The GHG emission avoidance calculation in practice

Energy storage

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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

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 GHG methodology
4. Reference: ETS benchmark for hydrogen production

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)

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

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

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

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

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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 GHG Methodology
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.

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 GHG Methodology
4. Reference: Electricity supplied by the 2030 grid mix (RES) and an NG turbine (for electricity storage output)

$$\Delta GHG_{abs} = \underbrace{\sum_{y=1}^{10}(Ref_y - Proj_y)}_{\text{RES}} + \underbrace{\sum_{y=1}^{10}(Ref_y - Proj_y)}_{\text{STORAGE}} = \sum_{y=1}^{10}\Big(Ref_{elect,y} + Ref_{energy,y} - \cancel{Proj_{energy,y}}^{\,0}\Big)$$

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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