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**ECONOMIC COMMISSION FOR EUROPE**

**EXECUTIVE BODY FOR THE CONVENTION ON LONG-RANGE  
TRANSBOUNDARY AIR POLLUTION**

Working Group on Strategies and Review

Fortieth session  
Geneva, 17–20 September 2007  
Item 3 of the provisional agenda

**REVIEW OF THE 1999 GOTHENBURG PROTOCOL**

**TECHNO-ECONOMIC ISSUES**

Report by the Co-Chairs of the Expert Group on Techno-economic Issues

1. This report presents the results of the eleventh meeting of the Expert Group on Techno-economic Issues, held on 2 April 2007 in Rome, and of the Workshop on Emerging Technologies for Air Pollution Abatement, held by the Expert Group on 3 April, in accordance with item 1.6 of the 2007 workplan (ECE/EB.AIR/2006/11) adopted by the Executive Body at its twenty-fourth session (ECE/EB.AIR/89).
2. The Task Force discussed progress achieved and the work ahead for the implementation of the workplan, focusing on the review and possible revision of the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (1999 Gothenburg Protocol), the revision of the methodology on large combustion plants (LCPs) and the provision of technical assistance

to Eastern Europe, the Caucasus and Central Asia (EECCA)<sup>1</sup> on air pollution abatement technologies. Presentations from the meeting and the workshop are available at [http://www.citepa.org/forums/egtei/egtei\\_meetings.htm#Steeringgroup10](http://www.citepa.org/forums/egtei/egtei_meetings.htm#Steeringgroup10).

3. Experts from the following Parties to the Convention attended the meeting of the Expert Group: Austria, Belgium, the Czech Republic, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom of Great Britain and Northern Ireland. Representatives from Canada and Ireland attended the meeting as observers. The Renewable Energy Unit of the Institute for Environment and Sustainability of the European Commission Joint Research Centre (JRC) was represented as well. Also present were industry experts from the Italian electricity association (ASSOELETTRICA), the European Cement Association (CEMBUREAU), the Standing Committee of the European Glass Industries (CPIV), the oil companies' European association for environment, health and safety in refining (CONCAWE), Electricity of France (EDF), the European Association of Internal Combustion Engine Manufacturers (EUROMOT), the Italian Petrol Union, and a representative of the Saint-Gobain Glass Company. The French Agency of Environment and Energy Management (ADEME), the Energy Research Centre of the Netherlands (ECN), the French-German Institute for Environmental Research (IFARE), the National Labour Bank of Italy (Banca Nazionale del Lavoro, BNL), the Interprofessional Technical Centre for Studies on Atmospheric Pollution (CITEPA), the Environment and Territory Unit of Italian research Institute (ISMES of CESI), the European Federation of Clean Air and Environment Protection Associations (EFCA), University College London (UCL), and the University of Messina (Department of Industrial Chemistry and Engineering of Materials) were represented. A member of the secretariat also attended.

4. Mr. J.-G. Bartaire (France) and Mr. T. Pignatelli (Italy) co-chaired the meeting, which was hosted by Italy.

## I. INTRODUCTORY REMARKS AND OBJECTIVES

5. A representative of the secretariat reviewed the conclusions from the tenth meeting of the Expert Group (Marseille, 23 November 2006) as well as the activities in the 2007 workplan adopted by the Executive Body. In addition, the Task Force was informed about the main outcomes of the "Saltsjöbaden III" workshop on air pollution and its relationship to climate change and sustainable development, which was held in Gothenburg from 12 to 14 March 2007

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<sup>1</sup> Countries of the EECCA sub-region include Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, the Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.

(ECE/EB.AIR/WG.5/2007/9)<sup>2</sup>. The workshop had further validated the need to pursue work on emerging technologies for air pollution abatement, exploring synergies with climate change.

6. Mr. R. Ballaman, the Chair of the Working Group on Strategies and Review, presented ongoing work for the review and possible revision of the Gothenburg Protocol, focusing on the review of obligations on the application of mandatory emission limit values to new and existing stationary sources, as well as for fuels and mobile sources. At the twenty-fifth session of the Executive Body, Parties would be invited to evaluate the emission limit values for new and existing boilers and process heaters with a rated thermal input exceeding 50MW<sub>th</sub> as well as for new heavy-duty vehicles, with a view to amending annexes IV, V and VIII to the Protocol. Mr. Ballaman welcomed the Expert Group's contribution to the first draft review report of the Protocol (ECE/EB.AIR/WG.5/2007/1) submitted to the Working Group at its thirty-ninth session, and invited the Expert Group to provide further modifications to the document for the fortieth session of the Working Group. Furthermore, he stressed the important role of the Expert Group in collecting information for the integrated assessment modelling that was needed for informed decision-making within the possible revision of the Protocol and its technical annexes. He encouraged the Expert Group to initiate work to this end, including through revising the guidance document on sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs).

7. The Co-Chairs of the Expert Group specified that, in addition to the official documentation, an informal document on the Expert Group's work for the review of the technical annexes of the Gothenburg Protocol would be finalized for consideration by the Working Group at its fortieth session.

8. The Co-Chairs provided an update on the revision of the European Union National Emission Ceilings (NEC) Directive, which the European Commission was carrying out with the assistance of the NEC-Policy Instrument Working Group (NEC-PI)<sup>3</sup>. The revision proposal would set emission ceilings to be respected by 2020 for the four already regulated substances (SO<sub>2</sub>, NO<sub>x</sub>, VOCs and ammonia) as well as for the primary emissions of particulate matter (PM<sub>2.5</sub>). It would take account of the decision of the European Parliament to cut the greenhouse gases by 20 per cent by 2020, or even more if non-European Union (EU) countries participated.

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<sup>2</sup> Conclusions and presentations from the Workshop are available at: <http://asta.ivl.se/>.

<sup>3</sup> Further information is available at: <http://ec.europa.eu/environment/air/ceilings.htm>

## **II. PROGRESS OF THE EXPERT GROUP**

### **A. Synopsis sheets for large combustion plants**

9. Mr. P. Kerdoncuff (IFARE) and Ms. N. Allemand reported on progress made in finalizing the “synopsis sheet” on LCPs, consisting of a background document and Excel spreadsheets on a common methodology proposed by the Expert Group. The Expert Group reviewed in particular the Czech and Swedish experiences in testing the applicability of the Expert Group’s methodology to their national conditions.

10. The test results presented by Ms. A. Krizova (Czech Republic) and Mr. M. Lindgren (Sweden) demonstrated the complexity of the sector due to differences between the countries and to the resulting difficulties in applying methodological guidance of general applicability. In Sweden, for example, the methodology had not been fully applicable due to the comparatively smaller size of the national combustion plants and to the difference in the mix of fuel used. For improving the methodology further, the Expert Group considered issues such as retrofitting costs for new plants, reduction efficiencies, fuel mix, and flexibility and verification of the distribution of PM.

11. The Expert Group considered that the feedback from the two countries was useful for the further development of the methodology. It recommended that the background document and the Excel spreadsheets be improved further to make them user-friendly, manageable for the national experts, and applicable to all Parties to the Convention. To this end, the team and the national experts would continue to cooperate closely, including through convening a technical meeting. The Czech Republic and Sweden agreed to retest the methodology, once improved. Denmark and Finland were among countries that also expressed their interest in testing it.

### **B. Results of work on small combustion plants**

12. Italian and German experts informed participants of the outcomes of four studies in the field of small combustion plants. English summaries of these studies would be posted on the Expert Group’s website once available.

13. Mr. Pignatelli presented preliminary results of the survey on small combustion installations in the commercial sector, which the Italian National Agency for New Technologies, Energy and the Environment (ENEA) and the National Labour Bank of Italy had carried out jointly in 2006, to collect and make available techno-economic data for the Expert Group.

14. Mr. F. Del Manso (Italian Petrol Union) informed the Expert Group about the outcome of a study carried out from 2003 to 2006 to evaluate the contribution of emissions from civil heating sector to the current level of air pollution in the urban areas in Italy. The study showed that in recent years, owing to the technological developments in heating systems as well as to the improved quality of fuels, the sector's emissions had been consistently reduced – with the exception of some local hot spot areas. The study had also concluded that the use of new emission factors was needed to properly assess the present emissions from civil sector and to quantify its real contribution to the global air pollution.

15. Mr. G. Carboni (ISMES of CESI) informed the Expert Group about a study focusing on emission factors and pollutant profiles of small boilers in Italy. The study evaluated, among other things, the potential for further introduction of medium-sized plants using combined heat and power (CHP) cogeneration techniques to improve the energy efficiency and environmental performance of district heating and refrigeration in urban areas. The study had provided complete emission measurement results for both individual boilers and collective domestic boilers.

16. Ms. K. Kraus (Germany) presented the results of a study carried out by the University of Stuttgart to determine the average emission factors for small combustion units in households and the consumer sector. The study served to improve the availability of data for various reporting requirements.

17. The Expert Group considered that more attention should be paid to the impacts, notably to the PM emissions due to the growing use of biofuels and wood burning in small combustion plants. The representative from Finland reported on the difficulties in controlling domestic wood-burning with end-of-pipe solutions. Domestic burning of biomass had also increased in a number of other countries in the UNECE region. The Expert Group recommended focusing on appropriate abatement techniques to counter these effects as well as better evaluating the costs involved.

### **C. Revision of the background document on glass**

18. Mr. G. Tackles from the Standing Committee of the European Glass Industries stressed the need to revise the background document on glass, prepared by the Expert Group in 2003, on the basis of 2007 data. He also recommended that the methodology developed by the Expert Group be used at the EU level for the ongoing revision of the Reference Document on the Best Available Techniques in the glass manufacturing industry. Mr. Tackles also noted the need to collect more data to carry out detailed calculations by type of glass, furnace and fuel. He recommended that an independent expert body, such as the Netherlands Organisation for

Applied Scientific Research (TNO), should do the data collection, to avoid involvement with the competitive practices within the industry. The glass industry would be willing to cooperate and assist in the collection of the data.

#### **D. Capacity-building in Kazakhstan**

19. Mr. A. Jagusiewicz (Consultant, EFCA) informed the Expert Group of the capacity-building activities carried out under the Convention to assist the countries with economies in transition of the UNECE region to implement their obligations under the Convention and its protocols. A three-year United Nations Development Account-funded project, Capacity-Building for Air Quality Management and the Application of Clean Coal Combustion Technologies in Central Asia (CAPACT), had led to the development of a national implementation plan for Kazakhstan and had provided training workshops for Central Asian experts. The workshops had been extended to other EECCA countries with donor support.

20. The Expert Group would take part in and contribute to the final CAPACT workshop, held in Almaty from 4 to 6 July 2007. On the basis of the outcome of the Workshop and following its assessment of the specific needs for information and assistance in EECCA, the Expert Group would organize a workshop of its own in Almaty in October 2007, focusing on abatement technologies, notably in the fields of energy production, refineries and cement production.

### **III. WORK ON EMERGING TECHNOLOGIES**

21. The Expert Group held a Workshop on Emerging Technologies for Air Pollution Abatement in Rome on 3 April 2007.

22. Mr. P. Daskalopoulos (Euromot) provided an update on the work carried out with the support of Euromot to review the emission limit values for stationary engines in the context of the review and possible revision of the technical annexes of the Gothenburg Protocol.

23. Mr. A. Mattucci (ENEA) presented a project (HyWays) for the large-scale introduction use of hydrogen energy in transport and power sectors through the development of a harmonized European Roadmap and an Action Plan. The use of hydrogen could represent a viable solution for tackling problems related both to climate change and to the security of energy supply. The Expert Group was informed that hydrogen could be obtained from a variety of different primary sources (e.g. fossil, renewable, nuclear) and was emission-free in its final use. Furthermore, pollutant emissions could be substantially reduced during the hydrogen production processes, for example through carbon capture and sequestration when produced from fossil fuels. The project

built on inputs from industry, research and development institutes and EU Member State experts, and combined known technology databases and socio-economic analysis.

24. Mr. E. Vésine (ADEME) presented future work and challenges for two emerging technologies expert panels on LCPs (> 500 MWth) chaired by ADEME. The expert panels would provide technical and economical information for modelling work on emerging technologies and on evolution of abatement technologies. They would focus on environmental performance of technologies over time, their energy efficiency and CO<sub>2</sub> impact, costs for new or existing plants and rate of penetration for new and existing plants. The panels would consider different timescales: the LPC 2020 expert panel would focus on the period extending from the present day until 2020 and the Power Generation (PG) 2050 expert panel on the period between 2020 and 2050. Kick-off meetings for both panels were scheduled to take place in June 2007 in Paris, and would involve preparation of a working document.

25. Mr. M. Barret (UCL) presented future needs and developments for buildings, focusing on the energy efficiency, solar energy and heat pumps in the residential and services sectors. He illustrated how lowering of the energy demand and switching to renewables would improve energy security and reduce the emissions of CO<sub>2</sub> and other greenhouse gases as well as air pollutants. High-quality refurbishment and construction were essential for bringing down the energy demand, involving highly insulated envelopes (e.g. walls, roofs, floors), high-performance windows and mechanical ventilation with heat recovery, as well as solar energy, to reduce heating and lighting. As regards heating, a shift from fossil fuel heating to solar and electric heat pumps was seen as a likely and viable future development. The energy technologies that would need to be further developed in the future included super insulation, solar photovoltaic (PV) technology integrated with buildings and electricity storage.

26. Mr. G. Centi (the University of Messina) presented research on converting CO<sub>2</sub> to fuel using solar energy. According to the results, the process would be feasible, but long-term research would still be needed to develop its commercial application.

27. Mr. R. Liberatore (ENEA) presented the outcome of the Solar Thermodynamic Project on production of hydrogen by solar energy. Thermochemical cycles fed by solar energy were identified as an important alternative for energy storage and for a clean production of hydrogen. Appropriate plants could be commercially available from 2030.

28. Mr. R. Maas (the Netherlands), Chair of the Task Force on Integrated Assessment Modelling, recommended that the following issues, which were important for future work under the Convention, be further clarified:

- (a) Effects from a switch to biofuels (biodiesel) in terms of emissions of NO<sub>x</sub>, SO<sub>2</sub> and PM (including its life-cycle effects), and the costs and effects of additional abatement measures required;
- (b) Effects from a switch to biomass burning in <50 MW combustion installations in terms of emissions of NO<sub>x</sub>, SO<sub>2</sub> and PM, and the costs and effects of additional abatement measures;
- (c) Co-benefits of carbon capture and sequestration for air pollution (decreases in emissions of SO<sub>2</sub>, NO<sub>x</sub> and PM);
- (d) Local air pollution consequences of electricity and heat generation for households by small CHPs and the costs of additional measures to avoid negative effects (emissions of air pollutants);
- (e) Potential emission effects of an “all electric strategy” (including hybrid cars) as compared to the potential emission effects of a “hydrogen economy strategy” (including fuel cells) in Europe.

29. Mr. Maas suggested calling on and bringing together national experts and researchers working on these topics to obtain information (to be provided as much as possible in a GAINS model format). Furthermore, he invited the Expert Group to interact with the Centre for Integrated Assessment Modelling (CIAM) to translate the answers into GAINS model scenarios, including future activity levels and life-cycle effects, emission factors, and abatement efficiencies and costs.

#### IV. CONCLUSIONS

30. The Expert Group agreed to:

- (a) Revise the Expert Group’s methodology on LCPs in the light of the final information provided by Sweden and the Czech Republic; revise the background document to better explain the methodology and to extend its applicability to all Parties to the Convention; make the Excel spreadsheets user-friendly; and, to this end, organize a technical meeting with the relevant experts. The Expert Group welcomed the interest by Denmark and Finland, and possibly by other countries as well to retest the methodology;
- (b) Make available summaries in English of the outcomes of the German and Italian studies on small combustion plants; explore how the outcomes can be used for modelling purposes within CIAM and how the methodologies could be applied by other Parties; collect the

cost-related data currently missing; make the information available to the Task Force on Emission Inventories and Projections as well as to CIAM; and carry out similar surveys in other countries, on voluntary basis, in order to verify the applicability of the results to other countries (preliminary contacts with Belarus are in progress);

(c) Revise and make available the informal document on the review of the annexes IV, V, VIII to the Gothenburg Protocol for the fortieth meeting of Working Group on Strategies and Review (17–20 September 2007), and inform the Working Group at its thirty-ninth session about the corrections to be made to document ECE/EB.AIR/WG.5/2007/1;

(d) Initiate work on the possible revision of the annexes to the Gothenburg Protocol, including through revising the guidance document (on SO<sub>2</sub>, NO<sub>x</sub> and VOCs);

(e) Finalize the background document on refineries, making use of the data collected by Belgium, and organize a meeting between all stakeholders (e.g. Concawe, Belgium, Expert Group team) in Brussels;

(f) Initiate work on emerging technologies focusing on the energy sector and large combustion plants. The Expert Group welcomed the organization of a kick-off meeting (to be held on 7 June 2007 in Paris) hosted and chaired by ADEME;

(g) Cooperate with the Task Force on Emission Inventories and Projections for the updating of the EMEP/CORINAIR Atmospheric Emission Inventory Guidebook;

(h) Cooperate with the European Integrated Pollution Prevention and Control Bureau for the revision of BREF documents for steel, glass and possibly the cement industry, mainly on cost issues;

(i) Take part in and contribute to the final workshop to be held from 4 to 6 July 2007 in Almaty under the CAPACT project, and use the opportunity of the workshop for informal discussions and a needs assessment with a view to organizing an Expert Group workshop in Almaty in October 2007, in collaboration with the secretariat, with a specific focus on information exchange on abatement technologies (in the fields of energy production, refineries and cement production);

(j) Contribute to the work of the small ad hoc expert panel on stationary engines led by Finland;

(k) Invite the Working Group on Strategies and Review to consider the further work identified by the Expert Group on biofuels, biomass use, carbon capture and sequestration, and hydrogen, including life cycle analysis, and further specify the work elements;

(l) Hold its next meeting on 1 and 2 October 2007 in France (venue to be specified).

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