

CREA CO2 Tracker Methodology

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Overview

The CREA CO2 Tracker is an online tool estimating daily CO2 emissions from fossil fuels within the EU27 region.

Approach - The tracker derives fossil fuel consumption from EUROSTAT's Supply, Transformation, and Consumption data¹ and then applies IPCC emission factors² to estimate associated CO2 emissions.

Scope - CREA CO2 Tracker covers CO2 emissions resulting from the combustion of fossil fuels. It does not include industrial process emissions that are not stemming from fossil fuels, nor does it include agricultural emissions or emissions related to Land use, land-use change, and forestry (LULUCF).

Frequency and latency - CREA CO2 Tracker offers CO2 emission estimates on a daily basis with a three to four-day lag. EUROSTAT data typically exhibits a one to two-month latency. To counter this and accurately estimate the most recent emission trends, the CREA CO2 Tracker utilizes data from ENTSOG for natural gas and from ENTSOE for electricity generation to project EUROSTAT time series. For oil and industrial coal consumption, we estimate the most recent emissions by continuing recent trends.

Fossil fuel consumption

The estimation of fossil fuel energy consumption within the CREA CO2 Tracker is derived from EUROSTAT's Supply, Transformation, and Consumption data¹. In cases where monthly data is not available, particularly for earlier years, we use yearly data as a substitute. For energy balance categories lacking monthly data, we estimate these figures by applying proportional ratios derived from the available yearly data.

For oil, consumption is based on observed gross inland deliveries, a measure of implied oil consumption based on refinery output, imports, exports and stock changes, as well as deliveries of crude oil and natural gas liquids to non-refinery users, along with several smaller flows. For coal, usage is based on final consumption and transformation input reported by (industrial) users.

The tables 1-3 below indicate which energy balance categories have been considered for solid fossil fuels (i.e. coal and coal related), oil and gas respectively.

Table 1 - Fuel and energy balance category considered - Solid fossil fuels

Fuel	Category
Hard coal	Final consumption - industry sector
Coke oven coke	Final consumption - industry sector - iron and steel
Hard coal	Final consumption - other sectors
Hard coal	Transformation input - coke ovens
Hard coal	Transformation input - electricity and heat generation - main activity producers
Brown coal	Transformation input - electricity and heat generation - main activity producers
Peat	Transformation input - electricity and heat generation - main activity producers
Oil shale and oil sands	Transformation input - electricity and heat generation - main activity producers

Table 2 - Fuel and energy balance category considered - Crude oil and oil products

Fuel	Category
Crude oil, NGL, refinery feedstocks, additives and oxygenates and other hydrocarbons	Direct use
Oil products	Gross inland deliveries - energy use

Table 3 - Fuel and energy balance category considered - Fossil gas

Fuel	Category
Natural gas	'Inland consumption' minus 'Final consumption - non-energy use'
Natural gas	Transformation input - electricity and heat generation

CO2 Emissions

Emission factors are taken from the Intergovernmental Panel on Climate Change (IPCC) Emission Factor Database.² Table 4 below indicates the emission factors considered, expressed in tonne CO₂ emitted per Terajoule (expressed in Net Calorific Value).

Table 4 - CO₂ emission factors considered from the IPCC.

Fuel	Value (t _{CO2} / TJ)	Emission Factor ID
Hard coal	92.8	EFID110620
Brown coal	113.1	EFID123085
Peat	117.8	EFID122005
Oil products	72.3	EFID113617
Crude oil	73.0	EFID110603
Natural gas	55.7	EFID123092-123095
Coke oven coke	113.0	EFID110624

Filling data gaps and downscaling

EUROSTAT data typically exhibits a one to two-month latency. To fill this gap and estimate the most recent emission trends, the CREA CO2 Tracker utilizes proxy data to project EUROSTAT data until the most recent dates. Proxy data includes power generation by source and country derived from ENTSOE and gas consumption derived from ENTSG. For the latter, we calculate “apparent consumption”, which is the residual of imports from outside the EU, domestic production and flows into and out of storage.

A linear model with no intercept is built between the data we want to project and the proxy data (i.e. a simple ratio). Provided this model reaches sufficient prediction capacity ($R^2 > 0.9$), it is used to estimate most recent emissions for this sector / fuel combination. The table below indicates the proxy data being used. For sector / fuel we don't have relevant proxy data for, we extend the latest monthly data based on the deviation from the last three years averaged over the past three months.

The proxy data is similarly used to downscale the CO2 emissions on a daily basis when it is available.

Table 5 - Method and data used to fill latest data

Fuel	Sector	Method
Coal (Hard coal and Lignite)	Electricity	Proxy model with ENTSOE
Fossil gas	Electricity	Proxy model with ENTSOE
Fossil gas	Others	Proxy model with ENTSG
Coal and Coke oven coke	Others	Trend continuation
Crude oil and oil products	All	Trend continuation

Validation

In this section, we compare our EU27 CO2 emission estimates with two sources, namely the PRIMAP-hist national historical emissions time series³ and EU Carbon Monitor.⁴

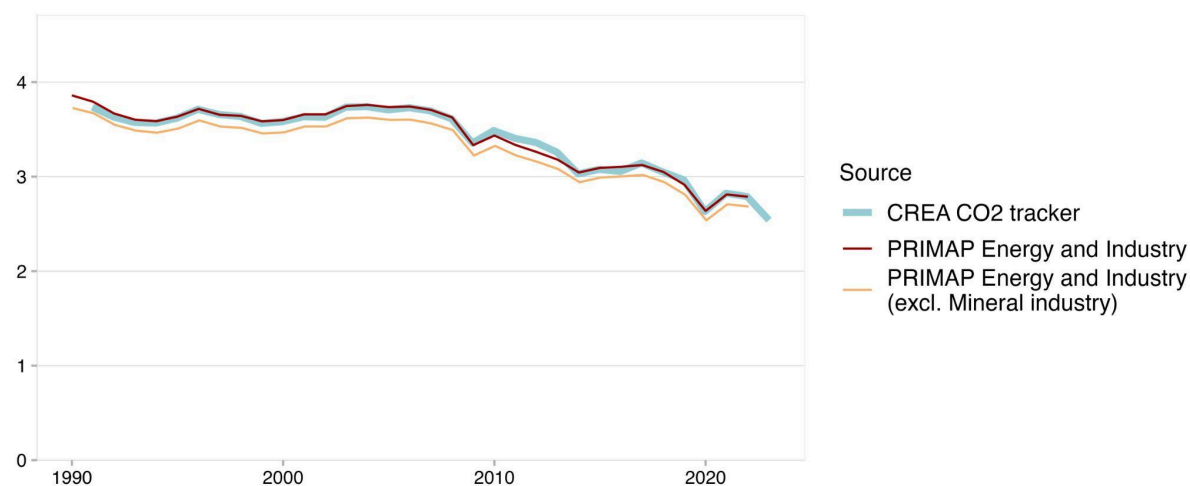
Comparison with PRIMAP-hist dataset

PRIMAP-hist dataset³ includes CO2 emission estimates for Energy and Industrial Processes and Product Use (IPPU) from 1750 to 2022. It notably includes non-fossil fuel related emissions in industrial processes, whilst CREA CO2 tracker doesn't. As Cement sector is by far the largest contributor of non-fossil fuel related emissions, with roughly half only of its emissions stemming from combustion of fossil fuels, we have included a version with and without mineral industry and expect CREA CO2 tracker to fall in-between. Results are shown in the figure below.

CREA CO2 tracker shows very good agreement with the PRIMAP-hist dataset. It is on the high-end of estimates, being notably closer to estimates that include non-fossil fuel emissions in Industry while we would expect it to be in between.

Figure 1 - **EU CO2 emissions from fossil fuels - Comparison with PRIMAP**

Billion tonne CO2 per year



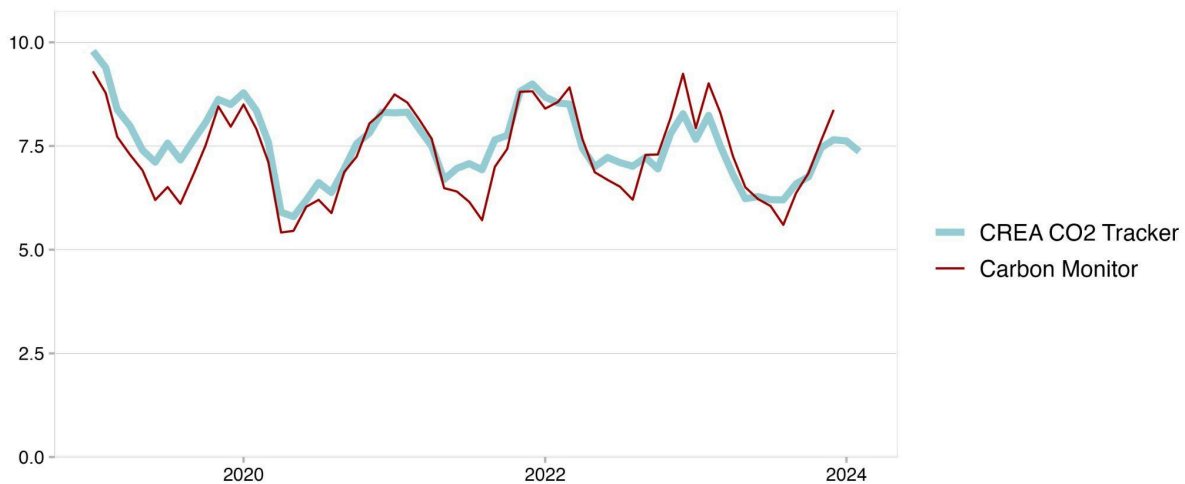
Source: CREA estimates based on EUROSTAT and IPCC. PRIMAP refers to PRIMAP-hist v2.5 and includes non-fossil fuels related emissions.

Comparison with EU Carbon Monitor

We proceed with monthly data comparison with the EU Carbon Monitor⁴. Both sources show fairly good agreement though CREA CO2 Tracker estimates seem consistently higher during summer months. The exact reasons remain unclear and will be investigated in a future version. Of note, the EU Carbon Monitor adopts a different approach consisting in updating EDGAR emission data with a series of proxy datasets.

Figure 2 - **EU CO2 emissions from fossil fuels - Comparison with EU Carbon Monitor**

Million tonne CO2 per day



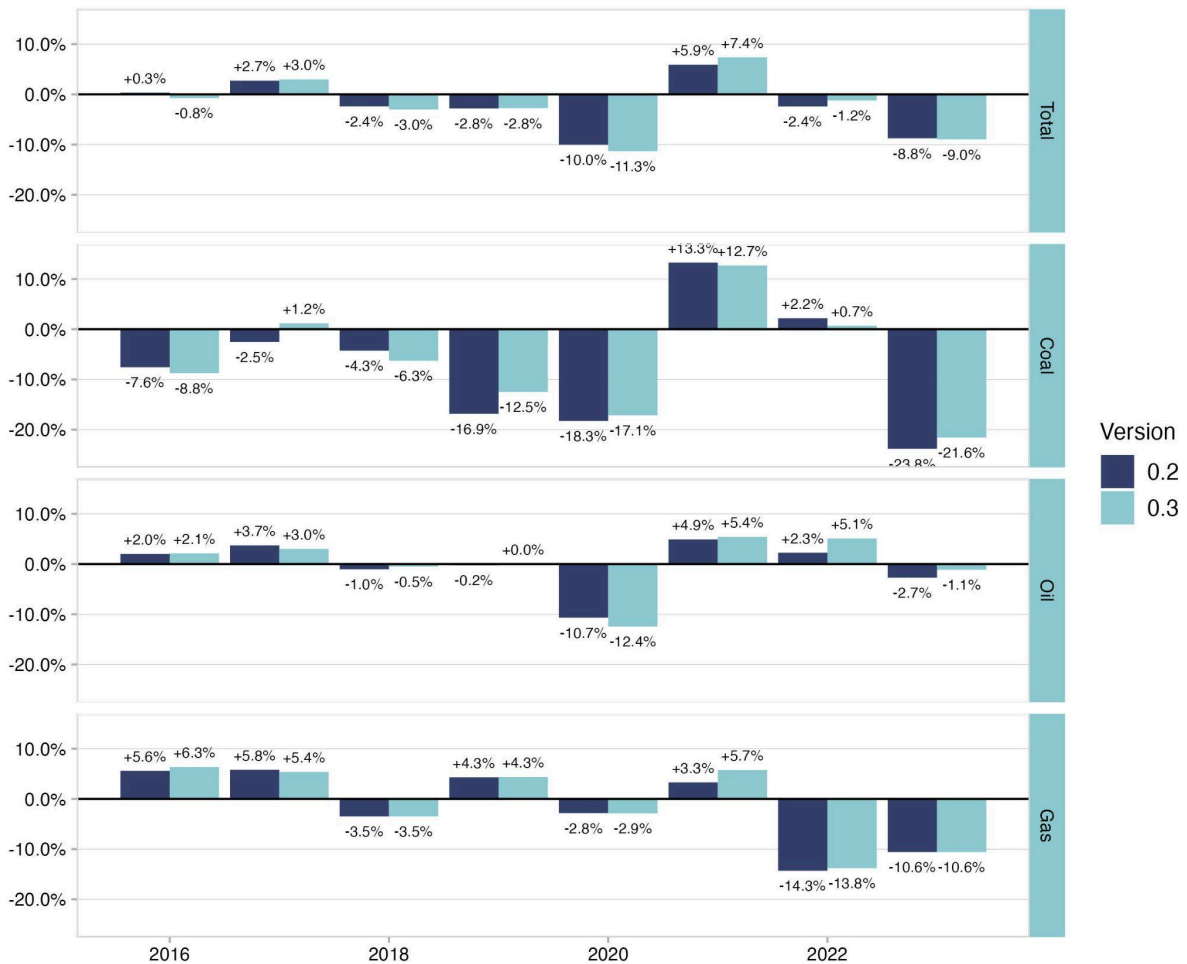
Source: CREA estimates based on EUROSTAT and IPCC.

Comparison with previous version

In January 2024, we released an article analysing the fall of EU CO₂ emissions in 2023⁵. The main findings remain largely unchanged with the new version, as shown in the charts below.

Figure 3 - Comparison with previous CREA CO₂ tracker version

Year-on-year changes of EU CO₂ emissions



Source: CREA estimates based on EUROSTAT and IPCC.

Future work

In upcoming versions, we expect to:

- derive emissions at the national level for a selection of Member States
- further segregate fossil fuels, especially oil products, into more granular categories
- include additional proxy datasets to fill the latest months with improved accuracy.

References

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