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NATIONAL COMMUNICATIONS FROM PARTIES INCLUDED IN ANNEX I TO THE CONVENTION

COMPILATION AND SYNTHESIS OF THIRD NATIONAL COMMUNICATIONS

Compilation and synthesis report on third national communications

Addendum

POLICIES AND MEASURES*

Summary

This report provides detailed information on policies and measures of Parties included in Annex I to the Convention as given in their latest national communications. It provides a broad overview of these policies and analysis of their impact on past and future emission trends, together with methods of assessing these impacts. The report summarizes major policies and measures by sector, including energy, transport, industrial process, agriculture, land-use change and forestry, and waste. It highlights new policies launched in response to the commitments of Parties included in Annex I to the Convention to the Kyoto Protocol, and steps taken by these Parties towards identifying and initiating the implementation of integrated climate strategies.

* Please note that this document will be available in all six official languages before the ninth session of the Conference of the Parties.

CONTENTS

I. INTRODUCTION

A. Background and mandate

1. The Conference of the Parties (COP),by its decision 13/CP.7, requested the secretariat to make available the information on implemented and planned policies and measures related to the work on "good practices" in policies and measures reported by Annex I Parties in their third national communication (hereinafter referred to as NC3) (FCCC/CP/2001/13/Add.1). In response to this decision, the Subsidiary Body for Scientific and Technological Advice (SBSTA), at its fifteenth session, requested the secretariat to compile information on policies and measures reported by Annex I Parties in their NC3 for consideration at its seventeenth session (FCCC/SBSTA/2001/8, para. 35 (c)). Furthermore, the SBSTA, at its sixteenth session, requested the secretariat to consider Article 2.3 of the Kyoto Protocol when compiling the above-mentioned information (FCCC/SBSTA/2002/6, para. 66 (c)).

2. Pursuant to the mandate referred to above, the secretariat prepared a report on policies and measures of countries included in Annex I to the Convention, which was considered by the SBSTA at its seventeenth session (FCCC/SBSTA/2002/INF.13). As the report covered information on the NC3 of 23 Parties which had submitted their NC3 by the end of June 2002, it was considered as a preliminary one. The current report is an update of the previous report containing, in addition to the previous report, information from nine countries that had submitted their national communications by 30 March 2003. The current report covers information from Australia,[1] Austria, Belgium, Bulgaria,[1] Canada, Croatia, Czech Republic, Estonia, the European Community, Finland, France, Greece,[1] Germany,[1] Hungary,[1] Italy,[1] Japan, Latvia, Liechtenstein, Lithuania,[1] Monaco, Netherlands, New Zealand, Norway, Poland, the Russian Federation,[1] Slovakia, Slovenia,[1] Spain, Sweden, Switzerland, the United Kingdom of Great Britain and Northern Ireland and the United States of America .

3. In addition, pursuant to decision 33/CP.7 and the conclusions of the Subsidiary Body for Implementation (SBI) at its sixteenth session, the secretariat is to prepare a compilation and synthesis report of the NC3 of Annex I Parties for consideration by the SBI at its eighteenth session. The current report is a background document for the part of the compilation and synthesis report related to policies and measures of Annex I Parties.

B. Approach

4. The analysis presented in this report is based on the information from the NC3, mainly in the chapter on policies and measures. However, it also draws upon information from other chapters, such as those on national circumstances, projections and total effect of policies and measures and, when relevant, from the chapters on research and systematic observation, and education, training and public awareness.

5. In addition, the secretariat used for this analysis information on greenhouse gas (GHG) emissions and trends from the 2002 annual inventory submissions by Annex I Parties summarized in documents FCCC/SB/2002/INF.2 and FCCC/WEB/2002/10, together with information from Parties who submitted data subsequent to the preparation of these documents (Bulgaria, Lithuania, Monaco, Russian Federation, Slovakia).

6. The analysis follows a sectoral approach, in accordance with the UNFCCC guidelines. Sectors addressed include **energy**, **transport**, **industry** (also referred to as **industrial processes**), **agriculture**, **forestry** (also referred to as **land-use change and forestry (LUCF)**) and **waste management**. Given that energy is the most important sector in terms of emissions for most Annex I Parties, and that most of the policies and measures have been identified and reported in this sector, the following subsectors within energy were addressed in accordance with the outcome of the workshop on Annex I national

[1] These are Parties that were not included in the previous report FCCC/SBSTA/2002/INF.13.

communications (FCCC/SBI/2001/INF.4) and Intergovernmental Panel on Climate Change (IPCC) emission source categories: **energy industries**, **energy use in industry** (includes energy use in manufacturing industry and construction), **energy use in the residential, commercial and institutional sector and "others" sector** (also referred to as energy use in other sectors), and **fugitive emissions**. When policies affected more than one sector (e.g. emissions trading), they were classified as **cross-sectoral**.

7. Within each sector, the analysis covers the implementation of policies and measures, using different types of policy instruments, as defined in the UNFCCC guidelines.[2] These include **economic instruments**, **fiscal instruments**, **voluntary agreements**, **regulations**, **information**, **education and public awareness**, and **research**. When the policy instruments were not specified or did not fit into any of these categories, they were classified as **policy processes**[3] or **others**. In addition to sectoral analysis, general tendencies in the implementation of policies and measures are presented, including some relevant aspects of national circumstances, institutional development and some indicators of policy performance.

8. To facilitate the analysis, the secretariat prepared a database of policies and measures of Annex I Parties from their NC3, referred to below as the database. The database contains mainly information on key policies and measures reported by the Parties in the relevant summary table, as required by the UNFCCC guidelines. It also contains policies which have been reported as having a substantial impact, or are innovative, or replicable, or could modify long-term trends or have a negative impact on emission trends. In cases when a Party reported a large number of policies and measures in the summary table of its NC3, a choice of those to be included in the database was made according to the following criteria: (i) policies and measures already implemented or adopted, and clearly on track to be implemented in the near future; (ii) policies and measures with a substantial effect; and (iii) policies and measures at national level.[4] The level of detail in the database broadly corresponds to the requirements of the UNFCCC guidelines for reporting of information on policies in the form of a summary table. The analysis in this report is strongly linked to policies and measures included in the database, but a great deal of information taken directly from the NC3 was also used.

9. A printout from the database is contained in the updated web-based document, "Policies and measures reported by Parties included in Annex I to the Convention in their third national communications. Database information (FCCC/WEB/2003/1)". For each country, this document contains its GHG emission profile based on the information from the 2002 annual GHG inventories and key policies and measures.

II. OVERVIEW OF THE POLICIES AND MEASURES

A. Reporting issues

10. The NC3 of Annex I Parties contain a wealth of information on their climate change policies and measures. Parties considerably improved the presentation of information and reporting of policies and measures in the NC3 compared to the previous national communications. This was most likely due to improvements in the UNFCCC guidelines and also because of the increased capacity of Parties for climate change analysis and reporting. The quality of reporting improved in the energy and transport sectors, which are the most important sectors in terms of emissions and mitigation policies for the countries being reviewed, except for New Zealand, where agriculture is the most important sector. The quality also improved in other sectors which had received considerably less attention in previous

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[2] Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications. Document FCCC/CP/1999/7.

[3] The secretariat used the category "policy processes" for policies that involved the preparation of national climate change programmes and strategies, with involvement in many cases of key stakeholders.

[4] Including information on policies and measures at regional and local level at this stage could potentially lead to double counting (see FCCC/SBI/2001/INF.4).

communications. For example, the increasing role of fluorinated gases (hydrofluorocarbons, HFCs, perfluorocarbons, PFCs and sulphur hexafluoride, SF_6) in industrial processes resulted in more attention being given to the policies targeting these gases.

11. Still, in many cases information was not very transparent and the reporting did not strictly follow the requirements and categorization required by the UNFCCC guidelines. Also, the UNFCCC guidelines are somewhat unclear in some respects: e.g. they contain a separate "industry" sector, and some Parties reported in this sector measures aiming at mitigation of both emissions from industrial processes and emissions resulting from energy use in industry. There was often no clear correlation between policies and measures and their effect on historical and future emission trends. The reporting of information on the status of implementation has improved, but in some cases it still remains unclear as Parties did not always use the terminology agreed in the UNFCCC guidelines ("implemented", "adopted" and "planned") in a consistent manner. Finally, if a policy was not included in the summary table required by the UNFCCC guidelines, it was difficult to ascertain the status of implementation from the NC3 text.

12. In many reports, some important elements of information were missing; for example, only a few Parties reported on the cost of measures (Australia, Croatia, France, Italy, Netherlands, Norway, Switzerland), although many Parties reported on overall funding of certain policies and measures (e.g. Australia, Finland, Latvia, Netherlands, Sweden). Some Parties did not report policies by sector, but rather by gas and then by sector (Japan, Latvia, Lithuania, Netherlands, New Zealand). Most Parties used the terms given in the guidelines to categorize the type of policy instrument (fiscal, regulation, etc.), although there were a few deviations from this terminology.

13. Parties also differed considerably in their approach as to which policies and measures to include in the summary table, which according to the UNFCCC guidelines should contain all the principal policies, and some did not provide such a table at all. Some Parties reported 10–15 key policies and measures in sufficient detail for the reader to have a good overview. Others reported more than 100 policies and measures, including projects on international cooperation, which did not contribute to the transparency of reporting. There was also inconsistency in terms of the detail provided in the NC3 of different Parties and within many NC3 across different sectors. Also, Parties rarely reported information on policies that may lead to greater levels of emissions, or policies and measures no longer in place.

B. Overview of policies reported

14. Climate change has risen in importance in the national policy agenda in recent years in almost all Parties, and some of them acknowledged this (e.g. Belgium, Netherlands). Others stressed the strong links between climate change, energy and mobility on the one hand and sustainable development objectives on the other hand (Belgium, Canada, European Community, Estonia, France, New Zealand, Poland, Slovakia, Sweden, United Kingdom). Related to sustainable development, most of these countries attempted to address all three aspects of the sustainable development paradigm – economic, social and environmental – in an integrated manner. The European Community highlighted sustainable development as being amongst its fundamental objectives and noted the links to climate change. Many Parties have become instrumental in integrating climate change into policy objectives of the different sectors, especially the energy sector (European Community, Estonia, Finland, France, New Zealand, Poland, Sweden). This is also true to a lesser extent for other sectors, such as agriculture and waste (New Zealand, Sweden), and transport (Finland).

15. Most of the Parties with economies in transition (EIT Parties) acknowledged the importance of harmonizing their national legislation with European Community legislation, in the framework of the European Community accession partnership, in shaping their climate policies and climate policy objectives. This involved the translation of several European Community directives into national law in the following areas: energy (liberalization of electricity and gas markets, fuel excise taxes), waste, air and water pollution and agriculture (European Community Common Agricultural Policy, CAP). It also extended to initiating implementation of this national law and launching environmental monitoring

systems. Several European Community programmes that provided the accession countries with both financial and methodological support (PHARE, SAPARD, ISPA) were noted.

16. Parties reported policies and measures in all sectors as required by the UNFCCC guidelines. These policies covered all important sources of emissions much more comprehensively than in the previous communications. The policies and measures reported in the NC3 broadly showed continuity with those reported in the previous communications, as Parties continued to report on strengthening of existing policies launched with objective other than climate change but having climate change benefits. However, there was also a clear shift towards implementing new policies and measures that have climate change as their primary objectives, and placing more emphasis on these policies in the evolving climate response strategies of Parties. Examples of such policies and measures include emissions trading, carbon dioxide (CO_2) taxes and green certificate trading. The most important objectives of policies and measures reported are summarized in box 1.

Box 1. Major objectives of climate change policies reported by Annex I Parties

Energy

- Promotion of economically efficient energy supply and energy use
- Enhanced energy security and diversification of energy sources
- Protection of the environment
- Promotion of energy sector reform to increase economic efficiency by introducing more private sector participation, more competition in supply and distribution, and increased consumer choice over energy suppliers
- Promotion of efficient use of resources, including energy resources, through green tax reform
- Climate change mitigation through emissions trading

Transport

- Air quality management
- Congestion management
- Energy security

Industrial processes

- Reduction of gases emitted as by-products in industrial processes
- Improved efficiency of industrial processes
- Minimization of the use of fluorinated gases in products, and of their emissions

Agriculture

- Improved environmental performance of agriculture, e.g. preventing pollution of underground waters
- Promotion of sustainability through, for example, improved food quality, rural development, organic farming and land-use planning

Land-use change and forestry

- Protection and sustainable management of forests
- Conservation of biodiversity, wildlife, soil and water
- Enhancement of forest sink capacity through afforestation and reforestation

Waste

- Reduced environmental impacts of waste management such as impacts on air, soil and underground waters
- Waste minimization and recycling.

17. In terms of gases and sectors targeted, emissions of CO_2 from the energy and transport sectors were by far the most important. This explains the large number of policies and measures reported in the energy sector. However, in the past many Parties have achieved substantial reductions in emissions of non-CO_2 gases from sectors other than energy, e.g. emissions from waste and industrial processes. It seems that these sectors and emissions were easier to address because of the much more limited number of industries and sources involved. In addition, it seems that measures targeting non-CO_2 gases are more cost-effective. This stems, in part, from the fact that a large proportion of the cost is associated with objectives other than climate change, e.g. reducing pollution of air and underground waters, or enhancing productivity in aluminium and adipic acid production. Also, many of the non-CO_2 gases originated from a very narrow sector of the economy, which was easier to address by policies and measures.

18. The overall emission reduction from the baseline in the United States, for example, totalled 242,000 Gg in 2000 with almost equal contribution from policies targeting CO_2 and non-CO_2 emissions. Similarly, Norway reported emission reductions of 7,600–9,900 Gg in 2000 with more than half of the reductions coming from non-CO_2 gases. Between 1990 and 2000 Germany achieved substantial emission reductions of methane (CH_4) by 45 per cent and nitrous oxide (N_2O) by 32 per cent, while the CO_2 reduction was around 15 per cent. The tendency to obtain a relatively high share of reductions from non-CO_2 gases is likely to be extended in the future, when most of the Parties expect emissions from non-CO_2 gases to decline or at least to stabilize at their baseline level, while, even with additional measures, CO_2 emissions will continue to rise in many Parties (FCCC/SBI/2003/7/Add.1). The European Community, for example, expected its CO_2 emissions to grow by 4 per cent between 1990 and 2010 with existing measures, while non-CO_2 emissions were expected to decrease by 10 per cent. The most frequently reported policies and measures in all sectors are summarized in box 2.

Box 2. Key policies and measures reported by Parties in all sectors

	AUS	AUT	BEL	BGR	CAN	CHE	CZE	DEU	ESP	EST	EC	FIN	FRA	GBR	GRC
Combined heat and power		X	X	X				X					X	X	
Renewable energy sources	X	X	X	X	X	X		X	X		X	X	X	X	X
Fuel switch (mainly to natural gas)				X			X	X	X	X		X	X	X	X
Energy efficiency improvements	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Vehicle and fuel taxes		X	X			X		X		X		X	X	X	
Integrated transport policy frameworks	X	X				X					X	X			
Pollution prevention in industry	X	X	X	X		X	X	X		X			X	X	X
Landfill site gas recovery	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fertilizer and manure management	X	X	X	X			X	X	X	X	X		X	X	X
Common Agricultural Policy		X	X					X			X	X		X	X
Afforestation/reforestation	X		X	X	X	X	X	X	X	X	X	X	X	X	

	HRV	HUN	ITA	JPN	LTU	LVA	NLD	NOR	NZL	POL	RUS	SVK	SVN	SWE	USA
Combined heat and power	X		X			X	X	X				X	X		X
Renewable energy sources	X	X	X	X	X	X	X	X				X	X	X	X
Fuel switch (mainly to natural gas)	X		X	X									X		
Energy efficiency improvements	X		X	X	X	X	X	X		X	X	X	X	X	X
Vehicle and fuel taxes							X	X						X	
Integrated transport policy frameworks							X							X	
Pollution prevention in industry	X		X	X		X	X	X				X	X		X
Landfill site gas recovery		X				X	X	X	X	X		X	X	X	X
Fertilizer and manure management	X		X	X	X	X			X	X		X	X		X
Common Agricultural Policy			X											X	
Afforestation/reforestation	X			X	X	X	X		X	X		X		X	

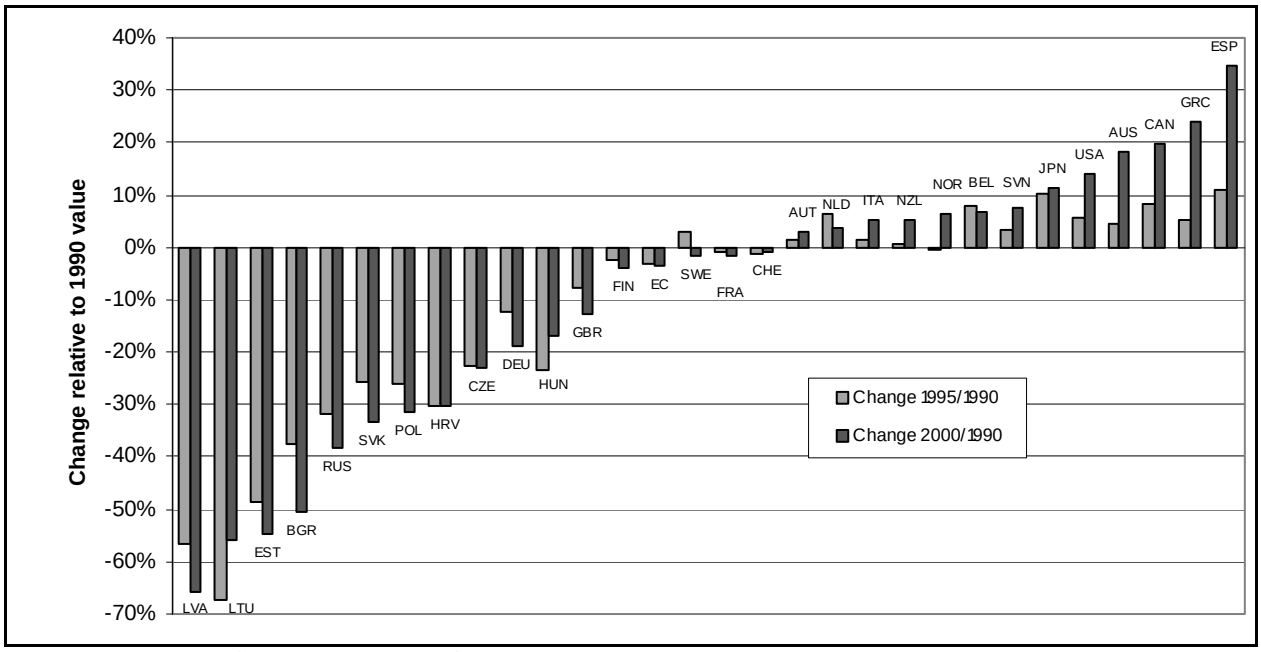
Note: For an explanation of country codes, please refer to the annex.

19. Some sectors, however, are yet to receive the necessary attention. Transport, for example, is among the largest emission sources and/or fastest-growing sectors for most Parties. However, few policies and measures were reported there (around 14 per cent of all key measures) and very few of them seem to deliver noticeable reduction gains. In the industrial processes sector, process-related CO_2 emissions from the iron and steel and cement industries were important sources of emissions. However, policies and measures were implemented as incremental mitigation options because industry-transforming technologies were not easily available. Agriculture is also an important sector for some Parties, but it was difficult to find noteworthy measures for emission reduction apart from fertilizer and manure management and the EC CAP.

C. Past and future emission trends as a context for consideration of policies and measures

20. As the data from the GHG inventories up to 2000 suggest, emissions of most Annex II Parties covered in this report were above the 1990 levels in 2000, without LUCF, but all EIT Parties remained below this level (figure 1 and boxes 3 and 4).

Figure 1. Changes in aggregated GHG emissions of Annex I Parties without emissions and removals from LUCF in 1995 and 2000 compared to 1990 (percentage)



Note: For an explanation of country codes, please refer to the annex.

21. Some policy-relevant national circumstances, e.g. higher-than-expected economic growth and lower-than-expected oil prices, contributed to the higher-than-expected baseline emissions and lowered the actual emission reductions from many policies, especially of policies aimed at energy conservation, in some of the Annex II Parties experiencing emission growth (e.g. Netherlands, United States). In addition, in many Parties climate policies implemented at the beginning of the 1990s were not sufficient to deliver the reductions needed to stabilize emissions, or the development and implementation of policies took much longer than expected, or policy mix relied heavily on voluntary approaches with no consequences in case of non-compliance with the targets set. However, the end of the 1990s saw some slowdown in the rate of emission growth in several Annex II countries (Belgium, Japan, Netherlands) and in 2000 emissions in some Annex II Parties only slightly exceeded their 1990 emission levels (Austria, Italy, Netherlands, New Zealand). This observation could be at least in part explained by the effects of climate policies, although some slowdown in economic growth at the end of the decade and milder winters could also have contributed. The Netherlands, for example, noted that more than half of the energy efficiency improvement throughout the last decade could be attributed to energy conservation.

22. In terms of emissions by sector, the emission profile of the Parties remained broadly unchanged. Energy industries, with a share of 32 per cent of the overall emissions in 2000, and transport, with a share of 22 per cent, remained by far the most important sectors. These were followed by energy use in industry (14 per cent), energy use in other sectors (residential, commercial, institutional and others) (11 per cent), agriculture (7 per cent), industrial processes (5 per cent), fugitive emissions (4 per cent) and waste (3 per cent). Substantial differences remained, however, between the shares of emissions by sectors between different Parties.

Box 3. Several Annex II Parties contributed significantly to attaining the aim of Article 4.2 of the Convention

The European Community, Finland, France, Germany, Sweden, Switzerland and the United Kingdom contributed substantially to attaining the aim of Article 4.2 of the Convention: individually or jointly to return the GHG emissions in 2000 to their 1990 levels. The success in achieving the stabilization aim of the Convention was attributed by Parties to a mix of factors, such as: proactive climate change policy, including policy to improve energy efficiency and to reduce non-CO_2 gases; fuel switch from coal to natural gas; increased utilization of nuclear power plants; growing share of renewables in energy supply mix; and some economic slowdown in the early or mid-1990s.

More specifically, the increase in emissions of many European Community member States was offset mainly by the emission drop in Germany and the United Kingdom. In Germany, a considerable overall reduction in emissions was achieved chiefly through reductions of CO_2 emissions stemming from the economic restructuring resulting from unification of the country, reduced use of lignite and a steep increase of the share of renewable energy in the energy supply mix There were also substantial reductions of CH_4 emissions from coal production, waste management and agriculture, and N_2O reductions from agriculture. In the United Kingdom the decrease in emissions was largely attributed to the effect of market liberalization and the resulting fuel switch from coal to natural gas. In France, the stabilization of emissions was mainly achieved by reducing emissions of N_2O from the chemical industry and increasing the share of nuclear power in electricity generation. In Finland, the decrease in emissions stemmed mainly from a shift from coal and peat to natural gas, increased share of renewables, especially linked to good hydropower availability in the Nordic electricity market, and upgrading of existing nuclear power plant.

23. Among all sectors, emissions from transport and international bunkers grew the most, by around 20 per cent and 17 per cent respectively, followed by emissions from energy industries (10 per cent). Emissions from industrial processes and energy use from the "other" sector (mainly residential, commercial and institutional) did not show a clear trend, but still slightly decreased at the end of the 1990s. Emissions from waste, energy use in industry and agriculture showed a considerable decrease of around 7 per cent between 1990 and 2000. Fugitive emissions exhibited a clear downward trend, and in 2000 they were around 30 per cent lower than they had been in 1990.

Box 4. Several Annex I Parties with economies in transition were successful in achieving economic growth without a corresponding increase in emissions

The 2000 inventory data suggest that emissions of Annex I EIT Parties, except for Slovenia, were well below their 1990 levels in 2000. Decreases ranged from 66 per cent in Latvia to 17 per cent in Hungary. The important observation, however, is that in many of these countries the economy revived after the crisis in the 1990s, but emissions grew at a much slower rate or even continued to decline (e.g. the Czech Republic, Hungary, Poland, Slovakia, Slovenia). In Poland, for example, the economy grew steadily between 1990 and 1998, with an average growth of 6.6 per cent annually between 1995 and 1997 and 4.3 per cent annually between 1997 and 1998, while emissions continued to decline. This suggests a significant decoupling of economic growth from emissions growth due to a profound structural reform of the economy combined with the effect of switching from coal to gas in energy supply. As the EITs continue to converge towards the much lower energy intensities typical of Annex II countries, this decoupling effect is likely to diminish.

24. Projected future emission trends by sector broadly followed the historical trends.[5] Transport and bunker fuel continued to be the fastest-growing sectors, followed by energy industries. Emissions from waste are expected to continue to decline, with very few exceptions (e.g. Canada). Most of the European Community countries are expecting emissions from waste to drop more than twofold between 1990 and 2010 (e.g. France, Italy, Netherlands, United Kingdom) and Germany expects a fourfold drop. Emissions from industrial processes are projected to increase in most of the Parties, as the growth of emissions driven by economic growth and phasing out of ozone-depleting substances is expected to outweigh effect of reduction of emissions of N_2O and SF_6. Emissions from other sectors did not suggest any consistent trend among the Parties.

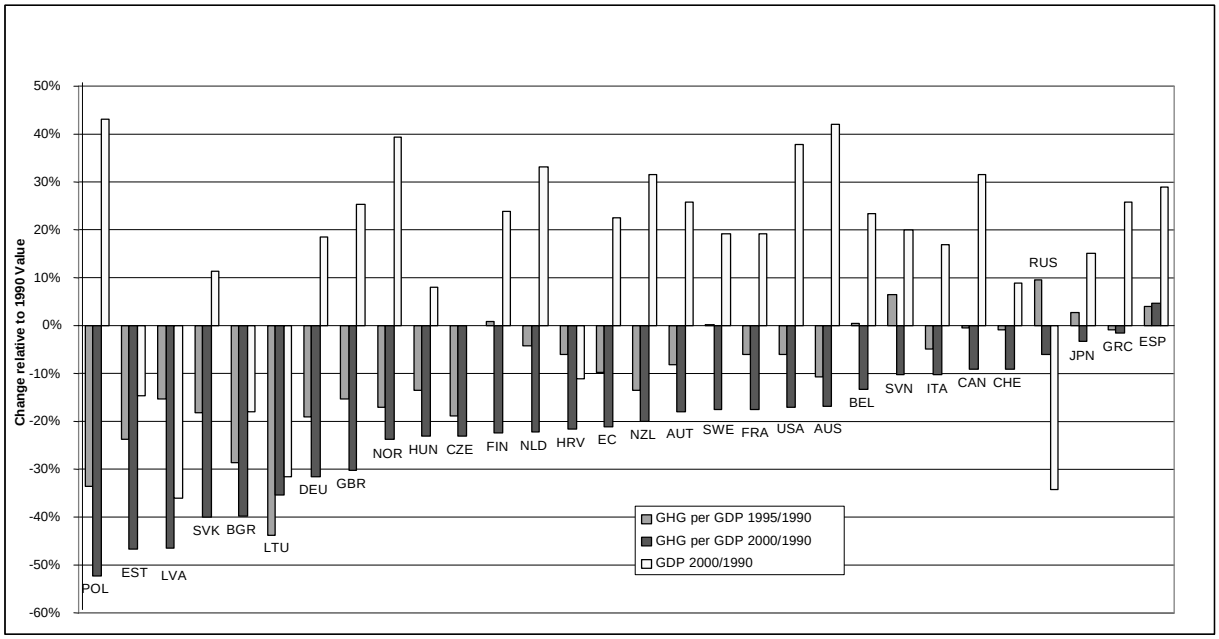
[5] For further details on projections in this paragraph and throughout the current report on policies and measures see the section on emission projections in documents FCCC/SBI/2003/7 and Add.3.

25. With a few exceptions (e.g. Norway, United States), Annex II Parties expected their total emissions to grow at a slower rate, or in some cases to stabilize after some initial post-2000 growth, with the existing policies and measures. However, for many Parties these policies may not be sufficient to achieve the Kyoto Protocol targets (e.g. Australia, Austria, Belgium, Canada, Croatia, Finland, France, Germany, Japan, Netherlands, New Zealand, Norway, Slovenia, Spain). Additional measures may help to at least return the emissions in some of these countries in 2010 to below the 1990 level (Austria, Croatia, Finland, France, Japan, Slovenia). Projections data for EIT Parties suggest that, after the drop in emissions between 1990 and 2000, either emission growth is expected to rebound, or emissions were already following an upward trend at the end of the 1990s. For these countries, except Slovenia and Croatia, it should not be difficult to achieve the Kyoto Protocol targets with the existing policies.

D. Some indicators of policy performance

26. Many Parties used different sets of highly aggregated indicators to assess policy performance and the impact of the key drivers on emission trends at national and sectoral level. These indicators were also used in setting the national and sectoral goals for policies. In particular, Parties used such indicators to assess improvements in the **emission intensity of their economy**, expressed as a ratio between total GHG emissions and gross domestic product (GDP) (figure 2).[6] This intensity could be defined by means of the **energy intensity of the economy**, expressed as a ratio between the total primary energy supply (TPES) and GDP (figure 3), and the **emission intensity of the TPES**, which could be expressed as a ratio between energy-related GHGs and the TPES (figure 4). Finally, a combination of two indicators, such as the emission intensity of the economy and emissions per capita, was also used. In most of these indicators, GDP was among the major factors considered, because in terms of growth and structure it reflects important aspects of national circumstances. In addition to these aggregated indicators, Parties used many disaggregated sector-specific indicators by which the effect of the mix of policies affecting the same output, e.g. vehicle miles travelled, could be monitored and assessed in detail.

Figure 2. Changes in emission intensity of economies in 1995 and 2000 compared to 1990 and change in GDP in 2000 compared to 1990 (percentage)

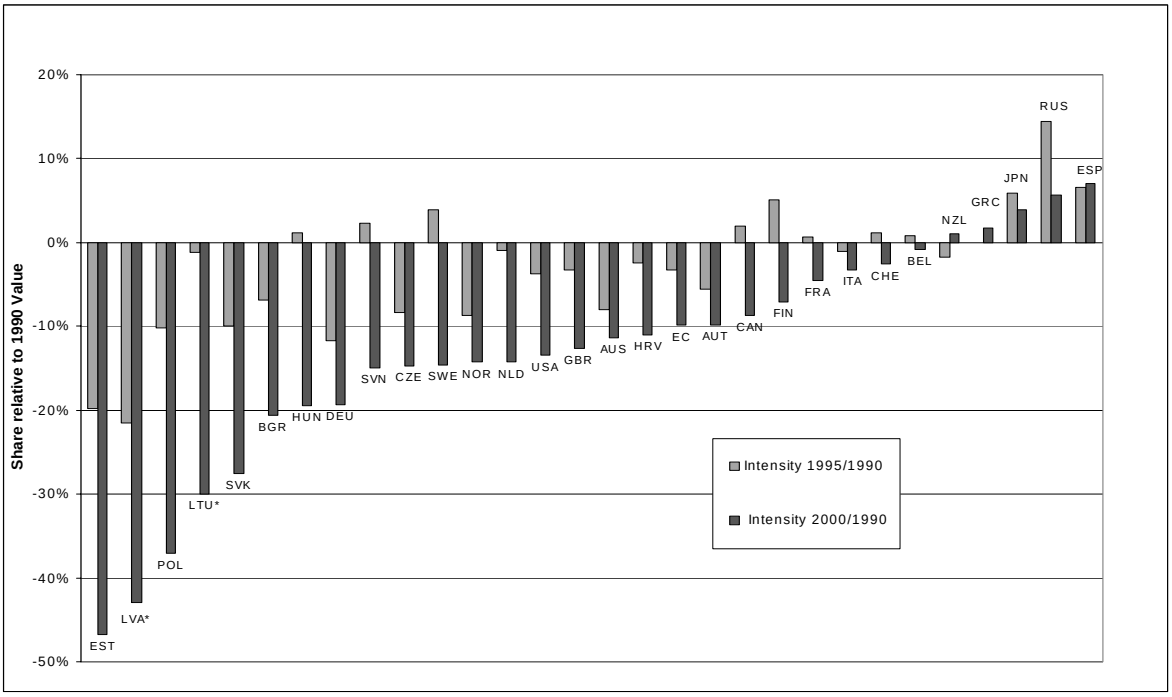


Note: For an explanation of country codes, please refer to the annex.

[6] Emission estimates to calculate the indicators are from the UNFCCC inventory database. GDP data, at constant prices expressed in purchasing power, and population data are from the International Energy Agency (IEA) database.

27. The data on the emission intensity of the economy suggest that, in all Parties except Spain, this intensity declined between 1990 and 2000. This reflects structural shifts and efficiency improvements in the economy, and some decarbonization of the energy supply mix. In terms of this indicator, Parties could be split into several groups. The first group encompasses Parties with an intensity improvement of more than 30 per cent. The EIT Parties formed the core of this group (Bulgaria, Estonia, Latvia, Lithuania, Poland, Slovakia) together with the United Kingdom and Germany.[8] Most of the Parties fell within the second group, with an emission intensity decrease of around 20 per cent (Australia, Austria, Croatia, Czech Republic, European Community, Finland, France, Hungary, Netherlands, New Zealand, Norway, Sweden, United States), which suggests intensity improvement of around 1.8 per cent annually. It is important to note that some Parties in the second group and some Parties in the first group experienced considerable economic growth but still ranked high in terms of emission intensity improvement (Australia, Netherlands, New Zealand, Norway, Poland, United States). The rest of the Parties had an intensity improvement of around 10 per cent (Belgium, Canada, Italy, Slovenia, Switzerland), or did not exhibit a clear decline in the intensity trend or even increased it (Greece, Japan, Russian Federation, Spain).

Figure 3. Changes in energy intensity of economy in 1995 and 2000 compared to 1990 (percentage)



Note: For an explanation of country codes, please refer to the annex.

* For these Parties the TPES data for 1990 were not available from the IEA database, so 1992 values were used instead.

28. The energy intensity of the economy declined in most countries, with a few exceptions (Greece, Japan, New Zealand, Russian Federation, Spain). This decline was more prominent in the EIT Parties, but also in some Annex II Parties (Australia, Austria, Germany, Netherlands, Norway, Sweden, United Kingdom, United States). The main drivers behind the decline were structural changes in economies reflecting the stage of development of post-industrialized societies in most of the Annex II Parties, with continuing emphasis placed on high-technology products and services. These structural changes have gradually altered energy and emission intensity, as well as composition of the national output. Other important drivers were autonomous improvements in energy efficiency due to capital stock turnover and,

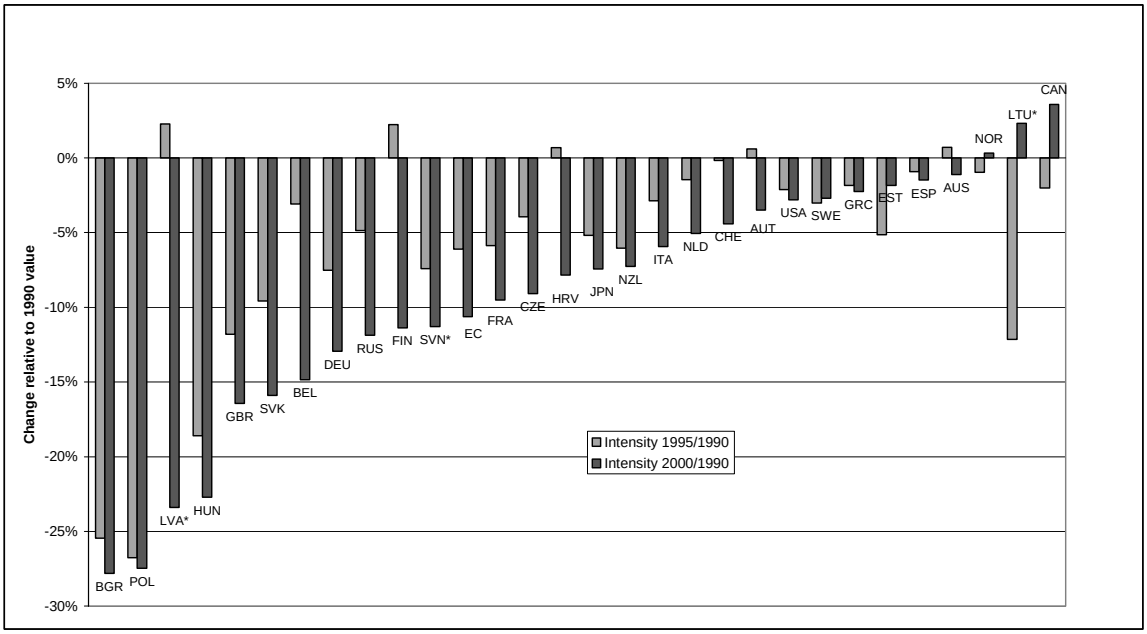
[7] The reasons for the intensity improvements in EIT Parties, the United Kingdom and Germany are explained in boxes 3 and 4 above.

[8] The reasons for the intensity improvements in EIT Parties, the United Kingdom and Germany are explained in boxes 3 and 4 above.

in some cases, success in promoting energy efficiency beyond this level. In the case of Japan, the country had already achieved high energy efficiency gains in its economy in the 1980s and the economic structure did not change much in the last decade, which explains the lack of progress in energy efficiency improvement.

29. The emission intensity of the TPES, reflecting mostly carbon intensity, declined in most countries except Canada, Lithuania, Norway and Slovenia, suggesting some level of decarbonization of the energy supply mix originating from a switch from coal to gas, increased utilization of nuclear plants where available, increased efficiency of energy transformation systems and an increased share of renewable energy (figure 4). The rate of decarbonization was substantial in several Parties (Belgium, Bulgaria, European Community, Finland, Germany, Hungary, Latvia, Poland, Russian Federation, Slovakia, United Kingdom).

Figure 4. Changes in emission intensity of the total primary energy supply in 1995 and 2000 compared to 1990 (percentage)



Note: For an explanation of country codes, please refer to the annex.

* For these Parties the TPES data for 1990 were not available from the IEA database, so 1992 values were used instead.

30. Sweden reported a combination of two related indicators: the emission intensity of the economy and emissions per capita. Following this approach, the trend analysis of these two indicators between 1990 and 2000 for all Annex I Parties suggests that most of the Annex II Parties that reduced the emission intensity of their economies also reduced their per capita emissions (European Community, New Zealand, Switzerland). The rest of the Parties continued to improve the emission intensity of their economies (Australia, Canada, Norway, United States) or at least maintained it at the same level (Japan), while increasing their per capita emissions, which in some of these countries were already among the highest (Australia, Canada, New Zealand, United States). Spain increased both its per capita emissions and the emission intensity of its economy. Although EIT Parties showed a remarkable decrease in both indicators, some of them showed some growth of emissions per capita while continuing to improve emission intensity (Hungary, Slovenia).

III. CROSS-CUTTING ISSUES ON POLICIES AND MEASURES

A. Role of the Kyoto Protocol in shaping of domestic policy responses

31. Parties included in this report, with a few exceptions (e.g. Russian Federation, United States), underlined the importance of the Kyoto Protocol in shaping their domestic climate policy responses. They noted the steps taken to prepare for the ratification of the Protocol, including the necessary legislation. They reiterated their Kyoto targets as a first step towards long-term and continued emission reductions, and stressed the importance of the domestic effort to deliver substantial contributions towards meeting these targets.

32. Parties stressed to a varying extent the need to use the Kyoto Protocol's mechanisms and removals by sink in addition to domestic measures to achieve these targets. In particular, Netherlands noted that it expects domestic policies and offshore emission reductions through the Kyoto mechanisms to contribute almost equal shares to the emission reductions needed to achieve its Kyoto target. Similarly, Norway noted that domestic policies are expected to deliver a substantial proportion of the reductions needed to achieve its Kyoto target, and could reach around half of these reductions, given the emission projections. Overall, Parties made references to all three Kyoto mechanisms: joint implementation (Bulgaria, Canada, Czech Republic, Finland, Hungary, Italy, Japan, Latvia, Netherlands, Norway, Poland, Slovakia, Sweden, United Kingdom), emissions trading (Hungary, Japan, Latvia, Netherlands, Slovakia) and the clean development mechanism (Canada, Finland, Italy, Japan, Netherlands, Norway, Sweden, United Kingdom). European Community members and European Community accession states referred to the European Community scheme of emissions trading in addition to emissions trading under the Kyoto Protocol outside the European Community.

33. Conversely, some Parties (for example, Sweden) seem to plan a very limited use of the Kyoto mechanisms and emphasized the role of specific policy instruments in the domestic policy context in order to meet the Kyoto target; e.g. France emphasized the role of **ecological or green tax reform**. A few Parties (e.g. Australia) envisaged that net emissions and removals from LUCF, including emissions and removals according to the Kyoto accounting rules, would contribute significantly to meeting the targets.

34. Some EIT countries noted that attaining the Kyoto targets is realistic in their specific economic and environmental context. They acknowledged the uncertainties of the future emission estimates and noted that these estimates could be higher projected due to possible faster economic growth. They commented on the role of energy efficiency, energy market reform and renewables in reaching the Kyoto targets.

35. The United States reported a new domestic target to reduce its emission intensity by 18 per cent over the next decade through a combination of voluntary, incentive-based and existing mandatory measures. This was reported to represent a 4.5 per cent reduction from the emission level projected in 2012 under a "business as usual" scenario.

B. Institutional framework for climate change policy

36. As part of their climate change policy framework, many Parties reported strengthening of the existing institutional arrangements for the design and implementation of climate change policy. In particular, more emphasis was placed on coordination and strengthening the interconnections between all relevant national institutions, together with involvement of new institutions, to ensure an integrated approach to policy (Sweden, United Kingdom). More emphasis was placed on the work of the ministries of energy and economic affairs and, when relevant, transport, agriculture and forestry. This reflected the prominence of particular sectors such as energy, and particular instruments such as economic instruments, in national climate change strategies. The ministry responsible for the environment continued to coordinate or at least to have key responsibilities for climate change policy in many Parties

(Austria, Czech Republic, Estonia, Finland, Latvia, Netherlands, Poland, Slovakia, Sweden, United Kingdom).[9]

37. A few Parties reported on new institutions being set up to address climate change, which provided a strong foundation for a comprehensive and targeted set of policies and measures. New Zealand reported on the Climate Change Ministerial Group set up in 2000, directly accountable to the Prime Minister. France reported on reinforcement of the inter-ministerial task force on climate change by placing it directly under the office of the Prime Minister. Japan reported on reinforcement of the global warming prevention headquarters set up in 1997 under the Cabinet of Ministers.

C. Level of government and stakeholders involved in climate change policy formulation and implementation

38. Central governments continued to play a major role in setting the overall climate response strategy. Greater involvement of local and regional governments and municipalities, as well as consultation and collaboration with targeted groups and major stakeholders, seem to have an increasingly important role in climate change policy-making (Austria, Belgium, Canada, European Community, Finland, Netherlands, New Zealand, Switzerland). This reflected the expectation that in the future regional and local governments, municipalities and key stakeholders were likely to play an increasingly prominent role in addressing both mitigation and adaptation issues. Such tendencies were either related to the existing distribution of powers (Austria, Belgium, Canada, Czech Republic, Finland, Japan, New Zealand, Norway, Slovakia, Sweden, United States) or linked to the ongoing process of devolution of power (e.g. France, Italy, United Kingdom).

39. Typically, the implementation of some specific aspects of climate policy has been delegated to local authorities, such as climate change aspects of territorial planning and management of buildings, energy conservation, transportation and waste. In some cases, however, regional governments were entrusted with the preparation and implementation of comprehensive policy plans and action programmes, sometimes in the context of the action plan Agenda 21 (e.g. Austria, Belgium).

40. Many Parties reported involvement of their cities in the Cities for Climate Protection (CCP) campaign of the International Council for Local Environmental Initiatives. This initiative aimed to provide technical assistance and training for cities to achieve GHG mitigation. The United States reported that 7,000 Gg CO_2 equivalent had already been saved annually as a result of this initiative. Australia noted that its CCP programme was the fastest-growing in the world.

41. In most Parties climate change policy emerged after several stages of intensive policy consultation with different branches and levels of governments, and key stakeholders. The consultations allowed the definition of principal measures in the national context and explored how these principal measures could be complemented by other measures at sectoral level, and at regional and local government level. Parties acknowledged that such cooperation and consultations have been critical in securing consensus and ensuring success in the implementation of climate policy.

D. A new, integrated approach to climate policy formulation and implementation

42. In some Parties the approach to climate policy formulation and implementation remained fragmented, but a clear tendency toward using a new integrated approach can be observed in most of the NC3 of the Parties that have ratified the Kyoto Protocol or intend to do so. To a lesser extent, this tendency could also be observed in the NC3 of the other Parties. This tendency was characterized by an emphasis on a portfolio and phased approach, referred to below, and also by greater involvement of local

[9] Examples of different institutional arrangements included the Ministry of Trade and Industry in Finland being responsible for coordinating the preparation of the climate change strategy, the Parliament of Norway being responsible for overall climate policy, and the United States inter-agency coordinating committee chaired by the Executive Office of the President being in charge of climate policy.

and regional governments and important groups of stakeholders in the design and implementation of climate change policy. In this integrated approach, Parties placed greater emphasis on mitigation but also included elements of adaptation, especially in sectors where the success in mitigation may depend on enhancing the adaptive capacity of different systems, e.g. LUCF.

43. Examples of such integrated approaches could be found in the draft Climate Strategy 2001 (Austria), the 2001 draft National Climate Plan (Belgium), the 2000 Implementation Strategy on Climate Change and First National Climate Change Action Plan (Canada), the 2000 European Climate Change Programme and the 2001 European Sixth Environmental Action Programme (European Community), the 1999 National Climate Policy Implementation Plan (Netherlands), the 2000 National Programme to Combat Climate Change (France), the National Climate Strategy (Finland), the 2002 Guideline for Measures to Prevent Global Warming (currently being updated) (Japan), the 1998 Climate Change Reduction Policy Plan (Latvia) and the 1999 Greenhouse Gas Abatement Programme (Australia).

44. Emphasis was placed on the portfolio approach, meaning that a wide range of instruments which complement each other were used to obtain maximum mitigation gains, for example in promoting renewable energy or energy efficiency. The portfolio approach was used at national level, for example when Parties considered supplementarity of emissions trading and CO_2 taxes, or at a level of specific policy, for example using a mix of preferential tariffs, grants and tax exemption to promote renewables. However, Parties continued to choose different portfolios and combinations of policy instruments even in cases when there is some similarity in their national circumstances.

45. Many Parties estimated that, even with the most recent measures launched in the late 1990s, they may not achieve the Kyoto targets. This is why some of them outlined a phased approach to their climate policy, meaning that they clearly identified initial and secondary or reserve policy packages to be put in place in the interim period a few years before the first commitment period under the Kyoto Protocol, if they are not then on track to meet the Kyoto targets (e.g. Japan, Netherlands, New Zealand, Switzerland). This is especially true for energy/CO_2 taxes for the Parties that have them in place or consider them as a part of their climate change policy package.

46. The Netherlands, for example, described a basic package of measures, to be supplemented by a reserve package only if it is not on track to meet its Kyoto targets. Switzerland focused on voluntary measures from 2000 to 2004 and envisaged introducing a CO_2 tax and other mandatory measures, if necessary, thereafter. The United Kingdom and Japan also identified an initial set of policies and measures to be introduced immediately and a secondary set of such measures to be introduced later.

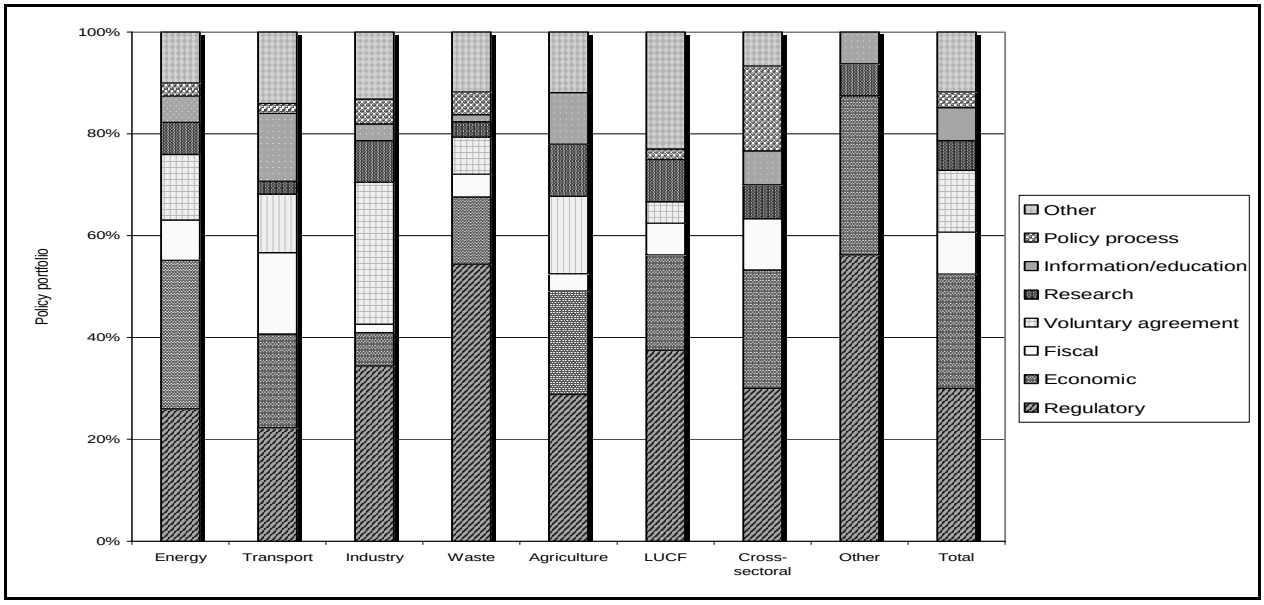
47. Greater involvement of local and regional government, as noted above, and consultation and collaboration with targeted groups and major stakeholders, seem to be pivotal elements of the new and integrated approach for climate change policy formulation and implementation. This involvement, together with the related consultation processes, contributed to defining the most effective mix of policies, given Parties' national circumstances.

E. Policy instruments used and major changes in policies and measures by sector

48. Parties used combinations of policy instruments for climate change mitigation. There was a clear common trend towards widening the scope and increasing the coverage of the policy instruments within each sector. Some important cross-sectoral instruments, such as CO_2 taxes and emissions trading, were given an increasingly prominent role. When the information from the key policies and measures from the database is considered, economic and fiscal instruments together with regulations appeared to be the most important instruments used, in terms both of their number and of the emission reduction expected (figure 5). In many cases, these instruments have created a pressure for businesses to innovate, e.g. the CO_2 tax in Norway induced some innovations in the oil and gas industry.

49. The mix of instruments used varied from sector to sector. For example, voluntary agreements still prevailed in the energy use by industry and industrial process sectors, whereas regulations together with a target-oriented approach were typical for the waste sector. More detail on the choice of policy instruments by sector and the underlying reasons for this choice is given in the analysis by sector below.

Figure 5. Composition of portfolio of policy instruments reported by Annex I Parties by sector



50. After 1997 there were significant changes in climate policies in the energy sector. These changes included: strengthening the role of some existing instruments and approaches, such as energy/CO_2 taxes; introducing new and innovative instruments, such as domestic emissions trading and green certificate trading; and placing more emphasis on climate-change-related aspects in pursuing regulatory reform in the energy sector, such as promoting renewables and combined heat and power (CHP) generation. Parties continued to explore the efficiency of different policies and approaches to mitigate emissions from transport, which remained one of the most difficult sectors for climate policies. Integrated transport policy frameworks that are well suited to national circumstances emerged as a promising climate policy approach in transport, e.g. in Finland (see box 9).

51. There was an increasing amount of fluorinated gases in the emissions from industry, resulting in an increase in policies and measures targeting these gases. In the waste sector, there was a significant shift from the end-of-pipe technologies and related policies (capture and treatment of landfill gas) to more comprehensive waste policies centring on waste minimization and recycling, and incineration and landfilling of only the remaining waste. Also, more attention was given to policies and measures in agriculture and LUCF, which stemmed from the increased awareness of the role sinks can play in meeting the Kyoto targets.

F. Role of new technologies

52. Most of the Parties attached great importance to policies fostering new technologies[10] in dealing with climate change, which underpins the need to consider these technologies as a separate issue. They also see these technologies in a broader context of dealing with other environmental economic, natural resource management and employment issues. However, it does not seem that so far the environment or climate change in particular, have been principal areas of corporate or technological emphasis. Pivotal

[10] Parties refer to new environmental and climate technologies in a broader sense, including technological aspects, skills and know-how in terms of technology and risk management.

technologies noted by most Parties included renewables, fuel cells and end-use technologies with higher efficiency.

53. Where they provided details, larger Parties generally reported a mix of long-term goals (e.g. nuclear fusion) and short-term goals (e.g. improved designs for wind turbine blades). The 2001 United States National Energy Policy, for example, referred to in the NC3, recommended the use of existing and developing technologies to reduce GHG emissions, including improved energy efficiency for vehicles, buildings, appliances and industry, development of hydrogen fuels and expanded use of cleaner fuels, including initiatives for coal and gas and new nuclear technology. Smaller Parties with limited research and development budgets frequently reported some specialization in technologies that reflect their national circumstances. For example, Hungary is one of the world's leading users of geothermal energy and has a major research and development effort in this area.

54. Most of the European Community countries considered innovations in technology as an important element of efforts to reduce emissions in the medium and long term and envisaged the expansion of programmes aimed at increasing the market penetration of the next generation of fuel-efficient technologies. They also mentioned the emission reduction gains that could be delivered by some new technologies which are close to commercial viability, such as microturbines, fuel cells, solar cells, solar heating, advanced biomass-based technologies, and propulsion systems and fuel cells in transport. Latvia noted the importance of the European Community Organization for the Promotion of Energy Technologies (OPET) network to promote new technologies, in particular renewables and energy-efficient technologies.

55. In addition to energy, several Parties reported policies aimed at stimulating research on mitigation in agriculture (France, Japan, New Zealand, Spain, United States). These policies are important, as they have the potential to provide the new technologies that will form the basis of future mitigation in a sector where so far only a few policy and technology options have been identified and implemented.

56. In most cases, the new technologies were referred to in the context of the Parties' research and development effort, or in the consideration of policies and measures, with no reference to their effect on GHG mitigation and impact on emission levels in the short and medium term. This is most likely due to the uncertainty as to when these technologies will become commercially available and their rate of market penetration. One of the exceptions in this context was Japan, which foresaw a reduction of 26,000 Gg CO_2 in 2010 from new technologies, in addition to the existing and additional measures. Also, no clear distinction was made between technologies which are at different stages of the innovative cycle. For example, new technologies that are now at the research and development or demonstration stage could bring climate change benefits in the medium and long term, e.g. beyond 2010, and for technologies in the market penetration stage limited government intervention could remove economic, regulatory, organizational and social barriers.

G. Minimizing the impact of response measures

57. As the NC3 from most Parties were prepared before the request by the SBSTA at its sixteenth session relating to the minimization of adverse effects of policies and measures of Annex I Parties on other Parties, especially developing country Parties, under Article 2.3 of the Kyoto Protocol (FCCC/SBSTA/2002/6, para 66 (c)), they did not include direct references to the implementation of this article. Moreover, according to decision 4/CP.5, para. 2, Annex I Parties had to report policies and measures following the UNFCCC reporting guidelines for the preparation of their NC3 due by 30 November 2001, (FCCC/CP/1999/6/Add.1) in accordance with decision 11/CP.4 para 2(a) (see FCCC/CP/1998/6 Add.1) rather than following the reporting guidelines under the Kyoto Protocol.

58. One Party, Norway, noted the issue of minimization of adverse effects of policies and measures of Annex I Parties on other Parties, especially developing country Parties, in the context of Article 4.8

and 4.9 of the UNFCCC. It noted that as a major exporter of fossil fuels "Norway is well aware that widespread taxation on these commodities, as well as other policies and measures that influence demand, could have implications for prices and thus affect the revenue earned by exporters". It also noted that "This has been emphasized in relation to Article 4.8 and 4.9 of the Convention. This is one of the reasons why Norway emphasized the need to devise cost-effective policies, and thus minimize such effects". It concluded that "The final effects are, however, highly uncertain and will generally also depend on the producer's policies. Norway's share as a consumer is anyway so small that it is not believed to significantly affect these markets".

59. Other Parties did not include in their NC3 information on the minimization of the impact of response measures; this is why it is not possible to draw conclusions on this issue.

IV. METHODOLOGICAL ISSUES RELATED TO DESIGN AND ASSESSMENT OF POLICIES AND MEASURES

A. Criteria used for climate change policy design and implementation

60. Parties used different sets of criteria and applied different weights to individual criteria in the ex-ante choice of climate change policies and in the ex-post evaluation of their effects. Environmental effectiveness and cost-efficiency appeared to be the most prominent criteria, but others included distributional impacts, social inclusiveness, competitiveness of industry and impacts on employment, commercial opportunities, human health and welfare, acceptability to various stakeholders, and effects in changing attitudes and behaviour.

61. The NC3 provided limited information on how these criteria were considered in policy-making. Information on the cost of implementation of specific policies was generally missing or considered uncertain and referred to other sources outside the NC3. Information on the reductions delivered or planned was provided for less than half of the measures. In most cases, only highly aggregated information on the total mitigation effect expected or the effect expected by sector was reported, and Parties noted difficulties in disentangling the effects of individual policies and measures. Even when information on cost was provided, it was difficult to judge what type of cost it represented – social, economic, marginal, shadow or other – as Parties used different cost concepts. It seems that in most cases when information on cost was provided, a cost-effectiveness analysis was conducted to estimate it, i.e. the cost associated with the implementation of a policy was assessed with regard to a policy goal set, e.g. $/tonne GHG emissions saved. Ranking the policies and measures in terms of cost efficiency depends to a large extent on national circumstances. Still, energy efficiency appeared to be among the most cost-effective measures even in countries with very different national circumstances, such as Netherlands and Australia.

62. Only a few Parties provided a comprehensive description of how different criteria were taken into account in the evolving climate change strategies (European Community, Netherlands, United Kingdom). The Netherlands, for example, reported the methodology used for cost estimates and how cost-efficiency was considered in ranking the measures within this strategy. It also reported on the possibility of saving 19,000 Gg CO_2 (11 per cent of base year emissions) at negative cost, as the value of energy saved would outweigh the cost of measures. The European Community presented in detail how cost-effectiveness could be used as an underlying criterion for climate policy design without compromising the environmental effectiveness of the policy.

63. The environmental effectiveness of policies and measures was primarily linked to climate change benefits in terms of mitigation of emissions compared to baseline levels. Parties noted substantial efficiency gains from specific policies, e.g. the European Community noted such potential gains from the Community-wide emissions trading scheme. However, the environmental effectiveness of climate policies could include not only climate change mitigation, but also other environmental benefits, e.g. local air and water quality improvement and transboundary air pollution reduction. These additional

environmental benefits could be considered together with some social and economic benefits, e.g. employment and welfare, land-use change practices, and reduced traffic congestion, as ancillary benefits arising as a consequence of climate change policies. The European Community, for example, expected around half a million jobs to be created within the renewable energy sector by 2010. Switzerland noted that its Energy 2000 programme, a core programme in implementing climate change policy, created new investment opportunities of SwF 4.4 billion and new employment amounting to 40,000 person-years.

64. However, Parties rarely elaborated on how such ancillary benefits had underpinned their policy choices. Moreover, cost-benefit analysis, although deemed important, was not provided and Parties seldom attempted to quantify the non-climate-related benefits from the reported policies and measures. This probably stems from the fact that, so far, most of the climate change policies and measures reported by the Parties have been implemented with primary objectives other than climate change. With few exceptions, climate change mitigation was a side effect of these policies, or a co-benefit.[11] An example of co-benefits for climate change is the strengthening of measures to encourage fuel switching from coal to gas reported by some Parties, with reducing air pollution being one of the policy drivers for fuel switching. New policies having climate change as their primary objective, e.g. emissions trading, which will possibly bring ancillary benefits, were launched only recently.

B. Monitoring and evaluation of policies and measures, and projections of emission levels

65. Many Parties, especially the European Community countries, stressed the role of monitoring and evaluation of climate change mitigation as an integral element of their climate change strategies. Monitoring provided a means of tracking annual emission levels and assessing progress towards meeting the policy objectives and targets, e.g. national emission targets and targets for renewables and CHP. In particular, the European Community referred to the1999 report "Monitoring mechanism of Community CO_2 and other GHG emissions". This monitoring was largely based on the result of the annual GHG inventory at national and sectoral levels. It also covered the assessment of future emission trends with existing measures and the performance of the common and co-ordinated policies and measures, as a part of the European Community Climate Change Programme.

66. Many Parties noted methodological difficulties in ex-post evaluation of the implementation of policies and measures and, in particular, difficulties in establishing a counterfactual baseline scenario, obtaining high-quality data and clearly separating the effect of different measures or portfolios of measures. They also noted inevitable uncertainties associated with estimates of mitigation effects and cost. This explains, in part, why effects were monitored more systematically for some policies, e.g. policies aimed at end-use energy efficiency, than for others, and why monitoring of the performance of individual policies or sets of policies targeting a single output was rarely reported.

67. Nevertheless, some Parties used different ex-post evaluation approaches to evaluate the effects of policies, including structural analysis of historical emission levels to distinguish between the impact of activity levels, changes in structure, weather and energy efficiency on energy and emission levels (Canada, Netherlands, Norway, Switzerland, United Kingdom). Norway, for example, used a dynamic equilibrium economic model to study the effect of the CO_2 tax. Switzerland provided details of independent evaluations of its Energy 2000 programme, a core element of its climate change policy. It is likely that the role of monitoring will become more prominent in future, given that most countries have a target value for emission reductions to be delivered by the key sectors and key measures (e.g. Japan, United Kingdom).

68. Methods used by Parties in the NC3 for preparing projections of future emission levels, and for assessing the ex-ante effect of policies and measures and their impact on future emission trends, remained broadly the same as in the previous communications. In most cases Parties used complex macroeconomic equilibrium or partial equilibrium models, or models combining the features of

[11] IPCC and the economic literature make a clear distinction between ancillary benefits and co-benefits.

macroeconomic models with engineering bottom-up models (optimization and simulation), to assess the total future effect of policies and measures. These models provided a more comprehensive reflection of the underlying drivers of the emission trends and links between the economy, energy and emissions than did previous models or previous versions, because of the longer time series of historical values available for analysis in the NC3 than in the NC2.

69. Parties rarely described in detail the models used for projections of non-energy sources, and usually employed expert judgement together with spreadsheet models for this purpose. However, several Parties (e.g. Australia, Austria, New Zealand, Spain) used carbon balance models to produce full carbon accounting by reflecting the dynamics of the carbon cycle. More details on the methods used for projections are included in the document FCCC/SBI/2003/7/Add.3.

70. As with the ex-post evaluation, Parties noted difficulties associated with ex-ante assessment of the effects from policies and measures and possible double counting and made a reference to some internationally accepted good practices in this field. In particular, Australia noted the Organization for Economic Co-operation and Development (OECD) paper *Greenhouse Gas Emission Projections and Estimates of the Effects of Measures – Moving towards Good Practice*. Also, Australia estimated and attempted to take into account possible double counting due to overlapping measures. Notwithstanding the difficulties, a few Parties estimated emission reductions from the key implemented, adopted and planned policies (Austria, Bulgaria, Germany).

V. ENERGY

A. Implementation issues for all energy subsectors

71. ***Reporting issues:*** All Parties reported policies and measures in the energy sector. The level of detail and transparency in reporting demonstrates an improvement over the NC2. Of the key policies and measures listed in the policies and measures database around 60 per cent were implemented, 20 per cent were adopted, and the rest were at the planning stage. Problems associated with reporting, described in section III of this report, are also relevant to the energy sector. Although some Parties provided detailed estimates of emissions reductions that are expected to result from key policies and measures, this practice was not sufficiently widespread to provide a sound basis for projecting emissions reductions from Annex I Parties as a whole.

72. ***Policy objectives and policy trends:*** Parties reported that key policy objectives in energy are: safeguarding the environment, promoting economically efficient energy supply and energy use, and security of energy supply. Climate-related policies mostly targeted CO_2 emissions, but tended to reduce other energy-related gases in proportion to their share in the primary energy supply. Many Parties emphasized that concern for the international competitiveness of their economy had a strong influence on the choice of policies in this sector.

73. Climate change has increased in importance as a policy objective in almost all Parties. This is most clearly demonstrated in Parties' reporting of new or strengthened measures that are mandatory or that provide direct financial incentives for actions that reduce emissions. Most Parties reported three or more such new measures (Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Japan, Liechtenstein, Netherlands, Norway, Poland, Slovakia, Slovenia, Sweden, Switzerland, United Kingdom).[12] Only those measures that Parties reported as being implemented, or adopted and clearly on track to be implemented in the near future, were included in the analysis of the energy sector.[13]

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[12] Parties reporting fewer such measures were Russian Federation (3), Latvia (2), Croatia (1), United States (1), Lithuania (0) and Monaco (0).

[13] Because of the style of reporting by some Parties, policies that might have qualified could have been overlooked. In particular, Spain's national communication was presented in Spanish only. In addition, several EIT

74. ***Policy instruments:*** Almost all Parties reported new mandatory policies, including taxes on energy and CO_2, negotiated agreements linked to environmental permits, emissions trading schemes, energy efficiency standards and portfolio standards, and generation quotas for renewables or CHP.[14] Also, Parties reported new policies that give a direct financial incentive to some actors to take measures that reduce emissions. These included investment grants and preferential loan rates for renewables and energy efficiency projects, preferential electricity tariffs for renewables or CHP, and tax relief including accelerated depreciation of capital and tax exemption on electricity tariffs.[15]

75. Many Parties reported on policies that give an indirect financial incentive to reduce emissions, including support for feasibility studies and project preparation, and research, development and demonstration of improved technologies. The United States placed particular emphasis on research and development. Some other Parties also stressed the importance of making new technologies available (Australia, Canada, European Community, Japan).

76. All but two Parties (Monaco, Spain) reported new or revised voluntary policies and measures of various kinds since the NC2, including labelling of consumer appliances, information, training and best practice schemes, and voluntary reporting of measures to reduce emissions from power generation with "early crediting" in the absence of government-mandated emission reductions (e.g. Canada).

77. ***Estimates of effects:*** Parties reported a variety of methodologies to monitor and evaluate the effectiveness of existing policies. Switzerland emphasized the role of independent experts in evaluating in detail the impacts of individual elements of the Energy 2000 programme, which was estimated to have reduced emissions by 10,000–14,000 Gg CO_2.

78. Some Parties reported estimates of the effects to date of some of the current policies, but the reports covered methods for estimating the impacts of only a limited number of these measures (e.g. Netherlands, United States). Norway reported difficulties in establishing hypothetical "no measures" baselines, gathering data and selecting analytical tools, which explains some incompleteness in its list of quantified emission reductions to 2000, e.g. it does not include measures relating to energy efficiency, non-traditional renewables and transport. Canada noted that, although it had comprehensively reviewed the impact of all government and some private sector initiatives[16] as an input to the NC2, there had been no equivalent assessment for the NC3. Few Parties addressed additionality and baselines, making estimates of cost-effectiveness uncertain and comparisons of cost-effectiveness between Parties difficult.[17]

B. Key cross-cutting energy policies

79. Parties reported on three main types of policies and measures affecting the energy sector as a whole. These were taxes on energy and CO_2, regulatory reform in the energy sector, and domestic emissions trading schemes.

80. ***Taxes:*** Many long-standing energy taxes reported by Parties were first introduced to raise revenue and/or to reduce demand and hence reduce dependency on foreign suppliers of energy,

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Parties reported increases in, for example, small hydro plants, or more efficient district heating networks, but did not specify if these are the result of direct expenditures by government (e.g. via state-owned energy enterprises).

[14] Five Parties did not report any policies of this type (Czech Republic, Lithuania, Monaco, Poland, Spain).

[15] Six Parties did not report any policies and measures in this category (Estonia, Croatia, Lithuania, Monaco, Spain, United States).

[16] Specifically, all Voluntary Challenge and Registry initiatives established under the National Action Program on Climate Change.

[17] The Netherlands noted that estimated emission reductions by industrial participants in negotiated agreements took account of comprehensive studies of the expected autonomous improvement in energy efficiency in the absence of policy. This allowed the true additional effect of policy to be estimated.

particularly of oil.[18] At the beginning of the 1990s, several Parties also introduced CO_2 taxes based on the carbon content of fuels (e.g. Finland, Norway, Slovenia, Sweden). The effectiveness of energy/CO_2 taxes in reducing emissions depends on their coverage of sectors and sources, level of taxation, extent of revenue recycling, and availability of lower-carbon alternative fuels and more efficient technologies.

81. Overall, there has been an expansion in the coverage of energy/CO_2 taxes and an increase in the number of Parties applying or seriously considering them. Norway has extended the coverage of its CO_2 taxes, although it reduced the level of the CO_2 tax on offshore oil and gas production in response to difficult trading conditions caused by low oil prices in 1998–1999. Sweden raised its CO_2 tax rate in 2001. In 2001 the United Kingdom introduced the climate change levy (CCL), a tax applied to energy used in the business and public sectors. In 2000 Estonia introduced a CO_2 pollution charge on emissions from all fossil-fuel-fired power plants with a capacity greater than 50 MW.

82. Sometimes it was not clear whether a new or updated energy/CO_2 tax had been introduced specifically to reduce GHG emissions, or to meet more traditional policy objectives. Austria acknowledged that, although its energy-related taxes are primarily revenue-raising, they have the positive effect of potentially reducing GHG emissions.

83. In some Parties, energy/CO_2 taxes have been introduced as part of a broader policy of moving towards "green" taxation, i.e. shifting the tax base from labour towards physical resources such as energy and minerals. Sweden stressed that adjustments to the general system of taxation (more than just energy/CO_2 taxes) can influence the behaviour of the public in ways that are positive for the environment. France emphasized ecological tax reform as its ultimate aim, and stressed that this approach could help the European Community as a whole meet its Kyoto targets. However, it noted that its proposed eco-tax system was suspended in 2000, after world oil and gas prices rose rapidly.[19] Germany noted that its ecological tax reform should reduce the relative cost of labour in the economy.

84. A few Parties emphasized the benefits of revenue recycling, i.e. allocating some or all of the revenue from an energy/CO_2 tax to specific uses. The United Kingdom recycles some CCL revenues to the businesses affected, by reducing the labour charges they pay towards public welfare schemes. A large part of the revenue from the levy was used to promote climate-friendly technologies and best practices. In effect, this is a shift towards green taxation. Some Parties reported their intention to use the revenues from any fines and penalties (e.g. incurred by electricity utilities that fail to meet quotas for supplying energy sourced from renewables) for similar purposes (Austria, Finland).

85. Regarding the cost-effectiveness of CO_2 taxes, Norway noted that its tax rates could not be equal in all sectors of the economy, as this could reduce the competitiveness of some sectors, particularly energy-intensive industry. This reduces the cost-effectiveness of the tax. Norway also reported on studies that suggest GHG emission reductions of between 1.5 and 4 per cent in the sectors where the tax applies (excluding offshore oil and gas). Another study of Norway's offshore CO_2 tax identified technological improvements that would have been cost-effective even without the tax, but that might not have been identified and implemented if the tax did not exist.

86. Sweden reported that (again for reasons of competitiveness) industry pays reduced or zero rates of CO_2 tax, thus reducing the cost-effectiveness of the overall tax. The United Kingdom emphasized ways of enhancing the cost-effectiveness of the CCL by allowing companies increased flexibility: they can join negotiated agreements and qualify for reduced tax rates, and choose to buy permits from the

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[18] Any tax on energy products raises the price for consumers, reduces energy demand when it is sensitive to price and reduces emissions. This relationship is long-established: Parties with the highest per capita energy consumption have the lowest energy taxes, and vice versa.

[19] France noted that the higher energy prices are restraining energy demand and that this was the original intention of the proposed tax reform. The United Kingdom cancelled its fuel duty escalator, intended to restrain demand for transport fuels, around the same time.

emissions trading scheme as an alternative to reducing emissions. However, the CCL is an energy tax, applied on the energy content (e.g. £0.0043/kWh of electricity) rather than the carbon content of the fuel.

87. In addition to the taxes that have been implemented or strengthened since the NC2, some Parties are considering introducing energy/CO_2 taxes as part of their package of measures under the Kyoto Protocol (e.g. New Zealand, Switzerland). Switzerland reported its intention to reintroduce a proposal for an energy savings tax, after its rejection in a referendum in 2000. Table 1 summarizes the status of climate-related energy and CO_2 taxes implemented, adopted or under consideration in Parties.

88. ***Regulatory reform of the energy sector:*** Most Parties are enacting regulatory reform in the energy sector (all European Community countries and EIT Parties included in this report, and Australia, Japan, New Zealand, Norway, United States). The main objective is to increase economic efficiency by introducing more private sector participation, more competition in supply and distribution and increased consumer choice over energy suppliers. Governments generally retain authority over gas and electricity transmission networks, to ensure reasonable terms of access to the networks and reasonable charges for using them.

89. One important element of regulatory reform is the reduction of subsidies for the production or consumption of energy, particularly fossil fuels. Phasing out of subsidies is a main objective of reforms in many EIT Parties (e.g. Bulgaria, Croatia, Czech Republic, Poland, Slovakia). Prices are now much closer to the real costs of production, stimulating much greater energy conservation measures than they were before.

Table 1. GHG-related taxes in the energy sector, excluding transport

Party	Implemented[a] updated[b], planned and optional[c]	Tax basis (Energy / CO_2)	Energy sub-sectors targeted	Rate: (local currency/ tonne CO_2))	Are there industry exemptions?	Comments
AUT	Updated, 2000	Energy	All	na	No	Mainly revenue-raising
BEL	Planned	Energy	na	na	Planned	
CHE	Optional, from 2004	CO_2	All	na	Yes, mandatory alternative	Initial proposal rejected in referendum
DEU	Implemented	Energy	All	na	Yes	
EST	Implemented	CO_2	All	EK 7.5	No	
FIN	Updated, 1998	Energy/CO_2	All	EC 17.2	Yes	
FRA	Planned	Energy/CO_2	All	na	na	Suspended until further notice due to high world oil prices
GBR	Implemented	Energy	Industry, commercial, institutional	na	Yes, mandatory alternative	
ITA	Implemented	CO_2	na	na	na	Rate of tax frozen in 1999 due to high world oil prices
LVA						
NDL	Implemented, 1998	Energy	All	na	na	
NOR	Updated, 1999	CO_2	na	up to NK 315	Yes	Planned switch from tax to emissions trading by 2008
NZL	Planned	CO_2	na	na	na	Tax scheme or emissions trading under consideration
SLV	Updated, 1998	CO_2	All	SIT 3000	Yes	
SWE	Updated, 2001	CO_2	All	SK 530	Yes	

Note 1: For an explanation of country codes, please refer to the annex.
Note 2: na = not available.
[a] New tax schemes implemented since the NC2 and not updated since then.
[b] Tax schemes existing at the time of the NC2 and significantly strengthened since then.
[c] To be introduced if other measures are not on track to meet targets for emission reductions.

90. Very few Parties reported on fossil fuel or electricity subsidies outside the context of regulatory reform. The European Community has proposed that its member States phase out all fossil fuel subsidies by 2010. France subsidizes electricity for residents in its overseas territories, where the cost of

production is higher than in mainland France. While noting that the electricity price subsidy makes solar water heaters uncompetitive, it noted that it has successfully stimulated the market through countervailing subsidies on the purchase price of solar water heaters.

91. Some Parties project that energy market reforms will favour natural gas over coal for new power plants. The European Community estimated that in its member countries this would avoid annual emissions of 63,000 Gg CO_2 equivalent from 2010 onwards. The United States reported that natural gas has been the fuel of choice in recent years for new power generation plants, and expected this trend to continue as market liberalization advances. No Parties quantified the sensitivity of the fuel-switching effect to future prices of coal and natural gas. Italy noted that, in parallel with the process of electricity sector reform, the government has allocated each major electricity supplier a GHG emission reduction target that is proportional to its share of national electricity production.

92. Some EIT Parties reported on new, broad, framework legislation for energy, air pollution, environmental strategy and environmental impact assessment (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Lithuania, Slovakia). Much of this legislation established new arrangements for energy markets and created new institutions with powers to take measures that might affect emissions of GHGs. These legislative programmes were part of the general overhaul of governmental structures in the EITs.

93. ***Domestic emissions trading schemes:*** Since the NC2, Parties have become more familiar with the concept of emissions trading schemes (see box 5). Discussions between Parties on the emissions trading "flexibility mechanism" under the Kyoto Protocol may have played a role in this.

94. One of the first domestic emissions trading schemes has been implemented by the United Kingdom. It covers all six GHGs defined under the Kyoto Protocol. Initially, 46 large companies volunteered to join the emissions trading scheme and were allocated emission permits. The Government then held an auction in which it bought back, and permanently retired, permits from participating companies. This created an initial incentive to join the scheme. By the end of 2006, total annual emissions from these companies would be about 4,000 Gg CO_2 equivalent less than their baseline emissions. Around 6,000 additional sites are now eligible to enter the emissions trading scheme, to help them meet targets arising from negotiated agreements. Permits will be convertible at the rate of 1 permit to 0.23 MWh of energy. Similarly, excess emissions reductions can, after verification of energy consumption (and production, for targets based on energy consumption per unit of product), be converted into permits that can be banked or traded within the United Kingdom's emissions trading scheme.

95. The United Kingdom plans to include power generation companies in the emissions trading scheme and to allow participants in other schemes, such as the Renewables Energy Obligation, to convert targets under those schemes into tradable permits. These linked schemes all involve voluntary or mandatory emission caps.

96. Other Parties have advanced plans for emissions trading schemes (box 5). The European Community has proposed a framework to ensure compatibility among the national trading schemes of its member States, as part of its package of measures for the implementation of the Kyoto Protocol. The proposed European Community directive would not harmonize the method of allocation and quantities of emission permits; rather, member States would be required to communicate to the European Community their plans on the allocation of permits. The scheme would apply to most of the significant emitting activities already covered by the Integrated Pollution Prevention and Control (IPPC) Directive, as well as some others. The only gas covered by the proposal is CO_2.

97. Canada reported a pilot programme that certifies private, voluntary trades of emission reductions. Certified reductions would be eligible for recognition within any future mandatory scheme for emission reductions. Other Parties are also considering emissions trading (Australia, Austria, Netherlands,

New Zealand, Sweden). Norway reported plans to shift from its current system of CO_2 taxes to a broad-based emissions trading scheme, which should cover around 80 per cent of all GHG emissions, by 2008.

Box 5. Domestic emissions trading schemes

The emissions trading schemes reported on by Parties all share the important feature that an absolute cap on emissions is imposed on (or voluntarily adopted by) some group of polluters. By doing this, governments create the market within which participants can trade. Individual polluters are allocated an initial share of the overall cap, e.g. in the form of permits to emit a certain tonnage of CO_2 each year. A polluter that emits less than its allocation allows can sell its spare permits to another polluter that is emitting more than its allocated amount. All Parties implementing or considering emission schemes invoke penalties, e.g. fines, for emissions that are not covered by permits (otherwise there would be no incentive for one participant to buy permits from another). Parties reported emissions trading schemes as "economic" measures, although the overall cap, and penalties for non-compliance, are mandatory regulations, and the buying and selling of emissions permits is a market measure.

98. ***Technology development:*** Most Parties use research and development, and technology demonstration programmes, to develop new technologies and reduce their costs to competitive levels (e.g. the European Community common funded programmes under successive framework programmes). Many Parties also use measures to increase the application of technologies by increasing the scale of production and so driving down costs through economies of scale and the technology learning effect (e.g. renewables procurement policies in Canada). Key technologies cited by most Parties include renewables and fuel cells. Several Parties emphasized advanced fossil-fuel power generation, including capture and storage of CO_2, and a few Parties noted the need for advanced nuclear power technologies.

C. Energy industries

99. ***Implementation issues:*** The energy industries sector is a priority area for policies and measures for almost all Parties. Many of the policies affecting energy industries were related to broader energy sector reforms, such as regulatory reform, restructuring of energy companies and privatization. Parties stressed that the main objective of these reforms was to increase economic efficiency and consumer choice, but emphasized the potential for reforms to introduce or strengthen climate change policies.

100. Since the NC2, most Parties have introduced or updated direct financial incentives for renewables and CHP (Australia, Austria, Belgium, Canada, Czech Republic, Germany, Estonia, Finland, France, Italy, Japan, Latvia, Liechtenstein, Netherlands, Norway, Poland, Slovakia, Sweden, Switzerland). Mandatory measures have been introduced or strengthened in some Parties (Australia, Austria, Belgium, Croatia, Estonia, France, Germany, Hungary, Netherlands, Slovakia, United Kingdom). Two Parties reported only indirect financial incentives (e.g. funding for feasibility studies, project preparation, pilot projects and research and development) for renewables and CHP (New Zealand, United States).

101. Some Parties (especially EIT Parties) have strengthened measures (such as investment grants and soft loans) to encourage fuel switching from coal to gas. One of the policy drivers for fuel switching measures was reduction of local and regional (acid-rain-related) air pollution.

102. New technologies appeared critical to maximizing emission reductions through renewables, cleaner fossil power technologies and nuclear power. Some Parties noted that reducing the cost of renewable technologies is a key objective of measures that increase their scale of application. Australia has a series of new programmes to support commercialization of renewable technologies. Activities include grants to promising technically proven technologies, strategic industrial development (through training, support for accreditation schemes, quality control facilities and renewable resource mapping), and promoting renewables in remote communities not connected to the grid.

103. ***Framework and description of policies:*** Policies and measures in energy industries centre on promotion of renewables, CHP and district heating, efficiency in oil and gas production, fuel switching in power generation, cleaner and more efficient fossil fuel technologies, and nuclear energy.

104. ***Renewables:*** Many Parties emphasized the need for substantial increases in renewable power generation to restrain future growth in GHG emissions. Renewables have been promoted by most Parties for decades, but, with a few exceptions (e.g. Germany; see box 6) have so far failed to capture a substantial share of electricity supply. In response, some Parties have established or strengthened quotas for the amount of electricity from renewable sources that electricity suppliers must supply (Australia, Belgium, France, Italy, Sweden, United Kingdom), or plan to do so in the near future (Belgium).[20] In some Parties (e.g. United Kingdom), quotas should increase the share of renewables to as much as 10 per cent of electricity supply by 2010. This is equivalent to a reduction of GHGs from the energy sector of a few percentage points. Australia has introduced a mandatory renewable energy target for electricity wholesalers. The overall target is an increase of 9,500 GWh per annum by 2010, i.e. 12 per cent of projected total electricity supply. In New Zealand the target for increasing renewable energy supply has been set at 25–55 PJ by 2012.

Box 6. Progress in promoting renewable energy in Germany

In Germany, a long-standing commitment to policies and measures to increase the share of renewables in electricity supply has had notable success. Renewables accounted for an estimated 7 per cent of electricity supply in 2001, up from 3.8 per cent in 1990. Existing renewables avoided emissions of 35,000 Gg CO_2 in 2000. Germany seems on track to increase the share of renewable electricity to its target of 12.5 per cent by 2010. Wind power, in particular, has increased rapidly, with 8,700 MW of installed capacity in 2001, generating one-third of the wind-powered electricity in the world. It forecasts that an additional 20,000–25,000 MW could be installed offshore by 2030.

105. Suppliers that do not meet their renewable electricity quotas are subject to financial penalties in some Parties (e.g. Austria, United Kingdom). Revenue from penalties is sometimes earmarked exclusively for measures that encourage renewables, or other environmentally friendly energy options (revenue recycling). In general, however, policies and measures for renewables were not sufficient to meet Parties' stated targets, and in particular the European Community umbrella target of 12 per cent renewable electricity supply by 2010 did not seem to be matched by member States' current and proposed measures. The interest in quotas has been accompanied by increased interest in green certificate (box 7).

Box 7. Green certificates

Parties emphasized that quota schemes (or renewables portfolio standards) require robust certification that a particular source of electricity is indeed renewable or, in the case of CHP, meets certain quality standards. This certification of green power has led to the concept of "green certificates". In some Parties, green certificates can be traded to give electricity suppliers more flexibility in meeting their quotas (Australia, Belgium, Canada). Green certificate trading in the European Community is supported by the Directive on the Promotion of Electricity from Renewable Sources, which addresses technical issues related to accurate and reliable certification of green electricity. As European Community member States begin to implement this directive nationally, these provisions should encourage trading of green certificates between countries. Hungary, an EIT Party that is acceding to the European Community, reported plans to introduce green certificate trading once the installed capacity of renewables reaches a high enough level to ensure competition.

106. Many Parties are using regulatory reform of the energy sector as an opportunity to introduce quotas, green certificates, and other incentives for renewables and CHP. Some Parties have applied green tariffs, which guarantee a higher price for a unit of renewable electricity than the prevailing market

[20] Some Parties refer to this quota as a "renewables portfolio standard", i.e. renewables must be accorded a certain percentage share in the "portfolio" of sources of power generation.

price, for over a decade, and many continue to report their use (e.g. Belgium, Germany, Hungary, Switzerland).

107. Many Parties also reported new or revised direct financial incentives, such as grants towards investment in renewable power generation projects, accelerated depreciation on capital invested and preferential interest rates on loans for project financing. Preferential tax treatment was used in many different ways to promote renewables. For example, Canada encouraged manufacturing, processing and mining companies to invest in renewable energy supply (and energy efficiency measures) by allowing these investments to be written off against tax on all sources of income.

108. Procurement schemes, in which public sector agencies (primarily) undertake to procure their electricity from renewable sources, were cited by some Parties (Austria, Canada). There was little information on their effectiveness, even for those schemes cited in the NC1 and NC2 (e.g. Canada).

109. Many Parties were placing increased emphasis on biomass within their renewables portfolios. Wood, in particular, was being promoted in several Parties (e.g. France, Latvia, United States) through grants and tax relief measures to encourage wood crops for electricity and heat generation.

110. ***CHP and district heating:*** For many Parties, measures to increase the use of CHP in electricity supply were closely linked to measures to encourage renewables: a similar array of incentives, such as generation quotas, preferential tariffs and tax treatment, capital investment subsidies and accelerated depreciation of capital investment, were seen to be useful (e.g. Austria, Croatia, France, Netherlands). For example, as of 1997, France has exempted CHP plants from a tax on natural gas and heavy fuel oil (for low-sulphur fuel only), supplementing reduced rates of business tax and accelerated depreciation on investment in CHP. In some Parties, CHP projects generated green certificates that were equivalent to certificates generated by renewables projects (e.g. Belgium). Other Parties addressed CHP and district heating systems under energy efficiency measures. Many EIT Parties have extensive district heating networks and are taking measures to improve their efficiency and to reduce the environmental impacts from their heating units. Bulgaria reported on investments by state-owned entities in energy efficiency in CHP and district heating systems. Slovakia cited a programme of subsidies and other financial assistance to improve the efficiency of district heating systems as being an effective measure to reduce CO_2 emissions.

111. A few Parties reported some problems for CHP arising from electricity market reform, suggesting a need for careful consideration of the incentives for CHP in the design of electricity markets (France, Netherlands, United Kingdom). The United Kingdom, for example, reported that demand for CHP fell substantially when the original post-privatization electricity trading "pool" was replaced with a new market model, the New Electricity Trading Arrangements. Sweden noted that changes to its energy tax structure, which were intended to reduce demand for electricity, had a negative impact on CHP.

112. ***Oil and gas production:*** Several Parties are large producers of oil and gas. Related emissions are not only CO_2 emissions from energy use in oil and gas production, but also fugitive emissions of CH_4 and non-methane volatile organic compounds (NMVOC).[21] Some Parties projected decreasing oil and gas production and, therefore, decreasing emissions, to 2010 (Netherlands, United Kingdom). The United States projected a slight decrease in oil production and a small rise in gas production.

113. Three reporting Parties are major oil and gas exporters (Canada, Norway, Russian Federation), and all three project increasing oil and gas production to meet growing export demand, through 2010. Canada reported that the production of oil and gas for export was responsible for 25 per cent of its overall increase in emissions between 1990 and 1999. The oil and gas sector in Norway accounted for more than 50 per cent of its total increase in emissions over the same period.

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[21] Specific measures to address fugitive emissions are discussed below.

114. In its baseline projection, Norway projected increasing emissions from the sector up to 2010. The key Norwegian policy restraining emissions is a tax on CO_2 emissions from offshore production, which helped to induce some technology innovations and associated emission reductions. When the Kyoto Protocol enters into force, the oil and gas sector could be covered by an emissions trading scheme that is likely to contribute to reducing emissions from all sources by 5,700 Gg CO2 equivalent.

115. ***Fuel switching in power generation:*** In most Parties with substantial coal-based power generation, a long-standing, policy-driven shift away from coal continued, in order to reduce local health impacts and to reduce emissions of acid rain precursor gases. This trend remained strongest in the EITs (e.g. Croatia, where the national electricity company is constructing new, high-efficiency CHP units fuelled by natural gas). The Czech State Environmental Fund provided subsidies for switching from coal to gas, which helped to reduce by 75–80 per cent between 1990 and 1999 the number of furnaces in the 0.2–5 MW range that continue to burn brown coal. In Australia, the Queensland government will require electricity retailers to source 15 per cent of their supply from gas-fired or renewable power generation, a measure that is expected to reduce GHG emissions through fuel switching from coal. Greece reported a major programme to develop natural gas, rather than coal, for new power generation.

116. At the time of the NC2, some Parties noted that factors such as low capital costs for new gas plants, low prices for natural gas and environmental pressures might encourage a switch from coal to gas power generation within liberalized electricity markets. In their NC3, some Parties continue to provide projections of the impact of fuel switching from coal to gas. For example, the European Community projected that full liberalization of electricity and gas markets in member States will lead to a reduction of 63,000 Gg CO_2 equivalent per year, from 2010 onwards, as a result of construction of natural gas power plants instead of coal plants. However, Parties' projections do not provide sensitivity analyses of factors currently affecting coal and natural gas markets, such as increased gas price volatility, increased difficulty in obtaining long-term, fixed-price, gas supply contracts and the fall in the price of world-traded coal.

117. ***Cleaner and more efficient fossil fuel technologies:*** Several Parties emphasized a possible contribution of advanced fossil fuel combustion technologies. The United States has large research and development budgets for more efficient coal- and gas-fired power generation. One particularly promising technology option – capturing CO_2 emissions from coal- or gas-fired plants and sequestering them in geological structures – has, in the view of several Parties (Canada, European Community, Japan, Netherlands, Norway, United States), recently become a serious medium-term option (box 8).

Box 8. Capturing CO_2 from fossil-fuel power plants and storing it in geological structures

Most of the technologies for CO_2 capture from power plants and geological sequestration are commercially available today, with the exception of power-plant-scale capture of CO_2 from flue gases. Since 1996, Norway has been injecting 1,000 Gg CO_2 per annum into a saline reservoir under the North Sea. Seismic monitoring suggests that the CO_2 is permanently trapped below the impermeable cap layer overlying the reservoir. The United States reported on a large research and development budget aimed at reducing the cost of carbon sequestration and capture from energy production activities; establishing the technical, environmental, and economic feasibility of carbon sequestration using a variety of storage sites and fossil energy systems; determining the environmental acceptability of large-scale CO_2 storage; and developing technologies that produce valuable commodities from CO_2 reuse. The United States is also pursuing versions of the technology that would produce hydrogen for use in power generation or transport. Canada reported on several studies and pilot projects in this field, including the Weyburn project to assess the use of CO_2 sequestration in enhanced oil recovery.

The Netherlands includes CO_2 capture and geological sequestration among its set of reserve policies and measures. Based on current cost estimates, it might use this option if the basic package of policies is not on track to meet its Kyoto targets. The EC identified CO_2 capture and sequestration as a measure for possible further action under the second phase of the EC Climate Plan.

118. To encourage efficiency improvements in existing plants, particularly coal-fired plants, Australia is pursuing voluntary Generator Efficiency Standards. Participating plants enter into legally binding agreements to achieve emission reductions, primarily through adoption of best practices in plant operation, determined through benchmarking of the most efficient plants. Australia has achieved a high rate of participation in this scheme.

119. ***Nuclear energy:*** In many Parties, nuclear power provides a significant proportion of the supply of electricity (Belgium, Bulgaria, Canada, Croatia, Czech Republic, Finland, France, Germany, Japan, Russian Federation, Slovakia, Sweden, Switzerland, United Kingdom, United States). Any decisions either to extend the lifetimes of nuclear plants, or to retire plants early, will have a major impact on emissions, unless carbon-free alternatives are available. Several Parties have expanded, or plan to expand, nuclear power generation (Croatia, Czech Republic, Finland, Japan, Switzerland). The Czech Republic reported that the Temelin plant was brought on line in 2001–2002, but that up to 2020 no new plants were planned. Japan noted that its programme for new plants has fallen behind the schedule set out at the time of the NC2. Extending the lifetime of existing nuclear plants is considered by some Parties to be a cost-effective means of reducing GHG emissions. The United States reported on a major research and development programme on lifetime extension. Finland considered constructing a new, fifth nuclear unit as a GHG mitigation option.

120. Some Parties drew attention to the impact of likely closures of nuclear plants. The United Kingdom noted that a recent announcement of possible nuclear plant closures would increase the emissions projections set out in their NC3 by 1,000 Gg of carbon per year in 2010. Canada noted that its CO_2 emissions projection for 2010 has increased by 4,000 Gg since the NC2, following an assumption that a nuclear plant in Ontario will not now be brought back into operation. Sweden emphasized a mix of long-term and short-term measures to compensate for the closure of the two nuclear reactors at the Barseback plant. Further accelerated nuclear plant closures in Sweden may occur only if adverse impacts on electricity price and availability, the environment and GHG emissions can be avoided. Germany estimated the increase in emissions expected in 2010, as a result of its planned closure of nuclear plants, at around 10,000 Gg CO_2, assuming that the nuclear generation capacity is replaced with state-of-the-art gas- and coal-fired power generation. Bulgaria reported that the planned closure of its nuclear plant (a condition of accession to the European Community) would lead to a large increase in CO_2 emissions between 2003 and 2007.

D. Energy use in industry

121. ***Implementation issues:*** For most Parties, the competitiveness of industries in the world market continued to be a major concern, which influenced the nature and stringency of policies and measures. In many Parties the measures applied to energy-intensive industries were different from those applying to the rest of the sector.

122. Voluntary and negotiated agreements were considered as key measures in this sector by many Parties. Direct financial incentives were also widespread. In many European Community countries, the IPPC Directive influenced domestic policies. Taxes and emissions trading schemes were also important in some Parties, although energy-intensive industries were often exempted to protect their competitiveness. Almost all Parties placed importance on programmes of education, training, dissemination of best practices and energy auditing and advice. Often these were tailored to help companies meet targets arising from agreements (e.g. Canada, Germany, Netherlands, New Zealand, United Kingdom).

123. The cost-effectiveness of new or existing measures was difficult to assess, largely because of the problem of identifying expenditures by industry that were truly in addition to what would have occurred in the absence of the measure. Similarly, when assessing improvements in energy efficiency, it was essential to estimate what the natural trend rate of improvement would be in the absence of measures. The Netherlands reported a high rate of energy saving (above baseline) from negotiated agreements, but

did not report on the cost incurred by industry. In EIT Parties, economic and policy reforms led to the creation of new institutions for encouraging energy savings and environmental improvements in industry. Common measures in these Parties included information on best practices, training, subsidies, preferential tax treatment, investment grants and soft loans.

124. ***Framework and policies reported:*** Policies and measures in this sector centre on the following policy instruments and approaches: voluntary and negotiated agreements; energy/CO_2 taxes; grants, subsidies and other direct financial incentives; energy efficiency site permits and the IPPC; eco-efficiency; and materials substitution.

125. ***Voluntary and negotiated agreements:*** As of 2002 several Parties (e.g. Australia, Canada, Finland, the Netherlands, New Zealand, Norway, Switzerland, United Kingdom, United States) were using voluntary or negotiated agreements between government and industry, and this practice was increasing. Agreements were often allied with benchmarking efforts, dissemination of information on best practices and improved technologies, and government support for energy audits.

126. In some Parties, agreements were negotiated within a framework that exerts pressure on industries and individual companies to join the agreements and achieve their stated targets. These negotiated agreements appear to be more effective than true voluntary agreements that are developed in isolation from other policies. The Netherlands, for example, negotiated an extensive set of long-term agreements with industrial sectors, covering the period 1989–2000 in their first phase. These delivered substantial additional energy savings of 2.2 per cent per annum, compared with an expected autonomous efficiency improvement rate of 1.3 per cent per annum. Measures that individual companies agree to take, as part of their involvement in the sectoral long-term agreement, become integrated into the environmental permit-setting process of each company. Companies that choose not to join the long-term agreement in their sector are obliged by the authorities to undertake every energy-saving measure with an internal rate of return on investment of at least 15 per cent, after tax. The Netherlands recently allocated additional funds to support the role of local authorities in the environmental permit-setting process. For reasons of competitiveness, energy-intensive sectors are not required to develop long-term agreements. Instead, from 1999, they have committed themselves to being among the world's most energy-efficient businesses in their sector.

127. Japan has taken a similar approach to the Netherlands, with regulators focusing their attention on those sectors of industry that have not established voluntary action plans, or that are failing to meet their previously agreed plans. It has recently strengthened its remedial action against companies that fail to meet their agreed targets. The United Kingdom has linked a new scheme for negotiated agreements to the European Community IPPC Directive: energy-intensive companies joining agreements benefit from an 80 per cent reduction in the CCL, on the condition that they achieve their agreed targets.

128. New Zealand reported that its 1995–2000 voluntary agreement scheme was successful, achieving a reduction of 1,500 Gg CO_2 in 1999. It planned to develop a successor scheme that might include more mandatory elements, e.g. linkages to carbon charges. Australia noted that a 1999 evaluation of its voluntary agreement programme showed that, in addition to reducing emissions from industry, the programme had improved the capacity of government and industry to identify, monitor, manage and report GHG emissions. In 1999 Switzerland implemented a framework for voluntary agreements that were judged to have been effective to date and were backed up by the prospect of exemptions from a proposed CO_2 tax.

129. ***Energy/CO_2 taxes:*** There was an increase in the application of energy/CO_2 taxes affecting the industry sector. Parties applying energy/CO_2 taxes took steps to avoid tax rates that would make their industries uncompetitive on world markets.

130. For energy-intensive industries, the United Kingdom applied the CCL at only 20 per cent of the standard rate, if these industries concluded negotiated agreements. Sweden reduced its CO_2 tax on fuel

to 35 per cent of the standard rate for all manufacturing industry, agriculture, forestry and aquaculture. When the tax exceeded 0.8 per cent of gross sales, the tax rate dropped to less than 10 per cent of the standard rate, so the marginal incentive to reduce energy dropped as energy use increased. For some energy-intensive industries (cement, lime and glass production) the tax was capped at 1.2 per cent of gross sales, at which point the marginal incentive to reduce energy drops to zero.

131. ***Grants, subsidies and other direct financial incentives:*** Tax relief on investments that improve energy efficiency in industry was introduced in some Parties (e.g. Belgium, Netherlands). Australia's Greenhouse Gas Abatement Plan has provided grants to projects that reduce GHG emissions in industry. Some Parties reporting investment grants, subsidies and other incentives did not distinguish between the sectors involved. This made it difficult to form a clear picture of the importance of these measures in the industry subsector (e.g. the United Kingdom reported a new scheme for accelerated depreciation of investments in energy efficiency by "businesses").

132. ***Energy efficiency site permits and the IPPC:*** In the European Community, the 1996 IPPC Directive required national governments to regulate energy consumption in all industrial sites falling within the scope of the directive. The directive applied to new and upgraded sites from 1999, and will apply to all sites from 2007. The European Community produced guidance documents on best available technology, which, for example, indicate that in many cases CHP is the most efficient way of supplying process heat and power. National permit-setting authorities have discretion to apply the guidance on best available technology according to local conditions, and industrial sites that take part in domestic CO_2 emissions trading schemes are exempt from requirements for energy efficiency permits. Several EIT Parties noted plans to implement the IPPC Directive in the lead-up to their accession to the European Community (e.g. Bulgaria).

133. The European Community reported that, as of 2001, experience with the application of IPPC to energy efficiency was limited. Two major challenges for future implementation would be to avoid solutions that have low cost-effectiveness, and to find an appropriate balance between energy reduction objectives and measures to reduce "traditional" pollutants that might increase energy requirements.

134. ***Eco-efficiency and materials substitution:*** Some Parties have been exploring the possibilities for large reductions in whole-life-cycle emissions through application of eco-efficiency principles, and substitution of traditional materials with less energy-intensive materials. For example, engineered wood can replace steel, and ash from coal-fired power plants can replace a substantial percentage of dry Portland cement. France, for example, has a new programme to develop the use of wood in construction which should avoid an estimated 26,000 Gg of CO_2 emissions by 2010. Japan also promotes wood as an alternative to steel and concrete. However, traditional regulatory approaches that focus on individual processes or industrial sites, including the European Community's IPPC, may create barriers to the multisectoral, innovative actions that are required for materials substitution. Eco-efficiency approaches generally claim to take a very broad perspective on industrial processes. Australia noted that Queensland and Victoria have eco-efficiency programmes that aim to identify cost-savings, energy efficiency improvements and pollution reduction in manufacturing, construction and transport industries.

E. Energy use in the residential, commercial and institutional sector and "others" sector

135. ***Implementation issues:*** Most Parties used a variety of measures in the residential, commercial and institutional sectors. In many cases, these built upon long-standing programmes designed to improve energy efficiency, which were initiated with energy security or economic efficiency, rather than climate change, in mind. Parties increasingly reported that new and revised measures in this sector were undertaken primarily within a GHG policy framework.

136. This sector differs from the industry sector in that there is a very large number of actors, i.e. consumers and small businesses. Parties therefore report mainly on broad instruments including taxes,

energy efficiency standards and labels, and information campaigns. Some measures, particularly investment grants, are targeted at narrower subsectors of the commercial or residential sectors.

137. Several Parties introduced or increased energy/CO_2 taxes affecting the sector, with the primary objective of reducing CO_2 emissions (e.g. Finland, Sweden, United Kingdom). Two Parties (France, Switzerland) reported postponing plans for climate-related energy taxes destined to encourage energy saving, because of a sudden increase in world energy prices feeding through to consumers and creating public opposition.

138. Many Parties reported the introduction or upgrading of mandatory minimum standards for energy efficiency in buildings and/or for consumer appliances[22] (Australia, Austria, Belgium, Canada, Estonia, European Community, France, Japan, Liechtenstein, New Zealand, Norway, Sweden, United Kingdom, United States). Many Parties also introduced or increased direct financial incentives such as investment grants, low-cost loans or preferential tax treatment, particularly to improve the energy efficiency of buildings (Bulgaria, Czech Republic, Finland, Hungary, Netherlands, Slovakia). Almost all Parties reported a wide range of measures to influence consumer behaviour, such as educational campaigns, energy audits and energy efficiency labelling.

139. ***Framework and policies reported:*** Policies and measures in this sector target energy efficiency improvements in buildings, consumer appliances and the institutional sector.

140. ***Buildings:*** The energy efficiency of buildings was a priority area for many Parties, which emphasized the large potential for energy savings not just through improvements in existing buildings, but also over the longer term, as the stock of buildings is gradually replaced. Building energy efficiency was subject to a wide range of measures.

141. Minimum national standards for energy efficiency of new buildings were updated by a number of Parties (e.g. Austria, France, Japan, New Zealand, United Kingdom). Australia required minimum energy efficiency standards in its national building code for the first time in 2000, with implementation occurring state by state. Generally, building standards were enacted as requirements that have to be met in order to gain approval for any new construction, for example a minimum level of thermal resistance for walls, or a minimum level of thermal efficiency for water heaters. In France, the required energy efficiency of housing was raised by 15 per cent in 2000, compared with the previous 1988 standard, and the efficiency standard for commercial buildings was raised by 40 per cent. France also committed itself to reviewing these standards every five years. It further sought to restrain the fast-growing demand for air conditioning.

142. Some Parties also use energy ratings for buildings, to supplement other measures. The United States reported its rating scheme, the "Energy Star" label, as the main measure for increasing energy efficiency in new and existing homes. Homes with this label have energy savings that are on average 35 per cent greater than those set out in the national "model energy code" (which is not enforced in all states).

143. New, mandatory standards were often considered inappropriate for existing buildings. Parties reported on a mix of measures to persuade owners or occupiers to make energy efficiency improvements. Foremost were subsidies in the form of direct grants (e.g. Hungary), or relief from income tax, and reduced rates of purchase tax on equipment and services that improve efficiency. Many Parties also provided free energy audits, gave information and advice to owners, and provided information and training for building contractors and architects.

144. Austria noted that apparently similar measures can vary greatly in their cost-effectiveness. Some of its regions gave subsidies for renovations that bring a building up to a minimum level of heating

[22] Recent Community-level minimum standards for appliances affect all European Community member States.

efficiency, e.g. 80 kWh/m^2 per year. Others set requirements for the thermal resistance of walls, windows, etc., that can qualify for subsidies. New, high-performance components received higher subsidies. This encouraged new technologies but might reduce the cost-effectiveness of the subsidies, at least in the short term.

145. ***Consumer appliances:*** Many Parties tightened labelling standards and increasingly moved towards mandatory standards, e.g. the United States. In Japan, the "Top Runner" set of appliance standards was expected to save around 30,000 Gg CO_2 per year, e.g. by cutting the energy requirements of home video recorders by 59 per cent, of refrigerators by 30 per cent and of computers by 83 per cent. The Netherlands reported on a measure to supplement the European Community-wide appliance standards: householders were entitled to a partial rebate on the purchase price of the most efficient appliances. The rebates also applied to improved wall and window insulation and household renewable energy systems. Slovenia reported on a similar scheme, but utilizing income tax deductions, in place of direct rebates. Australia estimated that its new programme of appliance standards and labelling would produce an economic benefit of A$ 31/tonne of CO_2 emissions avoided. This programme includes a 1 W maximum power consumption target for appliances on standby. Standby losses account for 11.6 per cent of residential electricity consumption in Australia.

146. Several Parties reported new voluntary agreements with manufacturers to increase the energy efficiency of appliances. The European Community introduced several initiatives, including an energy "code of conduct" in the area of digital television equipment and agreements with electronic equipment manufacturers to reduce standby power consumption.

147. Many Parties continued or expanded programmes to influence consumer behaviour and choices through education and awareness-raising. Japan has initiated an innovative programme to help guide its citizens towards sustainable (i.e. less energy-consuming) lifestyles, through their own efforts. Public education efforts were expected to persuade consumers to re-use shopping bags, reduce thermostat settings, pack refrigerators more efficiently and take a host of other measures.

148. ***Institutional sector:*** To address energy consumption in the institutional (primarily public) sector, Parties often choose to strengthen the measures that apply to the economy as a whole with policies to procure energy from low-GHG-emitting sources, especially renewables, and to reduce energy consumption in public procurement. The European Community reported on a draft directive and voluntary agreements on reducing energy consumption in goods and services procured by the public sector. Canada set a target of reducing GHG emissions from government operations to 31 per cent below 1990 levels, by 2010. In 1999, the President of the United States issued an Executive Order that requires federal government agencies to reduce energy use in federal buildings by 35 per cent from 1985 levels by 2010. The Federal Energy Management Agency tracks progress towards this target, provides government agencies with technical advice and assists them in acquiring private and public funding for energy conservation projects.

149. Austria emphasized its successful experience in inviting external commercial enterprises to take over financing of energy efficiency improvements in public sector buildings, in return for a share of the financial savings. The use of such third-party financing companies, known as energy service companies, was particularly effective for investments with a payback period of 5–10 years.

F. Fugitive emissions

150. More than 90 per cent of emissions of CH_4 in the energy sector were fugitive fuel emissions, e.g. from oil and gas production and leakage of natural gas from pipelines. This was a major issue in EIT Parties, where the oil and gas infrastructure has in the past had relatively high rates of fugitive

emissions.[23] Coal-mining was also a substantial source of CH_4 emissions. In 18 parties, fugitive CH_4 emissions fell by between 9 per cent (Croatia) and 70 per cent (Latvia), but in nine Parties they rose by between 4 per cent (Sweden) and 79 per cent (Norway). Only a few Parties provided information on efforts to reduce fugitive emissions in the energy sector. The United States reported on voluntary programmes under which coal-mining companies made cost-effective reductions in fugitive emissions.[24] In addition, the government helped to develop and demonstrate improved technologies and encouraged industry to adopt improved technologies and practices. The United States and Australia (where coal-mining accounts for the majority of fugitive emissions), both noted that a market-driven shift from deep mines to open-cast mines had restrained or reduced fugitive CH_4 emissions from coal-mining.

151. In Norway, fugitive emissions of NMVOC from the oil production industry amounted to 1,100 Gg CO_2 equivalent in 1999. This was several times greater than fugitive CH_4 emissions from all energy sources. Norway made an attempt, with limited success, to establish a voluntary programme to reduce these fugitive NMVOC emissions and decided to apply case-by-case requirements for best available technologies under the Pollution Control Act. Canada projected strongly rising emissions from oil and gas production through to 2010. It operates a tax incentive for investments in equipment to generate power from CH_4 that would otherwise be flared. Other measures were voluntary, such as a multi-stakeholder working group to review flaring practices in Alberta.

152. EIT Parties generally included measures to reduce fugitive emissions from oil and gas operations within broad packages of measures to improve operations and efficiency in their energy industries. Poland reported on a new programme to reduce CH_4 emissions from coal mines.

G. Policies and measures having a negative impact on emission trends

153. ***Reduced prices in liberalized gas and electricity markets:*** One of the main objectives of regulatory reform of energy markets is to increase efficiency in the production and supply of energy, and so reduce prices to consumers. Inevitably, lower prices will increase demand, and hence emissions of GHGs. Australia noted that, following the creation of a wholesale electricity market in 1998, excess supply led to depressed prices, which favoured low-cost, high-emission, established operators and so caused an "increase in the greenhouse intensity of electricity supply". Austria increased its electricity tax by 100 per cent in 2000, to "compensate for demand-driving electricity price-cutting", following market liberalization in 1999. Switzerland noted that incentives for energy efficiency may be reduced as liberalization of its electricity market progresses. Most Parties were yet to study this effect in detail, include it in projections and introduce countervailing measures. In addition, when regulatory reform reduced the cost of producing fossil fuels, or of producing heat and power from fossil fuels, alternatives that were already more costly, particularly renewables, found it even more difficult to gain market share. Sweden noted this effect following the creation of the Nordic common electricity market (Nordpool).

154. ***Incoherent treatment of GHG emissions in integrated, regional electricity markets:*** Finland noted that it was obliged to abandon a pure CO_2 tax on the fuel inputs to electricity production and shift instead to an energy tax on electricity consumption. Finland's border charges on imported electricity, intended to reflect the CO_2 content of the source fuels in neighbouring Parties, were disallowed under European Community trade rules. The energy tax was less cost-effective at reducing CO_2 emissions and could introduce distortions that had to be corrected by countervailing policies, further reducing the cost-effectiveness of the original measure.

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[23] Two EIT Parties that did not fully report their emissions in 2000 (Russian Federation, Ukraine) together accounted for over 50 per cent of total CH_4 fugitive fuel emissions in 1990.

[24] Such programmes in natural gas networks and coal-mining reduced emissions in 2000 by 15,000 Gg and 7,000 Gg CO_2 equivalent respectively, and should reduce emissions in 2010 by an estimated 22,000 Gg and 10,000 Gg respectively.

VI. TRANSPORT

A. Implementation issues

155. ***Reporting issues:*** All Parties reported policies and measures in the transport sector and most of them used a broad portfolio of policies and policy instruments. For most of the Parties, transport was seen as one of the priority[25] sectors for policy intervention (Austria, Belgium, Canada, Czech Republic, European Community, Finland, France, Germany, Japan, Liechtenstein, Netherlands, New Zealand, Poland, Slovakia, Switzerland, United Kingdom, United States). Of the key policies and measures listed in the policies and measures database, about two thirds were already implemented, and one sixth were adopted; the remainder were in the planning stage. Eighty per cent of key policies and measures were implemented at the national level; the rest were implemented equally at the regional and local levels.

156. ***Policy objectives and policy trends:*** Climate change policies and measures in the transport sector can be broadly divided into **technical measures** aimed at improving both the energy efficiency of the vehicle fleet and the carbon intensity of the fuel mix, and **non-technical policies and measures** addressing transport activity and structure through transport demand management, push-and-pull incentives for modal shifts towards less polluting transport modes, traffic flow improvements[26] and spatial planning. The reported transport policies were mainly linked to air quality management, congestion management and energy security (dependency on oil imports).

157. ***Policy instruments:*** Analysis of the key policies and measures in the database suggests that economic and fiscal instruments were by far the most important, accounting for around one third of the instruments used, followed by regulatory instruments, information and education, and voluntary agreements. Hence, compared to the policies reported in the NC2, a shift from regulatory approaches towards economic and fiscal approaches can be observed.

158. ***Estimates of effect:*** Several Parties reported the estimated effects of individual policies in the transport sector (Australia, Austria, Bulgaria, Czech Republic, Estonia, European Community, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom). Some Parties reported the estimated effects of transport policies as a whole (Czech Republic, Finland, United States). Except for the European Community White Paper on Transport (European Community), the voluntary agreements with car manufacturers (European Community), the ecological tax reform (Germany) and the fuel duty escalator[27] (United Kingdom), all other transport-related policies were either reported to have had only a limited effect in moderating the emissions growth from transport or no estimates were given. Finland was the only Annex II Party that managed to stabilize its emissions from transport (see box 9).

159. The fact that only half of the policies and measures were quantified reflected, among other factors, the complexity of performing ex-post and ex-ante assessment of transport measures. To some extent, it also reflected difficulties in identifying acceptable packages of measures to address the broad range of technological and behavioural determinants underlying the growth of passenger and freight transport demand. Costs and ancillary benefits of policies in the transport sector were quantified to an even lesser extent. The description of assessment methodologies in the NC3 lacked detail, especially

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[25] Priority was identified in those cases where one or more of the following attributes were used by Parties in the national communications: key, critical, urgent, strategic, main, particular, special emphasis, important role.

[26] Urban traffic flow improvements show an ambiguous effect on GHG emissions: while they reduce the specific emission factor of the vehicles, they increase the capacity of the transport system, inducing a higher activity. The overall effect can be positive or negative. In contrast, traffic flow improvements on highways clearly result in higher GHG emissions, since both the specific emission factors and the number of vehicle miles driven increase.

[27] This measure was no longer in place as of 1999 due to a rise in oil prices.

with regard to the definition of baseline scenarios, possibilities of double-counting, consistency of assumptions and elasticity values.[28]

Box 9. Finland's integrated transport strategy: zero growth of transport emissions

Since 1990, climate policy has been an integral part of Finland's transport policy. It explicitly aims at restraining the growth of transport. Finland's 1994 "Action Programme for Reducing the Adverse Effects of Transport on the Environment" already included the objective for the transport sector to stabilize GHG emissions at 1990 levels, which was indeed achieved in 2000. Finland's new environmental management programme "Environmental Guidelines for the Transport Sector" extended this aim until 2010.

This aim of decoupling transport volumes from economic growth is also mirrored in Finland's long-term strategic programme "Towards a Sustainable and Intelligent Transport Sector", which aims to reach a transportation system in which the demand for road transport (passenger car traffic and road freight traffic) should peak by the year 2020 and gradually decrease thereafter.

Finland's success story is built on a diverse, well-tuned mix of transport policies including strong taxation of vehicles and fuels as its core, complemented by promotion and development of public transport, walking and cycling. This policy mix provided the necessary push-and-pull effect to keep the market share of public transport at a relatively high level (around 20 per cent). In freight transport, the logistical efficiency of transport chains has been an important objective. The catalogue of future transport policies includes vehicle tax reform, regulations for the development of new agglomerations, voluntary agreements with transport operators, campaigns and better information, education and motivation aiming at changing transport behaviour.

B. Framework and description of policies

160. In analysing emission trends from transport, Parties reported one or more **underlying drivers of emission growth**. The steady growth in transport activity in many Parties was reported as the most important of these drivers (e.g. Canada, European Community, United States). More than 70 per cent of the growth in transport energy use in Canada stemmed from the activity effect. Losses in market share for public transport and non-motorized modes of transport also led to higher transport emissions. In particular, for goods transport, road transport and aviation gained high market shares at the expense of rail and ship transport. More than 25 per cent of the growth in transport energy use in Canada was due to this modal shift. A constant shift in consumer preferences towards heavier and more powerful passenger cars (sport-utility vehicles and light trucks) has been reported by several Parties (Canada, Germany, United States).

161. Parties reported policies and measures within a framework aimed at: (i) improving vehicle efficiency; (ii) reducing carbon intensity of the fuel mix; (iii) moderating growth of transport activities and shifts towards less polluting transport modes and (iv) improving traffic flow and spatial planning.

162. ***Policies and measures to improve vehicle efficiency:*** Such policies were reported by 14 Parties, and included average fuel consumption targets for new vehicles (Australia, New Zealand, Slovenia); adaptation of vehicle tax (Austria); a vehicle fuel efficiency programme (Canada); voluntary agreements with the domestic automobile industry (Germany, Italy, Japan) and with car manufacturers (European Community); energy efficiency improvement for railways, ships and aircraft and efficiency ("Top Runner") standards (Japan); differentiation of CO_2 in vehicle tax and car labelling (Netherlands); improvement of the vehicle and aircraft fleets (Spain); energy efficiency in transport (Switzerland), comprehensive transport planning and a fuel duty escalator (United Kingdom); and vehicle systems research and development and clean automotive technology (United States).

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[28] Quantification exercises in France, the Netherlands and the United Kingdom call for a refinement of assessment methods for the transport sector and for scientific effort to develop internationally agreed "best practices" on this.

[29] Quantification exercises in France, the Netherlands and the United Kingdom call for a refinement of assessment methods for the transport sector and for scientific effort to develop internationally agreed "best practices" on this.

163. Most of the European Community member States stressed the voluntary agreements between the European Community and European and Asian automobile manufacturer organizations, which set targets for passenger cars by 2008 (average CO_2 emission figure of 140 g/km[30] for all new cars sold in the European Community, as measured according to the European Community test procedure) and light commercial vehicles for the first commitment period. The European Community estimates a total mitigation impact of 82,000 Gg CO_2 in 2010, and thereafter a further 5,000–10,000 Gg CO_2. However, these targets are non-binding and the effectiveness of these agreements has yet to be proved and monitored over time. Further measures to improve vehicle efficiency are likely be required, especially in light of the growing share of sport-utility vehicles in passenger transport.

164. ***Policies and measures to reduce carbon intensity of the fuel mix:*** Such policies were reported by 13 Parties and included alternative fuel programmes (Australia); improvement of fuel quality[31] (Austria, Germany); promotion of "biodiesel" (Austria, Germany, Slovenia); an allowance for liquefied petroleum gases (LPG) (Canada, Italy); excise tax exemption for ethanol and methanol (Canada); a national biomass ethanol programme (Canada); alternative motor fuel support (Czech Republic); energy strategy for the transport sector (Germany); fuel quality standards (Estonia); recovery of fiscal dues on diesel fuel and gasoline and internalization of carbon costs (France); purchase and investment tax exemption for alternative fuels (Norway); CO_2 tax exemption for natural gas (Norway); biomass motor fuel pilot projects (Sweden); renewable energy for rail (Sweden); and a biofuels programme (United States). Whereas spark-ignition engines fuelled with combined natural gas or LPG have little potential for CO_2 emission reduction compared to standard diesel engines, the switch from mineral oil diesel to biodiesel significantly reduces vehicles impacts on GHG emission levels. In the longer term, fuel switches to natural gas or hydrogen were envisaged (Canada, Germany, Japan, United States).

165. ***Policies and measures directed at moderating the growth of transport activity and shifts towards less polluting transport modes:*** Eight Parties reported policies directed at the growth of transport activities, including reducing the demand for travel (Australia); road tolls (Austria); a mileage-based toll for lorries (Austria, Germany, Slovenia); ecological tax reform (Germany); teleworking (Japan); tax measures to limit passenger traffic (Netherlands); a CO_2 tax, petrol and diesel taxes (Norway); the fuel duty escalator (United Kingdom); and commuter options programmes (United States). Among these policies, vehicle and fuel taxes seem to play an important role (see box 10).

Box 10. Vehicle and fuel taxes: widely imposed but so far of limited effect

Fuel and other transport-related taxes have been widely used by Parties. They provide more than 90 per cent of all environmentally related tax revenues in OECD countries.

Fuel taxes are most often differentiated between gasoline and diesel fuel and are further differentiated by sulphur content in some countries (Germany, Finland, Norway, Sweden). Some Parties report a CO_2 tax in addition to these fuel taxes (Germany, Finland, the Nethelands, Sweden). Vehicle purchase taxes are sometimes differentiated by vehicle efficiency (measured by CO_2 emissions per kilometre driven in a given test cycle).

As short-term travel patterns are seen to be fairly unresponsive to changes in the fixed or even variable cost of travel, the effects of fiscal transport measures are reported to be moderate. However, within an integrated transport policy framework, vehicle and fuel taxes can have a much greater effect on fuel efficiency in transport given their role in providing price signals to car buyers and manufacturers.

166. Policies and measures to shift urban transport towards less polluting modes reported by 13 Parties included investments in public transport (Austria, Belgium); promotion of walking and cycling (Australia, Austria, Belgium, Germany, Latvia); promotion of public transport in urban areas (Belgium,

[30] This is 25 per cent lower than the corresponding figure for 1995.

[31] The use of low-sulphur gasoline and lean-burn engines offers a significant potential for CO_2 reduction in comparison with conventional gasoline engines.

Germany, Greece, Japan, Latvia, Slovakia, Slovenia, Spain); tax exemptions for public transport commuter tickets and car pooling expenditures (Belgium, Sweden); greater use of sustainable transportation (Canada); urban transport planning (France); greater investments in tramway infrastructure (Sweden); and a commuter options programme, a ground freight transport initiative and an emission reduction initiative[32] (United States). Although the combination of push (e.g. road pricing) and pull (e.g. promotion of bus and rail transport) measures can help to maintain the market share of public transport and non-motorized transport in urban areas, investment in public transport alone without the necessary disincentives for private car use (e.g. parking fees) does not seem to slow down growth of urban transport activity.

167. Policies and measures to shift long-distance transport towards less polluting modes were reported by 11 Parties, including investments in rail (Austria, Belgium); promotion of ship and rail in freight transport (Belgium, Japan, Switzerland); moving on sustainable transportation (Canada); intermodal freight transport (France); high-speed trains (European Community, France, Spain); inter-city connections (France); construction of transport systems with minimal environmental impact (Japan); environmentally differentiated charges for shipping and air travel (Sweden); road pricing for heavy goods vehicles (Austria, Germany, Switzerland); sustainable distribution (United Kingdom); and a ground freight transport initiative and an emission reduction initiative (United States). Measures to promote a modal shift in long-distance transport could not only help to attain climate change goals, but also to prevent some modes of transportation, e.g. road freight transport, from growing beyond the limits of today's infrastructure.

168. Policies and measures relating to air transport were reported by five Parties and included development of high-speed railway systems as alternatives to air transport (European Community); support for the introduction of an international kerosene tax (France, Germany); support for the introduction of an international GHG emissions charge (Germany); support for the introduction of an international emissions trading system as currently discussed within the International Civil Aviation Organization (ICAO) (Germany); support of mitigation measures adopted through ICAO (Finland, France, Germany, United Kingdom); and implementation of complementary or alternative measures within the European Community (France, Germany, United Kingdom). On the national level, the introduction of take-off and landing fees differentiated e.g. by CO_2 emissions (Germany) and an air transport White Paper for the sustainable development of aviation and airports (United Kingdom) were reported. The European Community has specifically addressed the environmental impacts of air transport, including climate change, by analysing and identifying ways for developing coherent and integrated policy action in the air transport field. Also, ICAO has established a working group on the inclusion of air transport into an international emissions trading system. As types of instrument, negotiated agreements and economic instruments were particularly mentioned.

169. ***Policies and measures aimed at improving traffic flow and spatial planning:*** Eleven Parties reported policies and measures aimed at improving traffic flow, including traffic management and speed limitation (Austria); intelligent transportation systems (Canada, Japan); an anti-traffic-jam programme (Germany); eco-driving (Finland); speed limits and speed limit enforcements (France, Netherlands); an optimization and collectivization system for private transport (Italy); road pricing (Netherlands); improved driving behaviour (Canada, Netherlands, Sweden); improved aviation control systems (Spain); and commuter options programmes (United States). Some of the these measures (e.g. speed limits, road pricing and driver training) were estimated to have a positive mitigation effect, but others (e.g. traffic

[32] The United States' emission reduction initiative launched by the Department of Transport includes transit programmes, congestion mitigation and air quality improvements, transportation enhancements, pilot programmes and corporate average fuel economy (CAFE) standards. The last-mentioned standards were adopted primarily to save energy in the use of automobiles and light trucks. Compliance is based on the average performance of a manufacturer's fleet, and additional credit toward compliance is available to alternatively fuelled vehicles.

signal timing, traffic information systems and motorway improvements) might have increased emissions by inducing new transport activity.

170. Policies and measures relating to spatial planning reported by five Parties included strategic transport planning (Australia); improvement of spatial planning (Austria, Finland); control of urban sprawl (France); comprehensive municipal planning (Sweden); smart growth and brownfields policies (United States). Parties acknowledged the role of spatial planning measures as an important element of medium- and long-term strategies, given the long response time until their effect becomes visible.

VII. INDUSTRIAL PROCESSES

A. Implementation issues

171. ***Reporting issues:*** Most Parties (Australia, Austria, Belgium, Bulgaria, Canada, Croatia, European Community, Finland, France, Germany, Greece, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, United Kingdom, United States) outlined detailed activities in the field of industrial process emissions and fluorinated gases, but other Parties only briefly described general activities (Czech Republic, Estonia, Latvia, Liechtenstein, Slovakia, Slovenia). Some Parties (Hungary, Monaco, Russian Federation) did not report on policies and measures in this sector.

172. Some Parties included policies and measures targeted at energy-related emissions from industrial processes or fugitive emissions in this section. The UNFCCC reporting guidelines on national communications are ambiguous as to where such emissions should be included, but the UNFCCC reporting guidelines on annual inventories require[33] them to be included under energy. Some Parties (Bulgaria, Croatia, Norway, Poland, Slovakia) report on technological reduction options but do not describe the governmental actions that led to the implementation of these options.

173. ***Policy objectives:*** The major objective of policies and measures in the industrial processes sector is the avoidance of unintended by-production and emission of GHGs. These gases can be destroyed in the waste gas stream at relatively small additional cost (e.g. N_2O emissions from adipic acid or by-production of HFC-23 from HCFC production), or their formation can be reduced by process optimization, which can also be economically beneficial (e.g. PFC emissions in the aluminium industry).

174. A further objective for policies aimed at the use of fluorinated gases is to utilize the least possible amount of GHGs in products and to prevent their emission into the atmosphere. A few Parties stated that the use of fluorinated gases cannot be considered sustainable in the long term (France, United Kingdom). Some countries have started banning the use of substances for specific applications (Austria, Switzerland). These policies are linked to the phase-out of ozone-depleting substances, controlled by the Montreal Protocol.

175. Additional considerations, such as health and safety, are also important for policies and measures related to industrial processes. For example, flammability may increase substantially when hydrocarbons instead of HFCs are used in foams and as cooling agents.

176. ***Policy instruments:*** The type of policy instrument used in this sector is influenced by the fact that emissions are mainly driven by the actions of private enterprises. Hence, Parties used consultation processes with industry as a policy approach before deciding upon specific policies in this sector.

177. Historically, voluntary agreements have been the most frequently used instruments for industry (Australia, Belgium, Canada, European Community, France, Germany, Italy, Japan, Netherlands, Norway, United Kingdom, United States). However, France questions the effectiveness of such

[33] Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications. Document FCCC/CP/1999/7.

agreements and does not give these instruments priority in new programmes. The European Community also plans to include energy and process emissions from industries in its emissions trading system.

178. Regulations were usually used to ensure the phase-out of ozone-depleting substances, and these instruments were also used to a lesser extent for their replacements. The few examples of Parties using regulations in the industrial processes sector include the members of the European Community, which implement the IPPC Directive,[34] or Switzerland, which has banned HFCs in some applications. Because of the complex emission structure, difficulty of monitoring and competitive pressures, fiscal instruments are rarely implemented, although France used a tax on N_2O emissions. Economic instruments are also rare: Austria, for example, provided subsidies for energy-efficient houses only if no HFCs or SF_6 were used in the building material. Only a few Parties (e.g. France, Japan) mentioned planned research and development efforts for uses of fluorinated gases. Education and training in the use of fluorinated gases was implemented by some Parties, focusing on maintenance workers and companies.

179. ***Estimates of effects:*** Most Parties report quantitative estimates of the impacts of at least some individual measures, but they rarely reported on the methods used for such estimation. Among the measures reported in this sector, the most easily quantified were reductions in emissions from production processes, including PFC emissions from the primary aluminium industry. Measures to reduce leakage of refrigerants and air-conditioning agents or regular inspections were very difficult to quantify, because of the uncertainties associated with the emissions data and leakage rates.

180. The methodologies applied for assessing the total effects of measures and for projecting future emissions from industrial processes mainly relied on the extrapolation of past activity trends and spreadsheet models. A few Parties (Belgium, Croatia, Czech Republic, Netherlands, Norway, Sweden) gave detailed information on the related background data and the underlying assumptions. The fluorinated gases received more attention in the NC3 than in the NC2. The complex emission structures are better understood, and comprehensive strategies are being developed.

181. Only a few Parties gave information on the costs of measures. The Netherlands provided cost curves for all sectors and considered emission reductions in the industrial processes sector to be highly cost-effective. The cost of applying catalytic converters for N_2O emission reductions in nitric acid production in the future was often mentioned (Croatia: 1 US$/tonne CO_2 equivalent; France: 1.1 EUR/tonne CO_2 equivalent; Norway: 7 NOK/tonne CO_2 equivalent; Italy: less than 0.5 EUR/tonne CO_2 equivalent). France also reported the results of a study on potential actions to reduce emissions of fluorinated gases, including the estimation of costs for selected applications. Italy provided the investments required for the implementation of its measures, together with the expected emission reductions during 2008–2012 resulting from these measures.

B. Framework and description of policies

182. Policies and measures in industry could be described within a framework consisting of: (i) policies targeting CO_2 and N_2O; (ii) policies targeting process-related emissions of fluorinated gases; and (iii) policies targeting the use of fluorinated gases in products.

183. ***Policies targeting CO_2 and N_2O:*** Process-related CO_2 emissions are important in the cement industry, the iron and steel industry, the aluminium industry, and glass and lime production. In these processes, CO_2 is produced as a by-product and there are no cost-effective measures for extracting CO_2 from the waste gas. Most policies in the cement industry and the iron and steel industry target the energy efficiency of the processes. One technological option to reduce process-related emissions for cement production is to reduce the clinker content in the cement, as its production causes energy-related as well

[34] The IPPC Directive takes an integrated approach to pollution prevention and control, whereby operators and authorities determine the measures that yield the best results for the environment, including energy efficiency.

as process-related emissions. Some Annex I Parties report voluntary agreements that provide incentives to encourage this option (Australia, Belgium, France, Germany).

184. Process-related N_2O emissions are relevant only for those countries where ammonia, nitric acid or adipic acid is produced (Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Czech Republic, European Community, Finland, France, Germany, Greece, Hungary, Italy, Japan, Netherlands, Norway, Poland, Russian Federation, Slovakia, Spain, Sweden, Switzerland, United Kingdom, United States). In other Parties (Estonia, Latvia, Liechtenstein, Monaco, New Zealand), there are no production facilities. The common and cost-effective technology for reducing N_2O emissions from adipic acid production is treatment of waste gas with catalytic converters. Emission reductions of N_2O for adipic acid were implemented through voluntary agreements (Belgium, Finland, Germany, Italy, Japan), regulation (Belgium, France) and taxation (France). Several countries with adipic acid production did not report any government measures and it remains unclear whether abatement technologies have already been implemented there. For nitric acid production, catalytic converters are expected to become available soon. Their implementation should result in further reductions.

185. Reducing N_2O emissions had a noticeable effect on total GHG emissions for some Parties. France, for example, noted that the stabilization of total GHG emissions from 1990 to 1999 was "mainly due to the fall in GHG emissions other than CO_2 and, in particular, to the determined action taken to reduce emissions of nitrous oxide from the chemical industry." For the United Kingdom, the reduction in N_2O emissions amounted to 3 per cent of total GHG emissions in 1990.

186. ***Policies targeting process-related emissions of fluorinated gases:*** PFCs are emitted during primary aluminium production when the process is in a sub-optimal state. Emissions can be reduced by process adjustments and optimizations with environmental and economic benefits. Several Parties reported on implemented voluntary agreements with aluminium producers (Australia, Canada, France, Germany, Japan, Netherlands, Norway, Slovenia, United States). New Zealand did not report any government measures but noted that "energy efficiency is also a major driver for improvements in the smelting process which can lead to lower emissions". The reductions from this measure in Norway are equivalent to 4 per cent of its total GHG emissions in 1990. France noted the use of inert anodes in primary aluminium production as a long-term goal. This would reduce PFC and CO_2 emissions resulting from the oxidation of the carbonaceous anodes currently used. A few Parties reported an increase in aluminium recycling as an indirect measure to reduce emissions (Canada, United Kingdom).

187. Specific HFCs are produced as by-products during the production of other fluorinated chemicals, and can be emitted into the atmosphere. For example, HFC-23 is emitted in the production of HCFC-22. Waste gas treatment can reduce emissions substantially. In some countries, a regulation requires abatement technologies to be installed or optimized to reduce HFC emissions (Netherlands, United Kingdom). The United Kingdom reported a reduction from this measure equivalent to 1.3 per cent of its total GHG emissions in 1990. The United States reported a partnership with industry aimed at reduction of HFCs.

188. PFCs and SF_6 are emitted during the production of semiconductors. Alternative materials, process optimization or waste gas treatment can reduce emissions. Some Parties (e.g. United Kingdom) refer to the voluntary agreement of the World Semiconductor Council, in which this global industry has committed itself to global action aiming at an absolute reduction by 10 per cent from 1995 to 2010. Regulations are planned (Austria, France, Netherlands) and voluntary agreements are implemented (United States) or planned (Germany). Austria reported plans to include semiconductor manufacturing in its legislation to reduce or phase out the application of SF_6. SF_6 is also used as a cover gas in magnesium foundries. It can be replaced by SO_2, but this can introduce occupational health risks. Regulation is planned (France) or voluntary agreements are implemented (Norway, United States).

189. ***Policies targeting the use of fluorinated gases in products:*** Fluorinated gases are used in several applications, and emissions occur during their use. In several cases, HFCs have been introduced

as a replacement for ozone-depleting chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). Some Parties reported regulations relating to the phase-out of ozone-depleting substances, sometimes also including HFCs (Canada, United States).

190. A range of measures targeted the uses of fluorinated gases as a group. Most strict is regulation aimed at phasing out these gases in specific applications (adopted: Liechtenstein, Switzerland, planned: Austria) or regulation on wastes containing HFCs and PFCs and their categorization as special waste (Switzerland). Taxes on use of HFCs and HFC imports are planned (France, Norway). Netherlands reports on its non-CO_2 reduction programme with a wide range of instruments. The European Community plans a framework directive on containment of fluorinated gases. Research and development is being conducted on alternative fluids and technologies (European Community, Finland, France, Japan).

191. HFCs are used as refrigerant fluids in stationary refrigeration and air-conditioning devices. Alternative refrigerants are available, e.g. hydrocarbons, and emissions can also be reduced by decreasing leakage. National preferences and the application of technologies in this subsector vary widely among Parties. For example, Sweden reported that 80 per cent of household refrigerators and freezers in 1999 contained isobutane (an HFC alternative) and that a changeover to isobutane in new appliances would be completed by 2005. In contrast, HFCs currently play an important role for household refrigeration in Italy, Spain and the United Kingdom.

192. Several policies and measures concerning emissions from refrigeration were implemented. Regulation applies to compulsory inspections, avoidance of leakage and sealing of refrigeration units (Austria, Belgium, France, Sweden) and the recovery of refrigerants (France, Japan). Voluntary agreements on reducing HFC emissions from refrigeration were reported by a few Parties (Austria, Switzerland, United Kingdom). Three Parties reported training for refrigeration technicians (Australia, France, New Zealand).

193. HFCs are also used in mobile air-conditioning systems in motor vehicles, although alternative refrigerants are expected to be available for commercial application shortly. The use of mobile air-conditioning systems is increasing considerably, and HFC emissions of existing mobile systems are higher than for stationary systems. Policies and measures included voluntary agreements (United Kingdom); reduction and phase-out plans (Austria); plans for a decree prohibiting venting into the atmosphere, plans for the standardization of piping systems and training of companies working on air-conditioning equipment (France); and plans to change over to CO_2 until 2007 (Germany). The European Community plans to integrate mobile air-conditioning into the existing voluntary agreements with European car manufacturers.

194. HFCs are also used as foam-blowing agents. Hydrocarbons are possible alternatives; they do not affect the climate but present a risk of increased flammability during production. Several Parties started activities in the field of foams and insulation material, including a project to phase out ozone-depleting substances and move to cyclopentane as a blowing agent (Poland); subsidies for energy-efficient houses on the condition that no HFC-blown insulation material is used (Austria); or implemented voluntary agreements and plans for further action (Germany, United Kingdom). HFCs are also used as propellants in aerosol cans in selected applications. Alternatives are available for many of these applications. Some Parties (Liechtenstein, Switzerland) banned HFCs as aerosols in most applications by regulation. Voluntary agreements with the industry are implemented (United Kingdom) or planned (Germany).

195. PFCs are used in fire extinguishers, but alternatives are available for most applications. The use of PFCs in fire extinguishers are banned by regulation in some Parties (Liechtenstein, Switzerland) and generally on ships through the International Maritime Organization. No alternatives were reported for SF_6 used in high-voltage equipment. Several Parties implemented (Germany, United States) or plan (France, Italy, Slovenia, Switzerland) voluntary agreements for leakage reduction, and gas recovery and recycling. Norway reported on a government-supported fund for gas recovery.

VIII. AGRICULTURE

A. Implementation issues

196. ***Reporting issues:*** Almost all Parties reported policies and measures in the agricultural sector, exceptions being Liechtenstein and Monaco. About half of the policies and measures have been implemented, around one third adopted and the remainder are planned. The low fraction of planned policies and measures reflects the fact that few Annex I Parties have identified and planned additional measures for the agriculture sector, should existing measures prove inadequate.

197. ***Policy objectives and policy trends:*** Most Parties cited other objectives in addition to climate change behind the implementation of agricultural policies. However, despite the lack of specific climate policies, most Parties reported decreases in agricultural emissions in 2000 compared to 1990 and expected further decreases by 2010, reflecting the fact that their portfolios of wider agricultural policies have a positive impact upon emission reductions. These wider agricultural policies have been strongly linked to a wide range of policy objectives, such as market reform (e.g. the CAP in the European Community and accession states); rural development (e.g. Agenda 2000 in the CAP); environmental pollution (e.g. the European Community Nitrates Directive and IPPC Directive; good agricultural practice; organic farming standards; and environmental protection); afforestation and its associated benefits (e.g. use of set-aside land in European Community member States); permanent cover programmes; sustainable agriculture; shelterbelts and others). Some Parties seem to be able to integrate directly elements of the climate change agenda in agricultural policies, while the rest established indirect linkages between these two issues.

198. Most agricultural policies impact upon both CH_4 and N_2O emissions, but some of them affect only one of these gases, or CO_2 sequestration. These policies may be summarized in terms of impacts as follows: (i) **All GHGs:** these are the most common policies in agriculture and tend to be driven by economic and environmental issues. They may be described as policies promoting improved environmental performance; (ii) **N_2O emissions:** these policies and measures are widely implemented and all focus on the use of nitrogen fertilizers and manure management. They include the European Community Nitrates Directive and associated national measures; taxation of nitrogen production from farms (France, planned); a range of water quality legislation and regulations; and manure and grazing management: (iii) **CH_4 emissions:** these policies and measures specifically target the number of livestock and management of fodder; (iv) **Carbon sequestration and CO_2 emissions:** policies and measures addressing carbon sequestration were limited to afforestation/reforestation of agricultural land, which should be reported under the LUCF sector. Sequestration in soils was correctly reported under the LUCF sector (e.g. Slovakia). Emissions of CO_2 arising from energy consumption in agriculture are to be reported elsewhere, but some Parties reported issues related to the growth of biomass or energy crops in the agricultural sector (e.g. oilseed crops in Austria).

199. Although none of the policies and measures reported were particularly innovative, some research activities could result in innovative policies in future. One exception is the proposed tax on nitrogen production on farms in France. Most policies and measures are broadly replicable, and, for example, policies focusing on improved environmental performance have already been widely implemented.

200. ***Policy instruments:*** An analysis of the instruments used to implement the policies and measures indicates that the most popular policies in agriculture were implemented using a wide range of policy instruments. The CAP strongly influences activity levels and profitability in the agricultural sector and hence has a strong influence on emissions in European Community countries. It was implemented throughout by a variety of regulatory, fiscal and economic means. A number of European Community accession states have reported substantial structural changes in agriculture in the 1990s, and some of them have adopted agricultural policies compatible with those to the European Community. In the

absence of estimates of the effectiveness of individual policies and measures, it is not possible to conclude which individual instruments are effective.

201. ***Estimates of effects:*** Most Parties reported on the expected impacts of portfolios of agricultural policies in their projections for 2010 under the "with measures" scenario, but fewer countries estimated impacts under the "with additional measures" scenario. Some Parties provided quantitative assessments of the environmental effectiveness of individual policies in agriculture (Australia, Bulgaria, Czech Republic, European Community, Italy, Spain). Methodologies for estimating the effectiveness of individual policies and measures and overall trends affected by portfolios of policies were not described in detail. In most cases these were based on projections of economic activity by macroeconomic models or predicted activity levels such as fertilizer applications and livestock numbers within the sector (e.g. New Zealand).

202. Spain provided consistent estimates of the impacts of several policies in agriculture on CO_2, CH_4 and N_2O emissions, which in 2005 were expected to reduce aggregate emissions from this sector by around 3,780 Gg CO_2 equivalent, or 7 per cent of aggregate emissions from the sector in 1999. The European Community reported the expected impact of the CAP on CH_4 and N_2O emissions to be a total reduction of 40,000 and 56,000 Gg CO_2 equivalent in 2000 and 2010 respectively, or 10 per cent and 14 per cent of 1999 emissions from the sector.

B. Framework and description of policies

203. Policies and measures in the agricultural sector can be described within a framework that distinguishes between: (i) policies and measures with wider policy objectives that also impact upon GHG emissions; (ii) policies and measures that focus more specifically on individual activities within the sector that may or may not have GHG emissions as their primary objective; and (iii) research-based policies and measures designed to provide new solutions to technical problems.

204. ***Policies and measures with wider policy objectives:*** The most commonly reported policies in agriculture fall into this first category. These policies are designed to reduce the negative environmental impacts of agricultural practices and promote sustainability. They include: extension of ecological farming (Austria); promotion of organic farming (Belgium, Germany, Estonia, Greece); a rural development plan (Belgium); the agricultural environmental stewardship initiative (Canada); the CAP (European Community); an organic farming act (Estonia); an agroenvironmental standard (Spain); ecological practices on farms (Switzerland); a programme for environmental agriculture (Hungary); a programme for stabilization and development of agricultural production (Russian Federation); and a code of good practice in agriculture (Bulgaria, Lithuania). These policies have the potential to affect emissions of both N_2O and CH_4, depending on their implementation.

205. New Zealand removed subsidies from agricultural products, which had a marked effect on the whole agricultural sector, resulting in substantial changes in land use and GHG emissions. Sweden began the removal of agricultural subsidies in 1990, but joined the European Community and came under the provisions of the CAP in 1995.

206. ***Policies and measures targeting specific activities:*** More focused policies and measures with direct impacts on the major sources of GHGs from agriculture were also widely implemented and are summarized below.

207. Policies and measures to address nitrate pollution and emissions of N_2O from applications of nitrate fertilizer and animal manure to agricultural soils encompass: reduced use of fertilizers (Australia); balanced agrochemical treatment and fertilizer use (Bulgaria); a manure action plan (Belgium); the Nitrates Directive (European Community); agriculture environment support (Finland); reduction of N_2O emissions from soil and taxation of nitrogen production (France); animal waste management systems and code of practice for the use of fertilizer (New Zealand); and nutrient

management tools (United States). Also, some of these policies affect CH_4 emissions by encouraging better management of animal manure and thereby reducing the occurrence and duration of anaerobic conditions when CH_4 is emitted.

208. Policies and measures addressing CH_4 emissions from enteric fermentation in livestock focus on reduction of livestock numbers through reducing national herds and intensifying farming practices combined with increased yields per head: reduction in pig breeding (Belgium); reduction in livestock numbers (Slovakia); and specific research programmes to investigate means of reducing CH_4 (and N_2O) emissions from farming practices (France, New Zealand).

209. Policies and measures promoting sequestration of CO_2 include afforestation and conservation programmes on surplus agricultural land. Most of these policies and measures have been implemented to meet agricultural policy objectives, and for recreational and environmental protection reasons, and should be reported under LUCF. These policies and measures included the permanent cover programme (Canada); support for afforestation of unused agricultural areas (Czech Republic); and reforestation (Spain).

210. Policies and measures to reduce CO_2 emissions include promotion of biomass as a source of renewable energy, emphasizing the link between the agricultural and energy sectors (Austria, Sweden); cultivation of oilseed crops (Austria); and start-up grants for energy forests (Sweden).

211. ***Research-based policies and measures:*** Research-based policies and measures are important as they have the potential to provide the new technologies that will form the basis of future policies. Many Parties referred to research activities in general (e.g. United States); others were specific about the exact objectives (Japan) and methods (Australia, France, New Zealand). In particular, new technologies have been sought to: (i) reduce emissions of N_2O from agricultural soils and from the excessive application of nitrogen fertilizers; (ii) reduce CH_4 emissions from enteric fermentation through fodder management, the introduction of enteric bacteria or the development of vaccine to reduce livestock emissions; (iii) better understand and monitor the dynamics of GHGs.

C. Policies and measures having a negative impact on emission trends

212. Policies and measures promoting agricultural intensification are likely to result in increased emissions of CH_4 from manure management (New Zealand) and increased emissions of N_2O from fertilizer use (Canada). The production of fertilizers, particularly nitrogenous fertilizers, is also very energy intensive (Canada). However, the impact of increased agricultural production on agricultural emissions depends on the individual circumstances of the Parties.

IX. LAND-USE CHANGE AND FORESTRY

A. Implementation issues

213. ***Reporting issues:*** Almost all Annex I Parties, except for Liechtenstein and Monaco, reported policies and measures in the LUCF sector making reference to the role of forests under the Convention. Others were more specific, referring to the land use, land-use change and forestry (LULUCF) activities under the Kyoto Protocol as a climate mitigation option. Almost all of the policies addressed CO_2 emissions and removals, with very little emphasis on N_2O and CH_4. Around three quarters of policies and measures in the LUCF sector have been implemented; the rest are adopted or planned.

214. Modalities for LULUCF under the Protocol were agreed by COP at its seventh session (Decision 11/CP.7). The provision of LULUCF under the Kyoto Protocol differs from the treatment of LUCF under the Convention. A few Parties are developing additional LULUCF activities to meet the Kyoto targets, to be implemented if the first batch of measures fails to deliver the required emission reductions (e.g. Croatia, Estonia, Italy, Japan).

215. ***Policy objectives and policy trends:*** Policies and measures in the LUCF sector are strongly linked to other domestic policies implemented by Parties, such as national forest programmes, land-use management within the agricultural sector (e.g. afforestation/reforestation and conservation policies in the agricultural sector); biodiversity and wildlife conservation; soil and water conservation; resource supply; sustainable forest management; rural development and protection from pests and fires. Most of the policies were implemented for primary objectives other than climate change, but some Parties noted the role of the LUCF sector in reducing total GHG emissions (Canada, Estonia, Japan, New Zealand, Poland, United States).

216. Policies aimed at enhancing sinks through afforestation/reforestation activities were predominant in the LUCF sector and have been reported by most of the Parties. Other policies targeted reduction of all GHG emissions from the sector. With the exception of trading regimes under development in Canada and New Zealand, none of these policies are particularly innovative. Developing new technologies in the fight against pests and fire may make forest protection systems more effective. Research into carbon dynamics and estimation methods in the products and waste pools may also help Parties to include these pools in their national inventories (subject to approval by the COP). Parties may further develop policies and measures for LUCF sector, as new and refined estimation and reporting methods for GHG inventories have been developed, such as the IPCC good practice guidance.[35]

217. ***Policy instruments:*** Policies and measures in the LUCF sector were implemented using a range of instruments including regulatory (e.g. forest code (Russian Federation) and enforcement of regeneration after harvesting (Estonia)); fiscal (linking energy taxes to afforestation (Netherlands); economic (financial compensation for converting agricultural land to forest (Belgium)); voluntary agreements (sustainable forest management certification (Finland, Sweden)); and specific projects (Australia, Bulgaria, Canada, New Zealand). The first three instruments are more common. Specific projects may help Parties in developing new policies and measures, and can have substantial impacts upon a Party's total GHG emissions (for example the East Coast Forestry Project in New Zealand aims to offset about 3 per cent of New Zealand's 1990 CO_2 emissions).

218. ***Estimates of effects:*** Few Parties reported quantitative assessments of some individual LUCF-related policies and measures. France reported that incentives to afforest 30,000 ha of farmland per year would result in net removals of 550 Gg CO_2 equivalent in 2010. Bulgaria reported potential carbon sinks resulting from specific policies and individual projects. Germany estimated that wood products currently in use store at least 340,000 Gg of carbon, corresponding to about 1,248,000 Gg CO_2, and that the storage is increasing annually by 15,000–18,000 Gg CO_2.

219. To assess the impact of these individual policies, several Parties reported estimates and predictions based on existing net removal rates (growth minus harvesting) under different scenarios reflecting activity levels and/or growth rates, and thus making the analysis more difficult. New Zealand, for example, reported increases of carbon in planted forests net of emissions from harvesting and other emissions from land-use changes. Sweden predicted sequestration net of improved growth rates and different levels of harvest. The Czech Republic provided details of the assessment approach for carbon stock changes based on predicted activity levels. Emissions of non-CO_2 GHGs were of less significance: the Czech Republic, for example, assumed they remained level throughout the first commitment period. There was little mention of methodologies for monitoring the emission and removal levels, although New Zealand specifically reported the development of a monitoring tool for the LUCF sector.

220. Eighteen Parties provided assessment of the total effect of policies and measures in the LUCF sector until 2010 under a "with measures" scenario indicating that, apart from Australia, Greece and the United Kingdom, the LUCF sector will continue to act as a net sink. Projections for "with additional

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[35] Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000.

measures" scenario were rarely presented, and when presented, they differed only slightly from "with measures" scenarios.

221. A few Parties reported the environmental effectiveness of LULUCF activities in the context of their Kyoto targets (Czech Republic, Japan, New Zealand). New Zealand expected carbon sequestration to fall from 24,200 Gg CO_2 equivalent in 2000 to 13,900 Gg CO_2 equivalent in 2012 as a result of a forecast increase in harvesting. Japan expected the implementation of identified policies and measures on LULUCF to deliver approximately 3.9 per cent of total GHG emissions in the base year. Italy reported on the maximum potentials and cost-effectiveness of different LULUCF activities.

B. Framework and description of policies

222. A framework for the classification of LUCF policies and measures includes: (i) policies and measures that deliver increased sequestration through activities in the LUCF sector, including a general forest policy framework or a subset of policies (e.g. afforestation/reforestation since 1990 that will count towards Kyoto targets); (ii) policies and measures that aim to reduce emissions of CO_2 and non-CO_2 GHG in the LUCF sector; and (iii) research-based policies and measures that aim to increase the understanding of carbon dynamics, improve monitoring capacity and develop innovative solutions.

223. ***Policies and measures to increase sequestration of CO_2:*** Several Parties reported the development of national forest strategies and programmes promoting a wide range of measures likely to contribute to an overall increase in carbon stored in forests and forest products (European Community, Estonia, Finland, Japan, Russian Federation, Slovenia, Sweden). Most of the Parties reported a range of afforestation/reforestation policies (Australia, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Estonia, France, Germany, Greece, Hungary, Latvia, Netherlands, New Zealand, Norway, Poland, Slovakia, Spain, United Kingdom, United States). Many Parties also reported policies to increase removals through improved forest management using regulatory and voluntary measures such as sustainable forest management, forest stewardship and forest management certification (Croatia, Estonia, Japan, Latvia, Liechtenstein, Slovakia, Sweden, United States). Japan reported the promotion of urban tree planting. Germany reported the promotion of use of wood products as a long-term carbon stock, and as a substitutes for other products.

224. Both Canada and New Zealand reported steps to implement carbon trading schemes that recognize the value of carbon stored in eligible sinks, and both these Parties also reported specific forest management and afforestation projects. These are significant steps towards the inclusion of LULUCF activities in domestic and international emissions trading schemes under the Protocol. Italy reported on steps to establish a national register to certify the quantities of carbon removed by the Italian agricultural and forestry system.

225. Few policies and measures aimed at increasing carbon sequestration in soils were reported in the LUCF sector, including policies aimed at promotion of the use of green manure crops (Japan); revegetation, and a plan for salinity and water quality (Australia); promotion of use of wood products (Germany); and promotion of wood and biomass for energy (Germany, Lithuania). Canada reported specific policies in the agricultural sector that will influence carbon sequestration in soils (e.g. no-tillage regimes, conversion of arable lands to pasture) and expected agricultural soils to function as a net sink in 2010 (soils in Canada are currently a net source). The United States reported that agricultural soils currently offset about 2 per cent of its total annual GHG emissions and estimated that removing environmentally sensitive farmland from production will offset 56,000 Gg CO_2 annually. Many forms of improved environmental practice in the agricultural sector (e.g. organic farming, use of organic fertilizers, manure management) will also increase carbon storage in soils, although Parties did not report or estimate these benefits.

226. ***Policies and measures to reduce emissions of GHGs:*** Specific policies and measures to reduce emissions of CO_2 and non-CO_2 emissions were seldom reported. Latvia intended to restrict conversion

of forest land to other uses and thereby reduce CO_2 emissions. Austria reported strengthening the protection of existing forests. Slovakia noted steps to protect the carbon stored in forest soils. Several Parties emphasized means to improve the protection of forest resources from fire and pests (Canada, Greece, New Zealand, Russian Federation). In some countries (e.g. Sweden), however, fires form an important element of long-term ecological stability and other policies encourage the use of fire on a controlled basis.

227. ***Research-based policies and measures:*** Five Parties reported research-based policies. Austria placed emphasis on research to better understand adaptive strategies within areas of high conservation value. Belgium reported research into carbon sequestration in forests. Canada and New Zealand reported research-based policies seeking to improve methods of fire control and thereby reduce emissions of non-CO_2 emissions. Norway reported research into carbon storage in buildings, furniture, landfills and other wood products. New Zealand reported research and development of a carbon monitoring tool based on satellite imagery and ground truthing. Other Parties reported more general research, extension and outreach programmes.

C. Policies and measures having a negative impact on emission trends

228. Policies and measures promoting sustainable forest management may result in the replacement of faster-growing conifers by broad-leaved species which are slower-growing and therefore sequester less carbon in a given time (Sweden). The promotion of controlled burning is also likely to reduce carbon storage in the short to medium term, although it protects biodiversity and natural ecosystems and increases carbon storage in the long term (Sweden). Policies promoting the use of timber resources (e.g. Japan) may result in increased timber harvesting.

X. WASTE

A. Implementation issues

229. ***Reporting issues:*** Almost all Parties (except Hungary, Monaco, Russian Federation) reported implemented general measures in the waste sector. Most Parties implemented measures directly related to landfills; only a few implemented measures related to waste incineration and wastewater treatment. Reporting was usually less detailed than for other sectors, and several Parties did not provide the policies and measures table as requested by the guidelines (Croatia, Greece, Hungary, Italy, Japan, Monaco, New Zealand, Norway, Poland, Russian Federation, Slovenia, Switzerland, United Kingdom).

230. ***Policy objectives and policy trends:*** The waste sector is a major concern of governments, not only because of its effects on climate but mainly because of other environmental effects, such as local pollution, possible soil and underground water contamination, and odour. However, policies in this area have a considerable indirect impact on GHG emission levels. Policies in the waste sector are driven by these general concerns (see also box 11, the waste management hierarchy) and only secondarily by climate change concerns. For example, modern landfills are covered to avoid rainwater leaching through, and CH_4 is collected to avoid risk of explosion. Only the final step – incinerating the collected CH_4 – is driven primarily by climate change concerns. Another example is waste incineration, which is regulated mainly since it has been an important emitter of dioxins and mercury in the past. The use of the heat generated by incineration is stimulated by climate concerns.

231. Preferences in waste management differ between Parties, and the related policy objectives have changed in many Parties in the last decade. The amount of waste generated varies substantially between Parties (e.g. Austria: 1 kg per capita per day; United States: 3.5 kg per capita per day), and it has increased for some (Australia, United States) and decreased for others (Canada, Finland). The rate of recycling also varies between Parties (Netherlands 79 per cent of all waste), but is generally increasing. Parties also have different priorities for waste disposal. For those countries that have uncontrolled waste dumps, a trend towards regulated landfill sites is visible (mostly in EITs, Greece, Spain). Other Parties

already deposit all waste in regulated landfills (e.g. Australia, New Zealand), or incinerate most waste (e.g. Japan). Another trend is the movement from many small landfill sites to fewer larger ones (e.g. Finland, Germany, Latvia, United States) or the movement away from landfilling to incineration (e.g. Germany, Netherlands). There is also an increasing trend to recover the energy from waste incineration (box 11). The amount of waste generated, together with waste management preferences, lead to a wide range of per capita emissions from waste, as noted above.

Box 11. Waste management hierarchy

Several options exist for minimizing the environmental impacts of waste, which have their advantages and disadvantages related to environmental performance and cost. To prioritize these options, several Parties (e.g. Austria, Bulgaria, European Community, Slovakia, Sweden) have introduced a hierarchy of waste management principles and related activities with targets assigned for many of these activities. Such a hierarchy of sustainable waste management establishes the following order of activities:

- Waste minimization
- Waste separation
- Waste reuse
- Material recycling
- Energy recycling through incineration
- Safe disposal.

232. In their NC3 Parties presented broadly the same range of measures related to the waste sector as in the NC2, but there was more emphasis on waste prevention measures.

233. ***Policy instruments:*** The most important policy instruments for the waste sector are regulations. Almost all Parties report general waste management plans, policy targets and standards for technologies. For example, the United States introduced a stringent landfill rule, including performance standards and emission guidelines, which required the largest landfills to collect and combust the landfill gas. It was estimated that with this rule, landfill CH_4 emissions in 2000 would be about half of what they would have been under "business as usual".

234. Fiscal instruments were also implemented by several Parties, most common as a landfill tax. This tax ranged from SwF 15 (US$ 9) per tonne of waste (Switzerland) to NKr 300 (US$ 33) per tonne (Norway). These taxes are designed to also reduce possible emissions per tonne of waste; e.g. the level of the tax depends on whether the landfill is sealed and CH_4 is recovered (Austria), or depends on the organic content of the waste (Slovenia, United Kingdom). A few voluntary agreements were reported (Australia, United States).

235. Education and training were mentioned in the context of waste minimization and recycling strategies directed towards the consumer and also towards companies. Enhanced research and development and emission monitoring programmes by the Parties received little attention.

236. ***Estimates of effects:*** Several Parties reported the effect of the measures on GHG emissions. Often the evaluation did not include absolute reductions but was based on a "business as usual" projection minus the emissions under an implemented measure.

237. Reductions in the emissions from landfills contributed substantially to the trends of total emissions for many Parties. These reductions (emissions from landfills in 2000 compared to those 1990) were 1.3 per cent (Austria), 2.1 per cent (Estonia), 2.7 per cent (Finland), 2.3 per cent (Germany), 1.6 per cent (Netherlands) and 1.5 per cent (United Kingdom) of total GHG emissions of these Parties in 1990.

238. Only a few Parties provided data on the cost of measures. The costs of landfill gas recovery are very low compared to the abatement cost in other sectors, as the large scale of the implementation suggests. Croatia reported US$ 7–11/tonne CO_2 for a future measure to reduce emissions from landfills

and states that this is a "valuable reduction option". A European Community study on available GHG abatement measures and the related costs for all GHGs in all economic sectors concluded that a substantial share of options to reach the Kyoto target were low-cost options, including substantial emission reductions from the waste sector, where low-cost measures would allow for a 40 per cent reduction from the 2010 baseline emissions from the sector. A considerable proportion of this was related to landfill emission reductions.

B. Framework and description of policies

239. The description of the policies reported by Parties below broadly follows the waste management hierarchy outlined in box 11.

240. ***Policies aimed at waste minimization and recycling:*** A range of policies and measures concerning waste minimization and material recycling were reported. Several Parties implemented national waste strategies and programmes to minimize and prevent waste generation (Austria, Belgium, Bulgaria, Estonia, Finland, Japan, New Zealand, Norway, United States). Many Parties require or encourage the separate collection of waste fractions and recycling of organic and other types of waste through regulation (Austria, Belgium, Croatia, Finland, France, Germany, Japan, Latvia, Liechtenstein, New Zealand, Norway, Slovakia, Sweden, United Kingdom, United States).

241. Regulations were adopted for several waste fractions: packaging and associated waste (Czech Republic, European Community, Germany, Spain); material recovered from used cars (European Community, Germany); electrical and electronic equipment waste (European Community); and sewage sludge (European Community, Poland). Preventive measures were reported on consumer education and proactive behaviour related to waste (Sweden) and on promoting the use of recycled products (Japan).

242. The build-up of the waste management infrastructure was a matter of concern to a few Parties (Canada, Croatia, Greece, Slovakia). The infrastructure development for both solid waste and wastewater included subsidies for municipal investments. Several measures targeted increasing the share of waste incineration compared to landfilling (Austria, Croatia, Netherlands, Spain, Switzerland).

243. ***Policies aimed at waste incineration:*** These policies aimed at improving energy recovery from waste incinerators (Austria, France, Japan) and strengthening standards for waste incinerators and improvement of their combustion efficiencies (Belgium, Japan). Fiscal measures included a tax on waste incinerated (Norway) and a tax exemption for electricity generated by waste incinerators (the Netherlands).

244. ***Policies aimed at waste disposal:*** Regulation to control landfill emissions was the most frequently implemented measure, and has an immediate effect on GHG emissions. It generally comprises the requirement to capture and combust landfill gas. Almost all Parties have implemented or at least planned such activities (Australia, Austria, Belgium, Bulgaria, Canada, Czech Republic, Estonia, European Community, Finland, France, Germany, Greece, Italy, Netherlands, New Zealand, Norway, Poland, Slovakia, Spain, Sweden, Switzerland, United Kingdom, United States).

245. Additional measures directly targeting landfills included the closure of uncontrolled landfills (Estonia, Croatia, New Zealand, Poland, Spain); the reduction of, or ban on, landfilling of organic and other waste fractions (Austria, Belgium, Bulgaria, Czech Republic, European Community, France, Germany, Greece, Italy, New Zealand, Norway, Poland, Sweden, Switzerland, United Kingdom); and the regulation of the pre-treatment of waste before landfilling and of its organic content (Austria). Taxes and charges on landfilling of packaging and other waste were implemented (Austria, Czech Republic, Finland, Norway, Slovakia, Sweden, Switzerland, United Kingdom) or planned by several Parties. Measures concerning wastewater included the generation of biogas and its utilization in wastewater treatment plants, and improved sewage treatment (Czech Republic, Japan, New Zealand, Poland).

XI. CONCLUSIONS

A. Overall conclusions

246. In their NC3, Parties summarized almost a decade of experience in identifying and implementing climate change policies. During that decade, Parties continued to shape their climate change policies in a way that fits their historical approaches for efficient policy-making, but also gives increasing preferences to some innovative instruments and approaches that could deliver significant emission reductions. Also, climate change rose in importance in the national policy agenda and climate change objectives were integrated into the objectives of several sectors, notably the energy sector, to various extents. Further, linkages were established between climate change issues, including energy and mobility, on the one hand, and sustainable development on the other.

247. Although, with few exceptions, climate change policies were driven by multiple objectives, e.g. enhancing economic performance through energy market liberalization, improving local air quality through emission and vehicle efficiency standards, or improving economic efficiency through restructuring and privatization of markets in EIT countries, these measures assisted many Parties in finding ways to achieve GHG emission reduction gains and moderate emission growth between 1990 and 2000. Some climate-driven policies and measures also led to substantial emission reductions from specific sources. For example, N_2O emissions were considerably reduced by the measures targeting the chemical industries, which have also proved to be very cost-effective.

248. Several Annex II Parties (including European Community, Finland, France, Sweden, Switzerland) returned their emissions in 2000 to their 1990 levels, excluding LUCF, or even reduced them (e.g. Germany, United Kingdom), thereby contributing to attaining the aim of Article 4.2 of the Convention for Annex I Parties individually or jointly to return their 2000 emissions to 1990 levels. Twelve other Annex II Parties and Slovenia exceeded their 1990 emission levels in 2000. Some of these Parties slowed their emission growth or even stabilized their emissions after an initial emission increase in the early 1990s. Different factors seemed to have contributed to this trend, including milder winters and an economic slowdown. However, climate-change-related policies seemed to be partly responsible for stabilization and the slowdown of emission growth in all these countries. Only a few Parties had a clearly rising trend of emissions at the end of the decade.

249. The contribution of the EIT countries to the aim of the Convention was substantial. It stemmed from the steep economic decline resulting from the transition from centrally planned to market economies, associated structural changes and related decrease in emission levels. Of overriding importance, however, was the fact that in recent years most EIT countries experienced appreciable economic growth with visible decoupling of economic growth from emission growth.

250. Effective integrated climate strategies are now emerging from lessons learned over almost a decade of implementation of climate change policies and measures, e.g. integration of emissions trading, energy taxes, negotiated agreements and the IPPC Directive. This could prove to be an effective means of finding the right mix of policies and allowing businesses flexibility in responding to increasingly stringent targets. These strategies are underpinned by a diverse and carefully designed policy mix. They focus clearly on climate mitigation but also contain elements of adaptation. A number of innovative policies and measures have also been identified by Parties as being likely to play an increasingly important role in these strategies. These included emissions trading, green certificates trading (energy industries sector), materials substitution and integration of energy efficiency objectives in industrial site licensing (industry sector), and promoting sustainable lifestyles (residential sector).

251. There is evidence that many Annex I Parties bound by the commitments of the Kyoto Protocol, or intending to be so, are on track to design and implement climate change policies and measures, and integrated strategies that could achieve substantial emission reductions in the medium term. For the most

part, the new policies and measures described in this report have not begun to have their full impact on reducing emissions because of the inertia inherent in the economic system. The full impact of these policies is likely to be seen in a few years, in the lead-up to and during the first commitment period of the Kyoto Protocol. Whether these strategies will be successful in modifying emission trends will depend on how comprehensively they cover all important sources of emissions, whether they identify and use cost-effective options, and how effectively they acquire public support. Success will also depend on how Parties translate these strategies into specific programmes and action plans.

252. Much emphasis was placed by Parties on the role of new technologies in modifying medium- and long-tem emission trends. Examples of such technologies included fuel cells, carbon sequestration, carbon-capturing technologies for process-related CO_2 emissions, and, for some applications, viable substitutes for ozone-depleting substances controlled by the Montreal Protocol, other than fluorinated gases. There was little indication, however, of which technologies are the most promising for the mitigation of emissions, and how research is targeting them. Also, there was little information on how existing policies could persuade the markets to ensure an optimal uptake of new efficient technologies that are close to economic viability, and what new policies are needed to stimulate technologies that could deliver emission reductions in the medium and long term.

253. It was evident from the analysis of the information reported that new, economically viable technologies are needed to reduce emissions substantially. They may not be critical for the first commitment period under the Kyoto Protocol, where in most of the Parties existing measures or measures to be phased in before this period, and existing technologies, could deliver most of the necessary emission reductions. However, the implementation of new technologies should start in the first commitment period, at least on a pilot basis, in order to deliver further emission reductions in the second period.

254. Many Parties considered the monitoring of implementation of policies and measures, and estimation of effects, as a priority. Moreover, they noted that monitoring will be critical to ensure that policies are on track to deliver the effect expected or to trigger the strengthening of existing policies and the launch of new ones if necessary to meet the Kyoto targets. Still, Parties acknowledged methodological problems related to ex-ante and ex-post assessment, data quality and the inevitable uncertainties associated with estimates of mitigation effects or cost, as the main reasons for not providing a comprehensive assessment of the effects of policies and measures in their NC3. Further refinement of methods for assessing the effects of policies and measures could help to overcome these problems and to make these methods consistent across Parties in terms of assumptions, approaches and results. This could help Parties to improve the cost-benefit analysis, which appears essential at the current stage of formulation and implementation of climate policies, especially when taking decisions on the balance of policy instruments, the most effective policy mix and the contribution of emission reductions that have to come from the implementation of the Kyoto flexible mechanisms.

255. Although the quality of reported information on policies and measures was considerably better in the NC3 than in previous communications, some gaps and ambiguities still remained. Major problems in reporting were linked to the need for more transparent reporting on key policies and measures. Providing details of more than 100 policies, measures and projects does not necessarily contribute to transparency. Problems were also linked to the reporting on the status of implementation of individual policies and portfolios of policies, methods used for estimating their effects and the results of these estimations.

B. Conclusions by sector

256. Most Parties are now putting in place policies and measures that should reduce **energy sector** emissions substantially from baseline levels. Other Parties plan to do so, or are holding measures such as

CO_2 taxes and emissions trading schemes in reserve, to be introduced if necessary. Some individual, effective measures to reduce emissions stand out, despite the difficulties in determining the true additionality of measures, or comparing measures between and within Parties. A number of effective or promising mandatory measures, both market based and regulatory, are summarized below.

257. **Energy/CO_2 taxes** have substantially reduced emissions in several Parties, notably Norway, Sweden and Finland. In the United Kingdom and the European Community the new **emissions trading systems** are likely to achieve substantial quantified emission reductions from the initial industrial participants. Some Parties noted the possibility of taxes and emissions trading schemes co-existing. **Quotas, or portfolio standards**, for the share of renewables or CHP in power generation should increase their rate of penetration and help to drive down their costs. Again, future enforcement of the quotas that have been set appears critical. For some Parties, this approach was a clear step forwards from the setting of soft targets for renewables and CHP. **Voluntary agreements and, in particular, negotiated agreements** to reduce energy use in industry have contributed to emission reduction in some Parties. Several Parties have moved from voluntary agreements to these tougher forms of agreement. Some Parties (e.g. Australia) strongly encourage industry participation in negotiations that lead to binding agreements. Mandatory **regulations for energy efficiency in buildings** have proved to be an effective policy in the residential sector and Parties acknowledged a large potential for saving energy and reducing emissions in this way. Parties also generally found **minimum energy efficiency standards** to be an effective way of reducing emissions from the use of appliances in homes and offices. In the institutional sector, many Parties have made **additional commitments** to increase energy efficiency in public buildings.

258. Policies and measures implemented in the **transport sector** still have a limited mitigation effect compared to other sectors. The policy response pattern showed a clear preference for addressing energy intensity and fuel mix through technical measures. Transport activity and structure were rarely addressed, although these two drivers contributed the most to emission growth in this sector. Improvements of public transport, walking and cycling were frequently reported but in most cases did not seem to be sufficiently implemented to avoid the decline in their shares.

259. Although the growing demand for passenger and freight transport was identified as the main driver of the steady GHG emission growth in the transport sector, very few Parties reported systematic policy approaches in this field. Integrated transport policy frameworks are a systematic approach which seems to be very promising in terms of emission mitigation. The mix of policies in transport differed greatly among Parties, but in most Parties there was a general trend towards a greater use of economic and fiscal instruments. However, consumers mostly responded to this shift by showing a willingness to pay higher fuel prices and vehicle taxes rather than reducing their transport activities. Given the projected upward trend of emissions from the sector, as well as the long lead time for land-use changes, the turnover of capital stock in the transport sector and the development of advanced fuel technologies and infrastructures, further effort may be needed, including enhanced involvement of industry in climate policy design and implementation, to improve emission trends in the medium term.

260. Measures to reduce unintended by-product emissions from some large-scale processes were more frequently implemented than other measures in the **industrial processes sector**. They included N_2O abatement technologies in adipic acid production, the reduction of PFC emissions in primary aluminium production by process adjustments and the application of waste gas treatment in HCFC production. These measures resulted in relatively large reductions in emissions (up to a few per cent of national total emissions in 1990) at relatively low cost and have been implemented by the industries concerned with relatively little pressure from governments, e.g. through voluntary agreements.

261. Other process-related emissions received little attention. N_2O emissions from nitric acid production are still unabated (although catalytic converters are expected soon); process-related CO_2 from cement has increased or decreased mainly in response to changes in production volume, since

technological abatement of emissions is difficult. Semiconductor manufacturing and magnesium foundries are relevant only for some Parties and are targeted with lower priority. Emissions resulting from the **use of HFC**s increased substantially in all Parties. Alternative options are available for almost all uses of fluorinated gases, but the few implemented policies did not lead to the widespread use of these alternatives and emissions remained unabated. Some Parties followed the earlier strategy to promote industry partnerships aimed at **reducing emissions without restricting the use of substances** (e.g. Japan, United States). Others, in contrast, started a move away from this strategy towards developing comprehensive phase-out legislation for certain applications (e.g. Austria, Switzerland), or taxes (France, Norway).

262. Most Parties reported policies and measures that will have both direct and indirect effects on emissions in the **agricultural sector**. Parties reporting policies with broader objectives tended not to quantify the environmental effectiveness, including climate change benefits; more targeted policies and measures were more easily quantified. Several Parties reported research-based policies with potential to deliver new and improved opportunities to reduce emissions from agriculture in the future.

263. Overall, the Parties reported decreasing emissions from the agriculture sector as a result of both non-climate-policy driven (e.g. structural changes) and climate-related policies and measures. Several Parties reported increases in emissions due to the rising demand for animal products, which resulted in an increased contribution of emissions of CH_4 and N_2O to the national total emissions. Many Parties expect agriculture to make substantial contributions to the reduction of long-term emission trends. These expectations are based on the indirect effects of portfolios of policies and measures that are not specifically related to climate change (e.g. market reform), and direct and indirect benefits from more specific policies and measures (e.g. control of nitrate pollution).

264. In the **LUCF** sector Parties reported a range of policies and measures focusing on afforestation/reforestation and forest management, and forest programmes with wider policy objectives than climate change. There was much less emphasis on the role of other LUCF activities such as cropland and grazing management, revegetation and the role of soils in carbon sequestration. Only a few Parties reported policies and measures to reduce emissions, for example from soil management and land clearance. Parties reported a range of research-based policies and measures including some that have potential to improve understanding of carbon dynamics and others tackling fire and pest control.

265. Most Parties, except Australia, Greece and the United Kingdom, expected the LUCF sector as a whole to continue to act as a net sink in 2010. There is no clear trend among Annex I Parties, as six Parties expect net removals by sinks to increase and eight Parties expect them to decrease. A few Parties quantified contributions of LULUCF activities implemented since 1990 with the specific intention of assessing the contribution of these activities to their Kyoto targets.

266. In the **waste sector**, several Parties assigned the highest priority to waste minimization and material recycling. Measures aimed at reduction of waste or increased recycling are directed at the longer term and have shown effects only in some countries. The most important contribution to the declining GHG emissions in the waste sector came from the regulation of landfill gas recovery and combustion. This has led to substantial immediate reductions of emissions in many Parties, due to the synergy between general environmental objectives (covering of landfills for groundwater protection) and climate change objectives (incineration of landfill gas) and the related low additional emission mitigation cost. Landfill gas recovery and combustion alone is, however, a limited option for the longer term, as at least 40 per cent of the landfill gas cannot be recovered.

267. Parties differ in their views on how to treat solid waste. Some Parties without space constraints favour landfilling, where the reduction in the amount of the organic fraction and landfill gas recovery can reduce emissions to a certain extent. Other Parties see waste incineration as a more environmentally friendly option than landfilling, and also encourage heat and electricity generation from waste

incineration. For incineration only the synthetic fraction (e.g. plastics) is relevant for GHG emissions. In the short term, most Parties have reduced emissions from the waste sector. In the long term, only the few Parties that consequently opt for waste minimization, recycling, ban of organic waste in landfills and enhanced waste incineration with electricity and heat generation for the remaining waste fractions will be able to further substantially reduce emissions in this sector.

Annex

List of Parties considered in this report and their ISO three-letter country codes

Party	Country code	Party	Country code
Australia	AUS	Latvia	LVA
Austria	AUT	Liechtenstein	LIE
Belgium	BEL	Lithuania	LTU
Bulgaria	BGR	Monaco	MCO
Canada	CAN	Netherlands	NLD
Croatia	HRV	New Zealand	NZL
Czech Republic	CZE	Norway	NOR
European Community	EC[a]	Poland	POL
Estonia	EST	Russian Federation	RUS
Finland	FIN	Slovakia	SVK
France	FRA	Slovenia	SVN
Germany	DEU	Spain	ESP
Greece	GRC	Sweden	SWE
Hungary	HUN	Switzerland	CHE
Italy	ITA	United Kingdom	GBR
Japan	JPN	United States	USA

[a] This is not an ISO symbol.

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