



## Framework Convention on Climate Change

Distr.: General  
27 September 2010

Original: English

---

### Subsidiary Body for Scientific and Technological Advice

Thirty-third session

Cancun, 30 November to 4 December 2010

Item 8 of the provisional agenda

**Scientific, technical and socio-economic aspects of mitigation of climate change**

### **Synthesis report on the work already undertaken under the Subsidiary Body for Scientific and Technological Advice agenda item on scientific, technical and socio-economic aspects of mitigation**

**Note by the secretariat\***

#### *Summary*

This note synthesizes the work undertaken by the Subsidiary Body for Scientific and Technological Advice (SBSTA) under its agenda item on scientific, technical and socio-economic aspects of mitigation. It covers the activities and discussions that have taken place since the adoption of the agenda item by the SBSTA at its twentieth session, including information presented during eight in-session workshops. Relevant submissions of views from Parties under this agenda item have also been taken into consideration. The information in the note is grouped according to two periods of work: identification of, and information-sharing on, framing issues; and information-sharing on specific sectors. The note highlights mitigation activities undertaken in the following thematic areas: mitigation planning, measures and actions; mainstreaming mitigation into sustainable development; and technology cooperation. In addition, it underlines scientific, technical and socio-economic aspects of mitigation actions in specific sectors, such as agriculture, energy, forestry, industry, transport and waste management, and specific to non carbon dioxide gases.

---

\* This document was submitted after the due date in order to enable the secretariat to compile all the necessary information.

## Contents

	<i>Paragraphs</i>	<i>Page</i>
I. Introduction.....	1–14	3
A. Mandate.....	1	3
B. Scope of the note.....	2–3	3
C. Possible action by the Subsidiary Body for Scientific and Technological Advice.....	4	3
D. Background.....	5–14	3
II. Synthesis of previous activities.....	15–87	5
A. Identification of, and information-sharing on, framing issues.....	15–39	5
B. Information-sharing on specific sectors.....	40–87	11
III. Summary.....	88–94	24

## **I. Introduction**

### **A. Mandate**

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its thirty-second session, requested the secretariat to prepare a synthesis report on the work already undertaken under the agenda item on scientific, technical and socio-economic aspects of mitigation, and to make it available to the SBSTA for consideration at its thirty-third session.<sup>1</sup>

### **B. Scope of the note**

2. This note provides a synthesis of the work undertaken by the SBSTA under its agenda item on scientific, technical and socio-economic aspects of mitigation, taking into consideration information presented under this agenda item since SBSTA 20, mainly at in-session workshops<sup>2</sup> and in submissions from Parties. Some of this information has been updated, in particular with the release of the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC), and the note takes into account these updates.

3. This note groups the activities under this agenda item into two periods of work: identification of, and information-sharing on, framing issues; and information-sharing on specific sectors. It highlights mitigation activities undertaken in the following thematic areas: mitigation planning, measures and actions; mainstreaming mitigation into sustainable development; and technology cooperation. In addition, it underlines scientific, technical and socio-economic aspects of mitigation actions in specific sectors, such as agriculture, energy, forestry, industry, transport and waste management, and specific to non carbon dioxide (CO<sub>2</sub>) gases.

### **C. Possible action by the Subsidiary Body for Scientific and Technological Advice**

4. Parties may wish to consider the information contained in this document, with a view to determining any future steps under this agenda item, as appropriate.

### **D. Background**

5. The SBSTA, at its eighteenth session, considered the IPCC Third Assessment Report and requested the secretariat to organize a pre-session consultation before its nineteenth session to provide information and share experiences in order to facilitate the development of two new agenda items: scientific, technical and socio-economic aspects of impacts of, and vulnerability and adaptation to, climate change; and scientific, technical and socio-economic aspects of mitigation.<sup>3</sup> At that consultation, one panel was organized on

---

<sup>1</sup> FCCC/SBSTA/2010/6, paragraph 103.

<sup>2</sup> For the sake of clarity, workshops organized under the SBSTA agenda item on scientific, technical and socio-economic aspects of mitigation have been assigned an identification symbol (WS-1, WS-2, etc.) in order to facilitate making reference to such workshops in the main text, figures and tables of this document.

<sup>3</sup> FCCC/SBSTA/2003/10, paragraph 10 (c).

mitigation, and presenters addressed experiences, success stories and barriers to implementation, together with technological developments and main drivers, and other issues relevant for consideration by the SBSTA.

6. The Conference of the Parties (COP), by its decision 10/CP.9,<sup>4</sup> requested the SBSTA to initiate its work on scientific, technical and socio-economic aspects of mitigation and to focus on “exchanging information and sharing experiences and views among Parties on practical opportunities and solutions to facilitate the implementation of the Convention”. It also requested the SBSTA to report on its work in these areas to the COP at its eleventh session.

7. To facilitate its consideration of this agenda item, the SBSTA conducted three in-session workshops on mitigation, one each at SBSTA 20 (WS-1), SBSTA 21 (WS-2) and SBSTA 22 (WS-3).<sup>5</sup> For each of these workshops, the SBSTA requested its Chair to take into account the relevant views and information provided by Parties.<sup>6</sup>

8. In addition, the SBSTA, at its twenty-first session, invited Parties to submit to the secretariat their views on lessons learned from the in-session mitigation workshops referred to in paragraph 7 above and on any future steps under this agenda item.<sup>7</sup> Furthermore, the SBSTA, at its twenty-second session, requested the secretariat to prepare a report on the topics presented at those workshops, under the guidance of the Chair of the SBSTA.<sup>8</sup>

9. The SBSTA, at its twenty-third session, agreed to continue its work on this agenda item and requested the secretariat to organize workshops on the following themes:<sup>9</sup>

- (a) Agriculture, forestry and rural development (WS-4, at SBSTA 24);
- (b) Urban planning and development, including transportation (WS-5, at SBSTA 26);
- (c) Energy efficiency, including industry, and residential and commercial end-use (WS-6, at SBSTA 26);
- (d) Power generation, including clean fossil fuels and renewable energy (WS-7, at SBSTA 26);
- (e) Non-CO<sub>2</sub> emissions, including methane recovery and utilization (WS-8, at SBSTA 27).

---

<sup>4</sup> FCCC/CP/2003/6/Add.1.

<sup>5</sup> Presentations and report by the Chair available at:

WS-1: <[http://unfccc.int/cooperation\\_and\\_support/items/3403.php](http://unfccc.int/cooperation_and_support/items/3403.php)>.

WS-2: <[http://unfccc.int/meetings/cop\\_10/in\\_session\\_workshops/mitigation/items/3313.php](http://unfccc.int/meetings/cop_10/in_session_workshops/mitigation/items/3313.php)>.

WS-3: <[http://unfccc.int/meetings/sb22/in\\_session\\_workshops/items/3405.php](http://unfccc.int/meetings/sb22/in_session_workshops/items/3405.php)>.

<sup>6</sup> Requests by the SBSTA are reflected in documents FCCC/SBSTA/2003/15, paragraph 11 (e), FCCC/SBSTA/2004/6, paragraph 113, and FCCC/SBSTA/2004/13, paragraph 21. Views and information by Parties were compiled into documents FCCC/SBSTA/2004/MISC.6 and Add.1, FCCC/SBSTA/2004/MISC.13 and Add.1, and FCCC/SBSTA/2005/MISC.2 and Add.1 and 2.

<sup>7</sup> FCCC/SBSTA/2004/13, paragraph 22. Submissions are contained in document FCCC/SBSTA/2005/MISC.12 and Add.1 and 2.

<sup>8</sup> FCCC/SBSTA/2005/4, paragraph 21. The report can be found in document FCCC/SBSTA/2005/INF.5.

<sup>9</sup> FCCC/SBSTA/2005/10, paragraph 26. Presentations and report by the Chair available at:

WS-4: <<http://unfccc.int/meetings/sb24/in-session/items/3647.php>>.

WS-5: <[http://unfccc.int/methods\\_and\\_science/mitigation/items/3972.php](http://unfccc.int/methods_and_science/mitigation/items/3972.php)>.

WS-6: <[http://unfccc.int/methods\\_and\\_science/mitigation/items/3974.php](http://unfccc.int/methods_and_science/mitigation/items/3974.php)>.

WS-7: <[http://unfccc.int/methods\\_and\\_science/mitigation/items/3973.php](http://unfccc.int/methods_and_science/mitigation/items/3973.php)>.

WS-8: <[http://unfccc.int/methods\\_and\\_science/mitigation/items/4114.php](http://unfccc.int/methods_and_science/mitigation/items/4114.php)>.

10. At the same session, Parties were invited by the SBSTA to submit to the secretariat views on issues that were discussed at the workshops referred to in paragraph 9 above.<sup>10</sup>

11. At SBSTA 24, the Chair requested the secretariat to provide, prior to SBSTA 27, input for deliberations by Parties based on the information presented by Parties during the mitigation workshops.<sup>11</sup>

12. The SBSTA, at its twenty-seventh session, invited Parties to submit their views on possible future work under this agenda item.<sup>12</sup> The SBSTA, at its twenty-eighth session,<sup>13</sup> recognized that mitigation was being addressed in the work and negotiations under the Bali Action Plan,<sup>14</sup> and it agreed to continue work on mitigation at its thirty-second session.

13. Given the nature of the activities undertaken thus far under this agenda item, this note divides these activities into the following two periods of work:

(a) **Identification of, and information-sharing on, framing issues:** This period started with the adoption of decision 10/CP.9, by which the COP requested the SBSTA to initiate its work on scientific, technical and socio-economic aspects of mitigation, and ended with the submission by Parties of their views on lessons learned from the mitigation workshops WS-1, WS-2 and WS-3, as well as their views on future work under the agenda item;<sup>15</sup>

(b) **Information-sharing on specific sectors:** This period started at SBSTA 23, when the secretariat was requested to organize five sector-specific workshops, WS-4 to WS-8.

14. Figure 1 shows the timeline for these two periods of work, while further information on the work undertaken during each of these periods is provided in chapter II below. Box 1 presents other SBSTA agenda items under which issues relevant to scientific, technical and socio-economic aspects of mitigation are being considered.

## II. Synthesis of previous activities

### A. Identification of, and information-sharing on, framing issues

#### 1. Description of the process

15. In this first period of work, the content of the work of the SBSTA on scientific, technical and socio-economic aspects of mitigation was negotiated from session to session. This approach provided the flexibility needed to address some specific mitigation issues and contributed to building confidence among Parties.

<sup>10</sup> FCCC/SBSTA/2005/10, paragraph 29. The submissions were compiled into document FCCC/SBSTA/2007/MISC.20.

<sup>11</sup> FCCC/SBSTA/2006/5, paragraph 109. This input can be found in document FCCC/SBSTA/2007/INF.3.

<sup>12</sup> FCCC/SBSTA/2007/16, paragraph 111. The submissions were compiled into document FCCC/SBSTA/2008/MISC.6 and Add.1.

<sup>13</sup> FCCC/SBSTA/2008/6, paragraphs 139–140.

<sup>14</sup> Decision 1/CP.13.

<sup>15</sup> FCCC/SBSTA/2005/MISC.12 and Add.1 and 2.

## Box 1

**Scientific, technical and socio-economic aspects of mitigation in other agenda items of the Subsidiary Body for Scientific and Technological Advice**

In addition to the work undertaken under its agenda item on scientific, technical and socio-economic aspects of mitigation, the Subsidiary Body for Scientific and Technological Advice (SBSTA) has also addressed specific mitigation issues under other agenda items, with the following currently being under consideration:

- (a) Development and transfer of technologies (including technologies for mitigation of, and adaptation to, climate change);
- (b) Reducing emissions from deforestation in developing countries: approaches to stimulate action;
- (c) Emissions from fuel used for international aviation and maritime transport (under agenda item “Methodological issues under the Convention”);
- (d) Carbon dioxide capture and storage in geological formations as clean development mechanism project activities (under agenda item “Methodological issues under the Kyoto Protocol”).<sup>a</sup>

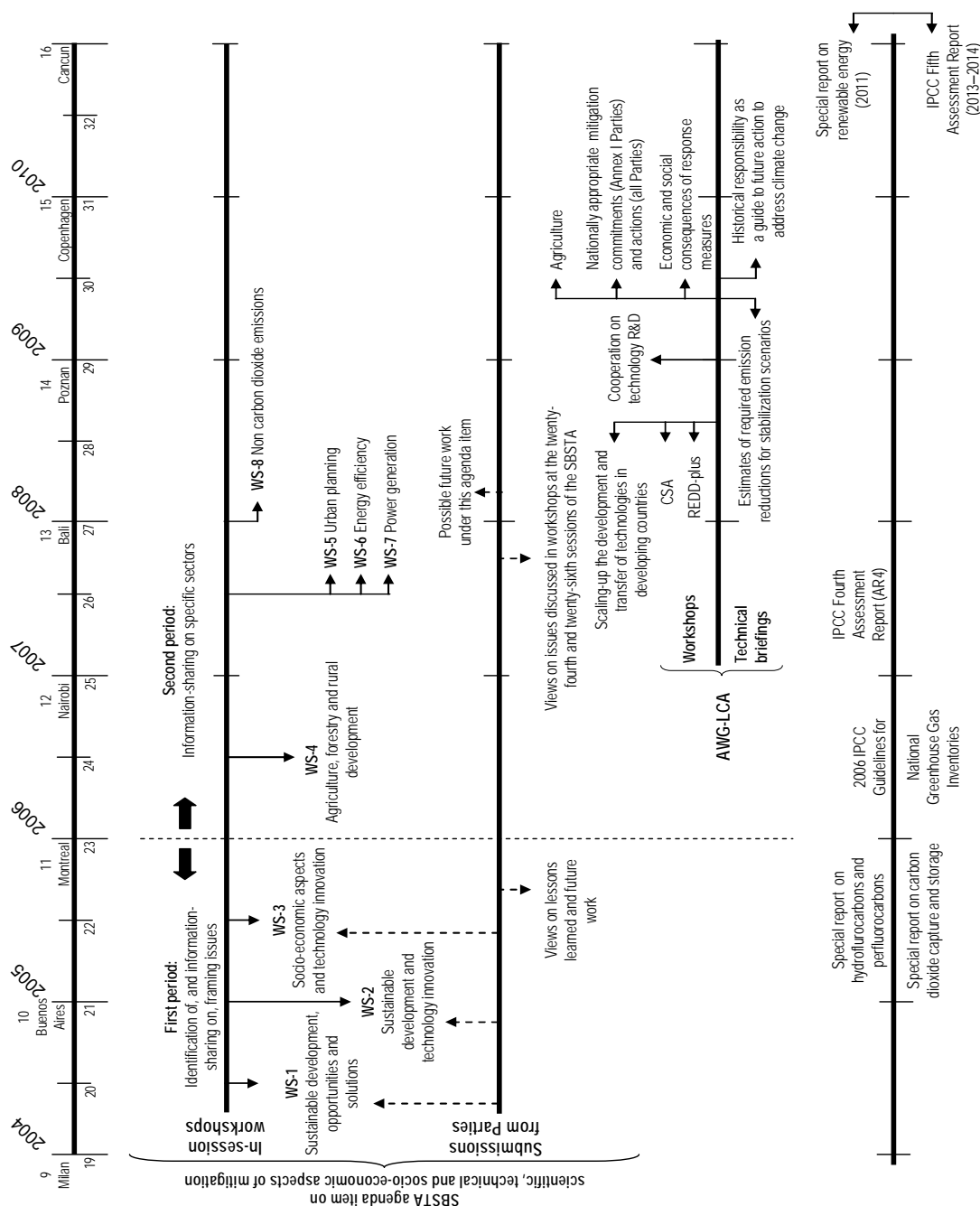
<sup>a</sup> The SBSTA acknowledged, at its twenty-third session, that “carbon dioxide capture and storage is an option, in the portfolio of mitigation options, for stabilization of atmospheric greenhouse gas concentrations”. Decision 1/CMP.2, requesting the SBSTA to prepare recommendations on carbon dioxide capture and storage in geological formations as clean development mechanism project activities for consideration by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) at its third session, with a view to taking a decision at CMP 4, led to the opening at SBSTA 27 of an agenda item on carbon dioxide capture and storage in geological formations as clean development mechanism project activities.

16. Three workshops on mitigation (WS-1, WS-2 and WS-3, see figure 1) were conducted between June 2004 and May 2005, which focused on exchanging information and sharing experiences on a range of cross-cutting issues, taking into account different national circumstances. The workshops sought to provide a broad overview of the scientific, technical and socio-economic aspects of mitigation and to represent a wide and diverse range of perspectives.

17. As work progressed, the SBSTA requested an increasing focus on technology, in particular the factors influencing, and barriers to, technology development, deployment and diffusion. Each workshop addressed the issues and priorities identified by Parties in their relevant submissions.

18. From a sectoral perspective, many Parties showed in their submissions an interest in discussing mitigation issues relating to energy, including opportunities for mitigation in the energy supply sector (e.g. use of renewable energy and combined heat and power) and opportunities to improve the efficiency of energy use in the transport, residential and industrial sectors. Agriculture was also a priority for many Parties, owing to the important link between agriculture and sustainable development in developing countries. Mitigation options in the waste sector, and through carbon dioxide capture and storage (CCS), were also addressed.

Figure 1  
**Timeline of activities related to the Subsidiary Body for Scientific and Technological Advice agenda item on scientific, technical and socio-economic aspects of mitigation**



Abbreviations: AWG-LCA = Ad Hoc Working Group on Long-term Cooperative Action under the Convention, CSA = cooperative sectoral approaches, IPCC = Intergovernmental Panel on Climate Change, REDD = reducing emissions from deforestation and forest degradation in developing countries, R&D = research and development, SBSTA = Subsidiary Body for Scientific and Technological Advice, WS = workshop.

19. The table summarizes the key issues discussed at each of the workshops organized during this first period of work.

**Key issues discussed at the first three in-session workshops on mitigation**

<i>Workshop</i>	<i>Topics</i>
WS-1	<p>Sustainable development, opportunities and solutions as they relate to mitigation of climate change</p> <p>The relationship between climate change mitigation and other policy and development objectives (e.g. economic growth and development, employment, energy and food security, and spillover effects); case studies on mitigation (costs and benefits, including co-benefits, and options for minimizing costs and maximizing benefits)</p> <p>Climate change mitigation and new technologies (what spurs technological innovation?); case studies on technology development and potential</p>
WS-2	<p>Practical opportunities and solutions for mitigation that contribute to sustainable development</p> <p>Innovation, deployment and diffusion of mitigation technology, including identification and removal of barriers</p>
WS-3	<p>Socio-economic aspects of mitigation, such as costs and benefits, co-benefits, poverty reduction and economic impacts, including spillover effects</p> <p>Factors that affect the innovation, deployment and diffusion of mitigation technology, including international cooperative efforts, and identification and removal of barriers</p>

*Source:* UNFCCC secretariat.

*Abbreviation:* WS = workshop.

**2. Views of Parties on lessons learned**

20. Most Parties underlined in their submissions that the workshops provided a good opportunity for Parties and stakeholders to exchange, in a relatively informal setting, information and views on relevant issues and that they helped to build understanding of opportunities and commonalities among Parties. The input of other stakeholders' views into the workshops, including those of businesses, academics and think tanks, highlighted some of the work on mitigation that is being done by these stakeholders.

21. Lessons learned from the views expressed in Parties' submissions and from the discussions at the in-session workshops were grouped into two thematic areas: integration (mainstreaming mitigation into sustainable development) and technology cooperation.

*Integration (mainstreaming mitigation into sustainable development)*

22. Parties identified and discussed a number of socio-economic aspects of mitigation, addressing the co-benefits for sustainable development of lowering greenhouse gas (GHG) emissions. These aspects included: energy security; electrification; economic development; poverty reduction and employment; public-health and local environmental benefits; financing and capacity-building needs; and barriers to implementing mitigation options at the national and local levels.

23. With regard to the challenges faced by both developed and developing countries when incorporating mitigation into sustainable development, some Parties pointed out that the demand for energy and transport is continuing to grow in all countries, particularly in developing countries. Much of the infrastructure required to support this demand is yet to be built and the choices countries make now will affect long-term sustainable development



and the associated emission levels (the so-called 'lock-in effect'). Discussions at the workshops also focused on other challenges, such as food security, economic development, environmental goals and potential spillover effects, as well as the need to enhance the technical capacity of developing countries.

#### *Technology cooperation*

24. Many Parties shared the view that technology plays a fundamental role and that significant technological change is required to address the enormous scale of emission reductions needed to address climate change. Discussions underlined that there is no single technological solution to resolve the issue of climate change and that the mix of approaches that works best for one country or region may not work best for another.

25. In this context, many Parties pointed out that in order to achieve climate stabilization the development and deployment of a portfolio of breakthrough technologies and the more efficient deployment and application of current technologies (including energy efficiency and renewable energy technologies) are required. Existing low-emission technologies and practices, available in both developed and developing countries, could reduce GHG emissions and contribute to sustainable development if applied on a large scale. Parties expressed their views on how the deployment and process of innovation of new technologies need to be speeded up.

26. Some Parties stressed the relevance of overcoming domestic and international barriers to the broader application of current technologies and practices, influencing the research and development, deployment and diffusion of these technologies. In this context, the role of intellectual property rights was discussed.

27. A number of critical stakeholders were mentioned, including governments, industry, and research organizations, and some Parties highlighted the need for partnerships among stakeholders, nationally coordinated actions and international cooperation. Parties discussed the role that governments could play in helping industry to overcome barriers to technology deployment and development, while recognizing the important role of the private sector in technology transfer. Government engagement was seen by some Parties as being particularly appropriate in the case of technologies for which the risk or magnitude of investment is high, the timescale is tight or where international cooperation is needed.

28. Parties provided their views on the factors that would contribute to a level playing field with regard to international technology cooperation:

(a) Technology-exporting countries require incentives to get fully involved in technology transfer mechanisms – Parties proposed incentive schemes with a focus on a wide range of tools, such as export loans, reduction of export tax, market mechanisms and favourable policies to encourage the set-up of joint ventures to enable equipment to be produced abroad;

(b) Importing countries can contribute in different ways; some Parties pointed out that policy frameworks have an important role to play in providing long-term stable investment scenarios and in spurring the development and deployment of climate-friendly technologies and that investment decisions in the short term will affect the ability to reduce emissions in the long term.

29. Given that mitigation actions in the energy sector were of interest to many Parties, the role of fossil fuels in the context of mitigation actions was discussed both in Parties' submissions and in workshop presentations. Some Parties were of the view that fossil fuels would continue to play a role in meeting energy needs for the foreseeable future. Therefore, it would be important to develop and implement cost-effective advanced fossil-fuel technologies, as well as other technologies to reduce or capture CO<sub>2</sub> emissions from fossil fuels. In this context, a group of Parties referred to the potential impact on oil-producing

countries if sectoral measures were taken and to the need to develop adequate tools to minimize that impact.

### 3. Views of Parties on proposals for future work

30. An analysis of the submissions from Parties and of the discussions at the in-session workshops made it possible to group the proposals for future work within the framework of the following thematic areas:

- (a) Mitigation planning, measures and actions;
- (b) Integration (mainstreaming mitigation into sustainable development);
- (c) Scientific, technical and socio-economic aspects of mitigation in specific sectors;
- (d) Technology cooperation, including in the deployment and diffusion of existing technologies, the research and development of new (innovative) technologies, and specific sectoral approaches and non-CO<sub>2</sub> emissions.

31. Activities relating to methodologies, data and modelling for mitigation were seen as cross-cutting and could therefore be integrated into these main thematic areas.

#### *Mitigation planning, measures and actions*

32. Parties expressed a wide range of opinions with regard to possible future work in this area. Some of the Parties proposed focusing work on the **costs and benefits of mitigation**, while some Parties expressing the need to advance robust solutions and opportunities to minimize the negative impacts of the response measures of Parties included in Annex I to the Convention (Annex I Parties) on Parties not included in Annex I to the Convention, including the negative spillover effects of the potential mitigation measures of Annex I Parties (e.g. removal of subsidies, restructuring of tax systems, enhancement of sinks and CCS).

33. Some Parties reflected in their submissions on the role of **market mechanisms** in reducing the costs of mitigation and on the need to undertake further technical work to consider whether and how to include **deforestation** in developing countries in post-2012 strategies.

34. A wider-scope approach to this issue proposed by some Parties would involve considering **emission pathways, technology deployment and road maps**, as well as the **mitigation scenarios** required to avoid dangerous climate change, in order to build synergies and address conflict with other environmental and development goals. This approach would also involve working on **regional emission projections** and their sustainability, as well as on the **potential of mitigation options and policies**.

#### *Integration (mainstreaming mitigation into sustainable development)*

35. Parties made different proposals as to how to advance work in this specific area, including how to develop policy frameworks for integrating mitigation into relevant policy areas, such as:

- (a) By linking mitigation actions with sustainable development;
- (b) By clarifying the interrelationships between GHG mitigation and other societal objectives and focusing more on approaches that satisfy both short- and longer-term sustainable development goals;
- (c) By carrying out further work on sustainable development in forestry, agriculture and transport.

*Scientific, technical and socio-economic aspects of mitigation in specific sectors*

36. Some Parties showed their interest in working on approaches to specific sectors where the benefits would be felt by all Parties. Proposed sectors include: energy-intensive sectors; agriculture and forestry (mitigation of emissions from deforestation); housing (energy efficiency and green building design); urban design and planning; transport (alternative transport fuels and technologies, and mass-transit/multimodal transport issues and planning); infrastructure; and non-CO<sub>2</sub> GHGs. With regard to the approach to sectoral issues, some Parties proposed focusing on how to best channel financial investment decisions and innovative financial schemes, whereas other Parties advocated exploring regional actions in this context.

*Technology cooperation*

37. Some Parties proposed continuing the discussion on the development, deployment, transfer and diffusion of mitigation technologies, including the role of international cooperation and frameworks of push-and-pull policies in achieving significant market penetration for relevant low- or no-carbon technologies.

38. The issue of barriers to the deployment and diffusion of existing technologies, as well as opportunities to overcome these barriers, was also seen by some Parties as an area for future work. Some Parties proposed that, with regard to existing technologies, the role of best currently available technologies in reducing emissions and avoiding lock-in to inefficient infrastructure would be a relevant area for further discussion and future work.

39. With regard to research and development in relation to new (innovative) technologies, some Parties proposed further work on issues such as identification of research needs and on specific technologies such as CCS, biotechnology and nanotechnologies. Some Parties expressed the view that further work could also involve analysing the role of relevant stakeholders, namely governments, the private sector and international cooperation mechanisms, as well as the effective participation of developing countries in technology cooperation.

**B. Information-sharing on specific sectors****1. Description of the process**

40. The SBSTA continued its work under this agenda item on the basis of the views expressed by Parties during the first period of work. Parties showed their interest in exploring topics and sectors singularly, with in-session workshops being an agreed way of focusing the debate. Five in-session workshops were organized between May 2006 and December 2007 (WS-4 to WS-8).

41. The SBSTA recommended that each of the proposed workshops should take into account ongoing work under its agenda item on development and transfer of technologies, including the work of the Expert Group on Technology Transfer, and should address the following aspects:

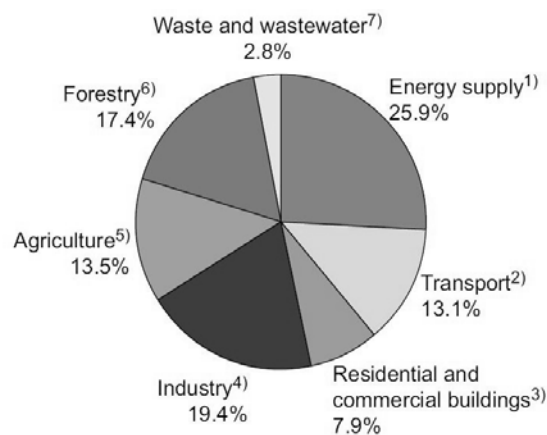
(a) Currently available and emerging technologies, including small-scale mitigation technologies, and the associated potential for reducing emissions; opportunities and best practices to overcome barriers to, and factors that promote, the innovation, deployment, transfer and diffusion of these technologies, including through innovative financing;

(b) International cooperative efforts to promote technology innovation, deployment, transfer and diffusion, and opportunities to enhance such cooperation;

- (c) Socio-economic aspects of mitigation, such as costs and benefits, co-benefits, spillover effects and ‘win-win’ practices that contribute to sustainable development;
- (d) Cross-cutting aspects and methods and tools for assessing mitigation opportunities.

42. Information provided in the AR4 shows that there are relevant differences among the sectors in terms of each sector’s contribution to global GHG emissions, mitigation potential, available technologies for mitigation, and geographical distribution and relevance. Figure 2 shows the distribution of global GHG emissions by sector in 2004; a discussion on the definition of sectors in different contexts is given in box 2.

Figure 2  
**Global greenhouse gas emissions by sector in 2004**



Source: Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

<sup>1</sup> Excluding refineries, coke ovens, etc., which are included under industry.

<sup>2</sup> Including international transport (bunkers); excluding fisheries and off-road agricultural and forestry vehicles and machinery.

<sup>3</sup> Including traditional use of biomass.

<sup>4</sup> Including refineries, coke ovens, etc.

<sup>5</sup> Including burning of agricultural waste and savannas (non carbon dioxide (CO<sub>2</sub>) emissions); CO<sub>2</sub> emissions and removals from agricultural soils were not estimated.

<sup>6</sup> Data include CO<sub>2</sub> emissions from deforestation, from decay (decomposition) of above-ground biomass that remains after logging and deforestation, and from peat fires and decay of drained peat soils.

<sup>7</sup> Includes methane emissions from landfill, methane and nitrous oxide emissions from wastewater, and CO<sub>2</sub> emissions from waste incineration (fossil carbon only).

43. The work undertaken in the second period of work involved information-sharing on mitigation options in specific sectors. In the following sections of this document, the information presented by Parties in the in-session mitigation workshops is reflected.<sup>16</sup> This information is supported by data taken from the AR4, the different sections of which were issued during the period of organization of these workshops.

<sup>16</sup> Examples and case studies included in boxes have been taken from presentations made in the workshops. In the case of data and figures used in presentations and extracted from publications which are periodically updated, the latest available data have been taken into consideration.

**Box 2****Definition of sectors**

The concept of 'sectors' has been used in a wide range of contexts, with its definition varying in order to maximize its usefulness for a given purpose. The Convention does not include a detailed enumeration of sectors, but its Article 4, paragraph 1(c), refers to "all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors".

Annex A to the Kyoto Protocol lists sectors and source categories, grouping them into the following categories: (a) energy (including energy industries, transport, and manufacturing industries and construction under "fuel combustion", and solid fuels, oil and natural gas under "fugitive emissions from fuels"); (b) industrial processes (including mineral products, chemical industry, metal production, production of halocarbons and sulphur hexafluoride, other production, and consumption of halocarbons and sulphur hexafluoride); (c) solvents and other product use; (d) agriculture (including fermentation, manure management, rice cultivation, agricultural soils, prescribed burning of savannas, and field burning of agricultural residues); and waste (including solid waste disposal on land, wastewater handling and waste incineration).

The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change identified the sectors contributing the highest level of greenhouse gas (GHG) emissions in order to assess the short- to medium-term mitigation options and costs in these sectors, the policies for achieving mitigation, the barriers to mitigation, and the relationship with adaptation and other policies that affect GHG emissions. These sectors are: energy supply; transport and its infrastructure; residential and commercial buildings; industry; agriculture; forestry; and waste management.

Most of the sectors identified in the AR4 were considered by the Subsidiary Body for Scientific and Technological Advice in the in-session workshops organized during the second period of activity. However, some mitigation issues cut across different sectors, and a specific approach to these issues might also be considered 'sectoral' to a certain extent. For example, energy efficiency clusters an array of mitigation options to be applied in almost every sector with the potential to reduce GHG emissions. Emissions of methane or fluorinated gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) are another relevant example, as they stem from a wide range of industrial and non-industrial sources.

44. As stated in paragraph 12 above, the SBSTA, at its twenty-eighth session, recognized that mitigation was being addressed in the work and negotiations under the Bali Action Plan. In particular, several workshops were held by the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) that were relevant to scientific, technical and socio-economic aspects of mitigation. Information from these workshops shows how the perception of Parties in relation to all relevant topics discussed under the SBSTA agenda item on scientific, technical and socio-economic aspects of mitigation has evolved over time.

## 2. Energy supply

45. Parties have discussed issues related to opportunities for mitigation in the energy supply sector on various occasions in the context of the SBSTA agenda item on scientific, technical and socio-economic aspects of mitigation:

(a) Workshops WS-1, WS-2 and WS-3 included a number of presentations dealing with these issues;

(b) Workshop WS-7 focused specifically on energy supply issues.

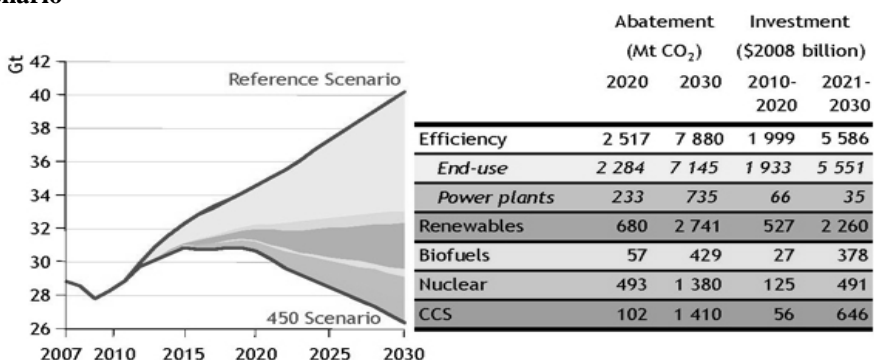
46. Parties discussed the mitigation potential in the energy supply sector, highlighting a number of challenges to be addressed. Identified needs include: increased use of energy efficiency programmes; development of low-carbon electricity systems; development of a portfolio of suitable technologies; and promotion of international cooperation on a global scale. Box 3 summarizes information provided by the International Energy Agency (IEA) concerning energy use projections and potential abatement of energy-related CO<sub>2</sub> emissions.

**Box 3**

**Projections by the International Energy Agency**

According to data from the International Energy Agency (IEA), global energy use fell in 2009 as a result of the financial and economic crisis, with energy-related greenhouse gas emissions falling accordingly. However, predictions show that energy use will quickly resume its long-term upward trend once economic recovery is under way, unless bold changes to national energy policies are made. The figure below shows the required level of abatement of energy-related carbon dioxide emissions in line with the 450 ppm scenario.

**World abatement of energy-related carbon dioxide emissions in the 450 ppm scenario**



Source: International Energy Agency. 2009. *World Energy Outlook*.

Abbreviation: CCS = carbon dioxide capture and storage.

According to IEA, global demand for electricity is expected to grow at an annual rate of 2.5 per cent up to 2030, with 80 per cent of this growth taking place in countries which are not members of the Organisation for Economic Co-operation and Development.

47. Many Parties agreed on the need to switch to low-carbon energy sources, although there are many different views as to the best way to achieve this objective. At the global level, coal remains the main energy source for the power sector, and projections show that its share in the power-supplying energy mix will increase unless national energy policies further promote alternatives. Alternatives proposed by Parties include: small and large hydropower; non-hydro renewable energies (wind, solar, geothermal, bioenergy, hydrogen, tidal, etc.); and nuclear. Box 4 summarizes the objectives set by the European Union in terms of renewable energy use and GHG emissions reduction.

48. Parties pointed out the need to consider the different stages that different technologies for power generation, transmission and distribution are at in the technology life cycle. Parties agreed that technologies such as hydropower and wind energy show a steady annual growth in their capacity to generate power, whereas others, such as tidal

energy or second-generation biofuels, are at the early stages of the technology life cycle.<sup>17</sup> The former require level playing fields and clearly defined institutional and policy frameworks for their further deployment, especially in developing countries. For the latter, increased investment in research and development and international cooperation are key, as well as adequate incentives at the level of national policy.

49. There was widespread agreement on the fact that the development of technologies that will lead to a reduction in GHG emissions from fossil-fuel sources (clean coal technologies, CCS, etc.) requires further efforts at the level of research and development.

**Box 4**

**The European Union's '20-20' objective**

The new European Union (EU) directive on renewable energy sets ambitious targets for all EU member States: the EU is aiming to achieve a 20 per cent share of energy from renewable sources by 2020, with a 10 per cent share of energy used specifically in the transport sector coming from renewable energy sources. The directive also improves the legal framework for promoting renewable electricity; requires national action plans that establish pathways for the development of renewable energy sources, including bioenergy; creates cooperation mechanisms to help to achieve the targets cost-effectively; and establishes the sustainability criteria for biofuels. It should be implemented by EU member States by December 2010.

Reaching the 20 per cent share of energy from renewable energy sources is one of the three interlinked key targets that the EU has set for 2020, together with reducing greenhouse gas emissions by 20 per cent (or 30 per cent subject to comparable commitments by other Parties) and achieving a 20 per cent improvement in the energy efficiency of both household and industrial applications.

### 3. Transport and its infrastructure

50. Parties have discussed various topics related to mitigation actions in the transport sector:

(a) Workshops WS-2 and WS-3 included presentations on diversification of fuels (hydrogen and biofuels);

(b) There were discussions at workshop WS-5 on, inter alia, issues related to urban transport, fuel efficiency and diversification of fuels. The workshop also included a presentation on emissions from aviation;

(c) Presentations at workshop WS-7 included information on the production and use of first- and second-generation biofuels for transport purposes.

51. It was widely acknowledged that urban planning should include **urban transport** as a key area, promoting public transport and alternatives to motor vehicle transport, such as walking and cycling. Parties identified different reasons for the increasing car traffic in urban areas, namely: inadequate city planning; poor public transport; subsidies for fossil fuels; and loss of quality of urban life. In order to tackle this trend, different policies and measures can be applied (depending on the context) in order to optimize urban transport and therefore reduce GHG emissions.

<sup>17</sup> Parties focused the discussion on the different positions of renewable energy technologies along the technology life-cycle curve. Parties agreed that even the most developed renewable energy technologies still face higher costs than fossil-fuel technologies, especially in developing countries.

52. Some of these policies and measures focus on vehicle control, such as: urban transport planning; priority for investment in public transport; adequate high-density, mixed-use and key-site development; and road pricing and fuel taxes. Other policies have a direct impact on GHG emission reductions, namely: inspection and maintenance programmes; standards for new vehicles and fuels; improvement programmes for high-use fleets; tax incentives for clean vehicles and fuels; and education of drivers and law enforcement officers.

53. Many Parties were of the view that further efforts are required in the transport sector with regard to **fuel efficiency and diversification of fuels**. Reducing emissions from car use is perceived as a multi-stakeholder process where different actors have different roles to play. On the one hand, the private sector is instrumental in promoting a switch to modes of transport which emit less CO<sub>2</sub>, especially vehicle manufacturers and providers of alternative fuels. On the other hand, governments are expected to apply the necessary fiscal measures that will encourage car manufacturers to produce more fuel-efficient cars, producers of alternatives to fossil fuels to supply the market and car drivers to buy fuel-efficient, hybrid (or alternative fuel) vehicles. Last but not least, there was agreement on the fact that the behaviour of consumers plays a key role; thus consumer awareness programmes have to focus on issues such as labelling of environmentally-friendly products and promoting ways of driving that reduce fuel consumption and GHG emissions.

54. According to the latest assessments, total CO<sub>2</sub> emissions from **international aviation and maritime transport** account for some 4 per cent of global GHG emissions. However, the growth in the GHG emissions from these sectors has proven to be one of the most challenging trends to change. These sectors' share in global GHG emissions could reach 6–8 per cent by 2020.

55. In the context of the negotiations under the International Civil Aviation Organization (ICAO), nations representing 93 per cent of global commercial air traffic have agreed on further reducing air travel's impact on climate change, setting a goal of a 2 per cent annual improvement in fuel efficiency globally up to 2050 and a global carbon emissions standard for aircraft. ICAO is also considering the possibility of adopting both market-based and regulatory measures. With regard to possible regulatory measures, different options proposed include: caps on aircraft movement; slot management; enhanced weather forecasting; transparent carbon reporting; and education and training programmes.

56. In order to tackle the limitation and reduction of GHG emissions from shipping operations, the International Maritime Organization (IMO) has established an action plan which includes technical measures (a new shipping Energy Efficiency Design Index) and operational measures (a revised Energy Efficiency Operational Indicator and Ship Energy Management Plan). IMO is also considering different market-based measures which could contribute to current efforts to curb GHG emissions from shipping.

#### **4. Residential and commercial buildings**

57. Discussion on mitigation measures in the building sector took place mainly in the context of workshop WS-5.

58. According to the United Nations Human Settlements Programme, UN-Habitat, 50 per cent of the world's population already lived in urban areas in 2007, with the share of the urban population in developing countries increasing at a high rate. In this context, urban planning and development becomes an increasingly relevant issue owing to the impact of urban activities on climate change. In addition to this, cities face other challenges and pressures, which call for a holistic approach. Well-planned cities are designed in a way that reduces the need for transport and minimizes the infrastructure needed to give the urban population the basic services it requires.



59. Parties proposed a wide range of activities to be taken into consideration in the context of mitigation approaches in different areas linked to urban planning and development, such as the building sector, urban transport, emissions from vehicles and waste management. With regard to each of these areas, Parties converged on the view that technological solutions for climate change mitigation are available in developed countries, but that they are not being used on a wide enough scale to generate significant impact. Moreover, developing countries require technical and financial support to be able to apply effective mitigation strategies in the context of urban planning.

60. Different initiatives at the city level, such as the sustainable city concept, have been developed worldwide in order to deal with all these areas in a comprehensive way. Other initiatives have focused on specific areas (e.g. waste management or energy consumption) which have become especially problematic for a city under exceptional circumstances or as a result of a 'business as usual' routine.

61. Parties agreed on the fact that opportunities in the **building sector** focus mainly on **energy efficiency measures**, such as those to be applied to construction materials such as building fabrics or insulation materials; savings in energy-providing systems (district heating, distribution systems, building combined power, heating and cooling systems, etc.); **control devices**, such as for temperature and humidity, or building automatic systems; and **efficient lighting devices**. Parties shared the view that existing efficient solutions (ventilators and exhaust heat recovery, heat pumps, high-efficiency lighting, etc.) are already available but still have to find their way onto the market, especially in developing countries. Efforts to upscale existing technologies have to be combined with increased funding in research and development for new technologies and solutions.

62. Parties also discussed the opportunities to apply some renewable energy technologies in the building sector, such as solar photovoltaic technology for power generation, solar thermal technology for water heating and energy production from biomass for power generation and district heating.

## 5. Industry

63. Mitigation actions in energy-intensive industries is a broad topic covering many different issues (energy efficiency, fuel switching, power recovery, renewable energy for industrial purposes, changing feedstock or product, material efficiency, non-CO<sub>2</sub> GHGs, CCS, etc.). Parties have discussed these issues on various occasions in the context of the SBSTA agenda item on scientific, technical and socio-economic aspects of mitigation:<sup>18</sup>

(a) Presentations given during workshops WS-1, WS-2 and WS-3 included information on **industrial energy efficiency** and on specific sectors, such as the **iron and steel** industry;

(b) Relevant presentations were given during workshop WS-6.

64. According to estimates from IEA, **end-use energy efficiency** (including industrial use) will be the largest contributor to the abatement of CO<sub>2</sub> emissions by 2030, accounting for more than half of the total savings in the alternative (450 ppm) scenario when compared with the baseline (reference) scenario. In addition, because of their mitigation potential, energy efficiency policies and measures should be a key part of governments' energy plans, owing to their contribution to energy security and the related reduction of energy costs.

<sup>18</sup> In addition to the discussions under the SBSTA, paragraph 1 (b) (iv), of the Bali Action Plan addresses the related issue of cooperative sectoral approaches and sector-specific actions. A workshop on this issue was organized under the AWG-LCA in August 2008 <[http://unfccc.int/meetings/ad\\_hoc\\_working\\_groups/lca/items/4491.php](http://unfccc.int/meetings/ad_hoc_working_groups/lca/items/4491.php)>.

65. Broadly speaking, **energy efficiency policies and measures** could be grouped into three areas: the **building sector**, the **transport sector** and **industrial energy efficiency**. An overview of the discussions among Parties with regard to energy efficiency measures for buildings and urban transport systems in the context of urban planning is provided in paragraphs 53 and 61 above.

66. **Industrial sectors** are responsible for one third of global primary energy use and two fifths of global energy-related CO<sub>2</sub> emissions. Industrial energy efficiency could contribute significantly to the abatement of CO<sub>2</sub> emissions in two related ways. On the one hand, some Parties advocate applying measures in specific energy-intensive sectors. According to the IPCC, these sectors (iron and steel, non-ferrous metals, chemicals and fertilizers, petroleum-refining, cement, and pulp and paper) account for about 85 per cent of the industrial sectors' energy consumption in most countries.

67. On the other hand, cross-sectoral energy efficiency measures could contribute significantly to further reductions in energy consumption, taking into account the fact that, according to IEA, as much as 30 per cent of industrial energy use could be accounted for by non energy intensive industries. These measures are related to common elements such as compressed-air systems, lighting, pumps and fans.

## 6. Agriculture

68. Mitigation actions within the framework of agricultural activities have been discussed by Parties on various occasions in the context of the SBSTA agenda item on scientific, technical and socio-economic aspects of mitigation:<sup>19</sup>

(a) At workshops WS-1, WS-2 and WS-3, agriculture was discussed as one of the two priority issues for Parties (together with energy);

(b) Relevant discussion took place at workshop WS-4;

(c) Presentations given during workshop WS-8 included information on approaches to mitigate GHG emissions in the agriculture sector.

69. Agriculture contributes 10–12 per cent of the total annual global anthropogenic GHG emissions. Between 1990 and 2005, emissions from this sector increased by about 17 per cent and such emissions are projected to increase further in the coming decades, owing to expected increases in demand for food and to dietary changes as the global population continues to grow.<sup>20</sup>

70. Agricultural activities are responsible for the release of significant amounts of CO<sub>2</sub>, methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) into the atmosphere. At the global level, the main sources of non-CO<sub>2</sub> GHG emissions from agriculture are soils (N<sub>2</sub>O emissions, owing mainly to nitrogen-containing fertilizers), enteric fermentation (CH<sub>4</sub> emissions), manure management (CH<sub>4</sub> and N<sub>2</sub>O emissions) and rice cultivation (CH<sub>4</sub> emissions).

71. Parties discussed a number of mitigation options in the agriculture sector, taking into account interlinkages between mitigation efforts and adaptation actions in the sector. They provided their views on **agricultural management practices** aimed at reducing CH<sub>4</sub> emissions (e.g. croplands, rice paddies and agroforestry) as well as at reducing CO<sub>2</sub> emissions (e.g. rehabilitation of severely degraded lands, building up soil carbon and

---

<sup>19</sup> In addition to the discussions under the SBSTA, an in-session workshop was organized under the AWG-LCA in April 2009 on opportunities and challenges for mitigation in the agricultural sector <[http://unfccc.int/meetings/ad\\_hoc\\_working\\_groups/lca/items/4815.php](http://unfccc.int/meetings/ad_hoc_working_groups/lca/items/4815.php)>.

<sup>20</sup> The UNFCCC secretariat published in November 2008 a technical paper on challenges and opportunities for mitigation in the agricultural sector (FCCC/TP/2008/8), which includes detailed information on this issue.

improved management of vegetation) and discussed approaches such as life-cycle analysis of agricultural activities and more efficient fertilizer use.

72. Mitigation options addressing **emissions from livestock**, mainly CH<sub>4</sub> emissions from ruminants, including improved efficiency of feed conversion, increased productivity and profit and reduced waste in the livestock industries, were discussed. The fact that not every mitigation option in this area is applicable at the national level because of factors such as local regulations or cattle profile was reflected on.

73. Also discussed were options for **bioenergy production**, such as biogas digesters, from agricultural residues.

74. Parties provided their views on challenges in and barriers to the implementation of mitigation actions in the agriculture sector, including the lack of financial resources for the development and transfer of environmentally sound technologies.<sup>21</sup> Box 5 presents information provided by China on the different initiatives undertaken to mitigate GHG emissions from agriculture in the country.

#### Box 5

##### **Promoting rural development and mitigating greenhouse gas emissions in China**

About 70 per cent of China's population lives in rural areas, with 17 per cent of the country's total greenhouse gas (GHG) emissions coming from the agriculture sector in 1994. In 2004, China accounted for as much as 19 per cent of the world's rice planting area, 30 per cent of the world's nitrogen fertilizer use and 50 per cent of the global stock of pigs.

The Chinese Government has undertaken a number of initiatives to improve farmers' living standards, with some of these initiatives contributing to reducing the country's GHG emissions from agriculture, namely:

(a) The construction of biogas digesters: by the end of 2005, there were 17 million biogas digesters used by 10 per cent of the country's rural population;

(b) A precise fertilization programme: since 2005, 50 million farmers have been trained in order to increase the efficiency of fertilization practices and to reduce nitrous oxide emissions from agriculture;

(c) Conservative tillage in order to increase the productivity of land and to decrease loss of carbon stores by mismanagement.

The Chinese Government finds it crucial to: carry out further work on the deployment of advanced production technologies; increase carbon sinks; implement the widespread use of agricultural residues for the production of bioenergy; and use market-based mechanisms such as clean development mechanism projects to support the construction of biogas digesters.

<sup>21</sup> Parties also discussed the existence of challenges in and barriers to the implementation of mitigation actions in the agriculture sector at the in-session workshop organized under the AWG-LCA mentioned in footnote 19 above. They grouped such challenges and barriers into the following categories: (a) scientific/technical (e.g. high cost and low availability of technologies and high level of uncertainty in emission estimates); (b) social (e.g. need for increased food production); (c) environmental (e.g. risk of loss of carbon stores because of changes in land use); (d) economic (e.g. market failures, distorting competitiveness); and (e) cross-cutting (e.g. need for reinforced international cooperation). The technical paper on challenges and opportunities for mitigation in the agricultural sector (FCCC/TP/2008/8) provides information on challenges and barriers linked to different types of livestock and crops.

7. Forestry

75. Discussion on mitigation measures in the forestry sector took place mainly in workshop WS-4.<sup>22</sup>

76. Parties agreed that the forestry sector is important in terms of its contribution to national and local economies, especially in developing countries. Forest ecosystems have a unique environmental role as they are responsible for both emissions and removals of CO<sub>2</sub>. In addition, carbon sequestration activities, through the protection of forest areas, have important co-benefits in terms of improving water quality, reducing the risk of loss of biodiversity, flood control, and combating land degradation and desertification. Box 6 presents key data on the forestry sector from the AR4.

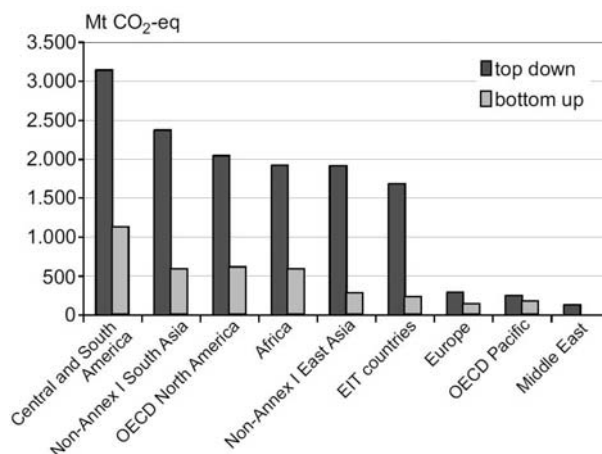
Box 6

**Data on the forestry sector from the Intergovernmental Panel on Climate Change**

According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, global forest cover represents about 30 per cent of the world’s land area. Between 2000 and 2005, the net loss of forest was 7.3 million ha/year, with the largest losses experienced in South America, Africa and South-East Asia.

Owing to the complexity of forest systems and the difficulty of collecting accurate data, different models can provide very different estimates of the sector’s mitigation potential. The figure below shows how top-down and bottom-up models of mitigation potential analysis by region can lead to very different outcomes.

**Comparison of outcomes of economic mitigation potential in 2030 in the forestry sector, on the basis of top-down global models versus regional modelling results**



Source: Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Note: The comparison considers a carbon price of < USD 100/t CO<sub>2</sub> eq.

Abbreviations: EIT = economy in transition, OECD = Organisation for Economic Co-operation and Development.

<sup>22</sup> In addition to the discussions under the SBSTA, an in-session workshop was organized under the AWG-LCA on policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries <[http://unfccc.int/meetings/ad\\_hoc\\_working\\_groups/lca/items/4480.php](http://unfccc.int/meetings/ad_hoc_working_groups/lca/items/4480.php)>.

77. Options discussed by Parties to reduce emissions by sources and/or increase removals by sinks in the forestry sector can be grouped into four general categories:

- (a) Maintaining or increasing the forest area;
- (b) Maintaining or increasing the site-level carbon density;
- (c) Maintaining or increasing the landscape-level carbon density;
- (d) Increasing off-site carbon stocks in wood products and enhancing the substitution of products and fuels.

78. Many Parties agreed that the largest short-term gains can be achieved through mitigation activities aimed at avoiding emissions (reduced deforestation or degradation, fire protection, reduction of slash burning, etc.), whereas the greatest sustained mitigation benefit in the long term will be obtained by a sustainable forest-management strategy aimed at maintaining or increasing forest carbon stocks.

79. Parties discussed possible mitigation actions in the forestry sector and a number of options were deemed relevant. There was widespread recognition that the sustainable management of forests is a key area (including enhancing reforestation and afforestation and reducing deforestation). Other key issues include: rehabilitation and conservation of peatlands; control of forest fires to increase soil carbon; development of GHG source/sink control technologies through conservation; and efficient management of terrestrial ecosystems.

## **8. Waste management**

80. The waste management sector has been discussed by Parties on various occasions in the context of the SBSTA agenda item on scientific, technical and socio-economic aspects of mitigation, namely in presentations included in workshops WS-2, WS-3, WS-5 and WS-8.

81. Waste management is perceived as a key issue, owing to the high rate at which urban populations are increasing (especially in developing countries) and to the increasing amount of waste generated per capita, thereby laying the foundations for applying integrated waste management policies (recycling, environmentally sound management and disposal of waste, use of inland waterways for transport of waste, etc.). Box 7 summarizes the key messages of a case study presented at workshop WS-5.

## **9. Non carbon dioxide emissions**

82. Mitigation actions addressing non-CO<sub>2</sub> gases have been discussed in different workshops organized under the SBSTA agenda item on scientific, technical and socio-economic aspects of mitigation:

- (a) Presentations included in workshops WS-1, WS-2 and WS-3 focused specifically on agricultural activities and waste management;
- (b) Workshop WS-8.

83. Anthropogenic emissions of non-CO<sub>2</sub> gases have been important contributors to enhancing the greenhouse effect since pre-industrial times. The IPCC shows in its AR4 that these gases accounted for 23.3 per cent of total global GHG emissions in 2004 on a CO<sub>2</sub> eq basis (see figure 3).

84. Anthropogenic CH<sub>4</sub> emissions come from a wide range of sources, namely: fossil fuels; waste management (combustion, landfilling and wastewater treatment); agricultural practices (rice cultivation, manure management and enteric fermentation); and bioenergy (biomass burning and biofuel combustion).

Box 7

**Lille’s experience of waste management**

In 1998, the Lille Metropolis (with 1.1 million inhabitants) experienced a serious problem with the incinerators that burned its domestic waste. Because of a high level of dioxin dumping, the three incinerators were stopped. Solutions had to be found before a new and more efficient incinerator was built and put into service.

The Ports of Lille proposed that the urban community use waterway transport for a part of the domestic waste that had to be sent to a landfill plant in the area. This system was put into service in June 1999. Waste was put into 20 open-top containers, loaded into barges and transported by waterway to the landfill plant. Between June 1999 and December 2002, more than 55,400 containers were transported by barge. Even after December 2002, when the new incinerator became fully operational, this system continued to be used to transport a part of the waste (25,000 containers between 2003 and 2006).

This experience convinced the urban community to entrust the waterways with the transport of large volumes of waste. In the new set-up, the valorization plants were settled along the canal, in ports areas, in order to be able to use environmentally friendly modes of transport. In 2007, two plants were put into service, using transport by waterway for more than 200,000 t waste per year.

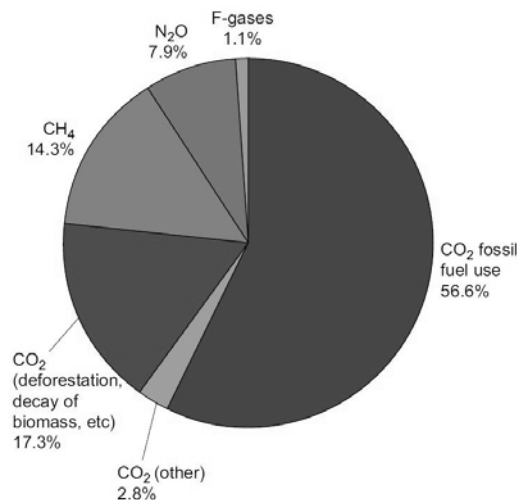
In 2003, the Ports of Lille launched a similar system for the transport of recycled glass to be used to produce new glass. Since July 2003, more than 13,000 containers of glass have been transported by barge.

These examples show that inland ports can be reliable and efficient partners in terms of urban development policy, especially for waste transport, which is a crucial issue.

85. With regard to N<sub>2</sub>O emissions, the following sources have to be taken into consideration: agriculture (nitrogen-containing fertilizers and manure management); industry; emissions from motor vehicles; emissions from bunker fuels; and waste management.

Figure 3

**Global anthropogenic greenhouse gas emissions in 2004**



Source: Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

Abbreviation: F-gases = fluorinated gases.

86. The term 'fluorinated gases' (F-gases) refers to a group of chemicals that includes hydrofluorocarbons (HFCs), perfluorocarbons and sulphur hexafluoride. These gases are emitted from a broad range of industrial sources and have a number of end-use applications. HFCs in particular are currently experiencing a sharp increase in their use as substitutes for ozone-depleting substances, which are being phased out in the context of the Montreal Protocol. Box 8 summarizes the current status of this issue under the Montreal Protocol.

#### Box 8

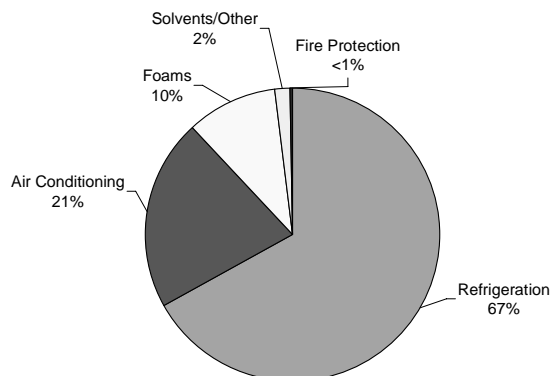
##### **Increased use of hydrofluorocarbons owing to the phase-out of hydrochlorofluorocarbons under the Montreal Protocol**

In 1992, the Montreal Protocol established a phase-out schedule for hydrochlorofluorocarbons (HCFCs). However, HCFC consumption remains higher than expected, particularly in developing countries.

As a consequence of this, Parties under the Montreal Protocol decided in 2007 to establish a new and more stringent phase-out schedule, calling for a faster step-down in HCFC consumption by developed countries. The new schedule also establishes a step-down in consumption for developing countries, which previously were only required to freeze consumption in 2016 and halt the use of HCFCs by 2040.

The implementation of the accelerated controls on HCFCs has necessitated the adoption of available alternatives, including perfluorocarbons and hydrofluorocarbons (HFCs), two groups of fluorinated gases covered by the UNFCCC which are also included in the Kyoto Protocol.

In order to establish the relative importance of each sector in terms of HCFC consumption from a quantitative perspective, the figure below shows HCFC consumption by sector before the adoption of the new phase-out schedule in 2007.



*Source: Technology and Economic Assessment Panel. 2007. Report of the Task Force on HCFC Issues and Emissions Reductions Benefits Arising from Earlier HCFC Phase-out and Other Practical Measures.*

The figure shows that current concerns about the increase in HFC use are focused on three main sectors: refrigeration, air conditioning and foams. Use of HCFCs in these sectors in developing countries is greater today than at the historical peak of HCFC use in industrialized countries, and HCFC use is still growing. This means that there will be a massive demand for HFCs should they become the primary replacement for HCFCs.

Different studies show that, in the absence of action at the international level to control HFC consumption in these sectors, the impact of HFCs in terms of global warming will grow significantly over time in proportion with the growth in total greenhouse gas emissions.

87. Given the wide range of gases and sources, many Parties were of the view that mitigation policies and measures have to be applied following a sectoral approach. As already detailed in paragraph 70 above, non-CO<sub>2</sub> gases represent a relevant share of the GHG emissions from agriculture, and mitigation actions address them accordingly. Technologies to reduce the impact of fossil fuels on global GHG emissions also address CH<sub>4</sub>, while N<sub>2</sub>O emissions from industrial sources have fallen as a result of air pollution controls. With regard to F-gases, both the UNFCCC secretariat and the Ozone Secretariat are exploring ways forward in order to limit the increased use of HFCs and other alternatives to ozone-depleting substances which have high global warming potential.

### III. Summary

88. The SBSTA, at its twenty-eighth session, agreed that its past work under its agenda item on scientific, technical and socio-economic aspects of mitigation of climate change, including the organization of in-session workshops, had facilitated useful and informative exchanges of information and views among Parties and practitioners.

89. The first period of work (**identification of, and information-sharing on, framing issues**) allowed Parties to discuss, in the context of three in-session workshops, a range of cross-cutting issues, taking into account different national circumstances.

90. Workshops organized in this period sought to provide a broad overview of the scientific, technical and socio-economic aspects of mitigation and to represent a wide and diverse range of perspectives. The workshops addressed the issues and priorities identified by Parties in their relevant submissions; from a sectoral perspective, the energy sector received the most attention, followed by agriculture, showing an increasing focus on technology cooperation, in particular the factors influencing, and barriers to, technology development, deployment and diffusion.

91. At the end of the first period of work, Parties expressed their views on lessons learned, which can be grouped into two thematic areas: **integration** (mainstreaming mitigation into sustainable development); and **technology cooperation**. For both areas, Parties identified key issues as well as challenges and barriers.

92. Parties also expressed their views on proposals for future work, which can be grouped into four thematic areas: **mitigation planning, measures and actions**; **integration** (mainstreaming mitigation into sustainable development); **scientific, technical and socio-economic aspects of mitigation in specific sectors**; and **technology cooperation**. Parties showed their interest in exploring topics and sectors singularly, with in-session workshops being an agreed way of focusing the debate in the second period of work.

93. The work undertaken in this second period (**information-sharing on specific sectors**) enhanced the understanding on benefits and limitations of mitigation options in specific sectors. Five in-session workshops were organized – **some of the workshops focused on specific sectors** identified in the AR4 (e.g. **agriculture, forestry and energy supply**), while other sectors were discussed in presentations given at workshops addressing broader topics (e.g. **industry, waste management, residential and commercial buildings, and transport and its infrastructure**). The last workshop focused on non-CO<sub>2</sub> emissions from a wide range of different agricultural and industrial sources.

94. At SBSTA 32, Parties discussed different proposals for work under this agenda item, taking into consideration the opportunity offered to the SBSTA to support the work and negotiations on mitigation under the Bali Action Plan and to undertake further scientific, technical and methodological work on mitigation under the SBSTA. These proposals address the following thematic areas and activities: mitigation scenarios to avoid dangerous



climate change; scientific, technical and socio-economic aspects of mitigation in specific sectors (e.g. agriculture and energy supply and use); near-term mitigation actions (e.g. potent short-lived climate-forcing agents); carbon space required to achieve industrialization, urbanization and modernization; and enhancement of the sharing and dissemination of information. Parties also expressed their views on possible modalities of future work, including the preparation of technical papers, the organization of workshops and the development of work programmes on specific issues.

---