RURAL POLICY CENTRE
POLICY BRIEFING
SAC

Climate change and agriculture: selecting the best strategy

Introduction

Agriculture produces a significant proportion of Scottish greenhouse gas (GHG) emissions, with estimates varying between 12%[1] and 25%[2] (depending on the definition of 'agriculture'). Although there have been significant reductions in emissions from agriculture in recent years, further reductions will be expected because governments are beginning to set challenging targets for long-term emission reductions. At the UK level, the draft Climate Change Bill proposes to reduce CO_2 by at least 60% on 1990 levels by 2050. At the Scottish level, the proposal is for a reduction of 80% by 2050. For such targets to be met, the potential mechanisms through which emissions can be reduced in each sector (e.g. transport, electricity generation, agriculture) will have to be examined and the best options adopted and promoted. This briefing focuses on agriculture and examines the process through which the most appropriate mitigation options can be identified.

Mitigating agricultural emissions

At a practical level there is a range of technically feasible ways of reducing emissions:

- Adopting energy saving practices on farms, not least by replacing older machinery/buildings with more modern and usually more efficient items;
- Improving efficiency of nutrient use (fertilisers and manure/slurry) by matching use with need and reducing wastage/needless emissions;
- Changing livestock diet to reduce emissions of methane (CH_4) and nitrous oxide (N_20);
- Improving manure and slurry storage;
- Reducing disturbance of soils; and
- Enhancing carbon storage in biomass by creating new woodlands.

Yet while there is a range of possible options for reducing emissions, it is not immediately apparent which options would be best to pursue. Some options will deliver greater reductions than others, but they may also be more expensive to undertake. A process for evaluating the options is required.

Selecting the best mitigation options

The Committee on Climate Change (CCC) has been established to advise on the best way to share out national targets.[3] As an input to this task, Defra has commissioned SAC to research the cost-effectiveness of various mitigation options in the agriculture, land use, land use change and forestry sectors. Cost-effectiveness is crucial because while there are many potential mitigation measures, some will be more attractive than others. The challenge is to stabilise GHG concentrations at a level that avoids the worst climate change risks for least cost – maximising emissions reductions without damaging the UK economy.

Current SAC research starts from the recognition that each potential measure for reducing agricultural GHG emissions will deliver a certain level of benefit (reduction in emissions) for a specific cost. This relationship between costs and benefits can be represented on a Marginal Abatement Cost Curve (figure 1). Some measures, such as adopting energy saving practices on farms, may be able to reduce emissions and save money (A). Other measures may reduce emissions more, but incur a positive cost (B). Generally speaking, the greater the level of mitigation sought, the higher the cost. The present task is to identify where on this curve different measures lie, thus enabling a judgement on which ones to adopt.

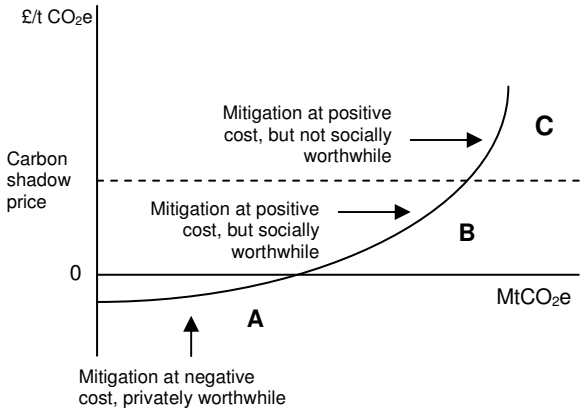

Figure 1. Stylised Marginal Abatement Cost Curve for CO_2e. (Source: Pareto Consulting, 2008). [2]

[1] http://www.scotland.gov.uk/Publications/2006/03/30091039/0
[2] http://www.scotland.gov.uk/Topics/Agriculture/Agricultural-Policy/17289/change
[3] http://www.defra.gov.uk/environment/climatechange/uk/legislation/committee

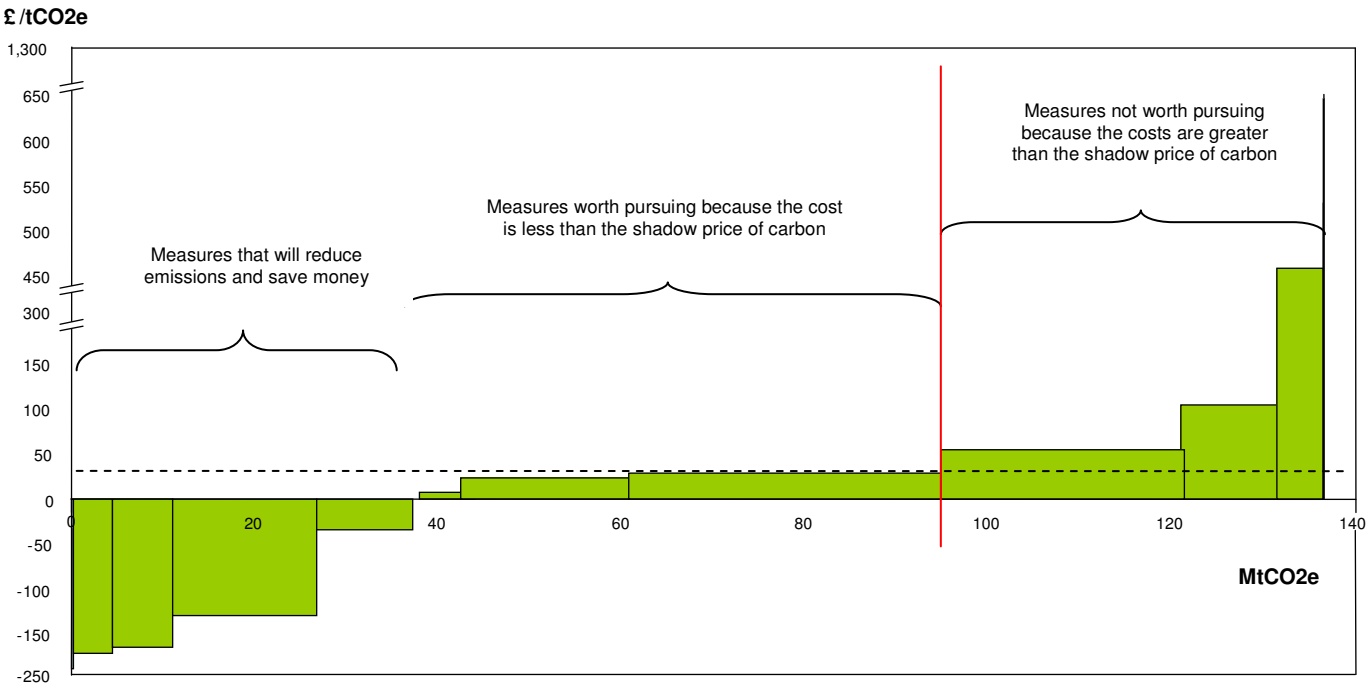

Figure 2: Stylised aggregate marginal abatement cost curve. (Source: adapted from Office of Climate Change, Full Report).

An important element in determining cost-effectiveness is judging whether the costs of implementing a particular measure are less than the value of the benefits that would be delivered. Putting a value on the benefits of reducing emissions is complex, but recent work by Defra has sought to put a value on the damage cost of one extra unit of carbon equivalent gas (currently £25/tonne/CO_2e).[4] This figure – the shadow price of carbon (SPC) – puts a value on the damage avoided (benefit) by reducing emissions. Cost-effectiveness can then be judged with reference to this figure. If a mitigation measure costs more than the shadow price of carbon, the costs exceed the benefits and the measure is not cost-effective (figure 1, C). Thus while all measures are technically feasible, only some are economically justifiable.

The current SAC research on the cost-effectiveness of mitigation measures in the agriculture, forestry, land-use and land-use change sector will allow a comparison of the different options (figure 2). The measures (represented by the boxes) on the left are the most cost-effective, with costs of abatement rising towards the right. This and similar work will provide insight into the best options to pursue. More broadly, similar work in different sectors can be integrated and used as the basis for determining national carbon budgets and for identifying where effort should be applied.

Wider issues

Ancillary benefits

Straightforward calculations of cost-effectiveness, made with reference to the shadow price of carbon, will not necessarily capture the wider benefits: a mitigation option to reduce GHG emissions, for example, may also benefit biodiversity or landscape, but this would not be included in the calculation. Of these wider ancillary benefits the most significant is likely to relate to the value of avoided damages from diffuse pollution to water. Accounting for these benefits is important because achieving multiple policy goals at once may significantly alter the cost. Measures that are apparently low-cost may be viewed less favourably if they also have a negative impact on landscape or biodiversity or water quality. High cost measures may become more effective if they also deliver ancillary benefits.

A changing situation

Calculations of cost-effectiveness balance the costs of mitigation measures and the shadow price of carbon. Thus the cost-effectiveness of any particular option can change as the costs of undertaking the measure fall or as the SPC rises. The SPC – currently £25/tonne/CO_2e – is likely to rise as our understanding of the impact of climate change improves. Measures that are currently cost-ineffective may become worthwhile as the SPC grows.

Acknowledging wider net effects

Beyond the ancillary effects, potential implementation of mitigation options in the UK (and thus their implicit cost-effectiveness) must also take into account the wider changes that these options might bring about. It is not clear, for example, that reducing emissions from UK agriculture would actually deliver a reduction in emissions globally. Although emissions in the UK could be reduced by cutting the number of livestock, unless the demand for livestock products also falls the demand would simply be satisfied by supplies from elsewhere. Displacing production activities into other countries does not address the global emissions objective. Such displacement and life cycle costs are also relevant to the accurate portrayal of the UK Marginal Abatement Cost Curve potential.

[4] http://www.defra.gov.uk/environment/climatechange/research/carboncost

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