Defra project AQ0834 - Identification of Potential "Remedies" for Air Pollution (nitrogen) Impacts on Designated Sites (R.A.P.I.D.S.)

Appendix 8: Implementation benefits and challenges of voluntary agri-environment and tax/subsidy schemes

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Benefits/Challenges/Actions to reduce NO_x/Ammonia pollution from agriculture

	Benefits	Challenges	Actions
Voluntary schemes	• Potential for greater environmental gains • Flexibility • Lower implementation costs	• Low rates of uptake • Low environmental gains • Mismatch of coverage and environmental need	• Raise payments • Increase participation • Target schemes to areas of low environmental quality
Tax/subsidy schemes	• Individual monitoring not required • Flexibility • Focus on environmental quality • Eliminates free-rider incentive	• Difficult to monitor environmental status of resource • Long time lag between emissions and environmental effect • Tax liability depends on random factors	• Monitor less/devise technological solution • Use simulations to estimate likely effect in the future • Allow for effect of random factors ex post

1. Voluntary Schemes

Voluntary schemes such as agri-environmental schemes and the Greenhouse Gas Action Plan (voluntarily adopted by the farming industry) appear to be the main approach used by government to limit the adverse environmental effects arising from agriculture. Although agri-environmental schemes are not the only element of this approach they are the largest, with such schemes being central to the Rural Development Programmes of the European Union member states (Ingram et al.,

2013). With an increasing budget and expanding area of land coverage, these schemes are set to remain a key tool in limiting the adverse environmental effects of agriculture (Espinosa-Goded et al., 2010; Riley, 2011). Voluntary agreements in general and agri-environmental schemes in particular, have the potential to realise substantial environmental gains through encouraging a pro-active cooperative approach between government and the agricultural sector, greater flexibility and freedom to identify cost-effective solutions. As the targets of regulation, i.e. the farmers, are involved in the process of drafting and implementing measures to control pollution, the costs of implementation can be reduced and actions implemented more quickly (Com(96)).

In the case of reducing ammonia emissions from agriculture, a possible solution to this challenge is to emphasise the nature of voluntary funding schemes as catalysing a long-term transformation in management practices towards those that give ongoing annual environmental benefits (e.g. reduced annual emissions to the air). For example, capital grants for the use of locally based new technologies (e.g. low-emission manure spreading equipment) which promote greater experience of the technology, allowing the benefits to be more widely appreciated (e.g. nitrogen savings from reduced losses, better fertilizer equivalence value of manures), and markets to develop so supporting the long-term replacement of older high-emission technologies.

However, there are also significant challenges that have to be overcome if voluntary schemes are to yield significant environmental benefits. Although a key feature in their attractiveness to farmers and policymakers alike, their voluntary nature can also be an obstacle to ensuring the delivery of required environmental benefits. Payments under the scheme may be too low to encourage sufficient participation, uptake may be patchy across the country often not coinciding with areas of greatest environmental need and actions set out in the scheme may simply codify what farmers would have done anyway. There is evidence to suggest that farmers who participate in such schemes do so because what is required under the schemes does not deviate significantly from what they already do (Hodge and Reader, 2010; Ingram et al., 2013).

Actions or remedies that can be taken to alleviate these problems include ensuring:

- payments cover the costs to farmers of participating in the scheme. Payments for the provision of environmental services should match the costs of providing those services. However, in the absence of such information the regulator might pay too much or too little. Too little and participation will be too low, too much and the cost of implementing the scheme will be too high. The regulator can elicit from the farmers the costs of providing these services through an auction. For example, the regulator could auction a package of actions and the farmers bid amounts that they would need to receive to undertake these actions. The lowest bid wins. In this way farmers have an incentive to bid just the amount that it will cost them to undertake these actions. Such an auction has the potential to lower implementation costs. These payments should be updated regularly enough to ensure that there are no conflicting incentives facing farmers, e.g. international commodity price movements such that intensive production is the best financial option.
- sufficient overlap between uptake of measures within schemes and environmental benefit. Identification of areas where environmental need is greatest may help in the targeting of areas and the provision of higher payments or some element of compulsory provision of environmental services by the land managers in such areas. The latter could take the form of mandatory measures or the provision of the opportunity to enter a scheme backed by the threat of a penalty on failure to do so. Segerson and Miceli (1998) predict that environmental

gains will vary depending on how much clout the regulator has. For example, 'voluntary schemes' backed up by a mandatory requirement or charge are more successful than those that do not have such a provision.

- the length of the contract between the farmer and the regulator does not introduce adverse incentives. There is a danger that once the agreement comes to an end, the land manager could undo all the accumulated benefits accrued over the lifetime of the agreement (Hanley et al., 1999). However, lengthening the agreement beyond the typical 5 and 10 year periods may have an adverse effect on participation, as farmers may not wish to be restricted in their activities for too long. The optimal length of a contract which maximises participation and provides long-term environmental benefits is a research question. Alternatively, different lengths could be tried and tested in the field.

Alternatives other than voluntary schemes include input taxes and tax/subsidy ambient schemes. Input taxes in this context include, for example, taxes on fertilisers. The problem with such taxes is that for them to be implemented properly, i.e. every farmer pays according to the damage they inflict on the environment, the taxes should be different across farmers which would imply that farmers pay different prices for the same fertiliser. Such a scheme would be un-implementable. The alternative is to implement a uniform tax. The problem here is that the tax rate would have to be set at a very high level since the demand for fertiliser tends to be inelastic, i.e. large changes in the price are required for there to be significant changes in demand. For this reason, input taxes will not be discussed any further.

2. Tax/subsidy Schemes

Tax/subsidy schemes were first introduced into the environmental economics literature by Segerson (1988). The problem with agricultural pollution is that it is often of a diffuse nature and so prohibitively costly to monitor. Thus, regulatory measures cannot be directly applied to emissions at source since there is no way of evaluating such measures. In addition, because non-compliance by the individual polluter cannot be detected, there is an incentive for polluters to free-ride. This means that there is an incentive for them not to incur the costs of controlling pollution while being able to enjoy any benefits of actions taken by others. To counteract the difficulty of controlling pollution at source the environmental resource to be protected, e.g. river is monitored under the tax/subsidy scheme. This scheme accords well with the catchment approach advocated by the Water Framework Directive. A target level of concentration in the river is chosen and all farmers within the catchment of the river are treated as a group, so that if the total concentration in the river exceeds the target level, all farmers pay a tax. On the other hand, if the total concentration in the river is lower than the target level, they receive a subsidy. In this way, because all farmers are responsible monetarily for deviations from the target, the free-rider incentive is eliminated. Additional benefits of such a scheme are that it is concerned with environmental quality rather than emissions per se and it provides flexibility. Polluters are free to choose the least cost options to reduce emissions which is cost-effective. However, there are significant challenges to be overcome before such a system could become widely used.

As with the voluntary scheme, its very design which makes it attractive as a method of pollution control, can produce a significant obstacle to its success in delivering environmental benefits. Since it treats polluters as a group, it eliminates the need for individual monitoring but it means that every polluter is liable for the actions of others within the group. This is fine from a regulatory point of view but from the perspective of the individual polluter or farmer, it may not be so. More problematic than this, for both the polluter and the regulator, is that tax liabilities can also arise even when group actions would imply compliance with the target but stochastic factors such as rainfall mean that the realised level of pollution is in breach of the target. The applicability of the scheme may be lower in cases where there is a long time lag between emissions at source and the environmental effects in the receptor. This is particularly the case with nitrate emissions in groundwater where the effects of fertilisers applied 40 or 50 years are being felt today.

Possible actions/remedies that could be put in place to increase applicability of the tax/subsidy scheme are:

- compensatory measures which could be incorporated into the scheme to take account of situations where rainfall caused the actual level of pollution to exceed the standard.
- information campaigns to highlight the benefits and to explain the merits of such a system. Such efforts would increase the political acceptability of a group scheme.
- to increase knowledge about the movement of nitrates and ammonia through the environment so that the relationship between emissions at source and appearance in the receptor can be quantified more accurately.

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