International Initiative for Impact Evaluation

EQ briefs analyze current policy issues and developments related to impact evaluation to help policy makers and development practitioners improve development impact through better evidence.

Number 3 UPDATED
December 2009

Climate change: Effective ways of cutting greenhouse gas emissions

© iStockphoto / Erlend Kvalsvik

Overview

There are few rigorous impact evaluations of climate change interventions. But some examples in the field of conservation stand out. A number of recent studies evaluate the impact of protected areas, payment for environmental services and decentralized forest management. Climate change interventions have much to learn from experiences in such fields. Despite the limited experience so far in the area, there are many opportunities to conduct impact evaluation of climate change.

Key words: Climate change, greenhouse gas emissions, mitigation and global warming.

Mind the development gaps

Evidence that the earth's climate is warming is overwhelming. Nine of the ten warmest years on record occurred between 1995 and 2004 (Aalst, 2006). Global greenhouse gas emissions due to human activities are rising steadily, making reductions (mitigation) all the more urgent.

Up to 600 million more people are facing malnutrition due to the breakdown of agricultural systems resulting from increased exposure to drought, rising temperatures, and more erratic rainfall. Semi-arid areas of sub-Saharan Africa with some of the highest concentrations of poverty in the world face the danger of potential productivity losses of 25 per cent by 2060. Tackling climate change is now key for reducing poverty (UNDP, 2008)

While global emissions are projected to grow over the next few decades, the level at which stabilisation is achieved depends upon the success of the policy instruments employed, mostly at national level. These include mitigation policies undertaken by countries under the Kyoto Protocol and outside of it, as well as non-climate policies that may reduce greenhouse gas emissions as a co-benefit.

There are several types of mitigation policy instruments: (i)*Regulations and standards* state either the technologies that must be used (to minimise emissions) or the levels of pollution allowed. (ii)*Taxes and charges* are imposed on each unit of undesirable activity by a source. (iii)*Tradable permits* are also known as marketable permits or cap-and-trade systems. They set limits on aggregate emissions by specified sources, require each source to hold permits equal to its actual emissions and allow permits to be traded among sources. (iv)*Voluntary agreements* between a government authority and one or more private parties aim to improve environmental performance beyond compliance to regulations. (v)*Subsidies and incentives* include direct payments, tax reductions or price supports from a government to an entity for carrying out a specified action. (vi)*Information instruments* require the public disclosure of environmental information, usually by industry to consumers, through labelling programmes and rating and certification systems. (vii)*Research and Development* (R&D) cover direct government funding and investment aimed at generating innovative approaches to mitigation or the infrastructure needed to reduce emissions, such as prizes and incentives for technological innovations (IPCC, 2007).

In terms of cost, the World Bank says developing nations need US$400 billion per year for mitigation. The December UN climate change summit is the deadline for countries to agree on a new global deal. Since funding and mandate for climate change mitigation and adaptation interventions is increasing substantially, there is an urgent need to ensure effective allocation of these resources and for policy makers to know which green house gas mitigation policy works, under what circumstances and at what cost.

3ie, Global Development Network, Second Floor, East Wing, ISID Complex, Plot No.4, Vasant Kunj Institutional Area, New Delhi 110 070
Tel: +91 11 26139494 | www.3ieimpact.org

Lessons learned

Evaluating the range of policy instruments for mitigation is problematic. Policies, interventions and their outcomes can be assessed on multiple levels and it is often difficult to compare interventions across sectors and countries. Impact evaluations are usually not integrated into mitigation interventions, which in any case may be too broad, long-term and complex. Since climate change interventions are still relatively recent, it's often too early to assess the environmental impact of many policy instruments. However, evaluators should consider measuring other intermediate outcomes such as behavioural changes instead (Ferraro, 2009). Evaluations can consider environmental effectiveness, cost-effectiveness, distributional considerations and institutional feasibility.

(i) *Regulations and Standards*: Provide more certainty about environmental effectiveness, and are often measured in greenhouse gas emission reductions:

There has been extensive use of standards to increase energy efficiency in over 50 countries (IPCC, 2001): the US ENERGY STAR programme reduced CO_2 emissions by 218.4 million tonnes of carbon dioxide a year ($MtCO_2$) from 2000-2007 over and above business-as-usual scenarios (EPA, 2008).

(ii) *Taxes and Charges*: These can set a price on carbon, though they cannot guarantee a particular level of emissions as emitters weigh the cost of avoiding emissions against the cost of the tax:

Though fixed emissions charges in Central and Eastern European transition economies were rendered ineffective by high inflation (Bluffstone and Larson, 1997), the introduction of more stringent environmental policies led to aggregate industrial CO_2 emissions for 2003 that were 18 per cent lower than in 1995. Without these policies, emissions would have increased by 31 per cent, all else being equal (Zugravu et al., 2008).

Flexible charges have been effective in Denmark, where CO_2 emissions decreased by 5 per cent in the year 1996-1997 when the tax rate was raised (Nordic Council of Ministers, 2002).

(iii) *Tradable Permits*: Economists favour market instruments such as tradable carbon permits, which set a carbon price. Their environmental effectiveness is determined by the volume of allowed emissions, and equity depends upon how permits are allocated. Pizer et al. (2006) find that an economy-wide programme will be more cost-effective in reducing emissions than a sectoral programme:

However, emissions trading programmes for sulfur dioxide (SO2) and nitrogen oxides (NOx) in the US and the EU Emissions Trading System for CO_2 only cover certain sectors, in the latter case to ease initial implementation (Christiansen and Wettestad, 2003).

Most programmes have distributed free permits (allowances) rather than using auctions. Ellerman (2005) claims this was key to winning acceptance for the concept in the US; others suggest interest group pressures led to the largely free allocation of allowances in the EU Emissions Trading System (Christiansen and Wettestad, 2003; Markussen and Svendsen, 2005).

More recently, the global economic downturn has contributed to tumbling prices for carbon permits. This means companies will have less incentive to reduce emissions. Further drops in permit prices could threaten the integrity of the EU Emission Trading System itself.

(iv) *Voluntary Agreements (VAs)*: Vas between stakeholders are politically attractive, raise awareness, stimulate innovation and may shape national policy development. But they have not, generally speaking, achieved significant national or regional-level emissions reductions beyond business-as-usual:

Darnall and Sides (2008) evaluate the environmental outcomes of VAs in over 30,000 US firms and despite the Environmental Protection Agency's enthusiasm for VAs non-participants improve environmental performance by 7.7 per cent over VAs participants.

Chidiak (2002) argues that the considerable greenhouse gas emission reductions achieved by the main aluminium producer and the packing glass industry association in France are attributable to general policies, regulations, investment in technology and cost reduction efforts rather than the VAs.

(v) *Financial Incentives*: Subsidies and tax credits are often used to boost the spread of new technologies such as renewable energy. Economic costs may be higher, but they are often necessary to overcome market barriers and corporate resistance:

In Europe, specific prices have been set at which utilities must purchase renewable electricity (feed-in tariffs). This has been effective in promoting development of wind power in Germany, Denmark and Spain, who accounted for over 80 per cent of additional installed capacity in Europe in 2000; feed-in tariffs have proven more efficient than national targets (Menanteau et al., 2003).

Payment for Environmental Services (PES) is another financial incentive that has received increasing attention in recent years for its potential to reduce deforestation. Recent impact evaluations of PES in Costa Rica suggest the program has had limited impact on deforestation and highlights the importance of targeting payments to areas with high risk of deforestation (Pfaff et al., 2008; Robalino et al., 2008). However, the 'Grain for Green' program in China has been successful in providing both environmental services and increased wealth for the poorest participants (Uchida et al., 2007).

(vi) *Information Campaigns*: These may encourage more sustainable lifestyle choices that contribute to mitigation, but their impact has not been assessed.

(vii) *Investment in Research, Development and Demonstration (RD&D)*: RD&D can lead to cost-effective, advanced technology, but these are essentially long-term mitigation measures. Their impact is not only difficult to evaluate but also depends crucially on the policy environment.

Closing the evaluation gap

Impact Evaluations need to be integrated into mitigation interventions from the outset. Each policy instrument should be evaluated in detail across different sectors to build up an

3ie, Global Development Network, Second Floor, East Wing, ISID Complex, Plot No.4, Vasant Kunj Institutional Area, New Delhi 110 070
Tel: +91 11 26139494 | www.3ieimpact.org

evidence base for comparison with other policy instruments and national contexts need to be accounted for.

In addition, there is a need to calculate the cost-effectiveness of the reduction of emissions resulting from different interventions. This requires identifying a value to all the costs and benefits resulting from the interventions. If the impact of the project on carbon emissions is known, it is quite straightforward to calculate the cost per ton of avoided emission (White 2009). Interventions can have both positive and negative development impacts, and this should be taken into account in the cost-benefit analysis of climate change interventions.

References

Aalst, Martin K., *The impacts of climate change on the risk of natural disasters,* Overseas Development Institute Disasters Volume 30 Issue 1, Pages 5 – 18, London, 200.

Bluffstone, R. and Larson, B.A. (eds.), '*Controlling Pollution in Transition Economies: Theories and Methods',* Edward Elgar: London, 1997.

Chidiak, M., 'Lessons from the French Experience with Voluntary Agreements for Greenhouse-gas Reduction', *Journal of Cleaner Production*, Vol.10, pages 121-128, 2002.

Christiansen, A.C. and Wettestad, J., 'The EU as a Frontrunner on Emissions Trading: How did it happen and will the EU succeed?', *Climate Policy*, Vol.3, pages 3-13, 2003.

Darnall, N. and Carmin, J., '*The Design and Rigor of U.S. Voluntary Environmental Programs: Results from the Survey*', North Carolina State University: Raleigh, 2003.

Darnall, N. and Sides, S., 'Assessing the Performance of Voluntary Environmental Programs: Does Certification Matter?', *Policy Studies Journal*, Vol.36, No.1, 2008.

Ellerman, A.D., 'U.S. Experience with Emissions Trading: Lessons for CO_2', in *Climate Policy and Emissions Trading After Kyoto*, Bernd Hansjurgen (ed.), Cambridge University Press: Cambridge, 2005.

Ellerman, D. and Buchner, B., '*Over-allocation or Abatement: A Preliminary Analysis of the EU ETS based on the 2005 Emissions Data*', Center for Energy and Environmental Policy Research, 06-16, 2006.

EPA, *ENERGY STAR and other Climate Protection Partnerships 2007 Annual Report*, 2008.

EUROPA, '*Emissions Trading: 2007 Verified Emissions from EU ETS Businesses*', Rapid Press Releases IP/08/787, 2008.

Ferraro, P.J., 'Counterfactual Thinking and Impact Evaluation in Environmental Policy', New Directions for Evaluation, 122, pp. 75-84, 2009.

Hasselknippe, H. and Røine, K., '*Carbon 2006: Towards a Truly Global Market*', Point Carbon: Oslo, 2006.

IPCC Climate Change 2001: Mitigation. *Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press: Cambridge/New York, 2001.

IPCC Climate Change 2007*:* Mitigation. *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*', Cambridge University Press: Cambridge/New York, 2007.

Markussen, P. and Svendsen, G.T., 'Industry Lobbying and the Political Economy of GHG Trade in the European Union', *Energy Policy*, Vol.33, pages 245-255, 2005.

Menanteau, P., Finon, D. and Lamy, M-L., 'Prices versus Quantities: Choosing Policies for Promoting the Development of Renewable Energy', *Energy Policy*, Vol.31, No.8, pages 799-812, 2003.

Nordic Council of Ministers, '*The Use of Economic Instruments in Nordic Environmental Policy 1999-2001'*, TemaNord 2002:581, Nordic Council of Ministers: Copenhagen, 2002.

Pfaff, A., Robalino, J. and Sánches-Azofeifa, G. A., 'Payments for Environmental Services: Empirical Analysis for Costa Rica', Working Paper Series, SAN-0805, Durham: Duke University, Terry Sandford School of Public Policy, 2008.

Pizer, W., Burtraw, D., Harrington, W., Newell, R. and Sanchirico, J., 'Modeling Economy-wide vs. Sectoral Climate Policies', *The Energy Journal*, Vol.27, No.3, 2006.

Prowse, M. and Snilstveit, B. 'Impact evaluation and interventions to address climate change', 3ie scoping study, 2009.

Robalino, J., Pfaff, A., Sánches-Azofeifa, G. A., Alpízar, F., León, C. and Rodríguez, C. M., 'Deforestation Impacts of Environmental Services Payments: Costa Rica's PSA Program 2000-2005', Environment for Development Discussion Paper series, EfD DP 08-24, 2008.

Uchida, E., Xu, J., Xu, Z. and Rozelle, S., 'Are the poor benefiting from China's land conservation program?', Environment and Development Economics, Vol.12, pp. 593-620, 2007.

UNDP Human Development Report 2007/2008, *Fighting climate change: Human solidarity in a divided world,* N.Y., 2008.

Wätzold, F., 'SO2 emissions in Germany: Regulations to Fight Waldsterben', in *Choosing Environmental Policy*, W. Harrington, R.D. Morgenstern and T. Sterner (eds.), Resources for the Future Press: Washington, D.C., 2004.

White, H. 'Using impact evaluation to increase the efficacy of climate change interventions', in Rob D. Van Den Berg and Osvaldo N. Feinstein (eds) Evaluating Climate Change and Development. World Bank Series on Development Volume 8, Transaction Publishers: New Brunswick, 2009.

3ie, Global Development Network, Second Floor, East Wing, ISID Complex, Plot No.4, Vasant Kunj Institutional Area, New Delhi 110 070
Tel: +91 11 26139494 | www.3ieimpact.org

Zugravu, N., Millock, K. and Duchene, G., '*The Factors Behind CO_2 Emission Reduction in Transition Economies*', The Fondazione Eni Enrico Mattei Note di Lavoro Series, 2008.

Credits

This brief was written by Rabi Thapa with inputs from Birte Snilstveit, Christelle Chapoy, and Howard White, and edited by Christelle Chapoy.

EQ briefs are works in progress. We welcome comments and suggestions regarding topics for briefs and additional studies to be included in any EQs. Ideas and feedback should be sent to Christelle Chapoy at: cchapoy@3ieimpact.org

To subscribe, please email: bjoy@3ieimpact.org

3ie, Global Development Network, Second Floor, East Wing, ISID Complex, Plot No.4, Vasant Kunj Institutional Area, New Delhi 110 070
Tel: +91 11 26139494 | www.3ieimpact.org