

Documentation: GHG Tool

Aim: Develop a responsive and flexible online tool, capable of measuring the CO₂ emission of a determinate renewable energy per year, the equivalent amount of trees that will produce that amount of CO₂ in their life cycle and the amount houses that will produce that amount of CO₂ per year.

Description: When the tool is loaded, an introductory screen is loaded where a description of the tool and a start button is shown

After pressing the start button, another screen will be loaded showing a drop-down menu and a simple general scheme of the life cycle of each renewable energy (Input/Processing/Output). The drop down menu will contain the following options: “Irradiation-Wind-Hydro”, Demolish wood, Sawdust and Manure. When you click in any of this option a form with some inputs will be loaded. Also, the general scheme of the life cycle will change into the specific one.

If the user clicks on “Irradiation-Wind-Hydro”, a form will appear asking for the expected annual production in MWhelectricity/year and the type of energy that it will be using (Wind, Hydro or Pv/Irradiation).

If the user clicks on “Demolish wood”, a form will appear asking for the expected annual output of the CHP plant (the MWhelectricity/year and GHJheat/year), three percentages of the wood weight lost between each stage, the percentage of moisture of the wood, the kilometers that a truck must drive in order to transport the material and temperature of useful heat at a point of delivery and the temperature of the surroundings.

If the user clicks on “Sawdust”, a form will appear asking for the expected annual output of the CHP plant (the MWhelectricity/year and GHJheat/year), the annual weight in kilograms of pellets used in the combustion stage, three percentages of the wood weight lost between each stage, the amount of electricity and/or gas used on the process (KWhelectricity/ton of pellets, MJgas/ton of pellets), two percentages that shows the moisture on the sawdust and on the pellets, the kilometers that a truck must drive to transport the material and the temperature of useful heat at a point of delivery and the temperature of the surroundings.

If the user clicks on “Manure”, a form will be loaded and it will ask the user for the expected annual output of the CHP plant (the MWhelectricity/year and GHJheat/year), the ton of manure used annually on the process, the m³ of biogas produced per ton of manure, three percentages of weight loss between each stage, the percentage of methane gas in the biogas, the kilometers that a truck must drive in order to transport the material, the temperature of useful heat at a point of delivery and the temperature of the surroundings, and the emission of gases that are directly generated (kgCO₂ / ton of transported manure, kgCH₄ / ton of transported manure, kgN₂O / ton transported manure).

After fulfilling all or partially the forms, the tool will proceed to do the calculations and update the result table.

Formulas of Wind-PV-Hydro:

$$C = (P * x) / 1000$$

- **P:** Annual production
- **x:** gCO₂eq/kWh emitted by the system specific of each type of energy and country.

$$T = (1000 * C) / eTree$$

- **C:** tonCO₂/year, The amount of CO₂ produced in a year by the system.
- **eTree:** kgCO₂eq/tree, kg of CO₂ used by a tree in its life cycle.

$$H = (C * 1000) / eHouse$$

- **C:** tonCO₂/year, The amount of CO₂ produced in a year by the system.
- **eHouse:** kgCO₂eq/house/year, estimated Kgs of CO₂ produced by a house per year in a specific country.