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TECHNO-ECONOMIC ISSUES RELATED TO AIR POLLUTION ABATEMENT

**Prepared by the Chairman and members of the
Expert Group on Techno-economic Issues in consultation with the secretariat**

Introduction

1. This report presents progress made in the work of the newly formed Expert Group on Techno-economic Issues. At its thirty-third session, the Working Group on Strategies and Review endorsed the proposal by the delegation of France to establish an expert group on techno-economic issues, and the Executive Body, at its nineteenth session, agreed to establish this Expert Group (ECE/EB.AIR/75, para. 28 and annex VI). The report summarizes the main conclusions of the first meeting of the Expert Group, organized by the Centre for Professional Studies on Air Pollution (CITEPA) of France in Paris on 30 April 2002, as well as the recommendations from a meeting on waste incineration, organized by CITEPA and the French-German Institute for Environmental Research (IFARE) in Paris on 14 June 2002 at the French Agency for Energy Management and Environment (ADEME).

Documents prepared under the auspices or at the request of the Executive Body for the Convention on Long-range Transboundary Air Pollution for GENERAL circulation should be considered provisional unless APPROVED by the Executive Body.

2. Experts from Belgium, Croatia, France, Germany, Italy, Norway, Poland, Spain, Sweden, Switzerland and the United Kingdom participated in the first and/or second meetings. The following were also represented: EUROMETAUX, the European Chemical Industry Council (CEFIC), the European Integrated Pollution Prevention and Control Bureau (EIPPCB), the National Institute for the Environment and Industrial Risk (INERIS), the National Institute of Public Health and the Environment (RIVM) of the Netherlands, the Netherlands Organization for Applied Scientific Research (TNO), the Oil Companies' European Organisation for Environment, Health and Safety (CONCAWE), the Permanent Committee of Glass Industries (CPIV), the Union of Chemical Industries (UIC) of France, the Union of Electricity Industry (EURELECTRIC), the University of Stuttgart (Germany). The Centre for Integrated Assessment Modelling (CIAM) was also represented.

3. Mr. Gerard CHAUMAIN (France) chaired the first meeting and Mr. Otto RENTZ (Germany) chaired the meeting on waste incineration.

I. FIRST MEETING OF THE EXPERT GROUP

A. Background to the work of the Expert Group

4. Ms. B. OUDART (CITEPA) stressed the importance of techno-economic data and their validation as essential inputs for integrated assessment modelling. She gave an historical overview leading to the creation of the Expert Group, beginning with the workshop on techno-economic databases on production processes and related emissions abatement options (October 1999, Angers, France). The aim of the Angers workshop had been to review the current status of methodologies and databases required for the techno-economic characterization of production processes and emission abatement options, and to identify longer-term needs. These needs concerned the elaboration of cost functions for integrated assessment modelling and the determination of best available techniques (BAT), as well as links with emissions inventories, emission forecasting and the exchange of information on technology (EB.AIR/WG.5/2000/5).

5. At the Angers workshop, France had offered to take the lead role in a future initiative, with support from Germany; the support of other Parties had also been welcomed. They proposed an expert group which would be a gathering of national experts, European organizations and industry, working closely also with EIPPCB, stakeholder countries and other programmes (Clean Air for Europe, (CAFE) etc.), providing CIAM with validated techno-economic data for cost curve generation. The outputs would be used in the RAINS model, and thereafter for the review and possible revision of technical annexes to existing protocols.

6. Following the Angers workshop, on 21 May 2002, France had hosted a meeting in Paris where representatives of CIAM, the Working Group on Strategies and Review, EIPPCB, the

UNECE secretariat, the Task Force on Assessment of NO_x and VOC Abatement Options, and French and German experts discussed the need for further work on techno-economic databases. The discussions led to the French proposal at the nineteenth session of the Executive Body, where, as noted above, it was decided to establish the Expert Group, with France as the lead country (EB.AIR/WG.5/2001/8).

B. Tasks to be undertaken by the Expert Group

7. The aim of the first meeting was to discuss the objectives of the Expert Group, together with its tasks and methods of work, and to set a timetable for the completion of its activities. The Expert Group noted that the review and extension of protocols was a priority for the work of the Convention and that it would give technical support to this process. According to the work-plan for the implementation of the Convention (ECE/EB.AIR/75, annex VI, item 1.6), the objectives of the Expert Group were to:

- (a) Further explore best available techniques (BAT) for emission abatement, their efficiency and costs;
- (b) Develop techno-economic databases and methodologies for evaluating uncertainties; and
- (c) Draw up draft revisions of techno-economic issues in annexes to protocols, including those on persistent organic pollutants (POPs) and heavy metals.

8. In keeping with the work-plan, the Expert Group saw its main tasks as:

- (a) Developing software describing emission control options, their costs and their ranges of uncertainties;
- (b) Validating the data and using the software in selected countries;
- (c) Disseminating the software to Parties for application;
- (d) Updating technical annexes of protocols to reflect these emission control options and their costs, as part of the protocol review process, beginning in 2004.

9. As an important first step in this work, national and industrial experts were invited to provide CITEPA and IFARE with the most recent information on emission reduction technique costs (reports, databases, etc.) in order to create an inventory of existing information.

10. CITEPA and IFARE agreed to design a user-friendly software programme providing

average European costs (default values) for emission reduction techniques for each type of emission source to be considered. A workshop would be organized to assist Parties in the use of the software; Parties would be invited to complete the database and data would be validated and aggregated according to the RAINS format for the generation of costs curves.

11. Mr. Rob MAAS, Chairman of the Task Force on Integrated Assessment Modeling, pointed out that CIAM, and the RAINS model, had no requirement for a specific type of cost curve, but that it was necessary to identify the sector involved and the measures used. He stressed the importance of keeping the database flexible enough to allow for the inclusion of new technologies for pollution abatement and energy-saving measures in the coming years, as well as to allow for the reduction in costs over time for any given technology (e.g. three-way catalytic converters have become less costly in recent years).

12. The costing method used in RAINS, which covers all of Europe, was presented. Cost components were made up of: investment, fixed operation and maintenance (O+M) and variable O+M costs. Costs parameters were either common for all countries (e.g. capital investment) or country-specific (e.g. labour, electricity). Cost curves could be generated for the following pollutants: SO₂, NO_x, VOC, NH₃ and particulate matter (PM) (fine, coarse and elemental carbon).

13. The existing model covered 100 emission sectors and 1000 sector/technology combinations. Emission abatement cost curves included a ranking of available options according to marginal abatement costs, beginning with "current legislation" emissions and costs. After implementation of the current legislation in Europe, emissions of certain sectors would proportionally increase. The following sectors were considered as a priority for CIAM because of the weakness of existing data: wood combustion (PM), industrial processes (stack emissions, fugitive emissions, PM control techniques), construction and agriculture, and off-road mobile sources.

14. Cost data would be needed by the beginning of 2003 in order to run calculations through the RAINS model by the end of 2003, in accordance with the timeframe of the CAFE programme. At present, the model does not allow for retrofitting in installations where it has already taken place. Due to the need for further reduction of some pollutants however, the request for new retrofitting could be taken into account (e.g. for the reduction of particulate matter, for which most combustion installations are already equipped, existing regulations require further progress; for existing heavy-duty vehicles, de-NO_x and particulate traps can be used).

C. Work of the Expert Group in the context of the Working Group on Strategies and Review

15. Mr. Richard BALLAMAN, Chairman of the Working Group on Strategies and Review, explained the importance of the work of the Expert Group in the context of the Working Group. He said the ratification and entry into force of the Gothenburg Protocol was expected for 2003, and the review process was foreseen for 2004, with 2015 or 2020 as the next target year. For the Gothenburg Protocol, he noted that, while emission ceilings were identified for each Party, it was not specified how to reach them. He stressed the importance of avoiding duplication of the work of the CAFE programme and urged the participation of the European Commission in upcoming meetings of the Expert Group. For the Aarhus Protocols on POPs and Heavy Metals, which had not yet entered into force, the reviews were expected to take place in 2005.

D. Multi-pollutant, multi-effect modelling of European air pollution control strategies

16. Mr. Stefan REIS (University of Stuttgart) presented a multi-pollutant, multi-effect model for European air pollution control strategies (the "MERLIN" Project). The model looked at the macroeconomic effects of the costs of abatement measures and how these costs were transferred to the population. The aim of the model was to provide this information to the Convention and the CAFE programme, as well as to other organizations. The project was nearly completed, with results expected by the end of 2003.

17. The model differed from RAINS by taking into account a larger number of pollutants (CO and greenhouse gases CO₂, N₂O and CH₄) and considering also global warming, secondary aerosols and urban air quality.

E. Method of work of Expert Group

18. The Expert Group discussed its method of work for the next three years (2002-2004). The main task of the nominated national experts would be to: provide CITEPA with available techno-economic data and materials on techno-economic issues; participate in meetings to discuss the work of CITEPA and the costs assessment; collect national data (default data to be made available); and provide a country-specific validated database with the assistance of CITEPA on the use of software. The development of the database and inventory of existing materials would be carried out on a voluntary basis (by CITEPA/IFARE, supported by France as lead country).

19. In the programme developed by IFARE, cost data would be elaborated at a high level of detail. Examples given by CITEPA provided costs for different reference installations. These data

must be aggregated in order to be included in the RAINS model. The aggregation concerned the emissions sources (according to SNAP) as well as costs defined for different reference installations. Sources considered by the Expert Group would be more disaggregated than sources considered in RAINS. Aggregation of some types of sources would be necessary. The process of aggregation would be an important part of the work of the Expert Group.

20. The costs of emission reduction techniques would be estimated according to the guidelines of the European Environment Agency and the guidelines of EIPPCB. Transparency and homogeneity in the cost assessment were key issues to be addressed by the Expert Group.

F. Results of database inventory and software development

21. Mr. Julien VINCENT (CITEPA) and Mr. Patrice GUYOMAR (IFARE) presented the preliminary results of the inventory of existing techno-economic databases, as well as the framework for the database of default values for the various abatement options. IFARE would be responsible for the database on NO_x, SO₂ and particulate matter / heavy metals emissions from stationary sources; CITEPA would be responsible for the database concerning VOC emissions from stationary sources and of all pollutants from mobile sources. Participants were invited to submit to CITEPA any new techno-economic information regarding reference installations in their countries.

G. Further work and timetable

22. Proposals were made on how to work most efficiently in the coming years. The Expert Group discussed the possibility of holding discussions according to pollutants and/or emission sources, by sector (SO₂, NO_x, VOC from stationary sources; heavy metals/PM from stationary sources; NH₃; mobile sources). It was decided to approach the work by sector, discussing all relevant pollutants for a given sector. The Expert Group would report on the work of its sectoral meetings. (The sectoral breakdowns and proposed meeting dates are annexed).

23. The Group decided to hold the first of its sector-specific meetings on 14 June 2002, in Paris, and would schedule forthcoming meetings for the remainder of 2002. The inventory of available databases and other information on costs, as well as the software development, was expected to be completed by the end of 2002. Dissemination and application of the software, data validation, uncertainty evaluation, provision of support to Parties and reference studies were expected to be completed by the end of 2003. Draft revisions of technical annexes were expected to be completed by the end of 2004.

24. It was noted that only one third of the forty-eight Parties to the Convention had nominated a national expert. Parties that had not nominated experts would be contacted again by CITEPA.

II. SECOND MEETING OF THE EXPERT GROUP: WASTE INCINERATION

25. The second meeting of the Expert Group was held on 14 June 2002, hosted by ADEME, in Paris. The meeting was devoted to a discussion of costs of abatement techniques in waste incineration. Mr. O. RENTZ (Germany) clarified that the objectives of the meeting were to:

- (a) Begin working on a first (exemplary) sector, in order to become operational as a group;
- (b) Agree on a method to pragmatically represent the waste incineration sector for data collection to be used as input into the RAINS model for the generation of cost curves;
- (c) Define concrete next steps for the Expert Group.

26. It was recalled that, at the first meeting, the Expert Group had reiterated that the RAINS model would be an important tool to assist in the negotiations for revision of protocols, and that the Group had thus decided to select a test sector (waster incineration) to explore ways of improving the input data to be used in RAINS. This process was crucial, as the RAINS model needed cost data on specific sectors in order to generate cost curves by the beginning of 2003.

A. Waste incineration in Europe and cost curve generation using RAINS

27. Mr. B. CALAMINUS (IFARE) explained that the RAINS program used gridded information from all over Europe; emission sources were also gridded. It was able to estimate the effects of emissions on human health and biodiversity. The model suggested where reductions should take place at the lowest cost possible for abatement technologies. Results were used for negotiations under the Working Group on Strategies and Review to establish national emission ceilings. In order to increase the acceptability of data in the RAINS model, the transparency of the origins of data must be improved. This was an important part of the work of the Expert Group.

28. Giving an overview of the European incineration situation, he clarified that waste incineration covered both domestic and industrial waste and some other waste treatment methods and he showed the comparative costs of incineration methods in European countries. Waste incineration emitted SO_x, NO_x, and VOCs, whereas landfill emissions were mostly methane. He pointed out that it was not the number of incinerators that was relevant for the model, but the

amount of waste burned. He described, moreover, a methodological approach for representing the incineration sector, dividing it into four classes of incinerators. He explained the procedure for data transfer to RAINS, noting that information contained in the software tool to be developed by the Expert Group would be aggregated by CIAM before being used in RAINS.

B. Methodology for development of cost curves

29. The Expert Group discussed the methodological approach to obtaining and assessing available techno-economic data, to be used as input data for the RAINS model, and considered both current data and estimated (future) data. It was noted that an important goal was to have high-quality “default” values of costs, which would be verified with Parties by comparing them to in-country costs, in an attempt to establish the state of the art for costs in each sector.

30. It was pointed out that the RAINS model was developed on the basis of energy flows, and thus any deviation from this tended to create problems. However, the model had increasingly become more focused on abatement technologies as inputs and greater improvements in this area were foreseen.

Information needed by RAINS could be summarized as follows:

- (a) Technologies of combustion;
- (b) Abatement capital costs (what do different options cost?);
- (c) Unit operating costs (use of electricity, labour, consumables, etc.);
- (d) Abatement efficiencies;
- (e) Annual full-load operating hours;
- (f) Activity data (current and future);
- (g) Information on data uncertainty.

C. General discussion

31. The Chairman pointed out that the Expert Group would need CIAM to define more precise data requirements and requested that this be clarified urgently. The Group agreed to contact CIAM to clarify specific data requirements for waste incineration and other sectors.

32. During the discussions, experts were asked about the specific problems in their countries in making data available. The representative of Italy said he had difficulties finding research information on capital costs and had contacted plant managers directly. Italy submitted a table of 41 incineration plants, although further information was needed on costs. He also met difficulties in finding information on data uncertainty.

33. The Expert Group underlined the importance of knowing the costs of the various processes

and how they were calculated. For this reason, the software tool to be sent to Parties would ask them to specify how costs were derived.

34. The Chairman stressed that the Expert Group would need more information on future emission reduction options linked with abatement costs. He said the regulatory authorities in each country would need to determine the lowest costs of procedures with the highest degree of accuracy and would be responsible for the validation of data.

35. The expert from the United Kingdom said that his Government had a database on the costs of abatement in municipal solid waste and that work had begun on waste incineration BAT reference documents (BREFS), with abatement costs included. The final version of these was expected to be available in 2003.

36. The secretariat pointed out the need not only for information on existing technologies, but also for information that allowed for technological developments over time, emerging technologies (thermal treatment, fuel cells), as well as to allow for the time function of technology (replacement function/depreciation). It was confirmed that the RAINS model used a replacement rate of technology.

37. Regarding data availability, the Expert Group clarified that it needed to develop a practical way to obtain data, and needed a list of parameters to complete the database. It was agreed that the structure in the technical annexes to the protocols was ineffective and inconsistent and the Expert Group would need a more realistic structure to feed the database from industry. Concerning data on efficiencies, much more economic data were needed (e.g. information on investment and operating costs of various processes). The Expert Group stressed the need to know, for each sector, parameters that were fixed and those that might change.

38. It was decided that Parties would be invited to submit information on waste incineration technologies in their countries (and their costs), and to provide any relevant comments. CITEPA would prepare tables and explanatory notes with best estimates of costs and technologies. Default values would be based on information from Parties.

D. Specific tasks to be undertaken

39. Based on the discussion, the following actions would be undertaken:

(a) CITEPA would clarify with CIAM the data needs for RAINS and its expectations of the outputs from the Expert Group;

(b) CITEPA would complete datasheets of variables for typical installations, including information on investment, costs, etc., and communicate this to CIAM. Parties that had this kind of information should make it available to the Expert Group. Based on this, the aggregation process for CIAM could already begin;

(c) CITEPA would prepare the tables for in-country data on costs of abatement techniques in each sector, as well as explanatory notes to the tables so that figures would be comprehensible. Tables used for the waste incineration sector would be taken as a model and adapted to each of the other sectors. By the end of October 2002, these would be sent to Parties, who would be invited to fill them in, in advance of the forthcoming sectoral meetings in November and December 2002. The sectors would need to be clearly defined according to SNAP/NFR (Nomenclatures for Reporting). The revised NFR was contained in the Draft Guidelines for Estimating and Reporting Emissions Data (EB.AIR/GE.1/2002/7) which would be sent to CITEPA.

Annex**EXPERT GROUP ON TECHNO-ECONOMIC ISSUES**Proposed sectoral breakdowns and meetings tentatively scheduled for
2002-2003

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| VOC solvent/chemical industry | 4 November 2002, Paris |
| Petroleum industry / petroleum products distribution | 5 November 2002, Paris |
| Ferrous/non-ferrous metals | 28 November 2002, Paris |
| Mineral products (cement, glass...) | 29 November 2002, Paris |
| Off-road | 16 December 2002, Paris |
| Combustion/waste incineration | 17 December 2002, Paris |
| NH ₃ emissions sources | 1st quarter, 2003 |
| Computer tool | Spring, 2003 |