

Recent trends in world CO₂ emissions from fuel combustion

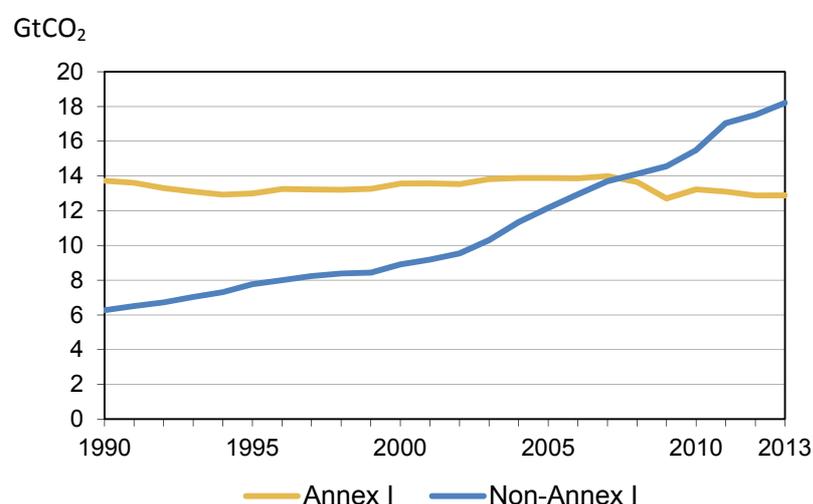
The importance of energy emissions

Among the many human activities that produce greenhouse gases (GHGs), the energy sector represents nearly two-thirds of total emissions, with the share higher in developed countries, where per-capita energy use is greater; within Annex I countries,¹ more than three-quarters of GHG emissions derive from the energy sector.

In 2013, global CO₂ emissions from fuel combustion reached 32.2 gigatonnes (Gt), an increase of 2.2% over 2012 levels. This was higher growth than in 2012 (0.6%), but lower than the average annual growth rate since 2000 (2.5%).

As in recent years, global CO₂ emissions growth in 2013 was driven by non-Annex I countries (Figure 1), where emissions increased (4.0%) at a higher rate than in 2012 (2.8%), while emissions in Annex I countries were flat (0.0%), with lower emissions from oil (-1.1%) balanced by higher emissions from natural gas (1.4%).

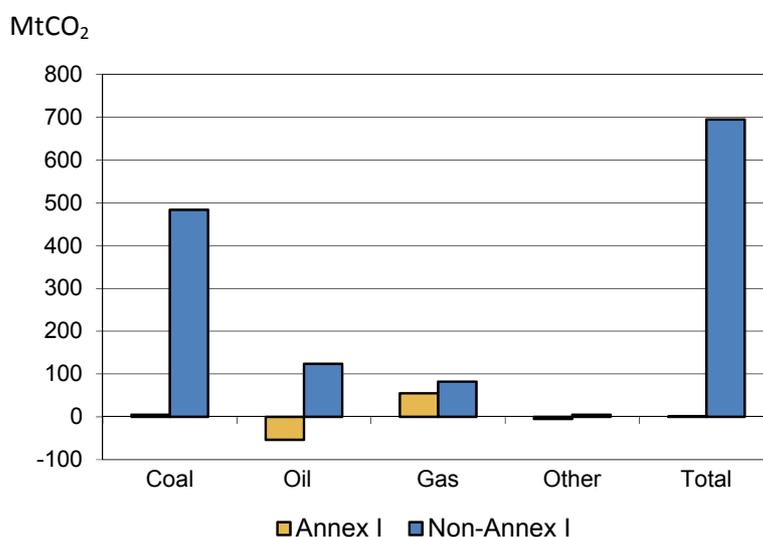
Figure 1. Regional CO₂ emissions trends (1990-2013)



1. The Annex I Parties to the 1992 [UN Framework Convention on Climate Change](#) (UNFCCC) are: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, European Economic Community, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom and United States.

In absolute terms, global CO₂ emissions increased by 0.7 GtCO₂ in 2013, driven primarily by increased emissions from coal and (to a lesser extent) oil in non-Annex I countries (Figure 2).

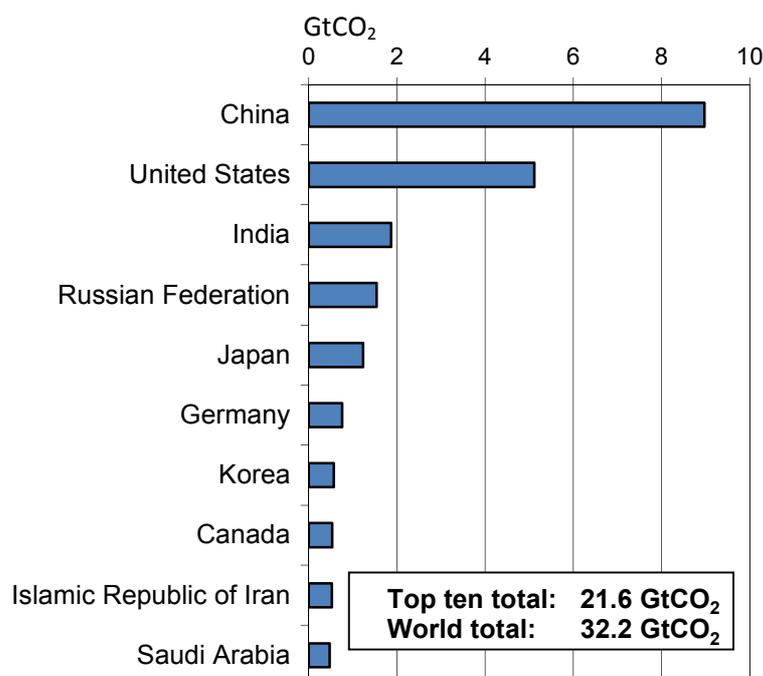
Figure 2. Change in CO₂ emissions (2012-13)



Emissions by country

Two-thirds of global emissions for 2013 originated from just ten countries, with China (28%) and the United States (16%) combined accounting for 14.1 GtCO₂. The top ten emitting countries include five Annex I countries and five non-Annex I countries (Figure 3).

Figure 3. Top ten emitting countries in 2013



As different regions and countries have contrasting economic and social structures, the picture changes significantly when moving from absolute emissions to indicators such as emissions per capita or per unit of gross domestic product (GDP).

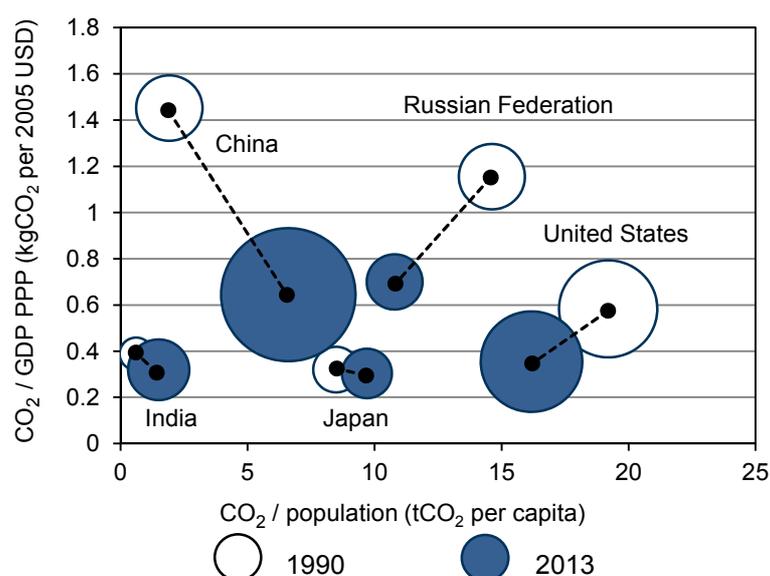
Emissions indicators

The range of per-capita emissions levels across the world is very large, highlighting wide divergences in how different countries and regions use energy. For example, among the top five emitters, 2013 levels of per-capita emissions range from 1.5 tCO₂ for India and 6.6 tCO₂ for China to 16.2 tCO₂ for the United States. But this range has narrowed over time (Figure 4).

Per-capita emissions, which increased by 16% globally from 1990 through 2013, showed contrasting trends among the top five emitting countries. China more than tripled its per-capita emissions, and India more than doubled its (as did some other rapidly expanding economies), both accompanied by strong increases in per-capita GDP. Conversely, per-capita emissions decreased significantly in both the Russian Federation (-26%) and the United States (-16%), although following very different patterns. Values for Russia dramatically dropped in the early 1990s, and have since slowly increased, while values for the United States began to decrease in the mid-to-late 2000s after remaining stable for many years.

Emissions per unit of GDP also vary across regions. However, the five largest emitters have shown reductions from 1990 through 2013, in line with the global trend (-28%). This decreasing trend was most pronounced for China and the Russian Federation, whose 1990 levels were significantly higher than those of other countries, and for the United States.

Figure 4. Trends in CO₂ emissions intensities for the top five emitting countries*



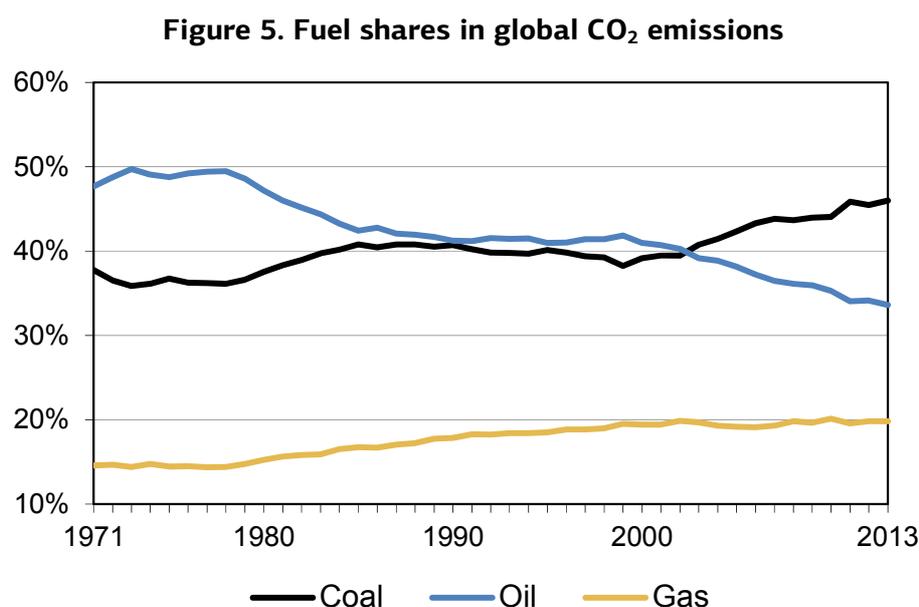
* The size of the circle represents the total CO₂ emissions from the country in that year.

Emissions by fuel

Coal represented 29% of global total primary energy supply (TPES) in 2013. But it accounted for 46% of CO₂ emissions due to its high carbon content per unit of energy released, and to the fact that 19% of global TPES derives from carbon-neutral sources. Compared with gas, coal is nearly twice as emissions-intensive on average.²

From the late 1980s until the early 2000s, coal and oil were each responsible for approximately 40% of global CO₂ emissions from fuel combustion, with emissions from oil generally exceeding those from coal by a few percentage points. However, trends differed at a regional level. In Annex I countries, oil was the largest source of fuel combustion emissions, whereas in non-Annex I countries, emissions from coal ranked highest.

Since 2002, these shares have changed significantly. Due to the increasing influence of non-Annex I countries in energy consumption, coal has increased its share of CO₂ emissions from 40% in 2002 to 46% in 2013, while oil has decreased from 39% to 33%, with natural gas staying approximately stable at 20% (Figure 5).

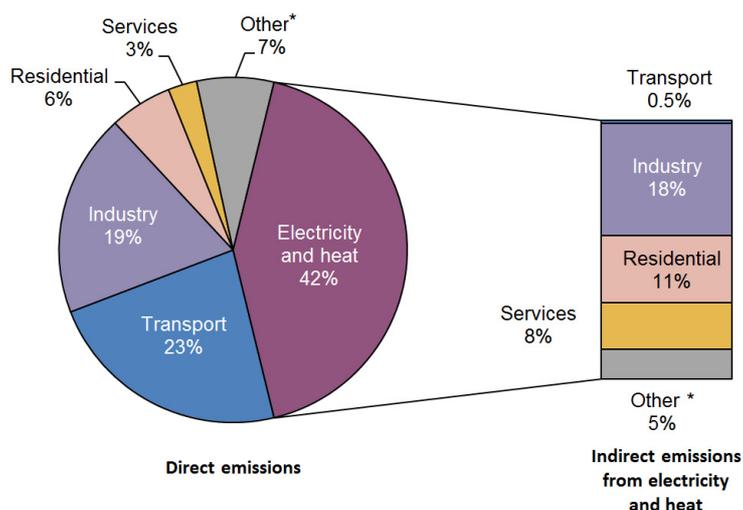


Emissions by sector

In 2013, two sectors produced nearly two-thirds of global CO₂ emissions: electricity and heat generation, which accounted for 42%, and transport, which accounted for 23% (Figure 6).

2. Default carbon emission factors from the 2006 IPCC Guidelines: 15.3 tC/TJ for gas, 15.7 to 26.6 tC/TJ for oil products, 25.8 to 29.1 tC/TJ for primary coals.

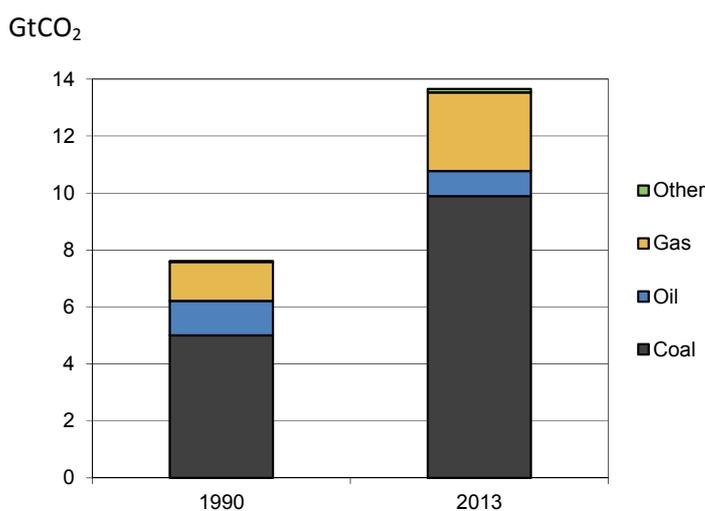
Figure 6. World CO₂ emissions by sector in 2013



* Other includes sectors not specified elsewhere *e.g.* agriculture/forestry, fishing, and energy industries other than electricity/heat generation.

From 2012 to 2013, CO₂ emissions from electricity and heat generation rose by 2.1%, similar to the increase in total emissions. Although recent years have seen an increasing share of electricity output from renewables (22% in 2013, compared with 19% in 2009), generation of electricity worldwide still relies heavily on coal. The share of electricity and heat emissions from coal has increased over time, from 66% in 1990 to 72% in 2013 (Figure 7).

Figure 7. CO₂ emissions from electricity and heat generation



For transport, growth in 2013 (1.8%) was driven mainly by growth in road vehicle emissions (2.1%), which account for three-quarters of CO₂ emissions from the transport sector.

Source: IEA [CO₂ Emissions from Fuel Combustion, 2015 edition](#).

Further information on CO₂ emissions statistics is available [here](#).

In addition, a wide range of free energy data can be accessed at the [IEA statistics webpages](#).

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