AIR CONVENTION

(CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION)

Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)

TASK FORCE ON INTEGRATED ASSESSMENT MODELLING (TFIAM)

48th session, 23 - 24 April 2019
Berlin, Germany

Chairs report

I. INTRODUCTION

1. This report describes the results of the 48th session of TFIAM, held from the 23rd to the 24th of April 2019 in Berlin, Germany. The presentations made during the meeting and the reports presented are available at: http://www.iiasa.ac.at/web/home/research/researchPrograms/air/policy/past_meetings.html.

2. 42 experts attended, representing the following Parties to the Convention: Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom of Great Britain and Northern Ireland. Other bodies represented were the EMEP Centre for Integrated Assessment Modelling (CIAM), the Task Force on Techno-Economic Issues (TFTEI), the Joint Research Centre of the European Commission (JRC), the Meteorological Synthesizing Centre-West (MSC-West), the Co-ordination Centre for Effects (CCE), the European Environment Agency (EEA), WMO Global Atmospheric Watch Urban Research Meteorology and Environment (WMO/GURME), the European Environment Bureau/Airclim (EEB), Environmental Action – Germany and CONCAWE.

3. Mr. R. Maas (Netherlands) and Mr. S. Åström (Sweden) chaired the meeting.

4. The head of the Division for Environmental health and protection of ecosystems at Umweltbundesamt, Dr. Lilian Busse, welcomed TFIAM to Berlin and opened the meeting.

II. NEWS FROM OTHER BODIES AND OBJECTIVES OF THE MEETING

5. Mr. Maas and Mr. Åström presented the latest developments within the Air Convention and other air pollution policy arenas, including the TFIAM-related recommendations from the Saltsjöbaden VI workshop and the long-term strategy of the Air Convention as well as the updated mandate of TFIAM. They defined the purposes of the 48th TFIAM meeting (TFIAM 48): to assess the current status of integrated assessment models, to learn from national and local assessments and to assess the effectiveness of global sectoral strategies.

6. The Saltsjöbaden VI workshop held in Gothenburg 2018 led to four recommendations of special relevance for TFIAM. These recommendations were: to include local population exposure in the long-term strategy of the Air Convention, to set up an expert panel on clean air in cities, to better align international policies with national and local policies, and to develop user-friendly guidance documents for local-level assessments of air quality, abatement options, and their effects.

7. The long-term strategy of the Air Convention, which was accepted in December 2018, building upon recommendations of the Scientific Assessment report published in 2016 and the Saltsjöbaden VI workshop, includes the ambition to assess health and ecosystem impacts at the local scale and compare the effectiveness of international measures with local air pollution measures. Moreover, the long-term strategy calls for assessing potential benefits of global cooperation for regional and local air quality.

8. TFIAM 47 proposed an update of the TFIAM mandate, which was accepted by the Executive Body of the Air Convention in December 2018. This update now gives TFIAM the mandate to work on multi-scale and multi-objective assessment modelling aimed at analysing cost-effective policy strategies that combine international, national, and local actions, and to consider the links between air quality policies and other policy processes.

9. It is expected that the amended Gothenburg protocol (AGP) will be ratified during 2019, and if so it is likely that a process of reviewing the protocol will be initiated. Such a review could require efforts by TFIAM and CIAM, inter alia to clarify which sectors contributed to emission reductions, which measures where most effective or which cost-effective measures were not yet taken.

III. UPDATES ON EUROPEAN SCIENTIFIC ASSESSMENTS

10. TFIAM took note of the presentation by Markus Amann (CIAM) of the latest research made for the European Commission. An exploration of different instruments to control emissions from international shipping in the Mediterranean Sea. SECA and NECA as well as climate policies and economic growth effects have been analysed. In general, the effectiveness of the instruments depends on scope, and doubles if EU and non-EU act together. SECA and NECA can by 2050 deliver reductions of PM2.5 concentrations of up to 3 $\mu g/m^3$ in coastal areas around the Mediterranean Sea. Benefits will outweigh costs with a factor of ~7 by 2030 and ~12 by 2050.

11. TFIAM suggested further studying the benefits of the measures in the Mediterranean Sea for adjacent seas, including the trade route towards the North Sea. Also the effectiveness of policy instruments to retrofit existing ships on sea and inland waterways require attention.

12. The importance of integrated local-regional-international air quality policies was shown with examples from a recent study done for India. The results show that local air quality standards for PM2.5 in most Indian megacities are unattainable with local measures only.

13. Key areas of GAINS model improvements for any AGP review should be the stabilisation of emission inventory data for historical years, updated data for activity levels and emission projections for EECCA countries and consensus on the contribution of transcontinental fluxes. Such a review should clarify what the

remaining distance will be form the long term health and ecosystem objectives of the Protocol when all technical annexes would be fully implemented.

14. TFIAM appreciated the presentation by the EEA (Evrim Ozturk) on the Air Implementation Pilot 2018 study focusing on 10 EU cities that have problems meeting air quality limit values. Within the study, several good practice examples are collected. In for example Milan, car traffic has reduced with 30% and bicycle sharing opportunities have increased in the last 8 years. The study also showed that the local administrative capacity is one of the most important challenges and that improved local-national co-operation is crucial. In general, local measures are not easily transferable to other cities due to city heterogeneity. Health is becoming an important driver for air pollution policies. Public acceptance of air quality measures requires citizen involvement, both in measurements and policy design.

15. TFIAM acknowledged the presentation by Mike Holland (United Kingdom) on recent developments in benefit assessments, including work on the health impacts of NO_2, and the revised damage cost estimates. A recent research review (COMEAP) has focused on NO_2 and health, and there is still discussion on how to consider health impacts of NO_2 in health impact assessments. The COMEAP study gives case-specific values for the response functions to be used when estimating health impacts from NO_2 emission changes; however caution is needed by the user.

16. Recent damage cost estimates (i.e. the monetized damage from one kilogram of emission) have been produced in the United Kingdom. Revised cost estimates include addition of a number of new health endpoints not previously considered. This decomposition shows how the 'cost profile' of NO_2 is different from the corresponding profile of primary PM2.5 emissions. The damage costs used in the UK do not include the damage that occurs outside the UK due to its emissions: participants reported that a number of other countries (Denmark, Finland, Sweden) are following a similar approach which implies only a partial recognition of the polluter pays principle. An EEA update of the damage costs (from industrial emissions) is ongoing and is expected during 2020, but will include analysis of effects of each country on all other countries in the modelled domain.

IV. UPDATES ON NATIONAL SCIENTIFIC ASSESSMENTS

17. TFIAM noted the presentation by Jeroen Kuenen (Netherlands) on source apportionment of PM2.5 concentrations in Europe. The analysis focuses on modelling daily PM10 and PM2.5 concentrations a.o. due to small-scale wood combustion, including subfractions like elemental carbon and organic carbon and taking into account total primary particles (including condensables) in a consistent way across Europe. This work is available online in the TOPAS model (https://topas.tno.nl). With the model one can see daily source apportionments per sector or per country with respect to local air quality in cities.

18. TFIAM noted that more discussion is needed on how to communicate the source apportionment for secondary particles (which can be a local product of emissions from different countries and sectors).

19. Simone Schücht (France) presented a French study on control of emissions from international shipping in the Mediterranean Sea, ECAMED. ECAMED studied both daily and annual impacts on PM2.5 and NO_2 concentrations due to a potential NECA and SECA in the Mediterranean Sea. The study also included impacts on ground-level

ozone. The cost-benefit analysis showed benefit-costs ratios that were slightly higher than the results of the Mediterranean study presented by CIAM.

20. TFIAM noted the presentation by Rob Maas (Netherlands) on ongoing Dutch work on the national air quality plan. Current trends show declining exposure to PM10 and NO_2. The possibility to use national options to reduce exposure is different for the pollutants. Exposure to PM2.5 in the Netherlands is 60% due to foreign sources, whilst exposure to NO_2-concentrations is 25% due to foreign sources. Local scale air quality is even more influenced by non-local sources. This means that local measures will have a small impact on average population exposure. On a national level, on average across the entire population 3 months of additional life-months per person can be gained between 2016 and 2030 if all current national and international policy measures are implemented as planned. Additional national air quality measures would add 0.5-1 month. National climate measures can contribute to some degree, but would be minimal if strong increase in the use of biomass would be included. Climate policies help more to reduce NO_2 than PM2.5 concentrations. Co-operation with surrounding countries is still needed. The Netherlands cannot reach a 50% improvement in air pollution related health without international cooperation (short of far-reaching decrease in macro-economic activity).

21. 21. TFIAM also took note of the presentation by Johanna Appelhans (Germany) on the German air pollution control programme. Draft results show remaining challenges for reaching the 2030 emission reduction commitments for most Gothenburg protocol pollutants (except for NMVOC) based on current legislation emission projections. However, the outcome of the German Commission on Growth, Structural change and Employment is currently being analysed and preliminary results indicate that the Commissions' suggested phase out of coal-fired power generation in Germany will have a substantial impact on SO_2 and NO_x emissions and might enable meeting the 2030 reduction commitments of the NEC Directive for SO_2, NMVOC and PM2.5 without additional measures. However, the outcome of the Commission increases the risk for regret-investments in new air pollution control (if made in coal power plants). Additional emission reduction measures would result in a substantial reduction of PM, NO_2 and NH_3 concentrations, but could increase annual mean ozone concentrations in agglomeration areas.

22. TFIAM appreciated the presentation by Antonio Piersanti (Italy) on the development of the Italian air quality plan. By 2020 Italy is on track to fulfil its emission reductions obligations, but for 2030, for all pollutants except SO_2, Italy needs to implement additional measures to fulfil the NEC Directive requirements. However, even these measures will not ensure that Italy is in full compliance with the EU Air Quality Directive. Italian IAM work is focussed on selecting priority actions on the basis in sectoral source apportionment and updates are planned of GAINS Italy.

23. TFIAM recommended to further analyse the implications for the ammonia projections of an increased growth of energy crops as part of the climate policy strategy. E.g. in Germany, the increased growth of corn for biogas production has increased German ammonia emissions by 10% during a 10-year period.

24. TFIAM noted the presentation by Stefan Åström (Sweden) on the new Swedish national air quality plan and results from recent IAM-related studies. To meet the requirements of the NEC Directive, Sweden must make further efforts to reduce NH_3 and NO_x emissions by 2030. To achieve further emission reductions of NH_3,

increased use of bandspreading of manure, instead of broadcasting, is identified as most important. To reduce NO_x emissions further, improved flue gas cleaning in existing industrial combustion plants as well as achievement of Swedish transport sector climate objectives (inter alia electrification) are considered as most important.

25. A new Swedish ex-post evaluation study indicates that the requirements for SO_2 end-of-pipe technologies in the Gothenburg Protocol was an important driver for the Swedish SO_2 emission reductions between 1990 and 2012. Another study showed that the use of different climate metrics (GWP, GTP etc.) does not affect the cost-effectiveness ranking of options to reduce emissions of SLCP-air pollutants. However, the cost-effectiveness ranking of emission control options can be sensitive to the chosen economic perspective in the analysis. There are also indications that the consideration of emission reductions from international shipping would increase the cost-effectiveness of reducing damage to health and ecosystems.

26. TFIAM appreciated the presentation by Helen Apsimon (United Kingdom) on the effects on UK air quality from national and international shipping. Ex-post analysis confirmed the significant role of European agreements in the improvement of air quality in the UK. The study showed that NO_x emissions from international shipping are soon likely to be 1.5 times higher than land-based anthropogenic NO_x emission, implying significant contribution to population exposure. In the UK there is ongoing work on assessing risk maps for ecosystem effects with focus on areas of special interest and Natura 2000 areas. Current plans are related to future road transport emissions (e.g. on electric vehicles and non-exhaust emissions) and embedded modelling down to the street scale, as well as locally specific modelling of agriculture and ecosystems.

27. TFIAM appreciated the presentation by Andrew Kelly (Ireland), who presented recent Irish work on the development of the National Air Pollution Control Plan and the Irish Clean Air Strategy. The Irish national air pollution control plan is focusing mainly on NH_3 challenges. The NAPCP process also reconfirmed that climate and air pollution policies and scenarios need to be better integrated. The Clean Air Strategy contains many ambient air pollution measures, as well as actions to replace fossil fuels with cleaner alternatives. Outcomes from recent research on the conflicts between air pollution and climate change policies in Ireland were also presented. The "CONAIR" project delivered high resolution air pollution concentration maps for Ireland, and explored a plausible problematic air pollution scenario, as well as a solution scenario which identified actions to make air and climate policies more robust.

28. TFIAM took note of the presentation by Stefan Reis (United Kingdom) on an ex-post evaluation of the drivers of emission reduction and reduced health damage over the past 40 years. The key messages are that mortality attributable to NO_x and PM2.5-exposure decreased with some 50% while those attributable to O_3 increased for the period 1970-2010. However, between 1990 and 2010, also O_3-attributable mortality decreased. General conclusions from the study are that it is important to convey positive messages and to estimate past effects of emission control policies. Future work will include a higher spatial-temporal resolution, as well as calculations on the morbidity effects of air pollution.

V. PROGRESS OF THE TFIAM WORK PLAN

Updates of GAINS control costs and assessment of the costs of inaction

29. Stefan Åström presented the activities related to the envisaged report on the costs of inaction. Scoping and co-ordination efforts were made together with TFTEI. And all parties with relevant information or activities are invited to give input.

30. With respect to the update of GAINS control cost data, TFTEI continues to regularly update cost data and is currently focussing on the costs to reduce emissions from the cement industry, which they would be able to present by the end of 2019.

31. TFIAM noted that several national assessment studies ignore the transboundary health and ecosystem impacts. Moreover, also national cost-benefit guidelines often contain values on the damage costs per emitted kilogram, which omit the damage abroad. This practice is not in line with the spirit of the Convention on Long-Range Transboundary Air Pollution and the principles of environmental economic theory, which implies that all external effects should be included in assessing the costs and benefits of projects or policy measures. Looking only at (local or) national damage costs would give less priority to policy measures to abate transboundary air pollution. If all parties to the Air Convention would use such damage cost estimates as the basis for policy, they would also receive less benefits from measures in other countries and the total cost-effectiveness of air pollution policy would be less.

Updates on the Ammonia Assessment report

32. Rob Maas presented the activities related to the ammonia assessment report. A first draft is expected to be circulated during the summer and interested expert from several bodies under the convention will be invited to react and add to this draft.

Updates on the expert panel on clean air in cities

33. Rob Maas introduced the current activities under the work plan. In November 2018 a scoping session involving several networks identified the potential role of the expert panel on clean air in cities (EPCAC). The Executive Body approved its mandate in December 2018. The parties to the Air Convention can still nominate experts or policy makers for this panel. The first formal workshop of the panel will be organised in autumn.

34. TFIAM appreciated the presentation by the Mike Holland (United Kingdom), on the efforts to assess the cost-effectiveness of local air quality measures. The lack of (ex-post) data proved to be a serious limitation. Multiple rationales for policies, as well as other policy measures (acting as confounders), affect the cost-effectiveness of local air quality measures. Regional variability in costs of measures, as well as analytical biases, complicate the development of a harmonised database, but at the same time greatly increase the importance of such work in the interests of providing guidance and learning from experience.

35. TFIAM noted that a focus on achieving air quality limit values or on achieving maximum improvement of human health would lead to different policy measures and different outcomes in terms of the costs per life year gained. Both approaches have

merits and together they could show the trade-off between effectiveness and equity of air pollution policy. Therefore TFIAM recommends to also look at highly exposed groups when designing a policy based on maximizing health improvement by reducing the average exposure of the population in a city as well as assessing the health benefits (in terms of life years gained) from measures that are focussed on reducing the exposure in local 'hot-spots'.

36. TFIAM acknowledged the presentation by Martin Lutz from the city of Berlin on managing air quality on a city level. Source appointment analysis showed that the local share of the contribution to Berlins $PM_{2.5}$ concentration levels is decreasing over time, and currently 60% of the problem is from non-local sources. For NO_2 the situation is reversed with a high contribution from local sources. Analysis of the local ban on diesel cars showed that some re-allocation of traffic can be expected, with an increase in air pollution in other streets. No net positive health effects are to be expected. City-wide measures would be more effective, but the key problem are conflicting interests of city and national governments with respect to for example the implementation of low emission zone. The focus on air quality limit values, has led to lacking assessments of health impacts from local policy proposals. The city is looking for indicators that better represent the health improvements that are to be achieved.

37. TFIAM appreciated the presentation from Ranjeet Sokhi (World Meteorological Organization), on understanding and forecasting local air quality on the basis of linked global and regional atmospheric models as applied in GURME, the Global Urban Research Meteorological and Environment project. Results from source appointment confirmed the importance of non-local sources for local air quality. Other results showed the combined effect of climate change and air pollutant emission changes on ozone and PM2.5 concentration levels. The project illustrated the importance of linking geographical scales for air quality projections, including proper accounting of local circumstances.

Updates on global sectoral strategies

38. TFIAM took note on the TFHTAP research presented by Jan Eiof Jonson (Norway). The results showed that different ozone metrics show different regional shares to total ozone concentration in a specific region. Regional shares are higher for the SOMO35 and POD indicators, and the rest of the world is more important for annual mean ozone. The results also show that international shipping contributes substantially to PM2.5 and ozone concentrations in European countries, but with a large variation dependent on sea region and country. Malta is an outlier with shipping contributing with some 60% of total PM2.5 concentrations.

39. TFIAM acknowledged the information about the EU action on black carbon in the arctic given by Stefan Åström. The action is a three-year effort to improve knowledge on black carbon emissions, to increase awareness and share knowledge on the problem, to provide advice documents and scenario analysis, and to develop a roadmap for international cooperation on black carbon. The action intends to give input to, and collaborate with, the Air Convention working bodies. It is foreseen that the future work will be coordinated with the Air Convention and give input to WGSR deliberations and joint outreach and communication efforts.

40. TFIAM recognised the presentation by the Rita Van Dingenen (JRC) on trends in global methane emissions and impacts on ozone concentrations. The observed global

methane emissions are increasing, especially since 2002, but they decrease at the EU-28 level. Ozone formation is largely independent from the regional location of methane emissions, but local peaks depend on local emissions of NO_x and NMVOC. On basis of the scenarios analysed, there is reason to expect a further increase in background ozone concentrations if no additional action is taken on methane emissions.

41. TFIAM appreciated the presentation by Toon Vandyck (JRC) on air pollution co-benefits of climate policies. The 2° target scenario will imply more co-benefits for air pollution than the nationally determined contributions scenario. Co-benefits entail reduced health impacts from PM2.5 and ozone exposure.

Preparation of the review of the Amended Gothenburg Protocol

42. Rob Maas presented experiences from the CIAM report #1 on the review of the Gothenburg protocol in 2007. Such a review could require efforts by TFIAM and CIAM, inter alia to clarify which sectors contributed to emission reductions, which measures where most effective or which cost-effective measures were not yet taken. An important question will be to what extent full implementation of the technical annexes will be able to reach the long term objectives of the Protocol on the protection of health and ecosystems? Following this, TFIAM participants raised items of that could be included in a review of the Amended Gothenburg Protocol. Harmonisation and stabilisation of the emission database would be an important precondition. Attention should be paid to measures to reduce black carbon, methane, ammonia and shipping, as well as to the linkages with climate change and the impacts on morbidity and biodiversity. It would also be good to show the benefits of international coordinated action for the various parties.

VI. ANY OTHER BUSINESS

43. A TFRN/INMS back-to-back meeting is expected to be held on 30th of Sept – 2nd of October 2019 in Brussels, which could be a suitable venue for a discussion on the envisaged ammonia assessment report.

44. The 49th session of TFIAM will take place in Edinburgh, UK, in end of April or early May 2020.

VII. GENERAL CONCLUSIONS AND RECOMMENDATIONS

45. **The Task Force noted that the GAINS model is ready to be used for a review of the Amended Gothenburg Protocol obligations and its technical annexes. However officially submitted emission data for 2005 and beyond are still being adjusted by the parties, and the consistency in emission reporting among parties cannot be fully guaranteed yet.** Especially equal or compatible treatment of condensables (particulates from a.o. residential wood burning that are formed due to cooling of emitted gasses) requires attention of the parties. Potential abatement measures for shipping in European seas have been added to the GAINS model.

46. Several participants presented assessment work in support of the development of local and national Air Quality Plans. Most of these assessment studies tended to look at domestic health and ecosystem benefits only and did not include transboundary effects (while often assuming that surrounding regions or countries will take further action where they will benefit from). **The Task Force recommends that assessment of the cost-effectiveness and benefits from local and national policies should include transboundary impacts on health and ecosystems, as transboundary fluxes still constitute a major part of air pollution. Also the damage cost data that are used in cost-benefit analysis of investment projects or policy measures should include transboundary damage.**

47. Several national experts presented ex-post assessments of air quality policies, showing that internationally agreed environmental legislation has had a significant influence on the improvement of air quality in their country. **The Task Force recommends other parties to do such ex-post assessments as they can be an important input for any upcoming review of the Amended Gothenburg Protocol and in showing the success and benefits of international co-operation.**

48. Even in large cities like Berlin and London, there is a large regional and transboundary contribution to the concentration of particulate matter at traffic stations. The Task Force emphasised that long-range transport of fine particulate matter, nitrogen compounds and ozone contribute significantly to local air quality and related impacts on health and ecosystems. The meeting called for the development of a multi-scale air quality management strategy. Integrated assessment modelling can support this, and can also reveal the benefits from coordinated action. **The Task Force reconfirmed that it will establish an expert panel on clean air in cities can give necessary input to air quality managers at all levels of governance.**

49. The Task Force noted that the focus on local measures to comply with air quality limit values along busy roads sometimes lead to measures that are not cost-effective or even counterproductive from a health perspective. **The Task Force recommends assessing the health impacts of such measures, and comparing the costs per life year gained with those of measures that aim to reduce the average exposure of the population in a city or neighbourhood, in order to inform policy makers about the price of reaching more equality in population exposure.**

50. New studies reconfirm the potential co-benefits for air quality of reaching the 2° climate target. **The Task Force noted that these co-benefits will not be enough for reaching the long term objectives of the Air Convention. Remaining nitrogen problems would require additional action. An integrated design of climate and air quality policy is needed to deal with policy trade-offs: fuel switch for climate reasons should not worsen (local or regional) air quality, and air pollution strategies should aim to be at least climate-neutral.**

Annex: work plan items 2018-2019

Item	Activity	Deliverable	Who
1.1.3.2	Ammonia: Improve understanding of cost effectiveness of local vs regional agricultural emission control for protection of human health and ecosystems in Europe.	Presentation of TFIAM at TFMM Synthesis report focussing on agriculture in 2019	TFIAM with support from TFMM and countries experts (France, Netherlands a.o.)
1.1.3.3	Local assessment modelling of measures to reduce population exposure	Workshop in 2018	TFIAM with support from local and national experts
1.1.4.6	Sectoral opportunities to mitigate intercontinental transport	Workshop in 2018 and synthesis report in 2019	TFHTAP with support from TFIAM/CIAM
2.3.4/ 2.3.9	Collect and provide data for inclusion in the GAINS model, in cooperation with the Centre of Integrated Assessment Modelling and other institutions and organizations. Review of the control costs currently used with a view to improving, on an ongoing basis, the cost-effectiveness analyses produced by the GAINS model	Updated data for selected sectors provided to CIAM for inclusion in GAINS	TFTEI, with support from national experts and CIAM
2.3.10	Assessment of the cost of inaction		TFTEI with support from TFIAM