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**Economic Commission for Europe**Executive Body for the Convention on Long-range  
Transboundary Air Pollution**Steering Body to the Cooperative Programme for  
Monitoring and Evaluation of the Long-range  
Transmission of Air Pollutants in Europe****Working Group on Effects****First joint session\***

Geneva, 14–18 September 2015

Item 5 (b) of the provisional agenda

**Progress in activities of the Cooperative Programme for  
Monitoring and Evaluation of the Long-range  
Transmission of Air Pollutants in Europe in 2015  
and future work: integrated assessment modelling****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-fourth meeting of the 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) (Edinburgh, United Kingdom 6–8 May 2015). The report provides an overview of recent changes in the Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS)

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\* The Executive Body to the Convention agreed that, as of 2015, the Working Group on Effects and the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe should meet jointly, to achieve enhanced integration and cooperation between the Convention's two scientific subsidiary bodies (ECE/EB.AIR/122, para. 47 (b)).

\*\* The present document is being issued without formal editing.



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 2014–2015 workplan for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR.122/Add.2, items 1.5.1, 1.5.2, 1.5.4, 1.5.6–1.5.8) and the Long-term Strategy for the Convention (ECE/EB.AIR/106/Add.1).

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## I. Introduction

1. This report describes the results of the forty-fourth meeting of Task Force on Integrated Assessment Modelling (TFIAM), held in Edinburgh, United Kingdom from 6 to 8 May 2015. The presentations made during the meeting and the reports presented are available at: <http://gains.iiasa.ac.at/index.php/tfiam/past-tfiam-meetings>.
2. Thirty six experts attended the meeting, representing the following Parties to the Convention: Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland, and the United Kingdom of Great Britain and Northern Ireland. Observers from China, India and Kenya were attending the meeting. Also, the EMEP Centre for Integrated Assessment Modelling (CIAM), the International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation), the Joint Research Centre, the European Environment Bureau (EEB) and the European Commission were represented.
3. Mr. R. Maas (Netherlands) and Mr. S. Åström (Sweden) chaired the meeting.

## II. Objectives of the meeting

4. Mr. Maas opened the meeting, presented the latest developments within the Convention on Long-Range Transboundary Air Pollution, and defined the purposes of the TFIAM forty-fourth meeting which were: to learn about recent European policy analyses and national modelling experiences, and to share national experiences of ammonia emission modelling and scenario calculations.
5. News from the Convention secretariat:
  - (a) Ms. Anna Engleryd was elected chair for the Executive Body (EB) in December 2014;
  - (b) Additional technical guidance has been developed for the adjustment procedure of the Protocol to Abate acidification, eutrophication and ground-level ozone (Gothenburg Protocol);
  - (c) The EB adopted a report on good agricultural practices, that can help Parties in taking action on reducing ammonia (NH<sub>3</sub>) emissions;
  - (d) There are a couple of outreach activities beyond the UNECE region:
    - (i) Co-operation with the Stockholm Convention on persistent organic pollutants (POPs);
    - (ii) Co-operation with the Arctic Council on black carbon;
  - (e) The 2016 Assessment Report is planned to be presented at the eighth Environment for Europe Ministerial Conference in Batumi, Georgia in June 2016;
  - (f) 2016–2017 workplan:
    - (i) The latest Global Burden of Disease report highlighted air pollution as the main environmental health issue. This has increased attention to air pollution from WHO, UNEP and other international bodies. Outreach activities and co-operation with other organisations should be explored;
    - (ii) Capacity building is recognized to be important, priority is given to emission inventories and abatement technologies.

6. Update on European Union (EU) policy:
- (a) In December 2013, a Clean Air Policy Package, including a new National Emission Ceiling (NEC) Directive and a Directive on Medium-scale Combustion Plants was released by the European Commission;
  - (b) The Commission had asked member states to comment on the ratification of the POP and Heavy Metal protocols. No national comments have been submitted from member states to the presidency, so the ratification is progressing;
  - (c) The ratification of the amended Gothenburg Protocol is currently not progressing as smoothly:
    - (i) Some countries would like to see the ratification as part of the adoption of the revised NEC Directive;
    - (ii) The European Commission is not opposing member states that want to move forward with ratifying the amended protocol individually.
  - (d) An agreement is reached in the European Council of Ministers on the Medium Combustion Plant Directive. Discussions have started in the European Parliament. A voting on the amendments took place on 6 May. A deal with the Council is expected after the summer break of the Parliament;
  - (e) The proposed NEC Directive has not been withdrawn, but an amended proposal from the European Commission might occur after the reading by the Parliament. The Environment Committee of the European Parliament is scheduled to vote on amendments in July 2015. The Parliament is using an International Institute for Applied Systems Analysis (IIASA) scenario based on the 40 per cent greenhouse gas reduction target of the EU. The European Council of Ministers is working on a proposal based on national emission projections. The Council will have a first formal discussion on the NEC Directive in June 2015. Currently discussion focusses inter alia on the inclusion of methane and on the nature of the interim 2025 targets.

### III. Recent policy analysis

7. The Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) model runs were extensively used to support the EU Clean Air Policy Package. The need for international co-ordinated action is illustrated by the large contribution of transboundary sources to urban fine particulate matter (PM<sub>2.5</sub>) levels in several cities. Reducing local air pollution emissions will not be enough to reach air quality targets in many European countries. The contribution of secondary aerosols is substantial. Ammonia plays a crucial role in the formation of secondary aerosols.
8. In 2014–2015 the GAINS team has worked on updating national information on the basis of bilateral consultations with all EU member states. Key issues during these consultations were:
- (a) Changes in national base year (2005) emission estimates between 2012 and 2014. The largest changes were for PM<sub>2.5</sub>;
  - (b) Differences in source coverage between GAINS and national data;
  - (c) Differences in emission inventory methods (Tier 1-methods vs. the Tier 2-method used in GAINS);

- (d) Discrepancies between energy statistics used for national emission calculations and the energy data reported by member states to Eurostat (that were used in GAINS);
- (e) Differences in emission factors due to national circumstances;
- (f) Differences in activity projections, assumed national legislation and assumed autonomous technological improvements;
- (g) Differences in remaining mitigation potentials.

9. After the bilateral consultations, the GAINS base year estimates show a reasonable comparison to the national emission inventories reported in 2014. The result of the bilateral consultations is found in the Thematic Strategy on Air Pollution (TSAP) report #14.<sup>1</sup>

10. In TSAP report #16<sup>2</sup>, an updated NEC directive proposal scenario has been analysed at the request of the European Council. In this scenario the additional abatement costs required were reduced to 2.2. bn €/yr. Monetised health impact benefits are almost a factor 10 higher than the abatement costs. Methane emission control provides larger cost savings. Current legislation already provides almost 90 per cent of required sulphur dioxide (SO<sub>2</sub>) emission reduction by 2030, 95 per cent for nitrogen oxides (NO<sub>x</sub>) and 85 per cent for non-methane volatile organic compounds (NMVOC). Current legislation achieves 60 per cent of the ambition level for PM<sub>2.5</sub>, and 30 per cent of the ambition level for NH<sub>3</sub>.

11. At the request of the European Parliament, the GAINS team made a sensitivity analysis on the Clean Air Policy Package by including the new climate and energy policies to 2030. The “optimal” air pollution ceilings could become more stringent at the same costs. The costs of a 75 per cent gap closure ambition level in the non-climate policy scenario would equal a 92 per cent gap closure ambition level in the scenario including climate policy.

#### **IV. Updates on European scientific research**

12. The ICP Vegetation had analysed trends in ozone and the impacts of ozone on vegetation. Recent research shows that ozone and nitrogen can have counteracting impacts on biomass growth. The biomass growth benefits of nitrogen deposition appear to have a limit. High ozone concentrations change the carbon/nitrogen ratio in leaf litter from trees and can increase nitrogen leakage. Between 1990 and 2010 ozone trends show an increase in background levels, while peak concentrations are decreasing. Hemispheric co-operation would be needed to tackle increasing background levels.

13. The new Task Force on Techno Economic Issues (TFTEI) under the Convention will focus on emission abatement technologies from stationary and mobile sources. Its tasks include upgrading and assessing on a regular basis the information on technologies to reduce emissions of SO<sub>2</sub>, NO<sub>x</sub>, VOCs, PM<sub>10</sub>, PM<sub>2.5</sub>, black carbon, heavy metals and POPs. TFTEI is aiming to create a reference place (clearing house) for pooling knowledge on emission abatement technologies. TFTEI is expected to co-operate with other bodies of the Convention, especially TFIAM and the Task Force on Emission Inventories and Projections (TFEIP). TFTEI will also co-operate with the Coordination group for countries of Eastern

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<sup>1</sup> See <http://www.iiasa.ac.at/web/home/research/researchPrograms/MitigationofAirPollutionandGreenhousegases/TSAP-reports.en.html>.

<sup>2</sup> Ibid.

Europe, the Caucasus and Central Asia. EGTEI's website will be available in English and Russian. The co-chair of TFTEI reminded Parties to nominate specialists to participate in the work of TFTEI.

14. A study by the University College London showed that in a post-carbon world the use of ammonia as a synthetic fuel for mobile combustion engines could become a realistic option. Such a synthetic fuel could be produced by using renewable electricity.

15. NO<sub>x</sub>-reductions from ships would contribute to the improvement of air quality and deposition on land. However baseline data are still uncertain. This could weaken the environmental impacts of the flexibility option in article 5 of proposed NEC Directive to partly exchange NO<sub>x</sub>-emission reductions on land by ship emission reductions, although cost reductions would be possible for member states with intensive shipping in their exclusive economic zone. This risk is even stronger when article 5 would apply for PM<sub>2.5</sub>, as PM<sub>2.5</sub> emission estimates are much more uncertain. The European Parliament Environment committee has deleted the shipping flexibility mechanism in the article 5 in their draft report. The Parliament's Committee on Industry, Research and Energy (ITRE) also deleted this flexibility mechanism, as did the European Presidency in their present compromise text for the Council.

16. The EU Seventh Framework (FP-7) project *Integrated assessment for regional and local air quality policies* (APPRAISAL) will soon be finalised. APPRAISAL will offer an online database of local Air Quality and Health Impact plans. Currently the database is covering some 65 plans. Common in the plans are the use of scenario assessments and (in some cases) optimization approaches at the local scale. APPRAISAL offers guidance on the integration of information at different scales, emission inventory uncertainties, integration of ground based & remote sensing monitoring, PM-fractions, multi-pollutant exposures, socio-economic aspects, energy efficiency and non-technical measures as well as multi-scale interactions.

17. In the FP7 Forum for Air quality Modelling (FAIRMODE) project, tools are being developed to enable evaluation of air pollution and policy scenarios used by member states. The project is looking for volunteers to discuss possible evaluation tools for scenarios.

18. There is an increasing interest in economic costs of air pollution, also from sectors not traditionally working on air pollution, such as the health sector. In the WHO Choice database the cost estimates of air pollution have been updated. The latest review reinforces the earlier finding that the monetized environmental and human health benefits are larger than the costs in the NEC-Directive proposal of the European Commission. The UK Committee on the medical effects of air pollutants (COMEAP) is currently reviewing a number of existing and emerging human health issues. Monetized damages from heavy metals are being further developed following recent developments in knowledge on human health impacts from heavy metals. The external costs from large combustion plants (E-PRTR facilities) show that currently, approximately 90 per cent of the total human health damage is caused by the 15 per cent of largest plants in Europe.

19. Recent developments in the valuation of ecosystem damage still imply that the economic value of ecosystem benefits is much smaller than the human health benefits. Nevertheless impacts on ecosystems remain important from a sustainable development point of view.

20. A joint workshop of TFIAM and the Task Force on Hemispheric Transport of Air Pollution (TFHTAP) has reviewed the available global emission scenarios for air pollutants. GAINS model offers a large number of potential abatement measures. GAINS scenarios show that without additional measures emissions tend to increase. In climate policy scenarios an automatic implementation of additional measures is assumed when

incomes increase. It was recommended to supplement GAINS scenarios with scenarios that include regional perspectives (e.g. Asia).

## V. Experiences in agricultural modelling

21. Ammonia emission scenarios with the GAINS model currently take into account developments in farm sizes. Although today most of the farms in the EU have less than 15 livestock units, the majority of the livestock is kept by a very small number of large industrial size farms. 80 per cent of NH<sub>3</sub>-emissions come from less than 10 per cent of the farms. Additional measures suggested by the new NEC-Directive would affect 2-2.5 per cent of the total number of farms in the EU.

22. Due to updates in its emission inventory in 2015, Germany will no longer comply with the NH<sub>3</sub>-emission levels in the existing NEC-Directive, and will have large problems reaching the proposed ambition level in the revised NEC-Directive. Available additional measures could reduce German NH<sub>3</sub>-emissions by 33 per cent by 2030.

23. As a result of the abolishment of the milk quota, Ireland expects a higher increase of livestock than the European Modelling System Common Agricultural Policy Regionalised Impact Modelling System (CAPRI) suggests. By 2020 Ireland will no longer be able to meet the NH<sub>3</sub>-emission reduction obligations of the amended Gothenburg Protocol and the proposed revised NEC-Directive.

24. Emissions of NH<sub>3</sub> in Denmark have declined substantially from 1985 levels, but there is still a high risk of exceedance of critical loads for eutrophication for many of the Natura 2000 areas in Denmark. The NH<sub>3</sub> emission targets in the proposed NEC directive have been heavily debated in Denmark. However, the targets suggested are considered feasible.

25. In the Netherlands ammonia emissions are part of an integrated analysis of nitrogen losses. Nitrate leaching, N<sub>2</sub>O-targets and nitrogen deposition on Natura2000 areas are binding restrictions. If the abolishment of the milk quota will lead to more nitrogen losses, compensation is expected by more export of manure as well as adding more advanced emission reduction measures such as air scrubbers.

26. Currently Sweden has good opportunities to meet the requirements in the proposed NEC-Directive. The co-benefits of measures reducing emissions of greenhouse gasses and NH<sub>3</sub> from the agricultural sector is an area that would need further attention.

27. For Switzerland, there was a good potential to reach the objectives posed by the amended Gothenburg Protocol. Scenario analyses show opportunities to reduce emissions even further.

28. In the United Kingdom current and future emissions of NH<sub>3</sub> are based on nitrogen flow modelling. Several abatement options were analysed. For dairy farms rapid manure removal from collecting yards (washing) was identified as an effective measure. Additional measures could reduce emissions in 2030 by some 20 per cent compared to 2005 levels.

29. According to the amended Gothenburg Protocol, Finland would need to reduce its NH<sub>3</sub> emissions by 20 per cent. With current policies emissions are expected to drop by 8 per cent compared to 2005 emission levels. Analyses of additional policies showed that the proposed NEC-Directive ambition level, is feasible for most pollutants, regardless the carbon scenario that is assumed.

## VI. Other national integrated assessment modelling

30. A sensitivity analysis of domestic PM<sub>2.5</sub> emission reductions in Finland showed the limited impact of the Ecodesign Directive (Directive 2009/125/EC) by 2030, due to the slow turnover of domestic heating equipment. A comparison between the European Commission estimates of installations affected by the Medium Combustion Plant (MCP)-Directive showed a significant difference with a recent Finnish inventory of the number of plants. Consequently compliance costs were estimated to be a factor 10 higher than the estimate of the European Commission.

31. The Irish institute IMP has developed a method to quantify marginal damage values of the NEC-Directive air pollutants in Ireland, using existing valuation data for health and ecosystem damage in combination with Irish specific emission and air pollution concentration data. The values can be used to easily assess air pollution impacts of local permits, projects or regional plans.

32. In Spain the integrated assessment model AERIS is now operational. AERIS calculates mean annual ambient air pollution concentration levels on a 4\*4 km<sup>2</sup> spatial resolution. Impacts include health damage due to exposure of particulate matter, ozone damage to crops and forests, exceedances of critical loads for acidification and eutrophication as well as damages to buildings. Road side air quality modelling was also performed to assess local traffic policy. Car registrations showed an increasing lifetime of vehicles after the economic crisis and a substantial share of emissions from cars older than 35 years.

33. Portable Emission Measurement Systems were used in the United Kingdom to assess real life NO<sub>x</sub>-emissions from Euro-6 vehicles. For many diesel cars emissions appear to be higher than the type classification emission limits. This uncertainty in the real emissions from Euro-6 vehicles has a large impact on the possibility to reach the ambition levels in the NEC-Directive proposal and the likelihood of meeting the air quality limit values for NO<sub>2</sub> at the kerbside.

34. A renewable energy study by the University College London showed that strong reductions of greenhouse gas emissions will require transforming the energy system at the local, national and European scale. The challenge is to deal with the increased variability in electricity production based on renewable resources, i.e. the need for storage facilities of energy and an electricity grid that can easily exchange wind, hydro and solar energy throughout Europe.

## VII. Further work

35. One of the key messages from the 2015 Assessment Report will be that remaining air pollution-related health challenges cannot be solved via local policies alone. Secondary particles form a large share of PM<sub>2.5</sub> exposure and are a transboundary air pollution problem. To meet WHO air quality guidelines measures will be needed on the international scale (e.g. effective Euro-standards), the national level (e.g. stringent emission control of cars), as well on the local scale (e.g. Low Emission Zones to stimulate replacement of old cars).

36. Most of the tasks described in the 2014–2015 work plan of TFIAM have been completed. There was a lack of funding to support participation of experts from countries of Eastern Europe, the Caucasus and Central Asia in the TFIAM meetings and web communication of results and developments. A workshop late 2015–early 2016 focussed on local measures to improve health is being considered.

37. The work plan for 2016–2017 is currently under development and input is appreciated. Besides European policy support, further model and scenario development and continuation of the exchange of national experiences, tasks will involve linkage with local scale health policies as well as linking with global/hemispheric policies and linkage with integrated nitrogen management. Given reduced funding and increased need for networking with national and local scale modellers in both western and eastern parts of Europe there is a rationale to apply for networking funds where available. Also for capacity building in countries of Eastern Europe, the Caucasus and Central Asia, additional funds will be required.

38. The time and venue for the forty-fifth TFIAM meeting in May 2016 is yet to be decided. Suggestions are welcome.

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