

MITIGATION

Accounting for air freight

Atmos. Environ. **45**, 7036–7045 (2011)

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The reduction targets agreed under the Kyoto Protocol omitted emissions from international air transport because they were too difficult to quantify. Reliable plane fuel data are hard to come by and, as they are commercially sensitive, government agencies are forced to use rough proxies such as fuel sales statistics. However, a group from the University of Otago in New Zealand hopes to change this. They present a method of estimating the carbon output of the aviation sector, country by country.

Oliver Howitt and colleagues first worked out carbon dioxide emission factors for aircraft based on data for the amount of fuel taken onboard individual planes that departed Auckland, New Zealand in 2007. These were 0.82 and 0.69 kg of carbon dioxide per tonne-km for short-haul and long-haul journeys, respectively.

They used these emission factors along with mass and distance travelled of international air freight to estimate the carbon dioxide emissions. In 2007, they report, air freight transported in and out of New Zealand emitted 1.2 Mt of carbon dioxide (compared with 4.3 Mt generated by international air-passenger transport). *AP*

MITIGATION

Gauging unconventional gas

Environ. Res. Lett. **6**, 044008 (2011)

Extracting shale gas trapped in rocks by hydraulic fracturing, or fracking, produces just 11% more greenhouse-gas pollution than drilling for natural gas in wells, according to an analysis by Nathan Hultman, of the University of Maryland, and his colleagues. The finding comes after another study placed the carbon footprint of shale gas alongside that of coal.

The greenhouse-gas content of the differently located gases is the same — both are mainly methane and both extraction processes leak some of this gas. However,

drawing up shale gas involves injecting high-pressure fluids to force the gases embedded in rock to diffuse into fractures, which requires slightly more energy and gas leakage. Hultman's group calculated the leakage rates using individual data provided by the US Environmental Protection Agency for more than 400,000 wells, but they acknowledge that methane leakage estimates for shale-gas production are 'uncertain'.

In a life-cycle analysis, the per kilowatt greenhouse-gas impacts of shale gas are 56% of those of coal when both are used in electricity generation for the US grid, the authors calculate. *AP*

ENERGY

Attributing carbon emissions

Proc. Natl Acad. Sci. USA **108**, 18554–18559 (2011)

Carbon dioxide emissions from fossil fuels are usually attributed to the country where the fuel is burnt. However, fuels are often extracted in one country and burnt in a different country, to produce goods that could be consumed in a third country. Failure to recognize this trade leads to an unfair attribution of carbon emissions.

Steven Davis, of the Carnegie Institution of Washington, and colleagues tracked global carbon dioxide emissions along the value chain — through the various stages from consumption back to production and fuel extraction — of 57 categories of goods and services in 112 countries and regions during 2004.

They found that 37% of global emissions were the result of burning imported fuels. They also found that 51% of global emissions were attributable to the

extraction of fuels that were then used for goods and services in a different country. In particular, the researchers showed that regulating the fossil fuels extracted in China, the United States, the Middle East, Russia, Canada, Australia, India and Norway would cover 67% of global carbon emissions. *MC*

ECOLOGY

Seaweeds recede

Curr. Biol. **21**, 1828–1832 (2011)



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Seaweeds around Australia's coast are shifting their distributions towards the South Pole so quickly that 100–350 species may be lost in the next 60 years, according to an analysis.

The study compares distribution records in Australia's Virtual Herbarium — a publicly accessible online database. It contains more than 20,000 records of seaweeds collected in Australian waters from the 1940s onwards.

A team led by Thomas Wernberg, of the University of Western Australia's Oceans Institute in Crawley, looked separately

CLIMATOLOGY

On blocking

Science **334**, 655–659 (2011)

The climate of the North Atlantic Ocean is heavily influenced by a climate system called the North Atlantic Oscillation (NAO). The NAO in turn was thought to be governed over decadal timescales by changes in the flow of warm water, which normally sweeps north near the Atlantic Ocean's surface and travels south at depth. But now there is a new theory. It suggests that long-term shifts in the Atlantic Ocean climate are actually prompted when the prevailing westerly winds that cross the ocean become blocked — sometimes for just five days — by a large anticyclone over the Atlantic Ocean.

Sirpa Häkkinen of NASA's Goddard Space Flight Center in Greenbelt, Maryland, and colleagues propose that such an atmospheric blockage can cause the high-altitude jet stream to develop large, near-stationary meanders. This reduces the wind-forcing that maintains the subpolar gyre to such an extent that a new pathway is opened up for warm, more saline water from the subtropics to flow north.

Among other evidence to support their idea, they show that winters with more blocking events between Greenland and Europe are also associated with a warmer and saltier subpolar ocean. *AP*