Acidification strategy sensitivity analysis

Flexibility leads to similar overall environmental protection at lower cost.

INTRODUCTION

In mid 1997, the European Commission published its strategy to combat adverse environmental effects resulting from the deposition of acidifying pollutants. The ultimate target was to achieve zero exceedance of critical loads for acidification (*CONCAWE Review* Volume 7, Number 1). As this will be unachievable within the foreseeable future, the Commission's proposals sought a least cost solution to achieving a 50 per cent gap closure by 2010 towards this ultimate target. At the time the proposals were published it was estimated that the proposed Acidification Strategy would cost the EU-15 an extra ECU 7 billion per annum, in addition to the ECU 40 billion per annum to implement existing emission reduction commitments for SO_x, NO_x and NH_3.

The 50 per cent gap closure target was chosen as it represented the 'knee' on the overall EU cost curve—the argument being that beyond that point, the cost-effectiveness of measures declines rapidly. However, the choice of this ambition level did not specifically include an examination of the consequences for individual EU countries. On analysis, it soon became apparent that certain countries would be expected to implement emission reduction measures that were in the least cost-effective part of their own country's cost-effectiveness curve (i.e. well above the 'knee' on the national cost curves).

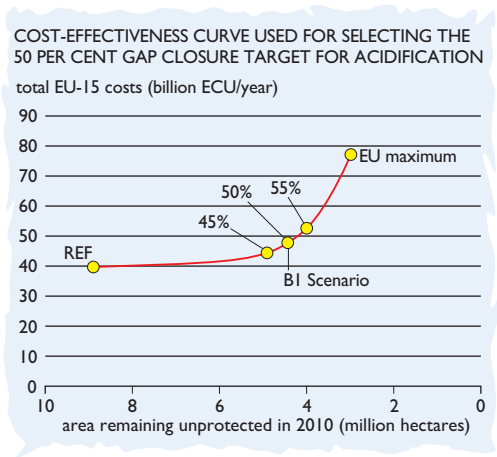


Figure 1
The EU-15 cost-effectiveness curve used by the European Commission as the basis for selecting the 50 per cent gap-closure target for acidification

CONCAWE has conducted an investigation into the consequences of no country being forced to implement measures in the least cost-effective part of its national cost curve. The aim was to provide further information and a sensitivity analysis beyond that which was provided by the Commission during the development of its proposed Acidification Strategy.

The International Institute of Applied Systems Analysis' (IIASA) Regional Air Pollution Information and Simulation (RAINS) model (Version 7.2) was used both to develop the Commission's Acidification Strategy and in this CONCAWE sensitivity analysis. Hence, the CONCAWE results can be compared directly with the RAINS results used in developing the original Acidification Strategy. However, there have been many changes to this model since Version 7.2 and these changes are likely to have a significant effect on any modelling results. This means that the results from the original Acidification Strategy work and this CONCAWE sensitivity analysis must necessarily be considered as indicative only.

MODELLING METHODOLOGY

Version 7.2 of the RAINS model was used, and specifically those files relating to the Commission Acidification Strategy's 50 per cent gap-closure scenario—the so-called 'B1 Scenario'.

It was first necessary to determine the 'knee' of the cost curves for each country. For many countries there is not a clear point of inflection, and choosing a point becomes rather subjective. However, for most countries, the cost curve starts to rise very steeply for abatement techniques that cost more than:

- 2000 ECU/tonne SO_2
- 2000 ECU/tonne NO_x
- 4000 ECU/tonne NH_3

The location of the 'knee' and ceiling is illustrated in Figure 2.

These cost-effectiveness ceilings were used as pseudo policy constraints in the model runs for the EU-15 countries, i.e. no EU-15 country would be expected to implement measures that were less cost-effective than the values used above. However, where an EU-15 country is already committed to implementing measures under the so-called REFerence Scenario[1] that are more expensive than the relevant value above, this additional commitment is used as the national ceiling in this analysis. Non-EU-15 countries were assumed not to implement any measures beyond those they are committed to under the REFerence Scenario.

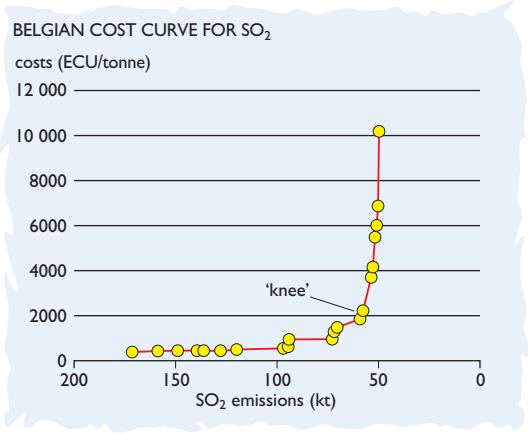


Figure 2
Relative cost-effectiveness of different measures to reduce SO_2 emissions, and the position of the 'knee' on the Belgian cost curve

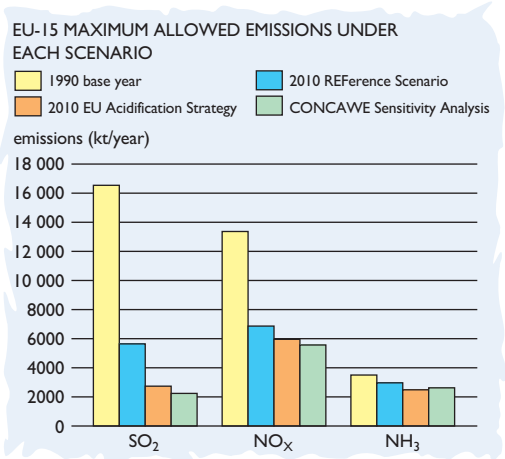
It should be noted that these new constraints posed in the CONCAWE sensitivity analysis mean that a strict 50 per cent gap closure target is infeasible in a very small number of the model's European grid squares (3 to 4 grids). Consequently, the target acid deposition levels in these squares had to be increased slightly above those used in the B1 Scenario analysis.

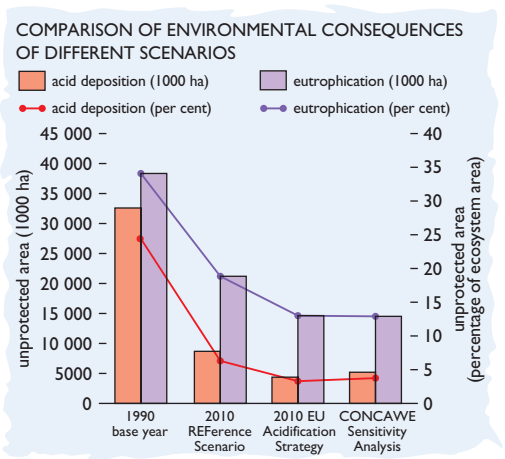
MODELLING RESULTS FOR THE EU-15

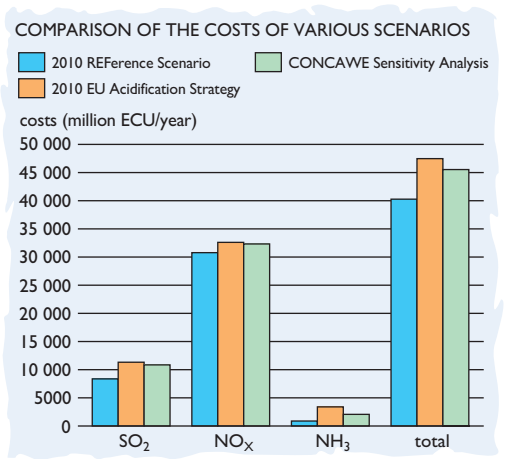
Comparing the results from the CONCAWE sensitivity analysis and the DG-XI B1 scenario, it can be seen that the CONCAWE sensitivity analysis would:

- require greater overall emission reductions (see Figure 3);
- achieve similar overall protection from acidification (0.6 per cent less area would be protected) (see Figure 4);
- achieve similar overall protection from eutrophication (0.1 per cent less area would be protected) (see Figure 4); and
- the overall costs in addition to the REFerence case are 27 per cent less (see Figure 5).

Figures 3, 4 and 5 (below, left to right) Modelling results from the CONCAWE Sensitivity Analysis and the DG-XI B1 scenario compared.







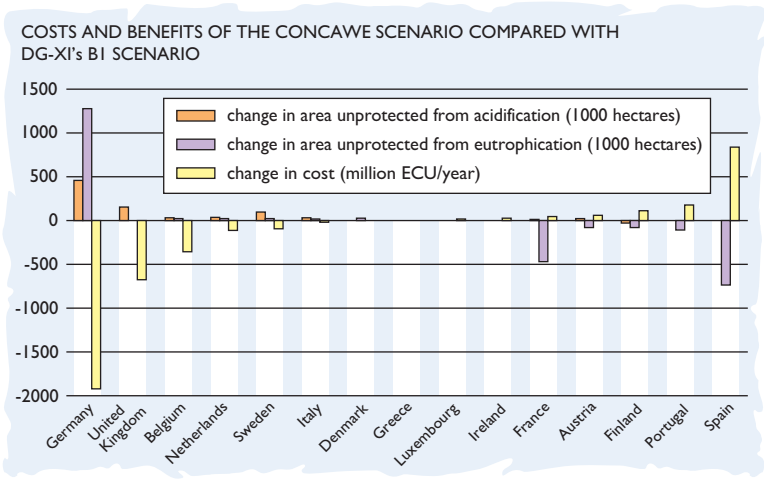


Figure 6
Costs and benefits of the CONCAWE scenario compared with DG-XI's B1 scenario

When the results of the CONCAWE sensitivity analysis results are compared with the Commission's proposal at the country level, it can be seen that there are substantial changes in the costs and benefits for certain countries. The changes are illustrated in Figure 6. Under the Commission's Acidification Strategy proposals Germany, Italy, The Netherlands and the UK would bear a large proportion of the EU total costs. Under the CONCAWE scenario the overall cost burden is more broadly shared. Comparing the environmental consequences, it is clear that the reduced costs for Germany (and its neighbours), would result in a greater area being left unprotected from acidification, particularly in Germany itself, the UK and Sweden, and from eutrophication, again particularly in Germany. The additional costs for France, Austria, Finland, Portugal and Spain are compensated for by an improved protection of ecosystems in those countries.

IMPLICATIONS FOR DECISION MAKERS

The analysis outlined above demonstrates that there are a number of ways in which the balance of costs versus benefits can be determined. Adherence to a strict 50 per cent gap closure target across the EU-15 means that very expensive measures would be introduced in some Member States. This degree of ambition and the rigidity of its application has been questioned by several countries and, at the request of the December 1997 Environment Council, the Commission is to consider alternative approaches to setting targets for reducing Acidification. Although the Commission is investigating different target setting approaches, it has indicated that it has no intention of relaxing its ambitions to combat acidification in its development of a National Emissions Ceilings Directive. This CONCAWE analysis indicates one way that the introduction of a little flexibility could substantially reduce costs without materially lowering the ambition level.

Up-to-date analysis is dependent upon the release of the most recent version of the RAINS model or on modelling runs being undertaken by IIASA themselves. Industry has pressed for release of the next version of the RAINS model so that it can explore the various policy setting options further. Unfortunately, there is every indication that the up-to-date model will not be released in time for important sensitivity analyses to be undertaken by industry or other interested parties. Indeed the Commission's current timetable is such that IIASA themselves will not be able to undertake the necessary sensitivity and uncertainty analyses to examine a wider range of options for setting mandatory national emission reductions under the proposed National Emissions Ceilings Directive.

It is important that the forthcoming National Emission Ceilings Directive, that will bring together measures to control acidification, tropospheric ozone and eutrophication, is realistic at the national, European and intercontinental levels. The emerging DG-XI proposal would require a significant percentage of the national gross domestic product (GDP) to be spent in certain countries and their economies may suffer unnecessarily if unreasonable emission reductions are imposed.

[1] *The REFerence Scenario from the IIASA 2nd Interim Report is the RAINS scenario for 2010 which takes into account the effects of existing and agreed legislation on emissions.*