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)

55th session, 22 - 23 April 2026
Brussels, Belgium and online

Chairs report as of 18th of May

Summary

TFIAM met in Brussels in April 2026 for its 55th session. The Task Force confirmed that the updated GAINS model remains suitable for supporting the revision of the Gothenburg Protocol, including optimisation analyses for health and biodiversity objectives and related cost-benefit assessments. Preliminary results showed that benefits consistently outweigh costs across all analysed scenarios, including combined health and biodiversity optimisation pathways.

Updated scenario analyses incorporated bilateral consultations with Parties, revised PM2.5 health-risk functions, updated demographic projections and revised nitrogen critical loads. Results indicated that a 50% reduction in PM2.5-related mortality remains technically feasible across the UNECE region, while biodiversity optimisation requires additional NH_3 and NO_x reductions. Work continues on alternative ambition levels, ozone mortality impacts and updated baseline scenarios.

Discussions also addressed differences between national projections and GAINS baselines, particularly regarding transport, agriculture, condensable PM emissions and assumptions in PRIMES and CAPRI models. Parties stressed the need for greater transparency and stronger dialogue between modelling teams.

Additional discussions covered NH_3 emissions, shipping fuels, hydrogen use, black carbon mitigation and integrating land-use and agriculture policies into modelling frameworks. TFIAM called for further technical input, national data and financial support to strengthen future modelling work.

I. INTRODUCTION

1. This report describes the results of the 55th session of TFIAM, held in Brussels, Belgium and online from the 22nd to the 23rd of April 2026. The presentations made during the meeting and the reports presented are available at: https://iiasa.ac.at/task-force-on-integrated-assessment-modelling-tfiam-past-meetings. All material produced by TFIAM and the Centre for Integrated Assessment Modelling (CIAM) are available at: https://iiasa.ac.at/policy/applications/task-force-on-integrated-assessment-modelling-tfiam-under-lrtap-convention.

2. 34 experts participated in Brussels, and 50 online. These represented the following Parties to the Convention: Austria. Belgium, Croatia, Cyprus, Denmark, the European Union, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Türkiye, and the United Kingdom of Great Britain and the Northern Ireland. Other bodies of the Convention represented were Working Group on Strategies and Review (WGSR), Co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe (EMEP) Steering Body, Working Group on Effects (WGE), EMEP Centre for Integrated Assessment Modelling (CIAM), WGE Coordination Centre for Effects (CCE), the Meteorological Synthesizing Centre-West (MSC-West), the Task Force on Techno-Economic Issues (TFTEI), and the Task Force on International Cooperation on Air Pollution (TFICAP). In addition, the Air Pollution and Climate Secretariat (AIRCLIM, the Joint Research Centre of the European Commission (JRC), the European Environment Bureau (EEB), the Health and Environment Alliance (HEAL), and CONCAWE were represented.

3. Stefan Åström (Sweden) and Simone Schucht (France) chaired the meeting.

4. The Deputy Unit Head Mr Thomas Henrichs, from European Commission-DG Environment, opened the meeting. The Deputy Unit Head highlighted the need for integrated modelling of policy options for improved air quality. Crucial for the modelling is that the scenarios are relevant, credible, legitimate, as well as plausible/context dependent. In essence the modelling must support the policy makers with actionable output, it must be peer reviewed by experts, it must reflect the real life policy constraints facing policy makers, and it must also frame the options in a way that allows decision makers to recognise their actual situation with respect to the decisions to be made.

II. NEWS FROM THE CONVENTION AND OBJECTIVES OF THE MEETING

5. TFIAM noted the presentations by the TFIAM co-chairs on the current development under the Air Convention, the corresponding requests from the Air Convention bodies to TFIAM, on the TFIAM/CIAM workplan and the objectives of the meeting.

6. The 2026-2027 TFIAM work plan contains several activities related to the ongoing revision of the Gothenburg Protocol. All in all, there are some 20 tasks requested of TFIAM. Amongst these, TFIAM leads seven tasks: the finalisation of the GAINS-update for O3 modelling, the cost-benefit analysis (CBA) for scenarios supporting the Gothenburg Protocol Revision (GPR), the development & assessment of further scenarios for the GPR, the stimulation of national integrated assessment capacity and exchange of experience, the development of updates of the policy brief, the

strengthening of the network of experts and policy makers at different scales, and the continuation of model comparison, for example on source attribution and effectiveness of measure.

III. GOTHENBURG PROTOCOL REVISION- OUTPUT FROM AIR CONVENTION WORKING GROUPS

7. TFIAM noted the presentation by the Chair of the Working Group on Strategies and Review (WGSR), **Till Spranger**, on items in the current revision of the Gothenburg Protocol (GPR) of specific concern for TFIAM. While the status of work emission scenarios and cost-benefit analyses will be presented to Parties at the informal pre-meeting to the 64th session of the WGSR (11 May), negotiations on emission reduction commitments based on final scenarios and CBA will only start at the upcoming Heads of Delegation (HoD) meeting (5-7 October). Further, negotiations on the Gothenburg Protocol are likely to continue until 2028, pending the formal decision of the EB.

8. It is essential for the success of the GPR process to negotiate possible flexibilities/simplifications of the GP to facilitate ratification of a future GP by current non-Parties.

9. TFIAM discussed the use of 'static' or 'dynamic' population. In general, it is considered that static population is suitable for target setting during optimization of cost-effective emission control, but it is not suitable for cost-benefit analysis. This is so because the costs assessed in GAINS are also based on dynamic data: population, activity levels. However, there is still a need to be very clear about which 'setting' is assumed in the CBA.

10. TFIAM noted the presentation by the TFIAM co-chair, **Simone Schucht**, presenting latest updates of the Policy Brief on potential targets to reduce risks for health and ecosystems. Then current version 6 and the associated "Summary for policy makers" use the updated scenario group v6b with recent demographic data and updated empirical critical loads for nitrogen. Health (PM2.5) target setting options, also in joint optimisation for a reduction in biodiversity risks, were carried out for alternative indicative ambition levels. Further information on the feasibility of reaching a joint 50% risk reduction for health effects associated with PM2.5 and O3 was provided. Also, different approaches to reducing the differences in additional costs (beyond baseline) between EU27/EFTA on the one hand and the regions EECCA, West Balkan and Türkiye, on the other hand, were tested. The major rationale behind these analyses was the wish to reduce barriers for ratification. However, none of these approaches have gained much support by the decision makers. For the current and upcoming analyses, EB requested optimisation aiming at reaching targets in the most cost-effective way over the whole region, to use static population for target setting, and to assess a range of ambition levels. EB also requested to align the baseline scenario for EU27 with the new baseline scenario developed in the framework of the Clean Air Outlook 5 (CAO5) European Commission (EC) study. Once this baseline will be available, CIAM will need to repeat modelling of the key scenarios, to the extent possible for the HoD meeting in October.

11. The discussion after the presentation focused on how 'fairness' should be interpreted. Some participants also reminded the TFIAM and CIAM to study the effect if air quality when concentrations are under current WHO guideline values.

12. TFIAM noted the presentation on IAM modelling developments given by the deputy head of CIAM, **Gregor Kiesewetter**.

13. The presentation describes the latest updates to the GAINS modelling scenarios used for the Gothenburg Protocol (GP) revision. Scenario set v6b builds on earlier versions by incorporating bilateral consultations with EU Member States, Western Balkan countries, the UK, Switzerland, and non-UNECE parties. Updates include revised $PM_{2.5}$ health-risk functions based on HRAPIE2 recommendations, new UN population projections, and refined baseline and MTFR (Maximum Technically Feasible Reduction) scenarios.

14. A central focus of the cost optimization scenarios that jointly address human health and biodiversity protection. Using updated empirical critical loads for nitrogen deposition (average accumulated exceedance, AAE $CLempN_{min}$), CIAM has explored whether a 50% reduction in ecosystem risk relative to 2015 could be achieved by 2040. Results show that this target is feasible at the UNECE-Europe level for most ecosystems, although not for four grassland habitat types. The modelling shows that achieving the PM-related health target alone already substantially reduces biodiversity risk, while additional NH_3 and NOx reductions are required for combined health and biodiversity optimization.

15. Sensitivity analyses of different mortality-reduction ambition levels tested targets ranging from 45% to 60% reductions in premature mortality, using both static and dynamic population target framing. Results show that accounting for future demographic change requires stricter emission reductions to achieve equivalent target values.

16. CIAM has also assessed the impact of updated NH_3 control costs in agriculture, particularly for manure management measures informed by TFRN input. Preliminary analyses suggest that lowering agricultural nitrogen mitigation costs only marginally reduces the total costs of combined health and biodiversity strategies—by roughly 1.5% beyond CLE scenarios. The presentation notes that many low-cost NH_3 measures are already selected in health-only optimization scenarios, meaning reduced nitrogen costs provide limited additional savings when biodiversity objectives are added.

17. Significant progress has been made in updating ozone (O_3) calculations within the GAINS model. The presentation reviews recent epidemiological evidence for both short-term and long-term ozone exposure metrics, including SOMO30 and MDA8 approaches. New modelling methods developed with EMEP simulations quantify ozone sensitivities to NOx and VOC emissions using largely linear transfer coefficients, with quadratic approaches applied where atmospheric titration effects occur. Preliminary results suggest that achieving a combined 50% reduction in $PM_{2.5}$ and ozone mortality is feasible under some methodological assumptions, especially when short-term ozone exposure metrics are applied.

18. The presentation also highlights trends and mitigation potential for black carbon emissions across the UNECE region. BC currently represents around 16% of anthropogenic $PM_{2.5}$ emissions, with residential combustion and transport accounting for nearly 85% of total BC emissions. Historical reductions have been driven largely by cleaner transport technologies, and future scenarios project further declines as residential and transport sectors continue to decarbonize. Although further BC mitigation potential is comparable to $PM_{2.5}$ reductions under MTFR scenarios, optimized health and biodiversity strategies produce somewhat smaller reductions for BC than for total $PM_{2.5}$.

19. The final section outlines future work supporting the EU Clean Air Outlook 5 (CAO5) and development of scenario version v7. Planned activities include incorporating updated PRIMES and CAPRI baseline projections, further bilateral consultations with countries, improved mitigation cost datasets, and continued implementation of ozone calculations in GAINS. Additional work will explore transformational "LOW" scenarios, alternative fuels such as ammonia and hydrogen, improved biodiversity metrics, and expanded modelling of black carbon concentrations and health impacts. These updates are intended to support future optimization scenarios and policy discussions within the UNECE framework.

20. The discussion ranged a bit around the forthcoming v7 scenario group. These topics included which international shipping scenarios are considered, and whether the EU Omnibus regulation proposals are included. The Omnibus is a proposed regulation to simplify certain legislation within the EU in one package. The primary goal of this simplification is to enhance the competitiveness of EU companies.

21. TFIAM noted the presentation by **Wilfried Winiwarter**, CIAM, on updates of NH3 costs by TFRN and their integration into the GAINS model. The currently implementation of cost update in the GAINS model has, due to resource constraints, been done for measures considered as 'low-hanging fruits', i.e. measures that should provide benefits to the farmers. These measures are so inexpensive that they will be amongst the selection of cost-effective measures to reach health targets of 50%. More work is needed to update the costs for the more expensive measures, which will then affect the additional costs for going from a health-only optimization to a health- and biodiversity optimisation. This requires obtaining additional information for which resources are not sufficient.

22. The group discussed how to communicate the TFRN update of GAINS model NH_3 control cost values. It is important that the note submitted to WGSR (https://unece.org/environment/documents/2026/03/working-documents/ammonia-mitigation-economic-and-environmental) clearly explains why the current (January 2026) GAINS NH3 control cost estimates are so similar to the earlier NH3 control costs, while earlier arguments have communicated that the GAINS model NH3 control cost estimates overestimate reality in an important way.

23. Another item that must be followed up is the choice of the fertiliser price. Should it be the current high price (due to international crises) or rather a price corresponding to prices observed in the longer term, as used in the energy scenarios. The price should be the same for all work done by TFRN and TFIAM.

24. TFIAM noted the presentation by **Markus Geupel**, CCE, who presented the CCE contribution to the WGE ex-post analysis. Since April 2025, CCE has updated the critical loads data used by the GAINS model, and these are implemented in the GAINS model since summer 2025.

25. CCE showed selected results of risk-assessment for biodiversity presented in its 2026 Status Report (CCE Status Reports | Umweltbundesamt). Risks for biodiversity have been assessed by calculating the average exceedance above critical loads (AAE) and calculating the area with exceedance (Area At Risk - AAR) under several scenarios. It was shown that the scenario involving biodiversity targets in the joint optimisation leads to larger compliance with the -50% target for biodiversity compared to the scenario only optimising for health effects.

26. TFIAM noted the presentation by the co-chair **Stefan Åström** on current developments of cost-benefit analysis (CBA) to support the revision of the Gothenburg Protocol. The purpose of the CBA is to complement cost-effectiveness analyses with explicit representation of effects on health benefits and environmental benefits in monetary terms so that decision-makers can compare control costs with health and environmental gains of emission reductions using a common metric (€).

27. The CBA method builds on the impact pathway approach and is directly coupled with the GAINS model scenarios, using data from sources such as the EU research programme VALESOR and UN population projections, as well as scenario data from CIAM and ICP Vegetation etc. The main results are expressed as benefit/cost ratios, where a benefit/cost ratio over 1 show that benefits of reducing emissions lower than assumed in a baseline scenario are larger than corresponding costs and therefore socio-economically effective.

28. The results, although preliminary, show consistently socio-economic benefits of reducing emissions. Further, benefits can be just as high if combining environmental and human health ambitions.

29. The results are preliminary and still incomplete — health effects from ozone, additional morbidity endpoints, material damages, carbon sequestration, and Baltic Sea impacts are still omitted from the analysis.

30. TFIAM noted the presentation by **Mike Holland** on benefits assessment following HRAPIE 2, EMAPEC and VALESOR. He presented new concentration-response functions (CRFs) recommended by WHO (HRAPIE 2 and EMAPEC). The overall interpretation is that all-cause mortality seems to be preferable. In addition, HRAPIE 2 presents that there is now high confidence in more health effects from PM2.5 than in HRAPIE. Some of these health effects are however at risk of being double counted with other health effects for which there exists solid knowledge. HRAPIE 2 and EMAPEC do not add much more information on O3 health effects. Another risk of double counting is the combination of short-term and long-term health effects, which is less of a problem for CBA since the total effect of long-term health effects dominates. Mike also gave information on the EU Horizon research project VALESOR (Valuation of environmental stressors) that developed an online tool for health impact quantification and monetisation, together with overall guidance.

IV. GOTHENBURG PROTOCOL REVISION- OUTPUT FROM PARTIES' REVIEW OF CURRENT GAINS POLICY SCENARIOS

31. TFIAM noted the presentation by **Nadine Allemand**, France, on the comparison of national French scenarios and the GAINS CAO5 baseline. If focusing on NOx emissions, the comparison shows that discrepancies in historical emissions are mainly due to different emissions from road transport. Also, historical NH3 emissions are slightly different, and the GAINS model scenarios to be used in CAO5 indicate larger NH3 emissions for future years than national projections. The comparison of total PM2.5 emissions shows relatively large similarities between national data and GAINS model data. In contrast to NH3, the GAINS model scenario indicates lower future PM2.5 emissions than national emission projections. Overall, a rather good consistency can be reported, with possibilities for improvement.

32. TFIAM noted the presentation by **Maaike Lammerts-Huitema**, the Netherlands, on comparison of national to GAINS scenarios. Starting the comparison with SO2, there is in general a good alignment between the Dutch projection and the GAINS model

scenario. For PM2.5 there are larger differences, mainly due to different non-exhaust and tire wear emissions. Also, the solvent sector has different PM2.5 emissions explaining the difference. For NH3, emissions deviate for future years, since the Netherlands assume a reduction in livestock, whilst the GAINS model scenario (developed by CAPRI) does not. A challenge for the Dutch comparison with the GAINS model scenario is that the national projection is expected to be finalised by spring 2027, whilst the GAINS model scenario is finalised by summer 2026.

33. TFIAM noted the presentation by **Johanna Appelhans**, Germany, on scenario analysis. She gave an overview about different scenarios, stressed some key drivers in emission developments, and showed differences compared to the GAINS CAO5 baseline for PM2.5 and NO2. Also, in Germany the timing for scenario updates differs from that in GAINS. New energy projections have just been developed, which will be the basis for updated emission projections. Germany is expected to meet its ERCs for NOx and PM2.5 although the compliance margin is small. GAINS projects lower NOx emissions, as is assumes greater decarbonisation potential in the industrial sector and lower mileage and energy consumption in the transport sector. Important drivers for NOx emissions are the uptake of electric vehicles and the timing of the phase-out of internal combustion engines. Updated emission factors published in 2025 will significantly revise estimates for both exhaust and non-exhaust transport emissions. A slower-than-planned coal phase-out could also lead to higher NOx emissions. For PM2.5, the main difference between GAINS and the national WM scenario is the treatment of condensables, which are not included in the German scenario, while the national projections also assume higher wood use in small combustion installations. However, emission estimates for small combustion plants will be revised and require further assessment. The most important PM2.5 sources are small combustion installations and industrial processes, while non-exhaust emissions dominate within the transport sector.

34. A second part of the presentations showed air quality modelling results and the likeliness of compliance with the new air quality limit values. Although attainment of annual mean NO_2 and PM2.5 values might be possible in 2035, there remains a risk of non-compliance in some spots.

35. In the discussions it was stressed that activity projections from PRIMES and CAPRI cannot be adapted by IIASA. To improve scenarios in the future, early exchange with the PRIMES and CAPRI teams would be needed. Big differences in EFs between COPERT and the Handbook on emission factors for road transport, for example for non-exhaust EFs, were also noted.

36. TFIAM noted the presentation by **Alexander Norowski**, Poland, on the impact of illustrative BAU and MFR national emission reduction scenarios on air quality and human exposure in Poland, as analysed in the pilot project ReduCost. The scenarios represent potential reduction measures identified by experts. The time horizon is 2040. The motivation of the work is the tightening of AAQD limit values and WHO guidelines and the question whether meeting them was technically, economically and socially feasible. Results show the potential of emission reductions by pollutants and the spatial resolution of remaining emissions. A significant reduction potential was identified for PM10, PM2.5, SO_x, NO_x and BaP in the BAU scenario, for PM2.5 and BaP especially in the regions where the residential coal combustion/heating is predominant for air pollution, and NO_2 reductions mainly in urban centres (transport).

PM2.5 concentrations are found to be in compliance with AAQD limit values under BAU and MTFR. The high reductions in the BAU scenario are explained by the importance of coal, also in residential heating. For NO_2, largest reductions are identified in Warsaw and Krakow. In MTFR emissions are reduced over the whole country.

37. Premature mortality for PM2.5 and NO_2 was quantified with the AirQ+ model (WHO), health effects (mortality and morbidity) for BaP with the Alpha-RikPoll tool. Health benefits were compared with abatement costs and showed that benefits outweigh costs. Overall, the project provides a roadmap for future air quality plans, but being a pilot study, more investigation on the feasibility of the assumed energy transition is required.

38. TFIAM noted a presentation by **Huw Woodward** (UK) on ammonia (NH_3) modelling for UK policy assessments. NH_3 is increasingly important due to limited past reductions, widespread exceedance of nitrogen critical loads, and emerging sources. Non-manure digestate – linked to biogas policy – is a growing source; it was excluded via an adjustment to meet the 2020 emission reduction commitment, but poses risks for future targets. Current inventory estimates already assume low-emission spreading, limiting further abatement potential.

39. The UK is concerned about the use of NH_3 as a shipping fuel, given surrounding shipping lanes. A scoping study assuming 1% leakage projects an additional 150 kt of emissions by 2050.

40. Agricultural land-use change is expected to significantly alter nitrogen-sensitive habitat areas, affecting projections of critical load exceedances. Further, the impacts of sustainable agriculture policies and land-use changes are not yet captured in activity data projections or technical measures and therefore not well captured in standard modelling and inventory projections.

41. NH_3 modelling remains challenging due to limited measurement data for deposition and evolving atmospheric chemistry; notably, the response of PM2.5 to NH_3 reductions is shifting as NO_x and SO_x emissions decline.

42. At the end of this session there was a general discussion about the fact that further difference between national and GAINS scenarios, that were not yet mentioned in the presentations, may come from some EU policies not yet being adopted on a national level and hence not yet being included in national baseline projections. This underlines the need for transparency about the legislative status of and policies included in scenarios, both by countries and by CIAM. Bilateral consultations are also useful in identifying such differences to understand reasons for differences in projections.

43. A possible explanation for differences between national and CIAM agricultural projections may also be that the CAPRI model insufficiently takes into account the higher manure transport costs in these countries due to application restrictions that are set in the Water Framework Directive.

V. FURTHER MODEL DEVELOPMENT

44. TFIAM noted the presentation by **Ebba Malmqvist** (AirClim/Lund University) on health co-benefits of climate action. For the city of Malmö, the scenario analysis illustrated the effects of non-exhaust transport in a potential future. Removing exhaust emissions from cars will imply that the main NO_x sources in Malmö would be waste incineration and shipping, both located at the port of Malmö. The reduced exhaust

emissions will lead to significant health improvements. In addition, emissions from refineries (wherever this activity takes place) would be reduced.

45. Another longitudinal cohort study for the city of Stockholm showed that children who are growing up in areas where air quality has improved much during the last decades, have better lung function than those who grew up in more polluted areas.

46. A study of persons living close to a coal power plant compared health statistics during the time the coal power plant was operating, and health statistics three years after the plant was closed. Similar results, but for children, have been seen because of coal power plant closures in the US city of Chicago. Yet more statistical longitudinal studies have been made for the London Low emission zones.

47. Looking at these studies together, it is important to remind policy makers and scientists that non-monetized benefits still are important, and that showcasing how improved air quality has real life effects is important.

48. TFIAM noted the presentation by **Canan Esin Koksal**, Türkiye, on modelling cases in Türkiye performed by the ministry in charge of the environment, urbanisation and climate change. Both CLRTAP protocols, and - being a non-party - the implementation of EU Directives are important issues. The Ministry has been doing AQ forecasts since 2021. Current work concerns the improvement of (spatial) emission inventories, and the development of emissions projections using their own model. Results are compared with those from GAINS. There are currently three scenarios: 3 national scenarios without measures (WOM), WM and WAM. The number of national scenarios is to be further extended. Population weighted exposure calculations (resolution is 2x2 km at national scale) and health impact analysis are also amongst the ongoing assessments. The objective is to maintain up-to-date data. In cooperation with the Ministry on health Türkiye specific relative risks (RRs) will be used next to the international estimates.

49. The Ministry is also in the process of updating their evaluation of the AAQD. For the Gothenburg Protocol process, Türkiye would like to continue following the process with the other non-parties. Türkiye will further use technical consultation support with IIASA/GAINS, they are planning to include the latest COPERT emission factors. In comparison of the inventory with GAINS they are aiming at a step wise improvement, evaluating policies step by step in the transition period. Within 6 months they hope to be available to give health impact results.

50. In the discussions the representative of CIAM indicated that getting access to the apparently good on the spatial distribution of heating and cooking appliances, and also the use of wood versus clean fuels, would be very useful for GAINS.

51. TFIAM noted the presentation by **Claudio Belis** from the JRC on scenario analysis of PM2.5 health impacts and costs in EU enlargement countries published in 2025.[1] It covered information on air quality in these regions, cost-benefit analysis for the Western Balkans and city sources of emissions. PM2.5 concentrations are much higher in the eastern part of Europe than overall in the EU. The tools used by JRC to assess AQ are FASST and SHERPA. One study shown was interested in the results for PM2.5 reductions of an assumed application of the Zero pollution Action plan target in the eastern region. Emissions scenarios from IIASA are used. No regions complied with the ZPAP targets under the existing projections. Optimisation of scenarios was carried

[1] https://doi.org/10.1016/j.jenvman.2025.126280

out by JRC relative to a mortality reduction target meeting the ZPAP. The VSL from OECD (and Ciarlantini et al., 2025) was used for mortality valuation but adapted to each of the Balkan economies. Abatement cost estimates relied on data extracted from GAINS. The results show increasing marginal abatement costs, but health benefits (mortality only) exceed these costs.

52. Claudio also informed the TFIAM about the Urban PM2.5 Atlas now covering also the enlargement country cities. 118 urban areas were added. The atlas is developed based on Sherpa using an emulator from EMEP, the emissions from CAMS V8.0 and meteo from IFS. Results available online per city in the Atlas. Results show that for smaller countries, transboundary emissions dominate (except for Bosnia), whereas for the larger countries the city contribution is higher. Key sectors dominating exposure are the residential sector and industry (including energy). More analysis is needed whether the limited importance of road transport compared to EU27 is due to inaccuracies in the emission inventory or a high influence of other sources that have been successfully tackled in EU27.

53. In the discussion, participants in the meeting expressed different views on whether the low contribution by the cities in the West Balkan came as a surprise or not, and which assumptions might drive this result.

54. TFIAM noted the presentation by Katarina Yaramenka (IVL, Sweden), on the EU project VALESOR, which developed a new online tool for valuation of environmental stressors. The tool consists of two modules: one for air pollutants (based on the methods earlier used in Alpha-RiskPoll) and one for chemical substances. The AIR module calculates health impacts and economic values for the selected health endpoints and CRFs and is developed as multi-pollutant multi-country tool that can apply country-specific or region-average valuation parameters. Users need to enter exposure data and then indicate what scenarios they wish to analyse, for which pollutants, years and health effects, and whether to assess the burden of disease or calculate health damage avoided due to policy measures (health impact analysis). Modifiable parameters in the AIR module are costs and CRFs. CHEM module is developed more as a framework for a single pollutant analysis – but with more possibilities to modify parameters. Specific solutions were implemented in the tool to avoid double-counting of health effects or costs. A case study report published on the project website is summarizes examples of how the tool can be used in practice.

55. TFIAM noted the presentation by **Adam Brighty** (ICL) on air pollution impacts of energy system decarbonisation using hydrogen in the UK context. The project presented used scenarios from IIASA, some including behavioural changes, the UK TIMES energy model, and the UKIAM AQ model. Soft linking of the two models through the CAPSAM model that collects data from Times and inputs them into UKIAM. Different pathways of reaching carbon neutrality were analysed, some using hydrogen, others not, some being less likely than others. Hydrogen heat, steel and cement production and use in transport were analysed. For all other sources emissions were kept constant. Emission factors were taken from the literature and improved EFs were used from a government report. For hydrogen production the study assesses PM2.5 and NO_x emissions, for hydrogen use only NOx emissions. 8 scenarios were created. Impacts on air pollutants were analysed up to 2050 in 10 year steps. Transport decarbonisation dominates for AP in the energy systems. Results are also shown in terms of concentration maps and in terms of population weighted mean concentrations (exposure). The study showed that improved EFs only improve exposure at the margin

for PM2.5. For NO_x improved EFs contribute a bit more. Conclusions are that hydrogen use might not compromise meeting PM2.5 targets but there are caveats to this. This result is also contingent to introducing ELVs for NO_x from hydrogen. More work is needed on analysing which sources are likely to be replaced by hydrogen.

56. The discussion showed interest by several participants in the hydrogen EFs for air pollutants. It was noted that these EFs do not include life cycle emissions. The EC is currently financing the improvement of the emission guidebook amongst which hydrogen EFs for road transport and shipping (but not aviation).

57. TFIAM noted the presentation by **Sophie Perroud-Akkerman** (HEAL) on clean air funding in the next MFF (Multi financial framework): ensuring financing for AAQD implementation. The presentation put emphasis on the need to act now because this year is crucial for all MS in terms of implementation of the AAQD and for funding for clean air. Investing in clean air is a proven net benefit into public health and the economy (GDP), but there is an investment gap into clean air that requires closing. The counting for the AQ road map also starts this year. Budgeting this year is important because Member States in the Council and the European Parliament are discussing the budget. Then there will be trilogues. There is no clean level of air pollution so there is a need to further reduce AP.

58. It is also important how things are named. The EEA in its environmental burden of disease (EBD) reports now takes away the counterfactual concentration level (corresponding to the WHO AQ guideline levels), which leads to an underestimate in the actual burden of disease. Below this counterfactual concentration the health functions are less robust, but there are still health effects.

59. The MFF is a 7-year budget for the EU. The current Commission proposes the next budget. In the current budget almost 10% are spent on AQ. The proposal for the next budget is well below 10%. HEAL asks for investment in better health while promoting equity, for obligatory health impact assessments, and for phasing out EU subsidies for fossil fuels. HEAL maintains that air pollution is too expensive and cannot be afforded. More dedicated targets are needed for zero pollution and AQ in the sub-budgets. Air pollution must not be forgotten over decarbonisation policies. Timely and full implementation of the AAQD is required.

VI. AOB & CLOSURE OF THE MEETING

60. The next EPCAC meeting is planned for autumn and might focus on inter-model comparison for source apportionment (importance of sectors and measures).

61. For a next TFIAM meeting it was suggested to put shipping on the agenda and also to invite country presentations on this. In this context outreach to IMO would be useful. An alternative might also be a dedicated workshop on further work needed on updating shipping in GAINS.

62. Another issue suggested for a further meeting were negative emission techniques.

V. KEY CONCLUSIONS FROM TFIAM 55 AND RECOMMENDATIONS TO WGSR 64

63. TFIAM concludes that the GAINS model is fit for purpose for assessing least cost target setting solutions with respect to health and biodiversity risks as input for the Gothenburg Protocol revision. Some developments are under way such as the updated ozone modelling. There is also progress in the representation of black carbon emissions.

64. The implementation on updated NH3 costs into GAINS has started. The complete assessment of new information on NH3 costs and collection of necessary associated data to implement it into GAINS would require additional resources. TFIAM encourages parties to make available information and financial support.

65. TFIAM acknowledges the importance of a consistent message from TFRN and TFIAM on NH3 costs and the consequences of changing costs for results of IAM.

66. TFIAM acknowledges that for target setting (cost-effective risk reduction, optimisation) the use of static population can be justified. The static approach is now implemented in the recent and ongoing CIAM modelling as requested by EB45.

67. TFIAM notes that the preliminary cost-benefit analysis shows that benefits exceed costs for all GAINS scenarios analysed, including scenarios for health only and for health and biodiversity targets. The CBA method will be further refined in the coming months, also adding currently excluded effect endpoints. TFIAM will reach out to the WGE experts for the work on additional endpoints.

68. TFIAM encourages all parties to analyse and present also transboundary health and environmental effects of domestic emission scenarios.

69. Several countries reported lower national NH3 emission projections compared to GAINS. While technical abatement measures are comparable, differences result from lower activity levels in national projections. Several other countries noted differences in activity projections in the transport sector, and how emissions are calculated (COPERT vs HBEFA), between the national and GAINS scenarios. Solid fuel burning in the domestic sector is another point of difference.

70. TFIAM invites the European Commission to facilitate contact between the national parties and the PRIMES and CAPRI modelling teams.

71. TFIAM appreciates the presentations on alternative fuels (NH_3, hydrogen) and recommends more studies on emission factors and system wide effects and what measures can be taken to avoid problems.

72. TFIAM encourages the development of an updated LOW scenario.

Appendix 1: 2026-2027 Workplan items

Decided at the 45th Executive Body of the Air Convention

SCIENCE

Workplan item	*Activity/Deliverable*	*Lead body(ies)*	*Resource requirements and/or funding source*
1.1 Improving tools to assess air pollution and its effects in the United Nations Economic Commission for Europe region			
Monitoring and modelling tools			
1.1.7	Finalization of GAINS update for simulating O_3 response to precursors' emission reductions	CIAM, MSC-W, TFHTAP	EMEP budget
1.1.9	EMEP Report chapter on exploration of techniques for model fusion/mapping/AI to provide "best" fine scale air pollution maps for Europe, including techniques for bias corrections and bias-corrected projections	MSC-W, TFIAM, TFMM, CCC	EMEP budget
1.1.13	Synthesis of O_3 mitigation options	TFHTAP, TFMM, MSC-W, CIAM	EMEP budget
1.1.43	Promotion of methods for health risk/impact assessment of air pollution and cost-benefit analysis (update to HRAPIE 2 and EMAPEC projects). Exploratory analysis of recent developments on BC and health*	TF-Health, TFIAM/CIAM, TFMM	Recommended contributions, additional resources required
1.1.46	Cost-benefit analysis of the scenarios supporting the Gothenburg Protocol revision*	TFIAM, CIAM, TF Health, WGE centres	Task forces are not funded by EMEP budget.
Emission and projection tools			
1.1.50	Improvement of spatial distribution of emissions, ensuring consistency across pollutants. Exploration of new data sources	CEIP, CIAM	EMEP budget
1.1.54	Development and assessment of risk reduction options and further modelling scenarios for the Gothenburg Protocol revision	TFIAM, CIAM, TFMM, MSC-W, CCC, TFHTAP, CCE, CDM,	EMEP budget, recommended contributions
1.1.55	O_3 modelling of future scenarios in support of the Gothenburg Protocol revision	TFHTAP, TFIAM, CIAM, TFMM, MSC-W, ICP	EMEP budget, recommended contributions
1.1.56	Stimulation of national integrated assessment capacity and exchange experiences	TFIAM	Parties' in-kind contributions
1.1.57	Stimulation of national integrated assessment capacity in EECCA, Türkiye and West Balkans countries	MSC-W, CIAM, CEIP, TFIAM, TFTEI	EMEP budget
Linking the scales			
1.1.59	New global and regional model simulations of historical trends and future scenarios for Gothenburg Protocol pollutants with assessment of human health and vegetation impacts	TFHTAP, TFMM, MSC-W, CIAM, ICP Vegetation	Parties' in-kind contributions
1.1.64	Strengthen network of experts and policymakers on multilevel governance of air quality; and continue the work on model comparisons. Report on progress and recommendations to TFIAM	TFIAM/ EPCAC, CIAM, TFMM, TFH, TFHTAP	Parties' in-kind contributions
1.1.65	Further exploration of the cause of differences in source attribution and effectiveness of emission reductions between models such as EMEP/GAINS, JRC/SHERPA, CHIMERE and local/national IAM modelling experiences	TFIAM/ EPCAC, CIAM	Parties' in-kind contributions

POLICY

Workplan item	*Activity/Deliverable*	*Lead body(ies)*	*Resource requirements and/or funding source*
2.1 Analysis of policy-relevant information and revision of the Gothenburg Protocol, as amended in 2012, and subsidiary bodies under WGSR			
2.1.1	Development of scenarios including cost benefit analysis for selected scenarios and recommendations on new emission reduction commitments for pollutants currently covered by Gothenburg Protocol, presented in updates of policy brief on scenario modelling	WGSR, TFIAM, CIAM, TFEIP, CEIP, WGE	Subject to availability of resources
2.1.6	Recommendations regarding the inclusion of methane in the revised Protocol	WGSR, TFIAM, TFEIP, TFTEI, TFRN TFHTAP	
2.1.7	Recommendations on new flexibi-lities and approaches for non-Parties to Protocol	WSGR, TFTEI, TFEIP, TFIAM, TFRN	
2.1.8	Recommendations on risk-based goal(s) related to health and ecosystem impacts for ECE region	WGSR, TFIAM/CIAM, WGE	
2.1.9	Recommendations regarding integrated approaches among climate, energy and air policies	WGSR TFIAM/CIAM TFHTAP, TFTEI, TFRN,	
2.2 Development and promotion of guidance documents			
2.2.1	Development and promotion of guidance documents, including information on opportunities for non-technical and integrated N and bioeconomy measures	TFRN, TFIAM, TFTEI	
2.2.7	Analysis of risks of use of ammonia as a fuel in different sectors	TFRN, TFTEI, TFIAM	Subject to availability of resources