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WORKSHOP ON TECHNO-ECONOMIC DATABASES ON PRODUCTION PROCESSES AND RELATED EMISSION ABATEMENT OPTIONS

Prepared by the Organizing Committee in collaboration with the secretariat

Introduction

1. In accordance with the work-plan for the implementation of the Convention (ECE/EB.AIR/59, annex III, item 4.1 (c)) and at the invitation of the Government of France, a workshop on techno-economic databases on production processes and related emission abatement options took place at Angers (France) on 28-29 October 1999.

2. The workshop was organized jointly by the French Ministry for Environment, the French Agency for Environment and Energy Management (ADEME) and the French-German Institute for Environmental Research (IFARE).

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3. More than 60 experts representing governmental agencies, research institutes and industry from 20 Parties to the Convention, nine of them countries in transition, participated. Representatives from the Asia-Europe Environmental Technology Centre (AEETC) from Pathumthani (Thailand), the Asian Institute of Technology (AIT) and the Centre for Energy-Environment Research & Development also attended, as did a representative of the UN/ECE secretariat.

4. The aim of the workshop was 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 concern the elaboration of cost functions for integrated assessment modelling and the determination of best available techniques (BAT), and the establishment of links with other related activities, e.g. creating emission inventories, emission forecasting and exchanging of information in the framework of technology exchange.

5. The workshop's conclusions including draft recommendations are set out below.

CONCLUSIONS

Current status of methodologies and databases for the characterization of abatement techniques

6. The UN/ECE Task Forces on Abatement Options/Techniques for Volatile Organic Compounds (VOCs) and Nitrogen Oxides (NOx) have developed an extensive techno-economic database covering all relevant stationary emission sources of VOCs and NOx. The database is based on the so-called reference installation approach, where VOC and NOx emission sources are assigned to different reference installations defined on a level of aggregation which allows for an unambiguous specification of all emission and cost-relevant parameters. For each reference installation, applicable reduction options are identified and characterized by emission factors, investments, operating costs, abatement efficiency and data quality indicators. The results are presented in sectoral technical data sheets (40 sectors described by about 180 reference installations for VOC and 7 sectors spread over some 130 reference installations for NOx). All data, calculation and estimation procedures are documented.

7. The technical data sheets have provided the background information to define best available techniques (BAT) and BAT-based emission limit values for NO_X and VOC emissions for the guidance documents (EB.AIR/1999/2) associated with the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone. They have also provided input to the integrated assessment model RAINS for the elaboration of national cost functions and to some of the work connected to the Directive on Integrated Pollution Prevention and Control (IPPC).

8. As the technological data are provided on a low level of aggregation, they depend mainly on the "intrinsic" properties of techniques and are only weakly country-dependent. The data have been validated by the experts of the Task Forces. The comments of some major professional organizations and representatives from industrial companies have also been integrated, especially for France, where extensive consultation has taken place.

9. The reference installations and the corresponding emission reduction options can be used to characterize the emission source structure of a given country. This structure (production and energy conversion processes) is characterized in terms of sectoral activities, market shares of reference installations and implementation shares of the emission reduction options that are summarized in the "country data sheets".

10. The data from the technology and country data sheets also provide part of the input required for the elaboration of emission inventories, emission projections, the analysis of the cost-effectiveness of environmental regulations on the sectoral/installation level (e.g. EU Solvent Directive) and the determination of national and sectoral cost functions. The use of a common assessment framework and technological database could improve the consistency between the various applications (e.g. creation of emission inventories and determination of cost functions) and the comparability of the data between different countries. Country data sheets have recently been developed for France (for VOC and NOx emission sources) and for Germany (VOC) as part of the work to determine cost functions.

Current status of tools and databases for the elaboration of cost functions

11. Techno-economic dynamic energy and mass flow optimization models are adequate tools for the determination of national cost functions. They take into account the full set of emission reduction options, including structural options related to changes in sectoral activities and production technologies, and integrate synergies with regard to the reduction in other pollutants and greenhouse gases. The production and abatement technologies are represented on a low level of aggregation, allowing for the assessment of legislative and technology scenarios, e.g. application of best available technologies or current legislation. Furthermore, cost-discounting effects and the temporal pathway of the implementation of emission reduction options within a given planning horizon (up to 2020) are taken into account.

12. Among these tools, techno-economic energy-emission models, e.g. EFOM-ENV/PERSEUS, have been widely used to optimize energy systems, including the aspect of resources and emissions (SO_2, NOx, CO_2), and thus support the generation of sustainable overall strategies for comprehensive future development. Considerable work supported by the European Union has been carried out to

facilitate the transfer of energy-economy-environment models to central and east European countries.

13. The latest version of the PERSEUS reference model, which integrates the emission reduction options for NOx and the corresponding techno-economic data developed by the Task Force on Abatement Options/Techniques for NOx, has recently been applied to France. It was used to calculate NOx cost functions for scenarios reflecting different delays in the implementation of emission reduction obligations, life time of nuclear plant, real interest rate and constraints on the stabilization of CO_2 emissions.

14. The dynamic mass flow optimization model ARGUS has been developed for the analysis of emission reduction strategies for stationary sources. The detailed representation of emission sources and abatement technologies based on the data sheets developed by the Task Force on the Assessment of Abatement Options/Techniques for VOCs combined with country-specific data on the structure of emission sources allow for an adequate representation of the relevant properties of technologies. The model has been applied to Germany and France and used for the elaboration of costs functions for various scenarios. The results for both countries show that the costs decrease and the maximum feasible emission reductions increase when transition periods for the achievement of the assumed emission reduction target are increased from 10 to 15 years. This difference is mainly due to the influence of considered structural options whose potential strongly increases with the delay for the achievement of envisaged emission reduction targets. The study further shows that the chosen interest rate and the state of implementation of emission reduction options in the base year have an important influence on the cost functions.

15. The RAINS model enables European-wide integrated assessment of emission control strategies for pollutants contributing to acidification, eutrophication and tropospheric ozone. RAINS uses data developed inter alia by the Working Group on Abatement Techniques. In its current version, RAINS adequately reflects the costs of available measures. Work done for the needs of the 1999 Gothenburg Protocol and for the EU National Emission Ceilings Directive has confirmed the usefulness of the tool. For future work, aiming for larger reduction rates, cost curve quality will be a key issue and will require a more detailed assessment of reduction options and costs. Structural changes and non-technical measures are included in the RAINS approach only through links to the results obtained with national energy-environment models. In this way synergies between the strategies for mitigation of greenhouse gases and those for controlling pollutants contributing to regional pollution are considered. Links with comprehensive national energy-traffic-agriculture-economy-environment models should be maintained and improved.

16. Next to models (like RAINS) that cover large international databases, a small, flexible and easy-to-use model, e.g. MOSES using Excel, can be useful

for quickly simulating investments, estimating the cost of environmental policies and comparing alternative abatement strategies (basically ?regulation" versus ?market-based").

17. Different types of sensitivity analysis on cost functions are useful to assess the overall uncertainty of cost curves.

18. Cost curves provided by different methods have been compared for NOx and VOCs. Differences appear to be important for large rate reductions. Part of the differences observed can be attributed to the addressing of structural measures and aggregation of data, but a full explanation could not be found for lack of detailed breakdowns of output data.

Future needs

19. According to the emission ceilings of the 1999 Gothenburg Protocol, most countries are committed to making considerable reductions in their total SOx, NOx and VOC emissions. This can be achieved by adopting and implementing strategies, policies and programmes containing a mix of measures, e.g. applying different energy pathways, sustainable traffic development, using limit values and control techniques based on BAT for stationary sources and economic instruments and market incentives. However, Parties will, to a large extent, have flexibility when designing the most appropriate combination of control options and specific techniques for preventing and reducing emissions. Techno-economic databases should play a crucial role when updating and/or increasing the number of limit values and reviewing guidance documents on BAT in order to take into account technological progress and to incorporate emerging techniques. They can also be very useful in providing data for tuning cost functions for different pollutants, if interrelationships between data collected on polluting activities and on the market penetration of technologies are established on an adequate aggregation level, and for aiding the review and extension of existing Protocols. Sensitivity analysis can provide help in assessing priorities for data input.

20. As the current objectives constitute an interim step towards long-term goals, there is a strong need for investigating new and more efficient control technologies, their reduction potential, applicability and costs.

21. With the increasing importance of post-Kyoto traffic and agriculture policies, synergies with future air pollution abatement strategies need to be explored. This will make it necessary to take structural changes and the impact of economic instruments into account in future integrated assessment.

22. Increasing air quality legislation creates the need to assess the connection between local air pollution and regional problems (oxidants, acidification, eutrophication) more thoroughly and develop joint abatement strategies. Modelling technology with higher spatial resolution, as currently used in the Auto-Oil II

programme, will create a demand for improvements in all sorts of input data, e.g. higher geographical and sectoral resolution of emission inventories, which require more detailed information on sectors, their activities and emissions of certain processes, etc.

23. For particulates it is also very important to develop techno-economic databases on emission abatement options/techniques.

Recommendations

24. The development of techno-economic databases on production processes and related emission abatement options/techniques should continue. Such an activity will be efficient if supported by an expert group or task force on techno-economic issues. It is also recommended that all stakeholders should be represented in the group, e.g. governmental agencies, industry, NGOs.

25. Such an expert group or task force should inter alia:

- Define the main characteristics of the cost function models to be used as input data for integrated assessment modelling, ensure the transparency of the input data and of the main assumptions, and analyse the output data;
- Prepare at the request of the Working Group on Strategies and Review, draft revisions of the techno-economic issues included (e.g. LVs) or annexed to (e.g. BAT) the existing protocols; and
- Analyse from a techno-economic viewpoint the outputs of the optimization models such as sectoral breakdowns, etc.

The outcome of this work would facilitate the work of the Task Force on Integrated Assessment Modelling and provide input to the IPPC Bureau in Sevilla (Spain).

26. A centre on techno-economic issues would be an adequate solution to support these tasks, if long-term financing could be provided.

27. The broad experience gathered under the Convention in developing protocols (e.g. databases, modelling, procedures) should be made available also to other regions, especially east and south-east Asia, and the need to find ways to transfer this experience has been recognized.

28. The task force on techno-economic issues should be coordinated with the bodies working with structural changes, inventory aspects, emission projections and monitoring combined with the updating of databases and tools/models. This coordination should allow for a more efficient use of the databases by the various bodies. Minimum requirements for these databases should be established.

29. Because much more communication is required between experts on emission inventory and projections, integrated modelling, monitoring and control options/techniques and their costs in order to explore their knowledge in a cross-sectoral manner and integrate the results of their work when implementing the existing agreements and developing new ones based on the multi-pollutant and multi-effect approach, joint meetings between different experts groups, including their secretariats, should be organized.

30. The technical datasheets on abatement options for VOC and NOx based on the "reference installation approach" developed by the Task Forces on Abatement Options/Techniques for VOC and NOx provide a reliable basis for future activities. They should be regularly updated and extended to other pollutants, e.g. SO_2, particulate matter and persistent organic pollutants.

31. As the national emission reduction levels derived from integrated assessment modelling and the corresponding costs play a key role in the negotiation process, they should be reasonably accurate. For cost functions this means that relevant sources and the available emission reduction options have to be taken into account, including technical pollution abatement measures but also structural options, which often show an important cost-saving potential. Techno-economic dynamic energy and mass flow optimization models provide one possible option for more in-depth studies on the national level in order to investigate the influence of structural options, synergies, for instance with greenhouse gas strategies, and strategy-relevant aspects, such as transition periods and technology mix changes.

32. In parallel with developing database activities, Parties should continue more actively not only to organize, but also to participate in target-oriented workshops devoted to the review of control options/techniques for particular pollutants or abatement programmes designed for specific sectors, like the Prague workshop on abatement framework for heavy metals and persistent organic pollutants.

33. The issue of aggregating costs of technology changes for NOx, VOCs and CO2 will have to be addressed, otherwise some double counting will be inevitable. The Convention on Long-range Transboundary Air Pollution and the Framework Convention on Climate Change are both involved and will have to deal with the issue.

34. RAINS, PERSEUS, ARGUS, MOSES and other models provide important tools for developing international and national air pollution abatement programmes. It is important to make operational versions of the models and the input data available to a broad group of stakeholders (so that the resulting differencies can be further analysed).