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Synthesis of information relevant to the determination of the mitigation potential and to the identification of possible ranges of emission reduction objectives of Annex I Parties: an update

Technical paper

Summary

This document updates technical paper FCCC/TP/2007/1 on information relevant to the mitigation potential and the identification of possible ranges of emission reduction objectives of Parties included in Annex I to the Convention (Annex I Parties). It provides information on different approaches to determining emission reductions by Annex I Parties, synthesizes submissions by Parties, presents updated data on relevant factors and indicators, and summarizes results from studies on mitigation potential by national and international organizations.

CONTENTS

I. Introduction

A. Mandate

1. The Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP), at its resumed fourth session, requested the secretariat to update the technical paper on information relevant to the mitigation potential and the identification of possible ranges of emission reduction objectives of Annex I Parties (FCCC/TP/2007/1).[1]

2. At the same session, the AWG-KP invited Annex I Parties to submit to the secretariat, by 5 September 2008, additional and updated available information and data[2] related to the tasks set out in paragraph 17 (a) (i) and (ii) of its work programme.[3]

B. Scope of the note

3. This document updates document FCCC/TP/2007/1 (hereinafter referred to as the first version of the technical paper), taking into account views submitted by Parties. The secretariat has included information from recent studies on mitigation potential and has updated the data contained in the first version of the technical paper.

4. Chapter II provides background information on different types of analyses that could be used to inform the consideration of further commitments for Annex I Parties under the Kyoto Protocol. Chapter III provides a synthesis of the submissions referred to in paragraph 2 above; the secretariat has also included information from the submissions contained in document FCCC/KP/AWG/2007/MISC.4 and Add.1–2 which, owing to their date of submission, were not considered in the first version of the technical paper. Chapter IV provides some examples of how to use the factors and indicators contained in the first version of the technical paper and provides an update of current values of these factors and indicators. Chapter V summarizes results from studies on mitigation potential by national and international organizations referred to in submissions by Parties. Finally, chapter VI provides a summary of the information presented in this document.

C. Possible action by the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol

5. The AWG-KP may wish to make use of the information contained in this document as it reverts to, and adopts conclusions on, the mitigation potential of policies, measures and technologies at the disposal of Annex I Parties, and the identification of possible ranges of emission reductions by Annex I Parties. It may also wish to consider the relevance of this information for its work during 2009 on the consideration of further commitments for Annex I Parties under the Kyoto Protocol.

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[1] FCCC/KP/AWG/2007/5, paragraph 21 (d) (iii).

[2] FCCC/KP/AWG/2007/5, paragraph 21 (d) (i). These submissions are contained in document FCCC/KP/AWG/2008/MISC.4.

[3] See document FCCC/KP/AWG/2006/4. The task set out in paragraph 17 (a) (i) is the analysis of the mitigation potential, effectiveness, efficiency, costs and benefits of current and future policies, measures and technologies at the disposal of Annex I Parties, appropriate in different national circumstances, taking into account their environmental, economic and social consequences, their sectoral dimensions, and the international context in which they are deployed. The tasks set out in paragraph 17 (a) (ii) are the identification of possible ranges of emission reductions by Annex I Parties, through their domestic and international efforts, and analysis of their contribution to the ultimate objective of the Convention, ensuring due attention to the issues mentioned in the second sentence of Article 2 of the Convention.

II. Background

6. The work programme of the AWG-KP, as agreed at its second session,[4] identifies analytical work required to assist the group in reaching agreement on further commitments for Annex I Parties under the Kyoto Protocol. The AWG-KP has recognized the importance of considering information on the science of climate change, in particular the emission reductions needed to achieve the stabilization of greenhouse gas (GHG) concentrations in the atmosphere at different levels. The group has also agreed to consider information on the ability of society to reduce emissions, focusing on national circumstances, technologies and costs that broaden or limit this ability.

7. For information on the science, discussions on ranges of emission reduction objectives of Annex I Parties have relied on the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC), in particular the analysis of stabilization scenarios. This analysis follows a top-down approach and focuses on the global reductions of GHG emissions that are needed to achieve the stabilization of GHG concentrations in the atmosphere at different levels. As regards the ability of society to reduce emissions, discussions on the analysis of the mitigation potential of policies, measures and technologies have looked at domestic factors that determine such potential. Such analysis can be undertaken for the economy as a whole, using top-down approaches, or at the sectoral level, using bottom-up approaches and focusing on the availability and cost of mitigation technologies and other factors relevant to different sectors.

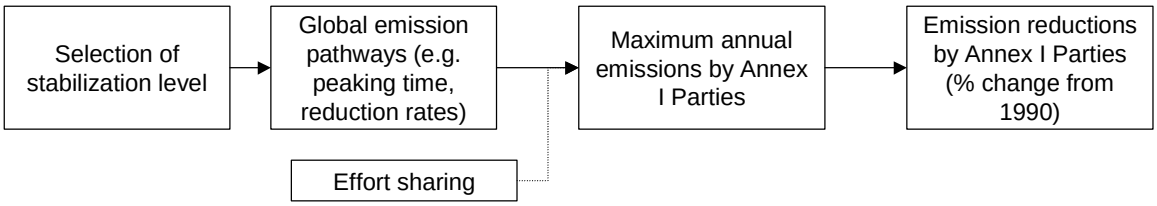
A. Stabilization scenarios and the reduction of greenhouse gas emissions

8. The AR4 provides estimates of emission reductions required to achieve the stabilization of GHG concentrations in the atmosphere at different levels. The IPCC followed a top-down approach which takes as a point of departure the level at which GHGs in the atmosphere are to be stabilized. Once this level has been specified, a global pathway of annual emissions that would lead to this level in the longer term needs to be determined. This pathway is determined by the trends in global GHG emissions, the time at which GHG emissions should peak and the rate at which GHGs decay in the atmosphere. The final step is to allocate emission reductions among different groups of countries (also referred to as effort sharing, see figure 1). In its analysis, the IPCC considered and applied various methods of allocation.

9. The type of analysis described in paragraph 8 above would yield the annual level of emissions for each group of countries that is needed to achieve stabilization of atmospheric GHG concentrations at the specified level. Annual emission reductions for a specific group of countries (for example, Annex I Parties) could be calculated by comparing the annual level of emissions resulting from this analysis with business-as-usual emissions.

[4] FCCC/KP/AWG/2006/4, paragraphs 11–25.

Figure 1. Analysis of emission reductions needed to stabilize greenhouse gas concentrations in the atmosphere



10. Table 1[5] provides information derived from the AR4 on the global emission reductions required in 2050 (compared to 2000 levels) and the emission reductions required by Annex I Parties in 2020 and 2050 (compared to 1990 levels) to achieve different categories of stabilization scenarios. The table also includes information on the global costs of global reductions expressed in terms of reduction in gross domestic product (GDP).

Table 1. Characteristics of greenhouse gas stabilization scenarios

Category	CO_2 eq concentration (parts per million)	Global mean temperature increase above pre-industrial level at equilibrium using 'best estimate' climate sensitivity[a] (°C)	Change in global CO_2 emissions in 2050 (% of 2000 emissions)	Range of reduction in gross domestic product in 2050 because of mitigation (%)	Allowed emissions by Annex I Parties in 2020 (% change from 1990 emissions)	Allowed emissions by Annex I Parties in 2050 (% change from 1990 emissions)
I	445–490	2.0–2.4	–85 to –50	Decrease of up to 5.5	–25 to –40	–80 to –95
II	490–535	2.4–2.8	–60 to –30			
III	535–590	2.8–3.2	–30 to +5	Slight gain to decrease of 4	–10 to –30	–40 to –90
IV	590–710	3.2–4.0	+10 to +60	Gain of 1 to decrease of 2	0 to –25	–30 to –80
V	710–855	4.0–4.9	+25 to +85	–	–	–
VI	855–1 130	4.9–6.1	+90 to +140	–	–	–

Source: Intergovernmental Panel on Climate Change. Fourth Assessment Report (AR4), Contribution of Working Group III. Columns 1–4, table SPM.5; column 5, table SPM.6; columns 6 and 7, box 13.7.
[a] According to the AR4, the best estimate of climate sensitivity is 3 °C.

11. It should be noted that for some of the categories of stabilization scenarios, estimates of reductions by Annex I Parties provided in the AR4 assume a deviation from baseline GHG emissions in non-Annex I Parties. This deviation is greater for lower stabilization scenarios.

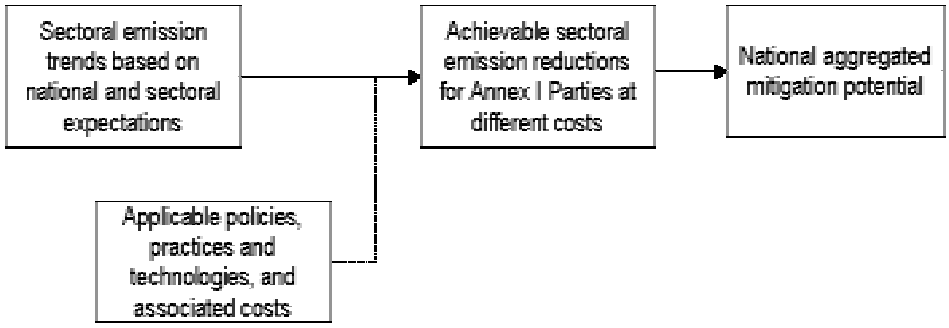
[5] This table was included in the first version of the technical paper and it has been incorporated into this document without changes. Values in this table would need to be revised in the light of revised information on business-as-usual emissions as well as expected emission levels in 2020 and 2050. A series of studies suggest that these values remain valid; see, for example, den Elzen M, Meinshausen M and van Vuuren D. 2007. Multi-gas emission envelopes to meet greenhouse gas concentration targets: costs versus certainty of limiting temperature increase. *Global Environmental Change*. **17** (2007): pp.260–280; and den Elzen M and Höhne N. 2008. Reductions of greenhouse gas emissions in Annex I and non-Annex I countries for meeting concentration stabilisation targets. *Climatic Change*. Online document DOI 10.1007/s10584-008-9484-z.

B. Mitigation potential and the reduction of greenhouse gas emissions

12. An analysis of mitigation potential focuses on the domestic dimension of mitigation. Such an analysis can be used to determine the emission reduction that a country could achieve on the basis of past and future emissions trends and underlying domestic factors, including costs.

13. As noted in paragraph 7 above, mitigation potential can be analysed using top-down or bottom-up approaches. National top-down mitigation studies generally use macroeconomic models to gather information from the economy as a whole, including historical and current data from different processes within this economy. Alternatively, individual bottom-up sectoral analyses make use of sectoral information, focusing on available technologies and practices, their characteristics and costs. As indicated in the first version of the technical paper, sectoral analyses could focus on efficiency or on best available technologies. Overall mitigation potential at the national level would be determined by aggregating mitigation potential from the different sectors (see figure 2).

Figure 2. Analysis of mitigation potential



14. The analysis of mitigation potential can be undertaken in different ways, using a combination of methodologies and tools, and different assumptions. This limits the comparability of the results from different analyses; however, national circumstances may represent an obstacle to applying the same methodologies and assumptions to all countries.

15. Two examples of studies of domestic mitigation potential, as submitted by Parties, are summarized in chapter V A below.

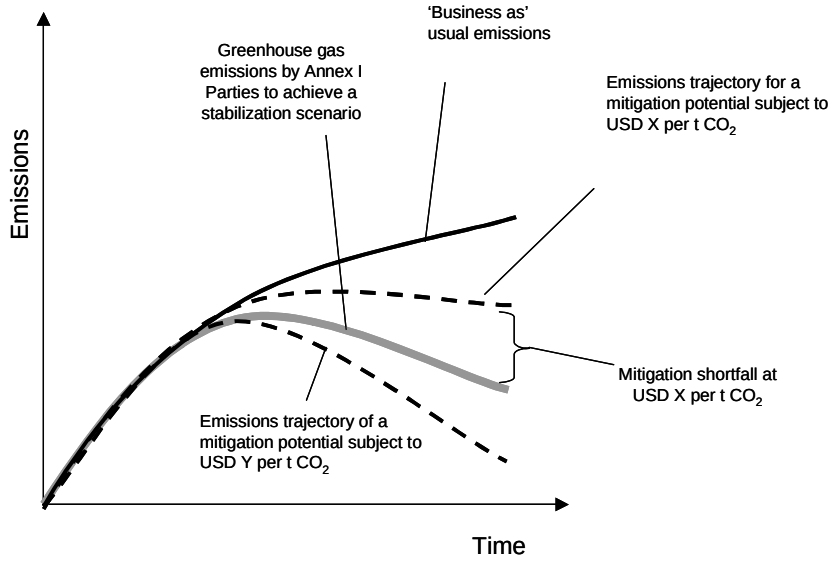
C. Comparing stabilization scenarios and mitigation potentials of Annex I Parties

16. Analysing stabilization scenarios and related ranges of emission reductions, and analysing mitigation potential, both provide information relevant to the consideration of further commitments for Annex I Parties under the Kyoto Protocol. An analysis of stabilization scenarios provides information on the emission reductions that are needed to stabilize atmospheric GHG concentrations at a certain level. An analysis of mitigation potential provides information on the emission reductions that can be delivered at a certain cost and subject to a set of assumptions, including on assumptions regarding national circumstances.

17. Whether the results of the two forms of analysis are the same depends on assumptions made, in particular with regard to the price of carbon at the time when the lowest categories of stabilization scenarios are analysed. If the price of carbon were high enough the corresponding mitigation potential would be enough to achieve stabilization of GHG concentrations at a given level. However, this depends entirely on the investment that Parties would be prepared to make (or to leverage, through policy interventions) in mitigation efforts, as well as on national circumstances. Figure 3 illustrates how the result of the two forms of analysis compare in terms of emission trajectories to be achieved through time.

18. A shortfall in emission reductions would occur if the emission trajectory of a given mitigation potential were above the emission trajectory needed to stabilize GHG concentrations in the atmosphere at a certain level. Such a shortfall could be reduced by, for example, identifying additional mitigation options, increasing the amount of resources to be invested in mitigation and/or extending mitigation efforts outside national boundaries, including through the use of flexibility mechanisms. In the longer term, collaborative research and development of new technology could lead to lower costs of mitigation and hence greater mitigation potential. It should be noted that in the context of the flexible mechanisms, the use of offsets may not necessarily lead to stabilizing GHGs in the atmosphere at a specified level. As noted in paragraph 11 above, emission reductions outside the group of Annex I Parties are also assumed in the scenarios.

Figure 3. Comparing stabilization scenarios and mitigation potential



III. Synthesis of submissions from Parties

19. Parties referred to information in the AR4 on the expected growth of GHG emissions, the reduction in GHG emissions needed to achieve different categories of stabilization scenarios, and the mitigation potential of different regions. Some Parties specifically referred to the importance of the range of emission reductions by Annex I Parties needed to stabilize GHG concentrations at the lowest levels assessed by the IPCC (e.g. 25–40 per cent below 1990 levels by 2020). One Party explicitly expressed support for this indicative range, noting that it should be "part of a global effort".

20. Several Parties noted that the mitigation potential of a country is primarily determined by its emissions profile, in particular the contribution of different sectors to national emissions, and by the costs associated with reducing emissions in each sector. In this context, one Party stated that the analysis of mitigation potential would give more accurate results if it were undertaken at the sectoral level. This Party suggested using a combination of intensity indicators and production volumes to analyse sectoral mitigation potential, and presented a method for setting quantified national emission reduction targets.

21. Several Parties referred again to the need to consider national circumstances that determine mitigation potential, looking not only at their present situation but also at expectations about the future. Such circumstances include physical factors such as geographical location and climate, political factors such as governmental structure and decentralization, and socio-economic factors such as population

dynamics, economic activity, patterns of energy production and use, and the availability of natural resources. One Party noted that these circumstances should be considered when apportioning the mitigation effort, in particular those circumstances that cannot be influenced through policy.

22. In their submissions, Parties mentioned several issues that need to be further discussed in the context of mitigation potentials and ranges of emission reduction objectives of Annex I Parties, including:

(a) The relationship between mitigation potential and individual commitments of Annex I Parties. One Party noted that divergent national circumstances and costs of mitigation at the national level among countries call for a "large spread in individual Parties' emission reduction commitments – greater that the corresponding spread in the first commitment period". This Party further noted that factors and criteria should be used to compare mitigation potentials across Parties within a broader discussion on how to differentiate commitments;

(b) The magnitude of emissions from specific sectors. For emissions from energy generation and use, Parties referred to the need for further efforts in energy efficiency and renewable energy. Two Parties also referred to the rate of increase of emissions from international aviation and maritime transport;

(c) The need to complement market instruments with cross-sectoral policies on mitigation, including those on research and development of environmentally sound technologies;

(d) The importance of technology. Several Parties stressed the mitigation potential of carbon dioxide (CO_2) capture and storage and noted the need for international efforts to realize this potential;

(e) The role of the means that may be available to Annex I Parties to reach emission reduction targets in creating opportunities for mitigation beyond national boundaries. Parties referred to the need to create a global "liquid global carbon market";

(f) The effects of historical emissions and related responsibilities.

23. Finally, the following Parties included information in their submissions on national GHG emission reduction goals:

(a) Belarus would meet a GHG emissions target of between 90 and 95 per cent of the 1990 level for the period after 2012, provided that the amendment included in decision 10/CMP.2 takes effect before the end of the first commitment period;

(b) The European Community would reduce emissions to 20 per cent below 1990 levels by 2020 without any precondition and to 30 per cent if an ambitious international agreement were reached;

(c) Norway would reduce its emissions to 30 per cent below 1990 levels by 2020; two thirds of this reduction would be achieved domestically. The Government aims at carbon neutrality by 2030 if an ambitious global agreement is reached;

(d) Canada has committed to reducing its total GHG emissions by 20 per cent below 2006 levels by 2020. It has set a long-term goal to reduce GHG emissions by between 60 and 70 percent below 2006 levels in 2050.

IV. Factors and indicators relevant to the determination of the mitigation potential and the identification of ranges of emission reduction objectives of Annex I Parties

24. The first version of the technical paper contained a list of factors and indicators relevant to the determination of the mitigation potential and the identification of ranges of emission reduction objectives of Annex I Parties. Such factors and indicators can be used in many ways, depending on the methodologies and tools selected for assessing mitigation potential.

25. A simple way to assess mitigation potential would be to look at current values of national or sectoral efficiencies or carbon intensities, and set goals (e.g. to reduce the carbon intensity of GDP to a certain level, or electricity use by a given percentage). The mitigation potential would be a function of the costs of available technologies and/or changes in practices required to reach such goals, and by the factors that allow or prevent the implementation of these technologies and/or practices.

26. More detailed and more complex analyses can also make use of these factors and indicators. A country could find that the carbon intensity of its cement production (emissions per tonne of cement produced) is higher than that of other countries. Underlying reasons may be found in the age and efficiency of its plants or the energy intensity of its practices, for example, linked to the use of clinker, and other factors. An analysis of mitigation potential would look into decreasing the carbon intensity of cement production by improving or replacing old plants, or by changing practices, for example by reducing the clinker content in cement. This analysis would look at several technological alternatives, their costs and limiting social, political and physical factors. It should be noted, however, that results of analyses at the sectoral level should be verified at the national level to take into account possible trade-offs. For example, the potential to reduce the use of fertilizers in the agricultural sector could have implications for energy use in the agricultural sector and for the production levels of fertilizers.

27. These factors and indicators can also be used to make comparisons across countries. Past and present values for different countries can be compared with a view to identifying improvements based on experiences in countries with higher efficiencies or lower carbon intensities. However, national circumstances may complicate such comparisons. For example, the fuel mix of a given country, in particular the share of renewable energy sources, is determined by geographical, climatic, political and other factors. In this context, comparisons of best practice for improving the intensity of total primary energy supply should take national circumstances into consideration.

28. In order to provide information to the AWG-KP, this document includes updated data on the current values for most of the factors and indicators referred to in chapter IV of the first version of the technical paper (see annex, tables 4–15).[6] Such data provide only a snapshot of the national and sectoral circumstances that determine the mitigation potential of Annex I Parties. They need to be interpreted with care, considering all national circumstances of Parties.

29. The selection of indicators could also be extended substantially to cover specific national circumstances. In their submissions, and through direct communication with the secretariat, Parties have

[6] The factors and indicators referred to in paragraph 29 have not been included in these tables. Additional information on national and sectoral GHG emission trends for all Annex I Parties is available within the GHG emissions profiles available at <http://unfccc.int/ghg_emissions_data/items/3954.php>.

also suggested factors and indicators additional to those included in chapter IV of the first version of the technical paper. These include:

(a) Projections of some indicators, for example of GDP growth in the period 2004–2020;

(b) GDP expressed in market exchange rates in addition to purchasing power parities;

(c) Further detail on shares of sectoral emissions – of electricity generation, of oil and gas production, of gas production, of light and medium oil production, of heavy oil production and of industrial process emissions, each as a percentage of the national total;

(d) Further detail on electricity generation – CO_2 emissions per unit of electricity generated from fossil fuels (g CO_2 per kWh), in addition to the emissions per unit of electricity generated from all sources;

(e) Further detail on exports and imports – share of exports of fossil fuels, share of import of electricity;

(f) Specific indicators in industry such as emissions per tonne of clinker used in cement production, instead of emissions per tonne of cement;

(g) Information on projections relative to 2006 instead of 2005;

(h) Further information on mitigation costs in United States dollars as a percentage of GDP;

(i) Additional national intensities – relating only energy-related GHG emissions to energy supply, not all GHG emissions;

(j) Cumulative indicators, taking into account historical developments and not only the current situation;

(k) Forest cover to include only managed and planted forests.

V. Other information on mitigation potential

A. Studies of domestic mitigation potential

30. The European Commission prepared an energy and climate package in January 2008, which includes the goals referred to in paragraph 23 (b) above. An evaluation of the impacts of this package assesses separately the mitigation potential of the sectors covered by the European Union emissions trading scheme (EU ETS) and the mitigation potential of those outside this scheme. For an indicative price of USD 40 per t CO_2, cost-effective emission reductions in the sectors covered by the EU ETS would be 18 per cent below 2005 levels by 2020 if aviation is included, and 21 per cent below if aviation is excluded. For sectors outside the EU ETS, efficient reductions were estimated at 12 per cent below 2005 by 2020.

31. Norway quotes in its submission a report on mitigation potential prepared for the Low Emissions Commission of 2006. In order to achieve domestically two thirds of a reduction goal of 30 per cent below 1990 levels by 2020, the following reductions would need to be achieved by different sectors: industry, 5 Mt CO_2 eq; petroleum, 3–5 Mt CO_2 eq; transport, 2–4 Mt CO_2 eq; and agriculture and waste, 1–1.5 Mt CO_2 eq.

B. Projections of Annex I Parties

32. Table 2 summarizes projections by Annex I Parties as contained in their latest national communications. The table is the same as that presented in the first version of the technical paper, except that projections from the United States of America have been added.

33. Column 2 lists GHG emissions in 1990 as reported in the chapter on projections within national communications; these may be slightly different from the information contained within national GHG inventories because they may have been prepared at a different date or have used different base year data. Most Parties provide a 'with measures' projection until 2010 and until 2020 (columns 3–5). The 'with additional measures' projection is provided by some Parties for 2010 and only by a few for 2020 (columns 6 and 7).

34. The information in table 2 indicates that additional measures are expected to result in emissions in 2010 being between 43 per cent above and 61 per cent below 1990 levels (table 2, column 6), and in emissions in 2020 being between 57 per cent above and 47 per cent below 1990 levels (table 2, column 7). The effect of additional measures, relative to the 'with measures' scenario, ranges between 1 and 22 per cent in 2020 (table 2, column 9).

Table 2. Projections reported by Annex I Parties in their national communications

Party	National total greenhouse gas emissions in Convention base year (Mt CO_2 eq)[a]	Percentage change 'with measures' (%)			Percentage change 'with additional measures' (%)		Effect of additional measures (% of 1990 levels)	
		1990–2005	1990–2010[b]	1990–2020	1990–2010[c]	1990–2020	2010[d]	2020[e]
Australia	417	27	35	54				
Austria	79		17		–1		18	
Belarus	127	–45	–38	–31				
Belgium	146	3	2	6			2	
Bulgaria	133	–49	–32	–21	–38	–30	6	9
Canada	*594*	*21*	*23*	*19*	*23*	*–2*		21
Croatia	34	–13	–1	14	–13	–9	12	22
Czech Republic	196	–25	–26	–38	–28	–39	2	1
Denmark	70		3	–4				
Estonia	43		–61		–61			
Finland	71	12	11	16	–2	–2	12	18
France	567		6	12		–2	6	14
Germany	1 228		–18	–17	–27	–38	8	21
Greece	*107*	*31*	*38*	*53*	*28*		*10*	
Hungary	116	–24	–24	–15	–25	–19		4
Iceland	3		–2	35				
Ireland	55	28	31	40				
Italy	517	6	12	28	4		8	
Japan	1 272		3		–3		6	
Latvia	26	–53	–48	–37	–51	–47	2	9
Liechtenstein			13					
Lithuania	49	–64	–50	–45				
Luxembourg	13							
Monaco								
Netherlands	213	1	1	4	–1	2	3	3
New Zealand	62	24	33	47				
Norway	50		24	38				
Poland	587	–35	–28	–18				
Portugal	60		47	60	43	57	4	3
Romania	282	–44	–32	–17	–36	–21	4	4
Russian Federation	2 990		–22	–5				
Slovakia	72	–32	–23	–3	–25	–8	2	4
Slovenia	20	3	4	1	–2	–7	6	7
Spain	287	46	52	84				
Sweden	72	–2	–1	6				
Switzerland	53	–2	–4	–7	–6		2	
Turkey	170	45	100	217				
Ukraine	924	–53	–48	–38				
United Kingdom	771		–19	–20	–25		6	
United States	6 229		24	33				
Values for Kyoto Protocol Annex I Parties:								
High		46	100	217	43	57	18	22
Low		–64	–61	–45	–61	–47		1

Note: Values in *italics* were provided by the Party directly. Otherwise data have been extracted from the latest national communication (NC). Exceptions: Belarus (second NC), Finland (report on demonstrable progress), Italy (third NC), Turkey (first NC) and Ukraine (second NC).

[a] Excluding land use, land-use change and forestry and excluding international transport, base year is 1990 except for Bulgaria (1988), Hungary (average of the years 1985 to 1987), Poland (1988), Romania (1989) and Slovenia (1986).

[b] The Russian Federation provided two equivalent scenarios. 'Scenario II' is included here, which is the only one that included non-CO_2 gases.

[c] The United Kingdom provided several scenarios. Here the 'with additional measures - high ETS' scenario is shown.

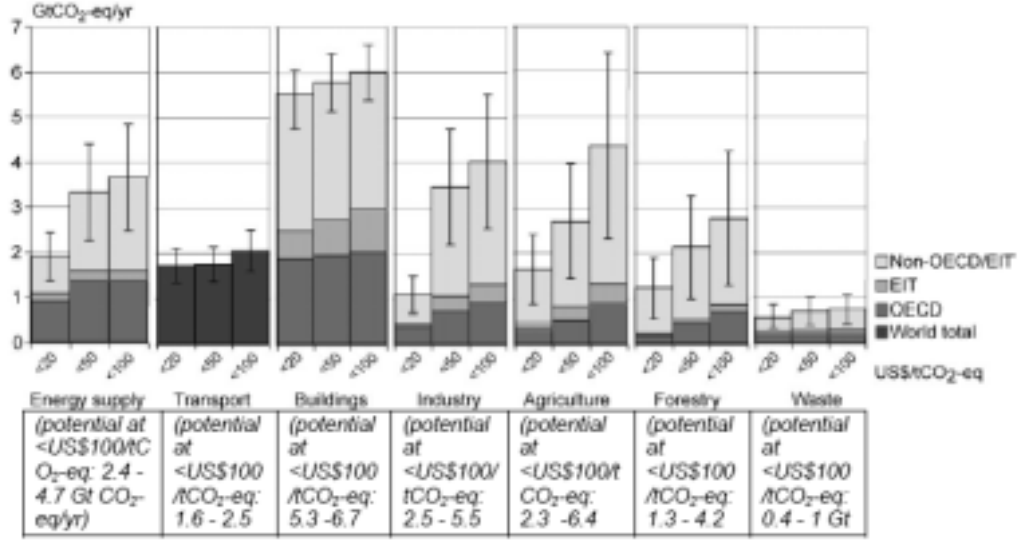
[d] Calculated as the difference between the percentage change 'with measures' for the period 1990–2010 and the percentage change 'with additional measures' for the same period.

[e] Calculated as the difference between the percentage change 'with measures' for the period 1990–2020 and the percentage change 'with additional measures' for the same period.

C. Fourth Assessment Report of the Intergovernmental Panel on Climate Change

35. As noted in the first version of the technical paper, the AR4 contains an assessment of available literature on the economic potential to reduce GHG emissions by 2030 assuming that policies will be successful in removing barriers to implementation. The AR4 evaluated results from sectoral bottom-up studies[7] for three geographical regions (Organisation for Economic Co-operation and Development countries, countries with economies in transition, and other countries) and from sectoral top-down studies[8] without geographical split. The IPCC found that results from both types of study are similar and states that "there is substantial economic potential for the mitigation of global GHG emissions over the coming decades, that could offset the projected growth of global emissions or reduce emissions below current levels"[9] (see figure 4).

Figure 4. Estimated sectoral economic potential for global mitigation for different regions



Energy supply	Transport	Buildings	Industry	Agriculture	Forestry	Waste
(potential at <US$100/tCO2-eq: 2.4 - 4.7 Gt CO2-eq/yr)	*(potential at <US$100 /tCO2-eq: 1.6 - 2.5*	*(potential at <US$100 /tCO2-eq: 5.3 -6.7*	*(potential at <US$100/ tCO2-eq: 2.5 - 5.5*	*(potential at <US$100/t CO2-eq: 2.3 -6.4*	*(potential at <US$100 /tCO2-eq: 1.3 - 4.2*	*(potential at <US$100 /tCO2-eq: 0.4 - 1 Gt*

Source: Intergovernmental Panel on Climate Change. Fourth Assessment Report, contribution of Working Group III. Figure SPM.6.
Abbreviations: EIT = country with an economy in transition, OECD = Organisation for Economic Co-operation and Development.

D. Other global studies

36. Parties referred in their submissions to studies published after the completion of the AR4 that assess mitigation potential for Annex I Parties as a group. Paragraphs 37–41 below provide a brief summary of their findings.

[7] According to the AR4, "bottom-up studies are based on assessment of mitigation options, emphasizing specific technologies and regulations. They are typically sectoral studies taking the macro-economy as unchanged."
[8] According to the AR4, "top-down studies assess the economy-wide potential of mitigation options. They use globally consistent frameworks and aggregated information about mitigation options and capture macroeconomic and market feedbacks."
[9] IPCC. Fourth Assessment Report, contribution of Working Group III, summary for policymakers, p.9.

37. **The *World Energy Outlook*** is an annual publication of the International Energy Agency. It analyses medium- to long-term energy market projections. The 2007 edition[10] includes projections for energy demand and supply by fuel and by region through to 2030, and quantifies energy-related CO_2 emissions. Its Reference scenario assumes no new energy-policy interventions by governments. The Alternative Policy scenario looks at a package of measures addressing energy security and climate change. Under this scenario, emission reductions would not be sufficient to stabilize GHG concentrations in the atmosphere at 450 parts per million volume (ppmv) CO_2 eq. The report estimates that stabilizing GHG concentrations at this level would require cumulative global investments in the power sector for the years 2006–2030 that are 36 per cent higher than under the Alternative Policy scenario and 31 per cent higher than in the reference case. The Alternative Policy scenario requires less investment than the reference case due to gains through energy efficiency measures.

38. ***Energy Technology Perspectives** 2008*[11] supplements and extends the *World Energy Outlook*. It provides detail on technology options and road maps, and their costs. The analysis estimates that the cost of reducing emissions in 2050 to current levels (under its ACT scenarios) range between USD 41 and 76 per t CO_2. For achieving a reduction in emissions to 50 per cent of current levels in 2050, costs would rise to USD 179–394 per t CO_2.

39. Vattenfall commissioned McKinsey[12] to create a global map of GHG abatement opportunities. The study found that in order to stabilize GHG concentrations in the atmosphere at 550 ppmv CO_2 eq, global costs of abatement would be EUR 25–35 per t CO_2 eq in 2030. For a scenario of 450 ppmv CO_2 eq, these costs would rise to EUR 35–40 per t CO_2, and for a scenario of 400 ppmv CO_2 eq, they would rise to EUR 40–50 per t CO_2.

40. The **National Institute for Environmental Studies**[13] assessed marginal abatement cost curves for Annex I Parties and non-Annex I Parties in 2020. It found that the mitigation potential in Annex I Parties below USD 100 per t CO_2 eq is about 3.616 Gt CO_2 eq, corresponding to about 32 per cent of the global mitigation potential.

41. The **Research Institute of Innovative Technology for the Earth**[14] assessed mitigation potential up to 2050 by country and sector, focusing on energy supply and demand. According to this study, global marginal costs for reducing emissions to 50 per cent of 2005 levels are about USD 334 per t CO_2 in 2050. The mitigation potential in Annex I Parties for a carbon price below USD 50 per t CO_2 is about 4.6 Gt CO_2 eq in 2050, and about 3.1 Gt CO_2 eq for a carbon price of USD 25 per t CO_2.

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[10] International Energy Agency. 2007. *World Energy Outlook 2007*. Paris: International Energy Agency. The 2008 edition is expected to be issued by the end of 2008.

[11] International Energy Agency/Organisation for Economic Co-operation and Development. 2008. *Energy Technology Perspectives 2008: Scenarios & Strategies to 2050*. Paris: International Energy Agency.

[12] Vattenfall. 2007. *Global Mapping of Greenhouse Gas Abatement Opportunities*. See <www.vattenfall.com/climatemap>.

[13] Kainuma M. 2008. *Case-study on Greenhouse Gas Emissions Reductions Potentials in 2020: Regional and Sectoral Analysis*. Paper presented at the "International workshop on sectoral emission reduction potential", 8 May 2008. Available at: <http://unfccc.meta-fusion.com/kongresse/AWG_08_Ghana/downl/080822_Ghana_AWG_SE_1300_Kotaro_Kawamata.pdf>.

[14] Sano F. 2008. *Sectoral Analysis of Mitigation Potential*. Paper presented at the International Energy Agency workshop "Sectoral approaches for international climate policy", 14–15 May 2008. Available at: <http://docs.docstoc.com/orig/185822/c8afebcc-068a-4faf-a211-86f14599b3b8.pdf>.

VI. Summary

42. This document updates information relevant to the determination of the mitigation potential and the identification of possible ranges of emission reduction objectives of Annex I Parties. Results are summarized in table 3, which contains information on emission reductions by Annex I Parties needed to achieve different stabilization scenarios. For example, stabilizing GHG concentrations in the atmosphere at 450 ppmv CO_2 eq would require emissions of Annex I Parties to be between 25 per cent and 40 per cent below 1990 levels in 2020.

43. Table 3 also provides estimates of mitigation potential at different costs. Information has been drawn from several sources, including the AR4 and the studies referred to in chapter V D above. The table also includes information from an analysis of mitigation potential based on Hoogwijk et al. (2008).[15] Such studies follow different methods, are subject to different assumptions and cover different time horizons, so care should be taken when comparing the results.

44. The different studies summarized in table 3 are compared in figure 5. Some general observations can be drawn:

(a) Results from different studies on mitigation potential at different carbon prices are relatively consistent;

(b) Mitigation analysis has also identified mitigation options to reach the lowest stabilization level identified by the IPCC. For stabilizing GHG concentrations in the atmosphere at 450 ppmv CO_2 eq, mitigation options with a cost between USD 50 and USD 100 per t CO_2 eq would need to be implemented in 2020.

[15] Hoogwijk M, van Vuuren D, Boeters S, Blok K, Blomen E, Barker T, Chateau J, Grübler A, Masui T, Nabuurs G, Novikova A, Riahi K, de la Rue du Can S, Sathaye J, Scrieciu S, Urge-Vorsatz D, and van Vliet J. 2008. *Sectoral Emission Mitigation Potentials: Comparing Bottom-Up and Top-Down Approaches*. Netherlands Research Programme on Scientific Assessment and Policy Analysis for Climate Change (WAB). (unpublished report). This study, as a follow-up activity to the AR4, compared the results of analysis of mitigation potential using bottom-up and top-down models.

Table 3. Estimates of emission reductions by Annex I Parties as a group below 1990 levels using various methods

Source of estimate		Emissions reduction in 2020 (% of 1990 levels)	Emissions reduction in 2030 (% of 1990 levels)	Emissions reduction in 2050 (% of 1990 levels)
Stabilization scenarios				
IPCC:[a] reductions by Annex I Parties based on allocation rules (before trading)	450 ppmv CO_2 eq	–25 to –40		–80 to –95
	550 ppmv CO_2 eq	–10 to –30		–40 to –90
	650 ppmv CO_2 eq	0 to –25		–30 to –80
Mitigation potential				
IPCC: indication[b] of possible reductions by Annex I Parties under scenarios A1B and B2, based on different levels for carbon price	< USD 100 per tCO_2 eq		A1B: –22 to –39 B2: –18 to –34	
	< USD 50 per t CO_2 eq		A1B: –27 B2: –23	
	< USD 20 per t CO_2 eq		A1B: –19 B2: –15	
Hoogwijk et al. 2008[c]	< USD 100 per t CO_2 eq	–26 to –31	–34 to –42	–37 to –49
	< USD 50 per t CO_2 eq	–7 to –20	–16 to –37	–24
	< USD 20 per t CO_2 eq	4 to –6	1 to –32	–6
Vattenfall[d]	< USD 40 per t CO_2 eq		–32	
RITE[e]	< USD 50 per t CO_2 eq	–26		

Abbreviations: IPCC = Intergovernmental Panel on Climate Change, ppmv = parts per million volume, RITE = Research Institute of Innovative Technology for the Earth.

[a] IPCC. Fourth Assessment Report, contribution of Working Group III.

[b] These figures exclude the agriculture and land use, land-use change and forestry sectors.

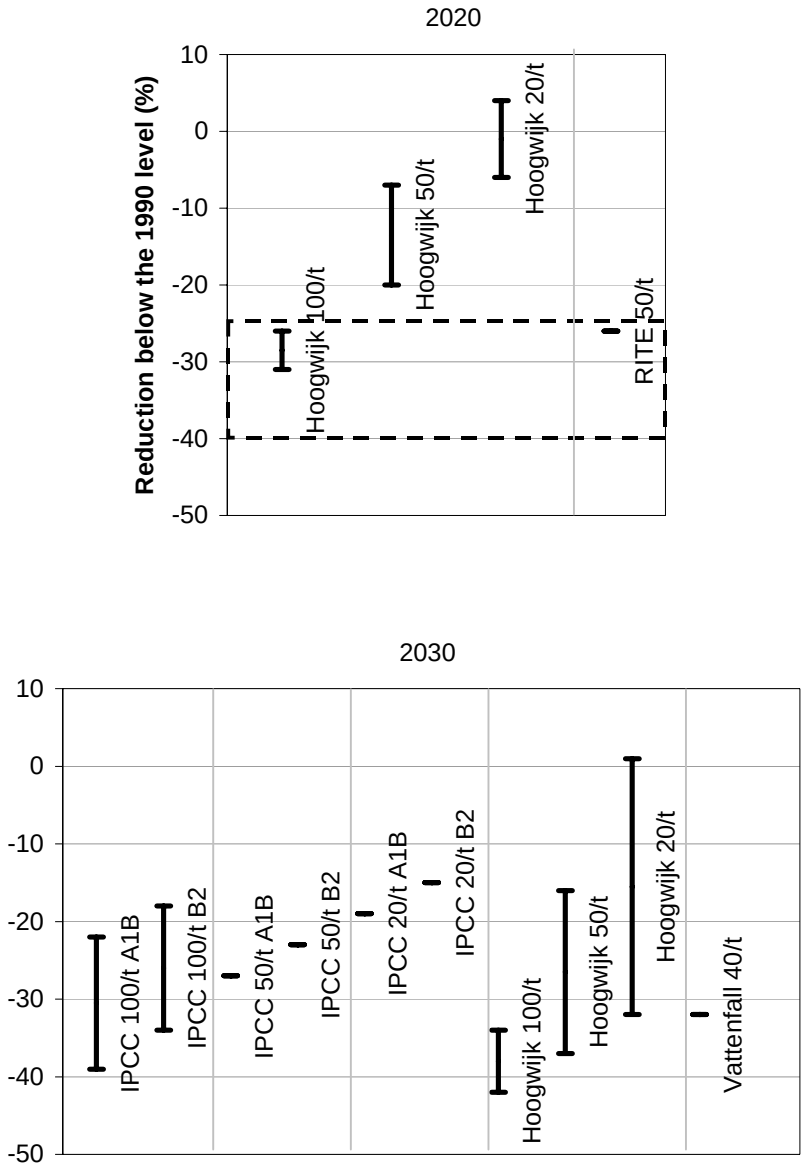
[c] Hoogwijk M et al. 2008. *Sectoral Emission Mitigation Potentials: Comparing Bottom-Up and Top-Down Approaches.* (unpublished report). Values for only two out of the seven models of this study are included here for the years 2020 and 2050 and from three models for the year 2030. Information to calculate these values is not readily available; it was obtained directly from the following sources: the MESSAGE model by the International Institute for Applied Systems Analysis; the ENV-Linkages model by the Environment Directorate of the Organisation for Economic Co-operation and Development; and the E3MG model by the Cambridge Centre for Climate Change Mitigation Research (2030 only).

[d] Vattenfall. 2007. *Global Mapping of Greenhouse Gas Abatement Opportunities.* See <www.vattenfall.com/climatemap>.

[e] Sano F. 2008. *Sectoral analysis of mitigation potential*. Paper presented at the International Energy Agency workshop "Sectoral approaches for international climate policy", 14–15 May 2008. Available at: <http://docs.docstoc.com/orig/185822/c8afebcc-068a-4faf-a211-86f14599b3b8.pdf>.

45. The results compiled in table 3 have been derived from analysis limited to domestic action and do not consider the use of flexibility mechanisms. As suggested by some Parties in their submissions, the use of market-based mechanisms, such as the clean development mechanism, joint implementation and emissions trading, and other measures, increases achievable emission reductions considerably. The IPCC estimates that the potential outside the group of Annex I Parties is about the same as the potential within this group. As noted in paragraph 18 above, realizing this potential through offset mechanisms may not necessarily lead to a desired stabilization scenario.

Figure 5. Comparisons of different estimates of mitigation potential



Sources: (1) Hoogwijk = Hoogwijk M et al. 2008. *Sectoral Emission Mitigation Potentials: Comparing Bottom-Up and Top-Down Approaches.* (unpublished report); (2) RITE = Sano F. 2008. *Sectoral analysis of mitigation potential*. Paper presented at the International Energy Agency workshop "Sectoral approaches for international climate policy", 14–15 May 2008. Available at: <http://docs.docstoc.com/orig/185822/c8afebcc-068a-4faf-a211-86f14599b3b8.pdf>;
(3) IPCC = Intergovernmental Panel on Climate Change (IPCC). Fourth Assessment Report, contribution of Working Group III;
(4) Vattenfall = Vattenfall. 2007. *Global Mapping of Greenhouse Gas Abatement Opportunities*. See <www.vattenfall.com/climatemap>.
Abbreviations: A1B and B2 = *Special Report on Emissions Scenarios* scenarios of the IPCC, X/t = USD X per t CO_2 eq.

Annex

Tables

A. Notes

Data are given for 2006 unless otherwise noted.

Values directly provided by Parties appear in italics; if a Party provided data for 2004, these were replaced with values from the same source for 2006.

References to Annex I Parties in the sources of information consulted, in particular the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, include those Annex I Parties that are not Parties to the Kyoto Protocol. Data for all these Parties have been compiled for all tables; however, averages and maximum and minimum values within these tables are only for Annex I Parties that are Parties to the Kyoto Protocol.

'KP Annex I Parties' refers to those Parties included in Annex I to the Convention that are also Party to the Kyoto Protocol.

European Community refers to the 25 member States of the European Community that are Annex I Parties (i.e. it excludes Cyprus and Malta).

B. Key to sources

Enerdata	Enerdata Information System database <http://www.enerdata.fr>
FAO	Food and Agriculture Organization of the United Nations. FAOSTAT database <http://faostat.fao.org>
Graus et al.	Graus WHJ, Voogt M and Worrell E. 2007. International comparison of energy efficiency of fossil power generation. *Energy Policy*. **35**(7): pp.3936-3951, and Graus WHJ and Worrell E. 2007. Effect of SO_2 and NO_X control on energy-efficiency power generation. *Energy Policy*. **35**(7): pp.3898-3908
IEA CO_2	International Energy Agency. CO_2 emissions from fuel combustion (2007) Electronic database
IEA EB	International Energy Agency. Energy balances (2008) electronic database
IEA EB 2006	International Energy Agency. Energy balances (2006) electronic database
IEA EE 2007	International Energy Agency. 2007. *Tracking Industrial Energy Efficiency and CO_2 Emissions*. Available at: <http://www.iea.org/w/bookshop/add.aspx?id=298>
IEA EE 2008	International Energy Agency. 2008. *Worldwide Trends in Energy Use and Efficiency: Key Insights from IEA Indicator Analysis*. Available at: <http://www.iea.org/G8/2008/Indicators_2008.pdf>
OECD	Organisation for Economic Co-operation and Development. Environmental Data Compendium 2006/2007: Waste database <http://www.oecd.org/document/49/0,3343,en_2649_34283_39011377_1_1_1_1,00.html>
UN population	United Nations. UN World Population Prospects database <http://unstats.un.org>
UNFCCC	UNFCCC - Locator, 2008 inventory submissions by Annex I Parties
UNFCCC Pr:	UNFCCC - Projections data base
World Bank	World Bank. 2008. *World Development Indicators*. Available at: <http://www.worldbank.org/data/wdi>
WRI	Word Resources Institute. Climate Analysis Indicators Tool (CAIT 3.0) database <http://cait.wri.org>

C. Abbreviations

CHP	combined heat and power
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
g CO_2	grams of carbon dioxide
GDP	gross domestic product
GHG	greenhouse gas
IEA	International Energy Agency
IEA EB	Energy Balances database of the International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ktoe	thousand tonnes of oil equivalent
kWh	kilowatt hour
LULUCF	land use, land-use change and forestry
Mt CO_2 eq	million tonnes of carbon dioxide equivalent
pkm	person kilometres
PPP	purchasing power parity
t CO_2 eq	tonne of carbon dioxide equivalent
tkm	tonne kilometres
toe	tonne of oil equivalent
TPES	total primary energy supply
UNDP	United Nations Development Programme

Table 4. Nationwide indicators of mitigation potential

Party	GHG emissions in 2006 (Mt CO_2 eq)[a]	Change in GHG emissions from base year to 2006 (%)[b]	Population in 2006 (million)	Projected population growth 2006–2020 (%)	GDP (PPP) in 2006 (2000 USD billion)	TPES supply in 2006 (ktoe)
Source	**UNFCCC**	**UNFCCC**	**UN population**	**UN population**	**World Bank**	**IEA EB**
Australia	536	29	21	13	713	122 474
Austria	91	15	8	4	289	34 227
Belarus	81	–36.4	10	–7.8	92	28 605
Belgium	137	–5.2	11	1	343	60 993
Bulgaria	71	–46.2	8	–10.7	77	20 697
Canada	*743*	*26*	*33*	*14*	*1 017*	*269 740*
Croatia	31	–5.2	4	–1.6	62	8 957
Czech Republic	148	–23.7	10	–2.2	220	46 054
Denmark	72	2	5	2	188	20 933
Estonia	19	–54.6	1	–4.8	25	4 888
Finland	80	13	5	3	169	37 435
France	547	–3.5	61	6	1 899	272 666
Germany	1 005	–18.2	82	–1.5	2 580	348 559
Greece	*133*	*25*	*11*	*1*	*249*	*31 509*
Hungary	79	–32.1	10	–4.4	178	27 594
Iceland	4	24	0.3	9	11	4 325
Ireland	70	26	4	18	167	15 456
Italy	568	10	59	–0.4	1 657	184 169
Japan	1 340	5	128	–2.6	3 955	527 560
Latvia	*12*	*–54.0*	*2*	*–7.0*	*16*	*7*
Liechtenstein	*0.27*	*19*	*0.04*	*20*	*1*	
Lithuania	23	–53.0	3	–6.1	52	8 542
Luxembourg	13	1	0.5	16	34	4 713
Monaco	0.09	–13.1	0.03	4		
Netherlands	207	–2.0	16	3	579	80 116
New Zealand	78	26	4	10	103	17 541
Norway	54	8	5	9	226	26 090
Poland	400	–28.9	38	–2.8	548	97 717
Portugal	83	40	11	2	213	25 428
Romania	157	–44.4	22	–7.0	218	40 149
Russian Federation	*2 120*	*–36.0*	143	–7.1	*1 309*	*682 856*
Slovakia	49	–33.6	5	–0.5	93	18 679
Slovenia	21	1	*2*	*–1.7*	47	*6 931*
Spain	433	51	44	5	1 225	144 556
Sweden	66	–8.7	9	6	301	51 308
Switzerland	53	0.8	7	5	270	28 213
Turkey	332	95	73	18	595	93 999
Ukraine	443	–51.9	47	–10.9	282	137 427
United Kingdom	656	–15.1	61	6	1 942	231 126
United States	7 017	14	299	14	12 757	2 320 697
European Community	5 139	–16.2	491	1	13 416	1 819 001
Values for KP Annex I Parties:						
Average		–15.3	944	0.6		
Sum	10 466				21 985	3 637 658
High	2 120	95	143	20	3 955	682 856
Low	0.09	–55	0.03	–11	1.41	6.80

Note: Values in *italics* were provided by the Party directly.

[a] Excludes LULUCF and excludes international transport.
[b] Base year is 1990 except for Bulgaria (1988), Hungary (average of the years 1985 to 1987), Poland (1988), Romania (1989) and Slovenia (1986).

Table 5. Nationwide intensities

Party	GHG emissions/ GDP PPP ($t CO_2 eq$/USD thousand)	GHG emissions/ capita ($t CO_2 eq$)	TPES/ capita (toe)	GHG emissions/ TPES ($t CO_2 eq$/ toe)	TPES/GDP PPP (toe/USD thousand)	GDP PPP/ capita (USD/capita)	Exports as proportion of GDP (%)	Human Development Index
Source	**UNFCCC/ World Bank**	**UNFCCC/ UN population**	**IEA EB/UN population**	**UNFCCC/ IEA EB**	**IEA EB/ World Bank**	**World Bank/ UN population**	**World Bank**	**UNDP**
Australia	0.75	25.9	5.9	4.38	0.17	34 450	20	0.96
Austria	0.31	11.0	4.1	2.66	0.12	34 936	58	0.95
Belarus	0.88	8.3	2.9	2.83	0.31	9 432	60	0.80
Belgium	0.40	13.0	5.8	2.25	0.18	32 507	88	0.95
Bulgaria	0.93	9.3	2.7	3.45	0.27	9 957	64	0.82
Canada	*0.73*	*22.8*	*8.3*	*2.75*	*0.27*	*31 178*	*37*	*0.96*
Croatia	0.50	6.9	2.0	3.44	0.15	13 867	48	0.85
Czech Republic	0.67	14.4	4.5	3.22	0.21	21 435	76	0.89
Denmark	0.38	13.2	3.9	3.44	0.11	34 590	52	0.95
Estonia	0.76	14.1	3.6	3.86	0.20	18 383	79	0.86
Finland	0.48	15.2	7.1	2.14	0.22	32 002	44	0.95
France	0.29	8.9	4.5	2.00	0.14	31 005	27	0.95
Germany	0.39	12.2	4.2	2.88	0.14	31 324	45	0.94
Greece	*0.53*	*11.8*	*2.8*	*4.22*	*0.13*	*22 137*	*20*	*0.93*
Hungary	0.44	7.8	2.7	2.85	0.15	17 712	78	0.87
Iceland	0.39	14.0	14.3	0.98	0.40	35 783	33	0.97
Ireland	0.42	16.3	3.6	4.51	0.09	39 025	81	0.96
Italy	0.34	9.7	3.1	3.08	0.11	28 156	28	0.94
Japan	0.34	10.5	4.1	2.54	0.13	30 961	14	0.95
Latvia	0.34	*5.1*	*3.0*	*1.71*	*0.43*	*8*	*41*	0.86
Liechtenstein	*0.19*	*7.8*				*41 529*		
Lithuania	0.45	6.8	2.5	2.72	0.16	15 252	60	0.86
Luxembourg	0.39	28.8	10.2	2.83	0.14	73 277	177	0.94
Monaco		2.9						
Netherlands	0.36	12.7	4.9	2.59	0.14	35 431	74	0.95
New Zealand	0.75	18.6	4.2	4.44	0.17	24 730	28	0.94
Norway	0.24	11.5	5.6	2.05	0.12	48 532	46	0.97
Poland	0.73	10.5	2.6	4.10	0.18	14 378	40	0.87
Portugal	0.39	7.8	2.4	3.25	0.12	20 142	31	0.90
Romania	0.72	7.3	1.9	3.90	0.18	10 109	34	0.81
Russian Federation	*1.62*	*14.7*	4.7	*3.31*	0.37	*9 098*	*35*	0.80
Slovakia	0.53	9.1	3.5	2.62	0.20	17 183	84	0.86
Slovenia	0.43	*10.1*	*3.5*	*2.90*	0.15	23 604	67	0.92
Spain	0.35	9.8	3.3	3.00	0.12	27 765	26	0.95
Sweden	0.22	7.2	5.6	1.28	0.17	33 137	51	0.96
Switzerland	0.20	7.1	3.8	1.89	0.10	36 046	48	0.96
Turkey	0.56	4.5	1.3	3.53	0.16	8 157	23	0.78
Ukraine	1.57	9.5	2.9	3.22	0.49	6 020	47	0.79
United Kingdom	0.34	10.8	3.8	2.84	0.12	32 066	29	0.95
United States	0.55	23.4	7.8	3.02	0.18	42 610	11	0.95
European Community	0.38	10.5				27 339		
Values for KP Annex I Parties:								
Average	0.48	11.1	3.9	2.88	0.17	23 283		
High	1.62	28.8	14.3	4.51	0.49	73 277	177	0.97
Low	0.19	2.9	1.3	0.98	0.09	8		0.78

Note: Values in *italics* were provided by the Party directly.

Table 6. Mix of energy sources per country

	Share in TPES in 2006 (%)									Share in final energy consumption in 2006 (%)				
Party	**Coal**	**Oil**	**Gas**	**Nuclear**	**Hydropower**	**Geothermal**	**Solar/wind/ other**	**Biomass/ waste**	**Electricity and heat[a]**	**Industry**	**Transport**	**Households and services[b]**	**Agriculture**	**Other[c]**
Source	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**
Australia	44	32	19	0.0	1	0.0	0.2	4	0.0	34	38	20	3	5
Austria	12	42	22	0.0	9	0.1	0.7	13	2	27	29	35	2	7
Belarus	2	31	60	0.0	0.0	0.0	0.0	5	1	27	11	39	5	18
Belgium	8	40	25	20	0.1	0.0	0.1	6	2	29	22	30	2	16
Bulgaria	34	25	14	25	2	0.2	0.0	4	–3.2	33	27	28	3	9
Canada	*12*	*35*	*30*	*7*	*11*	*0.0*	*0.0*	*4*	*–0.2*	*35*	*27*	*32*	*2*	*4*
Croatia	7	52	26	0.0	6	0.0	0.0	4	5	23	28	35	3	10
Czech Republic	45	21	16	15	0.5	0.0	0.0	4	–2.3	30	22	33	2	12
Denmark	26	39	22	0.0	0.0	0.1	3	13	–2.8	18	34	40	4	2
Estonia	59	15	17	0.0	0.0	0.0	0.1	11	–1.3	20	27	42	3	8
Finland	20	28	10	16	3	0.0	0.0	20	3	46	18	25	3	8
France	5	33	15	43	2	0.0	0.1	4	–2.0	19	29	38	2	12
Germany	24	35	23	13	0.5	0.1	0.9	5	–0.4	22	25	36	1	16
Greece	*27*	*58*	*9*	*0.0*	*2*	*0.0*	*0.8*	*3*	*1*	*20*	*40*	*35*	*6*	*4*
Hungary	11	28	42	13	0.1	0.3	0.0	4	2	17	23	46	2	12
Iceland	2	23	0.0	0.0	14	61	0.0	0.0	0.0	32	19	30	3	8
Ireland	16	55	26	0.0	0.4	0.0	0.9	1	1.0	21	40	35	2	3
Italy	9	44	38	0.0	2	3	0.2	3	2	26	31	31	2	11
Japan	21	46	15	15	1	0.5	0.1	1	0.0	29	26	33	0.8	11
Latvia	*2*	*29*	*23*	*0.0*	*5*	*0.0*	*0.1*	*36*	*4*	*27*	*18*	*22*	*2*	*31*
Liechtenstein														
Lithuania	3	30	29	27	0.4	0.0	0.0	9	2	19	28	37	2	15
Luxembourg	2	63	26	0.0	0.2	0.0	0.1	1	6	23	60	16	0.6	0.5
Monaco														
Netherlands	10	40	43	1	0.0	0.0	0.3	3	2	20	25	29	6	19
New Zealand	12	39	19	0.0	11	12	0.3	6	0.1	26	44	20	3	7
Norway	3	34	18	0.0	39	0.0	0.2	5	0.4	30	25	30	2	12
Poland	59	24	13	0.0	0.2	0.0	0.0	5	–1.0	25	21	39	7	8
Portugal	13	54	14	0.0	4	0.3	1	12	2	28	35	26	1	9
Romania	24	25	36	4	4	0.0	0.0	8	–0.9	33	17	39	1.0	10
Russian Federation	*14*	*27*	*47*	*5*	*5*	*0.0*	*0.0*	*0.5*	*0.0*	*48*	*12*	*30*	*3*	*6*
Slovakia	24	18	29	25	2	0.0	0.0	3	–1.1	31	20	37	1	11
Slovenia	*22*	*34*	*15*	*20*	*4*	*0.0*	*0.0*	*7*	*0.2*	*33*	*30*	*38*[d]		
Spain	12	49	21	11	2	0.0	1	4	–0.2	29	39	22	3	8
Sweden	5	28	2	34	10	0.0	0.2	18	2	35	24	32	2	7
Switzerland	0.6	46	10	26	9	0.5	0.1	7	0.8	19	32	45	0.6	4
Turkey	28	33	28	0.0	4	1	0.4	6	–0.2	32	20	35	5	8
Ukraine	29	11	42	17	0.8	0.0	0.0	0.4	–0.7	40	15	34	2	10
United Kingdom	18	36	35	9	0.2	0.0	0.2	2	0.3	20	35	37	0.5	8

Table 6 (continued)

	Share in TPES in 2006 (%)									Share in final energy consumption in 2006 (%)				
Party	**Coal**	**Oil**	**Gas**	**Nuclear**	**Hydropower**	**Geothermal**	**Solar/wind/ other**	**Biomass/ waste**	**Electricity and heat[a]**	**Industry**	**Transport**	**Households and services[b]**	**Agriculture**	**Other[c]**
Source	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**	**IEA EB**
United States	24	40	22	9	1	0.4	0.2	3	0.1	18	41	29	1	11
European Community										24	29	34	2	11
Values for KP Annex I Parties:														
Average	18	34	29	12	3	0.4	0.3	4	0.2	27	26	34	2	11
High	59	63	60	43	39	61	3	36	6	48	60	46	7	31
Low	0.6	11	0.0	0.0	0.0	0.0	0.0	0.0	–3.2	17	11	16	0.5	0.5

Note: Values in *italics* were provided by the Party directly.

[a] Can be negative owing to imports and exports.
[b] IEA EB categories commercial and public services and residential.
[c] IEA EB categories non-specified other and non-energy use.
[d] This value contains households, services and agriculture.

Table 7. National greenhouse gas emissions per sector

Party	Share of sector in total GHG emissions (without LULUCF and international transport) 2006 (%)						Compared with total GHG emissions (excluding LULUCF and international transport) (%)	
	Energy industries and fugitive emissions[a]	Industry[b]	Transport[c]	Households and services[d]	Agriculture[e]	Waste[f]	LULUCF[g]	International transport[h]
Source	**UNFCCC**	**UNFCCC**	**UNFCCC**	**UNFCCC**	**UNFCCC**	**UNFCCC**	**UNFCCC**	**UNFCCC**
Australia	47	14	15	4	17	3	3	2
Austria	18	30	26	16	9	2	–19.9	2
Belarus	42	16	5	11	15	6	–32.1	0.4
Belgium	21	31	20	21	8	0.9	–0.8	24
Bulgaria	44	24	10	3	7	11	–25.5	1
Canada	*34*	*16*	*26*	*11*	*7*	*3*	*10.7*	*2*
Croatia	29	26	18	12	12	2	–24.3	0.6
Czech Republic	42	29	11	9	5	2	–2.3	0.7
Denmark	42	12	19	10	14	2	–2.5	9
Estonia	68	6	11	2	6	4	–18.4	4
Finland	41	22	18	9	7	3	–41.7	4
France	13	22	27	19	18	2	–12.8	5
Germany	38	21	17	17	6	1	–3.6	3
Greece	*43*	*17*	*18*	*11*	*9*	*3*	*–3.9*	*10*
Hungary	27	19	13	21	14	5	–7.5	0.9
Iceland	4	42	17	14	12	5	27	13
Ireland	22	13	18	16	27	3	–0.7	5
Italy	29	22	23	16	7	3	–19.8	3
Japan	29	34	19	13	2	3	–6.8	3
Latvia	*40*	*2*	*29*	*9*	*0.6*	*7*	*–154.0*	*7*
Liechtenstein	1	*16*	*30*	*44*	*8*	0.7	*–2.4*	
Lithuania	25	24	17	7	16	7	–34.2	3
Luxembourg	11	18	55	10	3	0.3	–2.2	9
Monaco	25	0.8	38	37		1	0.0	20
Netherlands	31	21	17	19	9	3	1	32
New Zealand	15	12	18	4	48	2	–29.2	4
Norway	29	25	27	7	8	3	–52.0	
Poland	51	15	9	14	9	2	–10.1	0.5
Portugal	28	22	24	7	10	8	–5.0	5
Romania	39	26	11	9	9	6	–23.9	
Russian Federation	*59*	*14*	*8*	*9*	*7*	*3*	*–10.3*	*0.5*
Slovakia	25	40	12	11	8	5	–6.2	0.3
Slovenia	*34*	*18*	*21*	*14*	*10*	*3*	*–28.1*	*0.3*
Spain	28	25	24	9	11	3	–7.6	8
Sweden	18	27	31	8	13	3	–57.8	14
Switzerland	8	18	29	34	10	1	–4.2	7
Turkey	28	31	12	13	5	9	–22.9	
Ukraine	37	33	9	11	7	2	–7.4	0.2
United Kingdom	35	17	20	17	7	3	–0.3	7
United States	37	17	27	11	6	2	–12.1	2
European Community	33	21	19	15	9	3	–9.7	6
Values for KP Annex I Parties:								
Average	38	22	17	13	8	3	–4.4	4
High	68	42	55	44	48	11	27	32
Low	1	0.8	5	2	0.6	0.3	–154.0	0.2

Note: Values in *italics* were provided by the Party directly.

[a] Sum of IPCC source categories 1A1 (energy industries) and 1B (fugitive emissions from fuels).
[b] Sum of IPCC source categories 1A2 (manufacturing industries and construction), 2 (industrial processes) and 3 (solvents).
[c] IPCC source category 1A3 (transport).
[d] Sum of IPCC source categories 1A4 (other sectors) and 1A5 (other). Indirect emissions from electricity use are only included under energy industries and fugitive emissions.
[e] IPCC source category 4 (agriculture).
[f] IPCC source category 6 (waste).
[g] IPCC source category 5 (land use, land-use change and forestry).
[h] Sum of IPCC source categories 1A3a,i (transport civil aviation, international) and 1A3d,i (transport navigation, international).

Table 8. Mitigation potential indicators for energy industries and fugitive emissions

Party	Share of national GHG emissions 2006 (%)		CO_2 emissions/ kWh (g CO_2/kWh)[a]	Share of renewable energy in electricity production (%)	Share of nuclear energy in electricity production (%)	Share of combined heat and power in electricity from fossil fuels (%)[b]	Efficiency of fossil fuel power plants (%)[c]
	Energy industries	Fugitive emissions					
	Source UNFCCC	UNFCCC	IEA CO_2	IEA EB	IEA EB	IEA EB 2006	Graus et al.
Australia	41	6	841	7	0.0	6	33
Austria	17	1	221	60	0.0	34	
Belarus	40	2	302	0.1	0.0	55	
Belgium	20	0.4	281	1	55	20	
Bulgaria	41	3	471	9	43	26	
Canada	*26*	*8*	*209*	*58*	*13*	*7*	*40*
Croatia	22	7	298	49	0.0	34	
Czech Republic	38	4	503	3	31	34	
Denmark	42	0.7	308	14	0.0	100	41
Estonia	64	4	701	1	0.0	10	
Finland	41	0.2	261	14	28	50	41
France	12	1	87	10	79	0.0	33
Germany	37	1	453	9	27	0.0	38
Greece	*41*	*1*	*956*	*15*	*0.0*	6	
Hungary	25	3	401	0.7	38	33	
Iceland	0.8	4	1	100	0.0	0.0	
Ireland	22	0.2	573	9	0.0	2	42
Italy	28	1	455	15	0.0	29	
Japan	29	0.0	424	8	28	0.0	42
Latvia	*40*	*0.0*	*283*	*38*	*0.0*	*100*	*37*
Liechtenstein	*1*	0.4	40	*95*	*0.0*	*5*	
Lithuania	24	0.9	111	3	72	100	
Luxembourg	11	0.4	333	6	0.0	13	
Monaco	25						
Netherlands	30	1	440	3	4	100	
New Zealand	12	2	165	64	0.0	5	
Norway	23	6	7	99	0.0	8	41
Poland	47	3	665	2	0.0	100	
Portugal	26	2	452	29	0.0	14	
Romania	31	7	418	29	9	47	
Russian Federation	*41*	*18*	*325*	*19*	*16*	*100*	
Slovakia	23	2	247	14	58	90	
Slovenia	*31*	*2*	*395*	*21*	*38*	86	
Spain	27	0.9	383	17	20	22	
Sweden	17	1	51	44	47	88	41
Switzerland	7	0.5	24	50	45	100	
Turkey	27	0.5	462	25	0.0	19	
Ukraine	25	12	296	7	47	25	
United Kingdom	33	2	467	3	19	8	42
United States	34	3	576	8	19	11	35
European Community	31	2	370	12	30	29	
Values for KP Annex I Parties:							
Average	0.3	0.1	423	0.2	0.2	0.3	
High	0.6	0.2	956	1.0	0.8	1.0	0.4
Low	0.0	0.0	1	0.0	0.0	0.0	0.3

Note: Values in *italics* were provided by the Party directly.

[a] CO_2 emissions from electricity and heat ('main producer' and 'autoproducer') divided by electricity and heat generated from these plants.

[b] Share of CHP in electricity from fossil fuels includes complete energy output of all plants that are CHP capable.

[c] Efficiency calculated as weighted average over all fossil fuel sources (coal, oil and gas) for 2003. Values are based on IEA statistics but are corrected for use of CHP and for use of oxides of nitrogen and sulphur control. The United Kingdom and Ireland were analysed as one group, as were the Nordic countries of Denmark, Sweden, Norway and Finland.

Table 9. Mitigation potential indicators for the industry sector

Party	Share of sector in national GHG emissions 2006 (%)[a]	GHG emissions/output in chemical industry (CO_2 index)[b]	Energy Consumption/tonne clinker 2004 (GJ/tonne clinker)[c]	Non-CO_2 process emissions as percentage of national total (%)[d]
Source	**UNFCCC**	**IEA EE 2007**	**IEA EE 2008**	**UNFCCC**
Australia	14			1
Austria	30			2
Belarus	16			0.6
Belgium	31			3
Bulgaria	24			2
Canada	*16*		4.17	2
Croatia	26			4
Czech Republic	29			1
Denmark	12			1
Estonia	6			0.4
Finland	22			3
France	22	0.70	3.46	4
Germany	21	0.62		3
Greece	*17*			*4*
Hungary	19			3
Iceland	42			10
Ireland	13			1
Italy	22	0.55	3.50	2
Japan	34	0.73	2.97	1
Latvia	*10*			*0.2*
Liechtenstein	*16*			2
Lithuania	24			10
Luxembourg	18			0.7
Monaco	0.8			0.8
Netherlands	21	0.77		4
New Zealand	12			*0.9*
Norway	25			6
Poland	15			2
Portugal	22			2
Romania	26			2
Russian Federation	*9*			*0.5*
Slovakia	40			4
Slovenia	*18*			1
Spain	25		3.62	2
Sweden	27			3
Switzerland	18			2
Turkey	31			8
Ukraine	33			0.8
United Kingdom	17	0.71		2
United States	17	0.50	4.59	2
European Community	21			3
Values for KP Annex I Parties:				
Average	0.2			0.0
High	0.4	0.77	4.17	0.1
Low	0.0	0.55	2.97	0.0

Note: Values in *italics* were provided by the Party directly.

[a] Sum of IPCC source categories 1A2 (manufacturing industries and construction), 2 (industrial processes) and 3 (solvents).

[b] The index is derived by dividing the lowest carbon intensity ('best practice') for the product mix of a country by the actual CO_2 emissions of the country. It excludes emissions from electricity use. An index of 1 would denote that the country is applying 100 per cent best practice. A value of 0.8 denotes that only 80 per cent of the emissions would occur, if best practice were applied. Results should be viewed with caution as data quality and scope may vary between countries.

[c] Including alternative fuels. Results should be viewed with caution as emissions also depend on product mix and product quality as well as the availability of alternative fuels.

[d] Mainly N_2O emissions in industrial processes and emissions of HFCs, PFCs and SF_6.

Table 10. Mitigation potential indicators for the transport sector

Party	Share of sector in national GHG emissions 2006 (%)[a]	GHG emissions of sector/capita (t CO_2 eq)[b]	Fuel efficiency of passenger cars (litre/100 km)	Personal transport activity (pkm/capita)	Freight transport activity (tkm/capita)[c]	Modal split of passenger transport (%)[d]			Modal split of freight transport (%)[e]			Population density (people/km^2)
						Road	Rail	Domestic air	Road	Rail	Water	
Source	UNFCCC	UNFCCC/ UN population	IEA EE 2008	Enerdata/ UN population	Enerdata/ UN population	Enerdata			Enerdata			UN population
Australia	15	3.8	10.8									3
Austria	26	2.9	7.3	10 946	6 678	90	10	0.2	67	30	3	99
Belarus	5	0.5										47
Belgium	20	2.6			5 745				71	14	15	341
Bulgaria	10	1.0			2 269				62	30	8	70
Canada	27	5.9	*8.6*									3
Croatia	18	1.2		11 755		97	3	0.2				81
Czech Republic	11	1.5		9 016	6 521	92	7	0.0	75	24	1	129
Denmark	19	2.5	6.8	12 452		90	9	0.5				126
Estonia	11	1.5										30
Finland	18	2.7	6.9	14 223		93	5	2				16
France	27	2.4	7.2	14 050	4 399	89	9	2	82	15	3	111
Germany	17	2.1	7.8	12 599	7 244	91	8	1.0	72	17	11	232
Greece	*16*	*2.1*	6.3	10 543	3 027	96	3	0.8	69	1	30	*84*
Hungary	13	1.1										108
Iceland	17	2.4										3
Ireland	18	2.9	8.5		4 287				97	1	2	59
Italy	23	2.3	6.4	14 543		93	5	2				159
Japan	19	2.0	10.5									338
Latvia	*29*	*1.5*		6 393	12 139	79	7	14	39	61	0.0	*35.5*
Liechtenstein	*30*	*2.4*										216
Lithuania	17	1.2										52
Luxembourg	55	15.7										177
Monaco	38	1.1										21 812
Netherlands	17	2.2	7.8		5 038				41	6	53	393
New Zealand	18	3.4	10.4									15
Norway	27	3.1	7.7	13 974		88	5	7				12
Poland	9	0.9		6 971	5 018	93	7	0.1	71	28	0.6	118
Portugal	24	1.9			1 994				83	12	5	114
Romania	11	0.8			3 614				73	20	6	91
Russian Federation	*8*	*1.2*				*34*	*44*	*22*	*9*	*84*	*7*	8
Slovakia	12	1.1		7 244	5 956	87	6	7	69	31	0.0	110
Slovenia	21	2.1										99
Spain	24	2.3	7.6		9 573				87	3	10	86
Sweden	31	2.2	8.7	13 057	7 602	89	8	3	58	32	10	20
Switzerland	29	2.1	8.8									180

Table 10 (continued)

Party	Share of sector in national GHG emissions 2006 (%)[a]	GHG emissions of sector/capita (t CO_2 eq)[b]	Fuel efficiency of passenger cars (litre/100 km)	Personal transport activity (pkm/capita)	Freight transport activity (tkm/capita)[c]	Modal split of passenger transport (%)[d]			Modal split of freight transport (%)[e]			Population density (people/km^2)
						Road	Rail	Domestic air	Road	Rail	Water	
Source	**UNFCCC**	**UNFCCC/ UN population**	**IEA EE 2008**	**Enerdata/ UN population**	**Enerdata/ UN population**	**Enerdata**			**Enerdata**			**UN population**
Turkey	12	0.6										93
Ukraine	9	0.8										78
United Kingdom	20	2.2	7.1	13 088	3 124	93	6	1	88	12	0.1	248
United States	27	6.2	11.4									31
European Community	19	2.0										
Values for KP Annex I Parties:												
Average	17	1.9										
High	55	15.7	10.8	14 543	12 139	97	44	22	97	84	53	21 812
Low	5	0.5	6.3	6 393	1 994	34	3	0.0	9	1	0.0	3

Note: Values in *italics* were provided by the Party directly.

[a] Refers to domestic transport only.
[b] Refers to domestic transport only.
[c] Value for Netherlands corrected (*0.01).
[d] Calculated based on passenger kilometres per transportation type.
[e] Calculation based on tonne kilometres per transportation type.

Table 11. Mitigation potential indicators for the households and services sector

Party	Share of sector in national GHG emissions 2006 (%)[a]	GHG emissions of sector/capita (t CO_2 eq)[b]	Electricity use/capita (kWh/capita)	Heating degree days[c]	Cooling degree days[d]
Source	**UNFCCC**	**UNFCCC**	**IEA EB/ UN population**	**WRI**	**WRI**
Australia	4	1.0	5 374	828	839
Austria	16	1.7	3 536	3 446	173
Belarus	11	1.0	937	4 299	88
Belgium	21	2.7	3 783	3 009	102
Bulgaria	3	0.3	2 112	2 624	430
Canada	10	2.3	8 598	4 493	171
Croatia	12	0.8	2 471	2 289	418
Czech Republic	9	1.3	2 743	3 569	108
Denmark	10	1.3	3 918	3 621	40
Estonia	2	0.3	2 859	4 605	38
Finland	9	1.3	7 074	5 212	48
France	19	1.7	4 466	2 478	241
Germany	17	2.1	3 300	3 252	122
Greece	11	1.3	3 145	1 269	923
Hungary	21	1.7	2 161	3 057	256
Iceland	14	1.9	5 818	5 031	40
Ireland	16	2.6	3 795	2 977	19
Italy	16	1.5	2 476	1 838	600
Japan	13	1.4	5 013	1 901	896
Latvia	*9*	*0.4*	*3 234*	4 237	58
Liechtenstein	*44*	3.4	*10 550*	*2 879*	*50*
Lithuania	7	0.5	1 535	4 218	68
Luxembourg	10	2.9	4 481	3 467	99
Monaco	37	1.1			
Netherlands	19	2.4	3 428	3 035	68
New Zealand	4	0.8	4 924	1 609	165
Norway	7	0.8	11 750	4 535	43
Poland	14	1.4	1 455	3 719	100
Portugal	7	0.6	2 706	1 367	345
Romania	9	0.6	690	3 157	290
Russian Federation	8	*1.3*	1 578	5 235	197
Slovakia	11	1.0	2 013	3 498	158
Slovenia	11	1.2	*2 676*	3 290	189
Spain	9	0.9	2 981	1 431	702
Sweden	8	0.6	7 555	4 375	45
Switzerland	34	2.4	4 624	3 419	137
Turkey	13	0.6	957	2 048	641
Ukraine	11	1.0	1 022	3 752	224
United Kingdom	17	1.8	3 531	2 810	66
United States	11	2.5	8 855	2 159	882
European Community	15	1.5	3 127		
Values for KP Annex I Parties:					
Average	13	1.4	3 103		
High	44	3.4	11 750	5 235	923
Low	2	0.3	690	828	19

Note: Values in *italics* were provided by the Party directly.

[a] Sum of IPCC source categories 1A4 (other sectors) and 1A5 (other). Indirect emissions from electricity use or district heating are not included. Result therefore shows only an incomplete picture.

[b] As above excludes emissions from electricity use and district heating. Result therefore shows only an incomplete picture.

[c] Calculated for a period of 365 days for mean temperatures below 15 °C.

[d] Calculated for a period of 365 for mean temperature above 25 °C.

Table 12. Mitigation potential indicators for the agriculture sector (non-carbon dioxide)

Party	Share of sector in national GHG emissions 2006 (%)	GHG emissions of sector/capita (t CO_2 eq)	GHG emission of sector/GDP PPP of agricultural sector (tCO_2 eq/USD thousand)
Source	**UNFCCC**	**UNFCCC/UN population**	**UNFCCC/World Bank**
Australia	17	4.3	4.1
Austria	9	0.9	1.6
Belarus	15	1.3	1.4
Belgium	8	1.1	3.3
Bulgaria	7	0.7	0.8
Canada	8	1.7	*2.1*
Croatia	12	0.8	0.8
Czech Republic	5	0.8	1.4
Denmark	14	1.8	3.2
Estonia	6	0.9	1.5
Finland	7	1.1	1.3
France	18	1.6	2.5
Germany	6	0.8	2.6
Greece	*9*	*1.0*	*1.6*
Hungary	14	1.1	1.5
Iceland	12	1.7	0.8
Ireland	27	4.4	5.5
Italy	7	0.6	1.1
Japan	2	0.2	0.5
Latvia	*17*	*0.9*	*0.1*
Liechtenstein	*8*	*0.6*	
Lithuania	16	1.1	1.4
Luxembourg	3	0.8	3.2
Monaco			
Netherlands	9	1.1	1.4
New Zealand	48	8.9	
Norway	8	0.9	1.2
Poland	9	0.9	1.4
Portugal	10	0.8	1.4
Romania	9	0.6	0.6
Russian Federation	6	1.0	1.5
Slovakia	8	0.7	1.1
Slovenia	10	1.0	1.8
Spain	11	1.1	1.2
Sweden	13	1.0	2.0
Switzerland	10	0.7	1.5
Turkey	5	0.2	0.3
Ukraine	7	0.7	1.3
United Kingdom	7	0.8	2.5
United States	6	1.5	2.9
European Community	9	1.0	
Values for KP Annex I Parties:			
Average	8	0.9	
High	48	8.9	5.5
Low	2	0.2	0.1

Note: Values in *italics* were provided by the Party directly.

Table 13. Mitigation potential indicators for the waste sector

Party	Share of sector in national GHG emissions 2006 (%)	GHG emissions of sector/ capita (t CO_2 eq)	Percentage of methane recovered (%)	Municipal waste per capita (kg)[a]	Percentage of waste incinerated (%)	Percentage of waste landfilled (%)
Source	**UNFCCC**	**UNFCCC/ UN population**	**UNFCCC**	**OECD**	**OECD**	**OECD**
Australia	3	0.80	26	450		70
Austria	2	0.27	21	560	21	7
Belarus	6	0.53				
Belgium	0.9	0.12	45	460	34	12
Bulgaria	11	0.98				
Canada	*3*	*0.64*	*29*	*789*	*3*	*64*
Croatia	2	0.13	17			
Czech Republic	2	0.34	15	290	14	80
Denmark	2	0.24	20	740	54	5
Estonia	4	0.53	10			
Finland	3	0.47	24	470	10	60
France	2	0.22	61	540	34	36
Germany	1	0.16	57	600	25	18
Greece	*3*	*0.31*	*26*	*468*		*93*
Hungary	5	0.41	0.7	460	6	90
Iceland	5	0.69	9	520	9	72
Ireland	3	0.43	36	740		66
Italy	3	0.32	38	540	12	54
Japan	3	0.35	0.2	400	74	3
Latvia	*7*	*0.34*	*0.6*	*467*	*0.2*	*67*
Liechtenstein	0.7	0.05				
Lithuania	7	0.45				
Luxembourg	0.3	0.10	24	710	39	19
Monaco	1	0.03				
Netherlands	3	0.39	18	620	32	2
New Zealand	2	0.44	43	400		85
Norway	3	0.32	25	760	25	26
Poland	2	0.22		250	0.5	92
Portugal	8	0.64	13	470	21	64
Romania	6	0.46				
Russian Federation	3	*0.48*	*0.0*	*360*	7	73
Slovakia	5	0.47	0.9	270	12	78
Slovenia	3	0.35	22			
Spain	3	0.28	19	650	7	52
Sweden	3	0.23	22	480	50	5
Switzerland	1	0.09	28	650	50	0.5
Turkey	9	0.41		440		98
Ukraine	2	0.22	0.0			
United Kingdom	3	0.36	72	580	8	64
United States	2	0.54	50	750	14	54
European Community	3	0.30				
Values for KP Annex I Parties:						
Average	3	0.36				
High	11	0.98	72	789	74	98
Low	0.3	0.03	0.0	250	0.2	0.5

Note: Values in *italics* were provided by the Party directly.

[a] Values for Australia, Canada and New Zealand cover household waste only.

Table 14. Mitigation potential indicators for the land use, land–use change and forestry sector

Party	Share of sector compared with national GHG emissions in 2006 (%)	Net GHG emissions or removals of sector/capita (t CO_2 eq)	Forest area (km^2)[a]	Forest area as percentage of land area (%)	Net CO_2 emissions or removals per forested area (t CO_2/km^2)[b]	Net CO_2 emissions/ removals from soils per agricultural area (t CO_2/km^2)[c]
Source	**UNFCCC**	**UNFCCC/UN population**	**UNFCCC**	**UNFCCC / FAO**	**UNFCCC**	**UNFCCC**
Australia	3	0.7	167 836	2	–295	13
Austria	–19.9	–2.2	33 764	41	–584	22
Belarus	–32.1	–2.7	79 667	38	–341	
Belgium	–0.8	–0.1	6 210	21	–447	125
Bulgaria	–25.5	–2.4	40 636	37	–172	
Canada	4	1.0	2 551 313	28	4	*–18*
Croatia	–24.3	–1.7	20 896	37	–358	
Czech Republic	–2.3	–0.3	25 911	34	–130	–6
Denmark	–2.5	–0.3	4 684	11	–589	36
Estonia	–18.4	–2.6	21 128	50	–165	
Finland	–41.7	–6.4	224 877	74	–182	297
France	–12.8	–1.1	156 846	29	–540	25
Germany	–3.6	–0.4	108 402	31	–729	221
Greece	*–4.1*	*–0.5*	*65 602*	*50.9*	*–68*	
Hungary	–7.5	–0.6	17 703	20	–263	
Iceland	27	3.7	524	0.5	–255	37
Ireland	–0.7	–0.1	5 224	8	–183	9
Italy	–19.8	–1.9	127 680	43	–743	
Japan	–6.8	–0.7	249 507	68	–334	–18
Latvia	*–154.0*	*–7.8*	*36 030*	*56*	*–495*	*–22*
Liechtenstein	*–2.4*	*–0.2*	*69*	*43*	–327	105
Lithuania	–34.2	–2.3	19 877	32	–408	
Luxembourg	–2.2					
Monaco	0.0	–0.001				
Netherlands	1	0.2	4 433	13	–566	193
New Zealand	*–29.2*	*–5.7*	*81 000*	*30*	*–1293*	*1*
Norway	–52.0	–6.0	94 985	31	–319	182
Poland	–10.1	–1.1	91 710	30	–592	55
Portugal	–5.0	–0.4	31 210	34	–182	88
Romania	–23.9	–1.7	67 573	29	–555	
Russian Federation	*–10.3*	*–1.5*	6 195 041	38	–11	*186*
Slovakia	–6.2	–0.6	19 307	40	–160	–19
Slovenia	–23.0	–2.4	11 638	58	–407	
Spain	–7.6	–0.7	188 572	38	–178	
Sweden	–57.8	–4.2	274 285	67	–122	–141
Switzerland	–4.2		12 234	31	–274	37
Turkey	–22.9					
Ukraine	–7.4	–0.7	99 740	17	–533	64
United Kingdom	–0.3	0.0	24 630	10	–614	45
United States	–12.1	–2.8				–6
European Community	–9.7	–1.0	1 601 163	38		
Values for KP Annex I Parties:						
Average	–4.4	–0.5		34		
High	27	3.7	6 195 041	74	4	297
Low	–154.0	–7.8	69	0.5	–1293	–141

Note: Values in *italics* were provided by the Party directly.

[a] Forest area data for Croatia corrected (*0.001).
[b] Net CO_2 emissions and removals from IPCC source category 5A (forest land) divided by forest area.
[c] Net CO_2 emissions and removals from IPCC source categories 5B (cropland) and 5C (grassland) divided by cropland and grassland area.

Table 15. Mitigation potential indicators for international transport

Party	Share of international aviation in national GHG emissions (%)	Share of international navigation in national GHG emissions (%)	GHG emissions of sector/capita (CO_2 eq)	Share of international aviation in total aviation (%)[a]	Share of international shipping in total shipping (%)[b]
Source	**UNFCCC**	**UNFCCC**	**UNFCCC/UN population**	**UNFCCC**	**UNFCCC**
Australia	1	0.6	0.5	55	60
Austria	2		0.2	89	
Belarus	0.4		0.0	97	
Belgium	3	21	3.1	100	99
Bulgaria	0.7	0.5	0.1	80	100
Canada	1	0.3	0.3	53	24
Croatia	0.4	0.2	0.0	40	36
Czech Republic	0.7		0.1	98	
Denmark	4	5	1.1	95	88
Estonia	0.5	4	0.6	91	95
Finland	2	2	0.6	82	75
France	3	2	0.4	78	75
Germany	2	0.9	0.4	80	91
Greece	*2*	*8*	*1.1*	*72*	*81*
Hungary	0.9		0.1	99	
Iceland	9	3	1.8	93	73
Ireland	4	0.6	0.8	96	99
Italy	2	1	0.3	77	51
Japan	1	1	0.3	63	58
Latvia	*2*	*6*	*0.4*	*99*	*93*
Liechtenstein	0.3		0.0	85	
Lithuania	0.7	2	0.2	98	96
Luxembourg	9		2.7	100	
Monaco	4	16	0.6	100	91
Netherlands	5	27	4.1	100	99
New Zealand	3	1	0.8	68	73
Norway				59	47
Poland	0.3	0.2	0.1	94	99
Portugal	3	2	0.4	84	89
Romania	0.3	0.1	0.0	97	69
Russian Federation	*0.4*	*0.1*	*0.1*	85	50
Slovakia	0.2	0.1	0.0	90	100
Slovenia	0.4	0.5	0.1	98	100
Spain	2	6	0.8	58	90
Sweden	3	11	1.0	76	93
Switzerland	7		0.5	97	
Turkey					
Ukraine	0.2	0.0	0.0	79	45
United Kingdom	5	1	0.7	94	55
United States	1	0.8	0.4	32	59
European Community	3	3	0.6		
Values for KP Annex I Parties:					
Average	2	2	0.4		
High	9	27	4.1	100	100
Low	0.2	0.0	0.0	40	24

Note: Values in *italics* were provided by the Party directly.

[a] Share reported by Parties in national GHG inventories.
[b] Share reported by Parties in national GHG inventories.

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