



Why did greenhouse gas emissions fall in the EU in 2008?

EEA analysis in brief

This paper briefly analyses the major factors that accounted for reduced greenhouse gas emissions in the EU-27 between 2007 and 2008. It does not aim at providing a fully-fledged statistical analysis of the quantitative effects of each factor. The paper commences with an overview of EU trends, followed by summaries of the contributions of individual Member States, greenhouse gas types and main sectors. It then reviews other explanatory factors such as population, economic output, energy and carbon intensity, and concludes with a brief overview of 2009 emissions from the EU Emissions Trading System.

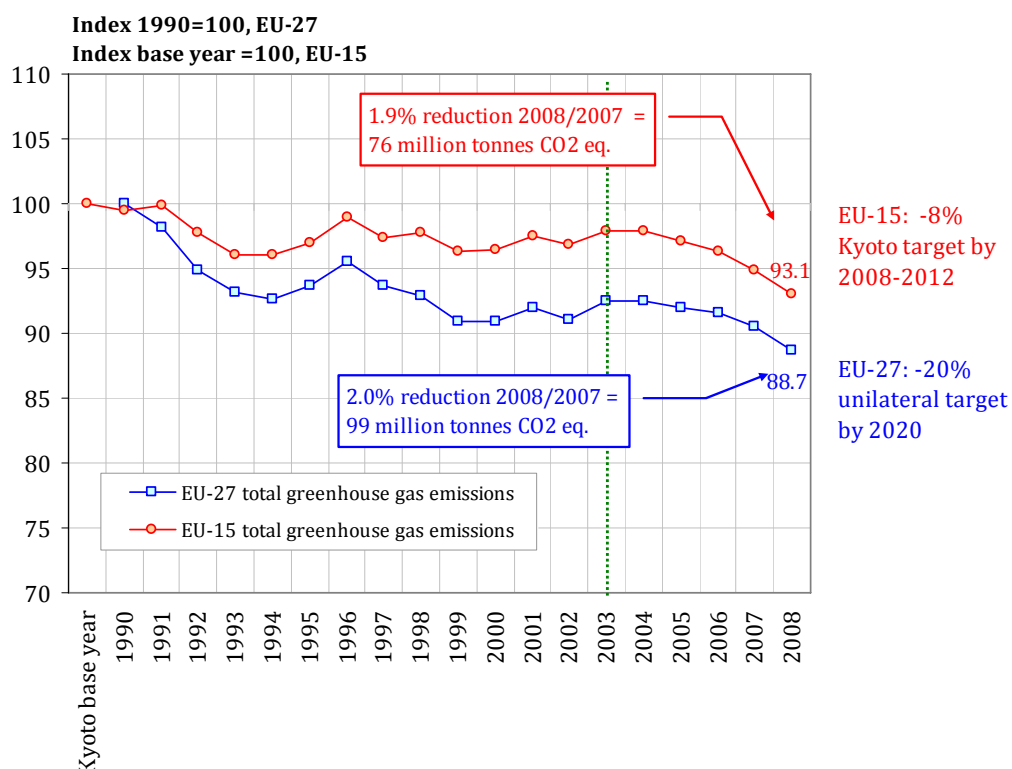
EU overview

Greenhouse gas emissions in the EU have fallen consistently since 2003. Figure 1 shows total greenhouse gas emissions in the period 1990–2008, both in the EU-15, as party to the Kyoto Protocol, and in the EU-27.

In 2008, EU-15 emissions were 6.9 % below the base year under the Kyoto Protocol. That constituted a net reduction of 295 million tonnes of CO₂ equivalents, of which 76 million occurred in 2008 alone.

Total greenhouse gas emissions in the EU-27 were 11.3 % below 1990 in 2008 ⁽¹⁾ — a net reduction of 627 million tonnes of CO₂ eq., of which 99 million took place in 2008.

Figure 1 EU greenhouse gas emissions relative to 1990/base year



Source: EEA.

⁽¹⁾ There is no Kyoto target for the EU-27 and therefore no applicable base year.



Overview by Member State

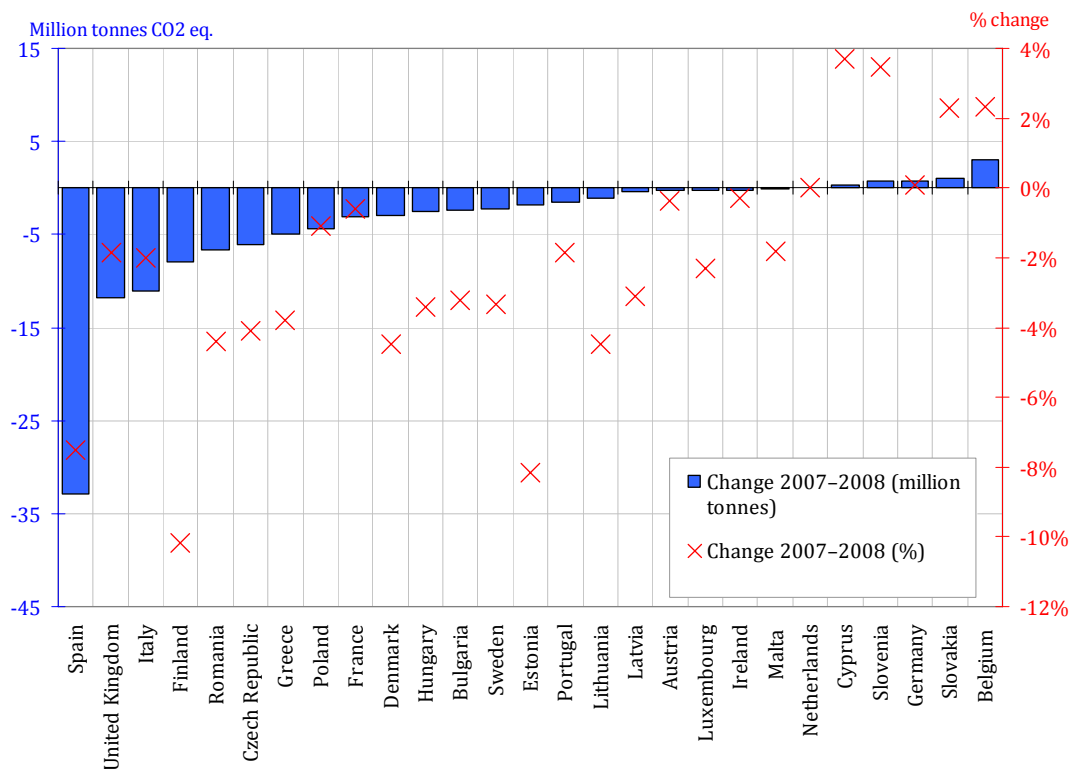
At the Member State level, almost all countries reduced greenhouse gas emissions in 2008 (Figure 2). Spain’s emissions fell by 7.5 % in 2008 alone, accounting for about one-third of the net EU-27 reduction.

Spain’s emissions reduction was largely due to using less coal for electricity generation and more gas and renewables such as wind, photovoltaics and biomass. Nuclear electricity production also increased in 2008. Transformation efficiency at conventional thermal stations also improved significantly. Equally, the rapid deceleration of economic activity during 2008 played a role. Emissions from road transport fell in Spain for the first time in 18 years. Contrastingly, between 1990 and 2007 Spain alone accounted for 25 % of the increase in EU-27 CO₂ emissions from road transport.

In Spain, emissions from gasoline have declined steadily since 1990 because of the popularity of diesel-powered passenger cars. This and the strong increase in freight transport led to a surge in diesel consumption between 1990 and 2007. Sales of diesel for road transport fell in 2008, partly because the economic downturn in the second half of the year reduced demand for freight transport.

Finland realised the highest relative reduction in emissions in 2008. This was mainly the result of using less coal and peat for heat and electricity generation and more woody biomass and hydro power.

Figure 2 Greenhouse gas emissions by EU Member State



Source: EEA.

Overview by greenhouse gas type

Of the Kyoto greenhouse gases, CO₂ accounted for the largest reduction in emissions in 2008 (Figure 3). This was mainly due to slower economic growth, improved energy efficiency, reduced use of coal and greater use of gas and renewables.

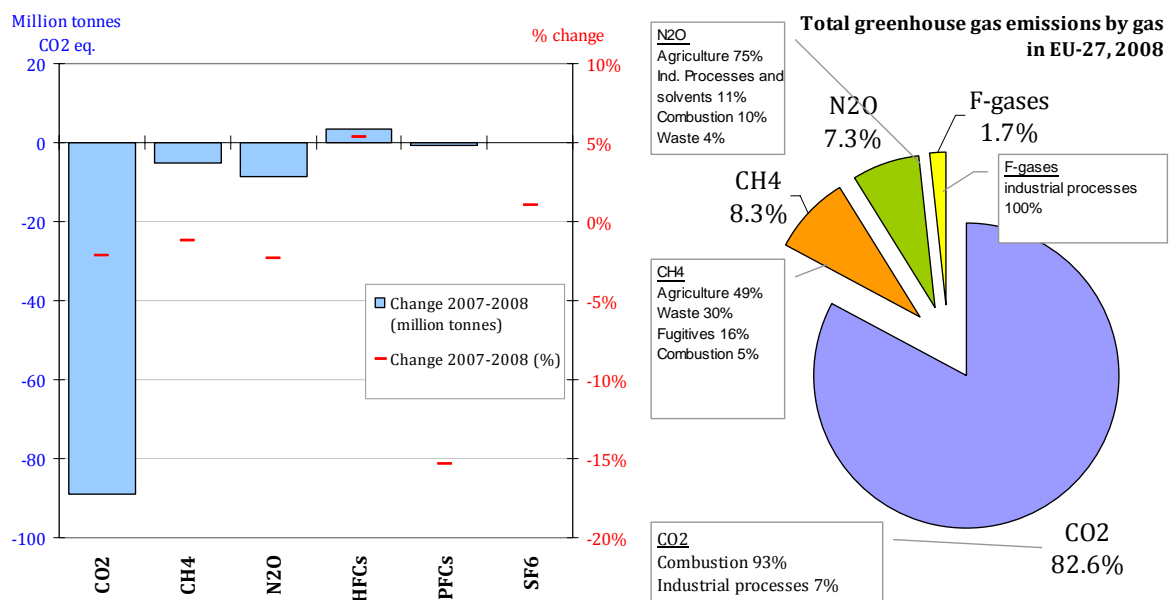


In 2008, almost 83 % of all EU greenhouse gas emissions were CO₂ related. About 93 % of the CO₂ released to the atmosphere stemmed from combusting fossil fuels and the remaining 7 % from industrial processes. Emissions also declined for methane (which accounted for 8.3 % of total greenhouse gas emissions in 2008) and nitrous oxide (7.3 % of the total).

The fall in methane emissions in the period 1990–2008 resulted from lower fugitive emissions from coal mining and post-mining activities, and lower emissions from managed waste disposal on land. Methane from enteric fermentation in the agricultural sector also fell significantly, partly due to reduced livestock numbers but also due to changes in the agricultural management of organic manures. Nitrous oxide emissions also fell because of lower emissions from agricultural soils.

HFCs from industrial processes were the only group of greenhouse gases that increased in 2008, continuing the long trend observed since 1990. HFCs are used in producing cooling devices such as air conditioning and refrigeration. The increase is consistent with both warmer climatic conditions in Europe and higher comfort standards.

Figure 3 Greenhouse gas emissions by main gas in the EU-27



Source: EEA.

Overview by main sector

All the main sectors reduced their greenhouse gas emissions in 2008 except households and services ⁽²⁾ (Figure 4). Based on energy balances, final energy consumption in households increased significantly in 2008. At least two reasons account for this. First, households used more fuel for heating purposes, partly due to lower temperatures than in 2007. This is confirmed by the increase in the number of ‘heating degree days’ (an indicator of household demand for heating) compared to 2007.

⁽²⁾ This includes emissions from fuel combustion in commercial and institutional buildings, all emissions from fuel combustion in households; and a smaller source category covering fuel combustion emissions from agriculture, forestry and fishing. It should be noted that greenhouse gas emissions from households and services do not include indirect emissions. That is, greenhouse gas emissions resulting from the production of heat and electricity supplied to households and services are included under public electricity and heat production. Direct combustion emissions from households are outside the EU ETS.



Viewed over a longer period, however, emission reductions from households (and services) are one of the key reasons for lower greenhouse gas emissions in the EU. One driver has been generally warmer winters in Europe and, correspondingly, less demand for heating. Even though 2008 was colder than 2007, it was still among the warmest years since 1850 and the number of heating degree days was still below the average for 1980–2004.

The second reason for increased household and services emissions in 2008, compared to 2007, was refilling of fuel stocks. Fuel purchases were avoided in 2007 because of the high prices, particularly in Germany.

In the energy production sector, emissions declined by around 5 % in 2008. This was largely due to an 8 % reduction in the use of coal for heat and power generation in the EU-27 partly due to a fall in the relative price of gas and high carbon prices.

Energy prices have increased very rapidly in the past decade, outpacing prices for other goods and the gross disposable income of households. Prices in the EU-27 increased by about 23 % between 2000 and 2008 (according to the Harmonised Consumer Price Inflation measure), whereas energy prices rose by 56 %. In 2008, the real end-use price for coal surged and gas prices become relatively more attractive, partly favouring a switch to less polluting gas.

Lower coal use could also be linked to the price of carbon in the EU ETS which reached €30 per tonne at the end of June 2008, before falling to its current level of about €15 per tonne by the end of 2008. In addition to the switch from coal to gas, there was a sharp 13 % increase in the use of biomass in conventional thermal stations ⁽³⁾.

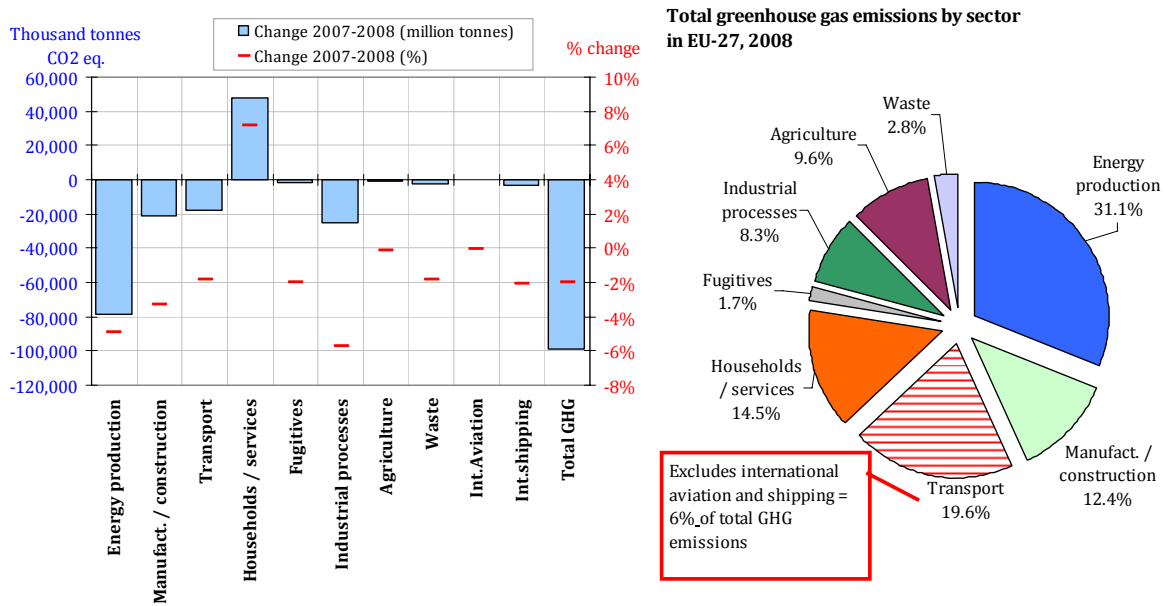
Emissions from manufacturing industries and construction, and industrial processes, declined by 4.3 % in the EU-27 in 2008, partly as a result of lower economic activity. GDP growth in the EU-27 fell from 2.9 % in 2007 to 0.7 % in 2008. Although still positive for the year as a whole, GDP contracted in the second half of 2008 and during 2009. The 2008 energy balances and the verified 2008 emissions from the EU ETS published last year also confirm lower final energy consumption and lower emissions in most industrial sectors.

Road transport emissions fell by almost 3 % in 2008 in the context of very high international oil prices. Gasoline emissions continued their downward trend, whereas diesel emissions fell for the first time since 1990. Diesel price inflation outpaced the rapidly increasing gasoline prices. Along with the start of economic recession in the second half of 2008, this may have triggered a fall in freight transport demand, particularly in Spain. To a lesser extent, increased use of biofuels may also have contributed to the lower road transport emissions in 2008.

⁽³⁾ CO₂ emissions from the combustion of biomass (including biofuels in transport) are considered neutral for IPCC/UNFCCC reporting purposes.



Figure 4 Greenhouse gas emissions by main sector in EU-27



Source: EEA.

Other factors explaining the change in greenhouse gas emissions

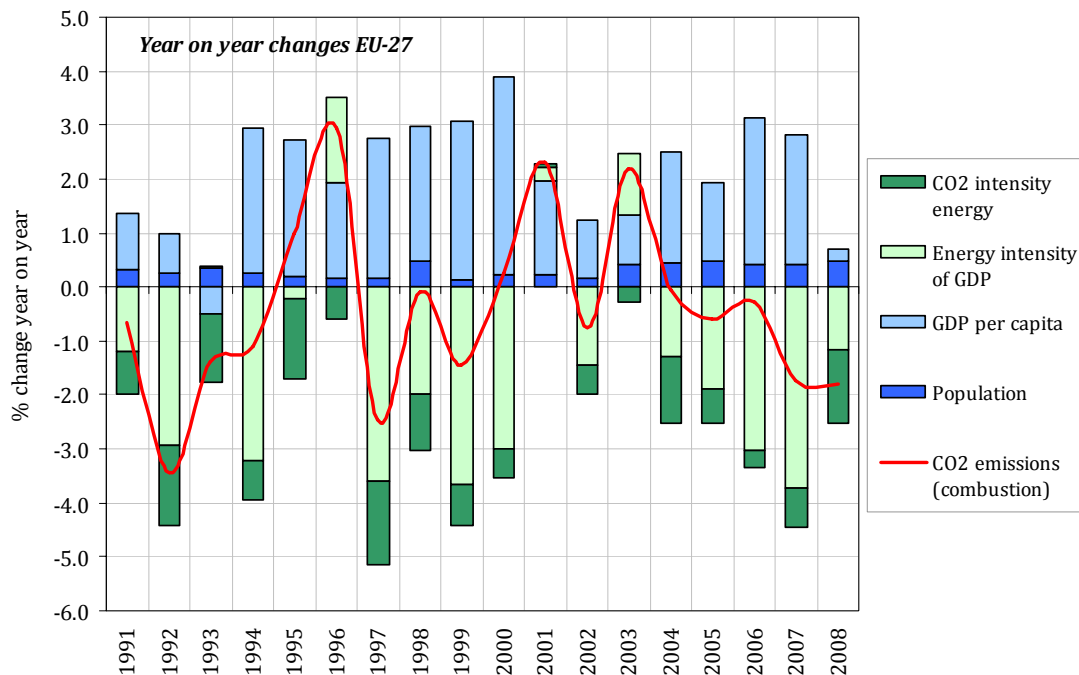
Energy combustion (i.e. the production and consumption of energy by all sectors, including transport) accounts for much of the reduction in EU-27 greenhouse gas emissions in 2008. Figure 5 shows a breakdown of the factors that help explain or illustrate year-on-year changes in CO₂ emissions from the combustion of fossil fuels.

CO₂ emissions from energy combustion fell by 1.8 % (70 million tonnes) in the EU-27 in 2008, while GDP increased by 0.7 % and the population grew by 0.5 % (2.3 million people). A growing population and GDP generally contribute to higher CO₂ emissions.

The remaining two factors, i.e. the energy intensity and carbon intensity of the economy, played a bigger role in explaining the change in CO₂ emissions in 2008. Energy intensity fell in 2008, as in previous years, mainly due to a contraction in primary energy consumption. Carbon intensity also declined as a result of the switch to less polluting fuels. These two factors are further analysed below.



Figure 5 Explanatory factors for CO₂ emissions from energy combustion in EU-27, 1990–2008

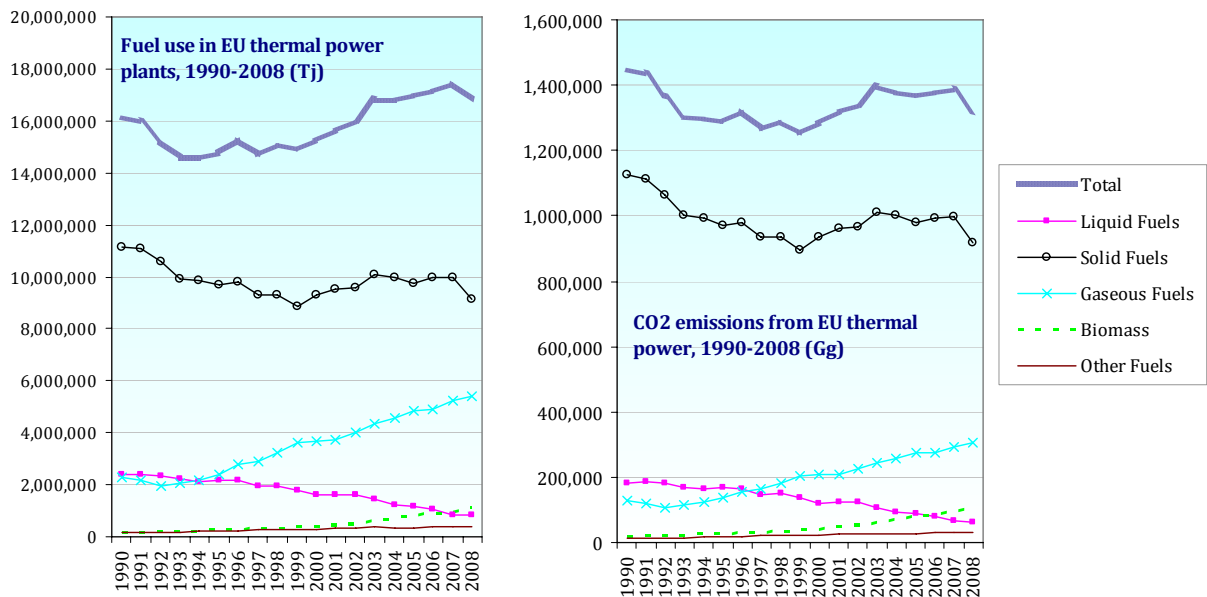


Note: The chart shows the estimated contributions of the various factors that have affected CO₂ emissions from energy production and consumption in the EU-27. This approach is often used to portray the primary forces driving emissions. The explanatory factors should not be seen as fundamental factors in themselves nor should they be seen as independent of each other.

Source: EEA (greenhouse gas emissions); Eurostat (population and energy balances); European Commission Ameco database (GDP).

Carbon intensity can be defined as the amount of CO₂ released to the atmosphere per unit of primary energy consumed. At EU level, the sector contributing most to the net emission reduction in 2008 was the production of heat and electricity. Less coal, more gas and more combustible renewables (i.e. biomass) explain why this sector emitted 73 million tonnes of CO₂ less than in 2007 (Figure 6).

Figure 6 also shows that the fall in CO₂ emissions from EU-27 public electricity and heat production in 2008 was greater than the drop in fuel use in the sector. The implied emission factor for coal and lignite in the EU-27 was on average 100 tonnes of CO₂ per terajoule in 2008. The emission factor for liquid fuels was 76 t CO₂ / Tj and for gaseous fuels it was 57 t CO₂ / Tj. This means that coal releases around 75 % more CO₂ than gas to deliver the same amount of energy. Therefore, a higher reduction in coal use compared to gas has led to a relatively stronger CO₂ emission reduction per unit of energy generated. The steady increase in biomass use is also providing a substitute for fossil fuels.

Figure 6 Fuel use and CO₂ emissions from electricity and heat production in the EU-27

Source: EEA

Other factors clearly contributed to the decline in greenhouse gas emissions in the EU-27. These factors are outside formal greenhouse gas reporting as they are not direct sources of emissions. Eurostat's 2008 energy balances confirm the decline of primary consumption of solid fuels and the increase in natural gas. The balances also show a very strong increase in the amount of renewable energy, particularly of wind and hydro for electricity generation. Nuclear electricity production also increased in 2008 (Figure 7).

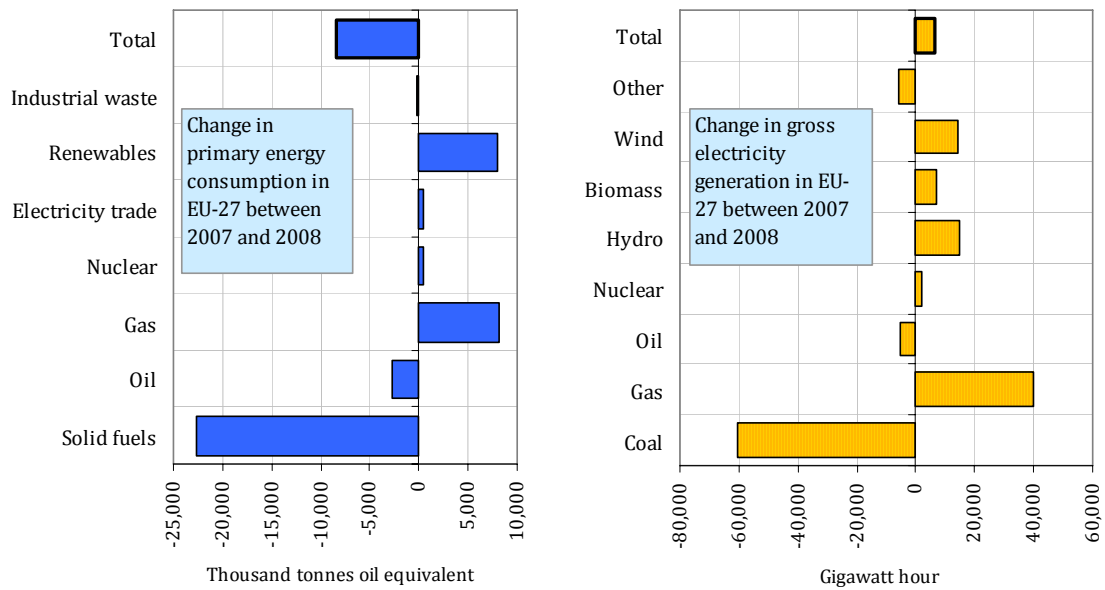
Energy intensity can be defined as the amount of primary energy consumed within a country relative to its gross domestic product. The contribution of energy intensity to lower CO₂ emissions from energy combustion in 2008 was lower than in previous years but still important for explaining the fall in CO₂ emissions.

In 2008, primary energy consumption fell in the EU-27, whereas final energy consumption available to the end-use sectors increased ⁽⁴⁾. At least two factors account for these trends. First, there was a strong increase in renewables, some of which can produce electricity by means of mechanical energy without any combustion. The avoided transformation losses in thermal power stations partly explain why higher energy demand was met using less primary energy. Second, there was also a 1 percentage point increase in the transformation efficiency in conventional thermal power stations in the EU, to about 48 % in 2008. This implies less input of primary energy per output of useful energy. The increased use of electricity from combined heat and power (i.e. cogeneration) and recovery of excess heat has also contributed to higher energy efficiencies in the EU.

⁽⁴⁾ It is worth noting that not all primary energy is available to the end users of energy such as industry, transport, households, services and agriculture. This is because various losses occur within the energy system to transform primary energy (e.g. coal and lignite, natural gas and crude oil) into useful energy (i.e. heat, electricity, gasoline etc). In addition to transformation losses there are additional losses related to the distribution of the energy, and the consumption of energy by the energy-production sector itself. In the case of non-combustible renewables such as wind, hydro (without pumping) or photovoltaics, mechanical energy is used to transform primary energy into useful energy.



Figure 7 Gross electricity and primary energy consumption by main fuel in EU-27, change 2007–2008



Source: Eurostat energy balances

International transport emissions

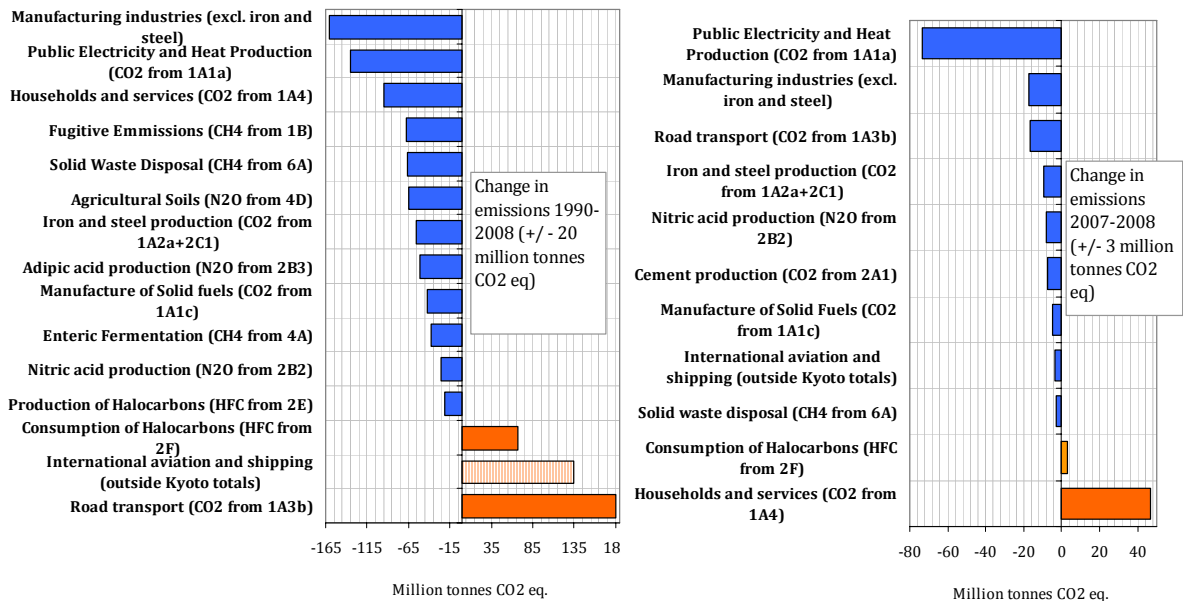
Emissions from international aviation and maritime transport are not relevant for Kyoto compliance. They are reported in the greenhouse gas inventory as Memorandum Items. They are shown in Figure 8 because of their significant contribution to greenhouse gas emissions in the EU.

In 2008, emissions from international aviation and maritime transport fell for the first time since 1992. International shipping was primarily responsible, partly reflecting the start of the economic recession. Since 1990, however, international transport emissions have grown very rapidly and have reached about 6 % of total greenhouse gas emissions in the EU.

The final charts show the most influential key emission source categories in the EU in the periods 1990–2008 and 2007–2008.



Figure 8 Overview of the EU-27 source categories showing the largest increases and decreases in the periods 1990–2008 and 2007–2008



Source: EEA

Verified EU ETS emissions for 2009

Verified data from the EU ETS for 2009 show greenhouse gas emissions fell by 11.6 % compared to 2008. This sharp decrease in emissions can be attributed to lower economic activity because of the recession and to lower gas prices relative to coal. The 2009 economic recession is also expected to hit other sectors outside the EU-ETS, including transport.

The EEA will publish early EU-27 greenhouse gas estimates for 2009 by September 2010 — one year ahead of the official EU greenhouse gas inventory submitted to the UNFCCC.

For more information

Annual European Union greenhouse gas inventory 1990–2008 and inventory report 2010

<http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2010/>

EEA GHG data viewer

<http://dataservice.eea.europa.eu/PivotApp/pivot.aspx?pivotid=475>

EEA EU ETS data viewer

<http://dataservice.eea.europa.eu/PivotApp/pivot.aspx?pivotid=473>