



Eurostat method to produce early CO₂ emission estimates for EU Member States

Eurostat uses cumulated monthly energy statistics to produce early estimates for CO₂ emissions from the combustion of fossil fuels, one year ahead of the official release of greenhouse gas emissions by the UNFCCC¹.

Member States provide monthly energy statistics to Eurostat and they provide official inventory data to the UNFCCC, albeit with a long time gap. In a simple two-step procedure, we combine these official data transmissions to produce early estimates of CO₂ emissions for Member States.

In a first step, Eurostat aggregates monthly data (January – December) for each fossil fuel group for two consecutive years to calculate the year-on-year change rate per fossil fuel group. In a second step, these change rates are applied to the official inventory data, provided by Member States to the UNFCCC, for each fuel group for the former of the consecutive years. The result is an early estimate of the amount of CO₂ in kt emitted by the Member State for the most recent year.

In detail:

Step 1: After having checked the monthly data for outliers and gaps, the data are aggregated for two consecutive calendar years and then compared. The year-on-year change, in percent, is calculated for each fossil fuel group (solid = coals and peat, gaseous = natural gas and liquid = oil and oil-products). For the other two minor fuel groups (non renewable waste and other fossil fuels), no calculation can be carried out because no monthly data are collected for these fuels.

Step 2: The UNFCCC requests countries to deliver official energy consumption data² per fuel every year (GHG³ inventories) for the year T-2. In CRF table 1A (b)⁴ their CO₂ emissions (in kt) are calculated based on the consumption of the fuels and then aggregated by fuel group (solid, gaseous, liquid fuels and non-renewable waste and other fossil fuels). The year-on-year change rate for each fuel group calculated with monthly data for year T-1 (from step 1) is multiplied with the CO₂ emissions in kt from the UNFCCC inventory data (CO₂ in kt * x%). The result is an estimated amount of CO₂ emissions in kt for each fuel group for the most recent year. The sum of Member States' CO₂ emissions from the different fuel groups then represents the EU-27 early CO₂ emission estimate from fossil fuel combustion.

¹ UNFCCC = United Nation Framework Convention on Climate Change

² All Annex I countries (all Member States) to United Nation Framework Convention on Climate Change are required to report annual emissions and sinks of greenhouse gases. This is done in form of an inventory

³ GHG = Greenhouse Gas

⁴ *CRF (Common Reporting Format) table 1.A (b) SECTORAL BACKGROUND DATA FOR ENERGY: CO₂ from Fuel Combustion Activities - Reference Approach (IPCC Worksheet 1-1)

Example: the production of the early CO₂ emission estimate for 2019:

1. The change of the consumption by fossil fuel group and by Member State is established using cumulated monthly data for the years 2018 and 2019 (e.g. percentage change of consumption of liquid fossil fuels in Austria between 2018 and 2019 = x%).
2. In the official UNFCCC inventory submission for 2018 for Austria, the figure representing the CO₂ emission for Austria from the combustion of liquid fossil fuels, expressed in kilotons (= 1000 t) is multiplied with x%. The result of this calculation then represents the early CO₂ emission estimate for liquid fossil fuels for Austria for the year 2019.
3. This calculation is done separately for all the fossil fuel groups, i.e. liquid, solid, peat and gaseous, and the sum is the estimate for total CO₂ emissions for Austria for 2019.
4. Potential variation of the method: The method described above works well if the quality of the monthly data of the two consecutive years used to calculate the change rate does not vary too much. If the quality of the monthly data for the first year is much lower than for the second year, data for the first year might be replaced by annual data, e.g. instead of using cumulated monthly data for the year 2018, annual data for 2018 might be used if available.
5. In some countries, both hard coal and lignite with different net calorific values are consumed. Hence, for these countries the calculated year-on-year change rate in physical units (kt) and calculated year-on-year change in energy units (TJ) show large differences for solid fuels. The CO₂ emissions are determined by the carbon content of fossil fuels. The carbon content is more closely correlated to the energy content of the fuel (TJ) than to the mass (kt) of the fuel. Therefore, instead of using the year-on-year change rate calculated from the consumption of solid fuels in kilotons, the year-on-year change rate based on the consumption in TJ for countries with significant shares in hard coal and lignite consumption is used.

As a concrete example:

Latest monthly data for year T-1 are downloaded from Eurobase around 15 April and are compared with data from the year before, also downloaded around 15 April of that year and frozen. The year-on-year change rate is calculated on basis of these two datasets.

Example Press Release 2018 (published 4 May 2018) calculating an estimate for **reference year 2017**:

Download of monthly data 2016 in mid-April 2017 compared with monthly data 2017, downloaded mid-April 2018.

The year-on-year change rate is then applied to UNFCCC data (sub-mission 2018) for reference year 2016 (UNFCCC T-2) and the CO₂ emissions are calculated.

About one year later, i.e. in 2019 when UNFCCC data for 2017 are sub-mitted, Eurostat's early estimate for 2017, which was available in May 2018, can be compared with final UNFCCC data for 2017 (=benchmark). For 2017, at EU level Eurostat overestimated the benchmark by 0.7 percentage points%.

Last updated: May 5th, 2020