generation can be claimed by projects in one of the following three cases:

- EII projects generating electricity for export to the grid can claim related emission avoidance by treating the produced electricity as a product and including the net amount of electricity exported to the grid as a term in the reference scenario, with an emission factor equal to the expected average emissions of the 2030 grid electricity mix (48.8 tCO<sub>2</sub>e/TJ [0.176 tCO<sub>2</sub>e/MWh]). Note that in the case that a project both consumes electricity from an external source (such as the grid) and exports electricity, only the net amount of electricity exported can be considered as a product when assessing reference emissions.

Note that projects that combine an EII component with a component of **renewable** energy generation for net export to the grid should instead apply as hybrid projects following the provisions in section 1.2.5.2.

- EII projects that reduce their electricity consumption with respect to the reference scenario can claim related emission avoidance by identifying the net amount of electricity saved as a term in the reference scenario, with an emission factor equal to the expected average emissions of the 2030 grid electricity mix (48.8 tCO<sub>2</sub>e/TJ [0.176 tCO<sub>2</sub>e/MWh]).

This type of project cannot be combined with other emission avoidance measures and shall follow the provisions detailed in section 2.2.7.4.

- EII projects that use predominantly electricity with low emission factor by timing their electricity demand, thereby increasing absorption of variable renewable electricity and reducing the need for dispatchable fossil power, can claim a credit related to the 'virtual' energy storage service provided by applying the provisions in section 2.2.7.4).

Table 1.3 summarises which emission factors for electricity shall be used in the calculations depending on the type of project and whether the electricity is consumed by or exported from it. These emissions factors apply to both the project and reference scenarios as specified in the table. The treatment of electricity under each project category is detailed in the respective section of this methodology.

Table 1.3. Emission factors for applications involving production, use and/or storage of grid electricity

Context	Net electricity exported	EF	Electricity consumed	EF
Energy intensive industry: general	Net amount of electricity exported from the project to the grid	$EF_{\text{electricity,ref}} = 48.8 \text{ tCO}_2\text{e/TJ}$ [0.176 tCO <sub>2</sub> e/MWh]	Amount of electricity fed from the grid to be consumed by processes in either the project or the reference scenario	0.00 tCO <sub>2</sub> e/TJ
Energy intensive industry: electricity-saving projects (see section 2.2.6)	Net amount of electricity saved (i.e. fed from the grid to the system in the reference scenario but not in the project scenario)	$EF_{\text{electricity,ref}} = 48.8 \text{ tCO}_2\text{e/TJ}$ [0.176 tCO <sub>2</sub> e/MWh]	Amount of electricity fed from the grid to be consumed by processes in either the project or the reference scenario	0.00 tCO <sub>2</sub> e/TJ
Energy intensive industry: timed electricity demand (see section 2.2.7.4):	Virtually-stored-energy-release component	140 tCO <sub>2</sub> e/TJ [0.505 tCO <sub>2</sub> e/MWh]	Constant average consumption component	0.00 tCO <sub>2</sub> e/TJ
Renewable energy: non-dispatchable electricity	Net amount of electricity produced in the reference scenario and replaced by renewable non-dispatchable electricity in the project scenario	$EF_{\text{electricity,ref}} = 48.8 \text{ tCO}_2\text{e/TJ}$ [0.176 tCO <sub>2</sub> e/MWh]	Amount of electricity imported from the grid and consumed at the project site	$EF_{\text{electricity,proj}} = 0.00 \text{ tCO}_2\text{e/TJ}$
Renewable energy: dispatchable electricity	Net amount of electricity produced in the reference scenario and replaced by renewable dispatchable electricity in the project scenario	$EF_{\text{electricity,ref}} = 140 \text{ tCO}_2\text{e/TJ}$ [0.505 tCO <sub>2</sub> e/MWh]	Amount of electricity imported from the grid and consumed at the project site	$EF_{\text{electricity,proj}} = 0.00 \text{ tCO}_2\text{e/TJ}$
Energy storage	Net amount of electricity produced in the reference scenario and replaced by dispatchable electricity supplied by the project	$EF_{\text{out}} = 140 \text{ tCO}_2\text{e/TJ}$ [0.505 tCO <sub>2</sub> e/MWh]	Amount of electricity consumed by the project (both storage and self-consumption)	$EF_{\text{in}} = 0.00 \text{ tCO}_2\text{e/TJ}$
Mobility	n/a	n/a	Amount of electricity consumed by the project	0.00 tCO <sub>2</sub> e/TJ

Context	Net electricity exported	EF	Electricity consumed	EF
Credit for CCU/S	n/a	n/a	Electricity consumed for CO <sub>2</sub> capture, transport and/or injection	0.00 tCO <sub>2</sub> e/TJ

Source: European Commission internal elaboration.

#### 1.4.3.2 Hydrogen

Table 1.4 summarises which emission factors for hydrogen shall be used in the calculations depending on the type of project and whether the hydrogen is consumed by or exported from it. These emissions factors apply to both the project and reference scenarios as specified in the table. The treatment of hydrogen under each project category is detailed in the respective section of this methodology.

For EII projects (section 2), the emission factor to be used for the hydrogen that is fed to the project as an input (i.e. sourced from outside the project boundary) is determined by the origin of the hydrogen. If hydrogen is used as an input in both the project and reference scenarios, **the applicant must assume the same origin for the hydrogen in both scenarios**, in line with the provisions in section 2.2.7.1. This includes the case in which the reference scenario is based on an EU ETS benchmark that includes the consumption of generic hydrogen (see example 2 below).

For EII projects, the origin of hydrogen can be classified as:

- Generic hydrogen, for which an emission factor of 6.84 tCO<sub>2</sub>e/tH<sub>2</sub> shall be used.
- Low-carbon hydrogen as defined in Directive 2024/1788 on common rules for the internal markets for renewable gas, natural gas and hydrogen, for which an emission factor of 2.40 tCO<sub>2</sub>e/tH<sub>2</sub> shall be used, and for which transport emissions must be considered if hydrogen is transported for more than 500 km to reach the first point of processing/treatment by the project (section 1.4.6).
- Renewable hydrogen (i.e. RFNBO or of biological origin) as defined in the Renewable Energy Directive 2018/2001 (RED) and its Delegated Regulations, and meeting the greenhouse gas emissions saving criteria set in Article 29 or Article 29a. An emission factor of 0.00 tCO<sub>2</sub>e/tH<sub>2</sub> may be used for renewable hydrogen, but transport emissions must be considered if hydrogen is transported for more than 500 km to reach the first point of processing/treatment by the project(section 1.4.6).

The applicant must credibly justify the assumptions made with respect to the origin of the hydrogen, for example by providing letters of support from potential suppliers or other supporting documents. If the origin of the hydrogen is not known yet at the time of the application, and/or if its renewable or low-carbon origin cannot be credibly justified, then the hydrogen should be considered of 'generic' origin.

In addition, the applicant must propose adequate monitoring measures in its monitoring plan (see section 1.5 and Appendix 3) to ensure adequate monitoring and reporting of the assumptions made at the application stage with respect to the origin of the hydrogen.

Failure to provide adequate justification and an adequate monitoring and reporting plan may affect the quality of the GHG calculations and the resulting evaluation. In addition, failure to demonstrate the actual origin of the hydrogen during project implementation may affect the overall GHG emission avoidance that can be achieved by the project, which may have consequence in terms of grant disbursement as specified in the Call Text.

**Example 1:** A project intends to use direct hydrogen reduction to produce sponge iron instead of a traditional coal-based steel making process. Hydrogen is only used as an input in the project scenario; therefore, the applicant shall choose the relevant emission factor based on the origin of the hydrogen. An emission factor of zero or 2.40 tCO<sub>2</sub>e/tH<sub>2</sub> can only be assumed if the applicant is able to credibly justify, and demonstrate during project implementation, the renewable or low-carbon origin of the hydrogen, respectively. Otherwise, the hydrogen shall be assumed to be of generic origin and an emission factor of 6.84 tCO<sub>2</sub>e/tH<sub>2</sub> shall be used.

**Example 2:** An ammonia production project will use hydrogen as an input, and the applicant intends to source RFNBO hydrogen from outside the project boundaries. The ammonia production process is similar to a conventional hydrogen to ammonia process, and the reference scenario is based on the EU ETS benchmark for ammonia production. Since the reference scenario is based on an EU ETS benchmark that includes the consumption of generic hydrogen, then the emissions associated to the hydrogen input in the project scenario must be based on the emissions factor for generic hydrogen, irrespective of the actual origin of the hydrogen.

**Example 3:** An ammonia production project includes within its scope (i.e. includes specific actions, tasks, and investments into) an electrolysis unit to produce electrolytic hydrogen on-site to be fed into the Haber-Bosch process. The hydrogen production process is within the project boundaries. Therefore, hydrogen is not an input to the project, and the rules concerning hydrogen used as an input do not apply. The project can consider an emission factor of zero for the electricity consumed by the electrolyser, and the reference scenario shall be based on the EU ETS benchmark for ammonia.

Table 1.4. Emission factors for applications involving production, use and/or storage of hydrogen

Context	Net hydrogen exported	EF	Hydrogen consumed or stored	EF
Energy intensive industry: where the project does not include specific actions and tasks related to a specific hydrogen use (i.e. the use of the hydrogen is outside the scope of the project)	Net amount of hydrogen exported	EF <sub>H<sub>2</sub>,ref</sub> = 6.84 tCO <sub>2</sub> e/tH <sub>2</sub>	Amount of generic hydrogen fed to the project in both the reference and project scenario	6.84 tCO <sub>2</sub> e/tH <sub>2</sub>
			Amount of low-carbon hydrogen fed to the project in both the reference and project scenario	2.40 tCO <sub>2</sub> e/tH <sub>2</sub>
			Amount of renewable hydrogen fed to the project in both the reference and project scenario	0.00 tCO <sub>2</sub> e/tH <sub>2</sub>
Energy intensive industry: where the project includes specific actions and tasks related to a	Net amount of hydrogen exported	EF <sub>H<sub>2</sub>,ref</sub> = Case specific depending on equivalent function	Amount of hydrogen (other than renewable or low-carbon hydrogen) fed to the project in both	6.84 tCO <sub>2</sub> e/tH <sub>2</sub>

Context	Net hydrogen exported	EF	Hydrogen consumed or stored	EF
specific hydrogen use (i.e. the use of the hydrogen is within the scope of the project)		replaced by produced hydrogen	the reference and project scenario	
			Amount of low-carbon hydrogen fed to the project in both the reference and project scenario	2.40 tCO <sub>2</sub> e/tH <sub>2</sub>
			Amount of renewable hydrogen fed to the project in both the reference and project scenario	0.00 tCO <sub>2</sub> e/tH <sub>2</sub>
Renewable energy	n/a	n/a	Amount of hydrogen consumed by the project in a renewable energy generation project or amount of hydrogen consumed by the facility or consumer product in a manufacturing of components project	0.00 tCO <sub>2</sub> e/tH <sub>2</sub>
Energy storage	Net amount of hydrogen exported from the project	EF <sub>out</sub> = 6.84 tCO <sub>2</sub> e/tH <sub>2</sub>	Amount of hydrogen consumed by the project (both storage and self-consumption) or amount of hydrogen consumed by the facility or consumer product in a manufacturing of components project	EF <sub>in</sub> = 0.00 tCO <sub>2</sub> e/tH <sub>2</sub>
Mobility	n/a	n/a	Amount of hydrogen consumed by the project	0.00 tCO <sub>2</sub> e/tH <sub>2</sub>
Credit for CCU/S	n/a	n/a	n/a	n/a

Source: European Commission internal elaboration.

#### 1.4.3.3 Heat

Table 1.5 summarises which emission factors for heat shall be used in the calculations depending on the type of project and whether the heat is consumed by or exported from it. These emissions factors apply to both the project and reference scenarios as specified in the table. The treatment of heat under each project category is detailed in the respective section of this methodology.

Table 1.5. Emission factors for applications involving production, use and/or storage of heat

Context	Net heat exported	EF	Heat consumed or stored	EF
Energy intensive industry	Net amount of heat exported	47.3 tCO <sub>2</sub> e/TJ EF <sub>Heat,ref</sub>	Amount of heat (including any identified as 'waste heat') fed to the project from outside the project boundary in the reference and/or project scenario	47.3 tCO <sub>2</sub> e/TJ
Renewable energy	Net amount of heat exported	47.3 tCO <sub>2</sub> e/TJ EF <sub>Heat,ref</sub>	Amount of heat consumed by the project	47.3 tCO <sub>2</sub> e/TJ
Energy storage	Net amount of heat exported from the project	47.3 tCO <sub>2</sub> e/TJ EF <sub>out</sub>	Amount of heat fed to the project and stored by the project	0.00 tCO <sub>2</sub> e/TJ EF <sub>in</sub>
			Amount of heat fed to the project and used for self-consumption by a renewable energy generation project or amount of heat consumed by the facility or consumer product in a manufacturing of components project	47.3 tCO <sub>2</sub> e/TJ EF <sub>on-site</sub>
Mobility	n/a	n/a	Amount of heat consumed by the project or amount of heat consumed by the facility or consumer product in a 'manufacturing of components' project	47.3 tCO <sub>2</sub> e/TJ
Credit for CCU/S	n/a	n/a	Heat consumed for CO <sub>2</sub> capture, transport and/or injection	47.3 tCO <sub>2</sub> e/TJ

Source: European Commission internal elaboration.

#### 1.4.4 Biomass-derived fuels and materials

For the purposes of this methodology, 'biomass-derived fuels' include biomass, biomass fuels, biogas and biomethane, bioliquids, and biofuels, used for energy generation (see Appendix 4). CCU fuels produced using CO<sub>2</sub> of biogenic origin are not considered to be biomass-derived fuels.

For the purposes of this methodology, 'biomass-derived fuels and materials' include biomass-derived fuels and biomass-derived materials (i.e. materials of biogenic origin used for purposes other than energy generation, see Appendix 4). CCU products produced using CO<sub>2</sub> of biogenic origin are not considered to be biomass-derived fuels and materials.

This methodology requires applicants to use an emission factor of zero for biogenic CO<sub>2</sub> emissions from: the combustion of biomass-derived fuels and materials; their decomposition or degradation; and other chemical or biological processes (e.g. fermentation). This methodology also excludes the avoidance of methane emissions from alternative disposal of biomass-derived fuels and materials entering the project as inputs (e.g. their diversion from landfill).

CO<sub>2</sub> and non-CO<sub>2</sub> emissions associated with the supply of biomass-derived fuels and materials used as inputs by an EII project, used for energy generation by a RES project, or used or stored by ES projects, are in scope and must be considered in line with section 1.4.4.2.

Emissions of non-CO<sub>2</sub> greenhouse gases (e.g. CH<sub>4</sub> and N<sub>2</sub>O) associated with the combustion or use of biomass-derived fuels and materials, the leakage or venting of biogas and biomethane, decomposition and degradation, and any other chemical or biological process within the system boundary (e.g. fermentation) are in scope, and must be included unless an exception is stated in the methodology sections 2, 3, 4 and 5 as relevant to the type of project (e.g. EII, RES, ES, MOB).

For EII projects, end-of-life emissions of biomass-derived fuels and materials are covered by the provisions of section 2.2.9.

##### 1.4.4.1 Sustainability requirements for biomass-derived fuels and materials

Any biomass used in Innovation Fund projects, including residual and waste biomass resources, must conform to the relevant minimum requirement specified in the Call Text.

Any biofuel, bioliquid, and biomass fuel (including biogas and biomethane) used in an Innovation Fund project must comply with the Renewable Energy Directive 2018/2001 (RED) and its Delegated Regulations, and meet the sustainability and greenhouse gas emissions saving criteria set in Article 29 of RED.

The applicant must credibly justify the assumptions made with respect to the classification and origin of a biomass-derived fuel or materials, for example by providing letters of support from potential suppliers or other supporting documents. In addition, the applicant must propose adequate measures in the monitoring plan (see section 1.5 and Appendix 3) to ensure that the nature and origin of biomass-derived fuels and materials can be adequately reported and monitored.

Failure to provide adequate justification and to propose adequate monitoring measures may affect the quality of the GHG calculations and the resulting evaluation. In addition, failure to demonstrate the actual nature and origin of the biomass-derived fuel or material during project implementation may affect the overall GHG emission avoidance that can be achieved by the project, which may have consequence in terms of grant disbursement as specified in the Call Text.

#### 1.4.4.2 Supply of biomass-derived fuels and materials

Where biomass-derived fuels and materials are consumed by a project as an elastic input under the EII category, are used as fuels for the production of energy under the RES category (in the term  $Proj_{bio\ supply}$  in equation 3.8), or are used or stored by ES projects, the GHG emission factor for the production and supply of those biomass-derived fuels and materials, including both CO<sub>2</sub> and non-CO<sub>2</sub> emissions, shall be calculated, in tCO<sub>2e</sub>/TJ, following the provisions in this sub-section.

When the biomass-derived fuels and materials utilised are listed in Annex V or VI of the Renewable Energy Directive 2018/2001 (RED), the applicant shall calculate the relevant emission factor by summing together the following terms, as provided in the directive:

- $e_{ec}$  emissions from the extraction or cultivation of raw materials;
- $e_l$  annualised emissions from carbon stock changes caused by land-use change;
- $e_p$  emissions from processing;
- $e_{sca}$  emission savings from soil carbon accumulation via improved agricultural management.

If the biomass-derived fuels and materials used are not listed in Annex V or VI of the RED, then the applicant shall define an appropriate emission factor following the RED calculation principles and the hierarchy of data sources (Appendix 1).

Emissions associated to the transport of biomass feedstocks are covered by the provisions in section 1.4.6, and must be considered only if the biomass feedstocks are transported for more than 500 km to reach the first point of processing/treatment by the project. When transport emissions must be considered, they shall be calculated in tCO<sub>2e</sub>/TJ and added to the emission factor for production and supply of biomass-derived fuels and materials as defined above. Otherwise, transport and distribution emissions may be treated as zero.

Credit for carbon capture and storage or carbon capture and use may only be given to a project by including a carbon capture credit following the rules in section 6. Therefore, a carbon capture term cannot be included in the emission factor for biomass-derived fuels and materials used as inputs/feedstocks.

#### 1.4.5 Renewable fuels of non-biological origin and low-carbon fuels, other than hydrogen

The provisions in this section apply to projects that consume externally-produced renewable fuels of non-biological origin (RFNBOs) or low-carbon fuels (LCFs), other than hydrogen which is covered by the provisions in section 1.4.3.2.

For the purposes of this methodology:

- Externally-produced RFNBOs are considered as defined in the Renewable Energy Directive 2018/2001 and its Delegated Regulations, and meeting the greenhouse gas emissions saving criteria set in Article 29a of RED.
- Externally-produced LCFs are considered as defined in Directive 2024/1788 on common rules for the internal markets for renewable gas, natural gas and hydrogen.

This methodology allows applicants to use an emission factor of zero for CO<sub>2</sub> emissions from the combustion or use of externally-produced RFNBOs and LCFs, their decomposition or degradation, and other chemical processes. To avoid double counting of the benefit, once first emitted the carbon that entered the boundaries of the project as part of an RFNBO or LCF loses its zero-rating characteristic and is treated as fossil carbon in any subsequent instance in which it is emitted. This means that, in EII projects, CCU products

produced using captured carbon that entered the system as part of an RFNBO or LCF are not considered to be zero-rated themselves.

Emissions of non-CO<sub>2</sub> greenhouse gases (e.g. CH<sub>4</sub> and N<sub>2</sub>O) associated with the combustion or use of RFNBOs and LCFs, the leakage or venting of methane, decomposition and degradation, and any other process within the system boundary are in scope and must be included unless an exception is stated in the methodology sections 2, 3, 4 and 5 as relevant to the type of project (e.g. EII, RES, ES, MOB).

The characterisation as RFNBO or LCF is only relevant for externally produced fuels used as feedstock/inputs, and not for fuels produced within the project boundaries. Therefore, for EII projects, the characterisation of a product as RFNBO or LCF has no bearing on the calculation of end-of-life emissions, which are covered by the provisions of section 2.2.9 as for any other product, and which shall NOT be treated as zero-rated unless otherwise permitted by other provisions in the Methodology. See also section 2.2.6.3.3 for CCU products.

The applicant must credibly justify the assumptions made with respect to the classification and origin of externally-produced RFNBOs and LCFs, for example by providing letters of support from potential suppliers or other supporting documents. In addition, the applicant must propose adequate measures in the monitoring plan (see section 1.5 and Appendix 3) to ensure that the nature and origin of the fuels can be adequately reported and monitored.

Failure to provide adequate justification and to propose adequate monitoring measures may affect the quality of the GHG calculations and the resulting evaluation. In addition, failure to demonstrate the actual nature and origin of the fuels during project implementation may affect the overall GHG emission avoidance that can be achieved by the project, which may have consequences in terms of grant disbursement as specified in the Call Text.

#### *1.4.5.1 Supply of externally-produced RFNBOs and LCFs*

Emissions associated with the supply of **RFNBOs** used as inputs by an EII project, used for energy generation by a RES project, or used or stored by an ES project, can be disregarded (i.e. they can be assigned an emission factor of 0 tCO<sub>2e</sub>/TJ).

Emissions associated with the supply of **LCFs** used as inputs by an EII project, used for energy generation by a RES project, or used by an ES project shall be calculated using an emission factor of 20 tCO<sub>2e</sub>/TJ.

Emissions associated to the transport of externally produced RFNBOs or LCFs are covered by the provisions in section 1.4.6 and must be considered if these are transported for more than 500 km to reach the first point of processing/treatment by the project. When transport emissions must be considered, they shall be calculated in tCO<sub>2e</sub>/TJ and added to the emission factor for production and supply of RFNBOs/LCFs as defined above. Otherwise, transport and distribution emissions may be treated as zero.

#### **1.4.6 Transport emissions**

Emissions associated with transport are to be considered in the following cases:

Where a project includes an **element of carbon capture and utilisation or carbon capture and storage (CCU/S)** the project emissions must include any emissions associated with CO<sub>2</sub> transport. This is to ensure that the net GHG benefits from carbon capture are not unduly undermined by any energy intensive CO<sub>2</sub> handling. Refer to section 6 for dedicated guidance.

Where a project is basing the reference scenario for one or more of its principal products on a **physically different product** that is used for a comparable function, then the project emissions must include any emissions associated with distributing that principal product to

the point of use. This is to ensure that the net GHG benefits from a shift to the use of novel products are not unduly undermined by energy intensive distribution practices.

*Example: Project scenario: hydrogen supplied for transportation.*

*The project scenario must include in the processes box the emissions associated with distributing the principal product (hydrogen) to the vehicle tank, including any emissions from the transfer of hydrogen by truck, pipeline or other means to a hydrogen refuelling station.*

*For example, hydrogen refuelling stations may lose hydrogen by boil-off from the liquid hydrogen storage tank, or use energy to re-liquefy the boiled-off hydrogen. Any emissions from re-liquefaction must be included in the processes box, and the amount of energy supplied in the reference scenario should reflect the amount of hydrogen that is finally supplied to vehicles if this is less than the amount of hydrogen leaving the hydrogen production facility.*

*The reference scenario emissions shall be calculated based on the relevant fossil fuel comparator following the provisions in section 2.2.5.4.*

Where a project uses **biomass, biomass-derived fuels or materials, waste materials, RFNBOs, or LCFs as feedstock/inputs**, the project emissions must include any additional emissions associated with gathering those materials and transporting them to the first point of processing/treatment by the project, when the transport range exceeds 500 km. This is to ensure that the net GHG benefits associated with utilising these resources are not unduly undermined by the emissions associated with their transport, given that they may be transported over potentially long distances. These provisions apply also to EII projects using renewable hydrogen or low-carbon hydrogen as inputs as specified in section 1.4.3.2.

The calculation of transport emissions shall include emissions associated with energy consumed for transport and (where relevant) any vented or fugitive methane emissions associated with transport. To calculate GHG emissions from these resources, applicants shall either use:

- Primary data: actual fuel consumption and methane loss figures when data can be tracked from the distribution/logistics companies, or;
- Secondary data: estimated fuel consumption, based on distance between sites, and volume transported multiplied by the emission factors presented in Table 1.6 or other similar values that the applicant could duly justify, plus methane loss estimated on a reasonable basis.

If applicants' data is available per trip, applicants should calculate the emissions for each trip, using the average distance in each leg, and the amount of material transported in that exact leg, which can be derived from the estimate capacity of the vehicle or vessel. Otherwise, an approximated estimate of the total distance travelled in the year and the total amount of material transported in the year can be used as proxies.

Table 1.6. GHG emissions (g CO<sub>2</sub>e/(t\*km)) from the transportation of biomass, biomass-derived fuels or materials, waste materials, RFNBOs, or LCFs. Excluding emissions from methane loss.

Mode of transportation	Type of vehicle	Emission Factor
Rail transport	Freight electric train	Refer to InnovFund assumptions for electricity consumption
	Freight diesel train	18.68 gCO <sub>2</sub> e/(t*km)

Road	40 t diesel truck (includes return trip)	60.03 gCO <sub>2</sub> e/(t*km)
Inland/coastal waterway	1.2 kt diesel tanker	37.38 gCO <sub>2</sub> e/(t*km)
	8.8 kt diesel bulk carrier	24.10 gCO <sub>2</sub> e/(t*km)
Sea	12.6 kt HFO tanker	9.29 gCO <sub>2</sub> e/(t*km)
	26 kt HFO bulk carrier Handysize	15.48 gCO <sub>2</sub> e/(t*km)

Source: Internal elaboration of data from JEC WTW v5 Annexes, UBA ProBAS database, GEMIS v. 4.9

#### 1.4.7 Combustion emissions

Emissions from combustion of fuels or other materials within the system boundary must be included in the emissions avoidance calculation as specified in each section of this Methodology as relevant for the type of project (e.g. EII, RES, ES, MOB). These emissions must include the amount of non-CO<sub>2</sub> greenhouse gases (in particular CH<sub>4</sub> and N<sub>2</sub>O) produced under the expected combustion conditions, on a CO<sub>2</sub> equivalent basis.

CO<sub>2</sub> emitted from the combustion of biomass-derived fuels and materials may be treated as having an emission factor of zero, but other greenhouse gases emitted in the combustion of biomass-derived fuels and materials shall be considered, as detailed in section 1.4.4.

CO<sub>2</sub> emitted from the combustion RFNBOs and LCFs that are **produced externally to the project and are used as inputs** may be treated as having an emission factor of zero, but other greenhouse gases emitted in the combustion of externally-produced RFNBOs and RCFs shall be considered, as detailed in section 1.4.5. The characterisation as RFNBO or LCF is only relevant for externally produced fuels used as feedstock, and not for fuels produced within the project boundaries.

Where materials containing carbon atoms are used or produced by a project, the methodology requires in some specific cases that the applicant must consider the 'stoichiometric combustion emissions' of CO<sub>2</sub> for that material. The stoichiometric emissions shall be calculated as the amount of CO<sub>2</sub> that would be produced if all of the carbon in the material were to be oxidised to CO<sub>2</sub>. Where the guidance asks for stoichiometric combustion emissions to be included, it is not necessary to consider the potential generation of other greenhouse gases under real-world combustion conditions.

#### 1.4.8 Changes in performance over the period of a project

Some projects will be subject to predictable changes in production over the course of the first ten years of operation. For example, solar panels are subject to a degree of degradation that can be expected to reduce electricity output per installed solar cell over the time. The effects of such degradation or other changes should be reflected in the calculation of the reference scenario emissions or project scenario emissions as relevant, and in line with best practice within the relevant industry or sector. If likely changes in performance have not been properly considered in the GHG calculation, this may affect the assessment of the quality of the GHG calculation.

### 1.5 Monitoring, reporting and verification of performance for disbursement and knowledge-sharing

During operation, beneficiaries will have to demonstrate the GHG emission avoidance actually achieved by the project, and demonstrate that the assumptions made at the application stage are representative of the actual operation of the project. Additional requirements may be introduced for the purpose of knowledge-sharing (KS).

During operation, beneficiaries will also have to demonstrate, through the provision of certificates where relevant, the origin and characteristics of any input or feedstock assumed to be a biomass-derived fuel or material (section 1.4.4), an RFNBO or LCF (section 1.4.5 and section 1.4.3.2 for hydrogen), or assumed to be of waste origin (2.2.7.3.5). Beneficiaries will also have to demonstrate that relevant sustainability requirements are met, and, for the case of EII projects using waste as an input, they will have to demonstrate compliance with the waste framework directive (Directive 2008/98/EC).

To these purposes, at the application stage, applicants will have to identify adequate monitoring and reporting provisions in their **monitoring plan** (see Appendix 3). Failure to provide an adequate monitoring plan may negatively affect the quality of the GHG calculations, and the resulting evaluation.

During **project implementation**, failure to demonstrate that the assumptions made at the application stage are representative of the actual operation of the project, as specified in Appendix 3, may affect the overall GHG emission avoidance that can be achieved, which may have consequences in terms of grant disbursement, as specified in the Call Text.

The GHG emission avoidance achieved by a project over the entire monitoring period will need to be verified by an **independent GHG verifier**. This includes a verification that the assumptions made are representative of the actual operation of the project, including with respect to the origin and characteristics of feedstocks and inputs, as specified above, and that relevant minimum requirements are met. A verified GHG emission avoidance report covering the entire monitoring period must be provided at the end of the last year of operation, as specified in the Call Text.

The general conditions on monitoring, reporting and verification (MRV) of project performance, disbursement of the grant, and knowledge-sharing are described in the Call Text. The duration of the monitoring and reporting period is also specified in the Call Text. Appendix 3 provides further details on the specific MRV requirements for the various project categories and sectors.

## 2 Energy intensive industry (EII), including substitute products, and carbon capture and utilisation (CCU)

### 2.1 Scope

This section deals with the methodology to calculate GHG emission avoidance in projects concerning activities falling in the energy intensive industry category and sectors (see section 1.2).

Projects that **produce a CCU product as one of their products** must follow the rules in this section. Projects concerned with innovative processing of biomass feedstock to produce biomass-derived fuels and/or materials in bio-refineries also must follow the provisions in this section.

Some guidance on cases where a sector choice might be less obvious is given in Table 2.1.

Table 2.1. Examples of sector choices

Projects	Choice of sector
Bio-refineries	Depending on the final products, bio-refinery projects need to choose either: refineries if predominantly producing fuels; or chemicals if predominantly producing chemicals; or pulp and paper if predominantly producing pulp and paper products. In some cases (such as a bio-based substance with both fuel and chemical applications) applicants will have to choose between refineries and chemicals referring to the guidance in section 1.2.
Direct air capture with CCS (DACCS) Waste-to-energy with CCS	EII / Other
DAC with CCU CCU	Such projects must produce substitute products for the products listed in Annex I of the ETS Directive. The sector to choose is the sector of the principal product or substitute product, as detailed in section 1.2.
Wastewater treatment	If biofuels are produced, then the sector EII/refineries can be chosen. If there is no EII relevant product is produced, but the treatment of wastewater uses renewable energy, then the sector is 'Use of renewable energy outside Annex I' under the RES category (section 3).
Water desalination	If using renewable energy, then the sector is 'Use of renewable energy outside Annex I' in the RES category. Otherwise, the sector can be EII/Other.
Production of hydrogen from electricity	Such projects generally fall under the sector EII/hydrogen. If the project includes specific actions and tasks related to ensure the use of the hydrogen in a specific application, then the sector may be determined by the application in which hydrogen will be used. For example, a project including actions and tasks related to setting up and operating hydrogen refuelling stations could apply in the sector EII/refineries. If the main aim of the project is the production of hydrogen as a mean of storage of excess renewable electricity (e.g. the electricity consumed is limited to periods of high renewable energy production, which result in a particularly low load factor) the project could apply in the sector Energy Storage/Other energy storage Following the provisions in section 4.

Source: European Commission internal elaboration.

## 2.2 GHG emissions avoidance

### 2.2.1 Absolute and relative GHG emissions avoidance

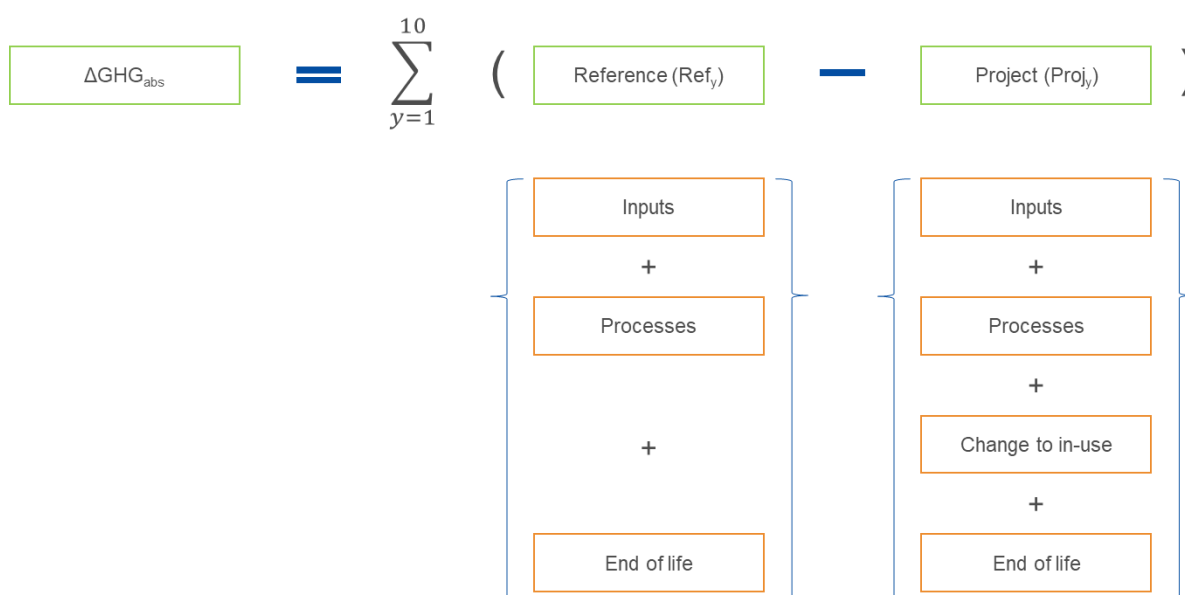
Applicants have to calculate both the absolute and relative GHG emissions avoidance expected from the project. For the general formulas, refer to sections 1.1.3 and 1.1.4. The **absolute GHG emissions** avoided by the project are the emissions of the reference scenario minus the emissions of the project scenario. The **relative GHG emissions avoidance** is then calculated by dividing the absolute emissions avoided by the emissions of the reference scenario.

### 2.2.2 Life-cycle stages

The GHG emissions for each life-cycle stage shall be included in the calculations for the reference scenario and the project scenario, as illustrated in Figure 2.1.

The reference scenario must provide the same function(s) as provided by the product(s) in the project scenario reflect the current state-of-the-art in the given sector. As explained in the section 1.2, the product(s) should reflect the main aim and innovation of the project.

Figure 2.1. Life-cycle stages of GHG emission avoidance related to InnovFund EII projects



Source: European Commission internal elaboration.

Both scenarios shall include any relevant emissions in the boxes corresponding to 'inputs', 'processes', and 'end of life'. The emission sources (positive emission terms) and credits (negative emission terms) to be considered in each life-cycle stage ('box') are explained in further detail in this section and in the following ones.

The 'change to in-use' emissions box appears only in the project scenario. If an innovative product reduces GHG in-use emissions compared to the reference scenario, then this change should be recorded only in the box for the project scenario with a negative term. The in-use emissions shall not be reported in the reference scenario.

### 2.2.3 System boundary

In the context of the GHG emission calculations for an Innovation Fund project, the system boundary defines the set of processes to be considered.

At the minimum, the system boundary for the project scenario must include the parts of an installation at which **innovative practices** are being introduced by the project and any

processes **downstream of those innovative practices** that are required to produce the principal products from the project. These processes must be included in the 'processes' box of the project scenario (see section 2.2.6).

Processes **upstream of the innovative processes** may also be brought within the system boundary if they are under the control of the applicants and within the scope of the project. Otherwise, the outputs of those upstream processes shall be treated as inputs to the project and included in the 'inputs' box (see section 2.2.7).

**Note for applicants familiar with earlier versions of the methodology:** *This provision has changed with respect to previous versions of the methodology, in which applicants were allowed to expand the system boundary to include any number of upstream processes, even when they were outside the scope of the project – this is no longer permitted.*

The reference scenario is defined by the reference product(s) being replaced by the product(s) produced by the project. The system boundary for the reference scenario will depend on the type of reference scenario that is appropriate to the project in question. The different cases for construction of a reference scenario are detailed in section 2.2.5.

Proposals may be submitted jointly by more than one entity that have formed a consortium. The methodology calculates the emissions savings for the whole project, not for each individual entity within the consortium. Therefore, there is no need to split the emission reduction between members of a consortium.

#### 2.2.3.1 System boundary in the case of an innovation applied to only part of a plant's throughput

In some cases, an innovative element of a process may be introduced that reduces the emissions of only a fraction of the overall throughput of an existing industrial plant. In such cases, the GHG calculations shall be undertaken as follows:

- If the innovation could, in principle, be extended (i.e. scaled up) to cover the entire throughput of the plant then the system boundary must be drawn around a part of the plant proportional to the amount of throughput to which the innovation is applied. If, for example, the innovation applies to 30% of the throughput, then the GHG calculations may include that 30% of the throughput only. The project scenario shall include only the portion of the throughput to which the innovation is applied, and the reference scenario shall include the conventional production of an equivalent amount of reference product.

*Example: an ammonia production plant that currently consumes 100 thousand tonnes of hydrogen and produces 550 thousand tonnes of ammonia per year applies to the Innovation Fund for support to add an electrolysis unit (powered by electricity from RES) capable of producing 10 thousand tonnes of green hydrogen per year (one tenth of the input hydrogen). In principle it would be possible to add additional electrolysis units to produce enough green hydrogen to supply the entire facility. The applicant may set the system boundary to include only a tenth of the whole facility, so that the project scenario would be based on 100% green hydrogen use and 55 thousand tonnes of ammonia output. The reference scenario would be based on the EU ETS ammonia benchmark for 55 thousand tonnes of production.*

- If there are technical reasons that prevent the innovation from being scaled up to cover the entire throughput of the plant, then the project scenario must include the whole throughput of the plant, including the portion to which the innovation is applied and the portion to which the innovation is not applied. The reference scenario should include the conventional production of an amount of reference product equivalent to the total throughput of the plant.

*Example: a glass production project will produce new glass by a combination of waste glass recycling and additional raw materials, recycling 20 thousand tonnes of waste glass a year and producing 40 thousand tonnes of new glass. For technical reasons, the project limits the use of waste glass to 50% of the input stream. Therefore, the whole facility must be placed within the system boundary, and the project must include the emissions associated with sourcing and processing the non-waste raw materials. The reference scenario would be based on the EU ETS benchmark for glass making for 40 thousand tonnes of output.*

If the system boundary is set to anything other than the size of the full facility, and the GHG calculations consider anything other than the entire throughput of the plant, applicants must justify this decision. Failure to do so may negatively impact the credibility of the GHG emission avoidance calculations, and the resulting evaluation.

#### 2.2.4 Process diagram

The applicants shall provide in the GHG calculator a detailed process diagram for the project and reference scenarios, indicating all the sub-processes, inputs, and products for both scenarios. The diagram shall clearly indicate the system boundary and should include quantities of material and energy flows where relevant. The applicants should develop the process diagram to adequately represent the complexity of their project.

#### 2.2.5 Reference scenario

The reference scenario includes emissions from the production of conventional reference product(s) that provide equivalent function(s) to the product(s) produced by the project. An **'equivalent function'** is usually the same quantity of a physically similar conventional product(s). If a product does not have a physically similar conventional alternative, then the reference scenario would be based on the production of the conventional product, or combination of conventional products, that would fulfil an equivalent function as the produced product.

In cases where there is more than one possible reference scenario, the reference scenario chosen must be based on the conventional products most likely to fulfil the function in the absence of the project, unless the project includes specific actions and tasks to use the product to substitute a physically different product (refer to section 1.2.1).

If the application is based on an inappropriate reference scenario (e.g. by choosing a reference scenario with higher emissions instead of a reference scenario that would be more likely in the absence of the project) then this may affect the quality of the GHG emission avoidance calculations and the resulting evaluation.

**Sum of individual reference scenarios:** the **full reference scenario** of the project will consist of the sum of the individual reference scenarios for each of the products identified for the project. This may involve summing reference scenario emissions calculated following more than one of the nine cases detailed below.

*Example: A project with two products: hydrogen and synthetic diesel fuel. The full reference scenario consists of the sum of a reference scenario based on the EU ETS product benchmark for hydrogen production, and a reference scenario based on the InnovFund fossil fuel comparator for diesel.*

**One 'combined' reference scenario:** in some cases, it may be possible to identify for two or more products in the project scenario just one 'combined' production process in the reference scenario, provided that it is possible to match the quantity of each product in the project scenario to the quantity of each product from the reference scenario. In the case that the use of a combined reference scenario does not allow the quantity of products produced by the project to be exactly matched, it may be possible to construct the overall

reference scenario by adding to the combined element of the reference scenario the production of an additional quantity of one or more of the individual products.

*Example: An innovative process produces ethylene and propylene as products. Ethylene and propylene are co-products of the conventional steam cracking process, for which there is an EU ETS benchmark. The EU ETS benchmark for steam cracking may be used as a combined reference provided that the outputs of ethylene and propylene from the project are consistent with the benchmark specifications. The description of the benchmark (definition of products covered) reads: 'Mix of high value chemicals (HVC) [...] with an ethylene content in the total product mix of at least 30 mass-percent and a content of HVC, fuel gas, butenes and liquid hydrocarbons of together at least 50 mass-percent of the total product mix'.*

### **Nine cases for setting the reference scenario for a product:**

The following nine cases (discussed in detail in sub-section 2.2.5.1 through 2.2.5.9) shall be used to define a reference scenario for each of the products of the project.

1. If there is an EU ETS product benchmark corresponding to production of the product, that benchmark shall be the basis for the reference scenario.
2. If there is no EU ETS product benchmark available that directly corresponds to production of a product, it may be possible to construct an appropriate reference scenario by combining EU ETS heat, fuel and/or process sub-installations with an existing EU ETS product benchmark.
3. If the project is a modification of an existing production system, the applicant may choose to use the existing production system as the reference scenario, subject to conditions detailed in sub-section 2.2.5.3.
4. If the product is a transport fuel substitute, then the reference scenario for that product shall be based on the InnovFund fossil fuel comparator values.
5. If the product is a natural gas substitute, then the reference scenario shall be based on the combustion emissions intensity of natural gas.
6. If the principal product can be synthesised from natural gas (e.g. methanol) and an emission value is available in the inputs data hierarchy (Appendix 1) for production of that product with natural gas as the primary feedstock<sup>10</sup>, then the applicant shall base the reference scenario on that emission value.
7. If the project is for CCS from direct air capture, the reference scenario is zero emissions.
8. If the project is to transport and/or store CO<sub>2</sub> captured outside the system boundary, the reference emission is the quantity of CO<sub>2</sub> entering the system boundary.
9. Where it is not possible to construct a reference scenario for the production of one or more of the products from a project in the ways identified above, then the applicant may propose an appropriate reference scenario, subject to the conditions detailed in sub-section 2.2.5.9. This option can only be used for situations that are not covered by any of the previous cases, and the choice to use this option must be credibly justified by the applicant. In addition, the applicant must provide clear justifications of the proposed approach, and a robust characterisation of the emissions associated with the reference system proposed.

<sup>10</sup> If it is not clear whether a value contained in the data hierarchy assumes a natural gas feedstock, then the applicant should instead propose a reference scenario following the requirements of case 9, section 2.2.5.9.

### 2.2.5.1 Case 1: A relevant EU ETS product benchmark (or benchmarks) exists

For projects producing products for which an EU ETS product benchmark is defined in Annex I of the applicable Benchmarking Decision<sup>11</sup> at the time of the submission of the application, the reference scenario shall be based on that EU ETS product benchmark. The EU ETS benchmark emissions **for the production of the relevant amount of the product** shall be included in the 'processes' box of the reference scenario.

For projects **producing heat as a product**, the EU ETS heat benchmark shall be used to calculate the emissions in the 'processes' box of the reference scenario.

For projects **producing hydrogen as a product**, the EU ETS hydrogen benchmark shall be used to calculate the emissions in the 'processes' box of the reference scenario unless the project includes specific actions and tasks related to the use of the hydrogen produced in a specified application (section 1.2.1).

*Example: A project produces hydrogen at a new facility to be used in an industrial application. The EU ETS benchmark value for hydrogen (2021 Benchmarking Decision: 6.84 tCO<sub>2e</sub>/tH<sub>2</sub>) shall be applied to all the hydrogen production as the reference.*

*Example: A project produces hydrogen at a new facility to be supplied to hydrogen refuelling stations for use in fuel cell vehicles, but the project **does not include any action or task related to the construction and operation of the hydrogen refuelling stations, nor associated investments**. The EU ETS benchmark value for hydrogen (2021 Benchmarking Decision: 6.84 tCO<sub>2e</sub>/tH<sub>2</sub>) shall be applied to all the hydrogen production as the reference.*

*Example: A project produces hydrogen at a new facility to be supplied to hydrogen refuelling stations for use in fuel cell vehicles, and the project includes relevant actions and tasks related to the construction and operation of a sufficient number of refuelling stations to supply the entire volume of hydrogen produced for the intended application. The applicant may choose to set the reference scenario emissions based on Case 4: Transport Fuel Substitutes instead of using Case 1 based on the EU ETS benchmark value for hydrogen, provided that this choice is credibly justified.*

Benchmark values for refinery units and processes included in Annex II of Commission Delegated Regulation (EU) 2019/331 **shall not be used to set reference scenario emissions**. If no relevant benchmark value is available in Annex I of the applicable Benchmarking Decision<sup>11</sup>, then the reference scenario shall be determined following one of the other cases below.

In some cases, the processes producing a product in the reference scenario may correspond to **a combination of multiple EU ETS product benchmarks**.

*Example: A project producing hot metal. Constructing the appropriate reference scenario may require the applicant to combine the benchmarks for coke, sintered ore, and hot metal as all are part of the conventional hot metal production process. It will be necessary to provide in the calculation the expected consumption per unit of output of the intermediate products (in this case coke and sintered ore) that are used in the production of the final product (hot metal).*

The reference scenario shall include emissions in additional boxes that **the EU ETS product benchmark(s) do(es) not cover**<sup>12</sup>:

<sup>11</sup> The applicable EU act is Commission Implementing Regulation (EU) 2021/447.

<sup>12</sup> The processes and emissions covered by the EU ETS product benchmarks can be found in European Commission (2019a).

**'Inputs'**. The EU ETS benchmarks do not include emissions associated with the production and supply of inputs used by the process. The applicant shall identify the quantities of inputs to be used in the conventional production process associated with the ETS benchmark in the reference scenario.

*Example: the EU ETS benchmark for 'bottles and jars of colourless glass' does not include upstream emissions associated to the production of the material inputs to the conventional glass making process, such as sand, soda ash, and limestone. Therefore, the applicant shall identify appropriate emission factors for sand, soda ash, and limestone in the input data hierarchy (Appendix 1) and include the relevant input emissions in the 'inputs' box or the reference scenario.*

Note that, in the definition of the reference and project scenario, and in the calculation of reference and project emissions, it is necessary to include also emissions that are the same in both scenarios as their exclusion would alter the relative emissions savings result. This is applicable to the case that some of the inputs are the same in the reference and project scenarios in terms of volumes and associated emissions.

**'End of life'**. The EU ETS benchmarks do not include emissions associated with the end of life of products. These should be included in the dedicated box following the provisions in section 2.2.9.

*Example: For a project producing ethylene glycol, emissions calculated using the EU ETS benchmark value will be included in the 'processes' box of the reference scenario, but this does not include end of life emissions associated with the carbon contained in the product. The emissions from conversion of the carbon in the ethylene glycol to carbon dioxide at end of life should be included in the 'end of life' box.*

#### 2.2.5.2 Case 2: An appropriate reference scenario can be constructed from a combination of EU ETS product benchmarks and other benchmarks sub-installation

Where the conventional processes required to provide the same functions as the product(s) do not correspond directly to an EU ETS product benchmark, it may be possible to construct an appropriate reference scenario by combining the existing product benchmark with the EU ETS fallback benchmarks sub-installations. In other words, when the boundaries of the project scenario do not coincide with an EU ETS product benchmark in the reference scenario, other EU ETS fallback sub-installations can be added to the 'processes' box in the reference scenario to balance the scenarios.

In these cases, the relevant EU ETS product benchmark plus additional fallback sub-installation(s) shall be added to the 'processes' box in the reference scenario to properly reflect the set of processes required to provide the same or equivalent function(s).

There are three types of other EU ETS fallback benchmarks sub-installations<sup>11</sup>:

- heat benchmark sub-installations.
- fuel benchmark sub-installations.
- process emissions sub-installations.

Heat benchmark sub-installations shall be added to the 'processes' box of the reference scenario to account for additional heat used to produce an equivalent quantity of products in the reference scenario, beyond the amount of heat already covered by any of the EU ETS product benchmark required.

Fuel benchmark sub-installations shall be added to the 'processes' box of the reference scenario to account for additional fuel use to produce an equivalent quantity of products in

the reference scenario, beyond the fuel use already covered by any of the EU ETS product benchmark required.

Process emissions sub-installations may be added to cover any emissions occurring in the 'processes' box of the reference scenario not already covered by any of the EU ETS product benchmark required.

*Example: A project manufacturing cold drawn steel bars may be able to construct a reference scenario in which the 'processes' box is based on combination of the product benchmark for hot metal and a fuel benchmark sub-installation reflecting additional fuel consumption for the drawing process.*

*Example: A project manufacturing sodium bicarbonate may be able to construct a reference scenario in which the 'processes' box is based on the combination of the EU ETS benchmark for soda ash and a fuel benchmark sub-installation reflecting additional fuel consumption for reacting soda ash with water and CO<sub>2</sub> to produce sodium bicarbonate.*

All assumptions made in the characterisation of these additional sub-installations should be clearly stated and justified (for example in determining whether to assume that additional energy is supplied as heat, fuel or electricity), and the applicant should provide a reasonable characterisation of normal practice in the conventional production process.

When a decision must be made between two alternatives that are both equally representative of the current practice, the reference scenario should always reflect the lower GHG emissions option (i.e. the most conservative).

*Example: If there is a choice between assuming that an additional process would be powered with electricity from the grid (zero emissions under the InnovFund calculation methodology for energy-intensive industry projects) or by adding an additional fuel benchmark sub-installation, then it should be assumed that power would be taken from the grid.*

Electricity consumption (see Table 1.3) is treated as having zero GHG emissions in energy intensive industry projects. Therefore, any additional electricity consumption not covered by the EU ETS product benchmark sub-installations should be included with zero emission factor for transparency.

The reference scenario shall include emissions in additional boxes that the EU ETS product benchmarks and other benchmarks sub-installation do not cover, such as 'inputs' and 'end of life'. See related guidance in section 2.2.5.1.

### 2.2.5.3 Case 3: Modification of an existing production system

A project may be treated as a modification of an existing production system if emissions reductions are delivered by modifying one or more units or processes in an existing system in an innovative way, without simply replacing the main processes of the system and without changing the principal product that is produced by the system, and that is used to determine the sector of the application.

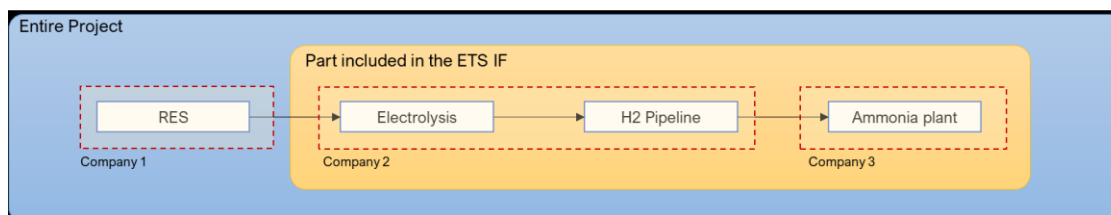
Projects that add carbon capture units to existing installations without changing the products from those installations and without other major modifications to the existing production system **may be treated as modifications to the existing system**, irrespectively of the CAPEX considerations discussed below.

With the exception of projects that add carbon capture units to existing production systems without other major changes to the production system, the CAPEX associated with the project must be compared to the CAPEX required to develop a whole new production facility. If the project CAPEX is more than a third of the CAPEX for a new facility, then the

project **cannot be treated as a modification of an existing production system**. In the case of a project that involves adding a carbon capture unit in combination with other innovative modifications to the existing production system, the CAPEX for the carbon capture unit shall be included when assessing the project against this requirement.

A project in which only inputs are changed **does not qualify as a modification to an existing system**.

*Example:* In the diagram below Companies 2 and 3 jointly submit a project to use additional renewable electricity to produce hydrogen as an intermediate product for making ammonia (the final product), replacing hydrogen from an existing steam methane reformer in the existing ammonia plant.



In a joint application, the project can be defined as a modification to the ammonia plant, as the hydrogen production unit is only a part of the production system. Therefore, the reference scenario may be taken to be the existing ammonia production plant, subject to the rules for modified plants detailed above.

Alternatively, company 3 could propose the project alone. The hydrogen coming out of the pipe from the electrolyser (company 2) would now be treated as an input (from 'outside' the system boundary). Company 3 would therefore not be permitted to treat this project as a modification to an existing production system, unless there were other innovative changes being made to the ammonia production system. The reference scenario would be the EU ETS benchmark for ammonia (see case 1 in section 2.2.5.1 above), and the relevant emission factor for the hydrogen used as an input in the project scenario is 6.84 tCO<sub>2</sub>e/tH<sub>2</sub> (see also example 2 in section 1.4.3.2). Note that this option prevents the applicant from claiming emission avoidance associated to the production of hydrogen, since it occurs outside the project boundaries.

Finally, if company 2 applied alone, then the final product is hydrogen. In this case it would also not be possible to treat the project as a modification of an existing plant, and the reference scenario would be the EU ETS benchmark for hydrogen (see case 1 in section 2.2.5.1 above).

In some cases, identifying a project as a modification will depend on the choice of the product.

*Example:* if a steam methane reformer at an oil refinery is replaced with an electrolyser and the product is identified as hydrogen, this could not be treated as a modification as the main element of the hydrogen production system is entirely replaced.

If, however, refined hydrocarbon fuels were treated as the product, then the project could be treated as a modification in the context of this wider production system, which should then be included within the project boundaries in both the reference and project scenario.

Applicants **must provide justification** to support the decision to treat a project as a modification of an existing production system. If the applicant incorrectly identifies a

project as a modification of an existing production system, or does not provide sufficient justification, this may affect the assessment of the quality of the GHG calculations.

**Rules for modified production systems:** When a project is identified as a modification of an existing production system, the applicant **may be permitted** to take the unmodified processes as the reference scenario, rather than the relevant EU ETS benchmark(s), under the following conditions:

- The emissions in the project scenario must be lower than the emissions in the reference scenario, otherwise the modification would not make sense from the GHG emissions avoidance perspective.
- Where modifications are made to at least one sub-process of a process corresponding to an EU ETS product benchmark, then the total emissions for that modified process must be lower than the respective EU ETS product benchmark emissions. For projects that include an element of carbon capture associated with a benchmarked process, the carbon capture credit may be subtracted from the project process emissions before making this comparison.
- If a project produces only one product and this product is associated with an EU ETS product benchmark, then the GHG emissions from the modified production system, calculated including any carbon capture credit, must be below the EU ETS product benchmark emissions for the relevant quantity of that product. This requirement is not relevant to cases where there is not a corresponding EU ETS product benchmark for at least one product of the project.
- When comparing the 'processes' emissions in a modification project to an EU ETS product benchmark, the benchmark must be chosen based on the modified plant, which may be different to the relevant EU ETS benchmark for the unmodified plant.

*Example: the existing, unmodified facilities operate a blast furnace steel production. The project would replace the blast furnace capacity with electric arc furnace (EAF) capacity. EAF processes only scrap steel, not iron ore, and therefore is a fundamentally less CO<sub>2</sub> intensive technology (hence the total of emissions for the modified process EAF has a much lower EU ETS benchmark than 'hot metal'). For the benchmark comparison: the project 'processes' emissions should be below those of a benchmark EAF facility.*

- When defining the reference scenario based on an existing production system, the applicant shall identify emissions in the pre-existing configuration using the 'processes', 'inputs', and 'end of life' boxes in the same way as when calculating project emissions.

Note that, in the definition of the reference and project scenario, and the calculation of reference and project emissions, it is necessary to include also emissions that are the same in both scenarios as their exclusion would alter the relative emissions savings result. This applies also to the case in which some of the inputs are the same in the reference and project scenarios in terms of volumes and associated emissions.

- In the case that the modified system produces additional products that were not produced by the unmodified system, then reference products shall be identified for those products, and reference scenario emissions for those products shall be identified in the usual way.
- In the case that a modification to an existing production system is accompanied by an increase in production of the principal product and/or other products, Case 3 may only be used to set the reference scenario emissions for the previously produced quantity of each product. Reference scenario emissions for the increased amount of production must be calculated based on one of the other cases.

*Example: an existing steel plant produces 100,000 tonnes of steel each year. This facility will be modified to reduce its emissions and to increase its output to 150,000 tonnes of steel a year. The reference scenario emissions for the first 100,000 tonnes of production may be assessed as a modification to an existing production system, but the reference emissions for the additional 50,000 tonnes must be assessed based on the relevant EU ETS benchmarks in accordance with Case 1.*

#### 2.2.5.4 Case 4: Transport fuel substitutes

For projects with a product that replaces (i.e. provides an equivalent function to) a conventional transport fuel, the reference scenario shall be based on the 'IF fossil fuel comparator'<sup>13</sup> (emission factors) of the substituted fuel(s) defined in Table 2.2. This includes projects producing novel transport fuels falling under the definition of biofuels, renewable fuels of non-biological origin (RFNBOs), or recycled carbon fuels (RCFs) under RED.

Proposals must credibly justify the intended use of the product as a substitute transport fuel, for example by providing draft contracts with distributors, letters of intent, or other relevant supporting documents.

For projects producing fuels for which transport is not the most common application, such as hydrogen, electricity, natural gas, natural gas substitutes, etc., a reference scenario based on a fossil fuel comparator can only be chosen if the project includes specific actions and tasks to supply the fuel produced to the final user for the intended application, for example through the construction and operation of hydrogen refuelling stations that will supply the hydrogen produced to fuel cell vehicles. See section 1.2 for further guidance.

The emissions for the equivalent quantity of substituted conventional fuel(s) shall be included in the '**processes' box of the reference scenario** and shall be calculated by multiplying the quantity of each fuel produced by its corresponding fossil fuel comparator<sup>14</sup>. This approach also applies to projects producing synthetic crude oil as a product, for which a specific fossil fuel comparator is provided in Table 2.2.

For projects using a fossil fuel comparator as the reference scenario, the combustion emissions of the novel fuel (if any) must be included in the 'end of life' box of the project scenario (section 2.2.9). These must include any non-CO<sub>2</sub> emission associated with combustion of the fuel in a relevant vehicle (e.g. CH<sub>4</sub> or N<sub>2</sub>O). Lower Heating Values (LHV), also called Net Calorific Values (NCV), shall be used for the different fuels as provided in Table 2.2.

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<sup>13</sup> For fuels that are blended into fossil transport fuel or used as their direct replacements in existing unmodified vehicle engines, the equivalent quantity of the substituted fuel is that with an equal lower heating value (LHV; = net calorific value, NCV). For fuels (such as hydrogen) used in heavily modified vehicles, the equivalent quantity of substituted fuel is that which provides the same transport function (i.e. delivers the same kilometres x tonne of load), derived from v5 of the JEC-WTW report.

<sup>14</sup> Note that the InnovFund fossil fuel comparator differs from comparator values used in RED because the InnovFund methodology (in order to align with EU ETS) does not consider the emissions from extraction and transport of crude oil, nor the transport and distribution of the final fuel. Specifically, in the InnovFund methodology, the fossil fuel comparators (FFCs) include: Combustion emissions + Transformation near market (crude refining). The FFCs do not include: production and conditioning at source (crude oil production), transformation at source, transportation to market (crude oil transport), conditioning and distribution (distribution and dispensing at retail site). The FFCs include CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub> emissions.

Table 2.2. 'InnovFund fossil fuel comparators (FFC)<sup>15</sup> and the lower heating values (net calorific values) for fossil fuels displaced by InnovFund projects.

Substituted fossil transport fuel	InnovFund fossil fuel comparator (tCO <sub>2</sub> e/TJ)	LHV = NCV (MJ/kg)
Diesel	80.4	43.0
Gasoline	78.9	44.3
LPG	65.4	47.3
Aviation kerosene	78.3	44.1
Aviation gasoline	78.9	44.3
Marine reference fuel oil	78.0	42.8
Synthetic crude oil	75.5	42.0

Source: JRC elaboration of data from JEC-WTW report v5.

For fuels used in highly modified vehicles, such as hydrogen for fuel cell cars, the applicant shall take into account a change in vehicle efficiency based on typical vehicle efficiencies documented in JEC-WTW report v.5 (matching the function provided as detailed above).

If the fuel or transport mode (e.g. maritime, aircraft) is not dealt with in JEC-WTW report v.5, the relative efficiency compared to fossil fuels in conventional vehicles is found from the hierarchy of data sources in Appendix 1. If the fuels will be used in vessels or aircraft and the applicant wants to include other non-CO<sub>2</sub> climate impacts (e.g. black carbon), then the applicant may submit a hybrid application as detailed in section 1.2.5.5.

When the novel fuel is physically different with respect to the relevant fossil fuel comparator, the project shall include in the 'processes' box emissions associated to the distribution of the novel (unblended) fuel to the vehicles, as detailed in section 1.4.6.

No inputs shall be included in the reference scenario for this case. No additional emissions shall be recorded in the 'end of life' box of the reference scenario.

**Simplification for PILOTS topic projects:** For the purposes of GHG calculations, PILOTS projects are not expected to submit letters of intent or other supporting documents when claiming the intended use of their product. However, applicants shall credibly justify their claim at the application stage, and will need to demonstrate the actual use of the product as a transport fuel substitute during project implementation.

#### 2.2.5.5 Case 5: Natural gas substitutes

For projects producing natural gas substitute products (e.g. biomethane, synthetic methane), unless the project includes specific actions and tasks to use the product in a specific application, the emissions for the equivalent quantity of substituted natural gas, calculated as equal energy content on a lower heating value basis, shall be included in the 'processes' box of the reference scenario based on the combustion emissions intensity (i.e. emission factor) of natural gas (56.2 tCO<sub>2</sub>e/TJ).

If the project involves specific actions or tasks to use the natural gas substitute to fulfil an identified function (e.g. to enable supply for natural gas vehicles replacing the function of

<sup>15</sup> The FFCs are not to be used as emissions factors for these fuels when combusted for process energy. In that case, combustion-only emission factors should be used, as stated in section 2.2.6.

liquid fossil fuels or for an identified industrial use replacing the function of a different fuel), then a different case may be used so that the reference scenario reflects emissions associated with providing that equivalent function. The emission factor for this function may be **different from a natural gas combustion reference**. The choice of a reference scenario and emission factor different than the standard one, subject to the conditions detailed above, must be credibly justified by the applicant.

*Example:* A project produces renewable gas fed into the natural gas grid with no specific actions and tasks related to, nor investments in, a specific product use. The reference for the natural gas fed into the gas grid would be the general combustion emissions intensity of 56.2 tCO<sub>2</sub>e/TJ.

*Example:* A project produces renewable gas and supplies it to a steel plant. The applicant does not foresee actions and tasks, nor investments, related to the steel making process. The reference would be the general natural gas combustion emissions intensity of 56.2 tCO<sub>2</sub>e/TJ.

*Example:* A project produces renewable gas and includes specific actions and tasks related to the construction and operation of refuelling stations to supply the gas for heavy duty transport. The applicant may use Case 4: Transport Fuel Substitutes and use the diesel fossil fuel comparator as the reference (80.4 tCO<sub>2</sub>e/TJ, Table 2.2), taking into account the relative efficiency of natural gas and diesel heavy duty engines. The project scenario shall include emissions associated with distribution of the produced gas to the fuelling station.

No inputs shall be included in the reference scenario for this case, and no additional emissions shall be recorded in the 'end of life' box of the reference scenario.

#### 2.2.5.6 Case 6: The product can be synthesised from natural gas and a life-cycle emissions factor is available in the data hierarchy

For projects where the product provides a function that replaces conventional carbon-based fuels or chemicals for which reference scenarios cannot be proposed under cases 1, 3, 4 or 5<sup>16</sup> it is allowed to take as a reference scenario a life-cycle<sup>17</sup> emission factor drawn from the hierarchy of data sources in Appendix 1, provided that the emission factor is based on a process with natural gas as the main feedstock (e.g. synthesis of methanol, formaldehyde, acetic acid).

In general, life-cycle emission factors from the data hierarchy may be expected to include the carbon contained within the product. If a value does not include carbon contained within the product, then that amount of carbon shall be added to the emission value from the data hierarchy on a stoichiometric basis. The resulting value can be used as a single emission factor associated to the production of the relevant product in the 'processes' box of the reference scenario.

No inputs shall be included in the reference scenario for this case. No additional emissions shall be recorded in the 'end of life' box of the reference scenario, because release of the carbon contained in the product shall be included in the emission factor used in the 'processes' box.

Several chemicals that can be produced by steam cracking of natural gas liquids fall on the 'high value chemicals' (HVC) list in the ETS<sup>18</sup>. However, they may be produced in ratios that do not meet the HVC definition, and in such a case the EU ETS HVC benchmark shall not be used to define the relevant reference scenario. In that case, the applicants shall

<sup>16</sup> I.e. the principal product does not replace any of: natural gas; fuels with fossil fuel comparator values (such as gasoline or diesel); or products with EU ETS product benchmarks.

<sup>17</sup> A life-cycle emission factor includes emissions associated with the production of the product. The stoichiometric combustion emission factors given in IPCC (2006a) do not constitute life-cycle emission values.

<sup>18</sup> Acetylene, ethylene, propylene, butadiene, benzene.

propose a reference scenario based on a lifecycle emission value for the relevant chemical from the hierarchy of data sources (Appendix 1) and operate under case 6. The value proposed must be based on steam cracking of natural gas liquids. For example, it is not permissible to propose a reference scenario under case 6 based on steam cracking of naphtha.

*Example: A project will produce propylene as the sole product.*

*The EU ETS benchmark for 'Steam cracking (high value chemicals)' states that it applies to processes, 'with an ethylene content in the total product mix of at least 30 mass-percent and a content of HVC, fuel gas, butenes and liquid hydrocarbons of together at least 50 mass-percent of the total product mix'. As the project produces no ethylene, this benchmark shall not be used as a reference.*

*The applicant shall look through sources in the data hierarchy (Appendix 1) to find a lifecycle emission value for propylene production from steam cracking of natural gas liquids and use that value as their reference scenario.*

Note that the reference scenario shall consider the function of the products of the project. For example, a fossil fuel comparator may still be the correct reference scenario even for a chemically distinct product, if that product will be used as a transport fuel, if applicable under the conditions detailed in sub-section 2.2.5.4.

*Example: If methanol will be supplied for use as a transport fuel in maritime applications, under the conditions set in sub-section 2.2.5.4, the reference scenario shall be based on the fossil fuel comparator for maritime fuel (section 2.2.4.4), and not on methanol production. Applicants must convincingly establish that the methanol will be used for maritime transport, and the project shall include emissions associated to the methanol distribution to the vessels.*

#### 2.2.5.7 Case 7: Direct air capture or capture of naturally occurring CO<sub>2</sub> for CCS

Where a project consists solely of the installation of a direct air capture facility, with the captured CO<sub>2</sub> sent for permanent storage, then the reference scenario emissions shall be set to zero. For such projects, it is not possible to use equation 1.2. Therefore, the relative GHG emission avoidance shall be set equal to 200% as specified in section 1.1.4.

Where a project consists solely of the installation of a facility to capture naturally released geological CO<sub>2</sub> (e.g. from a geyser), with the captured CO<sub>2</sub> sent for permanent storage, then the reference scenario emissions shall be set to zero. For such projects, it is not possible to use equation 1.2. Therefore, the relative GHG emission avoidance shall be set equal to 200% as specified in section 1.1.4. This case does not apply if the emission of CO<sub>2</sub> was stimulated by human intervention. If geological CO<sub>2</sub> is released due to a project to generate geothermal energy, then a project to capture that CO<sub>2</sub> should apply in category/sector RES/geothermal energy and follow the provisions of section 3.

See section 2.2.6.2, section 2.2.6.3 and section 6 for additional guidance on CCU/S.

#### 2.2.5.8 Case 8: Storage and/or transport of captured CO<sub>2</sub>

For projects that involve only the storage and/or transport of CO<sub>2</sub> that is captured outside the boundary for the project, the reference emissions shall be set as the quantity of CO<sub>2</sub> entering the system boundary, appearing as a positive emission term.

No distinction shall be made between CO<sub>2</sub> of fossil, atmospheric, biogenic, RFNBO or LCF origin in this case. For an applicant to gain recognition within the GHG calculation for the biogenic origin of the CO<sub>2</sub> in line with section 1.4.4, then the capture of that CO<sub>2</sub> must be within the project scope and system boundary, and reference case 8 would not apply.

See section 2.2.6.2.2 and section 6 for additional guidance on projects that involve only the storage or transport of CO<sub>2</sub> that is captured outside the boundary for the project.

#### *2.2.5.9 Case 9: The applicant proposes a reference scenario*

For projects whose product(s) cannot be given reference scenario(s) using any of the cases detailed above, the applicants may propose a reference scenario based on an emission factor for the conventional reference product sourced from the data hierarchy in Appendix 1. If no appropriate emission factor is available at a higher level of the data hierarchy, the applicant may propose a value based on a life-cycle analysis undertaken or commissioned by the applicants themselves (Level 7 of the data hierarchy: Duly documented and justified own estimates, Appendix 1).

The applicants must credibly justify the choice to resort to Case 9, and why the other cases described above could not be applied. Deviations from the data hierarchy, for example the choice of a value from a source lower in the hierarchy when a value is available at a higher source, or the choice to resort to a life-cycle analysis undertaken by the applicants themselves, must be well justified.

The specific sources should, as far as possible, be consistent with the principles of EU ETS benchmarking and with the principles of the Innovation Fund Methodology. Applicants shall not define a reference scenario with artificially high emissions when lower-emission alternatives are available that are also more realistic and more consistent with the principles of EU ETS benchmarking and with the principles of this Methodology.

Typically, a reference scenario defined under Case 9 shall reflect production within the European Union. Emission factors reflecting non-EU production systems may only be utilised in duly justified cases where there is no significant production of the relevant input/product within the EU.

The decisions and calculations that lead to the definition of the relevant emission factor must be well documented in the application documents, and the corresponding references must be duly indicated in a transparent manner, and should be provided as part of the documents supporting the application where relevant.

Under Case 9, emissions in the 'process' box of the reference scenario will be calculated by multiplying a quantity of conventional reference product providing an equivalent function as the principal product of the project, by the relevant emission factor identified as detailed in this section. Typically, emissions associated with 'inputs' are already reflected in emission factors sourced from the data hierarchy and therefore do not need to be separately listed. This is not generally the case for 'end of life' emissions which must be specified in the dedicated box, unless they are already included in the emission factor sourced from the data hierarchy.

#### **2.2.6 Emissions from processes**

For the **project scenario**, the applicant must include in the 'processes' box all the emissions expected to occur within the system boundary of the project and associated with the processes required to produce the chosen **product(s)** or delivering its function (section 1.2). The set of processes to be considered in the 'processes' box are defined by the system boundary (section 2.2.3).

- The 'processes' box must include **all emissions of CO<sub>2</sub> and other greenhouse gases occurring due to fuel combustion and any other chemical or biological processes** occurring within the project boundary, remembering that any emission of biogenic CO<sub>2</sub> (section 1.4.4) or of CO<sub>2</sub> from externally-produced RFNBOs or LCFs (section 1.4.5) should be recorded, but shall be treated as having a zero emission factor, while emissions of non-CO<sub>2</sub> greenhouse gases (e.g. CH<sub>4</sub> and

N<sub>2</sub>O) must be considered with the appropriate emission factor different than zero (section 1.1.6).

- When fuels are combusted in the project scenario (or otherwise consumed to release their chemical energy, e.g. in a fuel cell) an emission term must be included based on a relevant emission factor sourced from the hierarchy of data sources in Appendix 1. For the case of fossil fuels, this generally means combustion emissions for a relevant case documented in tables 2.2 and 2.3 of IPCC (2006b). The combustion emissions must include expected generation of non-CO<sub>2</sub> greenhouse gases (e.g. CH<sub>4</sub> and N<sub>2</sub>O).
- The 'processes box' must also include **any expected gas or methane leakage occurring within the project boundary**, including biogas and biomethane leakages. Leakages should be predicted based on standard rates for the type of facility/equipment proposed.
- Emissions associated with transport must be considered and included in the 'processes' box in the cases specified in section 1.4.5.
- Inputs from processes that are outside the system boundary are to be dealt with in the 'inputs' box (section 2.2.7).

The **reference scenario** includes in the 'processes' box emissions from all processes associated with producing the same quantity of product(s) or meeting the same functions as the product(s) produced in the project scenario. Refer also to section 2.2.5 for relevant provisions concerning the definition of an appropriate reference scenario.

**Note for applicants familiar with earlier versions of the methodology:** *The credit for carbon capture has been moved from the processes box and is now included in the calculation through Equation 1.1 (see section 1.1.3). Nonetheless, the credit for carbon capture should still be considered in the calculation of the process emissions per unit of product for the purposes of meeting the corresponding minimum requirement, as detailed in the Call Text.*

#### 2.2.6.1 Changes in emissions from waste processing

If a process produces waste, emissions from the processing of waste and waste handling emissions belong to the 'processes' box.

*Example: An innovative process (project scenario) may eliminate a waste stream that conventionally (reference scenario) requires energy-intensive treatment.*

#### 2.2.6.2 Projects with an element of CCS

Projects that involve capture of CO<sub>2</sub> for storage, transport of CO<sub>2</sub> to a storage site, and/or storage of CO<sub>2</sub> in a permanent storage site can calculate a carbon capture credit in accordance with section 6.

In the case that CO<sub>2</sub> capture and storage occur in the reference scenario (this may occur, for example, under Case 3: Modification to an existing production system), this must also be taken into account by the inclusion of an appropriate separate carbon capture credit for the reference scenario (See section 6 for more guidance on calculating this credit).

##### 2.2.6.2.1 Projects that capture CO<sub>2</sub> from within the system boundary, for storage

Projects that capture some or all of the CO<sub>2</sub> produced by processes within the system boundary and transfer it for storage **must include the full amount of CO<sub>2</sub> produced by those processes as an emission term within the processes box of the project scenario even though some of this CO<sub>2</sub> is to be captured**. Fossil CO<sub>2</sub> will appear as a positive emission term, while biogenic CO<sub>2</sub> or CO<sub>2</sub> from externally-produced RFNBOs or

LCFs used as inputs shall be reported with an emission factor of zero. Credit for the capture and subsequent storage of the CO<sub>2</sub> is then given by the separate calculation of a carbon capture credit following the rules in section 6 (cf. Equation [1.1]).

The reference emissions shall be calculated as for any EII project using the methodology as detailed in this section 2, and choosing the appropriate case as detailed in section 2.2.5.

- Projects that add carbon capture units to existing installations without changing the products from those installations **must be treated as modifications to the existing system** (Case 3, section 2.2.5.3).
- Projects consisting of CCS based on direct air capture (DACCS), in which CO<sub>2</sub> is captured from the atmosphere rather than from an industrial process, shall apply under category 'EII' and sector 'other' with the principal product identified as 'CO<sub>2</sub> storage'. The reference scenario emissions for a DACCS project shall be zero (Case 7, section 2.2.5.7).
- Projects consisting of CO<sub>2</sub> capture for geological storage from natural geological sources (e.g. a geyser) shall apply under category 'EII' and sector 'other' with the principal product identified as 'CO<sub>2</sub> storage'. The reference scenario emissions for such a project shall be zero (Case 7, section 2.2.5.7).

If, however, a project causes the release of geological CO<sub>2</sub> which would otherwise have stayed underground (e.g. by sourcing geothermal steam from a reservoir where the steam is mixed with CO<sub>2</sub>), and then captures the released CO<sub>2</sub>, then the CO<sub>2</sub> that is released as a result of the project activities must appear as a positive term in the project scenario, including the portion of CO<sub>2</sub> that will later be captured.

If geological CO<sub>2</sub> is released due to a project to generate geothermal energy, then a project to capture that CO<sub>2</sub> should apply in category/sector RES/geothermal energy and follow the provisions of section 3.

#### *2.2.6.2.2 Projects that transport and/or store CO<sub>2</sub> that was captured outside the system boundary*

Projects that transport and/or geologically store CO<sub>2</sub> captured outside of the system boundary of the project **shall include the full amount of CO<sub>2</sub> being brought into the system boundary as a positive emission term in the processes box of both the reference and project scenario**. This applies even though this CO<sub>2</sub> will not be emitted in the project scenario (excepting any fugitive, vented or leaked emissions). Credit for storage of the CO<sub>2</sub> is then given by the separate calculation of a carbon capture credit following the rules in section 6 (cf. Equation [1.1]).

Irrespective of its origin (e.g. fossil, biogenic, geological, or atmospheric), the captured CO<sub>2</sub> will appear as a positive emission term in both the reference and project scenario. Additional credit associated to the biogenic origin of the CO<sub>2</sub> cannot be claimed if the CO<sub>2</sub> is captured outside of the system boundaries of the project. In this case, the origin of the CO<sub>2</sub> or the nature of the processes from which it is captured makes no difference to the GHG calculations.

In line with the approach described above, the emissions in the processes box of the reference scenario shall be set according to Case 8: Storage or transport of captured CO<sub>2</sub> (section 2.2.5.8) as the amount of CO<sub>2</sub> entering the project boundary (i.e. the reference scenario is set as if the CO<sub>2</sub> would be released in the absence of the project).

### 2.2.6.3 Projects with an element of CCU

Projects that will use captured CO<sub>2</sub> by incorporating it in a product can calculate a carbon capture credit in accordance with section 6. The CO<sub>2</sub> may be captured within the system boundary of the project or brought in from outside the boundaries of the project.

In the case that CO<sub>2</sub> capture and utilisation occur in the reference scenario (this may occur, for example, under Case 3: Modification to an existing production system), this must also be taken into account by the inclusion of an appropriate separate carbon capture credit for the reference scenario (See section 6 for more guidance).

#### 2.2.6.3.1 *Projects that capture CO<sub>2</sub> from within the system boundary, for use*

Projects that capture some or all of the CO<sub>2</sub> produced by processes within the system boundary and utilise it or transfer it for utilisation **must include the full amount of CO<sub>2</sub> produced by those processes as an emission term within the processes box of the project scenario even though some of this CO<sub>2</sub> is to be captured and utilised**. Credit for the capture and subsequent utilisation of the CO<sub>2</sub> is then given by the calculation of a separate carbon capture credit following the rules in section 6 (cf. Equation [1.1]).

Fossil CO<sub>2</sub> will appear as a positive emission term, while biogenic CO<sub>2</sub> shall be reported with an emission factor of zero. As with CCS (see section 2.2.6.2.1), if the source of the captured CO<sub>2</sub> is atmospheric carbon or naturally released geological carbon, there is no requirement to include a positive emission term, unless the project causes the release of geological CO<sub>2</sub> which would otherwise have stayed underground. The reference emissions shall be calculated as for any EII project using the methodology as detailed in this section 2, and choosing the appropriate case as detailed in section 2.2.5.

**Both the process from which the CO<sub>2</sub> is captured and the process in which CO<sub>2</sub> is used shall be included within the system boundary of the project:** both processes must be included in the GHG calculations, and the applicant must provide a full characterization of both. At least one of the products of the process from which the CO<sub>2</sub> is captured, and one of the CCU products, must be set as products of the project, and the principal product which is the main aim of the project shall be identified following the provisions in section 1.2.3.

*Example: A project will add carbon capture to an existing steel plant, the steel plant is within the system boundary of the project and steel is one of the products of the project. The captured CO<sub>2</sub> will be used in an e-fuel production facility built and operated by the applicant as part of the project.*

*The CO<sub>2</sub> generated by the steel plant is included as an emission term in the processes box of the project scenario even though part of it will be captured, and a carbon capture credit will be included in Equation [1.1] based on the amount of carbon incorporated in the e-fuel, following the rules in section 6.*

*The applicant must include the e-fuel plant within the system boundary and fully characterise it as part of the GHG calculations. The produced e-fuel must be set as a product of the project, and the principal product which is the main aim of the project must be identified following the provisions in section 1.2.3.*

In the case in which CO<sub>2</sub> is captured by the applicant within the project scope, and it is then transferred to a third party for utilisation purposes, outside the project scope, the applicant must include the CO<sub>2</sub> utilisation process within the boundaries of its calculations, including inputs to the CO<sub>2</sub> utilisation process and the end-of-life emissions of the CCU products, following the provisions in this and other relevant sub-sections. An emission reduction by CCU **can only be claimed by projects that will demonstrate that the**

**captured carbon will be used by incorporation into a product**, and that this represents an additional utilisation of CO<sub>2</sub> (see section 6.3).

*Example:* A project will add carbon capture to an existing steel plant, the steel plant is within the system boundary of the project and steel is one of the products of the project. The captured CO<sub>2</sub> will be used in an e-fuel production facility built and operated by a third party and outside the scope of the project.

The CO<sub>2</sub> generated by the steel plant is included as an emission term in the processes box of the project scenario even though part of it will be captured, and a carbon capture credit will be included in Equation [1.1] based on the amount of carbon incorporated in the e-fuel, following the rules in section 6.

The applicant must include the e-fuel plant within the system boundary and fully characterise it as part of the GHG calculations. The produced e-fuel must be set as a product of the project, and the principal product which is the main aim of the project must be identified following the provisions in section 1.2.3.

#### 2.2.6.3.2 Projects that use CO<sub>2</sub> that was captured outside the system boundary

If the CO<sub>2</sub> is brought in from outside the project boundaries, then all the processes used to produce the CCU products and their associated emissions must be included within the system boundary of the project scenario.

In this case, there is no need to include a positive emission term for CO<sub>2</sub> production in the 'processes' box. This means that **for CO<sub>2</sub> produced outside the system boundary it makes no difference to any part of the calculation whether the source of the CO<sub>2</sub> is biogenic, fossil, atmospheric or geological.**

*Example:* A project will use CO<sub>2</sub> captured from a steel plant for e-fuel production. Both the steel plant and the carbon capture unit are outside of the system boundary: they are operated by a third party (not part of the consortium) from whom the applicant purchases the CO<sub>2</sub> that enters the project as an input.

The CO<sub>2</sub> generated by the steel plant **is not included** as an emission term in the processes box of the project scenario. The applicant must include the e-fuel plant within the system boundary and set the produced e-fuel as a product. A carbon capture credit may be included in Equation [1.1] based on the amount of carbon incorporated in the e-fuel, following the rules in section 6.

The reference emissions shall be calculated as for any EII project using the methodology as detailed in this section 2, and choosing the appropriate case following the provisions in section 2.2.5, based on which reference product is replaced by the CCU product produced by the project.

#### 2.2.6.3.3 End-of-life emissions of CCU products

For CCU products, the applicant must calculate end of life emissions as for any other product following the provisions in section 2.2.9. In particular, the applicant must consider the expected fate of the carbon contained in the CCU product at the end of life, following the provisions in section 2.2.9.1.

These provisions apply both to products that are to be combusted for energy (e.g. in the case of e-fuels produced using captured CO<sub>2</sub>), and to products intended for other uses. These provisions apply also in the cases in which a third-party CO<sub>2</sub> utilisation process has been brought within the system boundaries of the project (see section 2.2.6.3.1).

Note that, in line with section 1.4.5, the characterisation as RFNBO or LCF is only relevant for externally produced fuels used as inputs/feedstock, and not for fuels produced within the project boundaries. Therefore, the characterisation of a product as RFNBO or LCF has no bearing on the calculation of combustion and end-of-life emissions, which shall NOT be treated as zero-rated unless otherwise permitted by other provisions in the Methodology.

Note also that, in line with section 1.4.4, combustion and end-of-life emissions for CCU products are **not affected by the original fossil or biogenic status of the captured CO<sub>2</sub>**, i.e. combustion and end of life emissions for CCU products shall NOT be treated as zero even if the CO<sub>2</sub> was originally captured from a biogenic source. Similarly, to avoid double counting of the benefit and in line with section 1.4.5, the carbon that entered the boundaries of the project as part of an RFNBO or LCF loses its zero-rating characteristic once first emitted and if re-captured is treated as fossil carbon in any subsequent instance in which it is emitted. This means that CCU products produced using captured carbon that entered the system as part of an RFNBO or LCF are not considered to be zero-rated themselves.

*Example: a project aims to produce methanol using CO<sub>2</sub> captured from waste gasification, with a waste composition of 70% biogenic carbon and 30% fossil carbon. The release of the entire amount of carbon contained in the methanol shall be recorded as an emission under the 'end of life' box in the project scenario. The original status of the captured CO<sub>2</sub> as partly biogenic does not affect the calculation of this emission term.*

### 2.2.7 Emissions from inputs

The applicant must specify the inputs that enter the system boundary (see section 2.2.3) and are used by processes in the 'processes' box of the project or the reference scenarios. This shall include all **energy and material inputs, with the following exceptions:**

- Fossil fuels are an exception, as emissions due to extraction, processing, refining, distribution and storage of fossil fuels are excluded from the calculation in line with section 1.1.7.
- Captured CO<sub>2</sub> utilised by the project shall not be treated as an input, but shall instead be included in the calculation through the carbon capture credit (see section 2.2.6.3).
- In cases where solid materials are reshaped, reformed or assembled into a product by the project but remain largely unchanged in their chemical composition and physical structure, then the applicant may choose to not treat them as inputs. Such cases need to be well justified by the applicant, and the choice must be consistent between the project and reference scenarios.

*Example: A project consists of working steel into parts for machinery. The applicant may choose not to treat the steel used as an input, and therefore emissions associated to the production of the steel that is reshaped by the project will not be included in either the project or reference scenario. If instead the applicant decides to treat the steel used as an input, the same emission factor shall be used in both the reference and project scenario, in line with section 2.2.7.1.*

*Example: A project consists of applying a coating to steel components. The applicant may choose not to treat the steel component to which the coating is applied as an input, since it is simply the support to which coating is applied, and therefore steel production emissions will not be included in either the project or reference scenario. If instead the applicant decides to treat the steel used as an input, the same emission factor shall be used in both the reference and project scenario, in line with section 2.2.7.1.*

*Example:* A project produces bricks using a kiln-free curing process, mixing sand and clay with a binder. The chemical composition of the sand and clay may remain unchanged through the kiln-free curing process, but the physical structure is changed by mixing and binding, and therefore the sand, clay, and binder must be treated as inputs and assigned appropriate emission factors.

**Note for applicants familiar with previous versions of this methodology:** there is no longer a distinction drawn between elastic, rigid and semi-elastic inputs.

#### 2.2.7.1 Treatment of inputs in the project and reference scenario

The emission factors used for inputs in the GHG emission avoidance calculations should represent current typical practices. As a fundamental principle, when a project uses the same or similar inputs in the reference and project scenario, these inputs should be assigned the same or equivalent emission factors, respectively, and should be assumed to be of the same origin.

A project cannot claim the benefits associated to procuring inputs from a less carbon-intensive source by assuming a different origin of the same or similar inputs between the reference and project scenario. Similarly, applicants must follow the rules in section 2.2.7.3 regarding the selection of input emission factors, including following the input data hierarchy in Appendix 1 where relevant, and are not permitted to adjust input emission factors in the project scenario by making alternative assumptions about the upstream emissions for production of an input or product even if they are able to identify specific details that more closely represent the process used by their supplier.

Inputs are considered 'the same or similar' when they are chemically and physically the same, or they are adequately chemically and physically similar so that the input used in one scenario can be simply derived from the input used in the other (e.g. by a standard chemical process or by addition of a basic material).

Inputs are considered to be 'of the same origin' when they have the same status as being biogenic, RFNBOs, LCFs, waste, or none of the above. In the case of biomass-derived fuels and materials, they must be produced from the same type of biomass.

*Example:* A project proposes innovation in the steel manufacturing process that occur downstream with respect to the production of molten steel, which is an input in both the reference and project scenario. The applicant must assume the same origin of molten steel and must use the same emission factor in both scenarios, which must be representative of current typical practices. The applicant is NOT allowed to assume that, for example, the molten steel used in the project scenario is produced by an electric arc furnace, while the molten steel used in the reference scenario is produced by a basic oxygen furnace, as this would bring an undue benefit to the project by claiming emissions reductions that occur beyond the project boundaries.

*Example:* A project proposes innovation in the methanol-to-olefins process, with methanol as an input in both the reference and project scenario. The applicant must assume the same origin of the methanol and must use the same emission factor in both scenarios. The applicant is NOT allowed to assume that, for example, the methanol used in the project scenario is an RFNBO, while the methanol used in the reference scenario is of fossil origin, as this would bring an undue benefit to the project by claiming emissions reductions that occur beyond the project boundaries. Instead, the applicant may be allowed, in well-justified instances, to assume that the methanol used in both the reference and project scenario is of RFNBO origin, subject to the provisions detailed in section 1.4.5.

In the **project scenario**, some inputs may be identified as de minimis and disregarded as detailed in section 2.2.7.2.

For the **reference scenario only**, the applicant may choose to **simplify the calculation by ignoring the (positive) emissions of any number of inputs**. Note, however, that ignoring some positive emissions from inputs in the reference scenario would reduce the reportable absolute and relative GHG emissions avoidance of the project.

Where the reference scenario under 'Case 1' (see 2.2.5.1) or 'Case 2' (see 2.2.5.2) is based on one or more EU ETS benchmarks, it includes the emissions covered by EU ETS direct emissions calculations, but it does not include embedded emissions associated with any inputs used in those benchmarked processes. The applicant should therefore identify inputs that would be used in the conventional production system and include them in the 'inputs' box of the reference scenario. In general, the EU ETS benchmark documents do not specify the quantities of all inputs used in each process, in which case the applicant must provide a reasonable and well justified estimate. This estimate of inputs quantity may be based on engineering principles and/or appropriate sources taken from the data hierarchy. The applicant must explicitly detail the basis for assumptions on quantities of inputs used in the reference scenario and provide references.

### 2.2.7.2 *Materiality of inputs*

Inputs in the project scenario can be identified as major or de minimis, as detailed below.

#### 2.2.7.2.1 *Major inputs*

Major inputs must be assigned an emission factor following the rules in section 2.2.7.3, and must be included in the 'inputs' box.

#### 2.2.7.2.2 *De minimis inputs*

De minimis inputs are inputs that make such a small contribution to the overall emissions of the project scenario that they may be disregarded when assessing emissions avoidance, and may be treated as having an emission factor of zero.

Inputs used in very small quantities, as defined in this paragraph, may be stated generically, e.g. 'maintenance materials', and assigned zero emissions. Any input estimated as having total associated annual emissions of 10 tCO<sub>2e</sub> or lower during project operation may be treated as de minimis. The applicant may also select from the list of inputs a subset whose emissions jointly amount to less than 5% of the total emissions ascribed to the inputs for the whole project and treat them as de minimis.

For monitoring and reporting for disbursement purposes, the selection of de minimis inputs must be restricted so that their emissions jointly amount to less than 5% of the total emissions ascribed to the inputs; for monitoring and reporting for knowledge-sharing purposes, to less than 2% of the total emissions ascribed to the inputs.

**Simplification for SMALL-SCALE topic and PILOTS topic:** The applicant may select from the list of inputs a subset whose emissions jointly amount to less than 15% of the total emissions ascribed to the inputs for the whole project and treat them as de minimis.

### 2.2.7.3 *Emission factors for inputs*

#### 2.2.7.3.1 *Electricity, heat and hydrogen*

The emissions factors for **electricity, hydrogen and heat** used as inputs are stated in section 1.4.3. Electricity consumed in either the project or reference scenario shall be assigned an emission factor of zero, with the following two exceptions:

- 'Electricity-saving projects': Projects in which an existing production system is modified by means of specific innovative technologies that **reduce electricity consumption**, and this reduction in electricity consumption is the only change (i.e.

there is no change to the products of the system, to the use of non-electrical energy or to the consumption of inputs other than those associated with the reduced electricity consumption).

In this case the reference emissions related to electricity shall be obtained by multiplying the project net electricity savings by the expected 2030 electricity grid mix emission factor (48.8 tCO<sub>2</sub>e/TJ [0.176 tCO<sub>2</sub>e/MWh]).

Electricity-saving projects shall be submitted under the EII sector determined based on the principal product as normal (section 1.2). It is not permitted to combine electricity-saving projects with other type of projects under any category or hybrid projects in a single InnovFund application.

- Projects that **time their operation** to coincide with periods in which the GHG intensity of grid electricity is low are subject to specific rules. This is explained in section 2.2.7.4.

#### 2.2.7.3.2 Water

Emissions for **water provision** as an input should be neglected unless water provision involves desalination, purification, or additional pumping. If one of these is required, then an emission factor should be chosen from the data hierarchy in Appendix 1 that reflects the specific water supply case. For example, if the water is supplied by desalination, then an emission factor for desalinated water should be found in the data hierarchy.

#### 2.2.7.3.3 Biomass-derived fuels and materials

The emissions for biomass-derived fuels and materials entering the project boundaries as inputs are calculated following the rules in section 1.4.4.

Note that non-CO<sub>2</sub> greenhouse gas emissions (CH<sub>4</sub> and N<sub>2</sub>O) associated to the combustion or use of any biomass-derived fuels and materials that is combusted or used as part of the project must be included in the 'processes' box as appropriate (section 2.2.6).

#### 2.2.7.3.4 RFNBOs and LCFs, other than hydrogen

The emissions factors for externally-produced RFNBOs (as defined by Directive 2018/2001) and LCFs (as defined by Directive 2024/1788) used as inputs are calculated following the rules in section 1.4.5.

#### 2.2.7.3.5 Waste materials as inputs and inputs with no economic value

In the case that a project consumes as an input a material that has no economic value and that would otherwise have been disposed of, including any material defined as waste under Directive 2008/98/EC, then the input emissions for that material are defined as the sum of supply emissions plus transport emissions:

- **Supply emissions** shall be set equal to zero, unless a negative credit can be claimed following the provisions in section 2.2.7.3.5.2, below.
- **Transport emissions** can be set to zero if the waste input is transported for a distance below 500 km to the first point of processing/treatment by the project. Otherwise, they must be considered and calculated following the provisions in section 1.4.6.

If materials that have no economic value are used as inputs in both the reference and project scenarios, then they shall be given the same or equal treatment in the two scenarios in line with the provisions of section 2.2.7.1. For example, a project cannot claim a negative credit in the project scenario, while assigning an emission factor of zero to a similar amount of waste material used as an input in the reference scenario.

Any additional avoided greenhouse gas emissions from avoided methane production due to the diversion of materials from landfill or other disposition are considered out of scope of the GHG calculation (see section 1.1.7).

Note that projects using exclusively biomass waste or residues to produce heat or electricity as a product are typically classified as renewable energy projects (see section 1.2) and should apply the RES methodology (section 3). Projects using a mixed biomass/fossil waste input to produce heat or electricity as a product should refer to the provisions of section 1.2.5.2 on hybrid EII+RES projects. Projects involving a component of carbon capture should also refer to the examples in section 6.4.

#### *2.2.7.3.5.1 Waste Framework Directive, minimum requirements, and monitoring requirements*

Projects that involve the use of waste materials must respect the waste hierarchy in the Waste Framework Directive (Directive 2008/98/EC), which puts top priority on material recycling (e.g. recycling used plastic as plastic). Converting waste to a fuel is specifically excluded from the definition of 'recycling' in the Waste Framework Directive, and it does not count towards recycling targets for Member States. It is classified as 'recovery', on a lower level of the waste hierarchy, along with burning for electricity and/or heat production. Therefore, projects that use as feedstock materials covered in the Waste Framework Directive, such as used plastics, must precisely define the 'waste' they are intending to use, and, where relevant, must justify why it cannot be given a higher-priority treatment under the Waste Framework Directive during the lifetime of the project.

Any biomass used in InnovFund projects, including biomass wastes or residues, must conform to the relevant minimum requirements specified in the Call Text.

The applicant must credibly justify the assumptions made with respect to the classification and origin of materials with no economic value and waste materials, for example by providing letters of support from potential suppliers or other supporting documents. In addition, the applicant must propose adequate measures in the monitoring plan (see section 1.5 and Appendix 3) to ensure that the nature and origin of such materials can be adequately reported and monitored.

Failure to provide adequate justification and to propose adequate monitoring measures may affect the quality of the GHG calculations and the resulting evaluation. In addition, failure to demonstrate the actual nature and origin of the material during project implementation may affect the overall GHG emission avoidance that can be achieved by the project, which may have consequence in terms of grant disbursement as specified in the Call Text.

#### *2.2.7.3.5.2 Carbon-containing materials which are currently incinerated or landfilled*

If the existing fate of the material in the absence of the project is **incineration** with or without energy recovery **or landfilling**<sup>19</sup> (situations which the applicants must duly justify and document) and the material contains non-biogenic carbon atoms, then the input shall be assigned an emission credit equal to minus one multiplied by the CO<sub>2</sub> emissions from stoichiometric combustion of the material. Note that the **CO<sub>2</sub> emissions of any biogenic carbon must be counted with an emission factor of zero**, even when diverted from incineration or landfilling.

*Example: If the existing fate of municipal waste used as an input is incineration without energy recovery, then the input shall be assigned a negative emission credit based on the stoichiometric combustion to CO<sub>2</sub> of the non-biogenic fraction of the waste, while the biogenic fraction of the waste is assigned an input emission factor*

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<sup>19</sup> Although landfilling may sequester part of the carbon on a long-term basis, it is not desirable to encourage landfill for other environmental reasons, which is why the possibility to claim a negative credit is given.

*of zero. Note that the applicant must credibly justify that the existing fate of the municipal waste used is incineration (with or without energy recovery) or landfilling.*

In some projects, a material stream with no economic value may be taken as an input and only partly utilised. In such cases, the emission credit in the input box shall be based only on the fraction of the material stream actually utilised by the project.

***Example:** A project uses as an input a subset of plastics in a municipal waste stream, while the rest of the waste is returned for disposal. The emission credit in the input box must be based only on the subset of plastics that is actually utilised by the project. Note that the applicant must credibly justify that the existing fate of the plastic waste used is incineration (with or without energy recovery) or landfilling.*

Note that, when a carbon-containing material is diverted from either landfill or from incineration and used as an input for novel fuel or consumable chemical production, this will result in a project scenario with a negative emission term for the non-biogenic-carbon-containing material in the 'inputs' box, and a positive emission term in the 'end of life' box (see section 2.2.9). If the number of carbon atoms in the non-biogenic waste input is identical or close to the number of carbon atoms in the produced fuel, these terms would cancel each other out, or be very similar. In such cases, the applicants should still include both terms in the calculations for transparency and to aid the evaluators in understanding the project.

#### 2.2.7.3.6 Other relevant inputs

For other inputs, emission factors must be taken from the reference literature according to the method and hierarchy established in Appendix 1. The applicant must reference and justify all the literature values that are used for the emissions factors, so that evaluators can check them. Note that, with the exception of heat and 'generic' hydrogen, the **EU ETS benchmark emission factors shall not be used for inputs** as the scope of the EU ETS benchmark calculation is not appropriate for this purpose.

Emission factors for inputs shall **represent the typical emissions intensity for that specific input or product**. Typically, emission factors taken from the data hierarchy shall reflect production within the European Union or the European Economic Area. Emission factors reflecting non-EU/EEA production systems may only be utilised in duly justified cases where there is no significant production of the relevant input within the EU nor within the EEA.

If several emission factors are available at the same level of the hierarchy, representing different processes for obtaining the same product, the applicant shall select the process that best describes the **marginal** source (otherwise known as the 'swing producer') of the input, and must explain the choice.

For inputs containing carbon compounds, life cycle and well-to-wheel databases will often report the total carbon intensity, which is the sum of the emissions associated to the production and supply of the material, plus its stoichiometric carbon content, which is assumed to be entirely converted to CO<sub>2</sub> during the material's lifetime. However, including stoichiometric CO<sub>2</sub> release in the 'input' box as well as in the 'end of life' box would **result in double counting** of those carbon emissions.

Therefore, for carbon-containing inputs, where the emission factor selected includes the stoichiometric carbon content, the appropriate emission factors to be used can be calculated by subtracting from the total carbon intensity the carbon content of the input converted to mass of CO<sub>2</sub> using the molar weight ratio 44/12.

***Example:** A project uses hydrochloric acid (HCl) as an input. An emissions intensity value of 1061.1 gCO<sub>2</sub>e/kg is provided for HCl in the document 'Definition of input*

*data to assess GHG default emissions from biofuels in EU legislation' at level 3 of the data input hierarchy.*

*Example: A project uses methanol (CH<sub>3</sub>OH) as an input. An emissions intensity value of 97.1 tCO<sub>2</sub>e/TJ is provided for methanol in the document 'Definition of input data to assess GHG default emissions from biofuels in EU legislation', and this value is subdivided into supply emissions of 28.2 tCO<sub>2</sub>e/TJ and combustion emissions of 68.9 tCO<sub>2</sub>e/TJ. For methanol used as an input, only the supply emissions shall be considered so the emission factor to use is 28.2 tCO<sub>2</sub>e/TJ.*

#### *2.2.7.3.7 Allocation of emissions to inputs that are the co-products of processes occurring upstream of the project boundaries*

In some cases, it may be necessary to allocate emissions between the products of a process occurring upstream of the project boundaries to determine the GHG emissions intensity of an input. This would include the case in which a major input is a co-product of a process for which only an overall GHG emissions intensity is available in the data hierarchy in Appendix 1.

For such attribution purposes, the emissions to be shared shall be all the emissions that take place up to, and including, the process step at which the co-products are produced. If an input to said process is itself a co-product of an earlier process, the attribution of emissions at the earlier process must be done first. ISO 14044 (2006) provides a framework for such attribution as illustrated in Appendix 2.

#### *2.2.7.4 Timing operations to lower grid electricity emissions*

A plant using electricity (such as an electrolyser) can reduce the emissions of the grid electricity it consumes by operating only at times when the emissions of the electricity supply are below average. This approach helps grid stability in a similar way to electricity storage, and therefore a project that credibly commits to timed operation may treat electricity provided through 'virtual storage' as a product and **make a hybrid EII+ES application** (section 1.2.5).

Virtual storage can only be claimed in the case that a project is **grid connected**. No virtual storage shall be claimed if a project is directly connected to a renewable power facility without grid connection. Virtual storage shall not be claimed based on the expectation of reduced electricity consumption during periods of necessary maintenance, emergency shutdowns or shutdowns due to a lack of market demand, unless it can be demonstrated that such shutdowns can be purposefully timed to coincide with periods of higher-than-average grid electricity GHG emissions intensity.

To claim a virtual storage component, the applicant must provide a credible plan to manage grid electricity consumption to coincide with times when the emissions of the electricity supply are below average. The applicant must demonstrate that consumption decisions will be informed by relevant metrics for grid emissions, such as the instantaneous fraction of renewable power from intermittent sources supplied to the grid, the instantaneous price of grid electricity as a proxy for the level of renewable power supply, or other similar metrics. If applicants claim that a PPA is used to determine when electricity is consumed, they must provide convincing evidence that using this PPA is a reasonable basis to ensure that electricity consumption is preferentially reduced during periods of high grid carbon intensity. If a credible plan to time operation is not provided at the application stage, this may affect the assessment of the quality of the GHG calculations.

During project operation, beneficiaries shall demonstrate the delivery of the claimed virtual storage component, for example by providing hourly profiles and other relevant supporting documents. Failure to do so may impact the amount of GHG emission avoidance actually achieved by the project, which in turn may impact the amount of grant disbursed, as detailed in the Call Text.

The GHG emissions avoidance related to virtual storage shall be calculated following the rules for energy storage in Section 4 and using the relevant emission factor indicated in Table 1.3. The project emissions for the virtual storage component shall be set as zero. The reference emissions shall be calculated following Equation [4.3], in which the term  $E_{out,x,y}$ , for  $x = \text{electricity}$ , shall be set as the quantity of virtual storage that is delivered by reducing electricity consumption at times of higher grid carbon intensity, and shall be calculated in accordance with either Equation [2.1a] or Equation [2.1b], which are equivalent.

Parameter	=	Equation	
$E_{out,electricity,y}$	=	$(P_{average\ consumed,y} - P_{reduced\ operation,y}) * T_{reduced,y}$	[2.1a]
		$E_{consumed,y} * \tau_{reduced,y} - E_{reduced\ operation,y}$	[2.1b]

Where:

$T_{reduced,y}$  = the period of year  $y$  during which electricity consumption is actively reduced coinciding with periods of higher-than-average grid carbon intensity, in hours.

$\tau_{reduced,y}$  = the fraction of year  $y$  during which electricity consumption is actively reduced coinciding with periods of higher-than-average grid carbon intensity, expressed as a non-dimensional ratio.

$P_{average\ consumed,y}$  = average electric power consumption by the project in year  $y$ , including periods of standard operation and periods of reduced operation, in MW<sup>20</sup>.

$P_{reduced\ operation,y}$  = average electric power consumption by the project during periods of reduced operation (i.e. periods in which electricity consumption has been actively reduced) in year  $y$ , in MW<sup>20</sup>. If the plant is completely shut down during these periods, this term will be zero.

$E_{consumed,y}$  = total electricity consumed by the project in year  $y$ , including periods of standard operation and periods of reduced operation, in MWh or TJ.

$E_{reduced\ operation,y}$  = electricity consumed by the project during periods of reduced operation (i.e. periods in which electricity consumption has been actively reduced) in year  $y$ , in MWh or TJ. If the plant is completely shut down during these periods, this term will be zero.

## 2.2.8 Emissions from change to in-use

The methodology does not require applicants to include all emissions associated with the use phase of the products. However, in some cases, **the characteristics of innovative products may result in emissions savings in the use phase**, for instance by allowing more efficient operation. The 'change to in-use' emissions box allows credit to be claimed in the project scenario for such emissions savings.

Unlike the other boxes, the 'change to in-use' box in the project scenario focuses on changes in emissions rather than including all emissions occurring in the use phase of the product(s). Therefore **in-use emissions shall not be included in the reference scenario**. In other words, the 'change to in-use' emissions box should be filled-in for the project scenario only, and only if the applicants decide to do so.

<sup>20</sup> Applicants should apply the relevant conversion factor and ensure dimensional consistency in cases where  $E_{out,electricity,y}$  needs to be expressed in TJ rather than MWh.

When in-use emissions savings are claimed, they must be well justified and based on a realistic use case. The in-use emission avoidance is first estimated per tonne of product. Then, the quantity of product considered in the calculation of total in-use emission avoidance shall be limited to the quantity that the applicant can credibly demonstrate to be able to sell in a market in which the claimed in-use savings are achievable.

During project operation, applicants will need to demonstrate the achievement of the claimed emission reductions. Failure to do so may negatively affect the performance of the project and the related grant disbursement, as detailed in the Call Text. At the application stage, applicants shall propose appropriate monitoring and reporting arrangements. For example, applicants will have to monitor and report the amount of products sold into markets that allow the claimed in-use emissions savings to be achieved.

Applicant may claim in-use savings resulting from the innovative properties of the product(s) manufactured by the project.

*Example: A project produces an innovative nitrogen compound to use as a fertiliser, and the applicant provides convincing evidence that its use will reduce nitrous oxide (N<sub>2</sub>O) emissions compared to conventional nitrogen fertilisers when applied to the soil. Credit may be given in the 'change to in-use' box for the CO<sub>2</sub> equivalent emissions that can be avoided by using the new compound.*

*Example: A project produces a new material that enables improved tyre dynamics (e.g. light-weighting benefit and reduced rolling resistance) when the tyres are in-use. Credit may be given in the 'change to in-use' box for the associated reduction in fuel use through the lifetime of a tire.*

Savings from changes to in-use emissions may only be claimed where they are enabled directly by the properties of the produced product: it is not enough to state that the produced product may be used as an input for the production of a second product which would then deliver in-use emissions reductions.

*Example: A project produces steel with an innovative process, but the steel itself has comparable properties to steel from conventional processes. The applicant states that the steel will be sold to another company and used in a manufacturing process that has a lower carbon intensity than the state of the practice. The use of the steel in the manufacturing process is not enabled by any particular property of the produced steel, and therefore no additional credit may be given.*

In some cases, the use of an innovative product will enable in-use emissions savings only when coupled with one or more additional innovative products or practices. In such cases, the applicant should record in the 'change to in-use' emissions box a fraction of the emissions saved proportional to the ratio of the cost of the innovative product to the cost of the entire innovative system.

*Example: A project produces an innovative polymer that can be combined with a second innovative polymer (not produced by the project) and used to produce lightweight packaging material, allowing reductions in fuel consumption by delivery vehicles. If the costs of the two polymer components are equal, then the applicant may record a credit in the 'change to in-use' emissions box equivalent to half of the expected emissions saving due to reduced fuel use by delivery vehicles.*

Some emission reductions associated with the use of the products are dealt with outside of the 'change to in-use' emissions box. For example:

- if the use of a novel product replaces a larger quantity of a conventional product (for example 1 tonne of a novel product replaces 1.2 tonnes of a conventional product) this is dealt with by including 1.2 tonnes of conventional production in the reference scenario for every 1 tonne of novel production in the project scenario. In

these instances, the applicants must credibly justify that a smaller quantity of product produced in the project scenario provides an equivalent function as a larger quantity of reference product.

- Combustion emissions associated with the use of transport fuels produced as products in the reference scenario are already covered within the relevant fossil fuel comparator (section 2.2.5.4). Combustion emissions associated with the use of fuels produced as products in the project scenario are covered in the 'end of life' box (section 2.2.9). Therefore, savings related to differences in products' combustion emissions shall not be included in the 'change to in-use' box.

## 2.2.9 Emissions from end of life, including combustion of products

End of life emissions refer to the emissions associated with the disposal or recycling of a product after the end of its useful life, or with combustion or decomposition of the product during its use. Innovation Fund projects shall include end of life emissions only in the following two cases:

1. If a product contains carbon, then the applicant must include any emissions associated with the fate of that carbon in the 'end of life' box (see 2.2.9.1). These emissions must be included even if they are identical between the project and reference scenarios. Failure to consider the fate of carbon at end of life would distort the GHG emissions avoidance calculation and may affect their quality.
2. If a product produced by the project scenario will **deliver emission reductions** in its end of life compared to the equivalent conventional product in the reference scenario, then said emissions reduction **may be included** as a credit (negative emission term) in the 'end of life' box of the project scenario (see 2.2.9.2).

These two cases are further explained below.

### 2.2.9.1 *Products containing carbon*

For products containing carbon, the applicant must consider the expected fate of this carbon at the end of life as detailed in the sub-sections below. This fate may differ between the project and reference scenarios, but any assumed difference must be well justified.

#### 2.2.9.1.1 *Combustion, decomposition, incineration, landfilling*

In the **project scenario**, when the likely fate of a product would be any combination of combustion, decomposition, incineration (with or without energy recovery) or landfilling, then an emission term shall be included in the 'end of life' box based on CO<sub>2</sub>e emissions from stoichiometric combustion of all the carbon contained in the products (i.e. complete oxidation to CO<sub>2</sub> of all carbon atoms). The 'end of life' box shall also include any expected non-CO<sub>2</sub> greenhouse gas emissions occurring at end of life (e.g. expected non-CO<sub>2</sub> emissions associated with combustion or incineration).

In the **reference scenario**, the same provisions as for the project scenario generally apply. However, there is an exception to these requirements when the reference scenario is based on **Case 4** (Transport fuel substitute, section 2.2.5.4), **Case 5** (Natural gas substitutes, section 2.2.5.5), or **Case 6** (products that can be synthesised from natural gas and for which a life-cycle emissions factor is available in the data hierarchy, section 2.2.5.6). In these cases, end-of-life emissions are already included in relevant emission factors used in the 'processes' box (e.g. the relevant fossil fuel comparator) and therefore do not need to be also included in the 'end of life' box.

***Example:** A project produces methanol. Emissions from stoichiometric combustion of the methanol must be included in the 'end of life' box of the project scenario.*

*Concerning the reference scenario: (a) If the methanol is supplied as a transport fuel substitute, then the reference scenario is based on a relevant fossil fuel comparator (Case 4, section 2.2.5.4) and there is no need to include any emission in the 'end of life' box; (b) If the methanol is not supplied as a transport fuel substitute, then the reference scenario is likely based on the synthesis of the product from natural gas (Case 6, section 2.2.5.6), the relevant emission factor used in the 'processes' box already includes stoichiometric emissions, and there is no need to include any emission in the 'end of life' box; (c) If the reference scenario is based on a case different from Case 4, Case 5, or Case 6, then stoichiometric combustion emissions typically need to be included in the 'end of life' box of the reference scenario, along with any non-CO<sub>2</sub> emissions occurring at end of life.*

If a fraction of the carbon in the product(s) is of biogenic origin (section 1.4.4) or is derived from externally-produced RFNBOs or LCFs used as inputs (section 1.4.5), then the end-of-life CO<sub>2</sub> emissions for that carbon shall be treated as zero-rated.

**Attention:** An emission factor of zero does NOT apply to the carbon incorporated into a CCU product produced through the utilisation of CO<sub>2</sub> originally captured from a biogenic or RFNBO/LCF source. All the carbon incorporated into a CCU product shall be treated as fossil carbon for the purpose of calculating end of life emissions.

#### 2.2.9.1.2 Recycling

If the likely fate (i.e. expected for at least 90% of material produced) of the carbon in the product materials would be recycling into new products (condition which must be credibly justified by the applicant), then this term in the 'end of life' box shall be set to zero (this should still be explicitly recorded in the GHG calculation). If the likely fate is a combination of some recycling (less than 90% of the material produced) and other fates, then an emission factor of zero should be used only for the fraction of carbon that is recycled.

If an applicant claims that the product of the project scenario will be recycled but the conventional product in the reference scenario would not be recycled, then this assumption must be well justified by reference to the physical characteristics of the products (for instance replacing a plastic that is not normally recycled with one that is), or to actions within the power of the applicant (e.g. if the business model included collection of used items for recycling). Applicants shall not take credit for assumed increases in recycling rates that are not directly related to the project. Recycling rates assumed for products in either scenario must be credibly justified. For example, an applicant would not be permitted to assume 100% recycling of a material that is recyclable in principle, but is not normally recycled in practice.

There is no additional credit permitted in the GHG emission calculation of the Innovation Fund for avoiding primary material use by enabling recycling.

***Example:** A project produces recyclable plastic bottles as a product, and they will replace conventional plastic bottles that are not recyclable. The applicant provides evidence that the typical disposition of non-recyclable bottles in their region is to be sent to landfill, but that 70% of recyclable bottles are sent for recycling.*

*Landfilled material may be treated as if it would be combusted without energy recovery, therefore the applicant includes emissions term in the 'end of life' box of the reference scenario based on stoichiometric combustion emissions for 100% of the conventional bottles, and an emission term in the 'end of life' box of the project scenario based on stoichiometric combustion emissions for only 30% of the innovative bottles (the 30% that it is assumed are not sent for recycling).*

### 2.2.9.1.3 Carbon incorporated into products on a long-term basis

For products considered to permanently chemically bind CO<sub>2</sub> as listed in the Annex to Delegated Regulation (EU) 2024/2620, the applicant is not required to **include any emission in the 'end of life' box**.

In cases not listed in the annex to Delegated Regulation (EU) 2024/2620 but where the applicant can credibly show that most of the carbon in the product(s) will remain incorporated on a long-term basis, defined as a useful lifetime of 50 years or more before the product is disposed, then the applicant may **include in the 'end of life' box only 50% of the CO<sub>2</sub> emissions from stoichiometric combustion** of that product.

It is the responsibility of the applicant to convincingly demonstrate that the product is listed in the Annex to Delegated Regulation (EU) 2024/2620 or that it is reasonable to assume that the carbon will normally remain incorporated in the product for at least 50 years, and that the product has an equivalent or longer useful life. The applicant must be consistent in the consideration of long-term carbon utilisation in the reference and project scenarios, and the applicant must treat carbon incorporated in the products in the project and reference scenarios equally when considering the potential for long-term incorporation.

In general, if physically similar products are produced in the two scenarios, then the assumptions about long-term carbon utilisation should be identical. Applicants are not permitted to treat more than 50% of the carbon as long-term incorporated, unless the product is listed in the annex to Delegated Regulation (EU) 2024/2620.

*Example: A project produces polystyrene beads from fossil resources as a product, and the material will be used in building insulation. The product from the project is chemically identical to conventionally produced polystyrene beads (the reference product) but produced in an innovative manner. The applicant shows that the insulation can be expected to remain in place for at least 50 years. The applicant therefore includes an emission term in the 'end of life' box in both the project and reference scenarios equivalent to the emissions from stoichiometric combustion of only 50% of the carbon contained in the product.*

*This does not affect the absolute GHG emission avoidance of the project as the terms are the same in both scenarios. However, the end-of-life emissions are lower in both scenarios with respect to what they would be for a project producing polystyrene for short term use. Since the reference scenario emissions are lower, this results in a higher relative GHG emissions avoidance.*

### 2.2.9.1.4 End of life emission credit for zero-rated carbon which is recycled or incorporated on a long-term basis

**Attention:** When calculating end-of-life emissions, **carbon in a CCU product** shall always be treated as fossil carbon and shall **never be considered zero-rated**, irrespectively of the source from which it was originally captured. Recognition of the biogenic or RFNBO/LCF origin of the captured carbon is already given in the 'processes' box when this carbon is first emitted, and it cannot be given a second time in the 'end of life' box. (see section 2.2.6.3.3). Also, in line with section 1.4.5, the characterisation as RFNBO or LCF is only relevant for externally produced fuels used as inputs/feedstock, and not for fuels produced within the project boundaries. Therefore, the characterisation of a product as RFNBO or LCF has no bearing on the calculation of its end-of-life emissions, which shall NOT be treated as zero-rated, unless otherwise permitted by other provisions in the Methodology.

In other cases, when the carbon incorporated into products on a long-term basis or being recycled is of biogenic origin (i.e. derived from biomass-derived fuels or materials entering the project boundaries as inputs, section 1.4.4) or is derived from externally-produced

RFNBOs/LCFs entering the project boundaries as inputs (section 1.4.5), then the end-of-life emissions of this carbon are zero-rated and are unaffected by its likely fate.

Recognition may therefore be given to projects delivering recycling or long-term incorporation of zero-rated carbon through the inclusion of a credit (negative emission term) in the 'end of life' box. This credit shall be supported by credible justification and shall be calculated as:

- 100% of the stoichiometric combustion emissions for the amount of zero-rated carbon that will remain incorporated in products listed in the annex to Delegated Regulation (EU) 2024/2620 or that will be recycled to a rate of at least 90%.
- 50% of the stoichiometric combustion emissions for the amount of zero-rated carbon that will remain incorporated in other long-lived products with a useful lifetime of at least 50 years.

*Example: A project produces bio-PET bottles to replace conventional fossil PET bottles. Both types of bottles are recyclable, and the applicant shows that the recycling rate in the relevant region is over 90%. A zero-emission term is included in the 'end of life' box of the reference scenario, while an emission credit (negative emission term) is included in the 'end of life' box of the project scenario equivalent to 100% of the stoichiometric combustion emissions for the carbon in the PET.*

*Example: A project produces biochar as a product which is to be used as a soil improver. The applicant provides convincing evidence that the application of biochar to the soil can improve nitrogen retention and thereby reduce nitrogen fertiliser use, and therefore the reference product is set as nitrogen fertiliser, in the sector chemicals, on an equivalent function basis. The quantity of nitrogen fertiliser considered in the reference scenario is calculated as the expected reduction in nitrogen fertiliser consumption to be delivered over the first 10 years of operation of the project.*

*The applicant provides references to support the claim that the biochar will remain incorporated in the soil for a period of more than 50 years. This would normally allow the applicant to discount the end-of-life emissions from carbon release by 50%. However, since biochar is a biomass-derived product, the end-of-life emissions would be zero irrespectively of whether the carbon remains incorporated in the soil on a long-term basis or not. The applicant therefore is allowed to include a credit in the 'end of life' box calculated as the stoichiometric combustion emissions for 50% of the carbon contained in the biochar.*

#### 2.2.9.2 Other reductions in end-of-life emissions

If a project delivers further reductions in end-of-life emissions compared to the reference scenario, these **may** also be included in the calculation. This could be relevant in cases where a product replaces a chemically different conventional product and can be disposed of in a more energy efficient way, or if an innovative product avoids end-of-life emissions of non-CO<sub>2</sub> greenhouse gases.

In such cases, changes in end-of-life emissions should be estimated and added as a negative emission credit to the 'End of life' box in the project scenario. Any such credits must be clearly justified, and in general such credits can only be claimed when they relate to fundamental **physical properties** of the materials at end of life (such as a different global warming potential) and not when reductions at end of life are conditional on behaviour changes outside of the control of the applicant (such as changed waste disposal practices that are predicated on very specific waste sorting protocols that the project cannot guarantee will be adopted).

*Example: Innovative refrigerants could replace conventional refrigerants with higher global warming potential. This could avoid emissions associated with potential leakage of the conventional refrigerants at end of life (some leakage could occur during proper disposal of refrigerators, and some fraction of refrigerators may not be properly disposed of).*

### **2.3 Data and parameters**

Each project will identify the parameters that will remain constant throughout the duration of the project by choosing the relevant sources of data as explained in section 2. These typically include most emission factors, combustion emissions, and lower heating values (net calorific values), and should not be monitored unless otherwise stated in Appendix 3.

### 3 Renewable energy (RES)

#### 3.1 Scope and general provisions

This section describes the calculation of GHG emission avoidance for projects covered under the renewable energy (RES) category. These projects produce electricity, heat and/or cooling from renewable energy sources, or use renewable energy in activities that are not covered by Annex I of the ETS directive. This section also covers the manufacturing of components to be used in renewable energy facilities or consumer products, including stationary fuel cells.

Electricity produced from renewable sources may be dispatchable or non-dispatchable, depending on the nature of the source, and may be supplied to a grid or directly to an end user. Renewable energy sources include wind energy, solar energy, hydro/ocean energy, geothermal energy (including ambient energy through heat pumps), and bioenergy.

Renewable energy projects that include a CCS or CCU component, shall calculate the CC credit based on the guidance described in section 6.

Projects that include both the production and storage of renewable energy shall apply as hybrid projects following the provisions in section 1.2.5.41.2.5.4, and correctly applying the relevant emission factors for the RES and ES component of the project as specified in section 1.4.3.

This section also covers projects aiming at the retrofitting, repowering, rehabilitation, refurbishment, replacement, or capacity addition of an existing renewable energy plant. For these projects, only the added capacity, or the capacity affected by the retrofitting, shall be accounted for in the GHG calculations (See section 3.2.1).

##### 3.1.1 Products and sectors

Products and sectors covered under the RES category are defined in section 1.2, with additional guidance provided in sections 3.1.2, 3.1.3, and 3.1.4 below.

##### 3.1.2 Bioenergy projects, including the use of hydrogen and RFNBOs/LCFs for energy generation

Projects aiming at generating (as their principal product) electricity, heating, or cooling from biomass-derived fuels (section 1.4.4), hydrogen (section 1.4.3.2), or from RFNBOs/LCFs other than hydrogen (section 1.4.5) shall apply under sector RES/bioenergy.

Projects producing electricity, heating, or cooling as products from feedstocks that are only partly renewable or low-carbon (for example mixed municipal waste with both biogenic-carbon and fossil-carbon content) shall refer to the provisions of section 1.2.5.21.2.5.21.2.5.2 on hybrid EII+RES projects. When such projects also involve a component of carbon capture, applicants should also refer to the examples in section 6.4.

Projects aiming exclusively at producing biomass-derived fuels and materials shall follow the rules for Energy Intensive Industry (EII) projects in section 2. If the project includes both the production of biomass-derived fuels and their consumption for the purpose of generating electricity, heat, or cooling as a principal product, then the project can apply as a hybrid EII+RES project and follow the provisions in section 1.2.5.2.

##### 3.1.2.1 Emissions associated with the supply and use of biomass-derived fuels, hydrogen, and RFNBOs/LCFs

Bioenergy projects must consider the emissions associated to the supply of each renewable or low-carbon fuel under project emissions ( $Proj_{bio\_supply}$ ) as specified in equation [3.8], section 3.3. The relevant emission factor ( $EF_{bio\_supply}$ ) shall be calculated following the relevant provisions for each type of fuel:

- The emission factor(s) associated to the supply of biomass-derived fuels shall be calculated following the provisions in section 1.4.4.2.
- The emission factor associated to the supply of RFNBOs or LCFs shall be calculated following the provisions in section 1.4.5.1.
- The emission factor associated to the supply of hydrogen is equal to zero, in line with the provisions in section 1.4.3.2.

Emissions of CO<sub>2</sub> from the combustion of biomass-derived fuels, RFNBOs, and LCFs are zero-rated. However, emissions of non-CO<sub>2</sub> greenhouse gases associated to the combustion of such fuels must be considered in the project scenario (Proj<sub>bio combustion</sub>) as specified in equation [3.6], section 3.3 and using the relevant emission factor (EF<sub>bio combustion</sub>) specified in Table 3.2.

Emissions associated to other uses of such fuels, leakage, venting, or other chemical or biological process can be disregarded.

### 3.1.2.2 Sustainability requirements, origin of the fuel, and monitoring requirements

Any project using biomass-derived fuels must comply with the relevant sustainability requirement as specified in section 1.4.4.1, while any project using RFNBOs and LCFs other than hydrogen must comply with the relevant provisions in section 1.4.5.

The applicant must credibly justify the assumptions made with respect to the renewable or low-carbon origin of the fuel. Failure to provide adequate justification may affect the quality of the GHG calculations and the resulting evaluation. In addition, the applicants must propose adequate monitoring measures in their monitoring plan to ensure adequate monitoring and reporting of the assumptions made at the application stage. Failure to provide an adequate monitoring plan may negatively affect the quality of the GHG calculations, and the resulting evaluation.

During project implementation, failure to demonstrate the actual renewable nature of the fuel(s) used during project implementation may affect the overall GHG emission avoidance that can be achieved by the project, which may have consequence in terms of grant disbursement as specified in the Call Text.

### 3.1.2.3 Projects operating stationary fuel cells

Projects aiming at operating stationary fuel cells using biomass-derived fuels, hydrogen, or RFNBOs/LCFs other than hydrogen to generate electricity, heating, or cooling as their principal product should also apply under sector RES/bioenergy.

Projects aiming at operating stationary fuel cells using non-renewables or non-LCF shall follow the provisions for Energy Intensive Projects (EII, section 2). Projects aiming at operating stationary fuel cells using a mix of renewable/LCF and non-renewables, shall refer to the provisions of section 1.2.5.21.2.5.2 on hybrid EII + RES projects. When such projects also involve a component of carbon capture, applicants should also refer to the examples in section 6.4.

Projects aiming at operating fuel cells in mobility applications, shall refer to the provisions for mobility projects (MOB, section 5).

### **3.1.3 Manufacturing of components for renewable energy generation**

Projects that aim at manufacturing components for renewable energy generation shall refer to the provisions in section 1.3, in addition to those detailed below. The applicant should also refer to the relevant provisions in section 3.2 for the definition of the system boundary, and section 3.3.3 for relevant equations.

### 3.1.3.1 Projects manufacturing components for stationary fuel cells and other stationary technologies for the generation of electricity, heating or cooling using renewable or low-carbon fuels

Projects aiming at manufacturing fuel cells for stationary applications, and their components, shall refer to this sub-section, and the other relevant provisions in section 3. Projects aiming at manufacturing fuel cells for mobility applications, and their components, shall refer to the provisions for mobility projects (MOB, section 5).

Project aiming at manufacturing eligible components for facilities or consumer products that generate electricity, heating, or cooling in stationary applications using biomass-derived fuels (section 1.4.4), hydrogen (section 1.4.3.2), or RFNBOs/LCFs other than hydrogen (section 1.4.5) can also refer to the provisions in this sub-section. Applicants should carefully review the Call Text to check whether the component that they intend to produce is eligible under the topic in which they intend to apply.

Applicants must justify the assumptions made with respect to the operation of the facility or consumer product in which the component will be installed based on credible technical specifications. These assumptions must be representative of the expected use of the component, facility, and consumer product. This includes the type of fuel used by a fuel cell or a similar facility or consumer product. The applicant shall not assume that the facility or consumer product equipped with a component manufactured by the project will have better performance resulting in increased GHG emission avoidance with respect to standard practice, unless this is a direct consequence of the installation of the innovative component manufactured by the project.

For the case of facilities or consumer products which can run on a variety of different fuel mixes, credible assumptions shall be taken with respect to the expected fuel mix, and period over which the facility or consumer product will operate on renewables or LCFs as opposed to fossil fuels. Only the periods in which the manufactured component will run on renewables or LCFs can be included under the GHG calculations. Hybrid applications cannot be made for the manufacturing of facilities or consumer products operating on a mix of renewable and non-renewable fuels. This means that the reference emissions shall be representative only of the portion of energy displaced by the operation of the component on renewables or LCFs.

*For the case of eligible facilities or consumer products that can produce additional product(s) other than those covered under the RES methodology, these products shall be disregarded for the purpose of GHG calculations. This means that the reference and project emissions shall be representative only of the production of renewable electricity, heating, and/or cooling. As such, applicants shall ignore the production of other co-products (e.g. biochar or other byproducts). Hybrid applications cannot be made to consider the production of other such products. Note also that, as specified in section 6.1, a carbon capture credit cannot be claimed when submitting an application for a manufacturing of components project.*

Failure to provide adequate justification may affect the quality of the GHG calculations and the resulting evaluation. If, during project implementation, it is observed that the actual use of the components produced differs from the intended use specified in the application, the project may not be able to reach the expected GHG emission avoidance, with potential implications on grant disbursement (see also section 1.3.6).

### **3.1.4 Use of renewable energy in activities not covered under Annex I of the EU ETS directive**

Projects aiming to use renewable energy in activities not covered under Annex I of the EU ETS directive must consume solely electricity, heating and/or cooling that are wholly renewable. See relevant provisions in section 3.2 for the definition of the system boundary, and section 3.3.2 for relevant equations for such projects.

The applicant must credibly justify the assumptions made with respect to the renewable origin of the energy used by the project. Failure to provide adequate justification may affect the quality of the GHG calculations and the resulting evaluation. In addition, the applicants must propose adequate monitoring measures in their monitoring plan (see section 1.5 and Appendix 3) to ensure adequate monitoring and reporting of the assumptions made at the application stage. Failure to provide an adequate monitoring plan may negatively affect the quality of the GHG calculations, and the resulting evaluation.

During project implementation, failure to demonstrate the actual renewable nature of the energy used during project implementation may affect the overall GHG emission avoidance that can be achieved by the project, which may have consequences in terms of grant disbursement as specified in the Call Text (see also section 1.1.9).

### 3.2 System boundary

The emission sources that shall be included within the boundaries of the calculations for RES projects are shown in Table 3.1.

Table 3.1. Emission sources included in or excluded from the boundaries of the GHG emission avoidance calculation for RES projects

Source		Included in any topic except small-scale	Included in small-scale topic
Reference (Ref)	<p><b>Projects that intend to produce renewable energy (electricity, heating or cooling):</b></p> <p>GHG emissions for the net generation of dispatchable or non-dispatchable electricity (<math>Ref_{elec,prod}</math>), heating (<math>Ref_{heat,prod}</math>) or cooling (<math>Ref_{cool,prod}</math>) using the conventional technologies, which will be replaced due to the project activity</p>	Yes	Yes
	<p>Projects that intend to manufacture components for renewable energy generation (electricity, heating or cooling):</p> <p>GHG emissions for the net generation of dispatchable or non-dispatchable electricity (<math>Ref_{elec,prod,unit}</math>), heating (<math>Ref_{heat,prod,unit}</math>) or cooling (<math>Ref_{cool,prod,unit}</math>) using the conventional technologies which will be replaced by the component manufactured in the project activity</p>	Yes	Yes
	<p><b>Projects that intend to consume renewable energy (electricity, heating or cooling) in activities not covered under Annex I of the EU ETS directive:</b></p> <p>GHG emissions for the generation of dispatchable or non-dispatchable electricity (<math>Ref_{elec,use}</math>), heating (<math>Ref_{heat,use}</math>) or cooling (<math>Ref_{cool,use}</math>) using the conventional technologies, which will be replaced by the renewable energy used in the project activity</p>	Yes	Yes
Project (Proj)	GHG emissions due to consumed electricity, heat, and fuels for the operation of the renewable energy generation plant, in stationary machinery and on-site vehicles ( $Proj_{on-site}$ and $Proj_{on-site,unit}$ )	Yes	No
	GHG emissions due to leakage during the operation of geothermal power plants ( $Proj_{geo}$ and $Proj_{geo,unit}$ )	Yes	Yes

Source		Included in any topic except small-scale	Included in small-scale topic
	GHG emissions from the production and supply of biomass-derived fuels consumed in stationary machinery and on-site vehicles at the project site ( $Proj_{bio\ supply}$ and $Proj_{bio\ supply,unit}$ )	Yes	Yes

Source: European Commission internal elaboration.

In terms of emissions in the project scenario, sources of GHG emissions depend on the technology and supporting infrastructure for the operation of the plant. Normally, emissions from wind, solar and ocean energy generation are relatively limited. However, the same may not be true for other renewables, such as geothermal or bioenergy.

Applicants shall quantify all GHG emissions associated to electricity, heat and fuel use in stationary machinery and on-site vehicles for the operation of the renewable energy plant in the project scenario ( $Proj_{on-site}$ ). This includes (but is not limited to) emissions of non-CO<sub>2</sub> greenhouse gases from the combustion of biomass-derived fuels in the project scenario, for example, for the case of bioenergy projects.

For projects producing renewable energy from geothermal power plants, leakage during operation shall be accounted for under project emissions ( $Proj_{geo}$ ).

For projects consuming biomass-derived fuels in stationary machinery and on-site vehicles, including projects using biomass-derived fuels to produce bioenergy, the GHG emissions from the production and sourcing of the biomass-derived fuels consumed by the project shall be accounted for in the calculations, under project emissions ( $Proj_{bio\ supply}$ ).

**Simplification for SMALL-SCALE topic:** Projects submitted under the small-scale topic can disregard  $Proj_{on-site}$  and  $Proj_{on-site,unit}$  emissions, as also indicated Table 3.1.

### 3.2.1 Reference scenario for renewable energy projects

For the sake of simplification and to enable a fair competition between projects, the reference scenario has been pre-defined for all projects, despite the regional differences that may be observed in real life.

For RES projects, and in line with the provisions of section 1.4.3:

- The emission factor attributed to non-dispatchable electricity and to cooling in the reference scenario is the typical EU grid emissions in 2030 according to European Commission (2021), i.e.  $EF_{electricity,ref} = 48.8\ tCO_2e/TJ$  (0.176 tonnes CO<sub>2</sub>e/MWh).
- The emission factor attributed to dispatchable electricity in the reference scenario corresponds to the emissions from dispatchable power generation by a single cycle gas turbine plant with 40% electrical efficiency, i.e.  $140\ tCO_2e/TJ$  (0.505 tonnes CO<sub>2</sub>e/MWh).
- The emission factor attributed to heat in the reference scenario is the EU ETS benchmark for heat, i.e.  $47.3\ tCO_2e/TJ$ .

In the calculation of reference emissions, the following provisions shall apply:

- **Projects aiming at generating renewable energy (section 3.3.1):** the applicant shall always consider the net amount of energy that is delivered by the project for external usage (i.e. fed into the grid or directly to another party). This means that the amount of energy generated by the project and used for internal

consumption (i.e. for the operation of the renewable energy plant) cannot be included in the reference scenario.

- **Projects that use renewable electricity, heating and cooling in activities not covered under Annex I of the EU ETS directive (section 3.3.2):** the applicant shall consider the amount of energy that is displaced by the renewable energy used by the project.
- **Manufacturing of components projects under the RES category (section 3.3.3):** the applicant shall always consider the net amount of renewable energy that is delivered by the facility or consumer product, equipped with the component manufactured by the project, for external usage (i.e. fed into the grid, fed directly to another party, or used by the household or business where the consumer product is installed for purposes other than operation of the consumer product itself). This means that the amount of energy generated by the facility or consumer product and used for internal consumption (i.e. for the operation of the facility or the consumer product) cannot be included in the reference scenario.

For the situations where the project involves retrofit of an existing plant, the project shall consider only the part of the plant that is affected by the retrofit. For example, in the case of a retrofit at a wind farm that affects 10% of the wind turbines, only the energy generated by those 10% of the wind turbines would be considered in the reference scenario and only the emissions associated with operating those 10% of the wind turbines would be considered in the project scenario.

For the situations where the project involves capacity added to an existing plant, only the added capacity shall be accounted for. This means, for example, that in the case of the addition of a carbon capture unit to a bioenergy facility without any increase of the energy output of the facility, the reference emissions will be zero.

In some projects, an increase in the output of one product may be delivered at the expense of a reduction in the output of another product. For example, a project introducing carbon capture to a bioenergy facility may consume some of its produced electricity to run the carbon capture unit, but increase heat output by a combination of increased biomass intake and heat recovery from the carbon capture unit. In the case that the output of one type of energy is reduced by a project but others increase then the reference emissions should include a negative value for the term where there is 'negative displacement' by the project activity. The sum of the emissions in the reference scenario may, however, never be less than zero. For example, if a carbon capture unit consumed energy and thereby reduces total energy output from a facility, the  $Ref_y$  term should be reported as zero, not as a negative number.

### 3.3 Calculation of project and reference emission

The equation to be applied for the calculation of the emissions in the reference and project scenario for renewable energy projects are described as follows:

- For projects that intend to produce renewable electricity, heating or cooling, refer to section 3.3.1.
- For projects that intend to use renewable energy in activities not covered under Annex I of the EU ETS directive, refer to section 3.3.2.
- For projects involving the manufacturing of renewable energy systems or their components, refer to section 3.3.3.

### 3.3.1 Projects that produce renewable electricity, heating or cooling

Parameter	=	Equation	
Ref <sub>y</sub>	=	Ref <sub>elec,prod,y</sub> + Ref <sub>heat,prod,y</sub> + Ref <sub>cool,prod,y</sub>	[3.1]
Proj <sub>y</sub>	=	Proj <sub>on-site,y</sub> + Proj <sub>geo,y</sub> + Proj <sub>bio supply,y</sub>	[3.2]

Where:

Ref<sub>elec,prod,y</sub> = GHG emissions for the generation of dispatchable or non-dispatchable electricity using the conventional technologies, which will be displaced by the project activity in year *y*, in tonnes CO<sub>2e</sub>. Calculated according to Equation [3.3].

Ref<sub>heat,prod,y</sub> = GHG emissions for the generation of heating using the conventional technologies, which will be displaced due to the project activity, in year *y*, in tonnes CO<sub>2e</sub>. Calculated according to Equation [3.4].

Ref<sub>cool,prod,y</sub> = GHG emissions for the generation of cooling using the conventional technologies, which will be displaced due to the project activity, in year *y*, in tonnes CO<sub>2e</sub>. Calculated according to Equation [3.5].

Proj<sub>on-site,y</sub> = GHG emissions due to fuel, heat and electricity consumption at the project site in year *y*, in tonnes CO<sub>2e</sub>. Calculated according to Equation [3.6].

Proj<sub>geo,y</sub> = GHG emissions from the operation of the geothermal power plant in year *y*, in tonnes CO<sub>2e</sub>. Calculated according to Equation [3.7].

Proj<sub>bio supply,y</sub> = GHG emissions from the supply of biomass-derived fuels, hydrogen, RFNBOs, and LCFs consumed in stationary equipment and on-site vehicles at the project site, in year *y*, in tonnes CO<sub>2e</sub>. Calculated according to Equation [3.8].

*y* = year of the operation.

#### 3.3.1.1 Reference emissions sub-equations

Parameter	=	Equation		
Ref <sub>elec,prod,y</sub>	=	$(EG_{elec,disp,y} * EF_{elec,disp,ref}) + (EG_{elec,nondisp,y} * EF_{elec,nondisp,ref})$	$(P_{elec,disp,y} * PLF_{elec,disp,y} * T_{elec,disp,y}) * EF_{elec,disp,ref} + (P_{elec,nondisp,y} * PLF_{elec,nondisp,y} * T_{elec,nondisp,y}) * EF_{elec,nondisp,ref}$	[3.3]
Ref <sub>heat,prod,y</sub>	=	$EG_{heat,y} * EF_{heat}$	$(P_{heat,y} * PLF_{heat,y} * T_{heat,y}) * 0.0036 * EF_{heat}$	[3.4]
Ref <sub>cool,prod,y</sub>	=	$EG_{cool,y} * EF_{elec,nondisp,ref}$	$(P_{cool,y} * PLF_{cool,y} * T_{cool,y}) * EF_{elec,nondisp,ref}$	[3.5]

Where:

$EG_{elec,disp,y}$  = Net amount of dispatchable electricity to be generated by the renewable technology in year  $y$  and delivered to the grid, in MWh.

$EG_{elec,nondisp,y}$  = Net amount of non-dispatchable electricity to be generated by the renewable technology in year  $y$  and delivered to the grid or directly to an end user, in MWh.

$EG_{heat,y}$  = Net amount of heat to be delivered by the renewable technology in year  $y$ , in TJ.

$EG_{cool,y}$  = Net amount of cooling to be delivered by the renewable technology in year  $y$ , in MWh.

$P_{out,y}$  = Power plant capacity for energy output type 'out', i.e. net maximum power output also taking into account technology degradation, in year  $y$ , in MW.

$PLF_{out,y}$  = Plant Load Factor, i.e. plant's capacity utilisation, for each energy output type 'out', in year  $y$ , in %.

$T_{out,y}$  = operating hours for each energy output type 'out', in year  $y$ , in hours.

$EF_{elec,disp,ref}$  = Emissions factor for the generation of dispatchable electricity in the reference scenario, in tonnes CO<sub>2</sub>e/MWh. The appropriate EF presented in Table 3.2 shall be applied.

$EF_{elec,nondisp,ref}$  = Emissions factor for the generation of non-dispatchable electricity in the reference scenario, in tonnes CO<sub>2</sub>e/MWh. The appropriate EF presented in Table 3.2 shall be applied.

$EF_{heat}$  = Emission factor due to the generation of heat in the reference scenario, in tonnes CO<sub>2</sub>e/TJ. The EF presented in Table 3.2 shall be applied.

out = dispatchable electricity ('elec,disp'), non-dispatchable electricity ('elec,nondisp'), heating ('heat') or cooling ('cool').

$y$  = year of operation.

### 3.3.1.2 Project emissions sub-equations

Parameter	=	Equation			
$Proj_{on-site,y}$	=	$Proj_{FF,y} + Proj_{bio\ combustion,y} + Proj_{elec,y} + Proj_{heat,y}$	=	$(Q_{FF,y} * EF_{FF}) + (Q_{bio,f,y} * EF_{bio\ combustion,f}) + (Q_{elec,y} * EF_{elec,proj}) + (Q_{heat,y} * EF_{heat})$	[3.6]
$Proj_{geo,y}^{21,22}$	=	$Proj_{dry\_flash,y} + Proj_{binary,y}$	=	$(0.00544695 * M_{steam,y}) + ((M_{inflow,y} - M_{outflow,y}) * 0.00544695 + M_{working\ fluid,y} * GWP_{working\ fluid})$	[3.7]
$Proj_{bio\ supply,y}$	=	$Q_{bio,f,y} * EF_{bio\ supply,f}$			[3.8]

Where:

$Proj_{FF,y}$  = GHG emissions from fossil fuel consumption in stationary equipment and on-site vehicles at the project site in year  $y$ , in tonnes CO<sub>2</sub>e. This includes fuel consumed for generation of electric power and heat, and from auxiliary loads and vehicles used for regular maintenance.

$Proj_{bio\ combustion,y}$  = GHG emissions due to the consumption of biomass-derived fuels, hydrogen, RFNBOs, and LCFs in stationary equipment and on-site vehicles at the project site in year  $y$ , in tonnes

<sup>21</sup> When estimating leakage emissions for geothermal plants, the applicant may also consider using standard ratios for parameters like the mass of steam per MWh generated, steam losses and working fluid per tonne of steam, based on industry benchmarks, if available.

<sup>22</sup> The factor '0.00544695' is based on IPCC AR5 and CDM benchmarks. Assumes: Average mass fraction of methane in the produced steam = 0.00000413 tonnes CH<sub>4</sub>/ tonne steam; Average mass fraction of CO<sub>2</sub> in the produced steam = 0.00533144 tonnes CO<sub>2</sub>/tonne steam.

CO<sub>2e</sub>. This includes the use of such fuels for renewable energy generation purposes, for the case of bioenergy projects.

Proj<sub>elec,y</sub> = GHG emissions due to the electricity imported from the grid and consumed at the project site, in year y, in tonnes CO<sub>2e</sub>.

Proj<sub>heat,y</sub> = GHG emissions due to the heat purchased from third parties and consumed at the project site, in year y, in tonnes CO<sub>2e</sub>.

Q<sub>FF,y</sub> = Quantity of fossil fuel type FF consumed in stationary or mobile sources at the project site in year y, in TJ.

Q<sub>bio,f,y</sub> = Quantity of fuel type f (biomass-derived fuel, hydrogen, RFNBO, or LCF) consumed in stationary or mobile equipment at the project site in year y, in TJ.

EF<sub>FF</sub> = Emission factor due to the combustion of the fossil fuel type FF, in tonnes CO<sub>2e</sub>/TJ. The applicable EF presented in Table 3.2 should be applied.

EF<sub>bio combustion,f</sub> = Emission factor due to the combustion of the fuel type f (biomass-derived fuel, hydrogen, RFNBO, or LCF), in tonnes CO<sub>2e</sub>/TJ. The applicable EF presented in Table 3.2 should be applied.

Q<sub>elec,y</sub> = Amount of electricity imported from the grid and consumed at the project site in year y, in MWh.

EF<sub>elec,proj</sub> = Average EU electricity emissions factor in the project scenario, in tonnes CO<sub>2e</sub>/MWh. The appropriate EF presented in Table 3.2 shall be applied.

Q<sub>heat,y</sub> = Amount of heat imported and consumed at the project site in year y, in TJ.

EF<sub>heat</sub> = Emission factor for the consumption of imported heat in the project scenario, in tonnes CO<sub>2e</sub>/TJ. The appropriate EF presented in Table 3.2 shall be applied.

Proj<sub>dry\_flash</sub> = GHG emissions due to release of non-condensable gases from produced steam during the operation of dry steam or flash steam geothermal power plants in year y, in tonnes CO<sub>2e</sub>.

Proj<sub>binary</sub> = GHG emissions due to physical leakage of non-condensable gases and working fluid during the operation of binary geothermal power plants in year y, in tonnes CO<sub>2e</sub>.

M<sub>steam,y</sub> = Quantity of steam produced in year y, in tonnes steam.

M<sub>inflow,y</sub> = Quantity of steam entering the geothermal plant in year y, in tonnes steam.

M<sub>outflow,y</sub> = Quantity of steam leaving the geothermal plant in year y, in tonnes steam.

M<sub>working fluid,y</sub> = Quantity of working fluid consumed in year y, in tonnes of working fluid.

GWP<sub>working fluid</sub> = Global Warming Potential for the working fluid used in the binary geothermal power plant.

EF<sub>bio supply,f</sub> = Emission factor for the supply of the fuel type f (biomass-derived fuel, hydrogen, RFNBO, or LCF), in tonnes CO<sub>2e</sub>/TJ. To be calculated following the provisions in section 3.1.2.1.

y = year of operation.

### 3.3.2 Projects that use renewable electricity, heating or cooling in activities not covered under Annex I of the EU ETS directive

Parameter	=	Equation	
Ref <sub>y</sub>	=	Ref <sub>elec,use,y</sub> + Ref <sub>heat,use,y</sub> + Ref <sub>cool,use,y</sub>	[3.9]

Parameter	=	Equation	
Proj <sub>y</sub>	=	0	[3.10]

Where:

Ref<sub>elec,use,y</sub> = GHG emissions for the generation of dispatchable or non-dispatchable electricity using conventional technologies, which will be displaced by the renewable energy used in project activity in year *y*, in tonnes CO<sub>2</sub>e. Calculated according to Equation [3.11].

Ref<sub>heat,use,y</sub> = GHG emissions for the generation of heating using conventional technologies, which will be displaced by the renewable energy used in the project activity, in year *y*, in tonnes CO<sub>2</sub>e. Calculated according to Equation [3.12].

Ref<sub>cool,use,y</sub> = GHG emissions for the generation of cooling using conventional technologies, which will be displaced by the renewable energy used in the project activity, in year *y*, in tonnes CO<sub>2</sub>e. Calculated according to Equation [3.13].

*y* = year of the operation.

### 3.3.2.1 Reference emissions sub-equations

Parameter	=	Equation	
Ref <sub>elec,use,y</sub>	=	Q <sub>elec,y</sub> * EF <sub>elec,nondisp,ref</sub>	[3.11]
Ref <sub>heat,use,y</sub>	=	Q <sub>heat,y</sub> * EF <sub>heat</sub>	[3.12]
Ref <sub>cool,use,y</sub>	=	Q <sub>cool,y</sub> * EF <sub>elec,nondisp,ref</sub>	[3.13]

Where:

Q<sub>elec,y</sub> = Amount of renewable electricity to be consumed by the project in non-Annex I activities, in year *y*, in MWh.

Q<sub>heat,y</sub> = Amount of renewable heating to be consumed by the project in non-Annex I activities in year *y*, in TJ.

Q<sub>cool,y</sub> = Amount of renewable cooling to be consumed by the project in non-Annex I activities in year *y*, in MWh.

EF<sub>elec,nondisp,ref</sub> = Emissions factor for the generation of non-dispatchable electricity in the reference scenario, in tonnes CO<sub>2</sub>e/MWh. The appropriate EF presented in Table 3.2 shall be applied.

EF<sub>heat</sub> = Emission factor due to the generation of heating in the reference scenario, in tonnes CO<sub>2</sub>e/TJ. The EF presented in Table 3.2 shall be applied.

### 3.3.3 Manufacturing of components for renewable energy generation

In addition to the equations detailed below, equations [3.3 Ref<sub>elec,prod</sub>],[3.4 Ref<sub>heat,prod</sub>],[3.5 Ref<sub>cool,prod</sub>] and [3.6 Proj<sub>on-site</sub>],[3.7 Proj<sub>geo</sub>],[3.8 Proj<sub>bio supply</sub>] presented in section 3.2.1, shall be used as guidance for the calculation of reference and project emissions per year for a facility or consumer product equipped with the component produced by a manufacturing projects.

Parameter	=	Equation	
Ref <sub>y</sub>	=	$N_y * UP * CS_{\text{component}} * (Ref_{\text{elec,prod,unit,y}} + Ref_{\text{heat,prod,unit,y}} + Ref_{\text{cool,prod,unit,y}})$	[3.14]
Proj <sub>y</sub>	=	$N_y * UP * CS_{\text{component}} * (Proj_{\text{on-site,unit,y}} + Proj_{\text{geo,unit,y}} + Proj_{\text{bio supply,unit,y}})$	[3.15]

Where:

Ref<sub>elec,prod,unit,y</sub> = Specific GHG emissions for the generation of dispatchable or non-dispatchable electricity using conventional technologies, which will be displaced by the renewable electricity generated by a facility or consumer product equipped with an innovative component produced by the manufacturing project in year y, per unit and per year of use of the component, in tonnes CO<sub>2</sub>e/(unit \* year of use of the component). Refer to Equation [3.3] for general guidance.

Ref<sub>heat,prod,unit,y</sub> = Specific GHG emissions for the generation of heating using conventional technologies, which will be displaced by the renewable heating generated by a facility or consumer product equipped with an innovative component produced by the manufacturing project in year y, per unit and per year of use of the component, in tonnes CO<sub>2</sub>e/(unit \* year of use of the component). Refer to Equation [3.4] for general guidance.

Ref<sub>cool,prod,unit,y</sub> = Specific GHG emissions for the generation of cooling using conventional technologies, which will be displaced by the renewable cooling generated by a facility or consumer product equipped with an innovative component produced by the manufacturing project in year y, per unit and per year of use of the component, in tonnes CO<sub>2</sub>e/(unit \* year of use of the component). Refer to Equation [3.5] for general guidance.

Proj<sub>on-site,unit,y</sub> = Specific GHG emissions due to fuel, heat and electricity consumption by a facility or consumer product equipped with an innovative component produced by the manufacturing project in year y, per unit and per year of use of the component, in tonnes CO<sub>2</sub>e/(unit \* year of use of the component). Refer to Equation [3.6] for general guidance. Projects submitted under the small-scale topic may omit this parameter.

Proj<sub>geo,unit,y</sub> = Specific GHG emissions from the operation of a geothermal power plant equipped with an innovative component produced by the manufacturing project in year y, per unit and per year of use of the component, in tonnes CO<sub>2</sub>e/(unit \* year of use of the component). Refer to Equation [3.7] for general guidance.

Proj<sub>bio supply,unit,y</sub> = Specific GHG emissions from the supply of biomass-derived fuels, hydrogen, RFNBOs, and LCFs consumed in a facility or consumer product equipped with an innovative component produced by the manufacturing project in year y, per unit and per year of use of the component, in tonnes CO<sub>2</sub>e/(unit \* year of use of the component). Refer to Equation [3.8] for general guidance.

CS<sub>component</sub> = cost share of the innovative component as defined in section 1.3.5.

N<sub>y</sub> = number of innovative renewable energy components produced and supplied to the market in year y by the proposed manufacturing project. The applicant shall estimate this based on the expected output of the manufacturing plant and the market potential, and in line with the assumptions made in the rest of the proposal concerning the operation of the plant, and including financial calculations.

UP = Applicable use period of the manufactured innovative component, as defined in section 1.3.4. The use period is equal to a maximum of 5 years, or to the lifetime of the component, if the lifetime of the component is shorter than five years.

y = year of operation of the manufacturing project.

### 3.4 Relative GHG emission avoidance

Refer to section 1.1.4 for Guidance on the calculation of  $\Delta\text{GHG}_{\text{rel}}$ .

In the specific case of the addition of CCS to an existing bioenergy facility without increasing the energy output of the facility, the reference emissions are zero. For such projects, it is not possible to use equation 1.2. Therefore, the relative GHG emission avoidance shall be set equal to 200% as specified in section 1.1.4.

### 3.5 Data and parameters

Table 3.2 presents standard parameters to be used for RES projects. These are deemed constant throughout the duration of the project and should not be monitored, unless otherwise stated in Appendix 3. For emission or conversion factors not listed here, refer to the hierarchy of sources in Appendix 1.

Table 3.2 Standard parameters for RES projects.

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
Energy	0.0036	TJ/MWh	Conversion factor		Applies to all types of energy
$\text{EF}_{\text{heat}}$	47.3	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for heat	Commission Implementing Regulation (EU) 2021/447	
$\text{EF}_{\text{NG}}$	59.5	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the combustion of natural gas in stationary or mobile sources	IPCC (2006a) and IPCC (2013)	Based on the most conservative EFs for CH <sub>4</sub> and/or N <sub>2</sub> O among stationary and mobile use
$\text{EF}_{\text{LPG}}$	64.90	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the combustion of liquefied petroleum gas in stationary or mobile sources	Same as above	Same as above
$\text{EF}_{\text{heavyoil}}$	77.8	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for combustion of heavy fuel oil in stationary sources	Same as above	Same as above

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
EF <sub>gasoline</sub>	73.2	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the combustion of gasoline in stationary or mobile sources	Same as above	Same as above
EF <sub>diesel</sub>	75.2	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the combustion of diesel in mobile or stationary sources	Same as above	
EF <sub>bio combustion,biomass</sub>	0.4	tonnes CO <sub>2</sub> e / TJ	Emission factor for the non-CO <sub>2</sub> GHG emissions from the combustion or use of biomass-derived fuels in stationary or mobile sources	Same as above	
EF <sub>bio combustion,H2</sub>	0.0	tonnes CO <sub>2</sub> e / TJ	Emission factor for the non-CO <sub>2</sub> GHG emissions from the combustion or use of hydrogen in stationary or mobile sources	Assumption	
EF <sub>bio combustion,LCF</sub>	0.4	tonnes CO <sub>2</sub> e / TJ	Emission factor for the non-CO <sub>2</sub> GHG emissions from the combustion or use of LCFs in stationary or mobile sources	Assumption	
EF <sub>bio combustion,RFNBO</sub>	0.4	tonnes CO <sub>2</sub> e / TJ	Emission factor for the non-CO <sub>2</sub> GHG emissions from the combustion or use of RFNBOs in stationary or mobile sources	Assumption	

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
EF <sub>elec,nondisp,ref</sub>	0.176	tonnes CO <sub>2</sub> e / MWh	Emissions of electricity production in 2030	EU Reference Scenario 2020	Base year 2030. Combustion only.
EF <sub>elec,disp,ref</sub>	0.505	tonnes CO <sub>2</sub> e / MWh	Emissions of electricity production with single cycle natural gas turbine	Based on the EF for combustion of natural gas according to Commission Implementing Regulation (EU) 2018/2066 and a gas turbine with efficiency of 40 %	The value should be applied in all years y.
EF <sub>elec,proj</sub>	0.000	tonnes CO <sub>2</sub> e / MWh	Emissions of electricity production in 2050	Assumption	Base year 2050. Combustion only.
EF <sub>bio supply,biomass</sub>	To be calculated following the provisions in section 1.4.4.2, including transport emissions where relevant	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the production and supply of biomass-derived fuels	Section 1.4.4.2	
EF <sub>bio supply,LCF</sub>	20 (Plus transport emissions where relevant)	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the production and supply of LCFs.	Section 1.4.5.1	
EF <sub>bio supply,RFNBO</sub>	0 (Plus transport emissions where relevant)	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the production and supply of RFNBOs.	Section 1.4.5.1	
EF <sub>bio supply,H2</sub>	0	tonnes CO <sub>2</sub> e / TJ	GHG emission factor for the production and supply of hydrogen.	Section 1.4.3.2	

Source: see the column 'Source data'.

## **4 Energy storage (ES)**

The GHG emission avoidance of an energy storage (ES) project is calculated as the difference between the project emissions and the emissions in the reference scenario (i.e. in the absence of the project) following the provisions in this section.

The energy stored may be sourced from an energy grid or directly from a plant, and it can be delivered to an energy grid or directly to a plant. Emissions in the reference scenario correspond to the emissions associated to the energy displaced by the output of the energy storage system, whereas project emissions are those associated with the input to the energy storage system during operation, plus emissions associated to the operation of the energy storage facility.

If the services delivered by the project are useful from a system perspective, additional emissions avoidance associated with the delivery of the services may be claimed under certain conditions. In this respect, the energy storage methodology distinguishes various services that contribute to the GHG emission avoidance delivered by energy storage units, as specified in section 4.1.

During operation, projects will be required to maintain records of measurements, quality assurance and quality control procedures, and calculations used in the development of data reported, along with copies of reported data and forms submitted. During the monitoring period, beneficiaries will need to prove, based on the same methodology, that the GHG emission avoidance is delivered. In addition, the project operators will be asked to deliver hourly load profiles for knowledge sharing purposes. See also section 1.5 and Appendix 4 for relevant provisions.

### **4.1 Scope and general provisions**

This chapter applies to projects in the energy storage (ES) category (see section 1.2). These projects can include the construction and operation of a greenfield energy storage plant, or the extension of an existing plant by adding an energy storage unit.

An energy storage unit or plant can store any type of energy (e.g. electricity, heat, cold, hydrogen, gaseous or liquid fuels) from the time at which it was originally generated or supplied, to a later moment of use. It is not allowed to claim emission avoidance for an energy storage system during any period during which it is simultaneously charged and discharged with the same type of energy (e.g. electricity).

The storage of energy may include the conversion of one energy type into another. In the case of projects converting electricity into fuel, such as hydrogen or other synthetic fuels, the application should generally be made under the Energy Intensive Industry (EII) category and follow the provisions in section 2. Such projects may only apply under the ES category and follow the provisions in this section if the storage of excess renewable energy in another form is the primary aim of the project. For such projects, the electricity consumed must be limited to periods of high renewable electricity production that result in a particularly low load factor, condition that must be credibly justified by the applicant, and demonstrated during project implementation.

This chapter is also to be used to calculate emissions savings from timed operation in EII projects as detailed in section 2.2.7.4.

If a project includes an element of energy storage alongside EII activities, renewable energy generation, or other activities falling under other categories, then the applicant shall submit a hybrid application, following the provisions of section 1.2.5.

#### 4.1.1 Services, products and sectors

Products and sectors covered under the ES category are defined in section 1.2 with some examples provided below:

- **Intra-day electricity storage**, covering: arbitrage, reserve power, ramping, auxiliary services to electricity grids (including reactive power, synchronous inertia), and avoidance of renewable energy curtailment.
- **Other energy storage**, such as storage of hydrogen and storage of heat.
- **Manufacture of components** for energy storage, such as batteries and other components for stationary energy storage applications.

**Note for applicants familiar with earlier versions of the methodology:** Components for energy storage used in mobility applications, including road transport, are now covered under the MOB category, section 5.

#### 4.1.2 Emission factors

For electricity, heat, and hydrogen, default emission factors depending on the source and intended use must be applied as specified in section 1.4.3, and no deviations are allowed.

For externally-produced biomass-derived fuels and RFNBOs/LCFs other than hydrogen that are stored or used by an energy storage project, the provisions in section 1.4.4 and 1.4.5 apply, and the relevant emission factors shall be calculated as the sum of supply emissions and non-CO<sub>2</sub> emissions from the combustion or use of the fuel. In addition, transport emissions (section 1.4.6) must be considered in the project scenario when the feedstocks are transported for more than 500 km to reach the first point of processing/treatment by the project. Additional guidance and standard emission factors for  $EF_{in,bio}$ ,  $EF_{on-site,bio}$ ,  $EF_{in,LCF}$ ,  $EF_{on-site,LCF}$ ,  $EF_{in,RFNBO}$ , and  $EF_{on-site,RFNBO}$  are provided in Table 4.2.

The emission factors used to define the corresponding reference scenario ( $EF_{out,bio}$ ,  $EF_{out,LCF}$ ,  $EF_{out,RFNBO}$ ) shall be representative of the energy carrier replaced by the fuel supplied by the project, shall be based on standard market and grid conditions, and shall be supported by credible justification and relevant supporting documents. Where a corresponding emission factor is available in Table 4.2, then it shall be used. For example, the reference scenario of a project storing ammonia to replace heavy fuel oil, should be based on the relevant emission factor for heavy fuel oil as indicated in Table 4.2.

Other standard emission factors are provided in Table 4.2 and must be used, unless the applicant provides evidence and credibly justifies alternative assumptions made. For emission factors and conversion factors not listed in Table 4.2, refer to the hierarchy of sources in Appendix 1. In addition, refer to section 1.1.9 for relevant provisions concerning assumptions.

#### 4.1.3 Reference for auxiliary services

The reference scenario for auxiliary services may be more complex to identify with respect to other cases, because it may involve a change in the efficiency at which a service is delivered, rather than a change in the quantity of the service delivered.

Applicants must propose an appropriate reference scenario for their project by taking into account the specificities of the auxiliary service provided and the local context for providing such service. Equation [4.4] shall be used to calculate reference emissions for auxiliary services. Equation [4.4a] constitutes a specification of equation [4.4] and should be used in case the auxiliary service can be provided by running a CCGT with reduced load or reduced active power. Equation [4.4a] is further explained in the example below.

*Example:* A project provides dynamic reactive power services with a rating ( $R$ ) of 250 MVar. For the reference scenario, it is assumed that an equivalent reactive

power service could be delivered by running combined cycle gas turbines below optimal efficiency (e.g. running two turbines at 45% thermal efficiency instead of a single turbine at 55% thermal efficiency). The applicant identifies that 400 MW of power generation would need to run in this lower efficiency mode to provide the 250 MVar of reactive power (CCGT = 1.6 MW/ MVar), and that the reactive power service will be used by the grid for T hours per year.

The mean increase of the emission intensity of grid electricity due to the need for the auxiliary service ( $\Delta EF$ ) can be calculated by multiplying the emission factor for natural gas by the additional gas consumption, and is equal to  $EF_{out, natural\ gas} * 0.0036 * [(0.55 - 0.45) / (0.55 * 0.45)] * CCGT$ , where the emission factor for natural gas is expressed in tCO<sub>2</sub>e/TJ as defined in Table 4.2, and 0.0036 is a conversion factor from tCO<sub>2</sub>e/TJ to tCO<sub>2</sub>e/MWh.

The reference emissions in tonnes CO<sub>2</sub>e can then be calculated by multiplying the mean increase of the emission intensity of grid electricity ( $\Delta EF$ ) expressed in tCO<sub>2</sub>e / (MVar \* h) by the rating of the service R (250 MVar), and by the duration over which the service is provided in a year (T), expressed in hours.

## 4.2 System boundary

The system boundary for an ES project includes the energy storage plant/unit and all facilities that the energy storage plant/unit is connected to, and that are not metered separately. In well justified cases, such as for the management of distributed renewable energy, the condition for a single metering point may not be applicable.

The greenhouse gases and emission sources included in, or excluded from, the system boundaries are shown in Table 4.1.

Table 4.1. Emission sources included in the system boundary

Source		Included in any topic except small-scale	Included in small-scale topic
Reference scenario (Ref)	Ref <sub>energy</sub> : Emissions related to the provision of energy in the absence of the project activity. This includes direct emissions from the use of fossil fuels and generation of heat, indirect emissions from the use of grid electricity, hydrogen and heat, process-related emissions from the production of hydrogen, and from transmission losses <sup>23</sup> associated with the transport network.	Yes	Yes
	Ref <sub>services</sub> : Emissions related to the provision of auxiliary services to the grids in the absence of the project activity. This includes direct emissions from the use of fossil fuels and generation of heat, in particular from inefficient operation of fossil-fuelled plants, indirect emissions from the use of grid electricity, hydrogen and heat, and from transmission losses <sup>23</sup> associated with the transport network.	Yes	Yes

<sup>23</sup> Transmission losses associated to the transport and distribution of fossil fuels (e.g. transmission losses occurring in the natural gas grid) shall not be considered, as they are outside the scope of the Methodology, in line with section 1.1.7.

Project (Proj)	Proj <sub>energy</sub> : Emissions related to the provision of energy caused by the project activity. This includes direct emissions from the use of fossil fuels and generation of heat, indirect emissions from the use of grid electricity, hydrogen and heat, process-related emissions from the production of hydrogen, and from transmission losses <sup>23</sup> associated with the transport network.	Yes	Yes
	Proj <sub>on-site</sub> : On-site emissions of fugitive GHGs and emissions from energy use other than energy storage. This includes emissions from combustion in vehicles or stationary machinery, emissions from other processes at installations functionally connected to the transport network, including booster stations, and fugitive and vented emissions occurring at the project site.	Yes	No

Source: European Commission internal elaboration.

**Simplification for SMALL-SCALE topic:** Projects submitted under the small-scale topic can disregard Proj<sub>on-site</sub> for the purpose of GHG calculations. These will need to be reported only for knowledge sharing purposes.

### 4.3 Calculation of project and reference emissions

As explained in section 1.1.3, the absolute GHG emission avoidance is given by the difference of the emissions in the reference scenario Ref<sub>y</sub> and the project scenario Proj<sub>y</sub>, possibly adjusted by a credit for carbon capture.

The equations to be applied for calculating Ref<sub>y</sub> and Proj<sub>y</sub> by projects intending to operate energy storage plants are described in section 4.3.1. The equations to be applied for calculating Ref<sub>y</sub> and Proj<sub>y</sub> by projects manufacturing innovative energy storage systems or their components are described in section 4.3.2.

#### 4.3.1 Projects that intend to operate innovative energy storage systems

For projects that intend to operate innovative energy storage systems, Ref<sub>y</sub> and Proj<sub>y</sub> shall be calculated according to Equation [4.1] and [4.2].

Parameter	=	Equation	
Ref <sub>y</sub>	=	Ref <sub>energy,y</sub> + Ref <sub>services,y</sub>	[4.1]
Proj <sub>y</sub>	=	Proj <sub>energy,y</sub> + Proj <sub>on-site,y</sub>	[4.2]

Where:

Ref<sub>energy,y</sub> = Energy-related GHG emissions present in the reference scenario in year y that will not occur due to the energy storage plant put in place, in tonnes CO<sub>2</sub>. This includes direct emissions from the use of fossil fuels and generation of heat, indirect emissions from the use of grid electricity, hydrogen and heat, process-related emissions from the production of hydrogen as well as from transmission losses associated with the energy transport. It shall be calculated according to Equation [4.3] below.

Ref<sub>services,y</sub> = Auxiliary-services-related GHG emissions present in the reference case in year y that will not occur due to the energy storage plant put in place, in tonnes CO<sub>2</sub>. This includes direct emissions from the use of fossil fuels and generation of heat, in particular from inefficient use of primary energy, indirect emissions from the use of grid electricity, hydrogen and heat as well as from transmission losses associated with the energy transport. It shall be calculated according to Equation [4.4] below. In the case that a service could be delivered by running some amount of power

generation with CCGTs at reduced efficiency (45% rather than 55%) then Equation [4.4a] should be used, in particular for dynamic reactive power.

$Proj_{energy,y}$  = Energy-related GHG emissions not present in the reference scenario in year  $y$  that will occur due to the provision of energy by the energy storage plant, in tonnes CO<sub>2</sub>. This includes direct emissions from the use of fossil fuels and generation of heat, indirect emissions from the use of grid electricity, hydrogen and heat, process-related emissions from the production of hydrogen as well as from transmission losses associated with the energy transport. It shall be calculated according to Equation [4.5] below.

$Proj_{on-site,y}$  = Emissions from storage of energy carriers and their transport by pipelines, road or maritime modals in year  $y$ , in tonnes CO<sub>2e</sub>. This includes emissions from combustion in vehicles, and other processes occurring at installations functionally connected to the transport network, including booster stations, and fugitive and vented emissions from the transport network. It shall be calculated according to Equation [4.6] below and its [4.6a], [4.6b], [4.6c] sub-equations.

$y$  = year of operation.

Parameter	=	Equation	
$Ref_{energy,y}$	=	$\sum_{x=1}^X EF_{out,x,y} * E_{out,x,y} / (1 - \Theta_x)$	[4.3]

Where:

$X$  = number of energy types considered. This includes all energy types replaced, in particular all kinds of energy carriers as well as energy types such as electricity and heat.

$E_{out,x,y}$  = energy of type  $x$  supplied to energy grids or delivered to end user in year  $y$ , in terajoules (TJ). For the application, this shall be estimated by the applicant based on the foreseen operation of the energy storage plant in line with the planned storage capacity, storing cycles as well as the rated input and output power; those planned parameters shall account for technology degradation, where applicable (e.g. batteries). For the situations where the project will manufacture innovative components, it shall be estimated based on forecasted capacity, load factor, forecasted degradation and operating hours that the innovative technology(ies) or component(s) will feature once in operation.

$EF_{out,x,y}$  = emission factor for the energy of type  $x$  displaced by the output of the energy storage plant in year  $y$ , in tonnes CO<sub>2e</sub>/TJ. The values presented in Table 4.2 shall be applied as the default case. If the energy is delivered to a pre-defined set of end users with a reference emission intensity deviating from the default case, the applicant may use an emission intensity tied to the specific case, where deviations are allowed as specified in section 4.1.2, and providing credible justifications. Deviations are never allowed for the case of electricity, hydrogen, and heat.

$\Theta_x$  = mean losses from transport of energy type  $x$ , in percent. As long as no regulation prescribes the use of certain values for transport losses (situation that must be well substantiated by the applicant), the EU default values presented in Table 4.2 should be applied.

Parameter	=	Equation	
$Ref_{services,y}$	=	$\sum_{a=1}^A \Delta EF_{service,a} * T_{services,a,y} * R_{services,a,y}$	[4.4]
$Ref_{services,y}$	=	$\sum_{a=1}^A EF_{out, natural gas} * 0.0036 * [0.1 / (0.55 * 0.45)] * CCGT_{services,a} * T_{services,a,y} * R_{services,a,y}$	[4.4a]

Where:

$A$  = number of services considered.

$\Delta EF_{service,a}$  = mean increase of the emission intensity of grid electricity due to the need for the auxiliary service  $a$ , in tonnes CO<sub>2e</sub> per hour of service delivery and per unit of service (MW, MVar, GVAs). This is to be estimated by the applicant based on the local grid conditions. The reference case to be

considered is the provision of the auxiliary service  $x$  by running fossil fuel plants at a less-than-optimal efficiency.

$T_{services,a,y}$  = the amount of hours that the provision of the auxiliary service  $a$  is required in year  $y$ , in hours (h). This is to be estimated by the applicant based on the local grid conditions and the current local grid regulation. For the situations where funding will be used to finance the construction of a manufacturing plant of innovative technologies' components, it shall be estimated based on forecasted operating hours that the innovative technology(ies) or component(s) will be able to generate when implemented.

$R_{services,a,y}$  = rating of the energy storage plant with respect to the service  $a$ , in year  $y$ , in a unit depending on the service (MW, MVAR, GVAs). This is to be provided by the applicant based on the technical documentation of the foreseen energy storage plant. For the situations where funding will be used to finance the construction of a manufacturing plant of innovative technologies' components, it shall be estimated based on forecasted total rating that the innovative technology(ies) or component(s) will be able to generate when implemented.

$EF_{out, natural\ gas}$  = GHG emission factor for the combustion of natural gas in tCO<sub>2</sub>e/TJ, as defined in Table 4.2. Note that 0.0036 is a conversion factor from tCO<sub>2</sub>e/TJ to tCO<sub>2</sub>e/MWh, introduced in equation [4.4a] for dimensional consistency.

$CCGT_{services,a}$  = capacity of combined cycle gas turbines (CCGTs) required to run at 45% instead of 55% efficiency in MW per unit of service  $a$ , for instance MW/MVAR in the case of reactive power. Refer also to the example in Section 4.1.2.

Parameter	=	Equation	
Proj <sub>energy,y</sub>	=	$\sum_{x=1}^X EF_{in,x,y} * E_{in,x,y} / (1 - \theta_x)$	[4.5]

Where:

$X$  = number of energy types considered. The applicant needs to include all energy types used, in particular all kinds of energy carriers as well as energy types such as electricity and heat.

$EF_{in,x,y}$  = emission factor of energy type  $x$  used by the energy storage plant, in year  $y$ , in terajoules (TJ). The values presented in Table 4.2 shall be applied as the default case. If the energy is supplied by a pre-defined set of suppliers with a reference emission intensity deviating from the default case, the applicant may use an emission intensity tied to the specific case, where deviations are allowed as specified in section 4.1.2, and providing credible justifications. Deviations are never allowed for the case of electricity, hydrogen, and heat.

$E_{in,x,y}$  = energy of type  $x$  used by the energy storage plant of energy type  $x$ , in year  $y$ , in terajoules (TJ). This includes both the energy stored in the energy storage plant and used for its self-consumption. This shall be estimated by the applicant based on the foreseen operation of the energy storage unit in line with the planned storage capacity, storage efficiency, storing cycles and the rated input power. For the situations where of the project will manufacture innovative components, it shall be estimated based on forecasted capacity, load factor and operating hours that the innovative technology(ies) or component(s) will feature once in operation.

$\theta_x$  = mean losses from transport of energy type  $x$ , in percent. As long as no regulation prescribes the use of certain values for transport losses (situation that must be well substantiated by the applicant), the EU default values presented in Table 4.2 should be applied.

Parameter	=	Equation	
Proj <sub>on-site,y</sub>	=	Proj <sub>stat,y</sub> + Proj <sub>mob,y</sub> + Proj <sub>fug,y</sub>	[4.6]
Proj <sub>stat,y</sub>	=	$EF_{in,x} * E_{stat,x,y}$	[4.6a]

$Proj_{mob,y}$	=	$EF_{in,x} * E_{mob,x,y}$	[4.6b]
$Proj_{fug,y}$	=	$M_{fug,z,y} * GWP_{fug,z}$	[4.6c]

Where:

X = number of energy types considered. The applicant needs to include all energy types used, in particular all kinds of energy carriers as well as energy types such as electricity and heat.

Z = number of GHGs considered (see section 1.1.6).

$Proj_{stat,y}$  = GHG emissions from energy consumption in stationary equipment (except for the energy storage units) at the project site in year y, in tonnes CO<sub>2</sub>e. This should include fuel consumed for processing of materials, generation of electric power and heat, and from auxiliary loads. It shall be calculated according to Equation [4.6a] above.

$Proj_{mob,y}$  = GHG emissions from energy consumption from on-site vehicles and other transportation at the project site, in year y, in tonnes CO<sub>2</sub>e. This includes vehicles used for regular maintenance. It shall be calculated according to Equation [4.6b] above.

$Proj_{fug,y}$  = GHG emissions from fugitive greenhouse gas emissions at the project site in year y, in tonnes CO<sub>2</sub>e. It shall be calculated according to Equation [4.6c] above.

$E_{stat,y,x}$  = Quantity of energy type x used in stationary equipment at the project site in year y, in TJ. This shall be estimated by the applicant based on the foreseen operation of the energy storage unit in line with the planned storage capacity, storage efficiency, storing cycles and the rated input power. For the situations where of the project will manufacture innovative components, it shall be estimated based on forecasted energy use that the innovative technology(ies) or component(s) will require once in operation.

$E_{mob,y,x}$  = Quantity of energy type x used in mobile sources at the project site in year y, in TJ. This shall be estimated by the applicant based on the foreseen operation of the energy storage unit in line with the planned storage capacity, storage efficiency, storing cycles and the rated input power. For the situations where of the project will manufacture innovative components, it shall be estimated based on forecasted energy use that the innovative technology(ies) or component(s) will require once in operation.

$EF_{on-site,x}$  = Emission factor due to the use of the energy type x, in tonnes CO<sub>2</sub>e/ TJ. The applicable EF presented in Table 4.2 shall be applied following the provisions in section 4.1.2.

$M_{fug,y,z}$  = Amount of the fugitive emissions of greenhouse gas z at the project site in year y, in tonnes. This shall be estimated by the applicant based on the foreseen operation of the energy storage unit in line with the planned storage capacity, storage efficiency, storing cycles and the rated input power. For the situations where the project will manufacture innovative components, it shall be estimated based on forecasted fugitive emissions that the innovative technology(ies) or component(s) will feature once in operation.

$GWP_{fug,z}$  = Global Warming Potential of the fugitive greenhouse gas z (see section 1.1.6).

#### 4.3.2 Manufacturing of innovative energy storage systems or their components

For a manufacturing project that produces energy storage units,  $Ref_y$  and  $Proj_y$  shall be calculated according to Equation [4.7] and [4.8].

See also section 1.3 for other provisions relevant for the case of manufacturing projects.

Parameter	=	Equation	
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Ref <sub>y</sub>	=	$UP * N_y * CS_{\text{component}} * (Ref_{\text{energy},y} + Ref_{\text{services},y})$	[4.7]
Proj <sub>y</sub>	=	$UP * N_y * CS_{\text{component}} * Proj_{\text{energy},y}$	[4.8]

Where:

Ref<sub>energy,y</sub> = Energy-related GHG emissions in the reference scenario that will not occur due to the use of one energy storage facility or consumer product equipped with the component produced by the proposed manufacturing project in year y, per unit and per year of use of the component. Expressed in tonnes CO<sub>2</sub> / (unit \* year of use of the component). This includes direct emissions from the use of fossil fuels and generation of heat, indirect emissions from the use of grid electricity, hydrogen and heat, process-related emissions from the production of hydrogen as well as from transmission losses associated with the energy transport. It shall be calculated according to Equation [4.3] above.

Ref<sub>services,y</sub> = Auxiliary-services-related GHG emissions present in the reference scenario that will not occur due to the use of one energy storage facility or consumer product equipped with the component produced by the proposed manufacturing project in year y, per unit and per year of use of the component. Expressed in tonnes CO<sub>2</sub> / (unit \* year of use of the component). This includes direct emissions from the use of fossil fuels and generation of heat, in particular from inefficient use of primary energy, indirect emissions from the use of grid electricity, hydrogen and heat as well as from transmission losses associated with the energy transport. It shall be calculated according to Equation [4.4] above. In the case that a service could be delivered by running some amount of power generation with CCGTs at reduced efficiency (45% rather than 55%) then Equation [4.4a] should be used, in particular for dynamic reactive power.

Proj<sub>energy,y</sub> = Energy-related GHG emissions not present in the reference scenario that will occur due to the provision of energy by the proposed manufacturing project in year y, per unit and per year of use of the component. Expressed in tonnes CO<sub>2</sub> / (unit \* year of use of the component). This includes direct emissions from the use of fossil fuels and generation of heat, indirect emissions from the use of grid electricity, hydrogen and heat, process-related emissions from the production of hydrogen as well as from transmission losses associated with the energy transport. It shall be calculated according to Equation [4.5] above.

N<sub>y</sub> = number of components produced and supplied to the market by the proposed manufacturing project in year y. The applicant shall estimate this based on the expected output of the manufacturing plant and the market potential, and in line with the assumptions made in the rest of the proposal concerning the operation of the manufacturing plant, and including financial calculations.

CS<sub>component</sub> = innovative components' cost share, as defined in section 1.3.5.

UP = Applicable use period of the manufactured component, as defined in section 1.3.4. The use period is equal to a maximum of 5 years, or to the lifetime of the component, if the lifetime of the component is shorter than five years.

y = year of operation of the manufacturing project.

#### 4.4 Relative GHG emission avoidance

The relative GHG emission avoidance ( $\Delta\text{GHG}_{\text{rel}}$ ) of an energy storage project shall be calculated according to section 1.1.2.

#### 4.5 Data and parameters

The Table 4.2 presents standard parameters to be used for ES projects. These are deemed constant throughout the duration of the project and should not be monitored, unless otherwise stated in Appendix 3. For emission or conversion factors not listed here, refer to the hierarchy of sources in Appendix 1.

Table 4.2 Standard parameters for ES projects.

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Comment
$EF_{out,H2}$	57.0 (6.84)	tCO <sub>2</sub> e/TJ (tCO <sub>2</sub> e/tH <sub>2</sub> )	See section 1.4.3.2  Emission benchmark for generating hydrogen under the ETS	See section 1.4.3.2  Commission Implementing Regulation (EU) 2021/447	Value to be used for all the years y
$EF_{in,H2}$ $EF_{on-site,H2}$	0	tCO <sub>2</sub> e/TJ (tCO <sub>2</sub> e/tH <sub>2</sub> )	See section 1.4.3.2	See section 1.4.3.2	Value to be used for all the years y
$EF_{on-site,heat}$ $EF_{out,heat}$	47.3	tCO <sub>2</sub> e/TJ	See section 1.4.3.3  Emission benchmark for generating heat under the ETS	See section 1.4.3.3  Commission Implementing Regulation (EU) 2021/447	Value to be used for all the years y
$EF_{in, heat}$	0	tCO <sub>2</sub> e/TJ	See section 1.4.3.3	See section 1.4.3.3	Value to be used for all the years y
$EF_{in, natural gas}$ $EF_{on-site, natural gas}$ $EF_{out, natural gas}$	59.5	tCO <sub>2</sub> e/TJ	GHG emission factor for the combustion of natural gas	IPCC (2006a) and IPCC (2013)	To be used for storage and combustion of natural gas in all stationary and mobile applications for all the years y.
$EF_{in, diesel}$ $EF_{on-site, diesel}$ $EF_{out, diesel}$	75.2	tCO <sub>2</sub> e/TJ	GHG emission factor for the combustion of diesel fuel	Same as above	To be used for combustion of diesel in all stationary and mobile applications for all the years y.

<p>EF<sub>in, gasoline</sub> EF<sub>on-site, gasoline</sub> EF<sub>out, gasoline</sub></p>	73.2	tCO <sub>2</sub> e/TJ	GHG emission factor for the combustion of gasoline	Same as above	To be used for combustion of gasoline in all stationary and mobile applications.
<p>EF<sub>in, heavy fuel oil</sub> EF<sub>on-site, heavy fuel oil</sub> EF<sub>out, heavy fuel oil</sub></p>	77.8	tCO <sub>2</sub> e/TJ	GHG emission factor for the combustion of heavy fuel oil (residual fuel oil)	Same as above	To be used for combustion of heavy fuel oil in all stationary and mobile applications.
<p>EF<sub>in, other fossil fuels</sub> EF<sub>on-site, other fossil fuels</sub> EF<sub>out, other fossil fuels</sub></p>	look up in TABLE 2.2 of the source of data	tCO <sub>2</sub> e/TJ	Combustion emissions many fossil fuels	IPCC (2006b)	If not in that table, use the hierarchy of sources in Appendix 1
<p>EF<sub>in, electricity</sub> EF<sub>on-site, electricity</sub></p>	0	tCO <sub>2</sub> e/TJ (tCO <sub>2</sub> e/MWh)	See section 1.4.3.1	See section 1.4.3.1	Value to be used for all the years y
EF <sub>out, electricity</sub>	140 (0.505)	tCO <sub>2</sub> e/TJ (tCO <sub>2</sub> e/MWh)	See section 1.4.3.1  Emissions for dispatchable electricity generation.	See section 1.4.3.1  Based on the EF for combustion of natural gas according to Commission Implementing Regulation (EU) 2018/2066 and a gas turbine with efficiency of 40 %	Value to be used for all the years y
<p>EF<sub>in, bio</sub> EF<sub>on-site, bio</sub></p>	<p>Sum of: Supply emissions to be calculated following the provisions in section 1.4.4.2, plus transport emissions where relevant.  Combustion and use emissions, which are equal to 0.4 tonnes CO<sub>2</sub>e / TJ</p>	tCO <sub>2</sub> e / TJ	GHG emission factor for the production, supply, and combustion/use of <b>biomass-derived fuels</b>	Section 1.4.4.2	

$EF_{in, LCF}$ $EF_{on-site, LCF}$	Sum of: Supply emissions, which are equal to 20 tonnes CO <sub>2</sub> e / TJ, plus transport emissions where relevant. Combustion and use emissions, which are equal to 0.4 tonnes CO <sub>2</sub> e / TJ	tCO <sub>2</sub> e / TJ	GHG emission factor for the production, supply, and combustion/use of <b>LCFs</b> .	Section 1.4.5.1	
$EF_{in, RFNBO}$ $EF_{on-site, RFNBO}$	Sum of: Supply emissions, which are equal to 0 tonnes CO <sub>2</sub> e / TJ, plus transport emissions where relevant. Combustion and use emissions, which are equal to 0.4 tonnes CO <sub>2</sub> e / TJ	tCO <sub>2</sub> e / TJ	GHG emission factor for the production, supply, and combustion/use of <b>RFNBOs</b> .	Section 1.4.5.1	
$\Theta_{electricity}$	6.74	%	Mean losses due to transport of electricity to consumers via the grid in the EU in 2022	<a href="#">EUROSTAT Energy Database</a>	Use default, unless country-specific prescription exists.
$\Theta_{heat}$	11.25	%	Mean losses due to transport of heat to consumers via heat networks in the EU in 2022	<a href="#">EUROSTAT Energy Database</a>	Use default, unless country-specific prescription exists.
$\Theta_{hydrogen}$ $\Theta_{RFNBO}$ $\Theta_{LCF}$ $\Theta_{bio}$	0.64	%	Mean losses due to transport of gaseous fuels to consumers via the grid in the EU in 2022.	<a href="#">EUROSTAT Energy Database</a>	Use default, unless country-specific prescription exists.

$\Delta EF_{\text{service,a}}$	Individual calculation by the applicant	t CO <sub>2</sub> e per unit depending on service (MW/GVAs/MVAr)	mean increase of the emission intensity of grid electricity due the need for the auxiliary service a	No source available	Where relevant the reference case shall consider the provision of the service by a CCGT plant running at a less-than-optimal electrical efficiency of 45% instead of 55%.
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Source: see the column 'Source data'.

## 5 Mobility (MOB)

This section covers projects under the mobility (MOB) category. These projects can contribute to the reduction of GHG emissions (see section 1.1.6) from aviation, maritime, and road transportation activities within the scope of the EU ETS, and to the reduction of additional non-CO<sub>2</sub> climate impacts from aviation and maritime activities within the scope of the EU ETS (see section 1.1.8).

This section includes provisions on how to calculate the impacts that will be avoided in operating journeys as a result of the implementation of innovative projects. The absolute GHG emissions avoidance of the project is defined by the difference between the amount of emissions from GHGs and other non-CO<sub>2</sub> climate impacts, expressed in terms of CO<sub>2</sub> equivalent, that would occur for the delivery of the same transport services using a conventional technology in the reference scenario, and those associated to the project activity in the project scenario.

### 5.1 Scope and general provisions

Projects under the MOB category include projects that aim to provide transportation services, and projects that aim to manufacture innovative aircrafts, maritime vessels, road vehicles<sup>24</sup> and their components.

- **Projects that aim to provide transportation services** as their principal product may envisage a reduction in energy use per functional unit, e.g. per km, per journey), or a reduction in the emissions per unit of energy through, for example, the adoption of a less carbon intensive energy source, e.g. use of electricity, hydrogen, or biomass-derived fuels.
- **For projects that aim to manufacture innovative aircrafts, maritime vessels, road vehicles or their components**, the project emissions shall be defined by the emissions that the manufactured aircraft, vessel, or vehicle will emit when in use, which shall be estimated based on credible assumptions about the projected performance of all components of the finished vehicle, and underpinned with robust evidence. Refer also to section 1.3 for general provisions for manufacturing projects.

Examples of such projects include, but are not limited to:

- Projects that reduce energy use per functional unit (e.g. new vehicles/airframes, reduced weight, replacement of fleet with more efficient vehicles/aircraft/vessels).
- Fuel switch (e.g. use of sustainable biofuels or blends, electricity, hydrogen or recycled carbon fuels or renewable fuels of non-biological origin or alternative fuels with lower content of other pollutants associated with climate forcing effects, e.g. aromatics and sulphur, instead of the conventional fossil fuel).
- Projects that envisage a modal shift (e.g. new mode of transportation, or a combination or various modes); Manufacturing of electric or hydrogen-fuelled aircraft or their components.
- Manufacturing of innovative vessels and their components (e.g. new hull designs, wind propulsion technologies, energy saving propulsors, power train hull appendage and other hull technologies).

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<sup>24</sup> For the purpose of this Methodology rail transportation shall follow the provisions that are relevant for road transportation. This applies, for example, to projects aiming at manufacturing innovative batteries for trains.

- Manufacturing of innovative vehicles and their components (e.g. electric vehicles, fuel cell vehicles, batteries for mobility applications, fuel cells for mobility applications).
- Solutions to reduce GHG emissions from on-board ship systems (e.g. fuel cells for vessels, batteries for vessels).
- Wind propulsion technologies and power take-in from propulsors (e.g. Flettner rotors, sail rigs, other wind propulsion devices).
- Projects involving the decarbonisation of the supporting infrastructure (e.g. at the ports and airports).
- Projects that contribute to the reduction of non-CO<sub>2</sub> climate impacts.
- Projects combining the above.

### 5.1.1 Choice of a sector for mobility projects

For projects classified under the MOB category, the sector shall be defined as specified in section 1.2, i.e. it shall be determined based on the function of the principal product or service that is the main aim of the project.

*Example: A project that involves the manufacturing of innovative maritime vessels shall be classified under sector MOB/maritime.*

*Example: A project that intends to provide transportation services for passengers with an innovative aviation solution shall be classified under sector MOB/aviation.*

The general rule above applies also to the case of modal switch projects:

*Example: A project intends to replace road freight transport with maritime shipping. The project aims to provide maritime transportation services; therefore, it shall be classified under sector MOB/maritime.*

Only in case a modal switch project aims to provide a transportation service in the project scenario different than aviation, maritime, or road transport, then the sector shall be chosen based on the transport service replaced in the reference scenario (which must be either aviation, maritime, or road transport) following the provisions in section 1.2.1 and the other relevant provisions in section 1.2

*Example: A project intends to replace road freight with rail transport. The project aims to reduce emissions in the road transport sector by replacing road travels with transportation services in a sector different than road transport, maritime, or aviation. Then, the sector is determined by the transport service replaced, and the project shall be classified under sector MOB/road transport.*

Projects aiming exclusively at producing fuels shall apply under the EII category (section 2). However, projects that envisage both the production and use of such fuels may apply as hybrid EII + MOB projects, where the GHG emissions avoided are calculated separately for each component and added up while removing any double counting. See section 1.2.5.5 for specific guidance.

### 5.1.2 Reference scenario for mobility projects

The reference scenario for mobility projects shall be the delivery of the same transport services provided by the innovative project. This means that for a project delivering freight and passenger transport services, the delivered transport service in terms of tonne-kilometres and/or person-kilometres must be the same, respectively, while the number of vehicle, vessels and/or aircrafts may (in some cases within the provisions of section

5.1.2.1) differ between the reference and the project scenario, if the typical size of the innovative technology differs from the conventional one.

The emissions in the reference and project scenario shall be calculated following the provisions and equations in section 5.3. The reference scenario shall be based on a representative mode of transport as specified in section 5.1.2.1, and on the use of a relevant conventional fossil fuel and relevant average vehicle fuel consumptions as specified in section 5.1.2.2.

#### 5.1.2.1 Mode of transport in the reference scenario

As a general rule, the mode of transport assumed in the reference scenario shall be the same as in the project scenario. For a project aiming to deliver transport services, if section 5.3.1 allows for the selection of one out of multiple reference vehicles within the same mode of transport, the applicant shall match the project scenario by selecting the one most representative of the transportation service provided by the project.

This means that the reference scenario should typically be built by considering the same number of vehicles as in the project scenario, travelling the same distances and transporting the same volumes of passengers or goods as in the project scenario, and thus providing the same transport service in terms of tonne-kilometres and/or person-kilometres as in the project scenario.

*Example: the reference scenario for a project delivering aviation transportation services is an equivalent fleet of conventional aircrafts operating on the relevant conventional fuel as specified in section 5.1.2.2. The number of reference aircrafts should be the same as in the project scenario, and the type of reference aircraft should be selected as the one most representative for the type of service provided by the project among the options available, in terms of distance travelled and volumes of passengers or goods transported. The transport service provided in the reference scenario shall be the same as in the project scenario in terms of tonne-kilometres and/or person-kilometres.*

Two exceptions are allowed for specific **projects that aim to provide a transport service**:

- When it is not possible to build a reference scenario for the delivery of the same transportation service as in the project scenario (in tonne-kilometres and/or person-kilometres) by considering the same number of vehicles in the two scenarios, then the applicant may deviate from the standard approach in terms of number and type of vehicles and distance travelled. However, the mode of transport considered must be the same as in the project scenario.
- In situations in which the transport service provided by the project in the project scenario is typically provided through other modes of transport in the reference scenario, then the applicant can select the most common mode of transport used for such services in the reference scenario, among those available within the provisions in section 5.3.1. This is typically the case of projects that aim at reducing emissions through modal shift, where nonetheless the reference scenario shall provide the same transport service in terms of tonne-kilometres and/or person-kilometres as in the project scenario.

These situations must be well justified by the applicants, for example by providing relevant supporting documents. Deviating from the standard reference scenario without providing a credible justification may negatively impact the credibility of the GHG calculations and the resulting evaluation. In any case, the emissions in the reference and project scenario shall be calculated following the provisions of section 5.3.1, and the transport service provided in the reference scenario shall be equal to the transport service provided in the project scenario in terms of tonne-kilometres and/or person-kilometres.

For **projects aiming at manufacturing innovative aircraft, maritime vessels, or road vehicles** (section 5.3.2), deviating from the standard reference scenario is not allowed. For such projects, the mode of transportation to be considered in the reference scenario shall always match the one in the project scenario. For example, should the project involve the manufacturing of a certain number of innovative maritime vessel, then the applicant shall assume that these vessels will replace the same number of representative conventional maritime vessel, thus providing the same transport service in terms of tonne-kilometres and/or person-kilometres as in the project scenario.

#### 5.1.2.2 Type of fuel and specific fuel consumption in the reference scenario

In terms of fuel types to be used in the reference scenario, the following shall apply:

- Jet kerosene type A1 shall be used when the reference scenario is based on **aviation** as a mode of transport.
- Marine diesel oil (MDO) shall be used when the reference scenario is based on **maritime** as a mode of transport.
- Diesel B0 shall be used when the reference scenario is based on road transport.

With regards to specific fuel consumption (i.e. fuel use per functional unit,  $SC_{ref,t,y}$ ) applicants shall adopt the default values or estimate those based on the provided references as indicated in section 5.3.2.1, unless the average consumption of the reference aircraft, maritime vessel or road vehicle is expected to differ significantly from such standard values. In this case, applicants must provide appropriate references to justify all assumptions adopted and include this parameter in the monitoring plan.

Deviations in the specific fuel consumption in the reference scenario, must be duly justified and underpinned with robust evidence at the application stage. Failure to provide adequate justification may negatively impact the credibility of the GHG calculations and the resulting evaluation.

#### **5.1.3 GHG emissions and additional non-CO<sub>2</sub> climate impacts for mobility projects**

The methodology for mobility projects considers the greenhouse gases (GHGs) covered by section 1.1.6, including non-CO<sub>2</sub> GHGs. In addition, the methodology for mobility projects considers the additional non-CO<sub>2</sub> climate impacts from maritime and aviation activities covered by section 1.1.8.

With respect to GHGs, the methodology for mobility projects accounts predominantly for the CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions due to the combustion of fossil fuels, and for the CH<sub>4</sub> and N<sub>2</sub>O emissions due to the combustion of biomass-derived fuels, renewable fuels of non-biological origin (RFNBOs), and low-carbon fuels.

With respect to additional non-CO<sub>2</sub> climate impacts, the methodology for mobility projects considers the warming impact associated with black carbon emissions from maritime transport and other non-CO<sub>2</sub> climate impacts from aviation, such as emissions by aircraft of water vapour, formation of contrails (condensation trails) and cloudiness in the wake of aircraft, nitrogen oxides (NO<sub>x</sub>), soot particles, and oxidised sulphur species.

##### 5.1.3.1 Biomass-derived fuels, RFNBOs, and LCFs

The methodology allows projects to consider a zero-emission factor for the CO<sub>2</sub> emitted when combusting or using biomass-derived fuels, RFNBOs, and LCFs.

However, the emissions of non-CO<sub>2</sub> greenhouse gases (e.g. CH<sub>4</sub> and N<sub>2</sub>O) associated to the combustion of such fuels must be considered within the term  $Proj_{t,ene,y}$  (or  $Proj_{t,ene,unit,y}$ ), following the provisions in sections 5.3.1.2 and 5.3.2.2. Furthermore, leakage of fuels with a direct GHG impact, such as methane, must be considered within the term  $Proj_{t,fug,y}$  (or

$Proj_{t,fug,unit,y}$ ), following the provisions in section sections 5.3.1.2 and 5.3.2.2. Relevant emission factors are provided in Table 5.2. No other emissions associated to the use of these fuels (e.g. supply emissions) should be included in the calculations for mobility projects.

Concerning the definition of biomass-derived fuels, RFNBOs, and LCFs:

- For projects intending to use biomass-derived fuels, refer to section 1.4.4, and in particular to the sustainability requirements specified in section 1.4.4.1.
- For projects intending to use RFNBOs or LCFs other than hydrogen, refer to the provisions in section 1.4.5.
- The provisions in this sub-section are not relevant for the case of hydrogen used as a fuel by a mobility project, for which an emission factor of zero always applies irrespectively of its origin, as specified in Table 1.4, section 1.4.3.2.

For **projects that aim to provide a transportation service** (section 5.3.1), the applicant must credibly justify the assumptions made with respect to the classification of a fuel as biomass-derived fuel, RFNBO, or LCF, for example by providing letters of support from potential suppliers or other supporting documents. If the origin of the fuel is not known at the time of the application, and/or if its origin cannot be credibly justified, then the fuel should be considered of fossil origin. Failure to provide adequate justification may affect the quality of the GHG calculations and the resulting evaluation. In addition, the applicants must propose adequate monitoring measures in their monitoring plan (see section 1.5 and Appendix 3) to ensure adequate monitoring and reporting of the assumptions made at the application stage. Failure to provide an adequate monitoring plan may negatively affect the quality of the GHG calculations, and the resulting evaluation. During project implementation, failure to demonstrate that the assumptions made at the application stage are representative of the actual operation of the project, may affect the overall GHG emission avoidance that can be achieved, which may have consequences in terms of grant disbursement as specified in the Call Text (see also section 1.1.9).

For **projects that aim at manufacturing innovative aircraft, maritime vessels, road vehicles, or their components**, the applicant must credibly justify the assumptions made with respect to the fuel used by the aircraft, vessel, or vehicle based on credible operational assumptions and technical specifications. The applicant shall not assume that the consumer product equipped with a component manufactured by the project will have better performance, consume less fuel, or consume a fuel different than the reference fuels mix, unless this is a direct consequence of the installation of the innovative component manufactured by the project. The operation assumptions made, must be representative of the expected use of the component and consumer product. For example, for the case of dual-fuel engines, credible assumptions should be taken with respect to the expected fuel mix, and period over which the engine will operate on biomass-derived fuels, RFNBOs, and LCFs as opposed to fossil fuels. Failure to provide adequate justification may affect the quality of the GHG calculations and the resulting evaluation. In case the actual user of the innovative components produced during project implementation differs from, or is not compatible with, the intended use specified in the application, the project may not be able to reach the expected GHG emission avoidance, with potential implications on grant disbursement as specified in the Call Text (see also section 1.3.6).

#### *5.1.3.2 Additional non-CO<sub>2</sub> climate impacts for aviation activities*

For aviation activities, the approach for the calculation of non-CO<sub>2</sub> climate impacts is aligned to an overall climate impact in the range from 2 to 4 times the radiative forcing from CO<sub>2</sub> alone, recognised by the IPCC in its special report on Aviation and Global Atmosphere (IPCC, 1999).

In the reference scenario, the additional non-CO<sub>2</sub> climate impacts from aviation shall be assumed equal to 2 times the CO<sub>2</sub> emissions from jet A1 fuel combustion, corresponding to an overall climate impact equal to 3 times the radiative forcing from CO<sub>2</sub> alone. Applicants may opt to decouple the calculation of additional non-CO<sub>2</sub> climate impacts from aviation from the single factor of fuel use if, and only if, they rely on data monitored according to the Monitoring, Reporting, and Verification (MRV) framework for additional non-CO<sub>2</sub> climate impacts from aviation under the EU ETS, should that be available at the time of their application.

In the project scenario, applicants must calculate this term using a well-justified approach based on scientific literature, or by modelling global near surface temperature change. Alternatively, applicants can use data compliant with the MRV framework for additional non-CO<sub>2</sub> climate impacts from aviation under the EU ETS, should that be available at the time of their application, and if the same approach is used also for the reference scenario.

Any claimed reduction of additional non-CO<sub>2</sub> climate impacts from aviation activities must be a direct consequence of the innovation proposed by the project. This means that applicants are not allowed to claim a reduction in additional non-CO<sub>2</sub> climate impacts that only result from the adoption of a different calculation method between the reference and the project scenario. Similarly, for the case of projects aiming at manufacturing aircrafts and their components, the applicant shall not assume that the aircraft equipped with a component manufactured by the project will have better performance in terms of additional non-CO<sub>2</sub> climate impacts with respect to the reference scenario, unless the use of the component is part of the project and/or savings in terms of additional non-CO<sub>2</sub> climate impacts are a direct consequence of the installation of the innovative component manufactured by the project.

#### *5.1.3.3 Additional non-CO<sub>2</sub> climate impacts for maritime activities*

For maritime activities, and for the purposes of this Methodology, non-CO<sub>2</sub> climate impacts are primarily related to the releases of black carbon from vessels. Other non-CO<sub>2</sub> climate impacts are treated as out of the scope of the methodology.

To quantify the amount of black carbon emitted from maritime vessels in the reference scenario, applicants should apply the black carbon emissions factors for marine diesel oil (MDO) in Table 63 and 64 of the Fourth IMO GHG Study (2020), considering the relevant type(s) of vessel(s) as well as their load range. In the project scenario, applicants should apply the black carbon emissions factors in Table 63 – 66 of the Fourth IMO GHG Study 2020, considering the type(s) of vessel(s) used in the project scenario as well as their fuel mix and load range.

The applicable GWP for black carbon is provided in Table 5.2. The GWP provided is a global average, which is intended to provide a level-playing field between different applications in spite of the potential diverging impacts due to, for instance, shipping routes.

## **5.2 System boundaries**

The emission sources that shall be included within the boundaries of the calculations for mobility projects, and those that shall not be considered, are specified in Table 5.1.

Table 5.1. Emission sources included in or excluded from the boundaries of the GHG emission avoidance calculation for aviation, maritime and road transport activities

Source		Included in any topic except small-scale	Included in small-scale topic
Reference (Ref)	GHG emissions due to the use of one or more sources of energy in the various modes of transportation, for the delivery of the same transport services provided by the innovative project. ( $Ref_{t,ene}$ Or $Ref_{t,ene,unit}$ ).	Yes	Yes
	Fugitive GHG emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gases, such as methane, that will occur in the absence of the project activity due to maritime or road transportation activities ( $Ref_{t,fug}$ Or $Ref_{t,fug,unit}$ )	Yes	Yes
	Additional non-CO <sub>2</sub> climate impacts from aviation and maritime activities that would occur in the absence of the project ( $Ref_{t,AddnonCO2}$ Or $Ref_{t,AddnonCO2,unit}$ ).	Yes	Yes
	GHG emissions due to the energy use in the supporting infrastructure for aviation and maritime activities, for the delivery of the same transport services provided by the innovative project. This includes combustion of fossil or other fuels, use of electricity, that in the absence of the project activity would be consumed in the infrastructure that support the operation of the journeys covered by the project ( $Ref_{infra,ene}$ ).	Optional <sup>25</sup>	Optional <sup>25</sup>
	GHG emissions due to the energy use in the supporting infrastructure for road transport activities, in the reference scenario, for the delivery of the same transport services provided by the innovative project.	No	No
Project (Proj)	GHG emissions due to the energy use that will be consumed in aviation, maritime or road transportation activity proposed by the project ( $Proj_{t,ene}$ Or $Proj_{t,ene,unit}$ ).  This includes (including their share in blends): <ul style="list-style-type: none"> <li>▪ Fossil fuels</li> <li>▪ Biomass-derived fuels</li> <li>▪ RFNBOs</li> <li>▪ Low-Carbon Fuels</li> <li>▪ Heat</li> <li>▪ Electricity</li> <li>▪ Hydrogen</li> </ul>	Yes	Partial  Only emissions from fossil fuels and heat shall be considered

<sup>25</sup> Should the applicants wish to include emissions from aviation and maritime infrastructure in their GHG calculations, these shall be included in both the reference and project scenarios and the corresponding parameters shall be included in the monitoring plan. Emissions from road transport infrastructure shall not be included.

Source		Included in any topic except small-scale	Included in small-scale topic
	Fugitive emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gases, such as methane, that will occur in the proposed in the project activity due to maritime or road transportation activities ( $Proj_{t,fug}$ or $Proj_{t,fug,unit}$ ).	Yes	Yes
	Additional non-CO <sub>2</sub> climate impacts from aviation and maritime activities that will occur in the project scenario ( $Proj_{t,nonCO2}$ or $Proj_{t,nonCO2,unit}$ ).	Yes	Yes
	GHG emissions due to the energy use in the supporting infrastructure for aviation and maritime activities, in the innovative project. This includes combustion of fossil or other fuels, use of electricity, that is proposed to be consumed in the infrastructure in the project activity to support the operation of the journeys covered by the project ( $Proj_{infra,ene}$ ).	Optional <sup>2525</sup>	Optional <sup>2525</sup>
	GHG emissions due to the energy use in the supporting infrastructure for road transport activities, in the innovative project.	No	No

Source: European Commission internal elaboration.

**Simplification for SMALL-SCALE topic:** In the calculation of the terms  $Proj_{t,ene}$  and  $Proj_{t,ene,unit}$ , projects submitted under the small-scale topic shall only consider emissions from the consumption of fossil fuels and heat, while emissions from the consumption of biomass-derived fuels, RFNBOs, LCFs, electricity, and hydrogen can be disregarded.

### 5.3 Calculation of reference and project emissions

The equations to be applied for the calculation of the reference and project emissions of **projects that aim to provide a transport service as their principal product** are specified in section 5.3.1.

Projects aiming to build a plant for the **manufacturing of innovative aircraft, vessels, road vehicles or their components** shall calculate their absolute GHG emission avoidance according to section 5.3.2.

#### 5.3.1 Projects that aim to provide a transport service as their principal product.

Equations [5.1] and [5.2] define the parameters that shall be included in the calculation of the Absolute GHG emissions avoidance for projects that aim to provide a transport service as their principal product.

Projects envisaging a combination of one or more modes of transport shall calculate the emissions associated to each mode individually, before adding them up. In case the project involves more than one type of aircraft, maritime vessel, or road vehicle within the same transport mode, applicants shall calculate the emissions associated to each type of aircraft, maritime vessel, and road vehicle individually, before adding them up.

The number and type of transport mode considered, and the number and type of aircrafts, maritime vessels, and road vehicles considered, may be different in the project scenario and in the reference scenario, when allowed by the provisions in section 5.1.2.1.

Parameter	=	Equation	
Ref <sub>y</sub>	=	$\sum_{t=1}^T (\text{Ref}_{t,\text{ene},y} + \text{Ref}_{t,\text{fug},y} + \text{Ref}_{t,\text{AddnonCO}_2,y}) + \text{Ref}_{\text{infra},y}$	[5.1]
Proj <sub>y</sub>	=	$\sum_{t=1}^T (\text{Proj}_{t,\text{ene},y} + \text{Proj}_{t,\text{fug},y} + \text{Proj}_{t,\text{AddnonCO}_2,y}) + \text{Proj}_{\text{infra},y}$	[5.2]

Where:

Ref<sub>t,ene,y</sub> = GHG emissions due to the use of one or more sources of energy in mode of transportation type t, for the delivery of the same transport services provided by the innovative project, that in the absence of the project activity would be consumed for the operation of the journeys covered by the project, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.3].

Ref<sub>t,fug,y</sub> = Fugitive GHG emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gases in road transport or maritime modes of transportation, that will occur in the absence of the project activity for the delivery of corresponding transportation services, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.4].

Ref<sub>t,AddnonCO<sub>2</sub>,y</sub> = additional non-CO<sub>2</sub> climate impacts that would occur in the absence of the project activity in maritime and/or aviation transportation for the delivery of corresponding transportation services, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.5]. This includes black carbon emissions from maritime transport and other non-CO<sub>2</sub> climate impacts from aviation.

Ref<sub>infra,y</sub> = GHG emissions due to the use of one or more sources of energy in the supporting infrastructure for aviation or maritime transport, for the delivery of the same transport services provided by the innovative project, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.6].

Proj<sub>t,ene,y</sub> = GHG emissions due to the use of one or more sources of energy in mode of transportation type t, proposed by the project activity and which, alone or in combination with other modes of transportation, replaces corresponding services, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.7].

Proj<sub>t,fug,y</sub> = Fugitive GHG emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gases, such of as methane, that will occur in the operation of road or maritime transportation in the project activity, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.8]. Projects not envisaging the use of these modes of transportation may omit this parameter.

Proj<sub>t,AddnonCO<sub>2</sub>,y</sub> = additional non-CO<sub>2</sub> climate impacts that will occur in the project activity due to the operation of air and/or water transportation, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.9]. This includes black carbon emissions from maritime transport and other non-CO<sub>2</sub> climate impacts from aviation.

Proj<sub>infra,y</sub> = GHG emissions due to use or one of more sources of energy in the infrastructure that supports the operation of the aviation or maritime journeys covered by the project, in year y, in tonnes CO<sub>2</sub>e. Calculated according to equation [5.10].

t = mode of transportation type t used, including aviation (t=a), maritime (t=m), and road transport (t=r).

T = number of transport modes considered. The number and types of modes of transportation may differ between reference and project scenarios, when allowed by the provisions in section 5.1.2.1.

y = year of the operation of the project.

### 5.3.1.1 Reference emissions sub-equations

Parameter	=	Equation	
$Ref_{t,ene,y}$	=	Defined for each mode of transport t in the equations below: aviation (t=a), maritime (t=m), road (t=r).	[5.3]
$Ref_{a,ene,y}$	=	$Q_{ref,a,y} * EF_{jetA1}$	[5.3a]
$Ref_{m,ene,y}$	=	$Q_{ref,m,y} * EF_{MDO}$	[5.3b]
$Ref_{r,ene,y}$	=	$Q_{ref,r,y} * EF_{diesel}$	[5.3c]
$Ref_{t,fug,y}$	=	$\sum_{z=1}^Z Q_{ref,t,fug,z,y} * GWP_z$	[5.4]
$Ref_{t,AddnonCO2,y}$	=	Defined for each mode of transport t in the equations below: aviation (t=a), maritime (t=m).	[5.5]
$Ref_{a,AddnonCO2,y}$	=	$2 * Q_{ref,a,FF,y} * EF_{CO2,jetA1}$	[5.5a]
$Ref_{m,AddnonCO2,y}$	=	$Q_{ref,m,BC,y} * GWP_{BC}$	[5.5b]
$Ref_{infra,y}$	=	$\sum_{x=1}^X (Q_{ref,infra,x,y} * EF_x)$	[5.6]

Where:

$Q_{ref,t,y}$  = Quantity of energy used in mode of transportation type t consumed for the operation of journeys that will be reduced and/or replaced with other energy sources in the project activity, in year y, in TJ. For the proposal, this shall be estimated by the applicant based on the total transport distances and volumes of goods and passengers and the planned operation of the corresponding reference transport fleet in the reference scenario.

$EF_{jetA1}$  = Emission factor due to the consumption of jet kerosene type A1, in tonnes CO<sub>2</sub>e/TJ. The appropriate EF presented in Table 5.2 shall be applied.

$EF_{MDO}$  = Emission factor due to the consumption of the marine diesel oil, in tonnes CO<sub>2</sub>e/TJ. The appropriate EF presented in Table 5.2 shall be applied.

$EF_{diesel}$  = Emission factor due to the consumption of diesel, in tonnes CO<sub>2</sub>e/TJ. The appropriate EF presented in Table 5.2 shall be applied.

$Q_{ref,t,fug,z,y}$  = Quantity of fugitive emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gas type z in year y in the reference scenario for the delivery of the same transport services as provided by the innovative project, in tonnes. In particular, this covers slippage of methane and nitrous oxide. For the proposal, this shall be estimated by the applicant based on the total transport distances and volumes of goods and passengers and the planned operation of the corresponding reference transport fleet in the reference scenario.

$GWP_z$  = Global Warming Potential of the fugitive greenhouse gas z in tonnes CO<sub>2</sub>e/tonne. For all GWPs covered by EU regulation, see section 1.1.6.

$Q_{ref,a,FF,y}$  = Quantity of conventional aviation fuel consumed for the operation of flights that will be reduced and/or replaced with other energy sources in the project activity, in year y, in TJ. As specified in section 5.1.3.2, applicants may opt to decouple the calculation of non-CO<sub>2</sub> effects of flights from the single factor of fuel use if, and only if, actual data monitored according to the Monitoring, Reporting, and Verification (MRV) framework for additional non-CO<sub>2</sub> climate impacts for aviation

under the EU ETS is available at the time of their application. Not applicable to modes of transportation other than aviation.

$EF_{CO_2, jetA1}$  = CO<sub>2</sub> emission factor due to the combustion of the jet A-1, in tCO<sub>2</sub>/TJ. The applicable EF presented in Table 5.2 shall be applied. Not applicable to modes of transport other than aviation.

$Q_{ref,m,BC,y}$  = Quantity of emissions of black carbon from maritime vessels in the reference scenario for the delivery of the same transport services as provided by the innovative project in year y, in tonnes of black carbon. This shall be estimated following the provisions in section 5.1.3.3. Not applicable to modes of transportation other than maritime.

$GWP_{BC}$  = Global Warming Potential of black carbon, in tonnes CO<sub>2</sub>e/tonne of black carbon. The applicable GWP presented in Table 5.2 shall be applied.

$Q_{ref,infra,x,y}$  = Quantity of energy type x used at infrastructure facilities that are replaced by the innovative project in year y, in TJ. This may include fuels consumed at the supporting infrastructure (e.g. airports, ports). For the proposal, this shall be estimated by the applicant based on the total transport distances and volumes of goods and passengers and the planned operation of the infrastructure that serves the corresponding reference transport fleet in the reference scenario, evidenced by information from credible sources. Not applicable for road transport infrastructure.

$EF_x$  = Emission factor due to the consumption of the energy source type x, in tonnes CO<sub>2</sub>e/TJ. The applicable EF presented in Table 5.2 shall be applied.

t = mode of transportation type t used, including aviation (t=a), maritime (t=m), and road transport (t=r).

x = type of energy source used in the reference scenario. This includes any of the energy sources specified in section 5.2.

z = type of fugitive greenhouse gases considered in the reference scenario.

X = number of energy types considered in the reference scenario. This includes all energy types being used in the reference scenario, independently of their use in the project scenario.

Z = number of fugitive greenhouse gases considered in the reference scenario.

### 5.3.1.2 Project emissions sub-equations

Parameter	=	Equation	
$Proj_{t,ene,y}$	=	$\sum_{x=1}^X (Q_{proj,t,x,y} * EF_x)$	[5.7]
$Proj_{t,fug,y}$	=	$\sum_{z=1}^Z Q_{proj,t,fug,z,y} * GWP_z$	[5.8]
$Proj_{t,AddnonCO2,y}$	=	Defined for each mode of transport t in the equations below: aviation (t=a), maritime (t=m).	[5.9]
$Proj_{a,AddnonCO2,y}$	=	Refer to section 5.1.3.2	[5.9a]
$Proj_{m,AddnonCO2,y}$	=	$Q_{proj,m,BC,y} * GWP_{BC}$	[5.9b]
$Proj_{infra,x,y}$	=	$\sum_{x=1}^X (Q_{proj,infra,x,y} * EF_x)$	[5.10]

Where:

$Q_{proj,t,x,y}$  = Quantity of energy source type x used in mode of transportation type t consumed for the operation of journeys as part of the project activity, in year y, in TJ.

$EF_x$  = Emission factor due to the consumption of the energy source type  $x$ , in tonnes CO<sub>2</sub>e/TJ. The applicable EF presented in Table 5.2 shall be applied, even if (some of) the CO<sub>2</sub> from fuel combustion will be captured – credit for carbon capture is given through the  $CC_{credit}$  term in equation [1.1].

$Q_{proj,t,fug,z,y}$  = Quantity of fugitive emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gas type  $z$  estimated to occur in the project scenario, in year  $y$ , in tonnes. In particular, this covers slippage of methane and nitrous oxide. For the proposal, this shall be estimated by the applicant based on the total transport distances and volumes of goods and passengers and the planned operation of the corresponding vehicle fleet in the reference scenario. For fugitive emissions lower than in the reference case, the applicant needs to provide sufficient evidence for their mitigation by the project.

$GWP_z$  = Global Warming Potential of the fugitive greenhouse gas type GHG in tonnes CO<sub>2</sub>e/tonne. For all GWPs covered by EU regulation, see section 1.1.6.

$Proj_{a,AddnonCO_2,y}$  = Additional non-CO<sub>2</sub> climate impacts for aviation activities, in year  $y$ , refer to section 5.1.3.2. Not applicable to modes of transport other than aviation.

$Q_{proj,m,BC,y}$  = Quantity of emissions of black carbon from maritime vessels in the project scenario in year  $y$ , in tonnes of black carbon. This shall be estimated following the provisions in section 5.1.3.3. Not applicable to modes of transport other than maritime.

$GWP_{BC}$  = Global Warming Potential of black carbon, in tonnes CO<sub>2</sub>e/tonne of black carbon. The applicable GWP is presented in Table 5.2. Not applicable to modes of transport other than maritime.

$Q_{proj,infra,x,y}$  = Quantity of energy type  $x$  used at infrastructure facilities that will be used in the project scenario in year  $y$ , in TJ. This shall include fuels consumed at the supporting infrastructure (e.g. airports and ports). Not applicable for road transport infrastructure.

$t$  = mode of transportation type  $t$  used, including aviation ( $t=a$ ), maritime ( $t=m$ ), and road transport ( $t=r$ ).

$x$  = type of energy source used in the project scenario. This includes include energy sources specified in section 5.2.

$z$  = type of fugitive greenhouse gases considered in the project scenario.

$X$  = number of energy types used in the project scenario.

$Z$  = number of fugitive greenhouse gases considered in the project scenario.

### 5.3.2 Manufacturing of innovative aircraft, maritime vessels, road vehicles or their components

Projects aiming at manufacturing innovative aircraft, maritime vessels, road transport vehicles, or their components, shall calculate their GHG emissions avoidance based on the use phase of the manufactured aircraft, maritime vessel, road vehicle or component. As such, project emissions will be based on the emissions that the innovative aircraft, maritime vessel or road transport vehicle will emit when in operation.

These emissions shall be estimated based on credible assumptions and underpinned with robust justification on the projected performance of the component produced as well as of other components that will be needed for the final assembly of the aircraft, maritime vessel, or road transport vehicle. Refer to section 1.3 for general provisions for manufacturing projects, and to section 1.3.6 for further guidance on related assumptions.

Equations [5.11] and [5.12] below define the parameters that shall be included in the calculation of the Absolute GHG emissions avoidance for projects aiming at manufacturing innovative aircraft, maritime vessels, road transport vehicles, or their components.

Projects envisaging a combination of one or more modes of transport shall calculate the emissions associated to each mode individually, before adding them up. In case the project involves more than one type of aircraft, maritime vessel, or road vehicle within the same transport mode, applicants shall calculate the emissions associated to each type of aircraft, maritime vessel, and road vehicle individually, before adding them up.

The number and type of transport modes considered, and the number and type of aircrafts, maritime vessels, and road vehicles considered, must be the same in the reference and project scenario for manufacturing projects, as specified in section 5.1.2.1.

Parameter	=	Equation	
Ref <sub>y</sub>	=	$\sum_{t=1}^T N_{t,y} * UP * CS_{component,t} * D_{ref,t} * (Ref_{t,ene,unit,y} + Ref_{t,fug,unit,y} + Ref_{t,AddnonCO2,unit,y})$	[5.11]
Proj <sub>y</sub>	=	$\sum_{t=1}^T N_{t,y} * UP * CS_{component,t} * D_{proj,t} * (Proj_{t,ene,unit,y} + Proj_{t,fug,unit,y} + Proj_{t,AddnonCO2,unit,y})$	[5.12]

Where:

Ref<sub>t,ene,unit,y</sub> = GHG emissions due to the use of one or more types of energy in mode of transportation type t, for the operation of a corresponding conventional aircraft, maritime vessel or road transport vehicle that will be replaced by an innovative aircraft, maritime vessel or road vehicle manufactured by the project in year y, or replaced by an aircraft, maritime vessel, or road vehicle equipped with an innovative component manufactured by the project in year y. In tonnes CO<sub>2e</sub> per km. Calculated according to equation [5.13].

Ref<sub>t,fug,unit,y</sub> = Fugitive GHG emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gases, that will occur in the operation of a corresponding conventional vessel or road transport vehicle that will be replaced by an innovative aircraft, maritime vessel or road vehicle manufactured by the project in year y, or replaced by an aircraft, maritime vessel, or road vehicle equipped with an innovative component manufactured by the project in year y. In tonnes CO<sub>2e</sub> / km. Calculated according to equation [5.14].

Ref<sub>t,AddnonCO2,unit,y</sub> = additional climate impacts due to the non-CO<sub>2</sub> effects that would occur for the operation of a corresponding conventional aircraft or maritime vessel that will be replaced by an innovative aircraft, maritime vessel or road vehicle manufactured by the project in year y, or replaced by an aircraft, maritime vessel, or road vehicle equipped with an innovative component manufactured by the project in year y. In tonnes CO<sub>2e</sub> per km. Calculated according to equation [5.15]. This includes black carbon emissions from maritime transport and other non-CO<sub>2</sub> climate impacts from aviation.

Proj<sub>t,ene,unit,y</sub> = GHG emissions due to the use of one or more sources of energy in an innovative aircraft, maritime vessel or road vehicle manufactured by the project in year y, or in an aircraft, maritime vessel or road vehicle equipped with an innovative component manufactured by the project in year y. In tonnes CO<sub>2e</sub> per km. Calculated according to equation [5.16].

Proj<sub>t,fug,unit,y</sub> = Fugitive GHG emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gases in an innovative maritime vessel or road vehicle manufactured by the project in year y, or in a maritime vessel or road vehicle equipped with an innovative component manufactured by the project in year y. In tonnes CO<sub>2e</sub> per km. Calculated according to equation [5.17]. Projects not envisaging the manufacturing of road vehicles or maritime vessels, or their components, may omit this parameter.

Proj<sub>t,AddnonCO2,unit,y</sub> = additional non-CO<sub>2</sub> climate impacts due to the use of an innovative aircraft or maritime vessel manufactured by the project in year y, or due to the use of an aircraft or maritime vessel that is equipped with an innovative component manufactured by the project in year y. In tonnes CO<sub>2e</sub> per km. Calculated according to equation [5.18]. This includes black carbon emissions from maritime transport and other non-CO<sub>2</sub> climate impacts from aviation.

CS<sub>component,t</sub> = cost share of the innovative component for the mode of transport of type 't', as defined in section 1.3.5.

N<sub>t,y</sub> = number of innovative aircrafts, maritime vessels road vehicles, or their components manufactured and supplied to the market by the proposed manufacturing project in year y. Estimates shall be based on the expected output of the manufacturing plant and the market potential, and must

be consistent with the assumptions adopted in other parts of the application, such as those used to support the financial calculations.

UP = Applicable use period of the aircraft, maritime vessel, road vehicle, or component manufactured by the project, as defined in section 1.3.4. The use period is equal to a maximum of 5 years, or to the lifetime of the aircraft, maritime vessel, road vehicle, or component manufactured by the project, if its lifetime is shorter than five years.

$D_{ref,t}$  = annual average distance travelled by a conventional aircraft, maritime vessel or vehicle (i.e. mode of transport of type t) in the reference scenario. In km per year of use of the innovative technology. The value presented in Table 5.2 shall be applied. Deviations from the default values require a clear and credible justification and sufficient evidence of why this is necessary.

$D_{proj,t}$  = annual average distance travelled by an innovative aircraft, maritime vessel or road vehicle manufactured by the project (i.e. mode of transport of type t), or one that is equipped with an innovative component manufactured by the project. In km per year of use of the innovative technology. Applicants shall adopt the same values used for  $D_{ref,t}$ .

t = mode of transport of type t used, including aviation (t=a), maritime (t=m), and road transport (t=r).

T = number of modes of transport considered. It must be the same in the reference and project scenario.

y = year of operation of the manufacturing project.

### 5.3.2.1 Reference emissions sub-equations

Parameter	=	Equation	
$Ref_{t,ene,unit,y}$	=	Defined for each mode of transport t in the equations below: aviation (t=a), maritime (t=m), road transport (t=r).	[5.13]
$Ref_{a,ene,unit,y}$	=	$SC_{ref,a,y} * EF_{jetA1}$	[5.13a]
$Ref_{m,ene,unit,y}$	=	$SC_{ref,m,y} * EF_{MDO}$	[5.13b]
$Ref_{r,ene,unit,y}$	=	$SC_{ref,r,y} * EF_{diesel}$	[5.13c]
$Ref_{t,fug,unit,y}$	=	$\sum_{z=1}^Z SE_{ref,t,fug,z,y} * GWP_z$	[5.14]
$Ref_{t,AddonCO2,unit,y}$	=	Defined for each mode of transport t in the equations below: aviation (t=a), maritime (t=m).	[5.15]
$Ref_{a,AddonCO2,unit,y}$	=	$2 * SC_{ref,a,FF,y} * EF_{CO2,jetA1}$	[5.15a]
$Ref_{m,AddonCO2,unit,y}$	=	$SE_{ref,m,BC,y} * GWP_{BC}$	[5.15b]

Where:

$SC_{ref,t,y}$  = Specific consumption of energy in mode of transportation type t for the operation of one conventional aircraft (a), maritime vessel (m) or road vehicle (r) that will be replaced by an innovative aircraft, maritime vessel, or road vehicle manufactured by the project in year y, or one equipped with an innovative component manufactured by the project in year y, in TJ /km. The applicable specific consumption or relevant guidance provided in Table 5.2 shall be applied.

$EF_{jetA1}$  = Emission factor due to the consumption of jet kerosene type A1, in tonnes CO<sub>2</sub>e/TJ. The appropriate EF presented in Table 5.2 shall be applied.

$EF_{MDO}$  = Emission factor due to the consumption of the marine diesel oil, in tonnes CO<sub>2</sub>e/TJ. The appropriate EF presented in Table 5.2 shall be applied.

$EF_{diesel}$  = Emission factor due to the consumption of diesel, in tonnes CO<sub>2</sub>e/TJ. The appropriate EF presented in Table 5.2 shall be applied.

$SE_{ref,t,fug,z,y}$  = Specific fugitive emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gas type 'z' for the operation of one conventional maritime vessel or road vehicle that will be replaced by the project activity in year y, in tonnes of gas / km.

$GWP_z$  = Global Warming Potential of the fugitive greenhouse gas 'z' in tonnes CO<sub>2</sub>e/ tonne of gas. For all GWPs covered by EU regulation, see section 1.1.6.

$SC_{ref,a,FF,y}$  = Specific consumption of conventional aviation fuel for the operation of one conventional aircraft that will be replaced with an innovative aircraft, maritime vessel or road vehicle manufactured by the project in year y, or one equipped with an innovative component manufactured by the project in year y, in TJ / km. Applicants shall use the values indicated in Table 5.2. As specified in section 5.1.3.2, applicants may opt to decouple the calculation of non-CO<sub>2</sub> effects of flights from the single factor of fuel use if, and only if, actual data monitored according to the Monitoring, Reporting, and Verification (MRV) framework for additional non-CO<sub>2</sub> climate impacts for aviation under the EU ETS is available at the time of their application. Not applicable to modes of transport other than aviation.

$EF_{CO2,jetA1}$  = CO<sub>2</sub> emission factor due to the combustion of the jet A-1, in tonnes CO<sub>2</sub>/TJ. The applicable EF presented in Table 5.2 shall be applied. Not applicable to modes of transport other than aviation.

$SE_{ref,m,BC,y}$  = Specific emissions of black carbon from the operation of one conventional maritime vessel that will be replaced by an innovative aircraft, maritime vessel or road vehicle manufactured by the project in year y, or by one equipped with an innovative component manufactured by the project in year y, in tonnes of black carbon / km. This shall be estimated following the provisions in section 5.1.3.3. Not applicable to modes of transport other than maritime.

$GWP_{BC}$  = Global Warming Potential of black carbon, in tonnes of CO<sub>2</sub>e/tonne of black carbon. The applicable GWP is presented in Table 5.2. Not applicable to modes of transport other than maritime.

t = mode of transportation type t used, including aviation (t=a), maritime (t=m), and road transport (t=r).

z = type of fugitive greenhouse gases considered in the reference scenario.

Z = number of greenhouse gases considered.

### 5.3.2.2 Project emissions sub-equations

Parameter	=	Equation	
$Proj_{t,ene,unit,x,y}$	=	$\sum_{x=1}^X (SC_{proj,t,x,y} * EF_x)$	[5.16]
$Proj_{t,fug,unit,y}$	=	$\sum_{z=1}^Z SE_{proj,t,fug,z,y} * GWP_z$	[5.17]
$Proj_{t,AddnonCO2,unit,y}$	=	Defined for each mode of transport t in the equations below: aviation (t=a), maritime (t=m).	[5.18]
$Proj_{a,AddnonCO2,unit,y}$	=	Refer to section 5.1.3.2	[5.18a]
$Proj_{m,AddnonCO2,unit,y}$	=	$SE_{proj,m,BC,y} * GWP_{BC}$	[5.18b]

Where:

$SC_{proj,t,x,y}$  = Specific consumption of energy source type x in mode of transportation type t for the operation of one innovative aircraft, maritime vessel or road vehicle manufactured by the project in year y, or one equipped with an innovative component manufactured by the project in year y, in TJ

/ km. Estimated based on forecasted energy use that the innovative technology(ies) or component(s) will require when implemented, which shall be duly justified and underpinned with robust evidence.

$EF_x$  = Emission factor due to the consumption of the energy source type  $x$ , in tonnes CO<sub>2</sub>e/TJ. The applicable EF presented in Table 5.2 shall be applied.

$SE_{proj,t,fug,z,y}$  = Specific fugitive emissions due to intentional (venting) or non-intentional (leakage) releases of fuel gas type  $z$  for the operation of one innovative maritime vessel or road vehicle manufactured by the project in year  $y$ , or one equipped with an innovative component manufactured by the project in year  $y$ , in tonnes of gas / km. Estimated based on forecasted fugitive emissions that the innovative technology(ies) or component(s) will result in when implemented, which shall be duly justified and underpinned with robust evidence.

$GWP_z$  = Global Warming Potential of the fugitive greenhouse gas  $z$  in tonnes CO<sub>2</sub>e/tonne of gas. For all GWPs covered by EU regulation, see section 1.1.6.

$Proj_{a,AddnonCO_2,unit,y}$  = additional non-CO<sub>2</sub> climate impacts from the use of one innovative aircraft manufactured by the project in year  $y$ , or one equipped with an innovative component manufactured by the project in year  $y$ , in tonnes CO<sub>2</sub>e / km. Refer to section 5.1.3.2. Not applicable to modes of transport other than aviation.

$SE_{proj,m,BC,y}$  = Specific emissions of black carbon from one innovative vessel manufactured by the project in year  $y$ , or one equipped with an innovative component produced by the project in year  $y$ , in tonnes of black carbon / km. This shall be estimated following the provisions in section 5.1.3.3. Not applicable to modes of transport other than maritime.

$GWP_{BC}$  = Global Warming Potential of black carbon, in tonnes CO<sub>2</sub>e/tonne of black carbon. The applicable GWP is presented in Table 5.2. Not applicable to modes of transport other than maritime.

$t$  = mode of transportation type  $t$  used, including aviation ( $t=a$ ), maritime ( $t=m$ ), and road transport ( $t=r$ ).

$x$  = type of energy source used in the project scenario. This includes include energy sources specified in section 5.2.

$z$  = type of fugitive greenhouse gases considered in the project scenario.

$X$  = number of energy types used in the project scenario.

$Z$  = number of fugitive greenhouse gases considered.

## 5.4 Relative GHG emissions avoidance

Refer to section 1.1.4 for guidance on the calculation of the relative GHG emission avoidance ( $\Delta GHG_{rel}$ ).

## 5.5 Data and parameters

Table 5.2 presents standard parameters to be used for MOB projects. These are deemed constant throughout the duration of the project and should not be monitored, unless otherwise stated in Appendix 3. Emission factors are defined on a NCV basis and have been rounded to the fourth decimal. For emission or conversion factors not listed here, refer to the hierarchy of sources in Appendix 1.

Table 5.2. Standard parameters for MOB projects.

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
Energy	0.0036	TJ/MWh	Conversion factor		Applies to all fuels

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
EF <sub>jetA1</sub>	72.0	tonne CO <sub>2</sub> e/TJ	GHG emission factor due to the combustion of jet A-1 kerosene	IPCC (2006a) and IPCC (2013)	
EF <sub>CO<sub>2</sub>,jetA1</sub>	71.5	tonne CO <sub>2</sub> e/TJ	CO <sub>2</sub> emission factor for the combustion of jet A-1 kerosene	Same as above	For use in the calculation of additional non-CO <sub>2</sub> climate impacts only
EF <sub>avgas</sub>	70.5	tonne CO <sub>2</sub> e/TJ	GHG emission factor for the combustion of aviation gasoline	Same as above	
EF <sub>NG</sub>	59.5	tonne CO <sub>2</sub> e/TJ	GHG emission factor for combustion of natural gas	Same as above	Based on the most conservative EF for CH <sub>4</sub> and/or N <sub>2</sub> O
EF <sub>LPG</sub>	64.90	tonne CO <sub>2</sub> e/TJ	GHG emission factor for combustion of liquefied petroleum gas	Same as above	Based on the most conservative EF for CH <sub>4</sub> and/or N <sub>2</sub> O
EF <sub>gasoline</sub>	73.20	tonne CO <sub>2</sub> e/TJ	GHG emission factor for the combustion of gasoline	Same as above	Based on the most conservative EF for CH <sub>4</sub> and/or N <sub>2</sub> O
EF <sub>diesel</sub>	75.20	tonne CO <sub>2</sub> e/TJ	GHG emission factor for combustion of diesel B0	Same as above	Based on the most conservative EF for CH <sub>4</sub> and/or N <sub>2</sub> O
EF <sub>bio</sub>	0.70	tonne CO <sub>2</sub> e/TJ	Non-CO <sub>2</sub> GHG emission factor for the combustion of biomass-derived fuels	Same as above	Based on the most conservative values for combustion of biomass-derived fuels in mobile sources
EF <sub>H<sub>2</sub></sub>	0.00	tonne CO <sub>2</sub> e/TJ	GHG emission factor for consumption of hydrogen	See Table 1.4	See Table 1.4

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
EF <sub>elec</sub>	0.00	tonne CO <sub>2</sub> e/TJ	GHG emission factor for electricity from the grid for both EU and non-EU countries	See Table 1.3	
EF <sub>RFNBO</sub>	1.10	tonne CO <sub>2</sub> e/TJ	Non-CO <sub>2</sub> GHG emission factor for combustion of renewable fuels of non-biological origin (RFNBO) other than hydrogen	Regulation (EU) 2023/1805	
EF <sub>LCF</sub>	1.10	tonne CO <sub>2</sub> e/TJ	Non-CO <sub>2</sub> GHG emission factor for combustion of low-carbon fuels	Same as above	
EF <sub>other ammonia</sub>	104.80	tonne CO <sub>2</sub> e/TJ	GHG emission factor for combustion of ammonia not qualifying as biomass-derived fuel, RFNBO, or low-carbon fuel	Commission implementing Regulation (EU) 2021/447	Benchmark value for 2021-2025
EF <sub>other methanol</sub>	102.90	tonne CO <sub>2</sub> e/TJ	GHG emission factor for combustion of methanol not qualifying as biomass-derived fuel, RFNBO, or low-carbon fuel	Regulation (EU) 2023/1805	Including the Well-to-Wheel (WtT) emissions for natural-gas-based methanol and the defaults for non-CO <sub>2</sub> combustion emissions provided for e-methanol.
EF <sub>other LNG</sub>	56.70	tonne CO <sub>2</sub> e/TJ	GHG emission factor for combustion of liquefied natural gas not qualifying as low-carbon gas	Same as above	LNG slippage not included. The applicant needs to take the slippage into account under Ref <sub>other</sub> and Proj <sub>other</sub> .

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
EF <sub>MDO</sub>	76.20	tonne CO <sub>2</sub> e/TJ	GHG emission factor for combustion of marine diesel oil	Same as above	Calculated as the sum of CO <sub>2</sub> , N <sub>2</sub> O and CH <sub>4</sub> emissions using the GWP from the Annex to the Commission Delegated Regulation supplementing Regulation (EU) 2018/1999
GWP <sub>BC</sub>	900	tonnes CO <sub>2</sub> e/tonne BC	100-year global warming potential of black carbon	Bond et al. (2013)	No official EU regulation on black carbon in place. Therefore, the scientific source usually referenced (for instance by the Fourth IMO GHG Study and the ICCT) is used here.
D <sub>ref,avi</sub> (General Aviation)	68,714	km / year	Annual average distance travelled by an aircraft submodel 'general aviation', in km.	EASA (2023)	Estimated based on the product of the Average annual number of flights (taking into account assumed operations, forecasted maintenance, and expected downtime) and the average flight distance (taking into account average historical scheduled flights distance for this type of aircraft).

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
					Reference aircraft C208
D <sub>ref,avi</sub> (Turboprop)	671,282	km / year	Annual average distance travelled by an aircraft submodel 'turboprop', in km.	Same as above	As above. Reference aircraft AT75
D <sub>ref,avi</sub> (Regional jet)	969,550	km / year	Annual average distance travelled by an aircraft submodel 'regional', in km.	Same as above	As above. Reference aircraft E190
D <sub>ref,avi</sub> (Single-Aisle or narrow-body)	2,093,381	km / year	Annual average distance travelled by an aircraft submodel 'single-aisle or narrow-body', in km.	Same as above	As above. Reference aircraft A320
D <sub>ref,avi</sub> (Twin-Aisle or wide body)	5,461,404	km / year	Annual average distance travelled by an aircraft submodel 'twin-aisle or wide body', in km.	Same as above	As above. Reference aircraft B77W
D <sub>ref,mar</sub>	To be derived from table 81 in the Annex of the Fourth IMO GHG Study	Km / year	Average distance sailed by ships per year for various maritime transportation options	See table 81 (pp. 446ff) in the Annex of <a href="#">IMO (2020)</a>	To be used in reference calculation and as default for project calculation
D <sub>ref,r</sub> (on-road passenger cars)	12,500	km / year	Average distance driven by passenger cars in the EU per year	SWD (2021)	
D <sub>ref,r</sub> (on-road light-duty trucks)	18,000	km / year	Average distance driven by light-duty trucks in the EU per year	IEA 2017	
D <sub>ref,r</sub> (on-road HDV)	73,000	km / year	Average distance driven by Heavy Duty Vehicles (HDV) in the EU per year	IEA 2017	

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
SC <sub>ref,r</sub> (on-road passenger cars)	0.0000024	TJ / km	Average fuel consumption per distance for passenger cars	IPCC (2006a) and EEA (2025)	
SC <sub>ref,r</sub> (on-road light duty trucks)	0.0000031	TJ / km	Average fuel consumption per distance for on-road light duty trucks	IPCC (2006a) and EEA (2025)	
SC <sub>ref,r</sub> (on-road HDV)	0.0000121	TJ / km	Average fuel consumption per distance for on-road heavy duty vehicles	JRC (2021)	
SC <sub>ref,m</sub>	To be derived from the data source by the applicant	TJ / km	Average fuel consumption per distance for various maritime transportation options	See table 81 (pp. 446ff) in the Annex of <a href="#">IMO (2020)</a>	
SC <sub>ref,a</sub> (general aviation)	0.00018	TJ / km	Average fuel consumption per distance for aircraft submodel 'general aviation'	Eurocontrol (2024)	Reference aircraft type C208. 95km added.
SC <sub>ref,a</sub> (turboprop)	0.00029	TJ / km	Average fuel consumption per distance for aircraft submodel 'turboprop'	Same as above	Reference aircraft type AT75. 95km added.
SC <sub>ref,a</sub> (regional jet)	0.00050	TJ / km	Average fuel consumption per distance for aircraft submodel 'regional jet'	Same as above	Reference aircraft type E190. 95km added.
SC <sub>ref,a</sub> (single aisle or narrow body)	0.00054	TJ / km	Average fuel consumption per distance for aircraft submodel 'single aisle or narrow body'	Same as above	Reference aircraft type A320. 95km added.
SC <sub>ref,a</sub> (twin aisle or wide body)	0.00129	TJ / km	Average fuel consumption per distance for aircraft	Same as above	Reference aircraft type B77W. 95km added.

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Assumption / Comment
			submodel 'twin aisle or wide body'		

## 6 Credit for Carbon Capture and Storage or Utilisation

This section explains how a carbon capture credit ( $CC_{credit}$ ) can be calculated when a project includes an element of carbon capture and storage or utilisation. Guidance on the selection of the category and sector for CCU/S projects is provided in section 1.2.2.

In the case that following the rules below for the assessment of the GHG emissions credit would result in double counting of any GHG emission (source or sink) already included in the assessment of project or reference scenario emissions following the rules for EII, RES, or MOB projects, this double counting shall be removed.

In the unusual case that the reference scenario includes an element of carbon capture and storage (e.g. modification of an existing EII facility that already captures CO<sub>2</sub> for storage purposes), then a carbon capture term for the reference scenario shall be calculated following the rules in this chapter, and an overall carbon capture credit shall be defined as the difference between the carbon capture credit in the project scenario and the carbon credit in the reference scenario<sup>26</sup>.

In the unusual case that the reference scenario includes an element of carbon capture and utilisation (e.g. modification of an existing EII facility that already captures CO<sub>2</sub> for utilisation purposes), then only the additional utilisation of CO<sub>2</sub> can be claimed in the project scenario, as specified in section 6.3, and no carbon capture credit should be included in the reference scenario.

### 6.1 Scope

This section applies to projects that involve capturing CO<sub>2</sub> from point sources or directly from the ambient air for injection in storage sites permitted under Directive 2009/31/EC on the geological storage of CO<sub>2</sub> or for incorporation into products. This includes projects that involve capturing CO<sub>2</sub>, projects that involve transporting captured CO<sub>2</sub> for storage or use or utilisation, projects that involve storing captured CO<sub>2</sub>, and projects that involve utilising captured CO<sub>2</sub>. A given project may include one or several of these steps.

A carbon capture credit cannot be claimed based on the capture of CO<sub>2</sub> that is produced as a by-product of hydrocarbon extraction (such as CO<sub>2</sub> produced from natural gas wells).

A carbon capture credit cannot be claimed based on the capture of CO<sub>2</sub> that is produced intentionally for the purpose of capturing it (for example through extraction from a natural CO<sub>2</sub> reservoir or through additional combustion of fuels).

A carbon capture credit cannot be claimed when submitting an application for a manufacturing of components project (section 1.3).

### 6.2 Carbon Capture and Storage (CCS)

CCS is characterised by the capture of CO<sub>2</sub> to be transported, injected and permanently stored in a storage site permitted under Directive 2009/31/EC.

If the full CCS chain is not part of the application, the applicant should demonstrate the provision of the remaining services in the CCS chain by third parties, for example by providing letters of intent, draft contracts, or other relevant supporting documents. In addition, since the InnovFund grant disbursement is dependent on verified emission reductions, i.e. the amount of CO<sub>2</sub> stored in a site permitted under Directive 2009/31/EC, copies of contracts and other relevant documents will have to be provided during project implementation to ensure the intended emissions savings are taking place.

### 6.3 Carbon Capture and utilisation (CCU)

An emission reduction by CCU can only be claimed by **projects that will demonstrate that the captured carbon will be used** by incorporation into a product. Projects that include a CCU component shall identify at least one of the CCU products as a product under the EII category (see section 2.2.6.3). Projects that capture CO<sub>2</sub> from a source in a sector that falls under the RES category (e.g. a bioenergy plant) or the MOB category (e.g. a ship) shall submit a hybrid application (see section 1.2.5), and cover the production of the CCU product(s) in the EII part of the calculations.

A project can only claim an emission reduction because of CCU if the intended use represents an **additional utilisation** of CO<sub>2</sub>. No carbon capture credit can be claimed for supplying captured CO<sub>2</sub> to established markets, such as the production of carbonated beverages, or greenhouse plant growth enhancement. No carbon capture credit may be claimed for supplying CO<sub>2</sub> to a third-party facility that is already operational and where the CO<sub>2</sub> supplied would replace an existing source of CO<sub>2</sub>.

Even if the CO<sub>2</sub> utilisation phase is not part of the application and is carried out by a third party, the CO<sub>2</sub> utilisation processes, inputs, and the end-of-life emissions from the CCU product(s) must be included as part of the GHG calculations, in line with section 2.2.6.3.1, 2.2.6.3.3, and other relevant provisions.

If the full CCU chain is not part of the application, the applicant should demonstrate the provision of the remaining services in the CCU chain by third parties, for example by providing letters of intent, draft contracts, or other relevant supporting documents. In addition, since the InnovFund grant disbursement is dependent on verified emission reductions, copies of contracts and other relevant documents will have to be provided during project implementation to ensure the intended emissions savings are taking place.

### 6.4 CO<sub>2</sub> capture from biogenic, RFNBO or LCF sources

There is **no difference** when calculating the CC credit between CO<sub>2</sub> captured from fossil sources and from biogenic sources. Similarly, there is no difference between CO<sub>2</sub> captured from fossil sources and from RFNBO/LCF sources. The CC credit is calculated based solely on the quantity of CO<sub>2</sub> permanently stored or used, and it is not affected by the origin of the CO<sub>2</sub>. When adding a CCS/CCU element to a project in the EII or RES categories that involves CO<sub>2</sub> from biogenic or RFNBO/LCF sources, any additional benefit to the project from the use of biogenic resources is assessed under the EII or RES component of the calculations.

*Example (fossil CO<sub>2</sub>): A carbon capture unit is added to an existing natural-gas-fired power plant. The captured CO<sub>2</sub> will be geologically stored. The carbon capture credit shall be calculated following section 6.5 as the amount of CO<sub>2</sub> stored, minus any emissions associated with the capture, transport and storage of the CO<sub>2</sub>. The project shall apply with category/sector/product EII/Other/Dispatchable electricity. Following the EII rules in section 2.2.6.2 an emission shall be recorded in the processes box of the project scenario equal to the full amount of CO<sub>2</sub> generated by the power plant, even though some of it will be captured. This emission term will be partly offset by the carbon capture credit term.*

*Example (biogenic CO<sub>2</sub>): A carbon capture unit is added to an existing biomass-fired power plant. The captured CO<sub>2</sub> will be geologically stored. The carbon capture credit shall be calculated following section 6.5 as the amount of carbon stored, minus any emissions associated with the capture, transport and storage of the CO<sub>2</sub>. The project shall apply with category/sector/product RES/Bioenergy/Dispatchable electricity. As the output of the renewable energy plant is not expanded by the project, and all the innovation relates to the carbon capture unit, the applicant cannot claim reductions due to the renewable energy generation. As such, the terms*

$Ref_{elec,prod,y}$  and  $Ref_{heat,prod,y}$  shall be set to zero in Equation [4.1] when calculating the reference emissions for the project.

**Example (mixed CO<sub>2</sub> stream):** A carbon capture unit is added to an existing waste-to-energy combined heat and power (CHP) plant with 60% of the waste being of biogenic origin. The captured CO<sub>2</sub> will be geologically stored. As the project has elements of renewable and non-renewable energy generation it must apply as a hybrid RES/EII project. As the waste is primarily of biogenic origin the application may be made in the category/sector RES/Bioenergy. The carbon capture credit shall be calculated following section 6.5 as the amount of carbon stored (including both the fossil and biogenic fractions), minus any emissions associated with the capture, transport, and storage of the CO<sub>2</sub>. In the EII part of the calculation, the fossil CO<sub>2</sub> emissions from the waste to energy plant must be included as an emission term in the processes box of the project scenario, even though they will be captured. The reference emissions for the EII part of the project will be based on Case 3: Modifications to existing production systems and include the fossil CO<sub>2</sub> emissions prior to the addition of the carbon capture unit. The reference emissions for the RES part of the project will be zero unless the output of renewable energy is increased alongside the addition of the carbon capture unit, in which case, the reference emissions for the RES part of the project shall be based on the increased capacity only (see section 3.2.1).

### 6.5 Calculation of the credit

The equation to be applied for the calculation of the carbon capture credit is provided in the following.

The full set of emissions associated to the entire CO<sub>2</sub> value chain must be considered in the calculation of the carbon capture credit even when a project includes within its scope only one stage of the value chain. For example, a project that only transports CO<sub>2</sub> that will later be stored must still include a reasonable characterisation of expected emissions from the capture and storage stages.

GHG emission credit	=	Sinks	-	Sources	
$CC_{credit,y}$	=	$(CC_{storage,y} + CC_{use,y})$	-	$(CC_{capture,y} + CC_{injection,y} + CC_{EHR,y} + CC_{pipeline,y} + CC_{transport,y})$	[6.1]

Where:

y = year of operation.

$CC_{credit,y}$  = carbon capture credit. It defines the net GHG benefit delivered by a project through CO<sub>2</sub> storage or utilisation in year y. It is calculated as a positive term for inclusion in equation [1.1]<sup>26</sup>.

$CC_{storage,y}$  = Amount of CO<sub>2</sub> that is injected for permanent storage in year y, in tonnes CO<sub>2</sub>, determined in accordance with Commission Implementing Regulation (EU) 2018/2066, especially Articles 40 to 46 and Article 49 and Annex IV, Section 21. This term is therefore equal to the amount

<sup>26</sup> In the unusual case in which the reference scenario includes an element of carbon capture and storage, the overall carbon capture credit is defined as the difference between the carbon capture credit in the project scenario and the carbon credit in the reference scenario ( $CC_{credit,y} = CC_{credit,proj,y} - CC_{credit,ref,y}$ ), with  $CC_{credit,proj,y}$  and  $CC_{credit,ref,y}$  first calculated separately following the provisions of section 6.

of CO<sub>2</sub> captured, minus any CO<sub>2</sub> lost to fugitive emissions, leakage or venting between the point of capture (inclusive) and the point of permanent storage.

$CC_{use,y}$  = Amount of CO<sub>2</sub> that is incorporated into products in year  $y$ , in tonnes CO<sub>2</sub>e. This amount may be calculated as 44/12 multiplied by the mass of carbon atoms from captured CO<sub>2</sub> incorporated in the products. This amount excludes any CO<sub>2</sub> lost to fugitive emissions, leakage or venting between the point of capture and the point of incorporation.

$CC_{capture,y}$  = GHG emissions from CO<sub>2</sub> capture activities in year  $y$ , in tonnes CO<sub>2</sub>e. This includes emissions from fuel and input material used for compression and liquefaction of the CO<sub>2</sub>, but does not include CO<sub>2</sub> lost to fugitive emissions, leakage or venting during the capture process. It shall be calculated according to Commission Implementing Regulation (EU) 2018/2066, Annex IV, Section 21. If the CO<sub>2</sub> is bought off the industrial gas market from a **producer who does not provide data**, the estimated emissions for the capture and transport must be included by the project applicant based on appropriate referenced sources.

$CC_{injection,y}$  = For CCS projects, GHG emissions from injection and geological storage of CO<sub>2</sub> in a storage site permitted under Directive 2009/31/EC in year  $y$ , in tonnes CO<sub>2</sub>e. This includes emissions from fuel use by associated booster stations and other combustion activities including on-site power plants; venting from injection or enhanced hydrocarbon recovery operations; fugitive emissions during injection; breakthrough CO<sub>2</sub> from enhanced hydrocarbon recovery operations; and leakages during or after injection. It shall be calculated according to Commission Implementing Regulation (EU) 2018/2066, Annex IV, Section 23.

$CC_{EHR,y}$  = For projects in which CO<sub>2</sub> injection and storage is associated with enhanced hydrocarbon recovery (EHR), emissions consistent with stoichiometric combustion of the associated fraction of the produced hydrocarbons. This is to be calculated as  $CC_{EHR,y} = (CC_{storage,y} / EHR_{storage,y}) * HC_y * \%C_y * 44/12$ ,

where  $EHR_{storage,y}$  is the total amount of CO<sub>2</sub> stored at the EHR location in year  $y$ ,  $HC_y$  is the total mass of hydrocarbons in tonnes produced at the EHR location in year  $y$ , and  $\%C_y$  is the carbon fraction in the produced hydrocarbons.

$CC_{pipeline,y}$  = GHG emissions from transport of CO<sub>2</sub> by pipelines in year  $y$ , in tonnes CO<sub>2</sub>e. This includes emissions from combustion and other processes at installations functionally connected to the transport network including booster stations, but does not include CO<sub>2</sub> lost to fugitive emissions, leakage or venting during the transport process via pipeline. It shall be calculated according to Commission Implementing Regulation (EU) 2018/2066, Annex IV, Section 22.

$CC_{transport,y}$  = GHG emissions from transport of CO<sub>2</sub> via road, rail or maritime modals in year  $y$ , to be calculated based on distance travelled, type of modal and load according to Equation [3.2] in section 6.5.1 and relevant sub equations, in tonnes CO<sub>2</sub>e.

### 6.5.1 GHG emissions from transportation of CO<sub>2</sub> via road, rail, or maritime modals

This methodology assumes the transportation of the CO<sub>2</sub> will be done through heavy good vehicles (HGVs) when via road, and by sea tankers for maritime journeys. Related emissions are calculated according to equation [6.2] and relevant sub-equations.

Note that the more detailed and broken-down is the information available on distance between sites, and volume transported, the more accurate will be the calculation of  $CC_{transport,y}$ . Therefore, if applicants' data is available per trip, applicants should calculate the emissions for each trip, using the average distance in each leg, and the amount of CO<sub>2</sub> transported in that exact leg (which can be derived from the estimate capacity of the truck), and add them up, as described in the equations below. Otherwise, an approximated estimate of the total distance travelled in the year and the total emissions transported in the year is allowed as a proxy.

**Simplification for SMALL-SCALE topic:** Emissions due to the transportation of CO<sub>2</sub> can be disregarded if the total distance travelled from the point of capture to the point of storage is less than 5000 kilometres.

Parameter	=	Equation	
$CC_{transport,y}$	=	$CC_{transport,road,y} + CC_{transport,rail,y} + CC_{transport,maritime,y}$	[6.2]
$CC_{transport,road,y}$	=	$\sum_{L=1}^T (K_{road,L} * CO_{2road,L} * EF_{road} * 10^{-3})$	[6.2a]
$CC_{transport,rail,y}$	=	$\sum_{L=1}^T (K_{rail,L} * CO_{2rail,L} * EF_{rail} * 10^{-3})$	[6.2b]
$CC_{transport,maritime,y}$	=	$\sum_{L=1}^T (K_{maritime,L} * CO_{2maritime,L} * EF_{maritime} * 10^{-3})$	[6.2c]

Where:

$CC_{transport,road,y}$  = GHG emissions due to the transportation of CO<sub>2</sub> in tank trucks or other road modals, in year y, in tonnes CO<sub>2</sub>e.

$CC_{transport,rail,y}$  = GHG emissions due to the transportation of CO<sub>2</sub> by rail, in year y, in tonnes CO<sub>2</sub>e.

$CC_{transport,maritime,y}$  = GHG emissions due to the transportation of CO<sub>2</sub> in sea tankers or other maritime modals, in year y, in tonnes CO<sub>2</sub>e.

$K_{road,L}$  = distance of one-way trip travelled by road vehicles, in kilometres.

$CO_{2road,L}$  = amount of CO<sub>2</sub> transported in each one-way trip in road modals, in tonnes.

$EF_{road}$  = emission factor for road vehicles, in kg CO<sub>2</sub>e / (tonne of CO<sub>2</sub> transported \* km). The default EF is presented in section 6.6.

$K_{rail,L}$  = distance of one-way trip travelled by rail, in kilometres.

$CO_{2rail,L}$  = amount of CO<sub>2</sub> transported in each one-way trip by rail, in tonnes.

$EF_{rail}$  = emission factor for rail transportation, in kg CO<sub>2</sub>e / (tonne of CO<sub>2</sub> transported \* km). The default EF is presented in section 6.6.

$K_{maritime,L}$  = distance of one-way trip travelled by maritime transportation, in kilometres.

$CO_{2maritime,L}$  = amount of CO<sub>2</sub> transported in each one-way trip in maritime transportation, in tonnes.

$EF_{maritime}$  = emission factor for maritime transportation, in kg CO<sub>2</sub>e / (tonne of CO<sub>2</sub> transported \* km). The default EF is presented in section 6.6.

L = outbound trip by the modal.

T = total number of outbound trips by the modal in year y.

## 6.6 Data and parameters

Table 6.1 presents standard parameters to be used for the calculation of  $CC_{transport}$ . Should applicants wish to adopt emission and conversion factors different from those proposed, a justification must be provided, and the corresponding parameter(s) shall be included in the monitoring plan and monitored during project operation. The emissions attributed to electricity consumed for injection, transport, and/or capture shall be zero.

Refer to Commission Implementing Regulation (EU) 2018/2066, Annex IV, Section 23 for conversion factors to be used for the calculation of  $CC_{capture}$ ,  $CC_{pipeline}$  and  $CC_{injection}$ . For other

emission or conversion factors not listed here, refer to the hierarchy of sources in Appendix 1.

Table 6.1. Standard parameters related to the calculation of the CC credit.

Data / Parameter	Value to be applied	Data unit	Description	Source of data	Comment
EF <sub>road</sub>	0.108	kg CO <sub>2</sub> e / (tonne of CO <sub>2</sub> transported * km)	Emission factor for liquid CO <sub>2</sub> transport by heavy truck.	JRC, based on Perez et al. (2012)	40 tonne articulated truck carrying 20 m <sup>3</sup> pressurised cryotank. Includes empty return trip.
EF <sub>rail</sub>	0.065	kg CO <sub>2</sub> e / (tonne of CO <sub>2</sub> transported * km)	Emission factor for freight by rail modals	Perez et al. (2012)	Transport in liquid form. Includes necessary boil-off of CO <sub>2</sub>
EF <sub>maritime</sub>	0.030	kg CO <sub>2</sub> e / (tonne of CO <sub>2</sub> transported * km)	Emission factors for freight by maritime modals	IPCC (2005), chapter 4.	Lower end of IPCC range. Includes fuel combustion and boil-off of CO <sub>2</sub> and empty return trip.

Source: see the column 'Source data'.

## Appendix 1

### Hierarchy of data sources for inputs and products in industrial projects, including projects with CCS

The emission factors for inputs and the GHG emission intensities and combustion factors for products **that are not specified elsewhere in the relevant section of the methodology, such as section 2 for energy intensive industries (EII)**, and need to be sourced from literature, will be taken from the hierarchy sources listed below.

Emission factors that are taken from sources in the hierarchy should **represent the typical emissions intensity for that specific input or product**. Typically, emission factors taken from the data hierarchy shall reflect production within the European Union or the European Economic Area. Emission factors reflecting non-EU/EAA production systems may only be utilised in duly justified cases where there is no significant production of the relevant input/product within the EU nor within the EEA.

Emissions values for heat, electricity and hydrogen are provided in the methodology and therefore must never be taken from sources in the data hierarchy. For other inputs or products, the EU ETS benchmark emission factors **shall not be used** as emissions factors, as the scope of the EU ETS benchmark calculation is not appropriate for this purpose.

Note that the **emissions intensities** are not the same as **combustion emissions** (which are used for calculating the direct carbon emissions for processes in EU ETS). Emissions intensities, which are also known for transport fuels as well-to-wheels emissions, comprises combustion emissions and also all the 'upstream' emissions from the supply chain extraction of raw materials, all steps in the processing, transport and distribution.

Applicants should generally use values taken from the highest level at which a value is available, looking at the hierarchy from the top to the bottom. If an applicant deviates from the hierarchy (i.e. chooses to use a value from a source lower in the hierarchy when a value is available at a higher source) the applicant must credibly justify why the value from the lower source is a better characterisation of the typical emissions intensity of that input.

Since the values used in the GHG emission avoidance calculations should represent current typical practices, a deviation from the hierarchy cannot be justified by arguing that the chosen value more closely represents the situation of the applicant's supplier. Similarly, applicants are **not permitted** to adjust values from the hierarchy by making alternative assumptions about the upstream emissions for production of an input or product even if they are able to identify specific details about the process used by their supplier. Applicants are also **not permitted** to adjust values from the hierarchy to reflect the zero emission intensity for electricity consumption that is used elsewhere in the calculations.

If using values for different inputs from more than one source at the same level of the hierarchy, the application should explain why this was necessary; cherry-picking favourable values is not allowed.

Note that the use of LCA-derived and literature-derived values is only allowed within the provisions regulating the application of the hierarchy of data sources. It is not allowed to simply take a calculated value from the literature to characterise an entire process or an entire project without developing the GHG emission avoidance calculations in full alignment with the provisions of the GHG Methodology.

The hierarchy of data sources is provided below:

1. Typical emissions for production of a number of forms of **biomass, biogas, biomethane, bioliquid and biofuels** are provided in Annexes V and VI of Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (Recast).

2. Stoichiometric combustion emissions for a wide range of **fuels** are provided in 2019 Refinement to the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. More precisely, this information can be found in tables 2.2 and 2.3 of IPCC (2006b).
3. Emissions intensity for most widely-used process **chemicals** are provided in Table 47 of the Report 'Definition of input data to assess GHG default emissions from biofuels in EU legislation' (European Commission 2019b).
4. If the data is not available at a higher level of the hierarchy, coherent data for a different range of inputs/products may be found in JEC-WTW v.5, WTT Annexes (JEC, 2020), which shares the same input database as the calculations in Annex V of REDII.
5. The following sources are considered to be at the same level of the hierarchy:
  - a. Calculations using input data from **ECOINVENT 3.5**, or more recent versions. Calculations in ECOINVENT should use the 'cut-off system model'. An equivalent calculation may also be made in proprietary software packages (e.g. GABI, open LCA) using the same input data. If the calculation calls for allocation of emissions between multiple products, allocation by economic value should be selected (the database includes the cost of products).
  - b. **Official sources**, such as IPCC, IEA, or government sources (noting however that most IPCC and IEA tables show combustion emissions, not lifecycle emissions intensity).
  - c. Other **peer-reviewed sources of data**, such as E3 database, GEMIS database.
  - d. **Peer-reviewed publications**. The applicants should properly reference the source used so that the evaluators can check it, but they do not have to provide a review of the approach adopted by the chosen source, since the GHG Methodology is not prescriptive about specific LCA decisions when peer-reviewed sources are used.
6. Duly documented and justified own-estimates.
7. Grey literature: unreviewed sources, such as commercial literature and websites. This kind of sources can only be used if the applicants can credibly demonstrate that no other source at a higher level in the hierarchy is available.

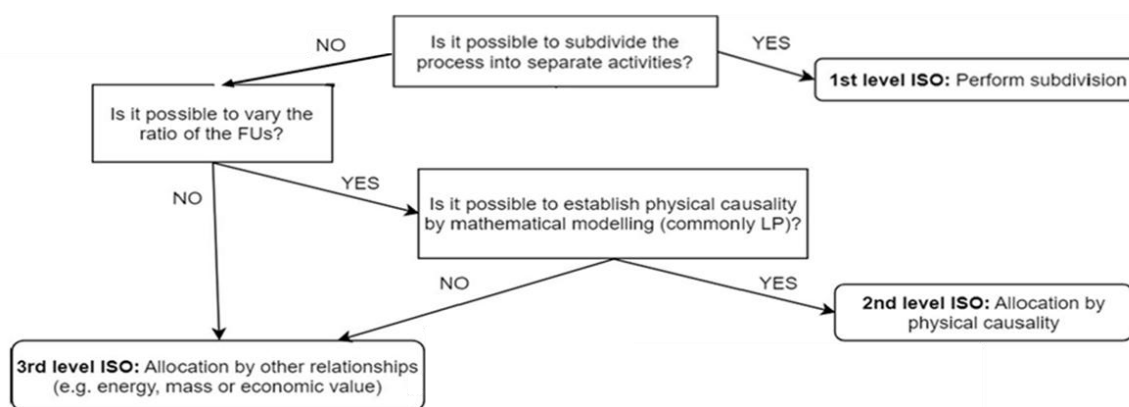
## Appendix 2

### Allocation of emissions to co-products in the calculation of the emission factors for inputs to Innovation Fund projects

In some cases, it may be necessary to allocate emissions associated with the production of an input between the input and its co-products. This will generally only be necessary if a source in the data hierarchy in Appendix 1 provides a characterisation of the production process but does not provide disaggregated emission factors for each co-product. In such cases, a simplified version of the ISO 14044 (2006) multifunctionality framework shall be used to allocate emissions to co-products, as shown in Figure A2.1<sup>27</sup>.

The point in the supply chain where the allocation is applied shall be at the output of the process that produces the co-products. The emissions allocated shall include the emissions from the process itself, as well as the emissions attributed to inputs to the process.

Figure A2.1. Simplification of the ISO 14044 (2006) method for allocating emissions between co-products (LP: linear programming, FU: functional unit)



Source: European Commission internal elaboration.

**First level allocation:** If it is possible to subdivide the process into separate activities, each dealing with the production of a single co-product, then it is possible to perform a subdivision and allocate the emissions from each activity to the corresponding co-product. If that is not possible, one can move to the second level.

**Second level allocation:** The next question is whether it is possible to change the ratio of the co-products produced by the process (as it is the case, for example, in a typical oil refinery) or whether the ratio of the co-products is fixed (for example by the stoichiometry of a chemical reaction). If the ratio of the co-products is variable, and if it is possible to establish physical causality by mathematical modelling, then this method should be applied by calculating the incremental impact on the process' emissions of increasing the output of just one co-product while keeping the output of the others constant. If this is not possible, including instances in which the applicant can reasonably justify that mathematical modelling would be too onerous for the purposes of this Methodology, one can move to the third level.

**Third level allocation:** In an industrial process, production decisions are guided by the market value of each co-product. Therefore, at this level, allocation by economic value should be preferred. Allocation by any other property (e.g. mass, chemical energy) is only justified in the case that the specific emissions being allocated are directly related to that

<sup>27</sup> The option in ISO 1044 (2006) to 'enlarge the system boundaries to include all the co-functions' is not considered in this case, because one must find the emissions associated to each co-product, which are already fixed. Also, the option to apply substitution to by-products is not considered, to simplify the calculations.

property. For example, transport emissions may be typically allocated by mass or volume of a good rather than its value.

## Appendix 3

### Overview of the Monitoring Reporting and Verification requirements for Innovation Fund projects

This appendix complements section 1.5 and presents an overview of the Innovation Fund GHG Monitoring Reporting and Verification (MRV) requirements.

#### *Monitoring plan*

When submitting their proposal, applicants shall include a detailed monitoring plan, consisting of a complete and transparent documentation of the parameters and data sources used in GHG calculations, and how they will be monitored during project implementation. This can be done by completing the dedicated '**Data traceability**' sections in the GHG calculators, which are provided as templates in spreadsheet format.

The monitoring plan shall cover both the reference scenario and the project scenario, and it shall include relevant parameters that are used in the calculations of both reference emissions and project emissions. Applicants must clearly identify the parameters that are expected to vary during the operation of the project and that will be monitored (e.g. production volumes) as opposed to parameters that are expected to remain constant and will not be monitored (e.g. some standard emission factors). The provisions in the sections below detail which parameters must be identified as '**parameters to be monitored**'<sup>28</sup>.

The monitoring plan should be in line with Commission Implementing Regulation (EU) 2018/2066, and monitoring activities should be performed accordingly.

#### *MRV specific provisions for InnovFund projects*

At the reporting stage, during project operation, all measurements should be conducted with calibrated measurement equipment according to industry standards and in line with relevant EU ETS MRV requirements as applicable.

Beneficiaries shall obtain, record, compile, analyse and document monitoring data, including assumptions, references, activity data and calculation factors in a transparent manner that enables the checking of performance achieved during the operation of the project. Beneficiaries shall ensure that the operational data determination is neither systematically nor knowingly inaccurate (Implementing Regulation (EU) 2018/2067) and avoid bias in the selection of assumptions. In selecting a monitoring methodology, the improvements from greater accuracy should be balanced against additional costs.

Each parameter monitored shall be accompanied with the following information, which shall be included in the dedicated 'Data traceability' section in the GHG calculators, which are provided as templates in spreadsheet format:

- Area / Department responsible for collection and archiving.
- Data source.
- Equipment used for monitoring, including details on accuracy and calibration.
- Monitoring frequency.
- QA/QC Procedures.
- Brief description, including measurement methods and procedures.

<sup>28</sup> Changes to assumptions and parameters that are NOT monitored during the implementation of the project are NOT allowed at the time of reporting, which typically include assumptions that are specific to the reference scenario, operational assumptions for manufacturing projects, and standard emission factors.

- Reliability.

Specific MRV provisions for each project category are given in the following sub-sections.

*1. Projects using biomass-derived fuels or materials, RFNBOs, LCFs, or waste materials as inputs or feedstocks*

During project operation, and as specified in section 1.5, beneficiaries will have to demonstrate, through the provision of certificates where relevant, the origin and characteristics of any input or feedstock assumed to be a biomass-derived fuel or material (section 1.4.4), an RFNBO or LCF (section 1.4.5 and section 1.4.3.2 for hydrogen), or assumed to be of waste origin (2.2.7.3.5). To these purposes, at the application stage, applicants will have to identify adequate monitoring and reporting provisions in their monitoring plan.

For projects using biomass-derived fuels and/or materials as inputs or feedstocks, the beneficiary must monitor the origin and type of the input for each utilised batch, demonstrate that it meets the sustainability requirements (see section 1.4.4.1), and report the associated emission factor. The emission factor must be calculated following the calculation rules of the RED. Where available, the project may report default emission factors as detailed in Part A or Part B of Annex V or Annex VI of the RED. Where default emission factors are not used, the project shall either report actual emission factors calculated in accordance with the methodology laid down in Part C of Annex V or Annex VI of the RED, or shall report typical emission factors for the relevant input sourced from the data hierarchy, in either case considering only the lifecycle stages specified in section 1.4.4.2.

For projects using RFNBOs/LCFs as inputs or feedstocks, the beneficiary must monitor the compliance of the utilised fuels with the requirements of RED (for RFNBOs and RCFs) or of Directive (EU) 2024/1788 (for other LCFs).

For EII projects using waste as an input, the beneficiary must demonstrate compliance with the waste framework directive (Directive 2008/98/EC), and must demonstrate what is the existing fate of the waste material, were it not used by the project.

*2. Projects manufacturing innovative technologies and their components*

For projects involving the manufacturing of innovative technologies and their components (section 1.3), beneficiaries shall monitor and report the number of components manufactured and sold each year and provide relevant supporting documents such as invoices. In addition, beneficiaries shall demonstrate the performance of the relevant component, facility, or consumer product manufactured.

Beneficiaries are not expected to monitor the actual operation of the components they manufactured and sold to third parties. Instead, they shall demonstrate that the performance of the innovative technology or component manufactured is in line with the assumptions made at the application stage, and that the actual user/offtaker of the technology or component manufactured is compatible with the intended use assumed at the application stage. To these purposes, beneficiaries shall provide adequate supporting documents during project implementation, such as offtake contracts, product specifications, and/or test results.

*Example: a project manufacturing cathodes and anodes for applications in electric vehicles, should demonstrate that these components are sold to a manufacturer of batteries for EVs. The beneficiary should also demonstrate that the cathodes and anodes manufactured meet the performance assumed at the time of the application.*

Changes to assumptions and parameters that are not monitored during the implementation of the project are not allowed at the time of reporting. This means that manufacturing projects, which, by definition, do not have operational control of the components manufactured, cannot change the **operational assumptions** on which the calculations were originally developed (e.g. the yearly operating hours of an electrolyser).

Data and parameters that are **technical characteristics** of the innovative technology or component manufactured and that are under the direct control of the beneficiary are considered 'parameters to be monitored' and shall be demonstrated by providing relevant supporting documents during the operation of the project. If the actual technical characteristics of the innovative technology or component manufactured are less favourable than those originally foreseen at the time of application, this shall be reflected in the reporting. Other changes to technical characteristics at the time of reporting are subject to discussion and agreement with the granting authority.

Concerning the use period of the component (UP), the beneficiary shall provide relevant supporting documents during monitoring and reporting to demonstrate that the lifetime of the technology or component manufactured is equal or longer than the use period assumed at the application stage. If that is not the case, the use period shall be reduced to match the reduced lifetime of the component during reporting.

If the beneficiary assumed a use period shorter than 5 years at the application stage and is able to demonstrate that the lifetime of the component is longer than 5 years during monitoring and reporting, then the use period may be increased up to the lifetime of the component or to a maximum of 5 years, whichever is lower, subject to discussion and agreement with the granting authority.

The cost-share of the component ( $CS_{\text{component}}$ ) is an assumption that shall be duly justified at the application stage, but that does not need to be monitored during project implementation, and that cannot be changed during monitoring and reporting.

### 3. *Energy Intensive Industry (EII)*

Considering the heterogeneity of the sectors covered under the EII category, the detailed list of the parameters required to be monitored is a function of the type of project. Parameters that may not need to be monitored are specified in section 2.3, while parameters to be monitored and reported shall include at a minimum:

- The quantities of inputs used by the project.
- The quantities of products produced by the project.
- The quantities of fuels consumed by the project.
- The emissions of greenhouse gases associated with the operation of the project and its processes. Either from direct measurement, or calculated from other parameters to be monitored (as listed here) or deemed constant (as specified in section 2.3).
- Emission factors associated with biomass-derived inputs to the project.
- Origin of biomass-derived fuels and material (section 1.4.4), hydrogen (section 1.4.3.2), other RFNBOs/LCFs (1.4.5), and any waste material (2.2.7.3.5) used as an input by the project.

For projects using biomass-derived fuels and/or materials as inputs, the applicant must monitor the origin and type of the input for each utilised batch, demonstrate that it meets the sustainability requirements (see section 1.4.4), and report the associated emission factor. The emission factor must be calculated following the calculation rules of the RED. Where available, the project may report default emission factors as detailed in Part A or

Part B of Annex V or Annex VI of the RED. Where default emission factors are not used, the project shall either report actual emission factors calculated in accordance with the methodology laid down in Part C of Annex V or Annex VI of the RED, or shall report typical emission factors for the relevant input sourced from the data hierarchy, in either case considering only the lifecycle stages specified in section 1.4.4.2.

For projects using RFNBOs/LCFs as inputs, the applicant must monitor the compliance of the utilised fuels with the requirements of the RED (for RFNBOs and RCFs) or of Directive (EU) 2024/1788 (for other LCFs).

For projects involving the manufacturing of components (section 1.3), the beneficiary shall monitor and report the number of components manufactured and sold each year. In addition, the beneficiary shall justify the sale volumes, cost assumptions, use period of the component, and the performance of the relevant component, facility, or consumer product with adequate supporting documents, such as invoices and test results.

As an example, Table A3.1 shows the parameters to be monitored for a sample project producing e-methanol from captured CO<sub>2</sub> and hydrogen electrolysis.

Table A3.1. Example of parameters for monitoring an EII project producing e-methanol

Data / Parameter	Data unit	Description
Electricity	MWh	Amount of electricity consumed for hydrogen production
Electricity	MWh	Amount of electricity consumed by the utilities
Water	tonnes	Amount of water consumption by the electrolysis installation and e-methanol synthesis
Catalyst	tonnes	Amount of catalyst consumed by the process
Natural gas input to process	tonnes	Amount of natural gas consumed for process heat
CO <sub>2</sub> captured	tonnes	Amount of CO <sub>2</sub> captured for input to e-methanol synthesis reactor
Off-gases	tonnes	Amount and type of off-gases produced by the processes
Hydrogen production	tonnes	Amount of hydrogen produced for input to e-methanol synthesis
e-methanol production	tonnes	Amount of e-methanol produced

Source: European Commission internal elaboration.

In addition to the parameters listed above, the following parameters may need to be monitored and reported for **knowledge sharing purposes** for projects using grid electricity, where applicable:

- Hourly profiles for use and feed-in of grid electricity.
- Hourly profiles for generation of electricity delivered to the project from PPAs.

- Hourly profiles for avoided curtailment based on final physical notifications of co-located RES plants or grid operator instructions.

Further details on the parameters to be monitored for knowledge-sharing purpose are provided in the Knowledge sharing report template available on the Funding and Tenders Portal.

#### 4. Renewable energy (RES)

Parameters that may not need to be monitored are listed in section 3.5, while Table A3.2, Table A3.3, and Table A3.4 present the parameters that, at minimum, shall be monitored on an annual basis and throughout the monitoring period of the project, and be part of the project's monitoring and reporting plan.

Table A3.2. Parameters to be monitored for a RES project that intends to produce renewable electricity, heating or cooling.

Emission source	Data / Parameter	Data unit	Description	Comment
Ref <sub>elec,prod</sub>	EG <sub>elec,disp</sub>	MWh	Net amount of dispatchable electricity to be generated by the renewable technology and delivered to the grid	
	EG <sub>elec,nondisp</sub>	MWh	Net amount of non-dispatchable electricity to be generated by the renewable technology and delivered to the grid	
Ref <sub>heat,prod</sub>	EG <sub>heat</sub>	TJ	Net amount of heat to be delivered by the renewable technology	
Ref <sub>cool,prod</sub>	EG <sub>cool</sub>	MWh	Net amount of cooling to be delivered by the renewable technology	
Proj <sub>on-site</sub>	Q <sub>FF</sub>	TJ	Quantity of fossil fuel type FF combusted in stationary or mobile sources at the project site	If derived from volume (i.e. litres or m <sup>3</sup> ) or mass (i.e. kg or tonnes), indicate the density and/or NCV used for the conversion
	Q <sub>bio,f</sub>	TJ	Quantity of biomass-derived fuel type 'f' consumed by the project in stationary or mobile sources	As above
	Q <sub>elec</sub>	MWh	Amount of electricity imported from the grid and consumed at the project site	
	Q <sub>heat</sub>	TJ	Amount of heat imported and consumed at the project site	
Proj <sub>geo</sub>	M <sub>steam</sub>	tonnes steam	Quantity of steam produced	When estimating leakage emissions for geothermal plants,

Emission source	Data / Parameter	Data unit	Description	Comment
				the applicant may also consider the adoption of standard ratios for parameters like the mass of steam per MWh TJ generated, steam losses and working fluid per tonne of steam, based on industry benchmarks, should these be available.
	$M_{inflow}$	tonnes steam	Quantity of steam entering the geothermal plant	As above
	$M_{outflow}$	tonnes steam	Quantity of steam leaving the geothermal plant	As above
	$M_{working\ fluid}$	tonnes working fluid	Quantity of working fluid leaked/reinjected	As above
	$GWP_{working\ fluid}$	tonnes CO <sub>2e</sub> / tonnes working fluid	Global Warming Potential for the working fluid used in the binary geothermal power plant	
Proj <sub>bio</sub>	EF <sub>bio supply.f</sub>	tonnes CO <sub>2e</sub> / TJ	Emission factor due to the production and supply of biomass-derived fuel f consumed at the project site, whether for energy generation or other purposes.	Refer to sub-section 1 of this appendix.

Table A3.3 Parameters to be monitored for a RES project that intends to consume renewable electricity, heating or cooling in activities not covered under Annex I of the EU ETS directive.

Emission source	Data / Parameter	Data unit	Description	Comment
Ref <sub>elec,use</sub>	Q <sub>elec</sub>	MWh	Amount of renewable electricity to be consumed by the project in non-Annex I activities	
Ref <sub>heat,use</sub>	Q <sub>heat</sub>	TJ	Amount of renewable heating to be consumed by the project in non-Annex I activities	
Ref <sub>cool,use</sub>	Q <sub>cool</sub>	MWh	Amount of renewable cooling to be consumed by the project in non-Annex I activities	

Table A3.4. Parameters to be monitored for a RES project that intends to manufacture components for renewable energy generation.

Emission source	Data / Parameter	Data unit	Description	Comment
n/a	N	units	Number of components supplied to markets by the manufacturing project	Based on relevant supporting documents, such as invoices. Refer to sub-section 2 of this appendix.
n/a	UP	Years	Use period of the manufactured component	Equal to a maximum of 5 years, or to the lifetime of the component if lower than five years. Refer to sub-section 2 of this appendix.
n/a	CS <sub>component</sub>	%	Cost share of the innovative component	Parameter not to be monitored, refer to sub-section 2 of this appendix.
Other parameters	Refer to data requirements described for the corresponding parameters in Table A3.2, pro-rated to a single facility or consumer product. Refer to the monitoring and reporting provisions for manufacturing projects in sub-section 2 of this appendix. Note the different treatment to be applied to technical characteristics of the innovative technology or component manufactured, as opposed to operational assumptions.			

Source: European Commission internal elaboration.

In addition to the parameters listed above, further parameters may need to be monitored for knowledge-sharing purposes: check the knowledge sharing report template available on the Funding and Tenders Portal.

### 5. Energy storage (ES)

Parameters that may not need to be monitored are listed in section 4.5, while Table A3.5 and Table A3.6 present the parameters that, at minimum, shall be monitored on an annual basis and throughout the operation of the project, and be part of the project's monitoring and reporting plan.

The reporting of achieved GHG emission avoidance will be based on the annual aggregation of the hourly output profiles, using the same equations and default parameters as during the proposal stage.

At entry into operation, the applicant will need to provide technical documentation of the energy storage plant and its connections to end users and energy grids, including the current local grid conditions with respect to renewable energy, grid congestions and auxiliary service requirements.

Table A3.5. Parameters to be monitored for an ES project that intends to operate an energy storage system.

Emission source	Data / Parameter	Data unit	Description	Comment
n/a	P <sub>in</sub>	MW	Input power rating	
	P <sub>out</sub>	MW	Output power rating	

Emission source	Data / Parameter	Data unit	Description	Comment
	$E_{stor}$	TJ	Maximum storage capacity including degradation	
Ref <sub>services</sub>	$R_{services,gen}$	MW	Generator rating	Only for intra-daily electricity storage
	$R_{services,var}$	MVAr	Reactive power rating	Only for intra-daily electricity storage
	$R_{services,inert}$	GVA	Inertia capability rating	Only for intra-daily electricity storage
n/a	$\eta$	%	Input-output efficiency including storage losses	To be derived from stock, input and output
Proj <sub>energy</sub>	$E_{in,x}$	TJ	Energy of type x stored by the project	Hourly data required for knowledge sharing purposes
Proj <sub>energy</sub>	$E_{stat,x}$	TJ	Energy of type x consumed by the project in stationary applications	
Proj <sub>energy</sub>	$E_{mob,x}$	TJ	Energy of type x consumed by the project in mobile applications.	
Ref <sub>energy</sub>	$E_{out,x}$	TJ	Energy of type x supplied by the project.	Hourly data required for knowledge sharing purposes
Proj <sub>on-site</sub>	$E_{stat,x}$	TJ	Energy of type x used in stationary sources (except in the energy storage units) at the project site	
	$E_{mob,x}$	TJ	Energy of type x used in mobile sources at the project site	
	$T_{services,a}$	H	Duration of delivery of service a by the project	
	$M_{fug,z}$	tonnes	Amount of the fugitive emissions of greenhouse gas z at the project site	All types of GHGs from section 1.1.6 to be included

Table A3.6. Parameters to be monitored for an ES project that intends to manufacture innovative components for energy storage.

Emission source	Data / Parameter	Data unit	Description	Comment
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n/a	N	Units	Number of renewable energy system units supplied to markets by the proposed manufacturing plant of renewable energy systems	Based on relevant supporting documents, such as invoices. Refer to sub-section 2 of this appendix.
n/a	UP	Years	Applicable use period of the manufactured component	Equal to a maximum of 5 years, or to the lifetime of the component if lower than five years. Refer to sub-section 2 of this appendix.
n/a	CS	%	Cost share of the innovative component as a fraction of the total capital cost of the relevant facility or of the retail price of the consumer product	Parameter not to be monitored, refer to sub-section 2 of this appendix.
Other parameters	<p>Refer to data requirements described for the corresponding parameters in Table A3.5, pro-rated to a single facility or consumer product.</p> <p>Refer to the monitoring and reporting provisions for manufacturing projects in sub-section 2 of this appendix. Note the different treatment to be applied to technical characteristics of the innovative technology or component manufactured, as opposed to operational assumptions.</p>			

Source: European Commission internal elaboration.

In addition to the parameters listed above, further parameters may need to be monitored for knowledge-sharing purposes: check the knowledge sharing report template available on the Funding and Tenders Portal.

## 6. Mobility (MOB)

Parameters that may not need to be monitored are listed in section 5.5, while Table A3.7 and Table A3.8 present the parameters that, at minimum, shall be monitored on an annual basis and throughout the operation of the project, and be part of the project's monitoring and reporting plan.

Table A3.7. Parameters for monitoring for MOB projects that aim to provide a transport service.

Emission source	Data / Parameter	Data unit	Description	Comment
Ref <sub>t,ene</sub>	Q <sub>ref,m</sub>	TJ	Quantity of energy consumed in maritime transportation for the operation of journeys reduced and/or replaced with other energy sources in the project activity	The monitoring plan shall include entries for each energy type used in this mode of transportation
	Q <sub>ref,a</sub>	TJ	Quantity of energy consumed in air transportation for the operation of journeys reduced and/or replaced with other energy sources in the project activity	The monitoring plan shall include entries for each energy type used in this mode of transportation
	Q <sub>ref,r</sub>	TJ	Quantity of energy consumed in road transportation for the operation of journeys reduced and/or replaced with other energy sources in the project activity	The monitoring plan shall include entries for each energy type used in this mode of transportation
Ref <sub>t,fug</sub>	Q <sub>ref,fug,z</sub>	Tonnes	Quantity of fugitive emissions due to intentional (venting) or non-intentional (leakage) releases of greenhouse gas type 'z' in the reference scenario for the delivery of the same transport services as provided by the innovative project	
Ref <sub>t,AddnonCO2</sub>	Q <sub>ref,a,FF</sub>	TJ	Quantity of conventional aviation fuel consumed for the operation of flights reduced and/or replaced with other energy sources in the project activity	Applicants who opt to adopt actual data monitored according to the MRV framework for aviation non-CO2 effects under the EU ETS shall include the corresponding parameters in their monitoring plan
	Q <sub>ref,m,BC</sub>	tonnes	Quantity of emissions of black carbon of mode of maritime transportation type 'm' in the reference scenario for the delivery of the same transport services as provided by the innovative project	
Ref <sub>infra</sub>	Q <sub>ref,infra,x</sub>	TJ	Quantity of energy type x used at infrastructure facilities that are replaced by the innovative project	

Emission source	Data / Parameter	Data unit	Description	Comment
Proj <sub>ene</sub>	Q <sub>proj,t,x</sub>	TJ	Quantity of energy source type x used in mode of transportation type t consumed for the operation of journeys proposed in the project activity	The monitoring plan shall include entries for each energy type used in each mode of transportation occurring in the project activity
Proj <sub>t,fug</sub>	Q <sub>proj,fug,z</sub>	tonnes	Quantity of fugitive emissions due to intentional (venting) or non-intentional (leakage) releases of greenhouse gas type GHG occurring in the innovative project	
Proj <sub>t,AddnonCO2</sub>	Parameters used for the calculation Proj <sub>a,AddnonCO2</sub>	To be defined by the applicant	Parameters used for the calculation of additional non-CO <sub>2</sub> climate impacts from aviation activities in the project scenario	Applicants who opt to adopt actual data monitored according to the MRV framework for aviation non-CO <sub>2</sub> effects under the EU ETS shall include the corresponding parameters in their MRV plan
	Q <sub>proj,m,BC</sub>	tonnes	Quantity of emissions of black carbon from maritime vessels in the project scenario	
Proj <sub>infra</sub>	Q <sub>proj,infra,x</sub>	TJ	Quantity of energy type x used at infrastructure facilities in the innovative project	
Other	TD <sub>goods</sub>	tonne-kilometre	Total transport of goods	
Other	TD <sub>passengers</sub>	person-kilometre	Total transport of passengers	

Table A3.8. Parameters for monitoring for mobility projects that aim to manufacture innovative aircrafts, vessels, road vehicles or their components

Emission source	Data / Parameter	Data unit	Description	Comment
n/a	N <sub>t</sub>	units	Number of innovative aircrafts, maritime vessels, road vehicles of type t, or their components, supplied to the market by the project	Based on relevant supporting documents, such as invoices. Refer to sub-section 2 of this appendix.
n/a	UP	years	Applicable use period of the manufactured component	Equal to a maximum of 5 years, or to the lifetime of the component if lower than five years. Refer to sub-section 2 of this appendix.

n/a	$CS_{\text{component,t}}$	%	Cost share of the innovative manufactured component(s) of type t, as a fraction of the cost of the entire aircraft, vessel or vehicle	Parameter not to be monitored, refer to sub-section 2 of this appendix.
n/a	$D_{\text{proj}}$	km	Annual average distance travelled by the innovative aircraft(s), vessel(s) or vehicle(s) of type t	Applicants shall adopt the same values proposed for $D_{\text{ref,t}}$
$Ref_{\text{t,fug,unit}}$	$SE_{\text{ref,t,fug,z}}$	tonnes of gas / km	Refer to data requirements described for the corresponding parameters in Table A3.7, pro-rated to a single facility or consumer product.  Refer to the monitoring and reporting provisions for manufacturing projects in sub-section 2 of this appendix. Note the different treatment to be applied to technical characteristics of the innovative technology or component manufactured, as opposed to operational assumptions.	
$Ref_{\text{t,AddnonCO2,unit}}$	$SC_{\text{ref,a,FF}}$	TJ / km		
	$SE_{\text{ref,m,BC}}$	tonnes of gas / km		
$Proj_{\text{t,ene,unit}}$	$SC_{\text{proj,t,x}}$	TJ / km		
$Proj_{\text{t,fug,unit}}$	$SE_{\text{proj,t,fug,z}}$	tonnes of gas / km		
$Proj_{\text{t,AddnonCO2,unit}}$	Parameters used for the calculation $Proj_{\text{a,nonCO2,unit}}$	To be defined by the applicant		
	$SE_{\text{proj,m,BC}}$	tonnes of black carbon / km		

Source: European Commission internal elaboration.

In addition to the parameters listed above, further parameters may need to be monitored for knowledge-sharing purposes: check the knowledge sharing report template available on the Funding and Tenders Portal.

### 7. Credit for Carbon Capture and Storage or Utilisation (CCUS)

In addition to the monitoring and reporting requirements under their specific category, projects that include a credit for carbon capture and storage or utilisation should monitor the additional parameters listed in this sub-section. Parameters that may not need to be monitored are listed in section 6.6, while Table A3.9 presents the parameters that, at minimum, shall be monitored throughout the project and that shall be covered as part of the project's monitoring and reporting plan.

Note that, for projects that include a CCU component, even if the CO<sub>2</sub> utilisation phase is not part of the application and is carried out by a third party, the CO<sub>2</sub> utilisation processes, inputs, and the combustion and/or end-of-life emissions from the CCU product(s) must be included as part of the GHG calculations (see section 2.2.6.3.1, 2.2.6.3.3, and other relevant provisions), and must be monitored in line with the provisions for EII projects.

For the parameters to monitor corresponding to  $CC_{\text{capture}}$ ,  $CC_{\text{pipeline}}$  and  $CC_{\text{injection}}$ , refer to Commission Implementing Regulation (EU) 2018/2066, especially Articles 40 to 46 and Article 49 and Annex IV, Sections 21, 22 and 23. For estimating such emissions, the

applicant may also consider the adoption of standard ratios in GHG emissions per tonne of CO<sub>2</sub> stored based on industry benchmarks, should these be available.

Table A3.9. Parameters for monitoring in CCS projects

Data / Parameter	Data unit	Description
CC <sub>storage,y</sub>	tonnes CO <sub>2</sub>	Amount of CO <sub>2</sub> transferred to the capture installation
CC <sub>use,y</sub>	tonnes CO <sub>2</sub>	Amount of CO <sub>2</sub> that is incorporated into products
CC <sub>capture,y</sub>	tonnes CO <sub>2</sub>	GHG emissions from CO <sub>2</sub> capture activities
CC <sub>injection,y</sub>	tonnes CO <sub>2</sub>	For CCS projects, GHG emissions from injection and geological storage of CO <sub>2</sub>
CC <sub>pipeline,y</sub>	tonnes CO <sub>2</sub>	GHG emissions from transport of CO <sub>2</sub> by pipelines
HC <sub>y</sub>	tonnes	Total mass of hydrocarbons in tonnes produced at the EHR location. For projects in which CO <sub>2</sub> injection and storage is associated with enhanced hydrocarbon recovery (EHR).
K <sub>road,L</sub>	km	Distance of each one-way trip L travelled by road modals
CO <sub>2road,L</sub>	tonnes CO <sub>2</sub>	Amount of CO <sub>2</sub> transported in each one-way trip by road modals
K <sub>rail,L</sub>	km	Distance of each one-way trip travelled by rail
CO <sub>2rail,L</sub>	tonnes CO <sub>2</sub>	Amount of CO <sub>2</sub> transported in each one-way trip by rail
K <sub>maritime,L</sub>	km	Distance of each one-way trip travelled by maritime modals
CO <sub>2maritime,L</sub>	tonnes CO <sub>2</sub>	Amount of CO <sub>2</sub> transported in each one-way trip by maritime modals

Source: European Commission internal elaboration.

In addition to the parameters listed above, further parameters may need to be monitored for knowledge-sharing purposes: check the knowledge sharing report template available on the Funding and Tenders Portal.

**Appendix 4****Definitions<sup>29</sup>**

For the purpose of this methodology, the following definitions apply:

- (1) 'accuracy' means the closeness of the agreement between the result of a measurement and the true value of the particular quantity or a reference value determined empirically using internationally accepted and traceable calibration materials and standard methods, taking into account both random and systematic factors.
- (2) 'activity data' means data on the amount of fuels or materials consumed or produced by a process relevant for the calculation-based monitoring methodology, expressed in terajoules, mass in tonnes or (for gases) volume in normal cubic metres, as appropriate.
- (3) 'auxiliary services to electricity grids' mean services required for the operation of electricity grids such as the provision of reserve power, reactive power, inertia, frequency response and similar.
- (4) 'binary geothermal power' plant is a geothermal technology that utilises an organic Rankine cycle (ORC) or a Kalina cycle and typically operates with temperatures varying from as low as 73°C to 180°C. In these plants, heat is recovered from the geothermal fluid using heat exchangers to vaporise an organic fluid with a low boiling point (e.g. butane or pentane in the ORC cycle and an ammonia-water mixture in the Kalina cycle) and drive a turbine. Binary geothermal plants are categorised as closed cycle technology.
- (5) 'biomass fuels' means gaseous and solid fuels produced from biomass. Definition in line with RED.
- (6) 'biofuels' means liquid fuel for transport use produced from biomass. Definition in line with RED.
- (7) 'biogas' means gaseous fuels produced from biomass. Definition in line with RED.
- (8) 'bio-heat' means heating or cooling from biomass-derived fuels. Definition in line with RED.
- (9) 'bioliquids' means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass. Definition in line with RED.
- (10) 'biomass' means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin. Definition in line with RED.
- (11) 'biomass-derived fuels' include biomass, biomass fuels, biogas and biomethane, bioliquids, and biofuels, used for energy generation. CCU fuels produced using CO<sub>2</sub> of biogenic origin are not considered to be biomass-derived fuels.
- (12) 'biomass-derived fuels and materials' include biomass-derived fuels and biomass-derived materials (i.e. materials of biogenic origin used for purposes other

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<sup>29</sup> Definitions are taken from EU legislative acts and from UNFCCC CDM0002, where relevant.

than energy generation). CCU materials produced using CO<sub>2</sub> of biogenic origin are not considered to be biomass-derived material.

- (13) 'biomethane' means biogas that is purified to a standard fit to inject into the natural gas grid.
- (14) 'calculation factors' means net calorific value, emission factor, oxidation factor, conversion factor, carbon content or biomass fraction.
- (15) 'calibration' means the set of operations, which establishes, under specified conditions, the relations between values indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values of a quantity realised by a reference standard.
- (16) 'capacity addition' is an increase the installed power generation capacity of existing power plants through: (i) the installation of new power plants/units besides the existing power plants/units; or (ii) the installation of new power plants/units, additional to the existing power plants/units; or (iii) construction of a new reservoir along with addition of new power plants/units in case of integrated hydro power projects. The existing power plants/units in the case of capacity addition continue to operate after the implementation of the project activity.
- (17) 'carbon intensity' is the sum of all emissions from processes in the supply chain of a material/energy output, and may also include the stoichiometric carbon content.
- (18) 'CO<sub>2</sub> capture' means the activity of capturing from gas streams CO<sub>2</sub> that would otherwise be emitted.
- (19) 'CO<sub>2</sub> transport' means the transport of CO<sub>2</sub> for use or storage.
- (20) 'CO<sub>2</sub>e' means the 100-year global-warming potential of a quantity of greenhouse gas emissions, including CO<sub>2</sub> and any other greenhouse gases listed in Annex II to Directive 2003/87/EC (i.e. CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>), expressed as the equivalent mass of CO<sub>2</sub> emissions.
- (21) 'combustion emissions' means greenhouse gas emissions occurring during the exothermic reaction of a fuel with oxygen.
- (22) 'direct emissions' means greenhouse gas emissions within the system boundary.
- (23) 'dry steam geothermal power plant' is a geothermal technology that directly utilises dry steam that is piped from production wells to the plant and then to the turbine. Dry steam geothermal plants are categorised as open cycle technology.
- (24) 'emission factor' means the average emission rate of a greenhouse gas relative to the activity data of a source stream assuming complete oxidation for combustion and complete conversion for all other chemical reactions.
- (25) 'emission sink' means a separately identifiable part of an installation or a process within an installation, which removes a greenhouse gas, an aerosol or a precursor of a relevant greenhouse gas from the atmosphere.
- (26) 'emission source' means a separately identifiable part of an installation or a process within an installation, from which relevant greenhouse gases are emitted.
- (27) 'energy from renewable sources' or 'renewable energy' means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas.

- (28) 'energy storage plant/unit' is a facility that stores a certain type of energy. Several energy storage units at one site comprise one energy storage plant, whereas an energy storage unit is characterised by the fact that it can operate independently from other energy storage units at the same site. Where several identical energy storage units (i.e. with the same power rating, age and efficiency) are installed at one site, they may be considered as one single energy storage unit.
- (29) 'enhanced hydrocarbon recovery' means the recovery of hydrocarbons in addition to those extracted by water injection or other means.
- (30) 'EU ETS product benchmark' is based on the average GHG emissions of the best performing 10% of the installations producing that product in the EU and EEA-EFTA states. They refer to the direct GHG emissions from the final process in a production chain that produces a unit quantity of a defined product, using a particular process whose boundary is defined. It is only part of the emissions intensity of the product, because it does not consider emissions from previous production stages (usually covered by other benchmarks) or from supplying inputs (or the combustion emissions of the product itself). The benchmark may comprise emissions from several sub-installations (Delegated Regulation (EU) 2019/331). The relevant benchmarks are those applicable at the time of the deadline of submission of the application.
- (31) 'flash steam geothermal power plant' is a geothermal technology that is used where water-dominated reservoirs have temperatures above 180°C. In these high-temperature reservoirs, the liquid water component boils, or 'flashes', as pressure drops. Separated steam is piped to a turbine to generate electricity and the remaining hot water may be flashed again twice (double flash plant) or three times (triple flash) at progressively lower pressures and temperatures, to obtain more steam. Flash steam geothermal plants are categorised as open cycle technology.
- (32) 'fossil carbon' means inorganic and organic carbon that is not biomass.
- (33) 'fugitive emissions' means irregular or unintended emissions from sources that are not localised, or too diverse or too small to be monitored individually.
- (34) 'generator rating' of an energy storage unit is the maximum power, expressed in megawatts (MW), for which the energy storage unit's generator has been designed to operate. The generator rating of an energy storage plant is the sum of the generator ratings of its energy storage units.
- (35) 'geological storage of CO<sub>2</sub>' means geological storage of CO<sub>2</sub> as defined in Article 3(1) of Directive 2009/31/EC.
- (36) 'geothermal energy' means energy stored in the form of heat beneath the surface of solid earth.
- (37) 'greenfield plant' means a new plant that is constructed and operated at a site where no plant of the same type was operated prior to the implementation of the project activity.
- (38) 'indirect emissions' means emissions associated with the generation of grid electricity and/or grid heat outside the system boundary.
- (39) 'inertia capability' means the maximum inertia, expressed in Volt-Ampere seconds (VAs) or one of its multiples, which the energy storage unit has been designed to provide at nominal conditions. The inertia capability of an energy storage plant is the sum of the inertia capabilities of its energy storage units.
- (40) 'input power rating (or installed input capacity)' means the (active) power, expressed in megawatts (MW), for which the energy storage unit has been designed to operate

at nominal conditions. The input power rating of an energy storage plant is the sum of the input power ratings of its energy storage units.

- (41) 'intra-daily electricity storage' means all electricity storage units providing auxiliary services to the electricity grid and/or taking part in intra-daily electricity markets
- (42) 'installation' is a stationary technical unit where one or more activities under the scope of the European Union Emissions Trading Scheme (EU ETS) and any other directly associated activities which have a technical connection with the activities carried out on that site and which could have an effect on emissions and pollution.
- (43) 'installed power generation capacity' or 'installed capacity or nameplate capacity' means the capacity, expressed in megawatts (MW), for which the power unit has been designed to operate at nominal conditions. The installed power generation capacity of a power plant is the sum of the installed power generation capacities of its power units.
- (44) 'low-carbon fuels' means recycled carbon fuels as defined in Article 2, point (35), of Directive (EU) 2018/2001, low-carbon hydrogen and synthetic gaseous and liquid fuels the energy content of which is derived from low-carbon hydrogen, that meet the greenhouse gas emission reduction threshold of 70 % compared to the fossil fuel comparator for renewable fuels of non-biological origin set out in the methodology adopted pursuant to Article 29a(3) of Directive (EU) 2018/2001. Definition in line with Directive 2024/1788 on common rules for the internal markets for renewable gas, natural gas and hydrogen.
- (45) 'low-carbon hydrogen' means hydrogen the energy content of which is derived from non-renewable sources, which meets the greenhouse gas emission reduction threshold of 70 % compared to the fossil fuel comparator for renewable fuels of non-biological origin set out in the methodology for assessing greenhouse gas emissions savings from renewable fuels of non-biological origin and from recycled carbon fuels, adopted pursuant to Article 29a(3) of Directive (EU) 2018/2001. Definition in line with Directive 2024/1788 on common rules for the internal markets for renewable gas, natural gas and hydrogen.
- (46) 'measurement system' means a complete set of measuring instruments and other equipment, such as sampling and data-processing equipment, used to determine variables such as the activity data, the carbon content, the calorific value or the emission factor of the greenhouse gas emissions.
- (47) 'net calorific value' (NCV) (also referred to as lower heating value, LHV) means the specific amount of energy released as heat when a fuel or material undergoes complete combustion with oxygen under standard conditions, less the heat of vaporisation of any water formed.
- (48) 'other energy storage' means all energy storage other than intra-daily electricity storage, in particular including heat / cold storage, gaseous and liquid fuel storage as well as long-term electricity storage
- (49) 'output power rating (or installed output capacity)' means the (active) power, expressed in megawatts (MW), for which the energy storage unit has been designed to operate at nominal conditions. The output power rating of an energy storage plant is the sum of the output power ratings of its energy storage units
- (50) 'power plant/unit' is a facility that generates electric power. Several power units at one site comprise one power plant, whereas a power unit is characterised by the fact that it can operate independently from other power units at the same site. Where several identical power units (i.e. with the same capacity, age and efficiency) are installed at one site, they may be considered as one single power unit.

- (51) 'proxy data' means annual values which are empirically substantiated or derived from accepted sources and which an operator uses to substitute the activity data or the calculation factors for the purpose of ensuring complete reporting when it is not possible to generate all the required activity data or calculation factors in the applicable monitoring methodology.
- (52) 'reactive power rating' means the maximum reactive power, expressed in volt-ampere reactive (var) or one of its multiples, which the energy storage unit has been designed to provide at nominal conditions. The reactive power rating of an energy storage plant is the sum of the reactive power ratings of its energy storage units.
- (53) 'rehabilitation' or 'refurbishment' means an investment to restore the existing plants/units that was severely damaged or destroyed due to foundation failure, excessive seepage, earthquake, liquefaction, or flood. The primary objective of rehabilitation or refurbishment is to restore the performances of the facilities. Rehabilitation may also lead to increase in efficiency, performance or production capacity of the plants/units with/without adding new plants/units.
- (54) 'renewable fuels of non-biological origin' means liquid or gaseous fuels the energy content of which is derived from renewable sources other than biomass. Definition in line with RED.
- (55) 'replacement' or 'substitution' is an investment in new plants/units that replaces one or several existing units at the existing plant. It shall be treated as a new/greenfield plant.
- (56) 'repowering' means renewing power plants that produce renewable energy, including the full or partial replacement of installations or operation systems and equipment for the purposes of replacing capacity or increasing the efficiency or capacity of the installation.
- (57) 'retrofit' or 'modification' means an investment to repair or modify existing operating plants/units, with the purpose to increase the efficiency or performance of the plants/units, without adding new plants/units. Retrofits include measures that involve capital investments and not regular maintenance or housekeeping measures.
- (58) 'Smart grids' for the purpose of the Innovation Fund include a number of applications which generally involve a self-sufficient electricity network system based on digital automation technology for monitoring, control, and analysis within the supply chain. However, in most use cases they refer to a specific component such as a smart substation, an appliance or a communications solution. The reference scenario of proposals should therefore refer to the specific use case.
- (59) 'storage site' means storage site as defined in Article 3(3) of Directive 2009/31/EC.
- (60) 'tonnes of CO<sub>2</sub>e' means metric tonnes of CO<sub>2</sub> or CO<sub>2</sub>e.
- (61) 'transport network' means transport network as defined in Article 3(22) of Directive 2009/31/EC.
- (62) 'upstream emissions' means emissions associated with the provision (extraction, processing, refining, transport) of fossil fuels and other inputs, which occur prior to the fuel or input entering the system boundary.
- (63) 'vented emissions' means emissions deliberately released from an installation by provision of a defined point of emission.

- (64) 'waste' means waste as defined in point (1) of Article 3 of Directive 2008/98/EC, excluding substances that have been intentionally modified or contaminated in order to meet this definition.

**Appendix 5****References**

Annex to GB decision no. CleanHydrogen-GB-2022-02, Strategic Research and Innovation Agenda 2021-2027, Clean Hydrogen Joint Undertaking. <https://www.clean-hydrogen.europa.eu/system/files/2022-02/Clean%20Hydrogen%20JU%20SRIA%20-%20approved%20by%20GB%20-%20clean%20for%20publication%20%28ID%2013246486%29.pdf>

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