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**Steering Body to the Cooperative Programme for
Monitoring and Evaluation of the Long-range
Transmission of Air Pollutants in Europe**

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Item 6 (b) of the provisional agenda

**Progress in activities in 2013 and future work:
integrated assessment modelling**

Report by the co-Chairs of the Task Force on Integrated Assessment Modelling

Summary

The present report describes the results of the forty-second session of Task Force on Integrated Assessment Modelling (Copenhagen, 22–23 April 2013) under the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP). The report provides an overview of recent changes in the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model and results of scenario analyses, as well as the exchange of national and international experiences with integrated assessment modelling, in accordance with the Task Force mandate set out in the 2012–2013 workplan of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/109/Add.2, item 2.3).

I. Introduction

1. This report describes the results of the forty-second session of Task Force on Integrated Assessment Modelling under the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP), held in Copenhagen, Denmark on 22 and 23 April 2013.¹

A. Attendance

2. Forty-three experts from the following Parties to the Convention on Long-range Transboundary Air Pollution attended the meeting: Belarus, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Norway, Russian Federation, Spain, Sweden, Switzerland, Ukraine and United Kingdom of Great Britain and Northern Ireland. In addition, the Network of Experts on Benefits and Economic Instruments (NEBEI), EMEP, the Centre for Integrated Assessment Modelling (CIAM), the International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation), the European Environment Bureau and the oil companies' European association for environment, health and safety in refining and distribution (CONCAWE) were represented. Representatives from the World Health Organization (WHO) and the European Commission's Joint Research Centre participated via web conferencing.

B. Organization of work

3. Mr. R. Maas (Netherlands) and Ms. A. Engleryd (Sweden) chaired the Task Force meeting.

II. Objectives of the meetings

4. Mr. Maas opened the meeting, presented the latest developments under the Convention and defined the objectives of the forty-second Task Force meeting, which were to review recent changes in the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model² and results of scenario analyses, as well as the exchange of national and international experiences with integrated assessment modelling.³

III. Recent developments of the GAINS model

5. CIAM presented an overview of the recent changes in the GAINS model and specific aspects of those changes:

¹ Presentations made during the meeting and the reports presented are available from <http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/Integrated-Assessment.en.html>.

² See <http://gains.iiasa.ac.at/models/>.

³ Further information is available from <http://www.unece.org/env/lrtap/welcome.html> and <http://www.unece.org/index.php?id=28153>.

- (a) New source-receptor matrices (28 kilometres (km) x 28 km); volatile organic compounds (VOCs) emissions contributed to fine particulate matter (PM_{2.5}) concentrations (secondary organic aerosols);
- (b) New critical loads;
- (c) New downscaling to 7 km; that scale allowed for capturing population exposure in cities; measurements from the European Air quality dataBase (AIRBASE)⁴ stations were used to downscale exposure further and evaluate compliance with air quality limit values;
- (d) Emissions of black carbon, particle numbers and mercury.⁵
6. Bilateral consultations with 15 European Union (EU) member States had improved emission inventories and support for scenarios made with the GAINS model.
7. Parties which had not yet submitted updated national projections to CIAM were encouraged to do so, in order to further improve the assessments. Parties were requested to deliver national projections up to 2030 when available.
8. The modelling of health impacts of long-term exposure to PM_{2.5} had been updated on the basis of a European meta-analysis. No threshold had been assumed. Health impacts of short-term exposure to ozone levels above 35 parts per billion had also been updated. In the future, specific nitrogen dioxide (NO₂)-related health effects might be included.
9. For the new European Thematic Strategy on Air Pollution (TSAP)⁶ 2013 baseline emission scenario, the following assumptions had been made on the basis of the latest EU-wide energy model (PRIMES)⁷ 2012 reference scenario:
- (a) Strong economic growth to 2030 (but in 2030 gross domestic product (GDP) would still be 7.5% lower than in the PRIMES 2010 scenario);
- (b) Implementation of EU energy, transport and climate policies;
- (c) Full implementation of the policy objectives for renewable fuels in transports and the rapid turnover of the capital stock in order to meet energy-efficiency targets;
- (d) Fast penetration of Euro 6⁸ vehicles and full effectiveness of the Euro-6 standards.
10. In general, 2030 fuel consumption for 28 EU member States (EU-28) was lower in PRIMES 2012 than in PRIMES 2010. Also, livestock numbers in 2030 for EU-28 were lower in the 2012 assessment than in the 2010 projection developed by the Common Agricultural Policy Regionalised Impact Modelling System (CAPRI).⁹
11. All in all, TSAP 2013 contained — compared with the TSAP 2012 baseline — similar emission reductions of sulphur dioxide (SO₂) (-70% compared with 2005) and similar reductions of nitrogen oxides (NO_x) emissions (-60 % compared with 2005). VOCs emissions were lower in TSAP 2013 (-40%), due to more diesel engines in light duty

⁴ <http://acm.eionet.europa.eu/databases/airbase/>.

⁵ Further information on changes in GAINS is available from <http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/Overview.en.html>.

⁶ See http://europa.eu/legislation_summaries/environment/air_pollution/l28159_en.htm.

⁷ See <http://ec.europa.eu/environment/air/pollutants/models/primex.htm>.

⁸ See http://europa.eu/legislation_summaries/environment/air_pollution/l28186_en.htm.

⁹ See <http://www.capri-model.org/dokuwiki/doku.php?id=start>.

vehicles. PM_{2.5} emissions were higher in TSAP baseline 2013, due to increased wood burning.

12. For environmental and health impacts, TSAP 2013 was slightly less optimistic than TSAP 2012, mainly due to the higher PM_{2.5} emissions, which offset lower VOC and NO_x emissions. PM_{2.5}-related health risks in 2030 were higher than the TSAP targets. For ozone, the health-effect targets set in TSAP would be met — a 25 % decline in premature deaths up to 2025 — but there would still be 18,000 cases in the EU-28. Eutrophication damages, including damages on Natura 2000¹⁰ sites, showed that in 2025 62% of the Natura 2000 areas and 420,000 square kilometres (km²) of ecosystem areas were under threat of eutrophication, out of which 95,000 km² could be saved with additional measures. In 2005, the corresponding area was 77% of Natura 2000 areas and 1,100,000 km² of ecosystem areas. The TSAP target would not be reached by 2020.

13. A representative of CIAM presented recent changes in modelling local concentrations of NO₂ and particulate matter (PM) in order to assess future compliance with air quality limit values. The analysis showed the importance of successful introduction of the new Euro-6 standards (starting in 2018) for compliance with NO₂ air quality limit values. A Euro-6 failure would require a reduction in local traffic emissions, with up to 50% to comply with the limit values.

14. In the TSAP 2013 baseline scenario, there was an increase in compliance with NO₂ limit values in the EU-28 at AIRBASE monitoring stations. In 2010, less than 70% of the 500 air quality management zones were likely to be in compliance. In 2030, more than 90% of the zones were projected to likely be in compliance. For coarse particulate matter (PM₁₀), improvement was projected up until 2020, but would then level off. Policies aiming at achieving PM₁₀ air quality limit values needed to pay more attention to solid fuel burning in the domestic sector, e.g., in Poland, Slovakia and Bulgaria.

15. Parties were requested to develop and report to EMEP their fine scale emission data at 0.1° x 0.1° or less for use in the GAINS model.

16. Long-term scenario calculations emphasized that climate policies provide co-benefits for SO₂ and NO_x emissions, but not for other pollutants. Current climate measures had much less impact on PM_{2.5} emissions than end-of-pipe control. Ammonia emissions were not influenced by climate policy.

17. All in all, due to existing legislation and co-benefits of climate policy, emissions would decline until 2030, but then the decline would flatten out. Further policies targeted at air pollution would be needed after 2030.

18. The Task Force took note of the GAINS-scenario analyses and stressed the need for further analysis of key uncertainties: the assumptions on the rapid turnover of capital stocks and the enforcement of Euro-6 emission standards for vehicles.

19. A WHO representative presented via Skype the latest WHO conclusions on air pollution impacts on human health. The Task Force noted that no threshold could be identified for the health impacts of PM_{2.5}: health benefits would result from any reduction of concentrations, both when concentrations were above or below the air quality limit value. That was important for defining cost-effective strategies to reduce health risks.

20. The Task Force took note of the summary by the co-Chair of Task Force on Hemispheric Transport of Air Pollution of the workshop jointly organized by both Task Forces in Laxenburg, Austria, in October 2012 on harmonizing long-term global emission

¹⁰ See <http://ec.europa.eu/environment/nature/natura2000/>.

scenarios for both air pollution and climate change. It was stressed that air pollution emissions would not simply be reduced as a consequence of economic development, but that explicit policy measures targeted at air pollution were needed.

21. The representative of the ICP Vegetation showed that the ozone situation would improve between 2005 and 2030 according to the analysed ozone scenario, which implied on average a 6% decrease in surface maximum ozone concentration for Europe. CIAM had prepared the GAINS model for including the ozone flux approach, awaiting advice on the thresholds that should be considered in integrated assessment modelling.

IV. Recent policy applications of the GAINS model

22. CIAM presented recent policy applications with the new methodology GAINS model. Air pollution policy scenarios had been explored in which different ambition levels had been analysed with respect to human health and environmental impacts, as well as economic costs.

23. A scenario had been derived where marginal costs would equal marginal benefits for PM-related mortality impacts. That would lead to additional expenditure on emission abatement of 0.04 % of EU-28 GDP (compared with current legislation) and provide health benefits corresponding to a 75% closure of the gap between current legislation and the maximum feasible reduction, or a 50% reduction in the years of life lost experienced in Europe in 2005. If the labour productivity improvement due to reduced absence from work would be included in the economic analysis, the macroeconomic effects would be neutral.¹¹

24. A representative of NEBEI presented a cost-benefit analysis of the EU ambition scenarios. Monetized economic benefits of air pollution abatement were used for human health, crop damages and damages to materials. The health impact assessment had been revised in line with the conclusions of the “review of evidence on health aspects of air pollution” (REVIHAAP) and “health risks of air pollution in Europe” (HRAPIE) projects,¹² led by the WHO Regional Office for Europe for the European Commission. The most significant change so far concerned assessment of chronic exposure to ozone on mortality, an effect not previously considered. Damage to ecosystems could not be included yet, but work continued in that area. A national damage assessment model (ALPHA-Riskpoll, France) has been developed and similar work was planned for the United Kingdom. An accounting framework had been developed in the United Kingdom for thorough assessment of the externalities (co-benefits and trade-offs) of climate policies.

V. Other work related to GAINS

25. The Chair presented the current level of knowledge regarding ecosystem effects from air pollution emissions. High nitrogen depositions played a key role in the loss of biodiversity in Natura 2000 areas. One of the key messages from ICP Vegetation and the Coordination Centre for Effects was that, in order to halt the loss of biodiversity, restoration measures were needed awaiting further ammonia emission-reduction measures. The

¹¹ The latest applications of the GAINS model are available from <http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP-review.en.html>.

¹² See <http://www.euro.who.int/en/what-we-do/health-topics/environment-and-health/air-quality/activities/health-aspects-of-air-pollution-and-review-of-eu-policies-the-revihaap-and-hrapie-projects>.

protection of Natura 2000 areas required a balancing of actions on the local, regional and EU levels.

26. The Task Force noted the work needed for two documents that accompanied the revised Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (Gothenburg Protocol). A short guidance document with quantified impacts for selected indicators for environmental and human health improvements envisaged for 2020 was being developed in cooperation with the Working Group on Effects. A draft would be presented in September 2013. A draft of a second, broader background document (including the activity and emission projections used for the preparation of the revision of the Gothenburg Protocol) would circulate among Task Force experts after the summer. The latter document was relevant for comparisons with actual outcomes in the future.

27. A representative of CIAM presented an innovative integrated assessment study for India with a wider economic, environmental and social context. The analysis showed that large investments in air pollution emission abatement (ranging from 0.15% to 0.5 % of GDP) contributed to health effects that would both increase human well-being (measured by the Human Development Index) and national net savings that would stimulate economic growth. The net effect would be an additional increase GDP with some 0.6% (percentage points) by 2030, although per capita GDP would be 0.2% (percentage points) lower due to a larger population.

28. The Irish representative presented the key messages from the Air Science Policy Forum organized in Dublin on 15 April 2013. Participants in the forum had discussed 10 main areas of importance for air pollution abatement in the EU and its member States.¹³

VI. European modelling experiences

29. An expert from the United Kingdom presented findings from the Linking Impact Assessment Instruments to Sustainability Expertise (LIAISE)¹⁴ network. The Task Force noted the importance of effective communication between scientists and policymakers.

30. An expert from France presented a European-scale air quality and health impact assessment co-coordinated by the Institut National de l'Environnement Industriel et des Risques (INERIS), that had taken into account long-term European and global air pollution and climate change policies. The results showed that up to 2050 there would be co-benefits for air pollution reduction and associated health impacts from a climate policy aimed at limiting temperature increase, but that air pollution mitigation policies were also a strong driver in the improvement of air quality.

31. The Task Force took note of the results from the Interprofessional Technical Centre for Studies on Air Pollution (CITEPA) conference on black carbon held on 21 March 2013, in particular the warning that reductions in population exposure to black carbon with measures to control tailpipe emissions might be undermined by increases in residential wood burning. Updated information from French and international experts had been provided on the role of black carbon in climate change and air quality. Monitoring

¹³ Presentations are available from <http://www.epa.ie/newsandevents/events/airsciencepolicyforum.html>.

¹⁴ See <http://www.liaise-noe.eu/content/our-mission-interdisciplinary-community-ia-researchers-and-practitioners>.

techniques, health impacts, main sources, reduction potentials and policy strategies had also been addressed.¹⁵

VII. National modelling experiences

32. The assessment of impacts of the latest Finnish climate strategy showed that residential wood combustion was likely to become more and more important as a source of black carbon emissions in the future.

33. An example of integrated assessment modelling in the United Kingdom illustrated the potential impacts on air quality of climate and energy measures across different sectors up to 2030. Measures could have a substantial effect, but could also increase damage, e.g., careful consideration was needed for measures that increased residential wood burning or the used combined heat and power in densely populated areas.

34. Integrated assessment modelling in Belarus indicated that additional policy measures would be needed if Belarus was to meet the NO_x commitments in the revised Gothenburg Protocol.

35. Integrated assessment modelling in the Russian Federation highlighted the challenges the country faced in meeting potential emission reduction obligations in the light of a projected increase in the use of coal for power generation.

VII. Workplan

36. The proposed workplan for CIAM was adopted by the Task Force, provided that sufficient means could be made available.

37. The Task Force would organize a workshop on the valuation of ecosystem services back to back with the Effects of Climate Change on Air Pollution and Response Strategies for European Ecosystems¹⁶ meeting in Zagreb, Croatia on 24 and 25 October 2013.

38. The Task Force planned to hold its forty-third session in May 2014.

¹⁵ The presentations from the conference are available from http://download-citepa.tropicalex.net/yzw_jouet2013.

¹⁶ See <http://www.eclairer-fp7.eu/>.