Energy storage
Overview and calculation

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Energy storage

Services and products

This section applies to projects that **store any type of energy** (in particular electricity, heat, cold, hydrogen, gaseous or liquid fuels) that was supplied to a later moment of use. The storing may include the conversion of one energy type into another.

Technologies	Electricity storage technologies
	Heat and cold storage technologies
	Hydrogen storage technologies
	Gaseous fuel storage technologies
	Liquid fuel storage technologies
	Combinations of the above, including smart grid technologies
Services	Short-term electricity storage (among others arbitrage, reserve power, ramping)
	Auxiliary services to electricity grids (among others reactive power, synchronous inertia)*
	Avoidance of renewable energy curtailment
	Other energy storage
Manufacture of components for energy storage, such as batteries.	

Applicants must provide appropriate reference scenarios supported by convincing evidence.

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Scope

- **In the case of projects converting electricity into fuel, such as hydrogen or other synthetic fuels, the application should generally be made under the EII 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.

- 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.
- It is **not permissible to claim credit for a storage system during any period during which it is simultaneously charged and discharged**.

Boundaries

Scenario	Emission source	Large and medium scale projects	Small scale projects
Reference	Ref_{energy}: Emissions related to the provision of energy in the absence of the project activity. This includes direct emissions, indirect emissions, process-related emissions from the production of hydrogen, and from transmission losses.	Yes	Yes
	$Ref_{services}$: Emissions related to provision of auxiliary services to grids in absence of the project activity. This includes direct emissions, in particular from inefficient operation of fossil plants, indirect emissions and from transmission losses.	Yes	No
Project	$Proj_{energy}$: Emissions related to the provision of energy caused by the project activity. This includes direct emissions, indirect emissions, process-related emissions from the production of hydrogen, and from transmission losses.	Yes	Yes
	$Proj_{on-site}$: On-site emissions of fugitive GHG and from energy use other than energy storage. This includes emissions from combustion at the vehicles, and other processes at installations functionally connected to the transport network.	Yes	No

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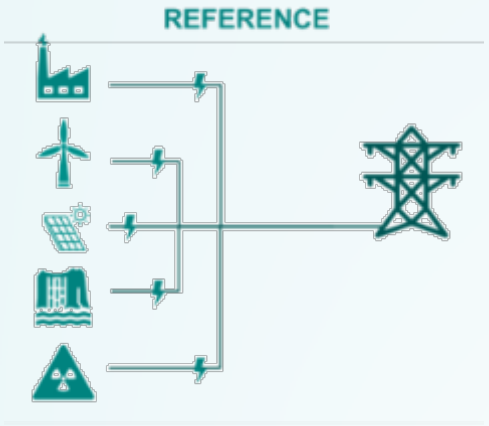
GHG emissions avoided is based on annual energy stored using emission factors depending on type of usage

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



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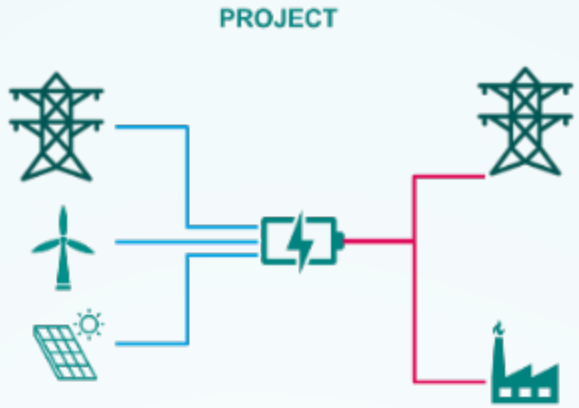

$$\left. \right)$$

$$= \sum_{y=1}^{10} \left(Ref_{energy} - Proj_{energy,y} \right)$$

= Net energy supplied
* EF for reference technology

= Fossil-based energy stored
* fossil fuel EF

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Example: Hydrogen storage

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

1. Description: An innovative hydrogen storage (e.g., using liquid organic hydrogen carrier (LOHC)) is used to deliver hydrogen produced in one chemical plant as a by-product to another plant, where it replaces fossil hydrogen.
2. Classification: Energy storage → other energy storage → hydrogen
3. Methodology: Energy Storage, Section 5
4. Reference: ETS benchmark for hydrogen production

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

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

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

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)

5. Data:
   - $E_{in/out,hydrogen,y}$ = **Assumed** amount of hydrogen stored/recovered 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

SIW: wrong reference scenario

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

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

(Ref$_{energy,y}$ → 0; Ref$_{services,y}$ → 0)

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

5. Data:

- N_y = **Assumed** additional 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 shall demonstrate the existence of a buyer of the component/technology 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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Example: Hybrid RES and Storage

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: RES, energy storage → solar energy, short-term electricity storage → electricity
3. Methodology: RES and Energy Storage, Sections 4 and 5
4. Reference: Electricity is supplied by the 2030 grid mix (RES) and an NG turbine (electricity storage)

$$\Delta GHG_{abs} = \underbrace{\sum_{y=1}^{10}(Ref_y - Proj_y)}_{\textbf{RES}} + \underbrace{\sum_{y=1}^{10}(Ref_y - Proj_y)}_{\textbf{STORAGE}} = \sum_{y=1}^{10}\Big(\underbrace{Ref_{grid,y}}_{\textbf{Remove double-counting}} + Ref_{energy,y} - \overbrace{Proj_{energy,y}}^{\textbf{0}}\Big)$$

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

$(EG_{grid,y} - E_{in,y}) * EF_{grid,ref} = (100 - 50)\ GWh/a * EF_{grid,ref}$

5. Data:
   - $EG_{grid,y}$ = 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 input in year y, in GWh/a.

SIW: Double-counting, which cannot be removed based on the information in the application

SIW: $EF_{grid,ref}$ is used for Ref_{grid} and $Ref_{energy,}$