

The carbon footprint of French consumption: evolution between 1990 and 2007

The carbon footprint calculated by the SOEs (statistical service of France's Ministry for Sustainable Development) represents the amount of greenhouse gases (GHG) emitted in order to satisfy France's consumption, including emissions relating to imports. In 2007, France's per capita carbon footprint was around 12 tonnes of CO₂ equivalent per year, compared to 8 tonnes per person emitted from metropolitan French territory. Between 1990 and 2007, the per capita carbon footprint increased by 5%, whereas the average per capita emissions per person from national territory decreased by 15%. During that period, emissions associated with imports grew by 64%, reaching almost half of France's carbon footprint for consumption in 2007.

According to the International Energy Agency (IEA), global CO₂ emissions from combustion of fossil fuels reached a record in 2010, whereas the countries covered by the Kyoto Protocol on reducing GHG emissions collectively stabilised their emissions in relation to 1990 levels. The increase therefore stems mainly from third countries, partly due to their providing for consumption in first countries.

Under the United Nations Framework Convention on Climate Change (UNFCCC), countries which, like France, are signatories to the Convention produce yearly inventories of the GHGs emitted from their national territory, in accordance with an internationally accepted method. This is often used by the countries in question as a way of monitoring their emission reduction commitments under the Kyoto Protocol.

The carbon footprint for final domestic demand (referred to here as consumption in France) provides additional information to that given by the GHG inventories by addressing a different perimeter: it includes the GHGs

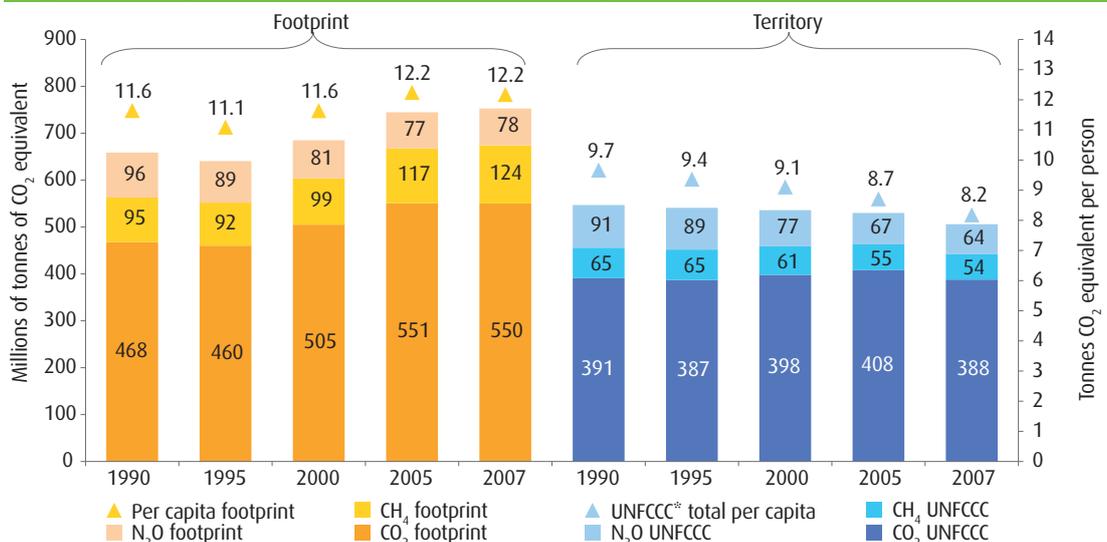
emitted directly by households (heating and cars) and emissions generated during manufacture and transport of the goods the households consume, whether made in France or abroad.

The carbon footprint for consumption in France does not support any international commitment, but it does constitute one of the 15 headline indicators of the country's National Sustainable Development Strategy.

France's carbon footprint is growing while emissions within national territory are decreasing

At an estimated 750 million tonnes of CO₂ equivalent (CO₂e, methodology) in 2007, the carbon footprint for France's domestic final demand is greater than the corresponding GHG emissions from metropolitan territory (506 Mt CO₂e). Related to the size of the population, an average French person's carbon footprint is 12.2 tCO₂e, against 8.2 tonnes for the same GHGs emitted within national territory (Figure 1).

Figure 1: comparison of evolution of carbon footprints and emissions from national territory



Note: *United Nations Framework Convention on Climate Change (Kyoto Protocol). 2009 version of GHG inventory for UNFCCC.

Source: IEA, Citepa, Customs, Eurostat, Insee, SOEs calculations.

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Moreover, between 1990 and 2007, France's carbon footprint grew (by 14%) whereas the amount of GHGs emitted on national territory reduced (by 7%). The per capita carbon footprint grew by 5% while per capita emissions in metropolitan France decreased by 15%.

The increase in France's carbon footprint is mainly due to increases in CO₂ (75% of the footprint: +18% between 1990 and 2007) and in methane (16% of the footprint: + 30%). Only nitrous oxide saw a reduction (-18%).

For 2010, on the basis of aggregated elements (totals of emission inventories, value of total imports and exports), France's per capita carbon footprint is estimated to be around 12 tCO₂e. A preliminary estimate by the Citepa indicates per capita emissions within national territory of around 8 tCO₂e for 2010.¹

The concept of "footprint" as applied to the environment

The concept of the "footprint" of the pressures exerted by human activities on the environment appeared in the 1990s with the Ecological Footprint developed by the Global Footprint Network (GFN), expressing all of the environmental pressures of consumption in terms of area required (global hectares). It includes a carbon component (expressed in the same units), corresponding to the area of forest needed to absorb the CO₂ emissions not absorbed by the oceans.

The carbon footprint calculated by SOeS represents the amount of GHGs, expressed as carbon dioxide equivalent (CO₂e), emitted to satisfy French consumption. It consists of a domestic part and an "imported" part. The first includes direct household emissions (cars and heating) and emissions from industrial and commercial facilities and administrative establishments producing the goods and services that meet domestic demand (emissions associated with exports are excluded). The "imported" part corresponds to emissions generated abroad during production of goods and services imported into France. These imports are intended either for productive use (raw materials or semi-finished products) or for final use, especially by households. The part of the emissions associated with France's imports that are re-exported (after processing or not) is excluded from the footprint.

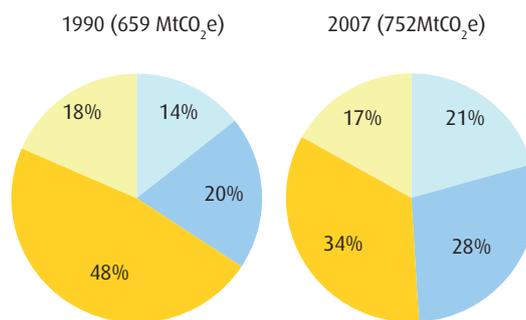
The increase in the carbon footprint results from the increase in domestic final demand coupled with the footprint for imports

Increase in domestic demand is a determining factor for the increase in France's carbon footprint. Between 1990 and 2007, the volume of total domestic demand increased by 39% (i.e. not considering corresponding price changes) and per capita demand grew by 28%. Furthermore, an increasing part of this demand is met by imports and their volume grew by 136% over the period.

Associated with the increase in France's consumption related carbon footprint is a part, itself increasing, of GHG emissions associated with imports. Whereas the domestic component of the footprint (384 MtCO₂e) shrank by 11% between 1990 and 2007, its external component (369 MtCO₂e) grew by 64%. Given the size of France's population, these two components, expressed as tonnes per person, decreased by 19% and grew by 50% respectively (Figure 2).

¹ - Citepa, Inventory of emissions of atmospheric pollutants and greenhouse gases in France (secten format), April 2011.

Figure 2: evolution of French carbon footprint per component



- GHG emissions associated with imports for final use
- GHG emissions associated with imports for intermediate consumption
- GHG emissions from national production to satisfy domestic demand*
- GHG emissions direct from households (cars and heating)

Note: * Emissions arising from production of French exports are excluded from France's carbon footprint.

Source: Source: IEA, Citepa, Customs, Eurostat, Insee, SOeS calculations.

The increase in import related emissions offsets the reduction in domestic emissions for many products

The domestic component of the per capita carbon footprint has decreased for most groups of goods, with the notable exception of transport services and waste treatment (Figure 4). The tertiarisation of the economy – with increasing relative importance of services in national production and deindustrialisation – as well as technological progress are two explanatory elements. However, for emissions from domestic production and for those arising directly from households, opposing effects are observed (CGDD-SOeS, 2010) between technological progress (CO₂ content of energy and energy intensity) and the increase in consumption (per capita and because of increase in population size), so that there is, in most cases, a rebound effect: the reduction in unit price resulting from technological progress leads to increased consumption and induced emissions.

The external component of the footprint can be broken down into a part relating to imports for productive use and another relating to imports for final use (Figure 4). Its increase more or less offsets the reduction in the domestic component, depending on the goods considered.

International comparison of CO₂ footprint for domestic final demand

Calculations performed by the OECD allow an international comparison for the year 2005, reduced to CO₂. On this basis, the per capita CO₂ footprint for France is below that of neighbouring countries and below the European Union average. It increased by 5% between 1995 and 2005.²

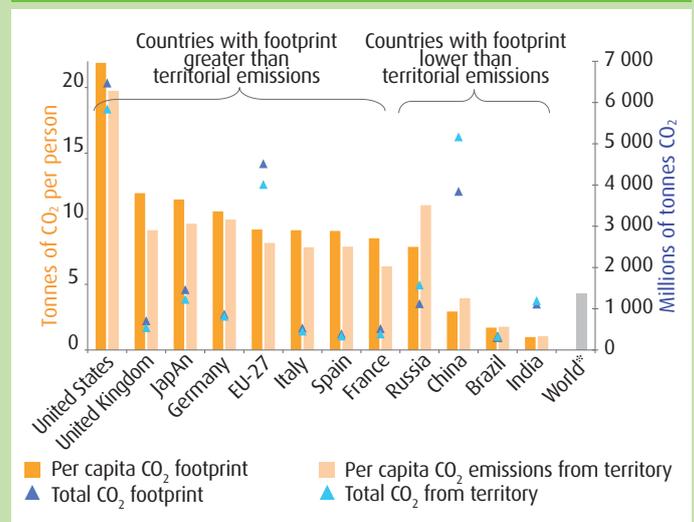
Large western European countries, the United States and Japan have a CO₂ footprint higher than the CO₂ emitted from their territories. Conversely, this is not the case for Brazil, China, India and Russia. China, given its size and rate of economic growth has been the world's largest emitter (CO₂ from its territory) since 2007. In 2005, it was still not ahead of the United States but had already overtaken the European Union. However, its per capita CO₂ footprint (2.9 t) was well below that of OECD countries (average of 12.5 t). It should be so again for 2010, in spite of an average per capita CO₂ emission level on Chinese territory approaching 6 t, against 3.9 t in 2005.

A recent study (Peters et al., 2011) shows the existence between 1990 and 2008 of a "transfer" of CO₂ emissions from all of the Kyoto Protocol countries towards third countries via international trade. Protocol countries have collectively stabilised emissions from their territories partly by an increase in imports from non-protocol countries, whose emissions doubled in the same period.

According to the Intergovernmental Panel on Climate Change (IPCC), limiting global warming to 2° C above the pre-industrial temperature level would require halving of global GHG emissions in relation to 1990 levels by 2050, i.e. by a little over 20 billion tonnes of CO₂e per year. Given the increase in population by then (population of 9 billion), an equitable sharing of emissions would require that each country should not exceed 2.5 t GHG per person and per year, of which 2 t for CO₂.

2 - The CO₂ footprint calculated by the OECD covers a slightly smaller perimeter than that of the SOEs. For 2005, the OECD obtained 8.5 t of CO₂ per person for France, against 9 t for SOEs.

Figure 3: international comparison of CO₂ emissions (2005), footprint vs territory

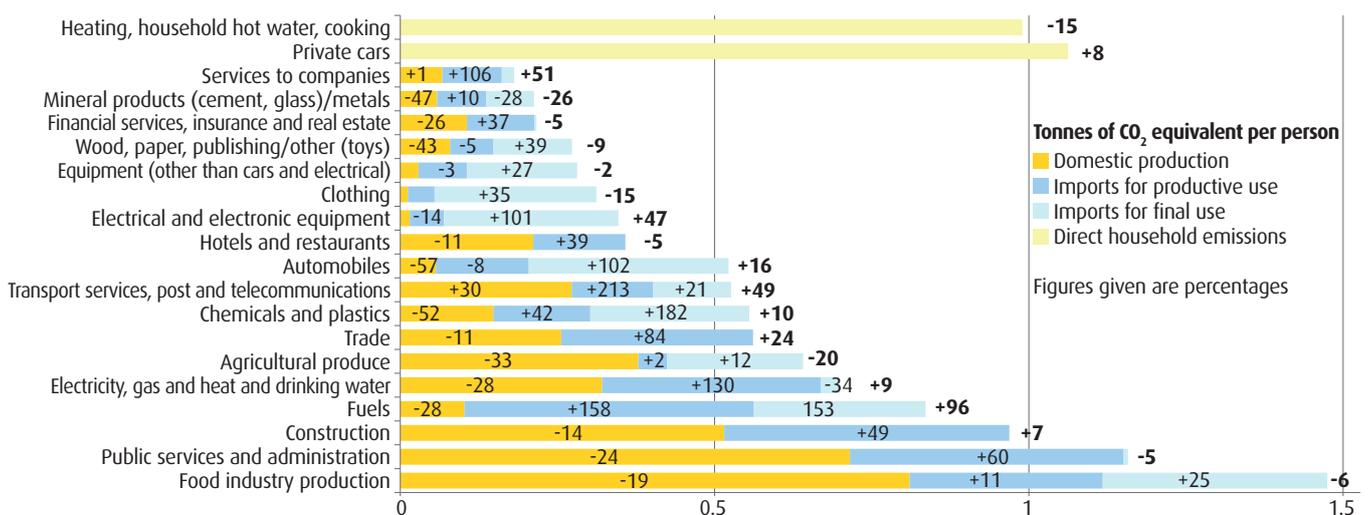


Key: for each country, the graphic shows the CO₂ footprint (dark colours) and the CO₂ emitted from national territory (light colour). In addition, the information presented is relevant both to emissions related to the size of the population (orange bars, left scale) and to total emissions (blue triangles, right scale). Countries or groups of countries are shown in descending order of per capita CO₂ emissions (dark orange bar).

Note: at the global level, the CO₂ footprint is equal to total CO₂ emitted. OECD data relate to CO₂ from combustion of fossil fuels, they do not include CO₂ other than from combustion (e.g. decarbonation of limestone during cement manufacture).

Source: OECD.

Figure 4: carbon footprint for domestic demand per goods and services³



Key: The domestic component of the footprint associated with produce of the food industry is around 0.8 t/person on average (19% reduction between 1990 and 2007) and the imported part 0.65 t, of which 0.3 t (+11% between 1990 and 2007) associated with imports for productive uses (agricultural produce and other supplies) and 0.35 t (+25% between 1990 and 2007) with imports for final use (finished foodstuffs). The total footprint is close to 1.5 t/person (6% reduction between 1990 and 2007).

Source: IEA, Citepa, Customs Eurostat, Insee, SOEs calculations.

3 - Unlike the presentation adopted by Lenglar et al. (2010, p. 111), trade emissions are not distributed over the different goods.

Four sources of equal importance: transport, food, housing and services

Transport, food, housing and services are the four main components of France's carbon footprint.

- In 2007, the carbon footprint for passenger transport was 2.5 t CO₂e per person, of which 2 t were for the private car (fuel consumption: 1.1 t; car manufacture: 0.3 t; fuel manufacture: 0.6 t) and 0.5 t for public transport.
- The footprint for food was 2.2 t CO₂e per person (foodstuffs: 1.5 t; agricultural produce: 0.6 t; cooking at home: 0.1 t).
- The carbon footprint for housing was around 1.9 t CO₂e (fuel consumption for space heating: 0.9 t; fuel manufacture: 0.2 t; production and supply of electricity, gas and water: 0.3 t; housing construction: 0.5 t).
- The services footprint was also 1.9 t CO₂e (including hotels and restaurants, not including transport services and trade).

Between 1990 and 2007, the carbon footprint for transport increased by 30%; footprints for housing and services were more or less stable and that for food decreased by 10%.

A recent study (Paillat, Adam and Wilmotte, 2011), based on a different methodology, confirms that the footprints relating to people's movements and to services are increasing, and that the footprint for food is falling. It emphasises that the increase in the total per capita footprint, estimated at 13% between 1990 and 2010, is mainly the result of the footprint for consumer other than foodstuffs, notably consumer durables.

Méthodologie

The footprint calculation presented here is based on three GHGs: carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), which represent 97% of the six GHGs covered by the Kyoto Protocol. They are expressed as CO₂ equivalent in terms of their radiative (i.e. global warming) potential over 100 years. Each tonne of CH₄ and tonne of N₂O are equivalent to 21 and 310 tonnes of CO₂ respectively.

CO₂ emissions arise mainly from combustion of fossil fuels; CH₄ emissions arise mainly from livestock farming but also from waste disposal facilities, gas mains and individual sewerage systems. N₂O arises primarily from agricultural use of fertilisers and the chemical industry.

The footprint is calculated with a standardised input-output analysis method extended to the environment and advocated by the Eurostat and the OECD. It is based on the combination of input-output tables (IOT) from national accounts with physical environmental accounts of GHG emissions broken down by branch of economic activity both using the same nomenclature of economic activities (NAF). The latter are prepared using a methodology harmonised by Eurostat (CGDD-SOeS, 2010).

Here symmetric IOTs are used broken down into 60 branches/products, separating, for their different components (intermediate consumption, final demand), imported elements from those arising from domestic production (to date the most recent symmetric IOTs are for 2007). This separation allows for calculation of emissions associated with imports integrating available information specific to (groups of) countries of origin of French imports, proportional to their relative importance for each of the 60 branches of the economy considered. The origins of these (groups of) countries' own imports are not taken into account. Five European countries (Belgium, Germany, Italy, Spain and UK), accounting for 45% of the value of France's imports in 2007, are dealt with on the basis of their own data. Average EU-27 coefficients are applied to other European countries, excluding Russia. For other countries, EU-27 IOTs were combined with CO₂ intensities for production in branches specific to one of the countries in a region (e.g. South Africa for Africa; China for Asia, excluding Japan) or a country thought to be relevant (e.g. North America for Australia), with adjustment for CO₂ intensity of electricity when necessary. For the other two GHGs, the average EU-27 coefficients were adjusted in accordance with the CH₄ or N₂O intensity of the GDP of the countries in question. When coefficients for a year were missing, those for the closest year were substituted, adjusted on the basis of the evolution in the emissions intensity of the GDP.

For further information:

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