The GHG emission avoidance calculation in practice

Renewable electricity, heat and cooling, including production facilities of components for RES

Renewable electricity, heating and cooling | Example (1/2)

Potential manifest error: unrealistic, too simplistic and/or non evidenced approach to estimate on-site emissions.

Potential clerical error: omission of Projelect,y (given that EFelectricty,proj = zero.

1. Description: The project foresees the innovative conversion of biogenic residues into heat, which will be sold to a nearby cement industry currently purchasing heat from a coal-fired CHP plant, and to the city where the project is based as district heating
2. Classification: EII → Other → Heat
3. Methodology section: RES, Section 4 of Annex C
4. Reference: Heating is supplied by natural gas boilers

$$\Delta GHG_{abs} = \sum_{y=1}^{10} (Ref_y - Proj_y) = \sum_{y=1}^{10} \left(Ref_{heat} - Proj_{onsite} \right) = \sum_{y=1}^{10} Ref_{heat} - \left(Proj_{FF,stat,y} + Proj_{FF,mob,y} + Proj_{elect,y} \right)$$

$$Q_{FF\_stat,y} * EF_{FF}$$

$$Q_{FF\_mob,y} * EF_{FF}$$

$$EC_y * EF_{electricity,proj}$$

5. Data:
   - QFF_stat/mob,y= Quantity of fossil fuel type FF combusted in stationary or mobile sources at the project site in year y, in litres or m^3.
   - ECy = Amount of electricity imported from the grid and consumed at the project site in year y, in MWh.

Renewable electricity, heating and cooling | Example (2/2)

And where

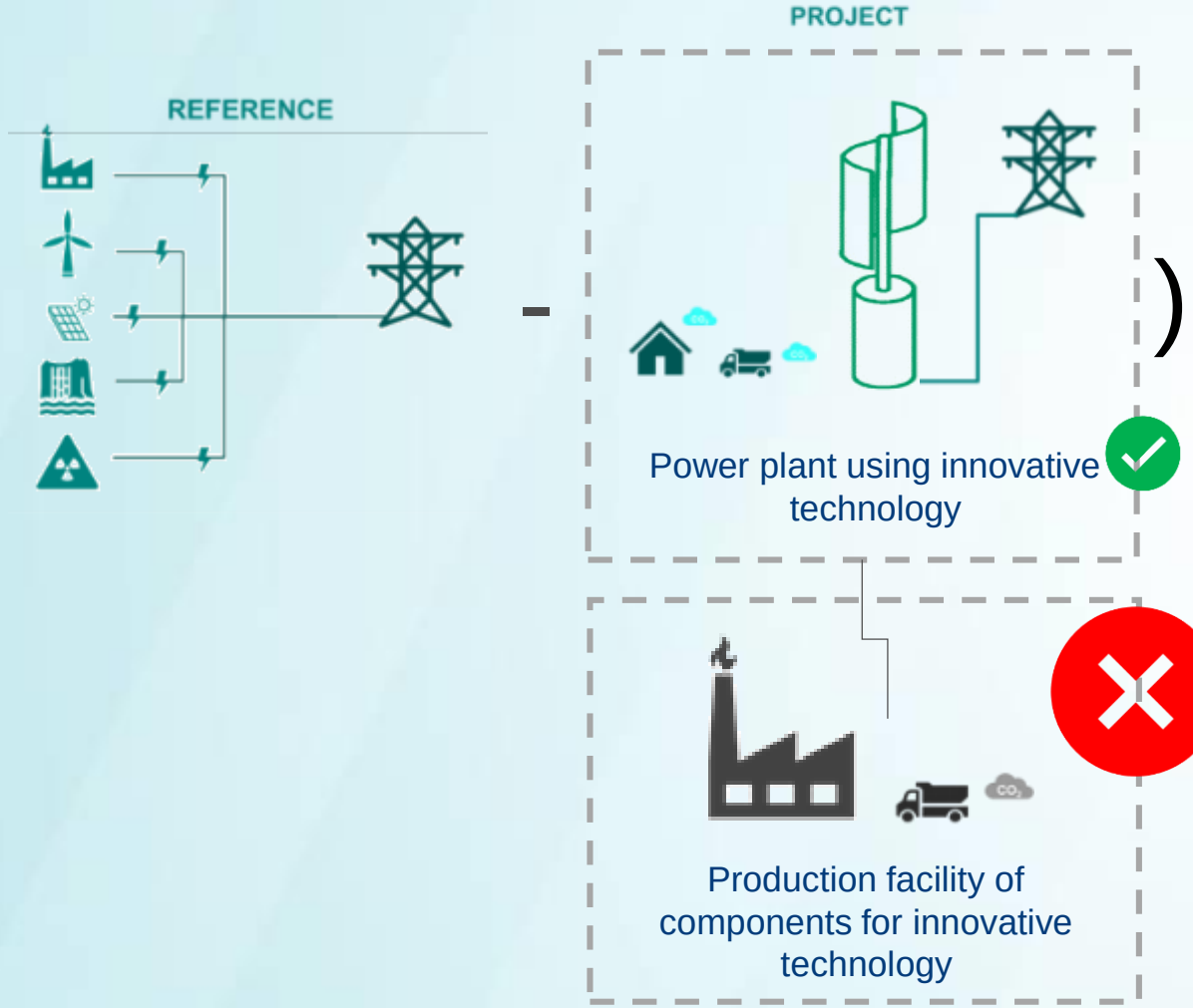
$$Ref_{heat} = P_{heat} * PLF * T_y * EF_{NG} / 0.90$$

Data:

- P_{heat} = Installed capacity, i.e. maximum thermal power output, in Watts.
- PLF = Plant Load Factor, i.e. plant's capacity utilisation, in %
- T_y = operating hours in year y, in hours

Production facilities of components for RES and energy storage

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



$$)$$

GHG avoidance will be equal to the emissions saved by the innovative technology when operating

Emissions due to the manufacturing are **out of the scope of GHG avoidance calculations**

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Production of components for RES

Example: blades for floating wind turbines for RES electricity

Potential manifest error: unrealistic and non-evidenced number of blades sold; components not sold on the EU + NO + IS market.

1. Description: Project envisages production of an innovative blade for use in floating wind power plants; the innovative blade has a higher capacity factor than a conventional blade.
2. Classification: Renewable energy → wind energy → electricity
3. Methodology section: RES, Section 4 of Annex C
4. Reference: Electricity is supplied by the EU grid mix (reference year 2030)

The applicant will have to demonstrate the existence of a buyer of the technology (i.e. a company that will run the floating wind power plant) to ensure the accountability over the promised GHG avoidance

$$\Delta GHG_{abs} = \sum_{y=1}^{10}(Ref_y - Proj_y) = \sum_{y=1}^{10} Ny*CS\left(Ref_{elect} - Proj_{onsite}\right) = \sum_{y=1}^{10} CS*EG_{elec,y} * EF_{elec,ref} - Proj_{onsite}*Ny*CS$$

$$CS* P_{elec} * PLF * T_y *EF_{electricity,ref} - Proj_{onsite,\ total}$$

Example:

$$0.6x(100\ MW + 300\ MW + 400\ MW + ... + 400\ MW) * 45\% * 8400\ hours/year * EF_{grid,ref} - Proj_{onsite,\ total}$$

CS is the innovative components' cost as a fraction of the total capital cost

Evidenced assumption of the total capacity installed until Years 1 – 10

Average capacity factor achieved

Assumption of operating hours

Applicants will have to present the rationale for the projected performance of the component as well as of other components that will be needed at the power plant, but not necessarily manufactured at the same facility.

See also the GHG calculator example: Renewable electricity and renewable heating

The GHG emission avoidance calculation in practice

Energy storage, including production facilities of components for energy storage

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

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

($Ref_{energy,y}$ = 0, $Ref_{services,y}$ = 0, $Proj_{energy,y}$ = 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 = 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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The GHG emission avoidance calculation in practice

Hybrid cases

Hybrid case: EII + RES

- Credits for the renewable energy exported.
- Particular attention to the correct emission factor for electricity in the different parts of the project, i.e. 0.1757 tCO2e/MWh for the net electricity exported from the RES part of the project, even if the hybrid project application is submitted for an EII sector. Own-estimated emission factor is a source of manifest errors.
- Avoid double counting
- The power from the RES part will be preferentially supplied to local use in the EII part
- Typical project: export renewable electricity and/or renewable heat from an industrial plant belonging to one of the EII sectors.

Hybrid case: EII + ES

- The EII emissions and the ES emissions need to be then summed up while removing double counting.
- In case of activities overlapping between the EII and the ES parts, the revenue should be the guiding principle to split production activities between the EII part and the ES part.

Hybrid case: RES + ES

- Clarify the system boundaries for the RES component and the ES component
- The RES emissions and the ES emissions need to be then summed up while removing double counting
- The applicant should demonstrate that the power from the RE facility will be supplied to the ES project when the timing of power generation is consistent with the needs of the storage facility, and may claim credit under the RES methodology for any excess power exported.
- The combined facility should never store power from the grid at the same time as it is exporting renewable power to the grid.

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)

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

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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Hybrid case: EII + RES + ES

- Credits for the renewable energy exported and for the energy stored in addition to the GHG emissions avoided in the EII part.
- Such hybrid projects application should combine the three components and clarify the system boundaries for the three parts.
- The three GHG emission terms need to be then summed up while removing double counting.

Differences between 2020 and 2021 calls

- In RES section, the reference scenario for renewable electricity (the expected 2030 grid mix) has been updated with the latest reference scenario for the Fit for 55 package.
- In RES section, introduced a split for dispatchable electricity, which is a different product now from non-dispatchable electricity. Dispatchable electricity is credited considering peak-power plant (reference scenario: NG single open cycle turbine).
- Production of components facilities: cumulated avoidance due to total plants put into service until each year, but emissions savings from the use of manufactured components should be multiplied by the component's fractional contribution to the capital cost of a facility
- Clarifies indications for hybrid projects, including that the RES part of a hybrid project must supply energy to the EII/ES part.