EUROPEAN COMMISSION
Directorate-General Climate Action

Innovation Fund

Guidance for GHG emission avoidance potential calculations for projects falling in the sectors of energy intensive industries

Innovation Fund Large-scale Projects

Version 1.0

7 August 2020

IMPORTANT NOTICE

This document aims at supporting the calculations of GHG emissions avoidance for projects falling in the sectors of the energy intensive industries. It complements the calculation tools published on the Innovation Fund call website for CCS, renewable electricity and heating, and energy storage.

For further detailed information on how to do the calculation and on all conditions linked to the application and grant award, please refer to the call text and its annexes. This guidance is provided only as support. In case of divergence of the information or formulas between here and the call text and its annexes, the call text and annexes takes precedence.

HISTORY OF CHANGES		
Version	**Publication Date**	**Change**
1.0	07.08.2020	• Initial version

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Introduction

This guidance is aimed to support the applicants with calculation of GHG emissions avoidance potential of projects falling in the sectors of the energy intensive industries.

Specific guidance and examples for projects falling in the sectors of the energy intensive industries

The potential eligible applications for projects under the category of Energy Intensive Industry are very varied. For example, they may concern new plants, modifications to existing plants, substitution of products, innovative biofuels, electrification, use of biomass in existing plant, electro-fuels, new products that save emissions in use or in their end-of-life treatment, or combinations of these. As it is difficult to foresee every permutation of a project, it is not feasible, at the moment, to create in advance an excel spreadsheet that will work to calculate GHG emissions avoidance for all, or even most, projects. Instead, the methodology seeks to indicate the choices to make in the calculation of emissions in as many situations as can be foreseen, but each project will come up with a different combination of these choices in different parts of the calculation.

Joint Projects

It is anticipated that many projects will be submitted jointly by more than one company. The methodology estimates the emissions savings for the project, not for each individual company within the project. Therefore there are no rules for "how the emissions saving is split between the project partners". Each company's emissions accounting under EU ETS follows the existing EU ETS rules and is not influenced by the accounting under the IF (although of course the reporting of the direct processing emissions in the MRR of an IF project should not contradict the data reported for the same plant under EU ETS).

Choice of principal product(s) and industrial sector

Applicants need to choose one or more products as the "principal products" of the project. The choice of the "principal product(s)" of a project determines which sector the project enters. As projects can apply only under one industrial sector, if more than one principal product is declared, they must all be in the same sector. The other "non-principal" products are still taken into consideration in the emissions calculation, see section 2.2.4 of the methodology.

As well as defining the industry sector, the choice of principal products influences the denominator in the calculation of the relative GHG emissions avoidance. The absolute emissions avoided are generally less affected.

The principal product(s) should conform to the main aim of the project, which in many cases will be obvious.

Example

A steelworks proposes a project to modify its existing plant to produce ethanol as well as steel products. The steelworks argues that the ethanol will be sold as an alternative transport fuel for blending in gasoline for road transport.

The principal product could be chosen to be either steel or transport fuel. Either would be eligible for IF because they displace products made in the EU ETS, but not both, as they are in different sectors (iron and steel vs refinery). As the project makes a relatively minor change to the steel emissions, relative emissions savings are likely to be higher if transport fuel is claimed to be the principal product. However, the applicant may consider that there is less competition for IF funds in the steel sector.

Toluene is a minor by-product of the ethanol production. It could be added as a second principal product in the case that transport fuel is chosen as the principal product, as both are in the refinery sector. However, it would be artificial and disallowed to propose that toluene is the only principal product.

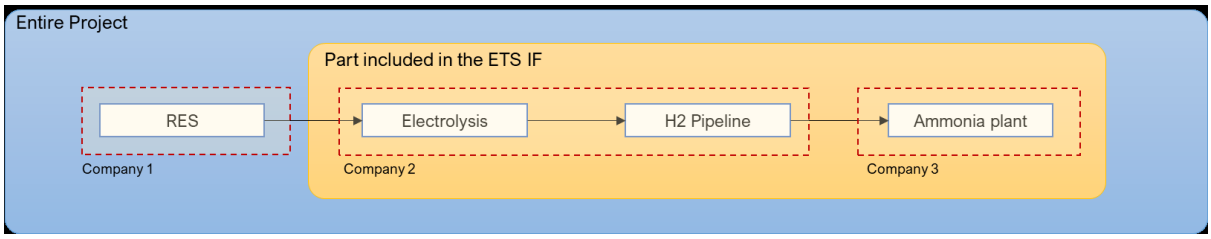
Product or function substituted

To be eligible for one of the energy intensive industry sectors, the principal products must be, or must substitute, a product whose conventional production is covered by EU ETS.

Substituting a product may include substituting the function of a product.

For example a project that includes hydrogen fuelling a fuel-cell car substitutes the transport function of conventional cars running on fossil fuel. So the substituted function is the fossil fuel required for a comparable conventional car to transport the same load an equal distance. Applicant has to convincingly establish that the hydrogen would indeed be used for fuel cell cars (otherwise the project replaces generic hydrogen according to EU ETS benchmark). Thus, the project should include the hydrogen distribution to cars, or at least show contracts with such a distributor, and also include the distribution in the emissions calculation.

Another example:

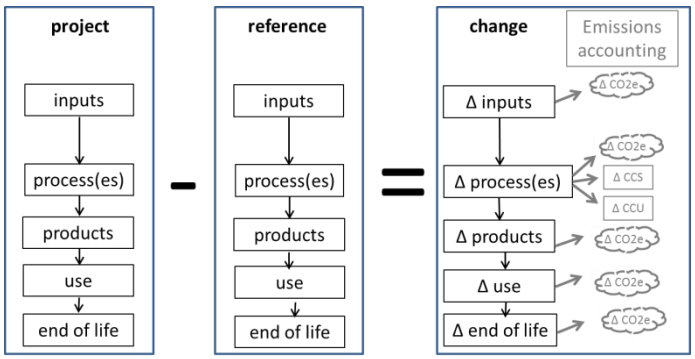


Companies 2 and 3 jointly submit a project to use additional renewable electricity to produce hydrogen for making ammonia, replacing hydrogen from an existing steam reformer in the ammonia plant. The principal product is ammonia (which falls under EU ETS), and the project can be defined as a modification to the ammonia plant, so the reference process may be taken to be the current ammonia production plant, provided that the process-emissions from new configuration of ammonia production (including the electrolysis plant), calculated using EU ETS rules, are lower than the EU ETS product benchmark for ammonia.

Alternatively company 3 could propose the project alone. The reference scenario would be the same. The hydrogen coming out of the pipe from the electrolyser would now be treated as an input, but the result of the emissions calculation would nevertheless come out the same as in the joint application. However, if company 3 could not provide evidence of using additional renewable electricity, it would score lower on the degree-of-innovation criterion.

However, if company 2 applied alone, the plant is new, and the principal product is "hydrogen delivered to that particular ammonia plant", so the reference process would be made up of the generic EU ETS benchmark for hydrogen, plus emissions attributable to the pipeline delivery…but if the pipeline is not innovative, the pipeline installation would anyway cancel out between the project and the reference.

The Diagram



Applicants need to populate the basic diagram (above) with details of the inputs, processes, etc. Although only the "change" diagram is needed for the absolute emissions savings calculation, the complete diagram needs to be filled in, at least qualitatively, to help evaluators understand the project. Furthermore, enough details are needed in the 'reference' diagram to calculate the denominator in the relative emissions reduction calculation. Each box is dealt with separately below. We start with the 'processes' box because that usually represents the heart of the project.

Reference scenario for transport fuels as principal products

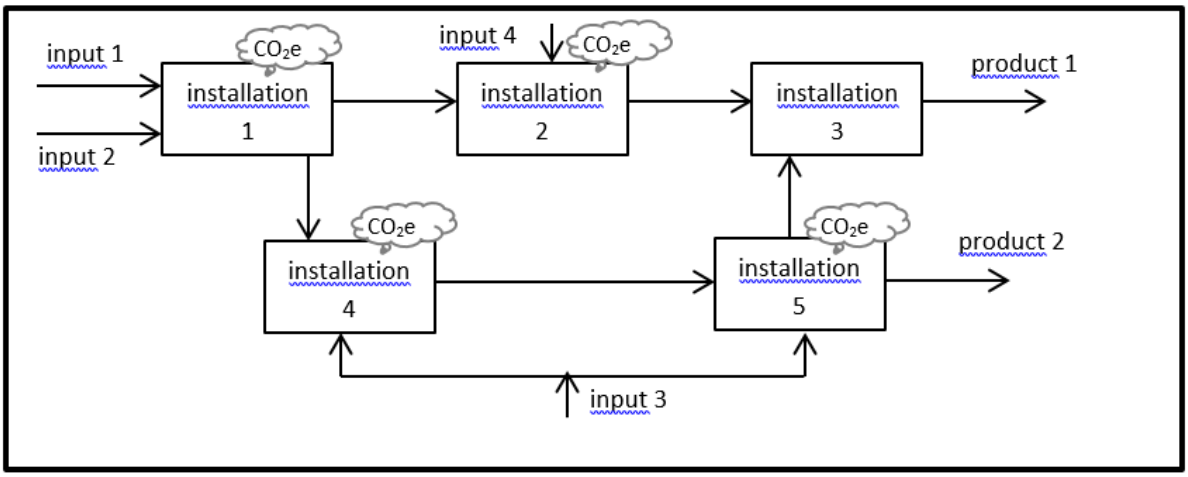
For the special case of projects which substitute transport fuels, the reference scenario representing the emissions from the conventional fossil fuels replaced is covered by the use of the "IF fossil fuel comparators", as explained in section 2.2.2.1 of the methodology, so it is not necessary in this case to provide separate boxes for each component of the reference scenario making fossil transport fuel. The carbon contents and LHVs of novel fuels can be found in the hierarchy of literature sources in SectionA1.3 of the methodology.

The first footnote in section 2.2.2.1 of the methodology explains that novel transport fuels blended into fossil fuels are deemed to replace fossil fuel on the basis of equal lower heating value (which is the same thing as net calorific value). That is in line with the rules for biofuels in REDII.

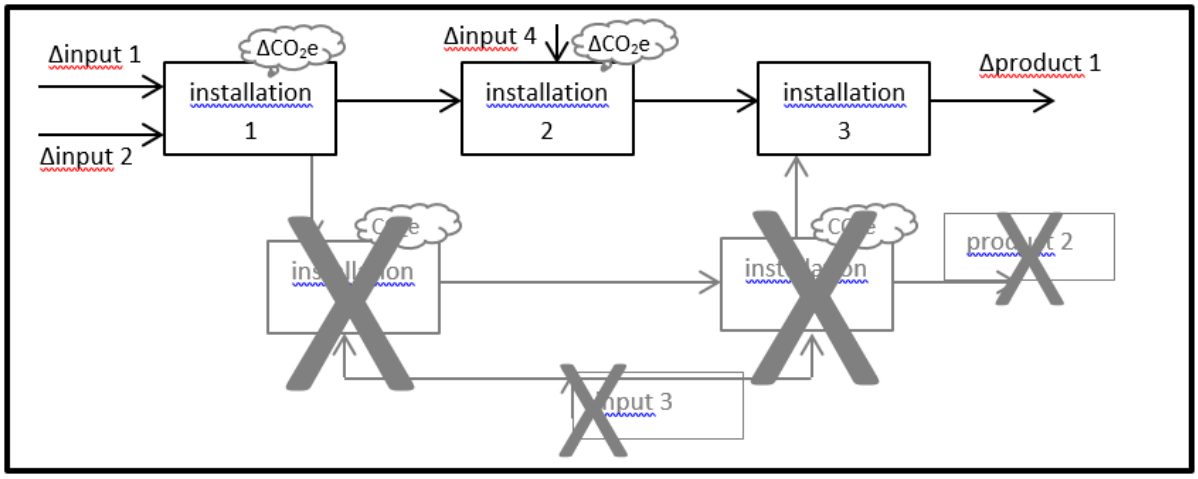
Solely in the case of fuels used only in highly-modified vehicles, such as hydrogen for fuel cell cars, can one take into account a change in vehicle efficiency. Therefore such projects should preferably include the distribution of the novel (unblended) fuel to the vehicles. At the least, proposals must shown proof, for example contracts from distributors, that the novel fuel is indeed destined to be used in transport. 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 is found from the literature hierarchy, section A1.3 of the methodology.

Process(es) boxes

The 3 processes boxes, one each for the project, reference and change scenarios, should contain all the installations that are under the control of the applicant that are needed to produce the principal products of the project. This needs to be done for the project and reference scenarios. The box for the "change" omits any installations whose inputs, outputs and emissions are not changed by the project.



A schematic illustration of a possible processes box for project or reference scenarios



Example of a processes box for the change-scenario for the same project: in this example, the project does not change installations 4 and 5 or the output of product 2; however, installation 1 is technically modified, leading to changes in inputs 1 and 2 as well as the throughput of installations 2 and 3, and the amount of product 1 that is produced. (In this example, product 1 could be proposed as the principal product).

The applicant needs to show all the information that the evaluators need (a) to understand the project, and (b) to check the calculation of the change in process emissions. If the information does not fit in the boxes, a supplementary table should be used.

Thus, at minimum, all the inputs, process-emissions and products that are changed by the project need to be specified in all three process boxes. However, considerably more data would typically be required to allow the evaluator to properly understand the project, to check whether the "unchanged" installations are really unchanged, and whether the proposed changes make sense from the point of view of heat and mass balance, for example.

The emissions from each (sub)installation in the process box for the project will be quantified by the applicant. If the project concerns the modification of an existing process, the applicant has to show the latest emissions declared under EU ETS for the existing plant.

The boundaries of the process box coincide with EU ETS boundaries, so they do not include distribution or storage of the product, nor emissions from the supply of fuels and materials inputs; only the GHG emissions from the installations themselves.

Units ("functional units" in LCA language)

The quantities in all the boxes must be for the same amount of production of the principal products. In the end, emissions need to be estimated for the first 10 years of project operation. For projects that foresee a constant production over that time, the most convenient unit is one year's production. But if the volume of production is foreseen to change, it may be necessary to quantify the data per tonne of the principal product, or another unit that stays constant with time.

Only S.I. units shall be used, including secondary units (e.g. grams, tonnes…) where this is more convenient.

Processes in the Reference Scenario

The guiding principle is that the processes in the reference scenario must produce the **same principal products or functions** as the project scenario. Other (co-)products are accounted for in the "products" box (see below).

For a new plant (which may or may not substitute an existing plant), the processes box of the reference scenario is built of EU ETS benchmark installations and sub-installations as

far as that is possible, in the same way that EU ETS compares the emissions of an actual plant against a (combination of) baseline (sub)installations. Please refer to EU ETS documents for guidance.

Industrial projects with CCS

A project that substitutes an EU ETS product and also stores some or all of its own process emissions with CCS is still accounted in the Emission Intensive Industry Sector, but the emissions savings for the CCS part are calculated using the specific methodology for CCS projects, and are added to the savings from the rest of the project. Projects in the CCS sector include those storing CO2 produced outside the project itself, air capture projects and CCS attached to existing factories without changing their products.

CCU in industrial projects

It is clearly explained in the methodology that an emission reduction by CCU can only be claimed by projects that **make use** of the captured carbon, within the boundaries of the project, to make products or functions that replace products using fossil carbon. The CO2 may be bought in from outside the project, but a project that does not include any additional **use** for captured CO2 will not get an emissions reduction because of CCU.

The subtraction from the process for the incorporation of carbon into products, of carbon that would otherwise be in the atmosphere, entirely accounts for the emissions saving of CCU. Therefore there is no change in the combustion emissions of CCU fuels in use. If the avoided-CO2 emissions derive from biomass, the subtraction for the incorporated carbon is the same, but the carbon in the combustion emissions of the bio-CCU fuel is not counted in the CO2 combustion emissions of the fuel (see section 2.2.2.1 of the methodology).

The INPUTS boxes

The three "input" boxes (for the project, reference and change scenario) consist of a list of each input to the process boxes. Inputs include fossil fuels, biomass-derived fuels, materials, energy and water. However, the emissions for water provision may be neglected if it does not involve desalination or additional pumping. Obviously, some very small inputs, such as "maintenance materials" can be generic. The inputs in the "change" box are only those that change quantitatively or qualitatively between the project and the reference. At the least, the inputs in the change box must be quantified, but for transparency, and to convince the evaluators, it is expected that the quantities of input should be specified in all three boxes.

Each input in the list for the change-scenario is then ascribed a status as "rigid", "elastic", or "semi-elastic", as explained in section 2.2.3 of the methodology. The rules for accounting rigid and semi-elastic mean that in the end the emissions for each rigid input (or the rigid component of semi-elastic inputs) is either quantified directly (as a foregone emission saving), or replaced by the emissions of the equivalent elastic input.

For example, if process heat is diverted to the project from another industrial process, and is replaced by natural gas heating, the emissions ascribed to the heat input are the natural gas required to replace the heat lost to the other process. Natural gas is an elastic input, and "NG replacing process heat" now replaces "process heat" on the list of inputs.

Projects using hydrogen from a chlor-alkali (Solvay) process as a major input provide three different scenarios for emissions calculations. Hydrogen is an economically minor by-product of a chlor-alkali plant, and it is produced in a fixed ratio to the other products because of the stoichiometry of the reaction. So it is considered a rigid source of hydrogen (section A1.2 of the methodology).

1. *The hydrogen is piped from an existing chlor-alkali plant, where it was being burnt to provide process heat. The process heat is then provided by natural gas instead.*

→ The emissions attributed to the hydrogen are the emissions from the supply and combustion of natural gas.

2. *The hydrogen is piped from an existing chlor-alkali plant, which previously sold it in cylinders on the general industrial gas market. The hydrogen is being diverted from the industrial gas market, and is unlikely to be replaced by more hydrogen production from chlor-alkali plants, because it is a rigid source. The elastic source that is likely to supply extra hydrogen to replace the hydrogen diverted from the industrial gas market, is steam reforming of natural gas.*

3. *A new chlor-alkali plant is built to supply the hydrogen. The emissions of the new plant must be shared between its products. Following the decision tree in section A1.3, part of the emissions of the chlor-alkali plant are allocated to the hydrogen in proportion to its share of the economic value of the products.*

Each input on the list for the change scenario, that is not already quantified, is now elastic. Each is now assigned a first estimate of the specific emissions per unit of the input (the "emission factor"). These are listed for commonly-used fuels in tables 4.2 and 5.2 of the methodology; others can be derived from the literature hierarchy (section A1.3), as explained in section 2.2.3.

The amount of each input is now multiplied by its emissions factor to derive a first estimate of the total emissions associated with each. The applicant also calculates the grand total first-estimate emissions for all inputs. The procedure for defining minor and *de minimis* inputs is derived from that used in EU ETS.

At the first stage of application, the applicant now starts at the bottom of the list and calculates the cumulated emissions for each input. A line is drawn representing the lowest 10% of total emissions, and another at (10%+30%=) 40% of the total emissions for all inputs separating the list into 3 sections: de minimis inputs at the bottom, minor inputs in the middle, and major inputs at the top. The "%" boundaries used in the later stages of the project application are specified in section 2.2.3.2 of the methodology.

Now the rules in section 2.2.3.2 of the methodology are used to calculate the definitive total emissions associated with each major and minor input in the change-scenario.

Emission factors for inputs

The applicant must reference all the literature values that are used for the emissions factors, so the evaluators can check them. 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 product, and explain the choice.

For example, a producer cannot claim that industrial hydrogen bought from an indeterminate source has the emission factor derived from a chlor-alkali plant, because that production is fixed by the demand for chlorine and soda; an increase in hydrogen demand would presently be supplied by steam reforming of natural gas.

Electricity inputs; timed use of electricity

To incentivize electrification projects, zero emissions are ascribed to the use of grid electricity (but use of additional renewable electricity is rewarded under "degree of innovation"). However, if the timing of the use of electricity by a project is correlated with variations in the emissions intensity of the grid, the project is effectively providing a service to the grid by virtually storing electricity. As described in methodology section 2.2.3.4, this is rewarded by a reduction in project emissions calculated like any other electricity storage project. So counterintuitively, a project may actually show negative emissions for electricity consumed. The reduction in emissions is applied at the end of the calculation of grand total emissions ascribed to inputs, described in the previous section.

The PRODUCTS boxes

Probably, few projects will need to use this box.

The products box does not concern principal products: these are already balanced out in the processes boxes for project and reference scenarios. Rather, it is there to balance co-products that it may be impossible to balance between the processes boxes of the project and reference scenarios using EU ETS benchmarks.

For an example of the use of this box, consider the modified steelworks that produces a little toluene co-product, along with the ethanol that has been chosen as the principal product. The toluene now appears in the products box of the project-scenario. As no toluene is produced in the unmodified steelworks used as reference plant, the products box of the reference scenario should contain the emissions for making toluene conventionally. The avoided emissions for toluene production are derived from the hierarchy of literature sources as explained in section A1.3.

The "Emissions savings in use" boxes

Probably most projects will produce principal products that are identical to the existing products that they substitute: in this case applicants need to declare "no change" in the project and reference "use" boxes.

It is **not** the correct place to take into account an improvement in efficiency compared to an existing product: for example hydrogen supplied to fuel-cell vehicles, compared to fossil-fuel vehicles, already quoted in the transport fuels section, above. That was already dealt with in sizing the output of the processes in the reference scenario.

It is also not necessary to use these boxes for projects with transport fuels as principal products, because any change in combustion emissions is already taken into account in the way the IF fossil fuel comparators are used in section 2.2.2.1.

The methodology quotes the example of a factory to produce an innovative fertilizer that reduces nitrous oxide emissions, compared with existing fertilizers, when used in agriculture. However, even in this case it would be necessary to establish that the novel fertilizer could actually be sold in the quantities claimed in the project application.

End-of-life emissions boxes

If the end-of-life emissions are the same for the project and reference scenarios, the applicant just needs to write "no change" in all three end-of-life boxes; then no estimates are needed. However, the boxes should not be deleted altogether, because it is necessary for the applicant to declare when this is true.

Calculating the absolute emissions savings of the project

All the emissions in the "change" boxes are summed to find the total emissions savings per functional unit chosen by the applicant (e.g. per tonne or MJ of principal product, or per year). The emissions per functional unit are multiplied by the number of functional units that correspond to the first 10 years of operation of the project. If the plant is planned to be modified or expanded during the project, a separate diagram and calculation may be needed for each stage of the development plan.

Calculating the relative emissions savings of the project

The absolute emissions savings are divided by the emissions in the reference scenario attributed to the principal products. Often, the reference scenario will produce only principal products. However, if other products are produced in the reference scenario, it is important to consider only the emissions in the reference scenario that are associated with the production of the principal products. This may sometimes require the use of the

attribution procedure in section A1.1 of the methodology. The procedure should be strictly followed.

Consider the example of a project where a steelworks is modified to produce CCU ethanol for use in transport, in the case that "transport fuel" is chosen as the principal product. The reference scenario includes the unmodified steel plant, as well as the emissions from the substituted transport fuel (in this case found directly from the IF fossil fuel comparators). The divisor for calculating the relative emissions avoidance is just the emissions from the substituted transport fuel, because the steel plant in the reference scenario is not associated with the production of the principal product.

However, imagine that the modified steelworks produced not ethanol as a principal product but an organic product for the chemical process industry. The EU ETS installations and sub-installations for the conventional production of that organic product would appear in the reference scenario. However, only the emissions related to the organic product should be used as the divisor for the relative emissions savings calculation. If the conventional method of production intrinsically produces several co-products, the attribution flow-sheet in section A1.1 of the methodology is used to isolate the emissions for the conventional production of the substitute product.