

# COMMENT

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Carbon markets tackle factory emissions in many nations around the world; the European Union is now looking to include non-EU aviation.

## Carbon trading needs a multi-level approach

International agreements are not enough. Interlinked national and regional tools are also needed to reduce carbon emissions, say **Mark Maslin** and **Joanne Scott**.

Carbon emissions rose to an all-time high in 2010, and international negotiations to agree binding national carbon-emissions targets have so far failed. However, intergovernmental failings have not slowed the expansion of trading in carbon emissions.

Carbon markets are being set up at multiple levels of governance — including locally, regionally and supranationally. Markets have been set up in the European Union (EU) and New Zealand, and plans are afoot for markets in California, Australia

and India. The biggest by far, the European Union's Emissions Trading Scheme (ETS), is using its carbon market power to experiment with new solutions to old problems, and to spur climate action elsewhere.

Controversially, the ETS is set to extend its carbon market to include some non-EU emissions. For example, from 2012, the ETS could cover emissions amounting to almost 60% of the world's international commercial aviation emissions. Although this move is being challenged in the courts, the EU claims that it is already encouraging the

United Nations International Civil Aviation Organization to consider a global regime for aviation emissions. Similarly, the EU is using the threat of further ETS expansion to galvanize global carbon regulation of maritime transport.

Such overlapping, interacting regulatory frameworks have many advantages. They offer multiple opportunities to learn which regulations are most effective in the short and long term. Local efforts also build redundancy into the system: they act as regulatory safety nets if higher-level ▶

► negotiations break down. And, as shown by the EU, local action can help to shape the dynamics of international negotiations. Critics fear multiple bureaucracies that are messy and confusing, and which introduce high transaction costs, but although a top-down system of governance may be neat, such an effort would be unlikely to succeed.

### THE RISE OF INTELLIGENCE

Trading in carbon emissions has created a major global market since the mid 1990s, with an estimated spend of US\$142 billion in 2010, of which 85% was through the ETS<sup>1</sup>. Another \$48 billion was spent in 2009–10<sup>2</sup> solely on carbon-market intelligence (gathering and analysing information required for the effective sale or purchase of carbon-based credits). The size of the carbon-emissions market itself was essentially unchanged between 2009 and 2010, despite the economic recession (see ‘The size of the carbon market’). At the same time, businesses and governments have been increasingly investing in efforts to understand the flow of carbon, in order to plan economic and environmental strategies. Updated figures compiled for this article by UK-based consultancy kMatrix show that the intelligence sector has grown again in 2010–11, to \$56 billion, a growth of 16% in a single year (see ‘The size of the carbon market’). The quality and usefulness of this information varies enormously, but its growth underscores the importance of reliable carbon data in understanding the development of this potentially huge market.

The bulk of the carbon-emissions market is made up of trading in carbon allowances in ‘cap-and-trade’ systems. These markets are usually national and regional because it is easier to set a cap on emissions within borders and in relation to particular industries. At the international level, carbon markets trade in credits from certified projects under the Kyoto Protocol’s Clean Development Mechanism (CDM). The CDM allows investors, such as companies and countries, to purchase carbon offsets known as Certified Emission Reductions by investing in carbon-reduction projects in developing countries. For example, the carbon credits from the emissions saved as a result of the construction of a wind farm in India can be bought by an EU power company to meet its emissions-reduction obligations under the ETS.

Assessing — monitoring, recording and verifying — the quality and quantity of carbon emissions ‘saved’ has long been a problem for the CDM. For example, credits for projects involving the capture of industrial gases (hydrofluorocarbons or HFCs) have been regrettably easy to game. The regulation has created a perverse incentive for companies to produce more HCFC-22, a refrigerant and powerful greenhouse gas being phased

out under the Montreal Protocol, in return for windfall profits for capturing the HFC-23 by-product from its production<sup>3</sup>. About 70% of Certified Emission Reductions have come from projects of this kind. Depressingly, the European Commission concluded this year that production of HCFC-22 could be higher today than it would have been in the absence of CDM activity.

The problem with industrial gas credits has been known since at least 2007, yet the multinational executive board that supervises the CDM has been unable to reach an agreement on how to solve it. So far, only a partial and provisional ban on gas-capture projects has been agreed. Happily, the EU does not rely exclusively on international regulation of the CDM. Having finally lost patience with international regulators, it will ban the use of credits from industrial gas projects in the ETS from 2013.

The industrial gases saga has highlighted other failings of the CDM. Perhaps the hardest problem for carbon offsets concerns ‘additionality’. In principle, Certified Emission Reductions come from projects that create emissions reductions that are ‘additional’ to those that would otherwise have been achieved. Verifying additionality by reference to a baseline, which rests on a business-as-usual assessment (the level of carbon

*“The EU has lost patience with international regulators.”*

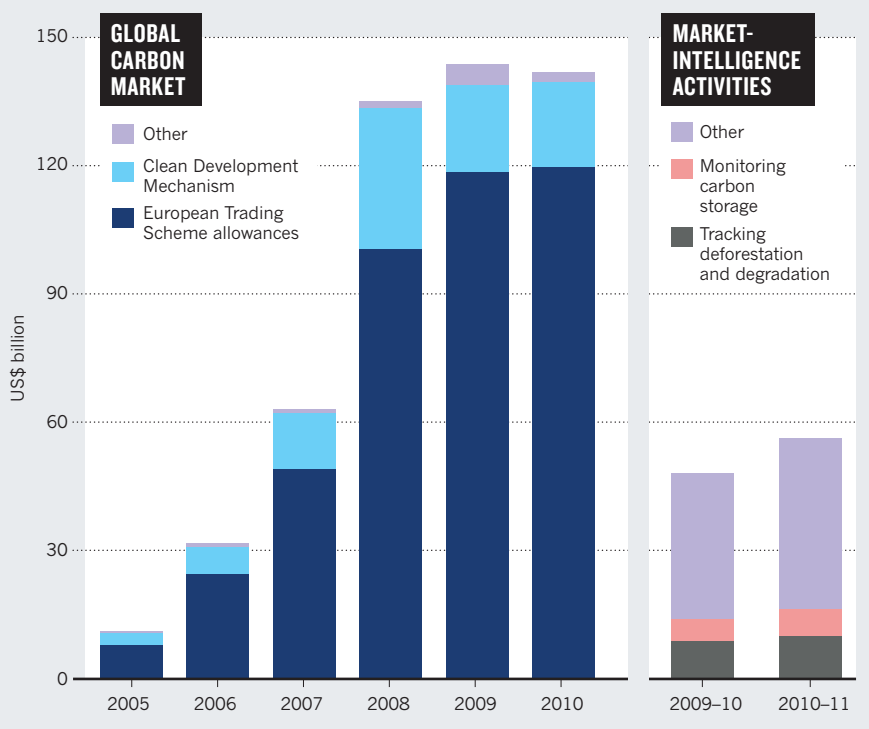
emissions if this project had not been put in place) has proved very difficult. As a result, there are doubts about the CDM’s ability to bring about genuine emissions reductions.

One solution to the additionality problem may come from the EU push into sectoral carbon trading. A ‘sectoral’ approach to emissions would fundamentally change the way in which the EU measures emissions saved as a result of CDM projects. Additionality would no longer be assessed by reference to a hypothetical business-as-usual baseline, but by reference to sector-by-sector carbon-efficiency standards. To generate credits, a project would have to cut emissions below the level of ‘mere’ compliance with the standard. In the absence of global agreement, the EU is seeking bilateral agreements to move forward with this approach, and is threatening to refuse Certified Emission Reductions from new projects after 2013 — except those based in least-developed countries — to persuade countries to come on board.

The EU is also extending the geographical reach of the ETS. From 2012, all flights arriving in or departing from an EU airport will be required to surrender an emissions allowance or certificate for each tonne of carbon emitted during flight, including those occurring outside EU airspace (unless those emissions are subject to climate regulation elsewhere). By 2020, the ETS could add an estimated \$11–56 to a return long-haul flight. At first, 85% of these certificates will

### THE SIZE OF THE CARBON MARKET

Carbon-emissions trading was growing fast until it stalled when global recession hit in late 2008. But spend on market-intelligence activities, from project development to carbon accounting, grew by 16% between 2009–10 and 2010–11.



SOURCES: REF. 1; KMATRIX

be issued by the EU free of charge, with the airlines buying the remaining 15% at auction. These rules are being challenged by the major US airlines in a case currently before the EU's highest court. A final judgment is expected in the first half of 2012.

Policy-makers need examples of good practice or good ideas. The International Carbon Action Partnership — a group of countries and regions that are pursuing cap-and-trade systems — is intended to share knowledge and experience on the development of carbon markets. Similarly, Sandbag, a London-based non-governmental organization, submitted comments in 2010 on California's plans to establish a cap-and-trade system, which drew heavily on the good, the bad and the ugly of European experience with the ETS.

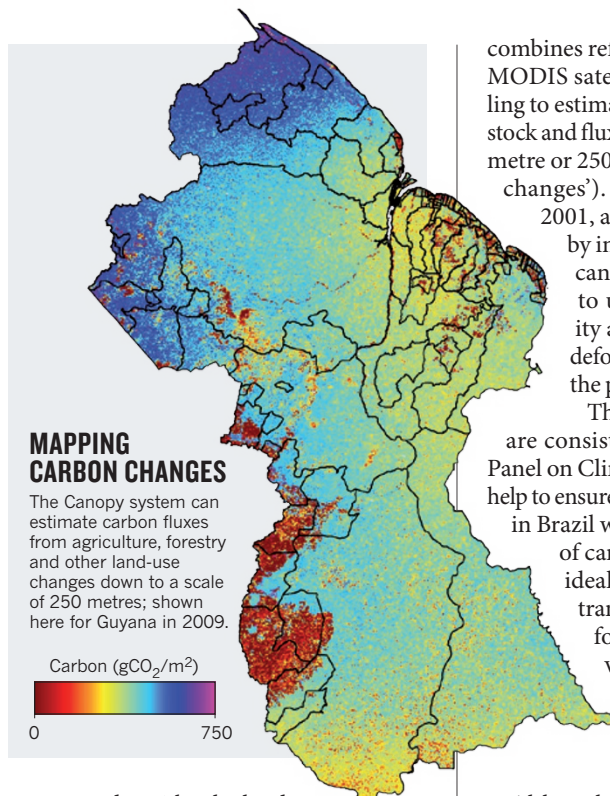
### IF NO ONE HEARS A TREE FALL

Lessons from the ETS experience with the CDM should be applied to the design and operation of the UN programme for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+). Although there is debate about the share of global carbon emissions that may be attributed to deforestation and land-use change, a figure of around 20% is often put forward<sup>4</sup>. Without proper oversight at multiple levels of governance, as with the CDM there will be real difficulties in assessing the quantity and quality of the carbon emissions 'saved'.

Following the UN climate negotiations in Copenhagen in 2010, developed countries made non-binding pledges to reduce emissions by between 13% and 19% (compared with a 1990 baseline)<sup>5</sup>. The EU has made a binding commitment to reduce emissions by 20% by 2020 (again compared with a 1990 baseline). If carbon allowances or offsets from REDD+ were available for use in achieving compliance with these targets, the need, worldwide, for meaningful domestic cuts would cease. Hence, it is crucial that there are robust ceilings on the use of REDD+ credits in domestic carbon markets, if incentives for national action are to remain meaningful.

It is also essential that the projects funded do not generate adverse social, cultural or environmental effects. Investors in REDD+ and governments that permit REDD+ allowances to be used for compliance must share responsibility with host governments for developing and improving project assessments to avoid negative effects. There are also worries that REDD+ underestimates implementation costs and could undermine good forest governance programmes in key countries<sup>6</sup>.

Again, the biggest and most intractable problem is additionality. Although 47% of anthropogenic carbon emissions remain in the atmosphere, 27% are absorbed by the



oceans and 26% by the land biosphere<sup>7</sup>. For a REDD+ carbon credit, something 'additional' must be done to prevent future loss of land carbon stock, for example, through avoided deforestation. Countries that take early and effective action to preserve their biosphere boost their baseline efforts, perversely making it harder to get financial rewards from REDD+. Current UN negotiations are considering possible ways of addressing this problem, including setting a regional deforestation rate, which would serve as a baseline for all countries in a given region, regardless of their actual or projected rate of deforestation.

The multiple challenges of REDD+ will not be solved by the UN alone. Until recently, measuring the change in land carbon stock and annual flux was thought to be 'beyond science', because only static data sets for the early 2000s were available<sup>8</sup>. Despite this, a staggering \$6.3 billion was spent in 2010–11 (a 20% increase on the previous year) on monitoring land carbon, with the quality of data often being extremely poor. The lack of verifiable data for REDD+ has the potential to undermine the whole programme by making it easy to cheat. However, considerable scientific progress is being made and new methods for verifying data are emerging.

One of us (M.M.) is involved in such an approach. Work by Carbon Auditors, a London-based company spun out from University College London, in partnership with business service company Logica, shows that monitoring, recording and verification can be done effectively using their jointly developed 'Canopy' system. Canopy

combines reflectance data from the NASA MODIS satellite with ecosystems modelling to estimate monthly-to-annual carbon stock and flux at a global resolution of 1 kilometre or 250 metres (see 'Mapping carbon changes'). Because the data go back to 2001, and accuracy can be enhanced by including ground data, Canopy can be used to draw up baselines, to understand natural variability and to identify major areas of deforestation and degradation over the past decade.

The development of systems that are consistent with Intergovernmental Panel on Climate Change guidelines<sup>8,9</sup> will help to ensure that one tonne of carbon saved in Brazil will be equivalent to one tonne of carbon saved in Australia. In an ideal world, there will be multiple, transparent, overlapping schemes for monitoring, recording and verification, with domestic and third-party organizations contributing to a sense of confidence in the emissions saved and the credits accrued.

Although we may continue to pin our hopes on the emergence of a comprehensive global agreement on climate change, we should recognise that even if this were to be achieved, multi-level governance would still be required. As emissions trading markets grow, governments at all levels must take responsibility for ensuring that such trading is delivering properly on its goals. ■

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The authors declare competing financial interests: for details see [go.nature.com/h8k4dk](http://go.nature.com/h8k4dk)