The GHG emission avoidance calculation in practice

Energy storage

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Energy storage| Scope

This section applies to projects that include the construction and operation of a greenfield plant or the extension of an existing plant by a unit that **stores any type of energy** (in particular electricity, heat, cold, hydrogen, gaseous or liquid fuels) that was supplied to the moment of use.
The storing 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 Industries eligibility category.*

*Such projects may only fall under this section if the utilisation of excess renewable energy is a primary aim of the project. For such projects, the electricity consumed will be limited to period of high renewable energy production that result in a particularly low load factor.

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Energy storage| Services and products

- Short-term electricity storage (among others arbitrage, reserve power, ramping);
- Auxiliary services to electricity grids (among others reactive power, synchronous inertia, or example from the list hereunder).*
- Avoidance of renewable energy curtailment;
- Other energy storage;
- Manufacture of components for energy storage, such as batteries.

*For LSC, applicant must propose appropriate reference scenarios supported by convincing evidence.

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Energy storage| System boundary

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

- **Has implication on the energy transport and associated losses.**

Energy storage| Reference scenario

Scenario in the absence of the energy project:

- 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 and grid heat,
  - process-related emissions from the production of hydrogen,
  - and from transmission losses associated with the transport network.

- 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 and grid heat
  - and from transmission losses associated with the grid transport.

Energy storage| Project scenario

Scenario in the absence of the energy project:

- 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 and grid heat,
  - process-related emissions from the production of hydrogen
  - and from transmission losses associated with the energy transport..

- **On-site emissions** of fugitive GHG and from energy use other than energy storage. This includes:
  - emissions from combustion at the vehicles,
  - emissions from other processes at installations functionally connected to the transport network including booster stations;
  - fugitive and vented emissions from the transport network.

Energy storage
Example: Hydrogen storage

Potential manifest error: wrong reference scenario

1. Description: An innovative hydrogen storage facility (e.g. using liquid organic hydrogen carrier (LOHC)) is used to recover hydrogen from a by-product of one chemical plant and store it in a tank by replacing fossil hydrogen.
2. Classification: Energy storage → other energy storage → hydrogen
3. Methodology section: Energy Storage, Section 5 of Annex C
4. Reference: ETS benchmark for hydrogen production

$$\Delta GHG_{abs} = \sum_{y=1}^{10} (Ref_y - Proj_y) = \sum_{y=1}^{10} \left(Ref_{energy,y} - Proj_{energy,y} \right)$$

$E_{out,hydrogen,y} * EF_{out,hydrogen}$ + $E_{out,heat,y} * EF_{out,heat}$

$E_{in,hydrogen,y} * EF_{in,hydrogen}$ + $E_{in,heat,y} * EF_{in,heat}$

The applicant can provide additional information on the source of the stored hydrogen, but does not need to do so.

$EF_{in,hydrogen}$ = EU ETS benchmark for hydrogen production (as long as no additional information on hydrogen source is provided)

You can access a quantitative version of this example in the GHG calculator example: Energy storage

5. Data:
   - $E_{in/out,hydrogen,y}$ = Assumed amount of hydrogen recovered and stored by the project in year y, in TJ.
   - $E_{in/out,heat,y}$ = Assumed amount of heat used/recovered by the project in year y, in TJ.
   - $EF_{in,hydrogen\ /heat}$ = Emission intensity of hydrogen/heat production for specific hydrogen/heat source
   - $EF_{out,hydrogen\ /heat}$ = EU ETS benchmark for hydrogen/heat production

Production facilities of components for energy storage | Example: batteries for electric vehicles

1. Description: The project envisages the production of innovative batteries to be used in electric vehicles, which will enable to replace long-distance internal combustion engine (ICE) cars.
2. Classification: Energy storage → Manufacturing of components → Batteries
3. Methodology section: Energy storage, Section 5 of Annex C
4. Reference: Cars run on diesel-fuelled ICEs

$$\Delta GHG_{abs} = \sum_{y=1}^{10} (Ref_y - Proj_y) = \sum_{y=1}^{10} N_y * CS \left(Ref_{energy,y} + \cancel{Ref_{services,y}}^{0} - \cancel{Proj_{energy,y}}^{0} \right)$$

$$N_y * CS * (EF_{transport,y} * E_{transport,y}) = N_y * EF_{transport,y} * FE_{transport,y} * 14{,}300 \text{ km/a}$$

5. Data:

- N_y = Assumption of the number of batteries installed in e-vehicles until year y
- CS = innovative components' cost as a fraction of the total capital cost
- $E_{transport,y}$ = Assumption of electricity supplied for use in e-vehicles in year y, in TJ
- $FE_{transport,y}$ = Assumed fossil fuel efficiency of a replaced vehicle in year y, in TJ/km

The applicant will have to demonstrate the existence of a buyer of the technology (i.e. a company that will install the batteries in electric vehicles) to ensure the accountability over the promised GHG avoidance.

Applicants will have to present the rationale for the projected performance of the batteries. For cars, an average travel distance of 14,300 km/year should be assumed.

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Hybrid RES and Storage Example

Potential manifest error: Double-counting, which cannot be removed based on the information in the application

Potential clerical error: $EF_{elec,ref}$ is used for $Ref_{electricity}$ and $Ref_{energy,}$ - -> suggest to replace $EF_{elec,ref}$ with $EF_{out,elec}$

1. Description: A floating PV plant (annual production 100 GWh/a) is combined with an innovative electricity storage (input 50 GWh/a, output 45 GWh/a) to provide controllable RES-E generation.
2. Classification: Hybrid
3. Methodology section: RES and Energy Storage, Sections 4 and 5 of Annex C
4. Reference: Electricity supplied by the 2030 grid mix (RES) and an NG turbine (for electricity storage output)

$$\Delta GHG_{abs} = \underbrace{\sum_{y=1}^{10}(Ref_y - Proj_y)}_{\text{RES}} + \underbrace{\sum_{y=1}^{10}(Ref_y - Proj_y)}_{\text{STORAGE}} = \sum_{y=1}^{10}\Big(Ref_{elect,y} + Ref_{energy,y} - Proj_{energy,y}\Big)$$

($Proj_{energy,y}$ → 0)

Remove double-counting

$E_{out,y} * EF_{out,elect} = 45\ GWh/a * EF_{out,elect}$

$(EG_{electricity,y} - E_{in,y}) * EF_{electricity,ref} =$

$=(100 - 50)\ GWh/a * EF_{electricity,ref}$

5. Data:
   - $EG_{electricity,y}$ = Annual PV generation in year y, in GWh/a.
   - $E_{in,y}$ = Annual energy storage input in year y, in GWh/a.
   - $E_{out,y}$ = Annual energy storage output in year y, in GWh/a.

EF is not the same for $Ref_{electricity}$ and Ref_{energy}
If the storage enables a controllable feed-in, the EF should be the one from energy storage (NG turbine).

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Some key examples of manifest errors – energy storage

- An energy type other than electricity is stored, but the emissions associated with the storage input have not been taken into account.
- An emission factor other than the default is used for the storage input, but no sufficient evidence provided for using it.
- GHG emissions avoidance are counted twice in the two parts of a hybrid project

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