This article is about carbon dioxide (CO2) emissions classified by final use of products in the EU-27, also known as ‘carbon footprints’. Eurostat uses a modelling approach to compile these estimates, based on economic information and air emissions accounts (AEA). Carbon footprints are one particular analytical application of AEA.

Eurostat also records and publishes the AEA, which include a range of greenhouse gas emissions. AEA are suited for integrated environmental-economic analyses such as the ‘footprints’ presented here or for calculating emission intensities. As a third set of greenhouse gas emissions statistics, Eurostat disseminates GHG emissions classified by technical processes. These are recorded in so-called GHG emission inventories and form the official data for international climate policies.

Eurostat estimates the EU-27’s carbon footprint at 7.0 tonnes per person in 2018. The EU-27 emits 0.4 tonnes CO2 per person more to produce exports than it avoids by importing goods and services. Services that account for 25 % of the total carbon footprint only account for 7 % of the direct CO2 emissions (transport, construction and real estate services are accounted for separately). The majority of the emissions originate from EU production activities.

Carbon dioxide emissions associated with EU consumption

The right-hand bar of Figure 1 shows the carbon dioxide (CO2) emissions due to final use of products within the EU-27 economy. The EU-27 final use of products encompasses consumption by private households and governments as well as the use of products for gross fixed capital formation, or in other words investments, such as buildings, plants and machinery, motor vehicles, and infrastructure. The estimate includes CO2 emitted to produce the final product, including emissions from intermediate inputs and CO2 emissions avoided due to importing intermediate and final products. The estimate of avoided CO2 emissions can be interpreted as an approximation of the CO2 emitted abroad to produce the imported products by the EU-27. As the point of reference is the final product, it gives a consumption perspective of CO2 emissions and is also referred to as consumption-based accounting. This type of estimate is also known as a ‘carbon footprint’. Eurostat’s carbon footprint of the EU-27 measures how much CO2 would have been emitted due to EU-27’s demand for products, if all imported products were produced within the EU-27 using an EU-27 average production technology.

The EU-27’s total carbon footprint was equal to 7.0 tonnes CO2 per person in 2018. It consists of about 1.6 tonnes of CO2 per person (tonnes/person) directly emitted by private households from burning fossil fuels (for example for heating dwellings and fuelling private vehicles) and 5.3 tonnes/person emitted indirectly along the production chains of final products which were either consumed or invested in within the EU-27. A majority of the latter — 4.4 tonnes/person — stemmed from domestic production activities actually located in the EU-27. A smaller part, equal to 1.0 tonnes/person, is estimated to have been avoided by importing intermediate and final products into the EU-27, eventually for EU-27 final use.
Eurostat’s carbon footprint estimate is based on the ‘domestic-technology-assumption’. This assumption is used to approximate the emissions embodied in imported products by assuming that the imported products are produced with production technologies similar to those employed within the EU-27. By importing various goods and services from the rest of the world, the EU-27 can be seen to have ‘avoided’ 1.0 tonnes of CO₂ emissions per person that would otherwise have been emitted by its own production activities. However, average production technologies in the EU-27 may not match very closely the production technologies used outside the EU-27 to produce products that are imported by the EU-27. To estimate emissions embodied in EU-27 imports based on the production technologies used abroad, a global model and accompanying dataset that include all inter-industry trade flows are needed. Although several research projects have produced global datasets, a regularly produced, standardised dataset is currently not available. Eurostat is developing such a dataset in the FIGARO project, but due to the scope and complexity, it will take several years before the development has advanced enough to use the dataset in carbon footprint modelling.

Carbon dioxide emissions associated with EU production

CO₂ emissions may also be analysed from a production perspective, in other words, emissions generated by the EU-27 economy. In 2018, these amounted in total to 7.3 tonnes CO₂ per person (see left-hand bar of Figure 1). CO₂ emitted in the EU-27 was made up of 1.6 tonnes/person direct emissions by private households (for example for heating and private transport) and 5.7 tonnes/person coming from domestic production activities, in other words from EU production activities. The majority of the latter relate to the production of goods and services for the EU domestic final use (4.4 tonnes/person). A smaller part of the EU production emissions is due to the production of goods and services that are exported outside the EU (1.3 tonnes/person). See the Statistics Explained article ‘Greenhouse gas emission statistics - air emissions accounts’ for more information about air emissions from the production perspective.

Note that, due to the modelling assumptions among which the domestic technology assumption, Eurostat’s carbon footprint estimate is more uncertain than the production-based emissions reported in the air emission accounts.

Net emission balance due to trade

Figure 1 shows that the difference between the consumption perspective and the production perspective, when looking at national footprint of all products together, is equal to the difference between the emissions due to exports and the avoided emissions due to imports.

Figure 2 has a closer look at the CO₂ emissions related to trade flows. The figure shows the development
over time of the emissions to produce exports, the avoided emissions due to imports and the difference between the two, which is the net emission balance due to trade. The balance shows the amount of CO2 emissions that the EU-27 would stop emitting in case it would not trade, all else kept equal. No trade means no exports, so the EU-27 would not emit the CO2 emissions to produce these exports, which are equal to 1.34 tonnes CO2 per person in 2018. In addition, without trade, the EU-27 would have to produce the goods and services it imports itself, so it would emit 0.98 tonnes CO2 per person extra. Together, the 1.34 tonnes per person emitted extra due to exports and the avoided 0.98 tonnes per person due to imports, result in a balance of 0.37 tonnes CO2 per person extra that the EU-27 emits because it trades goods and services.

![Graph showing CO2 emissions in exports versus avoided emissions due to imports, EU-27, 2014-2018](source: Eurostat (env_ac_io10))

**Figure 2:** CO2 emissions in exports versus avoided emissions due to imports, EU-27, 2014-2018 (tonnes per person)  
Source: Eurostat (env_ac_io10)

**Products with largest contribution to the carbon footprint**

Figure 3 shows the carbon footprint by broad product group. The size of each box represents the relative size of the CO2 footprint for that product group.

The broad product group classified here as 'Materials & manufactured products' represents 23 % of the total CO2 emissions due to domestic final demand for products. The groups 'Utilities' and 'Construction and real estate' represent respectively 12 % and 11 % of the CO2 emissions. Transport accounts for 6 %. The group 'Other services' represents with 25 % a slightly larger share as the tangible products of the group 'Materials & manufactured products'. Whereas services generally emit relatively little CO2 directly (7 %, source: air emission accounts), the CO2 footprints of the services product groups clearly show that the demand for some of these services is also an important driver of CO2 emissions, due to the indirect CO2 that is emitted to supply these services.

Note that the in Figure 3 reported CO2 emissions for these broad product groups cover the CO2 emissions due to domestic demand for products, which is 77 % of the total EU-27 carbon footprint. The other 23 % consists of direct emissions by households, which amounts to 1 629 kg of CO2 emissions per person.
Table 1 shows which products have the largest carbon footprints (CO2 emissions due to EU-27 demand for final products). With 0.76 tonnes/person or 764 kilogrammes per person (kg/person) the final use of the product group electricity, gas, steam and air-conditioning has the biggest carbon footprint. Next ranks the final use of constructions and construction works with 699 kg/person while the final use of food products, beverages and tobacco products ranks third with a carbon footprint of 381 kg/person.

Table 1: CO2 emissions due to final use of products, by type of final use and origin, EU-27, 2018

Source: Eurostat (env_ac_io10)

Table 4 shows for the same products the development of their carbon footprint over time. This figure shows that the general trend is not directly shaped by the products with the largest share in total carbon footprint. Emissions from the product group electricity, gas, steam and air-conditioning have been falling for the past three years after the maximum in 2015. Emissions from constructions and construction works have been slowly but steadily increasing over the past five years, but have levelled off since 2018. Emissions from the product group food products, beverages and tobacco products are the most stable of the three.

Figure 4 shows for the same products the development of their carbon footprint over time. This figure shows that the general trend is not directly shaped by the products with the largest share in total carbon footprint. Emissions from the product group electricity, gas, steam and air-conditioning have been falling for the past three years after the maximum in 2015. Emissions from constructions and construction works have been slowly but steadily increasing over the past five years, but have levelled off since 2018. Emissions from the product group food products, beverages and tobacco products are the most stable of the three.

Figure 3: CO2 footprints by product group, EU-27, 2018 (kilograms CO2 per person)

Source: Eurostat (env_ac_io10)
Figure 4: CO2 emissions due to final use of three products with highest CO2 emission footprints, EU-27, 2014-2018 (kilograms CO2 per person). Source: Eurostat (env_ac_io10)

Source data for tables and graphs

- Greenhouse gas emission statistics - carbon footprints: tables and figures

Data sources

Two main Eurostat data sources feed into the modelling to compile the estimates presented above.

The CO2 emissions from a production perspective come from air emissions accounts, which are part of Eurostat’s environmental accounts programme; air emissions accounts record the emissions of greenhouse gases and air pollutants by a detailed breakdown of economic activities, namely 64 industries and various activities of private households.

The carbon footprint estimates are based on single-region environmentally extended input–output modelling. The modelling is based on the aforementioned air emissions accounts, which are integrated with ESA supply and use tables. Please note that the subdivision into domestic and exported emissions shown on the left-hand side of Figure 1 — the production perspective — is also a result of this modelling. The model is implemented as Excel tool and available via Environment – methodology.

The modelling results are published in the dataset ’Emissions of greenhouse gases and air pollutants from final use of CPA08 products - input-output analysis, ESA 2010 (env_ac_io10)’. This dataset contains estimates not only for CO2 emissions, but for all greenhouse gas emissions, as well as several air pollutants.

Estimates for the most recent year in the dataset are estimated based on national accounts data for the year before and early estimates of air emissions accounts.

Three perspectives of greenhouse gas emission statistics

Eurostat presents three perspectives of greenhouse gas (GHG) emissions statistics:
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**Context**

Supply and use tables portray production and consumption activities of national economies in a detailed manner. They form the basis for so-called input–output models and analyses. Both the tables and the models constitute powerful tools for addressing a range of policy areas. The focus of these models is generally made through an analysis of long-term structural changes within economies, for example, by studying value added shares, trade shares, or accumulated value added along certain production chains.

By adding environmental information (for example, air emissions or the use of energy) to these input–output models, it is possible to extend their analytical scope. Environmentally extended input–output analyses are of particular relevance for policy areas such as sustainable production and consumption, the sustainable use of natural resources, and resource productivity.

**Other articles**

- [Greenhouse gas emission statistics - air emissions accounts](#)
- [Supply and use tables - input-output analysis](#)

**Publications**

- [Energy, transport and environment indicators — 2019 edition](#)

**Database**

- [Air emissions accounts (env_air_aa)](#)

Emissions of greenhouse gases and air pollutants from final use of CPA08 products - input-output analysis, ESA 2010 (env_ac_io10)

- [ESA Supply, use and input-output tables](#)

**Dedicated section**

- [Air Emissions Accounts](#)
- [ESA Supply Use and Input-Output tables](#)
Methodology

- Technical documentation eeSUIOT project
- Environmental accounts methodology
- Eurostat manual for air emissions accounts
- Supply, use, and input-output tables methodology
- Eurostat Manual of Supply, Use and Input-Output Tables

View this article online at http://ec.europa.eu/eurostat/statistics-explained/index.php/Greenhouse_gas_emission_statistics_-_carbon_footprints