TASK FORCE ON INTEGRATED ASSESSMENT MODELLING (TFIAM)

41st session, 7-9 May 2012, Bilthoven, The Netherlands

Chairs report

I. INTRODUCTION

1. This report describes the results of the 41st session of TFIAM, held from the 7th to the 9th of May 2012 in Bilthoven, the Netherlands. 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. 45 experts attended, representing the following Parties to the Convention: Belarus, Belgium, Croatia, Denmark, Finland, Germany, France, Ireland, Italy, Netherlands, Sweden, the Ukraine, the United Kingdom of Great Britain and Northern Ireland. Also the Working Group on Effects, the Network of Experts on Benefits and Economic Instruments (NEBEI), the EMEP Centre for Integrated Assessment Modelling (CIAM), the Coordination Centre for Effects (CCE), the European Commission, and the European Environment Bureau (EEB) were represented. Five participants from Italy, Croatia, Germany and Spain took part via video link.

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

II. OBJECTIVES OF THE MEETING

4. The co-chairs of TFIAM opened the meeting and defined the purpose of the 41st TFIAM meeting, which were to: (1) reflect on achievements; (2) discuss directions for further research; (3) report to WGSR on the impacts of the revised Gothenburg Protocol.

5. At the 30th session of the Executive Body a revised Gothenburg Protocol was agreed on 4th May. The Protocol can be seen as a step towards further improvement of the air quality in the UNECE region.

6. Instead of emission ceilings for 2020, the revised protocol includes emission reduction commitments as a percentage relative to 2005. PM2.5 is now included with additional consideration for the black carbon fraction. Technical annexes have been updated. A revised Annex I (critical loads and levels) was adopted without much debate. Annex IX (ammonia) was not updated and will be reviewed when the revised Protocol enters into force. Procedures for adjustments of commitments are included in the revised Protocol. EECCA countries got more time to improve their emission estimates. For EECCA

countries a delay of up to 5 years for reporting emissions from large combustion sources and VOC-emissions from mobile sources and fuel conversion was accepted.

7. Annex II includes the emission reduction commitments for parties to the protocol. It contains commitments for all EU27 member states, as well as Belarus, Croatia, Norway, Switzerland. The USA, the Russian Federation and other EECCA countries will include their commitments in the course of the ratification process.

8. The Executive Body has requested the EMEP-Steering Body to develop provisional guidance on the extraordinary circumstances in which the revised protocol allows adjustments to be made to the reduction commitments or emission inventories for compliance purposes, for consideration during the EB session in December 2012.

9. **The Task Force confirmed the point of view expressed in the Executive Body that new activity projections should not be viewed as an extraordinary circumstance and so as a reason to adjust emission reduction obligations.**

10. The European Commission had announced it was considering developing new ambitions beyond 2020 in the course of 2013, the year of 'air' in the EU. Currently the Thematic Strategy on Air Pollution (TSAP) is under review.

III. ANALYSIS OF THE REVISED GOTHENBURG PROTOCOL

11. CIAM presented the results on the analysis of the impacts of the revised protocol. The GAINS model calculations for the new GBG protocol show environmental improvements for the entire model region compared to the year 2000, although for all environmental endpoints they are lower than what has been estimated earlier by GAINS for the current legislation baseline based on the PRIMES energy scenario. The current GAINS estimates do not include potential impacts of the use of the adjustment opportunities in the revised protocol, which could further reduce the environmental benefits calculated in the first analysis.

12. For the EU-27, emissions implied by the protocol up to 2020 would remain significantly above the emission trajectories laid out in the 2050 roadmap. As a consequence, improvements of health effects from PM, as well as ecosystems protection against eutrophication and forest acidification will remain below the ambitions set out in the Thematic Strategy on Air Pollution. Results will be summarized in CIAM-report 1/2012.

13. Although the available emission reduction commitments of non-EU countries are in general closer to the earlier baseline projections than those of many EU countries, health impacts from ground-level ozone are expected to increase in the future due to growing emissions of non-EU countries that have not provided reduction commitments.

14. The CCE presented its tentative analysis of ecosystem impacts of the revised protocol. The ecosystem area where acidity critical loads are exceeded will decrease from 9.3 % in 2005 to 4.2 % in 2020. For eutrophication it will decrease from 51% to 42 % in 2020. A preliminary analysis for a subset of the ecosystems showed a reduction of the nature area with more than 5% biodiversity loss from 8.4 to 3.3 % in 2020. Overall, reductions in environmental impacts are achieved compared to 2010, but a lot remains to be done, especially with regard to nitrogen. The CCE has also looked at emissions per country area, per capita and as per GDP, which showed large differences between countries. The CCE will continue to investigate the impacts of equitable emission reductions. Work on aspirational long-term emission reduction targets indicates how large the deposition reduction needs to be to virtually eliminate negative environmental impacts. First results indicate that for acidification, a 50-60 % reduction in acid deposition will leave less than 1 % of the ecosystem area with critical load exceedances.

15. NEBEI presented their analysis on the economic benefits of the revised protocol. It was found that, in addition to the emission reduction commitments of the revised protocol, significant scope remains for further cost-effective measures for which the benefits exceed the costs by a factor of 8 and more. The TFIAM was reminded of the large benefit-costs ratios for all the scenarios that had prepared for the negotiations. In monetary terms, most of these benefits would emerge from reduced mortality if long term exposure were reduced further. However even a smaller share in total benefits - improved labour productivity from fewer work days lost – would balance the additional control costs. In addition further benefits would arise from improved ecosystem services, better protection of cultural heritage and lower costs of local emission control measures if stricter emission reductions were implemented at the European scale These areas should be considered for future analysis, as well as the quantification of damages caused by countries to other countries in comparison to the costs they would have to make to reduce such damages..

16. The editor of the TFIAM-background document to the revised protocol presented its progress. Results from IAM, CBA, and effects analysis are to be included. The background document has the objective to show the impact of the protocol. It will also specify the data and methods used. The document will cover emissions from 1990, 2000, 2005, 2010, 2020 (4 scenarios, including the revised Protocol), and 2050. Pollutants will include SO2, NOx, NH3, VOC, PM2.5, BC, CO2, CH4 and N2O. Results will be presented for the counties in the EMEP area, as well as for EU27 total. The plan is to have the document ready by September for the WGSR meeting. Efforts will be made to include 2030 into the report.

17. **Funding for translation into Russian will be sought. Interested experts are invited to review the draft report.**

IV. LESSONS LEARNED AND FUTURE PLANS

18. The TFIAM discussed the role science had played in the revision of the protocol. Science formed an important part in framing the problem. But modelling analysis was not the only information taken into account in the final negotiations.

19. The Task Force acknowledged that communication should be improved in four areas:

- Communication between integrated assessment experts and experts developing energy, transport and agricultural scenarios within the countries in order to improve consensus on the baseline scenario. The expectation is that PRIMES will remain the basis for review and revisions, but that more national knowledge should be taken into account. This requires a better communication with national energy analysts involved in the development of PRIMES scenarios.
- More and well-prepared bilateral consultations between national experts and CIAM on emission inventories and other input data can help to reduce misunderstandings and different interpretations of statistical and technical facts. This could avoid bargaining on technicalities during political negotiations, and facilitate a stronger focus on environmental improvements, cost-effectiveness and risk management.
- Communication between national experts and CIAM need to be improved. A stronger commitment from the WGSR is important to improve participation of national experts in the bilateral consultations.
- Communication between integrated assessment experts and national policy makers can be improved. A stronger commitment from the WGSR is important to improve participation of national experts in the bilateral consultations.
- Improved communication with the broader public: especially through the choice of understandable indicators (eg. on health effects and biodiversity loss)

20. The results of the bilateral consultations were outdated by the time of the final negotiations. A clear project plan of the process would be helpful to avoid this in future Protocol revisions.

21. IAM identifies economically efficient strategies to reduce the value of damage caused by transboundary air pollution and shows the added value of international agreements compared to unilateral or local actions to meet air quality limit values and the protection of Natura2000 areas.

22. Emission reduction commitments for the medium term should be derived, inter alia form long term (aspirational) targets, together with an analysis of the required phase-in of emerging technologies. This would avoid a lock-in in outdated technologies and provide reliable long-term planning horizons to industry.

23. A recent political development is the strong and emerging interest in short lived climate pollutants (SLCPs). In this context it can be useful to draw attention to the coalition for short lived climate pollutants. This is an attempt to seriously integrate climate change and air quality, which will achieve near term climate benefits and air quality improvements. This global coalition started out as 6 countries and has now grown to 10 countries, the EC, UNEP and the World Bank with a number of more countries considering joining. A stronger co-operation between TFIAM, TFHAP, TFEIP and EGTEI could help in developing cost-effective control strategies for SLCPs.

24. The chair of the EMEP Steering Body presented the work plan for the coming years. It has been recognised that more efforts into clear communication is needed.

25. The Extended EB-Bureau is discussing the implementation of the long term strategy of the CLRTAP including a possible reorganisation and communication strategy. TFIAM and CIAM will remain central in the work. Several new reorganisation options are currently being discussed. The actual work activities are planned to remain, but the work might be performed under a renamed or regrouped body.

26. **The Task Force suggests that a new organisational scheme of the CLRTAP will support the core tasks of the Convention, i.e. on Integrated Assessments, emissions inventories, monitoring of air quality and assessment of effects. A separate diagram showing how the Convention works and what it does would be a valuable communication tool.**

27. The EMEP model is now being implemented with enhanced resolution. This could be used for future work within the CLRTAP. The resolution of the model to be used in support of the CLRTAP is not decided. Improved communication between the CCE and MSC-W is encouraged.

28. **TFIAM advised EMEP to communicate changes in the spatial resolution of model outputs as soon as possible to the Working Group on Effects. The TFIAM recognises that fine scale emission dispersion modelling is still dependent on equally fine resolution in emission inventories.**

29. The representative of EGTEI presented the recent work and work plans for the coming years. Recent work has focused on developing technical annexes to the Convention, the guidance documents as well as a document on PM emissions from Small Combustion Plants. EGTEI will continue to work on emerging technologies in combustion plants and provide a report in September 2012. EGTEI is also involved in capacity building in EECCA countries. Plans are being made for training sessions. In co-operation with the Co-ordination group for EECCA countries, key documents will be translated. Sector specific developments relate to improving estimation of costs from large combustion plants (e.g for power installations > 50 MW). EGTEI will update the guidance document for reduction techniques of Black Carbon. The next EGTEI meeting will be held on the 11th to 12th of June 2012 in Nice, France.

30. **TFIAM acknowledges the active network and capacity building activities of the EGTEI.**

31. The representative of the CLRTAP NEBEI presented the work plan for the coming years. First of all, the cost-benefit analysis of the revised Protocol will be finalised. Also methodological differences in benefit assessments will be reviewed, and the emphasis on

economic instruments will continue. NEBEI communicates with a number of bodies of the CLRTAP to broaden the economic valuation of environmental effects to ecosystem services. There will be a website launched. Ideas for new work are to explore: options for national benefit models; promoting of broad base co-benefit work (climate, transport, energy security). Some measures in the supporting analysis for the revised Protocol have been shown to be very cost effective but are excluded from policy implementation, which calls for further analysis.

32. The representative of the CLRTAP TFRN presented the work plan. The latest addition to the work is the expert panel on nitrogen in EECCA countries. In the current work plan lies the finalisation the guidance document for preventing and reducing emissions of ammonia, updating the framework code on good agricultural practice, providing technical information on making and using nitrogen budgets, and also to strengthen the co-operation with EECCA countries. Furthermore, TFRN are exploring relationships between 'greening the economy and nitrogen emissions' which is estimated as a suitable co-operation with TFIAM.

V. EUROPEAN MODELLING EXPERIENCES

33. CIAM and European Commission presented the scientific work that will take place supporting the coming Thematic Strategy on Air Pollution review. The timeline for the update of the Thematic Strategy on Air Pollution is now under a tight time plan, with the analytical work ready by the beginning of 2013. The review includes an evaluation of the Thematic Strategy on Air Pollution and the current air quality legislation and the NEC-directive. Urban hot spots and the impacts of the climate and energy package are considered as well.

34. A number of scenarios are being produced. Currently there are consultations regarding the PRIMES 2012 scenarios which need to be co-ordinated internally in the member states. It is important that all key figures that are being fed into the PRIMES and GAINS models are reviewed by national experts.

35. The modelling work for the review of the thematic strategy will contain the following aspects. The main issue of linking transboundary emissions with local scale air quality issues has been finalised in the end of the EC4MACS project. In EC4MACS a new methodology has been developed that allows for European scale compliance assessments with CHIMERE/EMEP models for air pollutants. This implies an improved 'city-delta' methodology. The main improvements relate to fine-scale meteorology, street canyon contributions. The addition of these elements should allow for an indication on where local AQ limit values might occur.

36. Results from fine scale PM2.5 emission inventories show systematic problems in winter throughout Europe. Corrections were done for domestic heating emissions (related to degree days and urban population adjustments). A street canyon increment is being used, developed by regression of monitoring data. From the analysis it has been possible to

show the difference in emission reductions between urban and national traffic. Emissions are being reduced slower in urban traffic due to different driving patterns than in rural (national) traffic.

37. From the final assessment of the EC4MACS project emissions to 2030 will be delivered including CLE and MTFR results. The results will be based on the PRIMES 2010 scenarios. Secondly, the results on air quality impacts and economic benefits will be added.

38. For the TSAP there will be two scenarios developed before the June meeting of the TSAP-SEG meeting. Emissions for Europe up until 2050 will be delivered. There will be two main groups of emission scenarios, PRIMES baseline and PRIMES low carbon scenarios. The emissions from the low carbon scenario are based on the EU 2050 road map. On these groups there will be three ambition levels, (CLE, MTFR, and MCE (maximum effort).

39. Based on these scenarios, IIASA invites EU member states to bilateral consultations in the period July – October 2012 with focus on a number of questions related to emissions to air, not on PRIMES data. PRIMES discussion needs to be made with the national PRIMES model expert groups.

40. TFIAM took note of LIAISE (Linking Impact Assessment Instruments to Sustainable Expertise) Network of Excellence (http://www.liaise-noe.eu) and the development of the toolbox for policy impact assessment . The network has the purpose to expand and experts on impact assessments are invited to engage with LIAISE. LIAISE looks into possibilities to improve the efficiency Impact assessment tools, and to facilitate a structured dialogue between the wider research communities and policy makers. Several exercises on reviewing and linking tools are ongoing, in particular structured around specific cases (e.g. on agriculture and resource use efficiency). The outcome of these cases will be used to improve the toolbox, provide key lessons learned for the improvement of the Impact Assessment process, as well as the science-policy interaction in general. The Berlin Conference 'Evidence for sustainable development' will be jointly organised by LIAISE (October 5-6 2012 in Berlin, http://www.berlinconference.org/2012/).

41. TFIAM took note of a Dutch analysis on interactions between air and climate policies. Cost-effective air quality policies could achieve long reaching climate impacts even without additional climate policies. In an optimal strategy a large part of these cost-effective measures will have climate impacts. End of pipe measures would only contribute 33 % of the air pollution emission reductions. Especially emission reductions from small scale combustion emission sources offer synergies between climate and air pollution policy.

48. TFIAM took note of the presentation of results of the DG RTD project Megapoli about the integrated assessment of air pollution control policies in European megacities. Impacts stemming from air pollution, greenhouse gas emissions and indoor air pollution were

simultaneously assessed using the integrated assessment model ECOSENSE (www.externe.info, www.integrated-assessment.eu). European-wide modelling was accompanied by new approaches to estimate the urban increment and the distribution of the street canyon increment of PM concentrations. Taking into account indoor air pollution the study revealed that insulation improvements of existing buildings without taking care of increasing the air exchange rate would produce considerable health impacts. Expansion of district heating networks, electric vehicles, improvements in traffic management and substituting small combustion sources using wood and coal would be some of the most efficient measures in megacities.

49 TFIAM took note of an international analysis for the NOx-emission control area in the North Sea. Similar work had been performed earlier for SO2 and for the Baltic Sea. The study compared the cost-effectiveness of reducing sea based emissions with reductions from land based sources. In the baseline NOx-emissions in the North Sea would be reduced by 5% between 2009 and 2030. Additional measures could reduce emissions by over 30% in 2030 and 70% after 2045. The analysis included the marine contribution to PM and NOx air quality levels in coastal regions. The human health benefits are larger than the abatement costs. But for land based sources there is still a large potential for cost-effective abatement measures with a larger benefit-cost ratio than emission removal from the marine sources, although the costs per tonne are approximately the same.

50. The TFIAM took note of a Dutch analysis on the impact of changes in the energy system on the concentrations of air pollutants. The analysis took into account daily production conditions for renewable fuels and therefore the timing of the remaining fossil fuel combustion for electricity production. The results showed that the decrease in air pollutant concentrations was smaller than previously anticipated. The reason for this seems to be that emissions during the night (when fossil fuels are used) will not be as effectively dispersed as emissions during the daytime. The study also showed that increased land use for biofuel production could have an impact on European ozone concentrations.

VI. NATIONAL MODELLING EXPERIENCES

51.TFIAM took note of recent modelling of $PM_{2.5}$ concentrations in the UK. Contributions from primary emissions, secondary inorganic aerosols (SIA as SO4, NO3 and NH4), and other components (including water, secondary organic aerosol, and fine fractions of urban and mineral dusts) have been summed and compared with measurements. The primary contribution is enhanced in urban areas, but overall makes a small contribution to population exposure compared with the long-range SIA. Investigation of future trends to 2020 using emission projections for other countries from GAINS scenarios illustrates how the attainability of targets for reducing exposure to $PM_{2.5}$ set in the EC's Air Quality Directive critically depends on reduction of precursor emissions of SO2, NOx and NH3, and hence on the ceilings agreed under the revised Gothenburg protocol.

52. The TFAIM took note of the current developments of NIAM and that the next NIAM meeting will be taking place on the 29th of June in 2012 in Brescia, Italy.

53. TFIAM took note of the Dutch analysis of the environmental impacts of the economic crisis. During the financial crisis (2007–2011) exports and investments declined largely and private consumption modestly, while the public consumption actually increased. The results showed emission reductions somewhere between -5 to -10 % for all air pollutants. The projected impact of the financial crisis was for most sectors larger than the actual outcome for the period analysed. In the short term, the crisis reduced emissions, but this might not be the case in the long term. Reasons for this is that financial institutions are being less eager to give loans to environmental technologies, governments have less financial resources to subsidize environmental technologies, and the fossil fuel prices and CO2 prices decline. The effects of the crisis on premature scrapping of less efficient older installations with high emission factors have not yet been investigated.

54. TFIAM took note of the presentation of the APPRASIAL project to be started by June 2012 and lasting 3 years. The project reviews the Air Quality and health assessment methodologies at regional (sub-national) and local scale. The expected outcomes of the project are to have a database on integrated assessment methodologies with identification of its limitations. Different decision support model approaches will be identified. Furthermore, case studies will help develop a decision support framework for regional (subnational) and local policy makers.

55. The TFIAM noted the development on emission control legislation in the Ukraine. According to current legislation 130 pollutants are being controlled. There are emission standards for a number of emission sources, with more standards currently being developed. The Ukrainian representative identified that the old and energy intensive technological equipment makes it difficult to ratify the LRTAP protocols. Also the lack of modern emission monitoring technologies makes it difficult to gather necessary information. There are difficulties in reporting to EMEP, e.g. because of differences in statistical format. An EMEP monitoring station is being installed in the Karadag Nature reserve, together with EMEP CCC. The use of the GAINS model in the Ukraine would make it possible to facilitate emission control choices in the Ukraine. It would also make it possible to perform emission projections and analyse possible time frames for the ratification of the revised Gothenburg protocol.

57. The TFIAM appreciated information on the official national emission projections for Belarus, produced by the Institute of Ecology in Minsk and the challenges to meet the emission reduction targets in the revised Gothenburg Protocol. The TFIAM noted the progress in national integrated assessment modelling in Belarus. Comparisons had been made between available national statistics & estimates and the CIAM-scenarios Of special concern was the difference in estimates for the emission removal potential for PM, which differed both in absolute number as well as its allocation by sector. Belarus is working on a technical paper devoted to PM abatement technologies applicable in EECCA countries for EGTEI. The Task Force noted that integrated Assessment modelling work in Belarus has significantly developed through the Swedish-Belarussian co-operation project.

60.TFIAM also took note of progress in the Swedish-Russian bilateral project. The current activities in the Russian Federation took place in collaboration with IIASA and the

Norwegian Meteorological Office. The GAINS Russia model is now better representing administrative bodies of the Russian Federation, which makes the model more suitable as a decision support tool. Work has also been done on introducing updated data and estimates into the model, and comparisons have been made to identify differences between the IIASA estimates and the national estimates.

61. TFIAM took note of the Irish analysis of the air quality impacts of greenhouse gas emission reductions in sectors that are not being part in the Emission Trading System for CO2. For these non-ETS sources Ireland needs a 20 % greenhouse gas emission reduction in 2020 relative to 2005. Delivering this target was identified as a significant challenge for complex multi-agent sectors such as agriculture and transport. It is expected that non-technical measures will have to comprise a significant portion of the effort given the existing menu of technical measures. The combination of technical and non-technical measures that deliver the target will also have substantial impacts on air pollutant emissions. Further research efforts to advance analysis and incorporation of non-technical measures into the process are necessary. Emission scenario developers should be aware of the imminent impact of the emission reduction targets for non-ETS sources between 2013 and 2020.

VII. FURTHER WORK / WORK PLAN

62. The main points of attention of integrated assessment modellers will be:

- To develop a wider notion of benefits of a environmental improvement as well as measures and clarification of contribution to other environmental targets (water, energy security, biodiversity, etc)
- Abatement costs for local hot spots of air pollution in relation to European wide emission reduction efforts,
- Biodiversity projection in Natura2000 and other protected areas
- (Background) ozone, related to northern hemispheric emissions
- Climate and air pollution (policy) interactions, e.g. black carbon, biofuel use,
- Consequences of structural changes in the energy, transport and agricultural system, including the economic impacts.
- Definition of key measures to be taken in the short run.

63. A workshop on global 2030-2050 scenarios together with TFHAP will be held on 8-10 October in Austria. It will be held back to back with a Global Nitrogen scenario workshop on 11 October.

64. The 42nd session of the TFIAM is planned for May 2013.