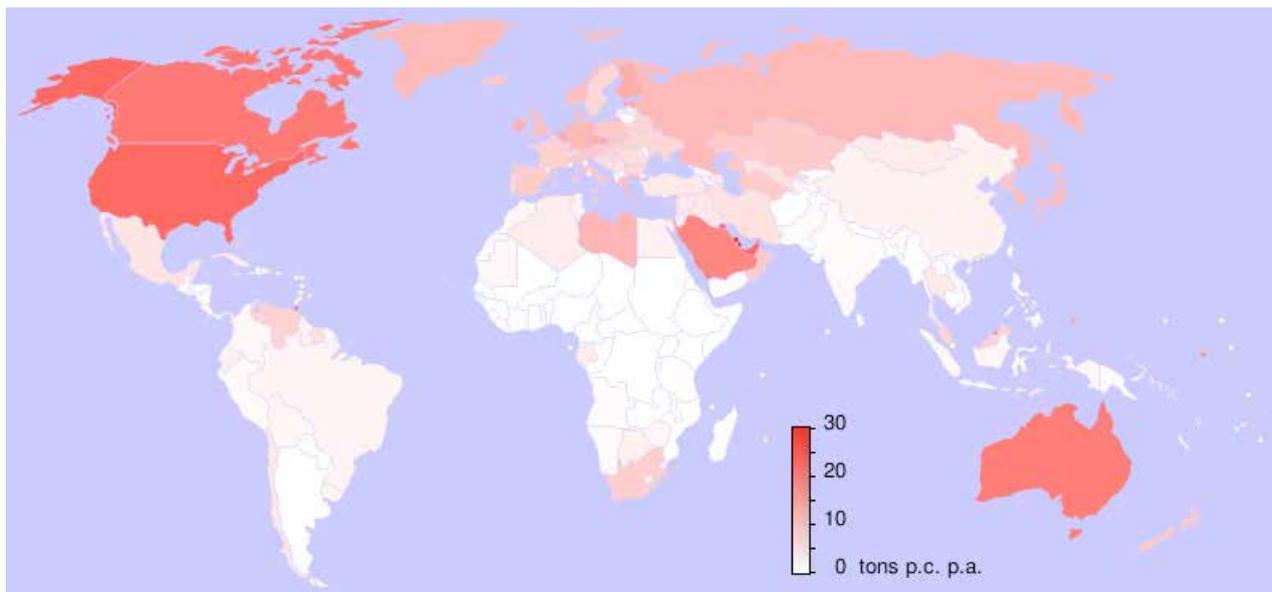


# Improving fuel- and energy-efficiency standards



Carbon dioxide (CO<sub>2</sub>) emissions per capita per country.

**More stringent fuel- and energy-efficiency standards are being implemented by the US government as the result of a model developed at the University of Sussex by Professor Richard Tol and colleagues. The model is used to calculate the additional damage done by carbon dioxide in the atmosphere (the social cost of carbon or SCC) and has been instrumental in producing the new estimate of the SCC that has been recently adopted by the US government.**

## Overview

Scientific evidence leaves little doubt about the impact of human activity, in particular greenhouse gas emissions, on climate change. The social cost of carbon (SCC) – a measure of the damage associated with releasing one additional tonne of carbon into the atmosphere – is estimated using integrated assessment models, which combine models of demography, the economy, energy use, emissions, greenhouse gas cycles, climate and the impacts of climate change. The SCC is an estimate of the monetary value of the damage associated with a small increase in carbon dioxide (CO<sub>2</sub>) emissions. The calculated figure is meant to approximate losses from incremental climate change

such as flood damage, reduced crop production, etc. Conversely, this monetary figure also represents the value of damages avoided for a given emissions reduction.

The 'Climate Framework for Uncertainty, Negotiation and Distribution' (FUND) is an integrated assessment model developed by Professor Richard Tol (Professor of Economics at the University of Sussex) and his students, most notably Dr David Anthoff (University of California, Berkeley). FUND is a computer model that is continually updated in light of changing information and new estimates of key parameters. Considerably more complex than other models, it is able to assess the relative importance of

parameters that are not included in other models. Another key difference is that FUND models how vulnerability to climate change evolves with economic development.

Among other applications, FUND 3.7 has been used to analyse the uncertainty about the SCC, the economic impact of ocean acidification, which is closely associated with climate change and CO<sub>2</sub> emissions, and has been used to investigate the Schelling conjecture, which asserts that economic development provides the best defence against the impact of climate change – the results of the latter study shows that this holds only for the least developed countries.

Professor Tol has worked as an advisor to the US Environmental Protection Agency (EPA) since 2007, and has been instrumental in helping them to understand the economic impact of climate change and the methods and assumptions that underpin the estimation of the SCC.

## Achieving impact

A major impact of Professor Tol's research has been the US government's recent announcement of an increase in the SCC from \$24 to \$38 per tonne. Regulations based on the new SCC initially applied to microwave ovens only, but will ultimately extend to legislation on a wide range of goods and services.

In the US, the SCC is incorporated into the cost-benefit analysis of measures to reduce CO<sub>2</sub> emissions. Previous versions of FUND have been used to derive estimates of the SCC by the US government since 2010, and these estimates have been used to justify more stringent fuel efficiency standards for new vehicles and energy efficiency standards for many appliances.

The higher cost of carbon of the new SCC implies that the estimated damage from inefficient microwaves is much higher than previously calculated. Thus, producers will be forced to withdraw inefficient appliances from the market. This change in microwave use alone is expected to result in both significant savings for consumers on their energy bills, an estimated \$23 billion, and a huge reduction in carbon emissions, an estimated 38 million tonnes of CO<sub>2</sub>, over the coming decades.



From June 2013, this new SCC applies to any new or revised regulation by any branch of the US government. Eventually it will apply to a wide range of products and investments including cars, white goods, machinery, buildings and power generation. The impact of this decision to increase the SCC is likely to be far reaching, as the US government estimates of the monetary value of the SCC are widely used by other decision-makers in the private sector, as well as banks, non-governmental organisations and other national governments.

## Future impact

The revised SCC is already being used in new legislation including the draft rules for methane leaking from shale oil and gas extraction, and for CO<sub>2</sub> emissions from new power plants. These new estimates are also feeding into proposed effluent regulations for power plants. The EPA is proposing regulation that would strengthen controls on discharges from steam electric power plants.

On 25 June 2013, President Obama outlined his 'Climate Action Plan', in which he includes a raft of proposed legislation to cut CO<sub>2</sub> emissions over the coming decades. Implicit in these regulations is the newly adopted SCC.

## Funding and partnership

The FUND model has been developed over 25 years with financial support from a wide range of sources and with a large number of collaborators. The main co-developer of the model is Dr David Anthoff of UC Berkeley.

## Working with us

If you are interested in working with us, please contact:

**Dr Ian Carter**

Director of Research and Enterprise  
Sussex House  
University of Sussex  
Falmer, Brighton BN1 9RH

**E** [research@sussex.ac.uk](mailto:research@sussex.ac.uk)

**T** +44 (0)1273 877718

**www.sussex.ac.uk/research**

For further information about Professor Tol, visit:

**[www.sussex.ac.uk/profiles/289812](http://www.sussex.ac.uk/profiles/289812)**

For more on economics, environment and energy, visit:

**[www.sussex.ac.uk/economics/research/environmentandenergy](http://www.sussex.ac.uk/economics/research/environmentandenergy)**