

## CO<sub>2</sub> EMISSIONS

### CO<sub>2</sub> Accounts

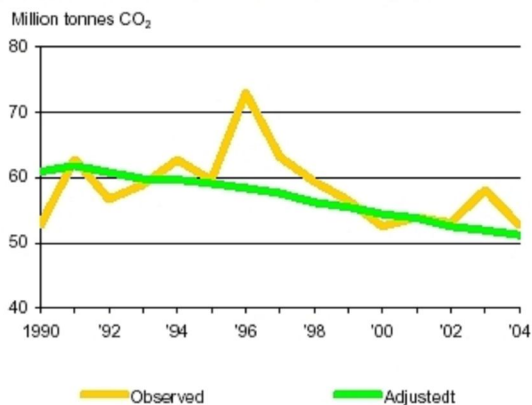
CO<sub>2</sub> accounts are used e.g. to monitor the development in relation to the international goals for emissions and absorption of greenhouse gases. Denmark's international environmental commitment means that in accordance with the EU's allocation of the total EU reduction commitment under the ratification of the Kyoto Protocol, Denmark must reduce average emissions of greenhouse gases in the period 2008-2012 by 21 per cent in relation to the base year 1990/95. However, the EU has given assurance that when Denmark's levels for greenhouse gas emissions are set (measured in tonnes) consideration will be granted for the adjusted estimate for emissions in 1990.

The level of total emissions of greenhouse gases in the base year was 75.9 million tonnes CO<sub>2</sub> equivalents when CO<sub>2</sub> from energy use is adjusted for net exports of electricity. In 2003, total emissions (without adjustments) were 73.9 million tonnes CO<sub>2</sub> equivalents, which is 6.2 per cent above base-year emissions at 69.6 million tonnes CO<sub>2</sub> equivalents. Of the relatively large emissions in 2003, nearly 7 million tonnes CO<sub>2</sub> are due to electricity generated for export.

This commitment partly includes CO<sub>2</sub> emissions from energy use (excluding emissions from international air travel, cross-border trade in petrol and diesel), CO<sub>2</sub> emissions from other sources (flaring of gas in the North Sea, plastic in wastes incineration and in certain industrial processes). Emissions of five other greenhouse gases are also included in the commitment: methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>), which are converted to CO<sub>2</sub> equivalents. Finally, CO<sub>2</sub> uptake, following from e.g. afforestation, is deducted from the commitment. On this background, Denmark's total net emissions of greenhouse gases are calculated in CO<sub>2</sub> equivalents.

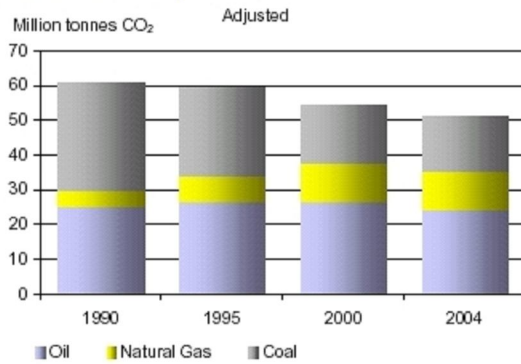
*Source: The Danish Environmental Protection Agency and The National Environmental Research Institute (an account of Denmark's total emissions of greenhouse gases in 2004 will not be available until the beginning of 2006).*

### CO<sub>2</sub> Emissions, Observed and Adjusted



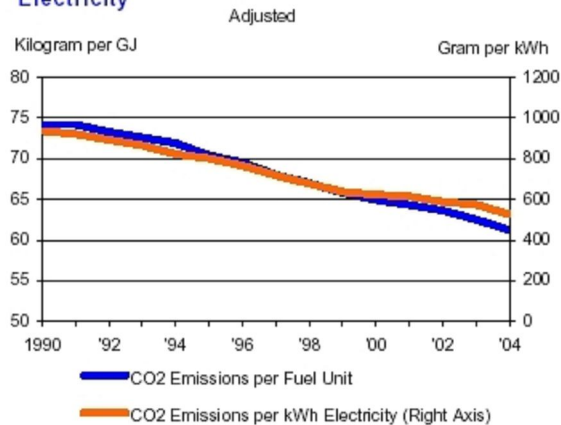
- The Danish Energy Authority calculates both observed CO<sub>2</sub> emissions and adjusted CO<sub>2</sub> emissions, which takes annual temperature variations and foreign trade in electricity into account, cf. the statement of gross energy consumption. The purpose of the adjusted calculations is to illustrate the trends underlying the development.
- In 2004, observed CO<sub>2</sub> emissions fell by 9.4 percent relative to 2003. This fall is primarily due to the fact that electricity production fell significantly in 2004. Warmer weather in 2004 than the year before, also contributed to the fall in emissions.
- Observed CO<sub>2</sub> emissions are unchanged compared with 1990. In 1990, Denmark had a large net import of electricity and very warm weather.
- In 2004, adjusted CO<sub>2</sub> emissions were 1.5 per cent lower than the year before. Relative to 1990, this means a fall of 15.9 per cent.

### CO<sub>2</sub> Emissions by Fuels



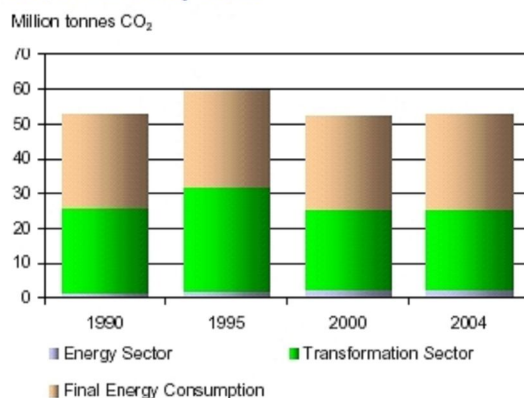
- Since 1990, there has been a significant shift in energy consumption analysed by fuels. Consumption of natural gas and renewable energy etc. has increased at the expense of coal.
- This shift in fuels for energy has led to reduced CO<sub>2</sub> emissions. Thus because burning coal leads to greater CO<sub>2</sub> emissions than burning natural gas, there has been a reduction in emissions even though gross energy consumption has gone up by 1.9 per cent since 1990.

### CO<sub>2</sub> Emissions per Fuel Unit and per kWh of Electricity



- Gross energy consumption has been more or less constant over the last 10 years; however, the fuels used have changed considerably. The shift from coal to natural gas and renewable energy etc. has meant that, year by year, less CO<sub>2</sub> is linked to each unit of fuel consumed. Thus, in 2004 each GJ of adjusted gross energy consumption was linked to 61.2 kg CO<sub>2</sub>, against 74.2 kg in 1990. This corresponds to a 17.5 per cent reduction.
- One kWh of electricity sold in Denmark caused 526 grams of CO<sub>2</sub> emissions in 2004. In 1990, CO<sub>2</sub> emissions were 937 grams per kWh of electricity sold. This corresponds to a reduction of almost 44 per cent. This large reduction is attributable to fuel conversions in electricity production and the growing significance of CHP production and wind power.

### CO<sub>2</sub> Emissions by Sector

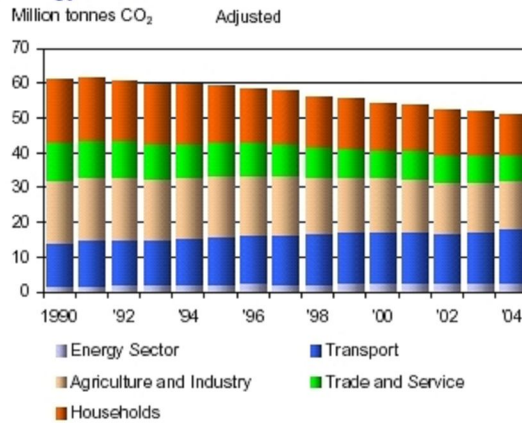


- The energy system is divided into three sectors: *energy sector* (extraction and refining), *transformation sector* (production of electricity, district heating, and town gas), and *final*

consumption (transport and consumption by households and industries).

- Of the total observed CO<sub>2</sub> emissions in 1990 of 52.7 million tonnes, 24.8 million tonnes came from the transformation sector, and 26.5 million tonnes from final consumption, while the energy sector emitted 1.4 million tonnes.
- The total observed CO<sub>2</sub> emissions were unchanged in 2004 at 52.7 million tonnes. In the transformation sector, CO<sub>2</sub> emissions fell to 23.3 million tonnes, even though 2004 had net exports of electricity, while in 1990 there were significant net imports of electricity. CO<sub>2</sub> emissions from final consumption rose to 27.0 million tonnes, while in the energy sector emissions rose to 2.4 million tonnes.

### CO<sub>2</sub> Emissions in Final Energy Consumption incl. Energy Sector



- Analysing CO<sub>2</sub> emissions from production of electricity, district heating, and town gas by end consumers, we get a picture of how total emissions of CO<sub>2</sub> can be allocated to the energy sector, transport, industries and households.
- In 2004, transport and the agriculture and industry sector were responsible for the largest shares of total CO<sub>2</sub> emissions, with 30.1 per cent and 27.2 per cent respectively. Households and the trade and service sector accounted for 22.9 per cent and 14.6 per cent respectively, while the energy sector accounted for 5.2 per cent of CO<sub>2</sub> emissions.
- CO<sub>2</sub> emissions from transport increased by 18.2 per cent relative to 1990. However, for industries and households there have been significant decreases. In the agriculture and industry sector and the trade and service sector, CO<sub>2</sub> emissions fell by 23.7 per cent and 29.7 per cent respectively, while emissions from households fell by almost 35.0 per cent.

[Front page](#) - [Table of Contents](#) - [Top of page](#) - [Search](#) - [Previous](#) - [Next](#)

This page forms part of the publication 'Energy Statistics 2004' as chapter 6 of 7  
Version 1. 11-01-2006

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