



Working paper No. 2 (2004)

## **Workshop on emissions projection**

Bonn, Germany, 6–8 September 2004

### **Issues in the preparation of GHG projections for the energy sector, transport, industry and waste management**

#### **Working paper**

#### **I. Introduction**

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its nineteenth session, requested the secretariat “to organize a workshop in the second half of 2004 on emissions projections of Parties included in Annex I to the Convention (Annex I Parties), as a contribution to the preparation of their fourth national communications. The workshop would cover methods, assumptions, indicators, key parameters of models and sensitivity analysis, and dissemination of methodologies<sup>1</sup>”.
2. This paper was prepared to support discussions at the UNFCCC workshop on greenhouse gas (GHG) projections of Annex I Parties in Bonn on Germany, 6–8 September 2004. Its objective is to outline major issues in the preparation of GHG projections for the energy sector, transport,<sup>2</sup> industry and waste management based on the experience with the preparation of GHG projections presented by Annex I Parties in the latest, usually third, national communications.
3. General and cross-cutting in the preparation of GHG projections and specific issues in the preparation of GHG projections for agriculture and land use, land-use change and forestry are dealt with in two other working papers prepared for the workshop.
4. The list of major methodological issues for the preparation of sectoral projections, provided in this paper, is not intended to be exclusive or definitive – participants may identify other issues and/or reformulate the issues presented here, as needed.

#### **II. Key methodological issues for the energy sector**

5. Preparation of GHG projections for the energy sector is a task of high importance and considerable complexity. Its importance stems from the fact that the supply and use of energy usually accounts for the largest part of national GHG emissions. The major challenges in preparing projections

---

<sup>1</sup> FCCC/SBSTA/2003/15, paragraph 14(f).

<sup>2</sup> Consistent with the UNFCCC guidelines for national communications of Annex I Parties, transport is considered in this document separately from the other components of the energy sector (see FCCC/CP/1999/7).

for this sector are the technological complexity of the processes of energy supply and use and the intricate links between policies and measures in the energy sector and GHG emissions.

6. The following paragraphs outline a number of methodological problems associated with projecting GHG emissions from the energy sector. The order in which the problems are listed is not indicative of their importance or priority. Some generic problems discussed in the Working paper No 1, such as the modelling of the effects of policies and measures or the modelling of technological progress, may be relevant for the energy sector as well. The workshop could discuss such overlaps and decide whether such issues should be dealt with as cross-cutting or sectoral ones.

#### A. Stationary combustion

7. ***Approaches to modelling energy demand:*** Assumptions on future levels of energy demand are a critical point for GHG projections. The approach to modelling energy demand in the latest national communications of Annex I Parties differed from Party to Party: some used expert assessment, others applied extrapolation of past trends, and some Parties conducted a detailed demand analysis using special models such as MEDEE.

8. **The workshop may wish to exchange experiences in modelling energy demand in the context of GHG projections and, if possible, identify best practices for addressing this problem.**

9. ***Projection of the energy supply mix:*** To a large extent, projected GHG emissions depend on how the projected energy demand will be met. This is directly related to assumptions about the future structure of the national energy supply system and in particular, the forecasted contributions of individual energy resources (coal, gas, oil, nuclear energy, renewable energy sources). For example, the penetration of low-carbon (natural gas) and non-carbon energy sources into the energy system can result in decreased GHG emissions even if energy demand grows. In their latest communications, Parties used different approaches to projecting the structure of their energy supply system, such as expert judgment, simulation of energy system development or optimization of the energy system. Regarding the power sector, different techniques have been used for the modelling of this very important part of the energy system; some Parties used detailed modelling at the level of individual power plants, whereas others used more aggregated representations of power generation.

10. **The workshop may wish to review the approaches used by Parties for projecting changes in the energy supply mix, including that of the power sector, in the context of GHG projections and, if necessary, formulate relevant guidance to modellers.**

11. ***Liberalization of energy markets:*** Many national communications note that energy markets are becoming more and more liberalized, which can have an impact on GHG emissions. However, only a few national communications mentioned that the factor of energy sector liberalization has been in some way integrated in the preparation of GHG projections.

12. **The workshop may wish to exchange views as to whether particular modelling techniques are required to take into account the factor of liberalization in GHG projection studies and, if so, what such techniques could be.**

13. ***Modelling of GHG mitigation measures particularly relevant for the energy sector:*** Some GHG mitigation options are particularly relevant for the energy sector and are mentioned in most national communications of Annex I Parties: **support for the use of renewable energy sources** (including various schemes such as mandatory or voluntary targets, “green certificates”, feed-in tariffs); **measures to improve energy use efficiency** (for example, in public, commercial and private buildings); and **energy or carbon taxation**. Parties used different modelling techniques for such measures, ranging from evaluating the measures outside the models (and then entering the effect of measures as part of the input data to the models) to running full-scope optimization in order to determine the most cost-effective combination of measures.

14. **The workshop may wish to review the approaches used by modellers to represent these GHG mitigation measures within national GHG projection studies and, if necessary, provide relevant advice.**
15. ***Modelling of emission trading and project-based mechanisms:*** With some national emission trading systems already in operation or in the final design stage, emission trading has become an important part of policies and measures for GHG mitigation. If the Kyoto Protocol enters into force, the implementation of emission trading under the Protocol, of projects under the clean development mechanism (which are already in progress) and of Joint Implementation (JI) projects will be accelerated.
16. **The workshop may wish to discuss what implications emission trading and project-based mechanisms have for GHG projections and whether any particular modelling approaches could be recommended in this respect.**
17. ***Presentation of main drivers for projected GHG emissions:*** In accordance with the UNFCCC reporting guidelines "...to provide the reader with an understanding of emission trends in the years 1990 to 2020, Parties shall present relevant information on factors and activities for each sector". For the projections to be transparent and credible, it is important that the presentation of projections be complemented with the analysis of the projected behaviour of GHG emissions. In some national communications either no such information was provided or the information provided was not sufficiently detailed to enable an understanding of the presented emissions trends.
18. **The workshop may wish to discuss what factors and activities could best be used to illustrate and clarify the projected behaviour of GHG emissions in the energy sector.**

## **B. Transport**

19. ***Challenges in reporting projected GHG emissions from transport:*** The review of reporting on GHG projections in the latest national communications (see table 1 in Working paper No. 1) shows that quite a few Parties did not provide GHG projections from transport. Instead, the emissions from transport were included in the total GHG emissions from energy and not shown separately.
20. **The workshop may wish to discuss whether there are any particular modelling difficulties in calculating and presenting GHG emissions from transport separately from the emissions of the other parts of the energy sector and, if so, to identify options for how these difficulties could be overcome.**
21. ***Links to specialized transport models:*** Parties that presented projections of GHG emissions from transport often used specialized models for the transport sector (or for particular components of transport, for example, for road or rail transport) in addition to energy models. However, Parties often did not provide sufficient information regarding how the two different model types were used and, in particular, whether there were any links between them.
22. **The workshop may wish to discuss whether links between energy and transport models could be useful in the process of projecting GHG emissions from transport and, if so, what methods could be used to implement such links.**
23. ***Modelling the impact of voluntary agreements on fuel efficiency of vehicles:*** Over the past few years voluntary agreements to increase fuel efficiency of vehicles have played an important role in mitigating GHG emissions from transport. Such agreements can be national or international, such as the agreements of the European Union with European, Korean and Japanese car manufacturers (the so-called ACEA, KAMA, JAMA agreements). However, in the latest national communications there is not sufficient information regarding whether the effects of such agreements have been taken into consideration in the preparation of projections from transport.

24. **The workshop may wish to discuss possible methods to model the impact of voluntary agreements on future GHG emissions from transport.**
25. *Modelling of the development of non-road transport:* Many Parties mentioned their efforts to change the modal split of transport in favour of non-road modes of transport. However, it was often not clear in national communications how changes in the modal split were projected.
26. **The workshop may wish to address this issue and review the modelling technique used for modelling future changes in the modal split of transport and the impact of such changes in GHG emissions.**
27. *Modelling of transport-related taxation:* Taxes on vehicles and fuels, which are in many cases differentiated, are often mentioned in national communication as GHG mitigation measures. Recently, some Parties implemented distance-related fees on trucks, which they considered to be promising for containing the growth of GHG emissions from freight transport. However, national communications rarely contain quantitative estimates of the impact of such measures on future GHG emissions.
28. **The workshop may wish to exchange experiences in modelling transport-related taxation within GHG projection studies and to identify problems for estimating its impact on GHG emissions.**
29. *Presentation of main drivers for projected GHG emissions from transport:* As mentioned above for the energy sector, the UNFCCC guidelines stipulate that “to provide the reader with an understanding of emission trends in the years 1990 to 2020, Parties shall present relevant information on factors and activities for each sector.”
30. **The workshop may wish to discuss what factors and activities could best be used to illustrate and clarify the projected behaviour of GHG emissions from transport.**
31. *Preparation of projections for bunker fuels:* Not all Annex I Parties provided a projection of GHG emissions from bunker fuels, that is, from international air and maritime transport.
32. **The workshop may wish to identify the major modelling problems for such projections and the possible solutions.**

### **III. Key methodological issues for the industry sector**

33. *Challenges in reporting GHG emissions from industry:* The review of reporting on GHG projections in the latest national communications (see table 1 in working paper No. 1) shows that some Parties did not provide projections of HFCs, PFCs and SF<sub>6</sub> from industry.
34. **The workshop may wish to discuss whether there are any particular modelling difficulties in calculating and presenting HFCs, PFCs and SF<sub>6</sub> emissions from industry and, if so, identify options for how these difficulties could be overcome.**
35. *Definition and projection of activity levels and emission factors:* The general approach for projecting GHG emissions from industry was based on estimates of future activity levels in industry, combined with assumptions about future emission factors.
36. **The workshop may wish to review the approaches used for projecting activity levels and emission factors in industry and, if necessary, identify best practices for such estimates.**
37. *Modelling of GHG mitigation measures particularly relevant for industry:* According to the information available in national communications, three factors have a major impact on future GHG emissions from industry: **technological progress, measures to improve energy use efficiency, other measures to mitigate GHG emissions.** These factors can appear in different forms, depending on

national context: as normal business decisions motivated by the intention to improve competitiveness, as a reaction to changes in the regulatory environment or as voluntary agreements with the government.

38. **The workshop may wish to exchange views on the methods used to take these factors and their interaction into account in modelling and, if needed, provide relevant advice.**

39. *Presentation of main drivers for projected GHG emissions:* Some national communications provided little or no information on the main drivers behind the projected levels of GHG emissions from this sector. The lack of such information reduces the transparency and credibility of GHG projections for industry.

40. **The workshop may wish to discuss what factors and activities could best be used to illustrate and clarify the projected behaviour of GHG emissions in industry.**

#### **IV. Key methodological issues for the waste management sector**

41. *Definition and projection of activity levels and emission factors:* As with the industry sector, the general approach for projecting GHG emissions from waste management was based on estimates of future activity levels and assumptions on future emission factors.

42. **The workshop may wish to review the approaches used for projecting activity levels and emission factors in waste management and, if necessary, identify best practices for such estimates.**

43. *Modelling of GHG mitigation measures particularly relevant for waste management:* Regulatory measures, with direct or indirect impact on GHG emissions, are usually particularly important in waste management. However, other instruments are also used for example, waste taxation.

44. **The workshop may wish to exchange opinions on the methods used to model GHG-related policies and measures in waste management and, if needed, provide relevant advice.**

45. *Presentation of main drivers for projected GHG emissions:* Some national communications provided little or no information on the main drivers behind the projected levels of GHG emissions from waste management. The lack of such information reduces the transparency and credibility of GHG projections from this sector.

46. **The workshop may wish to discuss what factors and activities could best be used to illustrate and clarify the projected behaviour of GHG emissions from waste.**

-----