

# Understanding Changes in UK CO<sub>2</sub> emissions 1992- 2004: A structural decomposition approach

## Executive Summary

A summary by the Department for Environment, Food and Rural Affairs (Defra) of a research report written for Defra by the Stockholm Environment Institute and the University of Minnesota

# **Understanding Changes in UK CO<sub>2</sub> Emissions 1992-2004: A Structural Decomposition Approach**

**Final Report to the Department for Environment, Food and Rural Affairs**

Project Ref.: EV0423

## **Original Study by:**

Minx, J.C., Baiocchi, G., Wiedmann, T. and Barrett, J., 2009, *Understanding Changes in UK CO<sub>2</sub> Emissions 1992-2004: A Structural Decomposition Analysis*, Report to the UK Department for Environment, Food and Rural Affairs by Stockholm Environment Institute at the University of York and the University of Durham, DEFRA, London, UK.

Dr Jan Minx, Dr Thomas Wiedmann, Dr John Barrett  
Stockholm Environment Institute, University of York

Dr Giovanni Baiocchi – Durham University, Durham  
Business School

<p>This report draws upon subsequent analysis by Defra and upon the conclusions set out in the original report. The views expressed do not necessarily represent those of Defra as a whole.</p>
---

## Executive Summary

---

In July 2008, Defra published a report prepared by the Stockholm Environment Institute (SEI) and the University of Sydney on the carbon dioxide (CO<sub>2</sub>) emissions embedded in UK imports. The report and a subsequent journal paper (Wiedmann et al., 2009) looked at developments in UK CO<sub>2</sub> emissions from three different perspectives:

- *Territorial emissions* refer to emissions from UK territory as reported under the United Nations Framework Convention on Climate Change (UNFCCC);
- *Producer emissions* differ from territorial emissions in that they include emissions from international aviation and shipping and some activities of UK citizens abroad and exclude the corresponding activities of non-UK citizens in the UK;
- *Consumer emissions* include all emissions released globally in the production of goods and services consumed by UK domestic final consumption. Therefore, they differ from producer emissions by including import related emissions and excluding export related emissions.

The report highlighted that, whilst the UK's *territorial* CO<sub>2</sub> emissions have decreased between 1992 and 2004, consumer emissions have increased considerably over the same time period.

While this earlier work described the general trends in the UK emission accounts, it was outside the scope of the project to analyse the underlying driving forces. Such an analysis is the focus of this project.

Structural decomposition analysis (SDA) is a technique frequently applied to quantify the impact of drivers behind changes in CO<sub>2</sub> emissions over time. Examples for such drivers are changes in energy efficiency, the supply chain or production structure, consumer demand and population size. In this study we apply SDA to analyse developments in UK producer and consumer emissions. Direct CO<sub>2</sub> emissions from households are a component of both and analysed separately.

UK producer CO<sub>2</sub> emissions (those generated by the production activities of the UK economy, in this context excluding direct CO<sub>2</sub> emissions from households) increased

by 4 million tonnes (Mt) or 2% between 1992 and 2004, while the increased reliance on imports from other countries led to more substantial growth in consumer emissions (again excluding direct CO<sub>2</sub> emissions from households) of 69 Mt (12%) over the same period of time. Most of the increase in import-related emissions occurred in the “rest of the world” region including the emerging economies such as China, India or Brazil and other developing countries without binding emission targets under the Kyoto Protocol.

The overall increase in both indicators mainly resulted from CO<sub>2</sub> emission growth induced by rising levels of final consumption in the UK reflecting a sustained period of economic success. Changes in final consumption levels would by 2004 have caused an increase in annual CO<sub>2</sub> emissions of 203 Mt on a production basis, from a base of 474 Mt in 1992. In practice this increase was almost entirely offset by changes in other factors such as the carbon intensity of production, changes in the production structure and shifts in consumption towards less carbon intensive goods and services. The report shows that 30% of these offsetting reductions are attributable to the relocation of production abroad, whilst energy efficiency improvements and a switch to less carbon-intensive fuels such as natural gas accounted for 32% and 21% respectively. Figure 1 below summarises the main findings.

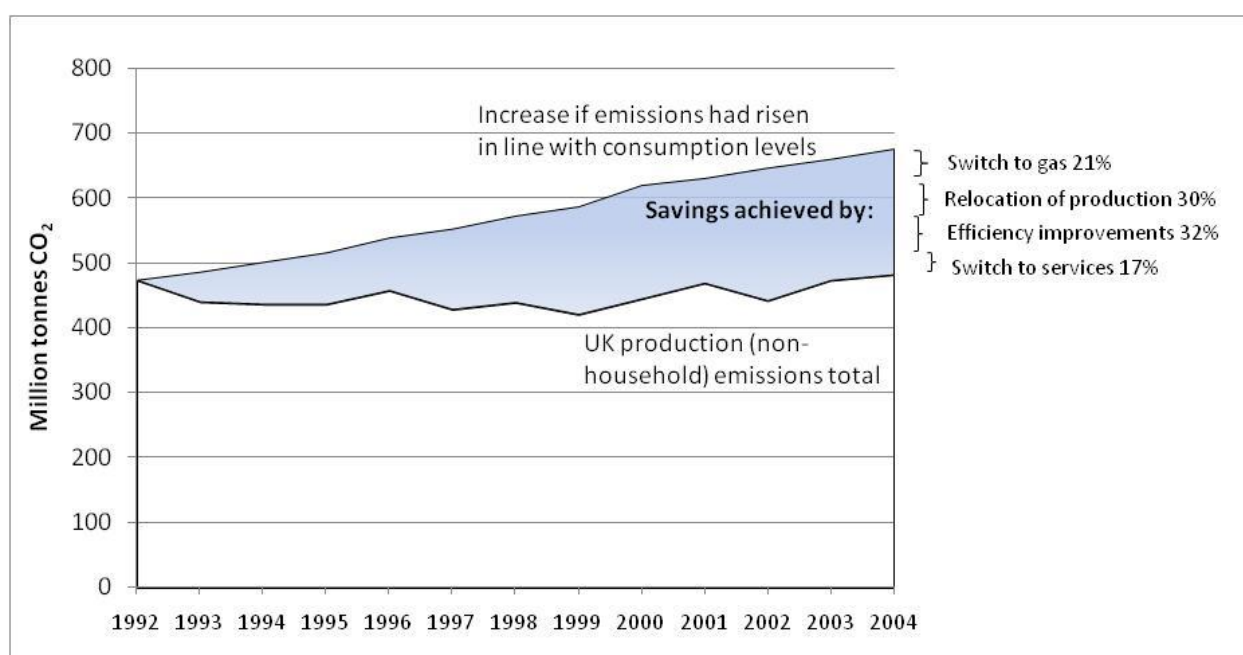


Figure 1: Savings in UK non-household CO<sub>2</sub> production emissions 1992 to 2004, achieved by relocation of production and other factors

Similarly, changes in final consumption levels would have generated an increase in annual UK consumer emissions of 249 Mt by 2004, from a base of 657 Mt in 1992. This figure includes emissions from the consumption of goods and services produced in the UK, from the consumption of imported products, and from emissions generated directly by households. However, while off-setting improvements in energy efficiency and changes to less carbon-intensive fuels in the global supply chain were still important, changes in the structure of the global supply chain were less significant, accounting for a reduction of only 11 Mt. Figure 2 shows the relative contributions of the different drivers.

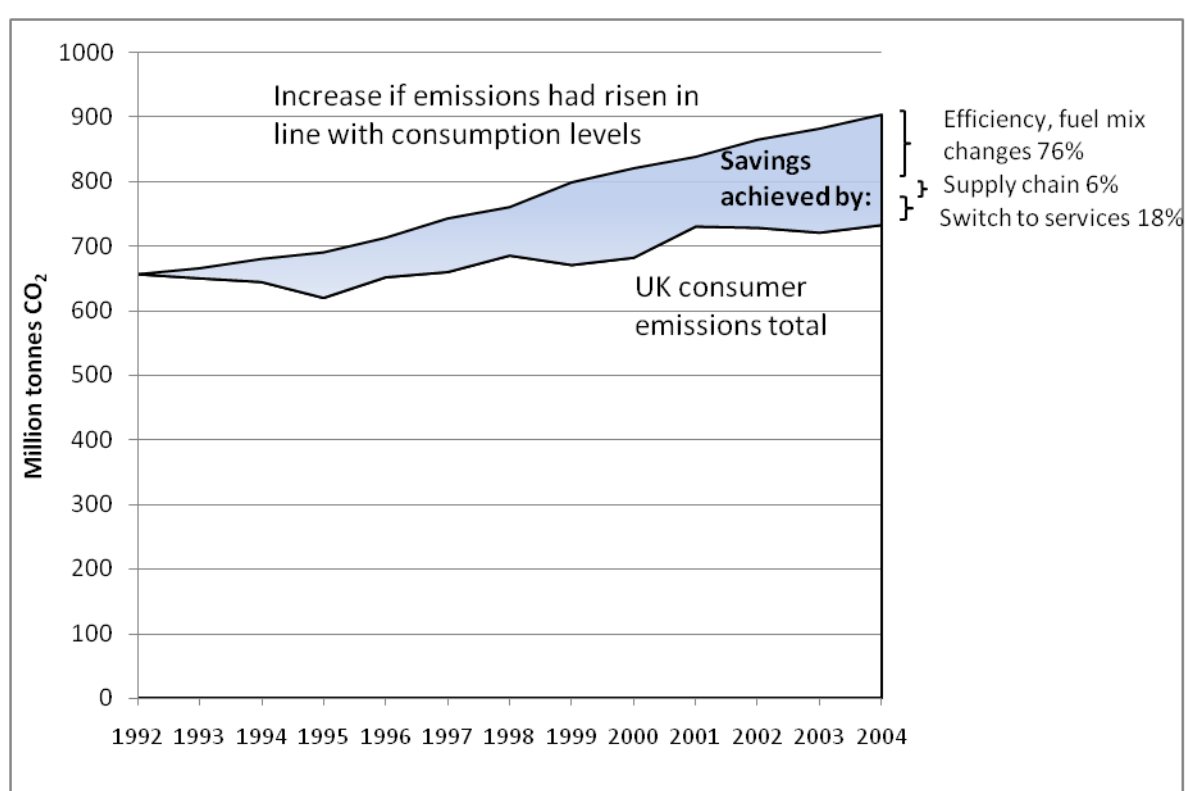


Figure 2: Savings in UK consumer CO<sub>2</sub> emissions 1992 to 2004 achieved by efficiency improvements and other factors

The report highlights that emission drivers can only be comprehensively understood if the UK is analysed in the context of the global economy. The systemic nature of structural change in the world economy implies that changes in one region are often directly related to changes in other regions. Structural change might therefore drive emission transfers between regions via international trade. For example, the reductions in producer emissions are closely related to the UK's increasing specialisation in service provision, with physical goods increasingly imported from

other countries such as China. However, while non-transport services appear “climate friendly” if the analysis is restricted to direct CO<sub>2</sub> emission contributions only, they become a major driver of the increase in consumer CO<sub>2</sub> emissions in the UK once all indirect emissions in their global supply chain are accounted for. Overall, they account for approximately a third of the consumer CO<sub>2</sub> emission growth between 1992 and 2004. Transport services such as aviation also account for about a third, with the remainder accounted for mainly by increases in household energy use and the consumption of manufactured goods. These findings are consistent with studies focusing on the US, Japan and elsewhere (Suh, 2006; Nansai et al., 2007) and cast doubts on the climate-friendly reputation often associated with services. Our analysis therefore suggests that the impact of service industries, from banking through to hotels and restaurants, should be given more weight in climate change discussions. This also concerns the inclusion of services in life cycle analysis studies – an issue that should be raised in the context of the further development of the PAS 2050 as well as other international efforts to standardise carbon footprinting. The report recommends a further investigation of the potential role of the service sector as a means of securing global CO<sub>2</sub> emission reductions.

The findings highlight the importance of developing a more detailed, regularly updated, multi-regional input-output model for the UK (see, Wiedmann et al., 2008a). This would provide an important source of evidence for the government’s sustainable development and climate change agendas (e.g. Product Roadmaps; Market Transformation; PAS 2050/ Carbon Footprinting). The UK government has been one of the pioneers in putting its progress in reducing CO<sub>2</sub> emissions at home into the context of international trade and structural change across the world. This report confirms the direction taken and provides further arguments for the growing need for taking a global perspective when addressing environmental concerns in an increasingly interdependent world.