Class exercise 📖

Based on the CO_2 equivalent emissions assessed at each stage, calculate the total carbon footprint.

The stage-specific figures are given in g CO_2eq per watt of capacity. However, according to industry standards, the total footprint should be expressed in g CO_2eq per kilowatt-hour (g CO_2eq/kWh). Assume that a photovoltaic system with a capacity of 1 kW produces an average of 1,000 kWh per year and has a lifespan of 30 years.

Exercise: What is the carbon footprint of a photovoltaic system operated in France?

Solution

By summing up all the figures provided for each stage, we obtain the result:

1316 g CO_2eq/W

(29.5 + 88.1 + 26.5 + 8.19 + 73.6 + 226 + 606 + 382 − 124)

A 1 kW photovoltaic system in France produces on average between 900 and 1,200 kWh per year, depending on the region and product efficiency. Using the intermediate value of 1,000 kWh, it will generate 30,000 kWh over an average lifespan of 30 years.

The system manufacturing emitted 1316 g for a capacity of 1 W, which amounts to 1,316,000 g for a capacity of 1 kW.

To express this per kWh, divide the emissions by 30,000 = 43.87, rounded to 43.9 g CO_2eq/kWh.

This matches the standard value mentioned in the carbon footprint assessment: 43.9 g CO_2eq/kWh.

This result aligns with the standard value published by ADEME. According to ADEME, the carbon footprint of photovoltaic systems is 43.9 g CO_2eq/kWh for Chinese panels manufactured using the Chinese electricity mix. For a European electricity mix, the footprint drops to 32.3 g CO_2eq/kWh, and to 25.2 g CO_2eq/kWh for a French electricity mix.