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The Thematic Strategy on Air Pollution

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Contents

Summary

The Communication containing the Thematic Strategy is a short document, accompanied by a lengthy Impact Assessment. The Strategy sets out actions that it claims will reduce the number of premature deaths in 2020 by 140,000 compared to 2000. The cost of implementing the strategy is estimated at €7.1 billion per year, although the health benefits amount to nearly six times as much at €42 billion per year, while environmental benefits are not quantified.

Accompanying the Strategy is a proposal for a Directive, which is the first concrete proposal arising from the CAFE process. It proposes that the air quality framework Directive be merged with its first three daughter Directives and the Decision on the exchange of air quality information into one piece of legislation. The proposal does have some new elements, as it would require Member States to monitor $PM_{2.5}$ concentrations for the first time, as opposed to the larger PM_{10} that is the focus of existing legislation.

The Strategy itself acknowledges that it does not deliver the objectives of the 6EAP with respect to air quality. The rationale behind the choice of the chosen scenario underlying the Strategy is set out in the Impact Assessment. This choice is not a point where costs outweigh benefits, as the Impact Assessment shows that more stringent measures would still deliver benefits that outweigh costs. The link between the chosen scenario and the measures proposed in the Strategy is also not explicit. The Impact Assessment contains much discussion of the policy measures that might be applied to meet the objectives of the three scenarios modelled. However, the scale and scope of the measures needed is not explicitly mentioned, or indeed linked explicitly to any of the three scenarios modelled.

The proposed Directive includes provisions on $PM_{2.5}$, but the obligations are not designed to be more stringent than existing measures. Achieving the existing objectives for PM_{10} is probably impossible for some Member States and the proposal relaxes this obligation. The proposal does not, therefore, require any additional action on particulate matter – indeed the obligations are relaxed – even though concern by health professionals has increased.

The Impact Assessment has used a number of economic models. The key model is RAINS that was used to assess the direct costs to economic sectors of meeting ambient air quality targets. In order to assess the development of emissions over time, RAINS relies on activity and emissions scenarios developed by other models, e.g. the PRIMES model regarding energy production and consumption. Finally, the GEM-E3 model was used to assess the macroeconomic effects of the selected air quality policies.

The models that were used in the preparation of the strategy are adequate for the task. They can be described as state-of-the-art and they have been tested before. The range of values that has been used to value damages from air pollution is based on a valid methodology and an up-to-date review of scientific and economic literature. The transparency and documentation of some of the models could be improved. With respect to transparency and documentation, the RAINS model is superior to the other models. The documentation of GEM-E3 is better than that of PRIMES. Although the GEM-E3 model is fairly well documented at the technical level, the documentation does not provide insights into why certain modelling choices were made and what the alternative would have been. This lack of motivation is also apparent for the Impact Assessment, which does not reflect on questions about its choices on modelling

approach and its choices for specific models, and the possible impacts of these choices on the evaluation of air quality strategies.

The consolidation of existing legislation within the proposed Directive is largely to be welcomed, not least the harmonisation and up-dating of monitoring and reporting requirements. However, the failure to include the fourth daughter Directive and the statement that this will be included at a later stage is not explained and is regrettable.

1. Introduction

The Thematic Strategy on Air Pollution[1] should establish a ten-year programme for reducing the impacts of air pollution on health and the wider environment in the EU. This briefing for the Environment Committee of the European Parliament considers, *inter alia*, the following issues:

- What does the Thematic Strategy contain?
- Do the results of the Impact Assessment underpinning the Strategy lead to the proposal in the Strategy?
- Are there particular issues relating to proposals to address $PM_{2.5}$?
- What is the adequacy of the proposals put forward by the Commission?
- What is the adequacy of the models used to support the development of the Strategy?
- What is the consequence of consolidating legislation?

2. The Contents of the Thematic Strategy

The Communication containing the Thematic Strategy is a short document, accompanied by a lengthy Impact Assessment[2], supported by numerous background reports, which outline the scenarios that underlie it. The Strategy sets out actions that it claims will reduce the number of premature deaths in 2020 by 140,000 compared to 2000. The cost of implementing the strategy is estimated at €7.1 billion per year, although the health benefits amount to nearly six times as much at €42 billion per year, while environmental benefits are not quantified. Estimates suggest that of the €7.1 billion annual costs, €2.5 billion would fall on agriculture (of which €1 billion relates to existing measures), €2 billion on transport, €1 billion each on households and combustion plants, and €600 million on households.

To achieve its objectives, emissions of sulphur dioxide will have to decrease by 82%, the oxides of nitrogen (NO_x) by 60%, volatile organic compounds (VOCs) by 27% and primary fine particulates (now defined as $PM_{2.5}$) by 59% relative to 2000. The strategy notes that some of these reductions will be achieved by measures that have already been implemented

[1] Communication from the Commission to the Council and European Parliament *Thematic Strategy on air pollution* COM(2005)446

[2] Annex to the Communication on *Thematic Strategy on air pollution* (COM(2005)446) and the Directive on *Ambient Air Quality and Cleaner Air for Europe* COM(2005)447 *Impact Assessment* SEC(2005)1133

by Member States, although other measures will be needed. The proposals that are being, or will be, considered by the Commission, include:

- A proposal for stricter emission standards for cars (Euro V), which was published in December 2005 (see Section 5), with stricter standards for heavier vehicles to follow.
- The expansion of the coverage of the IPPC Directive to cover smaller industrial installations.
- Harmonised technical standards for domestic combustion appliances and their fuels will be developed, while smaller residential and commercial buildings could be included in an extended energy efficiency Directive.
- Further measures to reduce VOC emissions at petrol stations.
- Tighter NO_x emission standards for ships, which will be set at the EU level if international action is not forthcoming.
- Reduction of the nitrogen content of animal feedstuffs and controls on the excessive use of nitrogen fertiliser.

These are in addition to existing measures in the field of energy and transport, for example, that are already being taken forward. The Strategy also commits the Commission to a review of the national emissions ceiling (NEC) Directive to take account of the scenarios that underlie the Strategy.

Accompanying the Strategy is a proposal for a Directive, which is the first concrete proposal arising from the CAFE process. It proposes that the air quality framework Directive (96/62/EC[3]) be merged with its first three daughter Directives and the Decision on the exchange of air quality information into one piece of legislation (i.e. Directives 1999/30/EC[4], 2000/69/EC[5], 2002/3/EC[6] and Decision 97/101/EC[7], respectively). The fourth daughter Directive 2004/107/EC[8] will be merged later.

The proposal does have some new elements, as it would require Member States to monitor $PM_{2.5}$ concentrations for the first time, as opposed to the larger PM_{10} that is the focus of existing legislation. It also includes a 'concentration cap' on $PM_{2.5}$ for 2010, and sets an indicative reduction target between 2010 and 2020. The action on $PM_{2.5}$ is based on recent scientific evidence, which has suggested that the smaller particles are more dangerous for human health. To take account of this change of emphasis, the indicative limit value for PM_{10} for 2010 is repealed.

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[3] Directive 96/62/EC of the European Parliament and the Council on ambient air quality assessment and management, OJ L 296, 21.11.1996, page 55 ('Framework Directive')

[4] Directive 1999/30/EC of the European Parliament and the Council relating to limit values for sulphur dioxide and the oxides of nitrogen, particulate matter and lead in ambient air, OJ L 163, 29.6.1999, page 41 ('First Daughter Directive')

[5] Directive 2000/69/EC of the European Parliament and the Council relating to limit values for benzene and carbon monoxide in ambient air, OJ L 313, 13.12.2000, page 12 ('Second Daughter Directive')

[6] Directive 2002/3/EC of the European Parliament and the Council relating to ozone in ambient air, OJ L 67, 9.3.2002, page 14 ('Third Daughter Directive')

[7] Council Decision 97/101/EC establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States, OJ L 35, 5.2.1997, page 14 ('Exchange of Information Decision')

[8] Directive 2004/107/EC of the European Parliament and the Council relating to arsenic, cadmium, nickel, mercury and polycyclic aromatic hydrocarbons in ambient air, OJ L 23, 26.1.2005, page 3 ('Fourth Daughter Directive')

The proposal accompanying the Strategy also includes the possibility for derogations from the existing limit values in specific urban areas where limits on NOx, benzene or particulates are currently being exceeded, provided that plans and appropriate measures are put in place to ensure compliance within five years. This is to accommodate the difficulties that a number of Member States are currently experiencing in meeting the limit values in some areas. The Strategy also sets out the Commission's proposals to 'modernise' monitoring and reporting by setting up a system of electronic reporting based on shared information system, in collaboration with the EEA.

3. Does the Strategy deliver the Objectives of the 6EAP?

The 6th Environment Action Programme (6EAP) set out the following objective in relation to air quality:

> to achieve 'levels of air quality that do not give rise to significant negative impacts on and risks to human health and the environment'[9]

The Strategy itself acknowledges that it does not deliver the objectives of the 6EAP with respect to air quality. Whilst it recognises that existing policy measures are not sufficient to meet this objective, the Impact Assessment[10] (IA) concludes that not even the implementation of the Maximum Technically Feasible Reduction (MTFR) scenario would enable this objective to be met. This latter scenario takes no consideration of the cost of measures, but includes all that are currently technically feasible. Under the MTFR scenario, 190,000 people would still be dying prematurely as a result of air pollution, while 28% of forests would be exposed to ozone levels above the critical level and 15% of ecosystems would be at risk from excessive nutrient nitrogen. Consequently, the Strategy had to make a choice as to what level of health and environmental protection would be achieved by 2020, taking into account the associated costs and benefits.

One could argue that the proposed approach is a 'strategy' in as much as it sets out objectives, assesses costs and benefits and comes up with a set of priority actions, based on background modelling and significant public and stakeholder consultation. The objectives are arrived at after an assessment of the costs and benefits arising from modelling three scenarios, in addition to the MTFR, all of which yielded at least 50% of the emission reductions between the baseline and the MTFR. This range was chosen, as analysis had shown that control costs started to increase significantly when reductions of around 75% between the baseline and the MTFR were achieved. As a result of an assessment of the costs and benefits with respect to both human health and the environment of these three scenarios, the approach yielding the emissions reduction objectives set out in the Strategy was chosen. Of the three additional scenarios modelled, the approach in the Strategy lies between the two weaker (in terms of emissions reductions achieved) scenarios. However, the link between the priority measures set out in the Strategy and the chosen scenario are not clear (see Section 4).

[9] Decision No 1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme

[10] SEC(2005)1133

The 6EAP also stated that the Thematic Strategy should review and update air quality standards and the NEC Directive with a view to reaching a long-term objective of not exceeding critical loads. While the Strategy does indeed announce a review of the NEC Directive to bring this in line with the scenario underlying the Strategy, it proposes to update the existing limit values by effectively weakening them, at least in the short-term. This would be the result of the proposal to allow Member States additional time to meet some limit values, as long as they have compliance plans in place, which the Strategy presents under the guise of 'strengthening implementation'. The IA states that the decision was made not to update the current limit values – apart from those relating to $PM_{2.5}$ and PM_{10}, as noted above – on the basis of 'advice received from the scientific community'.

4. Does the Strategy flow from the Impact Assessment?

The rationale behind the choice of the chosen scenario underlying the Strategy is set out in the IA[11]. As noted above, the scenario underlying the Strategy lies between the weaker two of the three scenarios modelled. The rationale behind this is presented logically, but the reason behind the choice of the exact emissions reduction objectives is not clear. Instead, it is argued that this choice 'delivers the lowest levels of air pollution that can be justified in terms of benefits and costs whilst attempting to prevent undue risk for the population'. This choice is not a point where costs outweigh benefits, as the IA shows that more stringent measures would still deliver benefits that outweigh costs. The justification must, therefore, arise from political considerations rather than directly out of the IA itself.

The link between the chosen scenario and the measures proposed in the Strategy is also not explicit. The IA contains much discussion of the policy measures that might be applied to meet the objectives of the three scenarios modelled. However, the scale and scope of the measures needed is not explicitly mentioned, or indeed linked explicitly to any of the three scenarios modelled. Rather the sectoral emissions reductions that would result from each of the three scenarios are presented, followed by a general list of measures that could contribute to realising these reductions[12]. No indication is given as to which measures are needed to achieve the reductions achieved by each scenario, or indeed whether, or how, the extent and scope of the application of these measures differs between the three scenarios.

The link between scenarios and the measures is not even explicit in the relevant background report, although apparently the measures needed can be extracted from the internet implementation of the model underlying the IA, RAINS[13]. However, given that the chosen scenario that underlines the Strategy is not one of the three originally modelled (as noted above), it is even less clear from the IA what measures are subsequently needed, let alone their necessary scope and scale. The measures to be considered by the Commission, i.e. those set out in the strategy, were chosen following the 'indicative' results of the integrated assessment modelling[14]. These are presented four chapters before the scenario underlying the

[11] See Section 10.1 of SEC(2005)1133
[12] See Section 6.1 of SEC(2005)1133
[13] IIASA (2005) *A final set of scenarios for the Clean Air for Europe (CAFE) programme* submitted to the European Commission.
[14] See Section 6.2 of SEC(2005)1133

Strategy is chosen, which raises more questions as to the extent to which the chosen measures will lead to the required emissions reductions.

5. Assessment of Subsequent Proposals

Of the priority measures identified by the Strategy, some are in a more advanced state of development than others. For example, the proposal for Euro V emission standards for light duty road vehicles[15] is part of an ongoing and established process for tightening the emission limit values of road transport vehicles. The Euro V emission limit values have been the subject of consultation and are based on numerous background reports and the discussions of the Motor Vehicle Emissions Group (MVEG)[16]. Given the time available for this briefing, it is not possible to assess the Euro V proposal in detail. However, the limit values, particularly those for NO_x (200mg/km) and particulates (5mg/km), fall short of those that some environmental NGOs desire[17], and which a background report for the MVEG[18] suggests are – more or less – technically feasible. The latter report, however, does note that the technical measures to reduce emissions to those levels desired by the NGOs would be more costly than the technical measures required to meet less strict emission limit values, such as those proposed by the Commission.

The Commission has also undertaken a lot of work recently, including the commissioning of numerous consultancy reports, regarding reducing emissions from ships. This is because, as the Commission notes in the Thematic Strategy, these emissions are expected to exceed those of all land-based sources in the EU by 2020. In 2005, legislation to reduce the levels of sulphur in fuel used by ships was introduced, which should contribute to reduced emissions[19]. However, more action is necessary and so the statement in the Strategy that the Commission will seek permission to pursue tighter emissions standards for ships internationally, or propose these for the EU by the end of 2006 if international standards are not forthcoming, is clearly a positive step.

In relation to agriculture, the Strategy noted that action is being taken to reduce emissions, particularly of ammonia, and that further measures are envisaged. However, it is not yet clear what the extent and scope of these might be, so it is not possible to assess their adequacy at this point.

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[15] Proposal for a Regulation on type approval of motor vehicles with respect to emissions and on access to vehicle repair information, amending Directive 72/306/EEC and Directive ../../EC, COM(2005)683

[16] http://www.europa.eu.int/comm/enterprise/automotive/mveg_meetings/index.htm

[17] For example, T&E *et al*, argue that the emission limit values for diesel cars should be 2mg/km instead of 5mg/km for particulates and 75mg/km instead of 200mg/km for NO_x emissions. See: *Euro 5 Emission Limits for Passenger Cars and Light Duty Vehicles: Position Paper* September 2005 at http://www.t-e.nu/docs/Positionpapers/2005/2005-09_euro5.pdf

[18] The report suggests that emission limit values for diesel cars of 2.5mg/km for particulates and 75mg/km for NO_x emissions are technically feasible. See: TNO (2004) *Euro 5 technologies and costs for light-duty vehicles: The expert panels summary of stakeholders responses* December 2004 at www.europa.eu.int/comm/enterprise/automotive/mveg_meetings/meeting97/tno_report.pdf

[19] Directive 2005/33/EC of the European Parliament and of the Council amending Directive 1999/32/EC as regards the sulphur content of marine fuels, OJ L191 22.7.2005

6. Health effects of PM, including $PM_{2.5}$

The inclusion of a derogation on the achievement of PM_{10} limit values in the proposed legislative revision has resulted in some criticism. The CAFE Working Group on Particulate Matter[20] examined the problem of why Member States might not comply with this requirement of the first daughter Directive. Major reasons included:

- A large proportion of PM in Member States arises from outside of their borders and is outside of their control. For example, research for London suggests that secondary PM from outside the city contributes to 26% of urban background PM_{10} levels.
- There are examples of rural background sites in Central Europe that exceed the Stage 1 24-hour limit value.
- Current areas of exceedence are so widespread that effective control in the near future is unlikely.
- Some measures will take many years to result in effects (such as some vehicle emission controls).

As a result the Working Group recommended that the Commission examine changes to the first daughter Directive. In effect, this has resulted in the proposal as published.

The CAFE Working Group on Particulate Matter undertook a review of the WHO's own analysis of the health effects of particulate matter (PM). The key conclusions were:

- Long-term exposure to PM may lead to a marked reduction in life expectancy, primarily through increased cardio-pulmonary and lung cancer mortality;
- Epidemiological studies have not been able to identify a threshold concentration below which ambient PM has no impact on health;
- In different studies various groups (elderly, asthmatics, those with pre-existing heart and lung disease and socially disadvantaged groups) are more susceptible to PM;
- There is strong evidence that fine particulates (<2.5µm) are more hazardous than larger ones;
- Few studies have examined the interaction of PM with other toxic pollutants; and
- To control health impacts there is a need to control both short and long term exposures.

The Working Group noted that health risks were elevated even at concentrations below 10µg/m^3 and that a limit value should probably not exceed 20µg/m^3, and 20-35µg/m^3 as a 24-hour average.

The Commission proposal is for a 'concentration cap' of 25µg/m^3 as an annual average. This is significantly higher than that recommended by the Working Group. This concentration would, according to the Working Group, result in continued health impacts. The IA justifies the choice of 25µg/m^3. Rather than based on a health objective, it derives from identifying a $PM_{2.5}$ concentration that would not 'set a more stringent requirement to Member States' compared to pre-existing obligations on PM. Thus while the proposal begins the process of

[20] CAFE Working Group on Particulate Matter. Second Position Paper on Particulate Matter. December 2004.

taking action on $PM_{2.5}$, it does this by moving the focus from PM_{10}, rather than seeking new stringent obligations in this area.

It is also important to note the inclusion of an 'exposure reduction target' in Annex XIV. This takes account of the benefits of general reductions in PM, not necessarily above a limit value or concentration gap. This is, therefore, different to objectives for pollutants addressed in the first daughter Directive, for which there are also concerns over whether threshold levels of health impacts exist. Thus this development for $PM_{2.5}$ could form a model for further regulation of other pollutants at a later date.

The 'exposure reduction target' is set at 20% by 2020. This was chosen, according to the IA[21], as it lies between the reductions in average urban $PM_{2.5}$ background levels predicted by the two weaker reduction scenarios that were modelled[22]. As noted in Section 4, the ultimate scenario underlying the Strategy was also identified as lying between these two weaker scenarios. Hence, it appears logical to assume that the 20% target was chosen so as to be consistent with the choice of scenario to underlie the Strategy; however, this is only an assumption, as it is not explicitly stated in the text. If this assumption is correct, then the same comments made in Section 4 in relation to the choice of the underlying scenario apply to the choice of reduction target. If it is not, then it is not clear why this target was chosen.

In conclusion:

- In recent years there has been increasing evidence of the adverse health impacts of small particulates ($PM_{2.5}$) at very low concentrations.
- The proposal, therefore, moves the focus to $PM_{2.5}$, but the obligations are not designed to be more stringent than existing measures.
- Achieving the existing objectives for PM_{10} is probably impossible for some Member States and the proposal relaxes this obligation.
- The proposal does not, therefore, require any additional action on particulate matter – indeed the obligations are relaxed – even though concern by health professionals has increased.

7. The adequacy of the Economic Model that has been applied in the IA

The IA has used a number of economic models. The key model is **RAINS** (Regional Air Pollution Information and Simulation Model) that was used to assess the direct costs to economic sectors in EU Member States of meeting ambient air quality targets. In order to assess the development of emissions over time, RAINS relies on activity and emissions scenarios developed by other models, e.g. the **PRIMES** model regarding energy production and consumption[23]. Finally, the **GEM-E3** model was used to assess the macroeconomic effects of the selected air quality policies.

21 See Section 7.3.1 of SEC(2005)1133

22 These predicted reductions in average urban $PM_{2.5}$ background levels of 19% and 22%, respectively.

23 Other models that provided scenario inputs to RAINS included TREMOVE for transport scenarios and CAPRI for agricultural scenarios. These models are not seperately discussed here.

7.1 Brief description of the models

RAINS. The RAINS model is an Integrated Assessment Model to support regional (transboundary) air pollution policies. It computes least-cost solutions for European emission control policies to attain specified environmental targets, taking into account geographically-differentiated environmental sensitivities, atmospheric source-receptor relationships, and country and source-specific marginal abatement costs. It includes information on the dispersion, impacts and marginal abatement costs of the air pollutants sulphur dioxide (SO_2), nitrogen oxides (NO_x), ammonia (NH_3), non-methane volatile organic compounds (VOC), and fine particles (PM_{10} and $PM_{2.5}$). It also includes information on greenhouse gases such as carbon dioxide (CO_2) and nitrous oxide (N_2O). Work is underway to include information on the greenhouse gas methane (CH_4), as well as on the air pollutants carbon monoxide (CO) and black carbon (BC)[24].

PRIMES. The PRIMES model is a Partial Equilibrium Model that describes producer and consumer behaviour in European energy markets. The model includes detailed descriptions of demand for energy, production and abatement technologies, and emissions of air pollutants and greenhouse gases. Within the IA of the CAFE strategy, the PRIMES model is used to develop EU energy baselines.

GEM-E3. The GEM-E3 model is a dynamic applied General Equilibrium Model (GEM) for Economy-Energy-Environment (E3) interactions. It is used in the IA of the Strategy to assess the macroeconomic effects of the implementation of the abatement measures. Its database contains a fairly detailed description of economic activities in the 25 EU Member States, including a description of various direct and indirect taxes at the Member State level.

7.2 Evaluation of the adequacy of the models

RAINS. RAINS[25] is a mature integrated assessment model that has supported European air quality policies for over twenty years[26]. The RAINS team at the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria, puts a lot of effort in consultation with country experts and other stakeholders. A recent peer-review of the model concluded, "the use of multi-effect cost-effectiveness analysis, *as implemented in the RAINS model*, is a reliable and scientifically defendable tool for policy advice for the CAFE strategy" (Emphasis added). Moreover, according to the same peer review, RAINS is, at this moment, the *only* tool currently available capable of giving policy advice at this level of complexity and integration.

PRIMES. The PRIMES model is extensively used by the European Commission to support its climate change policy. It is difficult to judge the scientific quality of the PRIMES model, as its documentation is largely insufficient for such a judgement. We are also not aware of independent peer-reviews of the model. The review of the RAINS model, as discussed above,

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[24] Amann, M., Bertok, I., Cofala, J., Gyarfas, F., Heyes, Ch., Klimont, Z. Schöpp, W., Winiwarter, W. (2005). Baseline Scenarios for the Clean Air for Europe (CAFE)

[25] Programme. Final Report. International Institute for Applied Systems Analysis, Laxenburg, Austria.

[26] The RAINS model has, for example, been used to assist negotiations of the second sulphur protocol and the Gothenburg Protocol under the Convention on Long-range Transboundary Air Pollution and for the EC Directive on National Emissions Ceilings with respect to acidification, eutrophication and tropospheric ozone.

did recommend that PRIMES and other models providing input to RAINS be subject to a similar degree of scrutiny as that given to RAINS. The review also concluded that limited knowledge of the externally created activity scenarios (such as the energy scenarios) would likely be the *largest source of potential error/ misstatement* in the RAINS output (Emphasis added)[27].

The IA of the Strategy only used one of PRIMES' scenarios as a baseline scenario. This was the scenario in which the EU will achieve its Kyoto objective with regard to the emissions of greenhouse gases and in which it will maintain emissions at this level until 2020 (the "climate policy" scenario). No use was made of the "illustrative climate" scenario in which the EU would continue to reduce its emissions beyond 2012. Besides noting that the "illustrative" scenario seems closer to the EU's own expressed ambitions with respect to climate change policies, the evaluation of the Strategy against both baselines could have resulted in a better understanding of the interactions (synergies and trade-offs) between both policy areas and therefore led to a more integrated vision on air quality *and* climate change policies.

GEM-E3. The GEM-E3[28] model is a fairly sophisticated and well-tested applied general equilibrium model. Its documentation is relatively good and its data seem up-to-date and appropriate. Its main conclusions with regard to the evaluated air quality policies are that their macro-economic effects are negligible. Total GDP losses of scenario A, B and C are 0.04%, 0.08%, and 0.12%, respectively. It may be noted that these percentages almost exactly equal a simple division of direct abatement costs (€14,177 billion in 2020)[29], which amounts to 0.04%, 0.08% and 0.11%[30]. The macro-economic assessment begs two questions:

1. Why was GEM-E3 not used to estimate the gross welfare costs of the abatement measures, so that benefits (= increases in welfare) and costs (=decreases in welfare) of the air quality policies could have been compared more directly?
2. Given the relatively small direct costs of the policies in terms of GDP, why was the economic assessment focussed on macro-economic impacts (which could have been assumed to be very small in the first place), and not on the economic impacts on particularly vulnerable industries and regions, perhaps with more industry and region-specific partial equilibrium models?

With respect to the first question, two things can be identified. First, the GEM-E3 model can compute changes in welfare through a Social Welfare Function that can even take distribution effects into account. Second, without any prior knowledge on the exact structure of the European economy, a common 'rule-of-thumb' is that total gross welfare costs of pollution abatement measures would be about 50 to 100% higher than their direct costs due to so-called tax-interaction effects. If the costs would be properly measured as welfare costs (by our rule-of-thumb), the benefits of the Strategy (€42-135 billion[31]) would still exceed the costs (€11-14 billion) by a wide margin.

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[27] Swedish Environmental Research Institute and AEA Technology (2004).

[28] GEM-E3. Computable General Equilibrium Model for Studying Economy-Energy-Environment Interactions for Europe and the World. http://www.gem-e3.net/ (last visited: 7-3-2006).

[29] See Mantzos, L., and Zeka-Paschou, M. (2004). Energy Baseline Scenarios for the Clean Air for Europe (CAFE) Programme: PRIMES model v.2. E^3M Lab, ICCS, Athens.

[30] Scenario A: (5.9/14,177)*100= 0.04; scenario B: (10.7/14,177)*100=0.08; scenario C (14.9/14,177)*100=0.11.

[31] see Table on page 16 of SEC(2005)1133

7.3 Overall evaluation of the economic models

The economic models that were used in the preparation of the strategy are adequate for the task. They can be described as state-of-the-art and they have been tested before. The transparency and documentation of some of the models could be improved. With respect to transparency and documentation, the RAINS model is superior to the other models. The documentation of GEM-E3 is better than that of PRIMES. Although the GEM-E3 model is fairly well documented at the technical level, the documentation does not provide insights into why certain modelling choices were made and what the alternative would have been. This lack of motivation is also apparent for the IA, which does not reflect on questions about its choices on modelling approach and its choices of specific models, and the possible impacts of these choices on the evaluation of air quality strategies. For example, we question the use of a full-scale, European-wide macro-economic model to assess the impacts of a relatively very minor economic shock and we wonder why no use was made of region and industry specific (partial equilibrium) models to examine the effects on particularly vulnerable industries and regions.

7.4 The relevance of the (range of) values that has been used to value damage from air pollution

The range of values that has been used to value damages from air pollution is based on a valid methodology and an up-to-date review of scientific and economic literature, including the World Health Organization's "Systematic Review of Health Aspects of Air Pollution in Europe". The IA did address uncertainties both with respect to the assessment of physical (health, environmental) effects and the valuation of these effects. In the valuation of mortality effects, two different approaches were used[32], and their relative strengths and weaknesses were discussed. The peer review of CAFE's IA noted that "the overall approach followed for valuation of health and other endpoints is a sound one and clearly much effort and careful thought went into the decisions made by the CAFE team"[33].

Given this deserved praise, we might ask one question. It pertains to the role of ammonia in the overall Strategy. From Table 37 of the IA it appears that more than one-third of the annual cost of the Strategy can be attributed to reductions in ammonia emissions, of which 92.7% are from agriculture (Table 2). Table 23 shows that from all economic sectors considered, agricultural production is hardest hit by the air pollution scenarios (and consequently by the Strategy). The reason for these relatively expensive reduction measures for ammonia can presumably be found in Table 1 of the IA, which states that the marginal contribution of ammonia to health effects (as a secondary form of particulate matter) is 46% in 2020. That is, the health damage per unit of emission is higher for ammonia than for all other pollutants, including primary particulate matter (for example in the form of diesel fumes). We might have expected that ammonia from agricultural sources would be emitted from and mostly deposited in rural areas with relatively low population densities. Why is its relative contribution to health effects so high? There is little to no explanation of this in the IA, hence it is not possible to identify why this is the case.

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32 The approaches are Value of a Statistical Life (VSL) and Value of Life Year (VOLY). See the peer review of Krupnick et al. (2004) for an excellent discussion of the relative merits of the two measures.

33 Krupnick, A., Ostro, B., and Bull, K. (2004). Peer Review of the Methodology of Cost-Benefit Analysis of the Clean Air for Europe Programme. Paper prepared for European Commission, Environment Directorate General, Brussels.

8. The Consolidation of existing Legislation

The proposal brings together the framework Directive, first three daughter Directive and a Decision. The two drivers to undertake this process are:

- To bring different items of legislation into a single text and, thereby provide a simpler legislative basis.
- To harmonise the requirements of the Directives (e.g. on monitoring).

The first of these is worth exploring in more detail. While the consolidation of multiple items of legislation is generally beneficial, it should be noted that this does not, in itself, bring direct benefits to those directly affected by this legislation. All of these Directives are already transposed (or being transposed) into national law. In some cases (such as the UK), the opportunity has been taken to consolidate the requirements in national law. Thus the process of consolidation alone at EU would not necessarily bring benefits. Indeed, if the proposed Directive did not introduce changes, then its consolidation would not result in any requirement to alter national law – it would only tidy-up EU law texts.

The proposed consolidating Directive does not include the fourth daughter Directive. While the Commission states that it is the intention to include this at a later stage, it is not clear why this should not be done at this opportunity. The Directive was adopted in 2004, so there has been time to take account of its provisions. Also later revision of the consolidating Directive could result in the need for Member States to revisit their national law yet again. This is not efficient law-making and ought to be reconsidered.

The harmonisation of the requirements in the consolidated Directives has focused mainly on monitoring and reporting. These issues have clearly developed since the adoption of the 1996 Directive and the changes are to be welcomed. In particular, the proposal to move to an electronic-only reporting system within the INSPIRE framework is a progressive development and will help integrate both the compliance assessment work of the Commission and the environmental analytical work of the European Environment Agency.

In conclusion, the proposal to consolidate the pre-existing legislation is welcome, particularly updating monitoring and reporting requirements, but the exclusion of the fourth daughter Directive is not explained and fails fully to deliver better lawmaking objectives.

9. Conclusions

The processes leading to the development of the Thematic Strategy, i.e. the supporting models and the impact assessment itself, have been rigorous and subject to peer review, wide participation, etc. The concern is that the Thematic Strategy itself contains little in the way of proposals for concrete action to deliver its objectives. Indeed the only concrete proposal accompanying the Communication is a draft Directive that reduces obligations on Member States. The lack of clarity on why a particular set of objectives has been identified in the

Thematic Strategy is to be regretted. It should be noted that implementation of these (which some organisations consider to be too weak) will only be delivered through further proposals (such as a revision to the national emission ceilings Directive), which would again open up debate on these issues including different vested interests, but no longer in the integrated context of CAFE.