Institution: London School of Economics and Political Science

Unit of Assessment: 17: Geography, Environmental Studies and Archaeology

Title of case study: Pricing carbon to mitigate climate change

1. Summary of the impact (indicative maximum 100 words)

This case study highlights the impact of LSE research on national and international carbon pricing policy. This includes a fundamental change in the way the UK government sets a carbon price for policy and project appraisal, and its approach to carbon trading in Europe. LSE work has also had impact beyond the UK, in particular on legislating – for the first time – policies to price carbon in strategically important countries across the world, including Australia, China, Mexico and South Korea.

2. Underpinning research (indicative maximum 500 words)

Research Insights and Outputs:

A 'carbon pricing' policy that reduces emissions of greenhouse gases should be the core element of an economically efficient response to climate change. Yet, while this basic insight is increasingly widely understood in policy circles, how to design policies to do so is not. This is because policy design choices are numerous and complex.

In several countries, including the UK, Cost-Benefit Analysis (CBA) is central to the evaluation of new spending and regulatory proposals. The CBA should include an economic valuation of any changes in carbon emissions brought about by the proposed project or policy (i.e. the change in the quantity of emissions multiplied by the price). However, there are competing approaches to pricing. The original approach was to price a ton of emissions at the so-called 'social cost of carbon', i.e. the economic value of the damage caused by an extra ton of greenhouse gases in the atmosphere. However, our research has strongly emphasised the uncertainty about the social cost of carbon. Dietz et al. [1, 2] and Dietz [4] updated the economic modelling they previously undertook for the ground-breaking Stern Review on the Economics of Climate Change to show that the social cost of carbon could take a much wider range of values than the published estimates in the Stern Review. Dietz and Fankhauser [3] concluded from this that the price of carbon for the purposes of CBA should rather be based on the cost, at the margin, of cutting a ton of emissions, as the uncertainties about this quantity are much smaller. Doing so would provide a much more robust basis for ensuring CBA aids the Government in hitting its statutory emissions targets.

Beyond CBA, policies to price carbon – such as carbon taxes or cap-and-trade and the carbon markets they create – are being adopted around the world as a means to mitigate climate change, alongside supporting economic instruments such as subsidies for the innovation of clean technologies. Cap-and-trade in particular is a complicated policy instrument that needs to be designed carefully to have the desired effect. LSE research has analysed important design elements, such as inter-temporal properties (e.g. the banking and borrowing of emission permits) and their interaction with markets, taxes and subsidies [5], and ways to reduce price volatility (e.g. through hybrid schemes; Gruell and Taschini [6]). We also monitor and document the implementation of carbon pricing policies worldwide, as part of a broader review of the promulgation of climate change legislation [7]. This helps inform countries about what actions are being taken elsewhere and thereby provides the basis for confidence building and the diffusion of ideas and good practice.

Key Researchers:

The research has taken place at LSE since 2006 and is now concentrated in the Grantham Research Institute on Climate Change and the Environment, which is affiliated with the Department

of Geography & Environment, and part of the Unit of Assessment (UoA). The key researchers are Simon Dietz, who joined the UoA as a member of full-time staff in 2006 and who is now a Director of the Institute, Sam Fankhauser, who joined in 2008 on a 0.8 FTE basis and who is also a Director of the Institute, and Cameron Hepburn and Luca Taschini, who joined in 2009 at 0.4 and 1 FTE respectively.

3. References to the research (indicative maximum of six references)

1. Dietz, S., C. Hope, et al. (2007a). "Some economics of 'dangerous' climate change: reflections on the Stern Review." Global Environmental Change **17**(3-4): 311-325. DOI: 10.1016/j.gloenvcha.2007.05.008

2. Dietz, S., C. Hope, et al. (2007b). "Reflections on the Stern Review (1): a robust case for strong action to reduce the risks of climate change." World Economics **8**(1): 121-168. http://eprints.lse.ac.uk/4846/

3. Dietz, S. and S. Fankhauser (2010). "Environmental prices, uncertainty, and learning." Oxford Review of Economic Policy **26**(2): 270-284. DOI: 10.1093/oxrep/grq005

4. Dietz, S. (2011). "High impact, low probability? An empirical analysis of risk in the economics of climate change." Climatic Change **103**(3): 519-541. DOI: 10.1007/s10584-010-9993-4

5. Fankhauser, S. and C. Hepburn (2010). "Designing carbon markets part I and II", Energy Policy*,* **38**(8)**:** 4363-4370 and 4381-4387*.* dx.doi.org/10.1016/j.enpol.2010.03.064 and dx.doi.org/10.1016/j.enpol.2010.03.066

6. Gruell G. and L. Taschini (2011). "Cap-and-Trade Properties Under Different Hybrid Scheme Designs", Journal of Environmental Economics and Management, **61**(1): 107-118. DOI: 10.1016/j.jeem.2010.09.001

7. Townshend, T., S. Fankhauser, R. Aybar, M. Collins, T. Landesman, M Nachmany and C Pavese (2013). "How national legislation can help to solve climate change", Nature Climate Change, **3**(May): 430-432. DOI: 10.1038/nclimate1894

Evidence of quality: All published in peer-reviewed journals of international standing.

Grants that have supported the research:

Grantham Foundation for the Protection of the Environment, core funding of the Grantham Research Institute on Climate Change and the Environment (£12.6m, 2008-2018)

ESRC Research Centre grant, Centre for Climate Change Economics and Policy (£5.8m, 2008-2013)

Munich Re, research programme on Evaluating the Economics of Climate Risks and Opportunities in the Insurance Sector (£3m, 2008-2013)

4. Details of the impact (indicative maximum 750 words)

The Nature of the Impact:

A. Changing the way carbon is priced in UK cost-benefit analysis:

In UK government, all new national spending and regulatory proposals are subject to Cost-Benefit

Analysis (CBA), and guidance has existed since 2002 on how to price greenhouse gas emissions as part of this. In 2009 the Department for Energy and Climate Change (DECC) issued revised guidance on the price of carbon for CBA, which fundamentally changed its basis from the social cost of carbon to the marginal cost of emissions abatement.

Our research had advocated this change (see section 2 above) and played a key role in the revision [A]. The main source of impact was our direct engagement in the process of reviewing and updating the existing guidance. Dietz was one of the six official, independent peer-reviewers of interim guidance produced in 2007 (his comments were published online by DEFRA; [B]), while he was then employed as a consultant by DECC on the preparation of the new guidance in 2008/2009. As part of his consultancy, Dietz advised on the approach, as well as peer-reviewing the draft guidance line-by-line, suggesting changes to the wording and argumentation [C].

A result of this change is to increase the likelihood that the UK government, all else being equal, can deliver on its statutory obligation in the Climate Change Act to reduce overall emissions by at least 26% by 2020 and 80% by 2050.

B. Design of carbon pricing policies worldwide:

We have had a broad impact on the design of carbon pricing policies, especially carbon markets, both domestically and internationally. We have had impact on legislating new carbon pricing policies in, for example, Australia, China, Mexico and South Korea, all of which have recently adopted new measures or are in the process of doing so (though Australia has now withdrawn its). The fact that there is serious climate legislation in these countries is crucial to the prospects for an international agreement on climate change, according to the senior UN official in charge of the negotiations [D]. Legislators confirm that the international debate among parliamentarians -- and LSE's background research to guide and support it – has been instrumental to this outcome [E]. Our research was, for instance, the basis of discussions between UK/EU legislators and China's chief negotiator, Minister Xie Zhenhua, in the House of Commons in October 2011, in which "good practice" was compared. In the case of Australia, the LSE team provided well-received direct advice on a particular technical point of the Australian trading scheme related to the treatment of carbon offsets [F].

Our research has influenced both the *dynamics* and the *substance* of carbon pricing legislation. In terms of dynamics, our work on documenting international climate legislation has changed the perception that "nobody else is taking action", making it easier for countries to move ahead with carbon pricing [D, E]. In terms of substance, close links with policy makers have allowed us to feed our research findings (e.g. on valuing carbon in CBA and on a carbon floor price) into national and international decision making processes. We do this both through formal channels (e.g. through written evidence and technical reports) and informally (e.g. through seminars and discussions with officials). Close contacts with GLOBE International, a global forum of parliamentarians, has created a direct link between our research and the legislative process: in particular, our research has fed directly into an international policy paper, which aimed to help legislators understand the nuts and bolts of carbon markets as they were drafting the relevant legislation [G]. The LSE team contributed to the drafting of the paper and it incorporates many of our research findings.

Wider Implications:

194 countries have accepted – in principle, as part of the United Nations climate negotiations – the need to radically decouple greenhouse gas emissions from economic activity and growth by the middle of this century. Since there is an externality at the heart of the climate problem – that the negative effects of emissions are not automatically internalised into polluters' decisions – there is a case for policy intervention and it is widely accepted that the cost of such a policy intervention is greatly reduced by making it economically efficient. Estimates in the literature suggest that the cost savings could be of the order of $1 trillion per year globally. Carbon pricing satisfies the necessary and sufficient conditions for an efficient intervention, but only if the policies that create such prices

are well designed.

5. Sources to corroborate the impact (indicative maximum of 10 references

All sources listed below can also be seen at https://apps.lse.ac.uk/impact/case_study/view/10

A. DECC (2009). *Carbon Valuation in UK Policy Appraisal: A Revised Approach*. London. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/245334/1_20090715105804_e___carbonvaluationinukpolicyappraisal.pdf https://apps.lse.ac.uk/impact/download/file/1520

B. Dietz, S. (2007). Review of DEFRA paper: "The Social Cost of Carbon and the Shadow Price of Carbon: what they are and how to use them in Economic Appraisal in the UK". London, London School of Economics and Political Science. *Mimeo* LSE Research Online ID: 21613 https://apps.lse.ac.uk/impact/download/file/1521

C. Testimonial from Economic Advisor, DEFRA (formerly DECC). This source is confidential.

D. Figueres, C. (2013). Address at the Launch of the LSE-Globe Climate Legislation Study, January 2013. http://www.globeinternational.org/index.php/high-level-opening-session/christiana-figueres-unfccc https://apps.lse.ac.uk/impact/download/file/1523

E. Testimonial from Secretary General of Globe International. This source is confidential.

F. Hepburn, C., Chapman, S., Doda, B., Duffy, C., Fankhauser, S., Rydge, J., Smith, K., Taschini, L., and Vitelli, A. (2012). *The 'surrender charge' on international units in the Australian ETS*. Policy paper, Grantham Research Institute, London, UK. http://www.cccep.ac.uk/Publications/Policy/docs/PP_surrender-charge-australian-ets.pdf https://apps.lse.ac.uk/impact/download/file/1525

G. Globe International (2011). *Emissions Trading: Lessons Learned from Europe and Recommendations to Countries Developing New Schemes*, mimeo, unpublished. Confidential: available from LSE on request.