The Integrated Pollution Prevention and Control (IPPC) Directive

The justification for its proposed revision is further challenged by the findings of the Euro-Delta Project

In the Autumn of 2005, during the preparatory work by DG Environment to revise the current Integrated Pollution Prevention and Control (IPPC) Directive, CONCAWE published the results of a small but important study examining the consequences of a departure from the concept of a 'local BAT' approach to a common Europe-wide concept of BAT[1]. The concept of 'local BAT' (i.e. a BAT that accounts for the specifics of a given plant and its impact on human health/the environment) is an integral part of the existing IPPC Directive and is at the heart of the optimised cost-effective design of the Commission's Thematic Strategy on Air Pollution (TSAP). A significant finding of the study was that, for the same environmental goal in the EU as a whole, the overall cost of meeting the TSAP ambition for reduced exposure to fine particulates would double as a result of a move away from the local BAT concept to a rigid, common EU-wide BAT. The study also highlighted the fact that for some individual Member States, the cost burden could increase sevenfold or more.

At the end of 2007, the European Commission adopted their proposed revision of the current IPPC Directive[2]. Formally, the proposal as adopted is a 'Recast' Directive which seeks to consolidate some seven Directives[3] into a single IPPC Directive. Disappointingly though, one key structural change in this proposal is that, in essence, the concept of 'local BAT' has been abandoned in favour of a common Europe-wide BAT. While the repercussions of this departure from local BAT have already been exposed in an earlier CONCAWE study, in this article, we explore the implications of a more extensive study, called Euro-Delta, on the justification for some other key elements of this 'Recast' proposal.

The Euro-Delta project (ED Phase I) was initially designed as a comparative exercise between five European Transboundary air pollution models/modelling teams i.e. exploring the variation in results from the different models for the same emission scenarios and their implication for robust policy design. Included in the five models was the European Monitoring and Evaluation Programme (EMEP) model which, up to the present time, has been the sole model used to support policy development at both the EU and wider UNECE level. The more recent availability of similar 'Eulerian Models' in France (the CHIMERE model), Germany (the REM-3 model), The Netherlands (the LOTOS model) and Sweden (the MATCH model) justified and enabled such a project. The Commission's Joint Research Centre (JRC) acted as co-ordinator of this project as well as a clearing house for all modelling results.

The second phase of the project (ED Phase II) focused on a larger number of emission reduction scenarios. The majority of these were 'terrestrial' scenarios, designed to explore sector-specific emission reductions. The aim here was to determine whether the same unit emission reduction in different sectors gives significantly different impacts on human health and the environment. This is an important policy question, since the main tool used to develop air-related legislation is Integrated Assessment Modelling (IAM)[4]. Currently these models do not differentiate between the impacts of emission

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1 *'EU-wide BAT—an expensive suit that doesn't fit everybody!' CONCAWE* Review, *Volume 14, Number 2, Autumn 2005.*

2 *Com(2007) 844 final, December 21, 2007.*

3 *Three TiO_2 Directives: 78/176/EEC; 82/883/EEC; 92/112/EEC; the original IPPC Directive 96/61/EEC; The VOC Solvents Directive 1999/13/EC; The Waste Incineration Directive 2000/76/EC and the Large Combustion Plant Directive 2001/80/EC.*

4 *The IIASA RAINS and now GAINS Integrated Assessment Models have been extensively used to inform the development of the UNECE Gothenburg Protocol, the current EU National Emission Ceilings Directive (NECD), the EU Thematic Strategy on Air Pollution and the current work associated with the revision of the NECD.*

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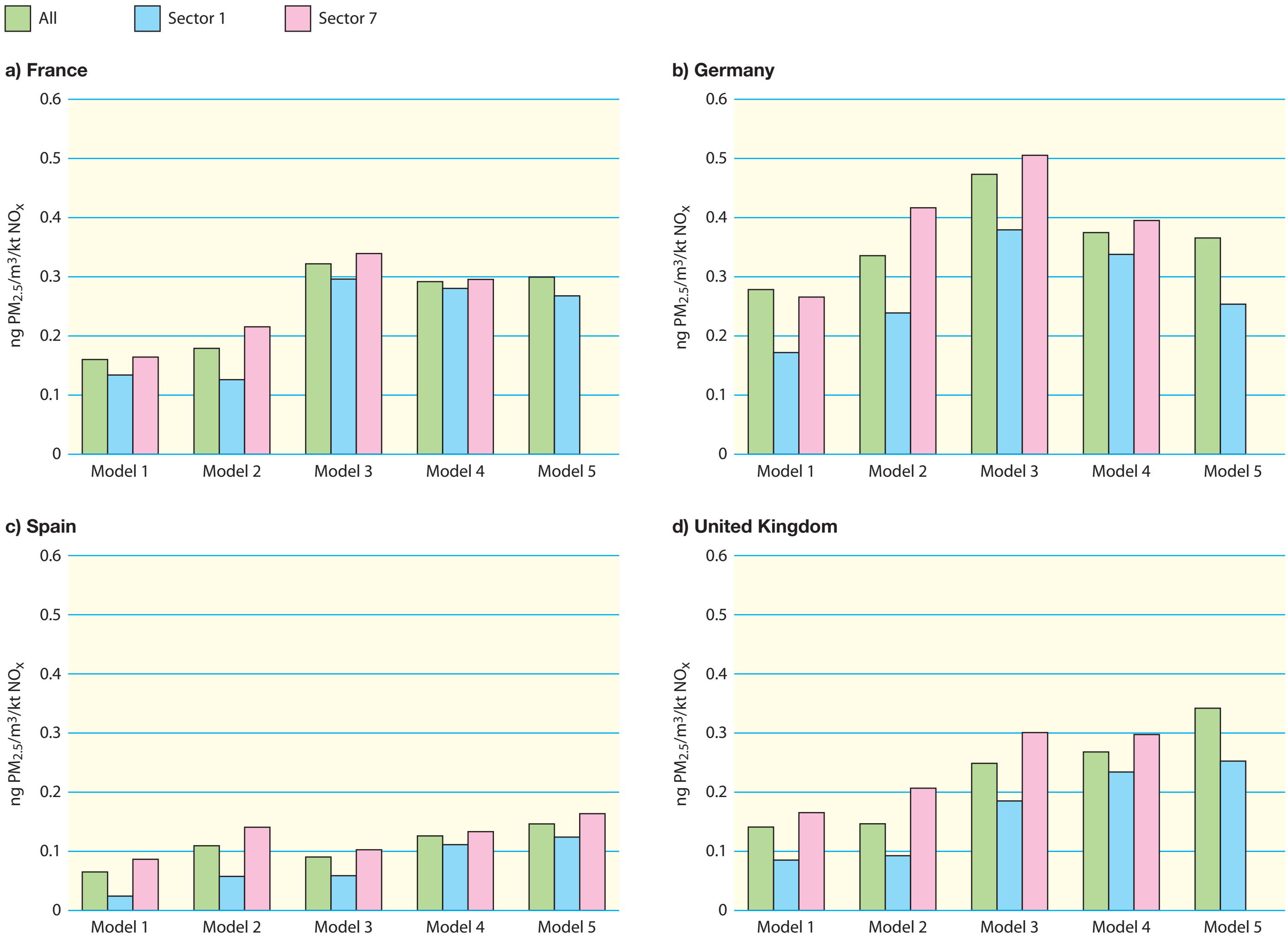
Figure 1 Impacts of NO_x emission changes in France, Germany, Spain and UK on population weighted $PM_{2.5}$ concentrations over EU-25



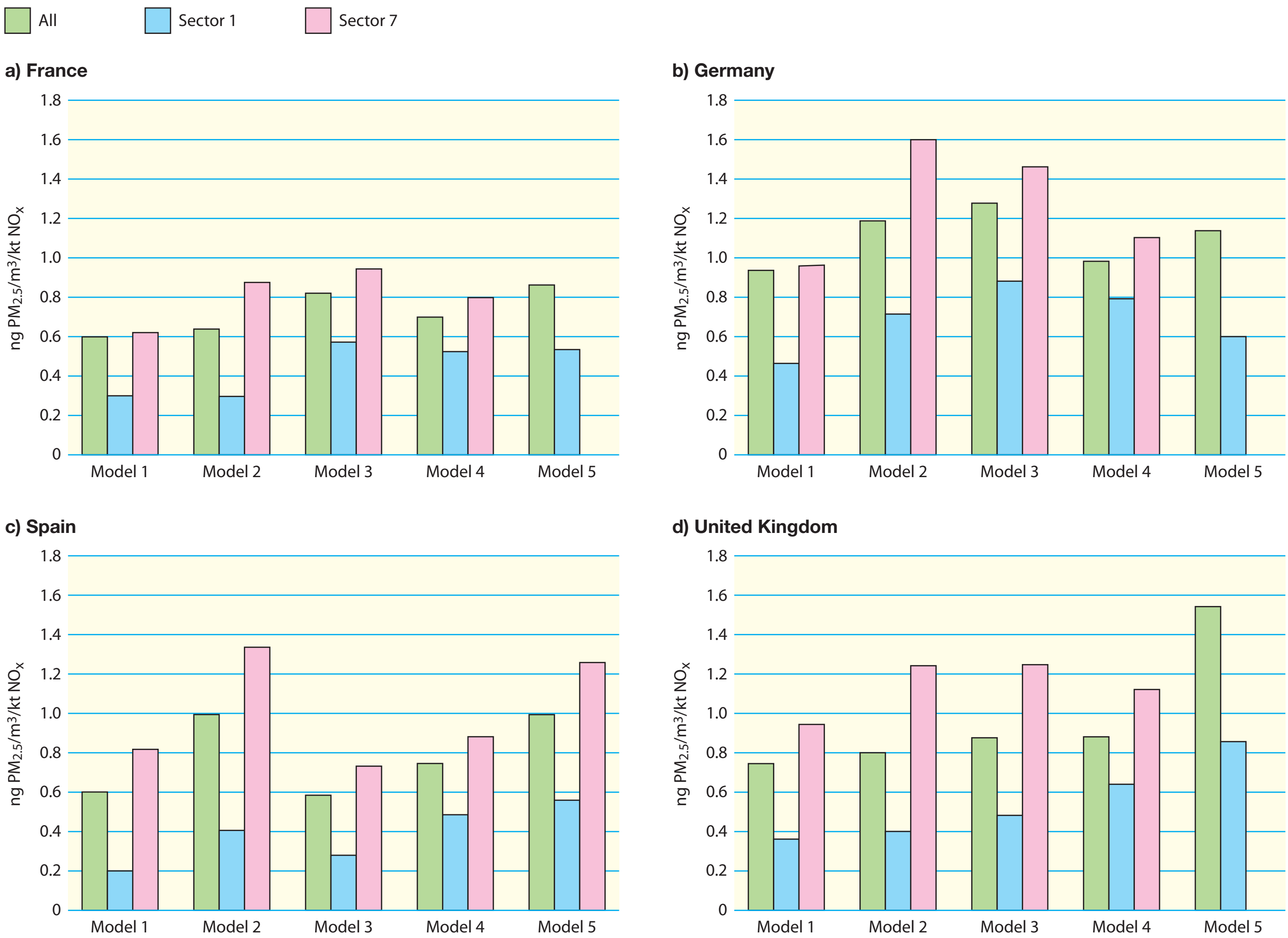
changes from different sectors in their so-called source-receptor functions[5]. These are derived from simultaneously applying the same percentage emission reduction to all sectors in a given country.

Some 50 emission reduction scenarios were run by each of the five modelling teams. These scenarios focused on France, Germany, Spain and the UK. For each of these countries, separate scenarios were run simulating reduced emissions in a single sector (e.g. the power generation sector), and in all sectors by the same percentage. To ensure that reductions remained within the 'policy range' they were confined to 90% of that achievable by Maximum Technical Feasible Reductions (MTFR).

In order to make it possible to compare the results of different scenarios with each other on a common basis, the change in impacts (measured from a common 'Base Case') were expressed 'per unit of emission change'. This metric expresses an 'emission potency' i.e. the change in impact for a unit change in emissions.

[5] *Source-receptor functions are derived from multiple runs of a regional trans-boundary air pollution model (in the case of RAINS/GAINS, the EMEP model) the results of which are regressed into linear relationships which relate an emission change in a country to the change in impact at each receptor (i.e. a 50x50 km EMEP grid).*

Figure 2 Impacts of NO_x emission changes in France, Germany, Spain and UK on population weighted $PM_{2.5}$ concentrations within each country



Secondary PM impacts

As noted above, human exposure to fine particulates continues to be a priority concern in the development of air quality-related regulation in the EU. This was clearly reflected in the EU Clean Air For Europe (CAFE) programme and the resulting EU Commission's TSAP. Therefore the results presented in this article focus on this concern.

For each of the five models, Figures 1 and 2 show the change in $PM_{2.5}$ health impact indicator (expressed here as change in population-weighted $PM_{2.5}$ concentration per kilotonne of NO_x emission reduction) for three reduction scenarios:

1. A fixed percentage emission reduction across all NO_x emitting sectors in each country (as represented currently in RAINS/GAINS): the 'All' case.
2. A NO_x emission reduction in 'Sector 1' (combustion in energy industries, e.g. power generation plants): the 'Sector 1' case.
3. A NO_x emission reduction in 'Sector 7' (road transport): the 'Sector 7' case.

Figure 1 shows the population-weighted impact for EU-25 as a whole, Figure 2 the population-weighted impact for the country in which the emission reduction takes place.

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What is clear from both series of charts is that a unit reduction in NO_x emissions in Sector 1 (large point sources in the energy industry) gives a significantly smaller reduction in population weighted $PM_{2.5}$ exposure than Sector 7 (road transport) or the fixed percentage reduction across all sectors simultaneously. In the case of Spain and the UK, this difference in 'emission potency' is more than twofold. In the case of 'change in impacts in the countries where the emission change is made', the difference in potency is between two and fourfold. Importantly, these significant differences in potency are reflected in the results from all five models.

Given that population exposure is a function of proximity to source, the fact that large point sources have significantly lower potencies than road transport is not, in principle, surprising. What is perhaps unexpected is the magnitude of the differences, at least in some countries.

Similar results were also found in emissions reduction scenarios for both primary $PM_{2.5}$ and, to a lesser extent, SO_2. This has potentially significant implications for the current generation of Integrated Assessment Models if they are to be made fit for purpose as input into the design of sectorally specific policies such as the revision of the IPPC Directive.

Implications for the 'justification' of the IPPC Directive

In a companion article in this *Review*[6], the justification of the European Commission's proposed revision of the IPPC Directive is called into question in the light of updated scientific data on the monetary valuation of health impacts (VOLY values) and with regard to methodological issues in the marginal benefit analysis that was undertaken as part of the Commission's associated impact assessment. The analysis underpinning this article is based on the source-receptor functions currently used in the EU Commission's RAINS/GAINS models. As discussed above, these are derived from EMEP modelling runs which, for a given country, simulate emission reductions across all sectors by the same percentage. This is equivalent to the 'All' scenarios in Figures 1 and 2. In the case of Sector 1 (covering a significant proportion of the large combustion plants), the health impacts benefit for reductions in emissions (and other similar large point source sectors) will be overstated, and in the case of France and Spain, significantly overstated by RAINS/GAINS.

By adjusting the potencies of emissions from sectors associated with large point sources (in line with the findings of Euro-Delta discussed above), it has been possible to make a first assessment of the implications of the lower potency on the 'justification' of the IPPC proposal using CONCAWE's in-house IAM[7]. Even when the adjustments are confined to the four countries examined in Euro-Delta (France, Germany, Spain and the UK) the implied Cost/YOLL ratio measured from the TSAP optimised case increases from about k€ 100, as mentioned in the companion article, to some k€ 150; this needs to be seen in the light of the latest recommended VOLY of k€ 18.

At an individual Member State level, the situation is even more dramatic: in Spain the Cost/YOLL ratio based on the non-sector specific potencies is about k€ 165. This rises to about k€ 500 when the lower potency for large point sources is accounted for.

These findings highlight the need for further development of the current IAM tools if they are to continue to be 'fit for purpose' in supporting sectorally differentiated policies. They also raise serious questions on the justification of the Commission's proposed revision of the IPPC Directive as set out in the associated Impact Assessment. In recent years, the Commission has committed itself to basing new environmental legislation upon sound science supported by thorough technical analysis and impact assessment. It is essential that these principles are adhered to in the review of the IPPC Directive, a piece of legislation which has a major impact on the industries concerned.

[6] *'Cost-benefit analysis for air quality policies: an update and an IPPC Directive case study'—see page 10.*

[7] *CONCAWE's in-house IAM utilises the same source-receptor functions, emissions and cost databases as the IIASA RAINS/GAINS model.*