**D2Grids CO2 calculation tool**

1. Aim

This simple calculation model is designed to:

* Calculate the carbon footprint of a 5th generation network and its carbon intensity[[1]](#footnote-1)
* Compare 5th generation networks to other heating/cooling solutions
* Calculate the impact of a 5G grid improvements or extension on future GHG emissions
* Compare 5th generation networks to other DHC networks
1. Methodology

Based on discussions with project partners, the following decisions were made:

* Only GHG emissions from the different energy sources necessary for the grid are taken into account. Grey emissions (all emissions linked to upstream activities necessary to produce energy as the construction of energy plants and energy production equipment, transportation of energy carriers) are not included in this version of the calculation model. It may be included in a further version.
* Fossil and biogenic emissions were considered separately. Fossil emissions include emissions of GHGs linked to burning of fossil fuels or to generation of GHG that are were not included in the biogenic cycle of carbon. Biogenic emissions: when currting biomass such as crops or wood, it is considered that all carbon they had previously sequestered during their lifecycle is emitted in the form of biogenic CO2 when burned.
* The carbon intensity of energy was defined by partners as the ratio between total GHG emissions and total energy delivered. In this regard, we do not take into account that heating, cooling or domestic water may be produced differently and therefore may have different carbon intensity. Heating, cooling and DHW are all necessary to preserve the system efficiency, therefore, the intensity is the same for all energy types.
* Carbon from electricity: we assume that the carbon intensity of national electricity mixes are equivalent to the intensity of the production mix. This model could be finetuned by using the actual consumption mix rather than the production mix (the consumption mix includes transnational power exchange).
* Heat storage: Heat storage allows to store heat that may not be useful at any given time, to use it later. In the production estimation calculations, we estimate that we cannot use 100% of the source capacity due to the impossibility to fully balance production & demand. We therefore estimate that about 70% of the total capacity of the source can be harnessed over the year. If storage is implemented, we estimate that about 90% of the capacity can be used.

The annual GHG emissions of a 5G grid are calculated as follow:

$$GHG\_{total}=\sum\_{}^{}E\_{i}\*CC\_{i}$$

With

Ei = energy consumed during a year for each source of energy (kWh/year)

CCi = carbon content of each source of energy (CO2e/kWh)

GHG in CO2e/year

All sources of carbon content are specified in the CO2 tool.

1. How the tool works

This model allows the user to input basic energy data and calculates the GHG emissions of the network. The model proposes 2 data input areas: one for the current situation, one for data following potential improvements to the network.

It proposes a comparison of GHG emissions between the modelled network and other energy supply solutions.

Tabs of the tool

|  |  |
| --- | --- |
| **Results** | Presents the results of the calculations. |
| **Input data** | Collects data supplied by the user. |
| **Demand estimation** | Can be used to estimate the energy demand for Sanitary Hot Water, space heating & space cooling |
| **Production estimation** | Can be used to estimate the energy production available of the different renewable energy sources |
| **Database** | Contains standard values and elements used for the calculations. |

Usage

|  |  |
| --- | --- |
| Green | These cells should be filled/modified by the user. |
| Grey | These are automatically calculated or standard data. |

1. The carbon intensity of energy was defined by partners as the ratio between total GHG emissions and total energy delivered. [↑](#footnote-ref-1)