

**Framework Convention on
Climate Change**Distr.: General
3 June 2011

English only

**Quantified economy-wide emission reduction targets by
developed country Parties to the Convention: assumptions,
conditions and comparison of the level of emission reduction
efforts****Technical paper***Summary*

This technical paper presents an overview of the quantified economy-wide emission reduction targets to be implemented by developed country Parties, as well as assumptions and conditions related to the attainment of these targets, and discusses comparison of the emission reduction efforts. This paper is intended to facilitate understanding of these assumptions and conditions. It is based on submissions by Parties and their contributions to the workshop held in Bangkok, Thailand, on 3 April 2011 on assumptions and conditions related to the attainment of quantified economy-wide emission reduction targets by developed country Parties.

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I. Introduction

A. Mandate

1. The Conference of the Parties (COP), at its sixteenth session, in decision 1/CP.16,¹ recognized that deep cuts in global greenhouse gas (GHG) emissions are required according to science, and as documented in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), with a view to reducing global greenhouse gas emissions so as to hold the increase in global average temperature below 2 °C above pre-industrial levels, and that Parties should take urgent action to meet this long-term goal, consistent with science and on the basis of equity. The COP also recognized the need to consider, in the context of the first review under the Convention subsequent to its sixteenth session, strengthening the long-term global goal on the basis of the best available scientific knowledge, including in relation to a global average temperature rise of 1.5 °C.²
2. The COP, by decision 1/CP.16, urged developed country Parties to increase the ambition of their targets, with a view to reducing their aggregate anthropogenic emissions of carbon dioxide (CO₂) and other GHGs not controlled by the Montreal Protocol to a level consistent with that recommended by the Fourth Assessment Report of the IPCC.³
3. The COP, by decision 1/CP.16, requested the secretariat to organize workshops to clarify the assumptions and conditions related to the attainment of the targets by developed country Parties, including the use of carbon credits from the market-based mechanisms and land use, land-use change and forestry (LULUCF) activities, and options and ways to increase their level of ambition.⁴
4. The COP also requested the secretariat to prepare a technical paper based on the submissions of Parties with the aim of facilitating understanding of the assumptions and conditions related to the attainment of their emission reduction targets and comparison of the level of emission reduction efforts.⁵

B. Scope of the paper

5. This paper was prepared in response to the above mandate. It comprises an introduction (chapter I) and three substantive chapters. Chapter II provides an overview of the quantified economy-wide emission reduction targets (referred to hereinafter as targets) by developed country Parties, including assumptions and conditions. Chapter III presents a discussion of the targets of developed country Parties, including assumptions and conditions related to the attainment of targets, including the use of carbon credits from market-based mechanisms,⁶ referred to hereinafter as carbon credits, and LULUCF.

¹ Decisions 1/CP.16 and 1/CMP.6 form part of the decisions that are also known as the Cancun Agreements.

² Decision 1/CP.16, paragraph 4.

³ Decision 1/CP.16, paragraph 37.

⁴ Decision 1/CP.16, paragraph 38.

⁵ Decision 1/CP.16, paragraph 39.

⁶ 'Carbon credits from market-based mechanisms' is a general term that refers to emission reductions or removals achieved outside the domain of a country or entity having an emission reduction target. They may be used to meet part of an emission reduction target by a Party or entity, as they offset part of the emissions. Carbon credits are usually expressed in units of tonnes of carbon dioxide equivalent saved. In the context of the Kyoto Protocol, carbon credits include certified emission reduction units under Article 12, emission reduction units under Article 6 and assigned amount units under Article

Chapter IV discusses comparison of the level of emission reduction efforts among developed country Parties, including comparison of the emission reductions by 2020, individually and in aggregate, with respect to 1990 (the base year of the Convention) and other selected years (2000, 2005 and 2008), based on several metrics.

6. The annex to this paper contains background information submitted by Parties included in Annex I to the Convention (Annex I Parties) in their annual submission of GHG inventories on emission trends and emission reductions associated with the targets by developed country Parties, and related metrics. Illustrations are also presented to show how different metrics affect the comparability of emission reduction efforts.

C. Background

7. This paper is based on information provided by developed country Parties concerning:

(a) Economy-wide emission reduction targets contained in document FCCC/SB/2011/INF.1 to be implemented by Annex I Parties;

(b) Assumptions and conditions related to the attainment of quantified economy-wide emission reduction targets by developed country Parties, as provided during the workshop on this matter held on 3 April 2011 in Bangkok, Thailand (hereinafter referred to as the workshop);⁷

(c) Annual submissions of GHG inventory information and submissions of the fifth national communication under the Convention by Annex I Parties;

(d) The possible contribution of LULUCF and Kyoto Protocol mechanisms in attaining the pledges for emission reductions, as submitted by Annex I Parties that are also Parties to the Kyoto Protocol⁸ as given in document FCCC/KP/AWG/2010/INF.2/Rev.1⁹ for Parties for which information on the contribution of carbon credits and LULUCF was not available from (a) to (c) above.

D. Possible action by the Ad Hoc Working Group on Long-term Cooperative Action under the Convention

8. The Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) may wish to identify the next steps to be taken to facilitate

17. Carbon credits also include those generated from LULUCF activities, as the LULUCF sector is not included in the sectors listed in Annex A to the Kyoto Protocol.

In the future it might also be possible to generate carbon credits through new market mechanisms under the Convention, for example from reduced deforestation and forest degradation and/or from nationally appropriate mitigation measures. Unless specified otherwise, this paper refers to international carbon credits or offsets, for example those that can be used for adhering to the targets of developed countries under the Convention.

⁷ The workshop report can be found at <<http://unfccc.int/meetings/awg/items/5928.php>>.

⁸ Annex I as defined in Article 1, paragraph 7, of the Kyoto Protocol.

⁹ Using information in document FCCC/KP/AWG/2010/INF.2/Rev.1 is relevant for the purposes of the preparation of this paper, since for Annex I Parties that are also Parties to the Kyoto Protocol, pledges included in this document are the same as the quantified economy-wide targets included in document FCCC/SB/2011/INF.1. In addition, both the COP, by decision 1/CP.16, and the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, by decision 1/CMP.6, took note of the quantified economy-wide emission reduction targets to be implemented by Annex I Parties, as communicated by them and contained in document FCCC/SB/2011/INF.1 (see para. 9 below).

understanding of the assumptions and conditions related to the attainment of emission reduction targets and of the comparison of the level of emission reduction efforts.

II. Overview of quantified economy-wide emission reduction targets by developed country Parties, including assumptions and conditions

9. The COP, by decision 1/CP.16, took note of the quantified economy-wide emission reduction targets to be implemented by Annex I Parties, as communicated by them and contained in document FCCC/SB/2011/INF.1.¹⁰ The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, by decision 1/CMP.6, also took note of the quantified economy-wide emission reduction targets to be implemented by Annex I Parties that are also Parties to the Kyoto Protocol, as communicated by them and contained in the same document.¹¹

10. Table 1 provides an overview of information on quantitative economy-wide emission reduction targets of developed country Parties, and information on assumptions and conditions related to the attainment to these targets, including general assumptions and conditions, and assumptions and conditions on the use of carbon credits and LULUCF. A discussion of the information contained in table 1 and of the quantitative implications of these assumptions and conditions is contained in chapter III.

¹⁰ Decision 1/CP.16, paragraph 36. In accordance with this decision, Parties' communications included in document FCCC/SB/2011/INF.1 are considered communications under the Convention.

¹¹ Decision 1/CMP.6, paragraph 3. In accordance with this decision, the information in document FCCC/SB/2011/INF.1 is presented without prejudice to the position of the Parties or to the right of Parties under Article 21, paragraph 7, of the Kyoto Protocol.

Table 1

Overview of information on quantitative economy-wide emission reduction targets of developed country Parties and on assumptions and conditions related to the attainment to these targets, including general assumptions and conditions, and assumptions and conditions on the use of carbon credits from market-based mechanisms and land use, land-use change and forestry

	<i>Quantified economy-wide emission reduction targets for 2020 and related general assumptions and conditions</i>	<i>Assumptions and conditions relating to LULUCF</i>	<i>Assumptions and conditions relating to carbon credits from market-based mechanisms</i>
Australia^a	Target of 5%, up to 15% or 25%, emission reduction relative to 2000. Australia's 5% target presents a minimum unconditional commitment. The 15% target is conditional on a global agreement which falls short of securing atmospheric stabilization at 450 ppm CO ₂ eq, under which all major developing economies substantially restrain emissions, in the context of a strong international financing and technology cooperation framework, and advanced economies take on commitments comparable to Australia's, in the range of 15–25% below 1990 levels. In addition, the 25% target is conditional on an ambitious global deal capable of stabilizing levels of GHGs in the atmosphere at 450 ppm CO ₂ eq or lower, including a clear pathway to achieving an early global peak in emissions, advanced economy reductions in aggregate of at least 25% below 1990 levels by 2020, major developing economies with a collective reduction of at least 20% below business as usual by 2020, and a nomination of a peaking year for major developing economies	In defining its targets for 2020, Australia considered that these targets refer to Australia's net emissions from the sector and source categories included in Annex A of the Kyoto Protocol as well as from afforestation, reforestation and deforestation activities, for the base year (2000) and 2020. The 25% target is conditional to the inclusion of forests (reducing emissions from deforestation and forest degradation in developing countries) and the land sector in the global agreement, while the 15% target is conditional on progress for their inclusion	The 15% target is conditional to access on deeper and broader functional carbon markets The 25% target is conditional on global action that mobilizes greater financial resources, including from major developing economies, and results in fully functioning global carbon markets
Belarus	Target of 5–10% emission reduction relative to 1990 Belarus' target is premised on the existence of and access of Belarus to the flexibility mechanisms under the Kyoto Protocol; the intensification of technology transfer, capacity-building and enhancing the experience of Belarus, taking into consideration the special conditions of the Annex I Parties undergoing the process of transition to a market economy; and there being clarity on the use of new rules and modalities for LULUCF	<i>The position of Belarus on the use of LULUCF is subjected to the agreement on the new LULUCF rules and modalities, but if LULUCF is included, the target could increase by a further 5%</i>	<i>Participation of Belarus in the mechanisms is conditional on access to other Kyoto Protocol mechanisms</i>
Canada	The Canadian target of 17% emission reduction relative to 2005 is to be aligned with the final economy-wide emission reduction target of the United States in enacted legislation. The target was made with the expectation that other Annex I Parties and major non-Annex I Parties would submit information on their emission targets	<i>Preliminary estimates presented by Canada suggest that LULUCF emissions and removals would be in the range of –2% to +2% of total 2006 emissions, depending on the rules, and assuming that natural disturbances are not accounted</i>	<i>Although rules on the use of international offsets have not been finalized, Canada does not assume or provide for significant use of Kyoto Protocol mechanisms for its 2020 target. According to preliminary estimates, use of mechanisms could account for less than 5% of total reductions by 2020</i>
Croatia^b	Target of 5% emission reduction relative to 1990, with its level of emissions for 1990 (the base year) calculated in accordance with	<i>To be determined</i>	<i>To be determined</i>

	<i>Quantified economy-wide emission reduction targets for 2020 and related general assumptions and conditions</i>	<i>Assumptions and conditions relating to LULUCF</i>	<i>Assumptions and conditions relating to carbon credits from market-based mechanisms</i>
	decision 7/CP.12. The target communicated by Croatia is temporary and, upon the accession of Croatia to the European Union, the target will be replaced by an arrangement in line with and as part of the European Union mitigation effort		
European Union and its 27 member States	<p>Target of 20%/30% emission reduction relative to 1990</p> <p>The 20% emission reduction target by 2020 is unconditional and supported by legislation in place since 2009 (Climate and Energy Package). The European Union would move to a 30% target as part of a global comprehensive agreement for the period beyond 2012, provided that all Parties contribute their fair share to a cost-effective global emission reduction pathway, where other developed countries commit themselves to comparable emission reductions and developing countries contribute adequately according to their responsibilities and respective capabilities</p>	<p><i>LULUCF is not included for the 20% target, but it is included for the 30% target. Preliminary estimates of the contribution of LULUCF to the 30% target range between -0.7% and +2.1% of 1990 emissions</i></p>	<p>The European Union in the context of the AWG-LCA is more ambitious in the use of market-based mechanisms compared with such use in the context of the Kyoto Protocol: for example, inclusion of international aviation, higher CDM quality standards, complementarity defined, recognition of early action, no carry-over of assigned amount units, a single base year of 1990, annual compliance cycle, higher penalties for non-compliance in emissions trading sectors, taking into account of direct and indirect effects of biofuels on land-use change.</p> <p><i>European Union legislation limits the use of CDM and JI credits to achieve the targets, and the limits are different for different sectors</i></p> <p><i>Preliminary estimates of the contribution of JI and CDM amount to 4% of 1990 levels for the 20% pledge and 9% of 1990 levels for the 30% pledge</i></p>
Iceland	<p>Target of 15%/30% emission reduction relative to 1990</p> <p>The 15% target assumes that the rules governing the Kyoto Protocol will continue to apply after 2012 and that there is an extension of decision 14/CP.7. The 30% target is to be achieved in a joint effort with the European Union, with Iceland adhering fully to the European Union Climate and Energy Package, as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities. Iceland expects joint target setting with other Parties (in accordance with Article 4 of the Kyoto Protocol, or a similar arrangement)</p>	<p>A substantial share of mitigation efforts by Iceland will have to be achieved through the LULUCF sector, since there is almost no mitigation potential in the energy sector.</p> <p>Actions in the LULUCF sector will allow Iceland to take on targets comparable with other developed countries, but large changes in LULUCF rules might call for a recalculation of Iceland's target</p>	<p><i>Iceland intends to fulfil its pledge mostly or even fully through domestic efforts and expects the role of market-based mechanisms in achieving its target to be small. However, Iceland does not rule out the need to buy offsets</i></p>

	<i>Quantified economy-wide emission reduction targets for 2020 and related general assumptions and conditions</i>	<i>Assumptions and conditions relating to LULUCF</i>	<i>Assumptions and conditions relating to carbon credits from market-based mechanisms</i>
Japan	Japan's target of 25% emission reduction relative to 1990 is conditional on the establishment of a fair and effective international framework in which all major economies participate and on agreement by those economies on ambitious targets	<i>The contribution of forest management for Japan may vary from -2.9% to +1.5% relative to the 1990 level, depending on the accounting rules for LULUCF currently under negotiation by the AWG-KP</i>	<i>To be determined</i>
Kazakhstan^c	Kazakhstan communicated a target of a 15% emission reduction by 2020 compared with 1992 levels	<i>To be determined</i>	<i>To be determined</i>
Liechtenstein	Target of 20%/30% emission reduction relative to 1990 Liechtenstein's 20% target is unconditional. Liechtenstein communicated that it is prepared to raise this target to 30% if other developed countries agree to comparable reductions and emerging economies contribute according to their respective capabilities and responsibilities within the framework of a binding agreement	<i>Liechtenstein intends to refrain from using LULUCF in meeting its target</i>	<i>Liechtenstein is planning to use Kyoto Protocol mechanisms as an additional tool for being in compliance with the provisions of the Kyoto Protocol. Liechtenstein provided preliminary estimates in the range of 10% to 40%</i>
Monaco	Monaco is committed to an unconditional target of a 30% emission reduction by 2020 compared with 1990 levels. Also, Monaco aims to become carbon neutral by 2050 at the latest and as such maintains the possibility of exceeding its emission reduction target for 2020 through the use of mechanisms	<i>Not applicable</i>	Monaco intends to use the Kyoto Protocol mechanisms, in particular the CDM in achieving its target
New Zealand	Target of 10–20% emission reduction relative to 1990 New Zealand's target is conditional on a comprehensive global agreement, meaning that: (a) The global agreement sets the world on a pathway to limiting temperature rise to no more than 2 °C; (b) Developed countries make comparable efforts to those of New Zealand; (c) Advanced and major emitting developing countries take action fully commensurate with their respective capabilities; (d) There is an effective set of rules for LULUCF; (e) There is full recourse to a broad and efficient international carbon market	New Zealand's target is conditional on an effective set of rules for LULUCF <i>The quantitative implications of LULUCF are uncertain and to be determined: change in rules may significantly impact on accounting for emissions/removals from LULUCF, even though the flux remains constant</i>	New Zealand's target is conditional on the full recourse to a broad and efficient international carbon market <i>The quantitative implications of the use of market-based mechanisms are uncertain since emission reduction obligations are the responsibility of emitters through an international emissions trading scheme covering all sectors and all gases</i>
Norway	Target of 30–40% emission reduction relative to 1990 The 30% target is unconditional based on a political agreement on Norwegian climate policy made in Parliament in 2007. Norway will move to a target of 40% as part of a global and comprehensive	Norway provided preliminary estimates for the LULUCF contribution of around 6% of 1990 emissions (3 Mt CO ₂ eq), in accordance with current Kyoto	An important feature of Norwegian climate change policy is the flexible and cost-effective Kyoto Protocol based approach. Norway underlined the importance of pursuing various approaches, including opportunities to use

	<i>Quantified economy-wide emission reduction targets for 2020 and related general assumptions and conditions</i>	<i>Assumptions and conditions relating to LULUCF</i>	<i>Assumptions and conditions relating to carbon credits from market-based mechanisms</i>
	<p>agreement for the period beyond 2012 whereby major emitting Parties agree on emission reductions in line with the objective of a maximum 2 °C global temperature rise. Under the same conditions Norway presented the target of becoming carbon neutral by 2030.</p> <p>The continuation of the Kyoto Protocol or its basic elements as part of a future framework, in particular the availability of flexibility mechanisms for compliance with emission reduction commitments, is therefore an underlying premise for Norway's emission reduction target</p>	<p>Protocol rules. In addition, Norway stated that it intends to revise its commitments in accordance with rule changes, with the aim of keeping the overall high ambition level unchanged</p>	<p>markets post 2012. The aim of Norway is that about two thirds of emission reductions in 2020 will be cuts in domestic emissions; preliminary estimates indicate that this represents 15–17 Mt CO₂ eq by 2020</p>
Russian Federation	<p>Target of 15–25% emission reduction relative to 1990</p> <p>The range of the target of the Russian Federation depends on the following conditions:</p> <p>(a) Appropriate accounting of the potential of the Russian Federation's forestry sector in the context of its contribution to meeting the obligations of anthropogenic emission reductions;</p> <p>(b) The undertaking by all major emitters of legally binding obligations to reduce anthropogenic GHG emissions</p>	<p>Appropriate accounting of the potential of the forestry sector of the Russian Federation</p>	<p>To be determined</p>
Switzerland	<p>Target of 20%/30% relative to 1990</p> <p>The 20% target is unconditional. Switzerland reiterated its conditional offer to move to a 30% reduction as part of a global and comprehensive agreement for the period beyond 2012, provided that other developed countries commit themselves to comparable emission reductions and that developing countries contribute adequately according to their responsibilities and respective capabilities. Switzerland noted that bunker fuels have to form part of global reduction objectives covered under a sectoral approach</p>	<p>Switzerland provided preliminary estimates of the use of LULUCF: net yearly emissions from LULUCF could range between zero (net-net with the projected reference level for the period 2013–2020) and 3.97 Mt CO₂ eq (net-net with the reference year 1990), but having no emissions is the most likely scenario. Expressed in 1990 emission levels, the LULUCF sector could represent 0–7.50% of total 1990 emission levels excluding LULUCF or 0–7.94% including LULUCF</p>	<p>The draft legal text containing the Swiss national climate policy after 2012 contains a legally binding limit on the use of flexible mechanisms of a maximum of 50% of the reduction effort for both the 20% and the 30% targets. The government's proposal, which is currently under parliamentary debate, envisages two thirds of emission reductions coming from domestic measures and one third of reductions to be realized abroad; no use of carry-over units and use/purchase of foreign assigned amount units is expected</p>
Ukraine	<p>The target of Ukraine of 20% emission reduction relative to 1990 was communicated under the following conditions:</p> <p>(a) That developed countries have an agreed position on the quantified emission reduction targets of Annex I Parties;</p> <p>(b) That Ukraine maintains its status as a country with an economy in transition and the relevant preferences arising from such a status;</p> <p>(c) That the existing flexibility mechanisms under the Kyoto Protocol</p>	<p>To be determined</p>	<p>The conditions associated with the target state that the existing flexibility mechanisms under the Kyoto Protocol are to be kept</p>

	<i>Quantified economy-wide emission reduction targets for 2020 and related general assumptions and conditions</i>	<i>Assumptions and conditions relating to LULUCF</i>	<i>Assumptions and conditions relating to carbon credits from market-based mechanisms</i>
	are kept; (d) That 1990 is kept as the single base year for calculating Parties' commitments; (e) That the provisions of Article 3, paragraph 13, of the Kyoto Protocol are used for the calculation of the quantified emission reductions of the Annex I Parties under the Kyoto Protocol for the relevant commitment period		
United States of America	The target communicated by the United States is in the range of a 17% emission reduction by 2020 compared with 2005, in conformity with anticipated United States energy and climate legislation, recognizing that the final target will be reported to the secretariat in the light of the enacted legislation. In addition, the pathway set forth in pending legislation would entail a 30% emission reduction by 2025 and a 42% emission reduction by 2030, in line with the goal to reduce emissions by 83% by 2050. The submission of the target by the United States was made on the assumption that other Annex I Parties, as well as more advanced non-Annex I Parties, would associate with the Copenhagen Accord and submit mitigation actions	For the United States the target is economy-wide and will create incentives to reduce net emissions from all sectors that have mitigation potential, including the LULUCF sector. The United States will undertake a comprehensive, land-based approach that takes advantage of the broadest array of mitigation actions	There is no current federal law in the United States that provides for emissions trading or international offsets, but some States provide credit towards emissions for allowances/reductions secured abroad. In addition, any mechanisms in the United States would meet high standards for environmental integrity and transparency

Notes: Information provided in italics is on the possible contribution of LULUCF and Kyoto Protocol mechanisms to attaining the targets for emission reductions, as submitted by Annex I Parties that are also Parties to the Kyoto Protocol, and is taken from document FCCC/KP/AWG/2010/INF.2/Rev.1 for Parties for which information was not available from the sources listed in paragraph 7(a–c). With a view to presenting the emission reduction targets consistently for all of the Parties, and given that the word “reduction” already appears in the chapeau of the table, all emission reduction targets have been presented as positive numbers.

Abbreviations: AWG-KP = Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol, AWG-LCA = Ad Hoc Working Group on Long-term Cooperative Action under the Convention, CO₂ = carbon dioxide, CDM = clean development mechanism, GHG = greenhouse gas, JI = joint implementation, LULUCF = land use, land-use change and forestry.

^a Most of the information for Australia comes from its presentation at the workshop and the fact sheet presented there; see <www.climatechange.gov.au>. In that fact sheet, Australia clarified that “advanced economies” refers to Annex I Parties and at least some other high/middle income economies, and that “major developing economies” refers to non-Annex I members of the Major Economies Forum.

^b Croatia’s emission level for the base year was calculated in accordance with decision 7/CP.12.

^c Kazakhstan is an Annex I Party for the purposes of the Kyoto Protocol, in accordance with Article 1, paragraph 7, of the Kyoto Protocol, but not an Annex I Party for the purposes of the Convention.

III. Discussion of the assumptions and conditions related to the attainment of quantified economy-wide emission reduction targets by developed country Parties, including the use of carbon credits from market-based mechanisms and land use, land-use change and forestry

A. Overview of the assumptions and conditions

11. The targets communicated by most Parties are generally not represented as a single unconditional value, but as a range of values. While for a number of Parties the lower targets are unconditional (see para. 12 below), more stringent targets are usually dependent on conditions and assumptions about a new global agreement on climate change. Other conditions and assumptions relate to the use of domestic action in sectors such as energy, industrial processes, agriculture and waste (hereinafter referred to as domestic action), action to enhance removals and reduce emissions from the LULUCF sector, and use of market-based mechanisms (see table 1).

12. Only one Party (Monaco) presented a single unconditional target, while five Parties (Australia, European Union, Liechtenstein, Norway and Switzerland) presented their lower targets as unconditional. Kazakhstan did not provide information on conditions and assumptions. With some nuances in the language, many Parties' higher targets¹² are conditional on the following: achieving a comprehensive global agreement, with the participation of all major economies; advanced economies agreeing to comparable mitigation efforts and actions; developing countries taking action in accordance with their differentiated responsibilities and respective capabilities; and all Parties contributing their fair share to a cost-effective global emission reduction pathway.

13. Australia specifically linked its higher target with a global deal capable of stabilizing GHG concentrations in the atmosphere at 450 ppm carbon dioxide equivalent (CO₂ eq) or lower, while setting a clear pathway to achieving an early global peak in emissions; advanced economy reductions in aggregate of at least 25 per cent below 1990 levels by 2020; major developing economies achieving a collective reduction of at least 20 per cent below business as usual by 2020; and a nomination of a peaking year for major developing economies. The European Union made reference to the overall goal of keeping the average global temperature increase below 2 °C, which requires global GHG emissions to peak by 2020 at the latest and then to be reduced by at least 50 per cent below 1990 levels by 2050. The European Union high target is conditional on a global comprehensive agreement for the period beyond 2012, provided that all Parties contribute their fair share to a cost-effective global emission reduction pathway, where other developed countries commit themselves to comparable emission reductions and developing countries contribute adequately according to their responsibilities and respective capabilities. The United States noted during the workshop that its target should be in conformity with its anticipated energy and climate legislation recognizing that the final target will be reported to the secretariat in the light of the enacted legislation. The submission of the target by the United States is made on the assumption that other Annex I Parties, as well as more advanced non-Annex I Parties, would associate with the Copenhagen Accord and submit mitigation actions. Canada's target is to be aligned with the target of the United States. Croatia and

¹² Targets associated with larger emission reductions by 2020.

Iceland linked their targets with the joint efforts of the European Union countries. Ukraine¹³ and Belarus made a reference to maintaining their status under the Convention as countries with economies in transition, with Belarus specifically mentioning related provisions on technology transfer and capacity-building.

14. The targets of many Parties are conditional on the definition of the rules for the use of market-based mechanisms and LULUCF (e.g. Belarus, Iceland, New Zealand, Norway, Russian Federation and Ukraine). The European Union acknowledged during the workshop that rules for the use of market-based mechanisms and LULUCF considerably influence the stringency of their targets and stressed the need for robust, rigorous and consistent accounting rules, in particular on the coverage of sectors and gases, and common metrics to calculate the CO₂ equivalence of GHGs. Norway noted as a condition for its target the continuation of the Kyoto Protocol or its basic elements as part of a future framework, in particular the availability of market-based mechanisms. The European Union and Switzerland noted the assumptions not to use carry-over of units¹⁴ from the first to a second commitment period of the Kyoto Protocol. The United States noted in the context of its target that currently there is no federal law that provides for emissions trading or offsets, although some States provide credits towards emission reductions resulting from activities undertaken abroad, and that any mechanisms that could be used in the United States would meet high standards for environmental integrity and transparency. The United States also noted that on LULUCF it is considering using a full land-based approach.

15. Overall, there is a recognition that the use of carbon credits from market-based mechanisms is essential in order to achieve cost-efficiency of the mitigation effort to attain the targets and to enhance their stringency. However, there is little clarity on the anticipated use of such credits or on their sources and scale of contribution to attaining the targets. Decision 1/CMP.16 contains provisions for consideration of the establishment, at the seventeenth session of the COP, of one or more market mechanisms under the Convention that may broaden the use of such mechanisms. It stipulates that the implementation of such new market mechanisms should maintain and build upon existing mechanisms, including those established under the Kyoto Protocol.

16. The option that some nationally appropriate mitigation actions (NAMAs) by developing countries and activities related to reducing emissions from deforestation and forest degradation in developing countries could generate carbon credits remains under consideration by the AWG-LCA. In addition, while some Parties, for example the European Union, are working towards linking compatible emissions trading systems on a bilateral basis, this is a work in progress and it is not clear whether and how emissions trading under such bilateral agreements could be used to attain the targets under the Convention. Overall, matters related to the use of carbon credits from the existing and possible new market-based mechanisms are part of ongoing negotiations under the AWG-LCA and the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP) relating to further commitments for Annex I Parties under the Kyoto Protocol for the period beyond 2012. Any decisions to that end that may bring more clarity on the use of carbon credits are to be expected no earlier than the end of 2011.

17. In most cases, Parties referred to the use of carbon credits, including from existing and possible new mechanisms, in qualitative terms and emphasized that the majority of the

¹³ Specifically for the Kyoto Protocol, Ukraine noted that its target is subject to continuation of the use of the Kyoto Protocol mechanisms and the provisions of Article 3, paragraph 13, of the Kyoto Protocol.

¹⁴ Since this paper addresses matters related to the targets of developed countries under the Convention, some issues that are specific to the Kyoto Protocol, such as carry-over of units that have not been used for compliance in the first commitment period of the Kyoto Protocol, have not been further addressed here, although they were mentioned by some Parties during the workshop.

overall mitigation effort will take place domestically, although for some of them moving to a higher target may entail an increased use of carbon credits. Even when quantitative information on the use of these offsets is available, it is based on very preliminary estimates.

18. Switzerland, for example, in the context of its targets, referred to the Swiss Government proposal to set a legally binding limit on the use of any mechanisms at 50 per cent of the overall emission reductions and noted the ongoing discussion in its parliament on achieving two thirds of the emission reduction through domestic emission reduction efforts and the remaining part through market-based mechanisms. It also referred to the possible increase in the use of carbon credits when and if it moves to the higher target. Similarly, the European Union expects that carbon credits could contribute up to 4 per cent of the 1990 emission levels for its 20 per cent target, but this contribution could increase to 9 per cent of the 1990 emission levels for the 30 per cent target. For Australia, meeting the more stringent targets (of 15 and 25 per cent) is conditional on access to deeper, broader and fully functional carbon markets. Similarly, New Zealand refers to a full recourse to a broad and effective international market as a condition of its target. For a number of Parties, for example Belarus, Croatia, Japan, Kazakhstan and Monaco, the contribution of emissions trading and international offsets is either yet to be determined or is uncertain.

19. Similarly to the use of carbon credits from market-based mechanisms, there is little clarity on the rules governing the accounting of domestic LULUCF actions by developed country Parties in relation to the attainment of their targets. Currently these Parties use a land-based approach for reporting on emissions and removals from LULUCF under the Convention, but there are no accounting rules agreed how these emissions and removals could contribute to the target. The United States noted during the workshop, in the context of its target, that it will follow a comprehensive, land-based approach to LULUCF that takes advantage of the broadest array of mitigation actions. The United States also noted that they are working towards finding ways to manage some important issues relating to LULUCF, such as climate impacts and natural disturbances, baseline approaches, in particular with regard to forest management, and uncertainty in LULUCF data, issues that are similar to those under consideration by Parties in their current discussions under the AWG-KP. In these discussions, Parties centred on the continuation of the activity-based approach to LULUCF for a second commitment period under the Kyoto Protocol, although the option to apply a full land-based approach remains under consideration.

20. Notwithstanding the uncertainty of the rules for LULUCF, some Parties, for example the European Union, Norway and Switzerland, provided information on the expected contribution from LULUCF in attaining their targets, or on expected caps of the contribution thereof (see paras. 25, 27 and 30 below).

21. Some Parties, for example Belarus, Iceland, New Zealand and the Russian Federation, specifically noted that their target is conditional on the set of rules for LULUCF. In defining its target, Australia included emissions and removals from LULUCF and noted that its 2020 targets “refer to Australia’s net emissions from the sector and source categories included in Annex A of the Kyoto Protocol as well as from afforestation, reforestation and deforestation. The same sectoral coverage applies to both the base year and 2020 emissions”.

B. Quantitative implications of the assumptions and conditions of individual Parties on the use of carbon credits from market-based mechanisms and land use, land-use change and forestry

22. Information relating to the quantitative implications of the assumptions and conditions of individual developed country Parties on the use of LULUCF and carbon credits is available only for several Parties. As noted in chapter III.A, even when this information is available it is very preliminary and uncertain, and should be considered with due caution. To assess these quantitative implications, in addition to the sources listed in paragraph 7 above, further information communicated in earlier submissions to the secretariat or in workshops organized by the secretariat was used.

23. Australia includes emissions and removals from deforestation, afforestation and reforestation activities in the LULUCF sector in its target for 2020 (see para. 21 above), and has estimated that net emissions from deforestation, afforestation and reforestation amounted to around 12 per cent of total emissions from other sectors in 2000 (the base year for its target). On the use of carbon credits, for Australia the 15 per cent target is conditional on access to deeper and broader carbon markets and the 25 per cent target is conditional on global action that mobilizes greater financial resources, including from major developing economies, and to a fully functioning global carbon market.

24. Canada preliminarily estimates that LULUCF can contribute around –2 per cent to 2 per cent of total emissions in 2006 to attaining its target. According to preliminary estimates, market-based mechanisms are expected to contribute less than 5 per cent of the total emission reductions needed to attain its target.

25. The European Union does not envisage a contribution from LULUCF for its lower target of 20 per cent. However, moving to its possible higher target of 30 per cent would require some contribution from LULUCF, which is estimated to be within the range of net removals equal to 0.7 per cent of 1990 emissions to net emissions equal to 2 per cent of 1990 emission levels. The European Union considers the access to global carbon markets as indispensable, but stressed on the need to ensure of supplementary of the use of market-based mechanisms to domestic action. As noted already, the European Union expects that carbon credits could contribute up to 4 per cent (based on 1990 emissions) of the reductions needed to attain its 20 per cent target, but this contribution could increase to 9 per cent (based on 1990 emissions) for the 30 per cent target.

26. On LULUCF, Japan acknowledges¹⁵ that the contribution of forest management, which accounts for the bulk of the possible LULUCF contribution to its target in 2020, might be within the range from –2.9 per cent to 1.5 per cent (with negative values being removals) of their total GHG emissions in the base year under the Kyoto Protocol.

27. Norway anticipates that the contribution of LULUCF to its target is of the order of 6 per cent of 1990 emissions based on the current LULUCF accounting rules under the Kyoto Protocol, which is equivalent to 3 Mt CO₂ eq. In the event that the LULUCF rules change, Norway would modify its target for 2020 with a view to maintaining the overall high ambition of this target. On the use of market-based mechanisms, Norway anticipates that about two thirds of emission reductions in 2020 would be achieved through domestic emission reduction efforts, which is equivalent to 15–17 Mt CO₂ eq, with the remaining part coming from such mechanisms.

¹⁵ Available at <http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/japan_lulucfwskp13.pdf>.

28. New Zealand refers to a full recourse to a broad and effective international market and effective set of rules for LULUCF as conditions for its pledge. It acknowledged that the contribution from market-based mechanisms and LULUCF is uncertain.

29. The Russian Federation acknowledges the need for an appropriate accounting for the potential of its LULUCF sector in meeting its target that LULUCF can contribute to a net removal of 121.1 Mt CO₂ eq per year according to current rules.¹⁶ However, this estimate is uncertain given that the forest sink could be expected to decrease between 15 per cent and 20 per cent by 2020.

30. Switzerland expects the LULUCF contribution to its 2020 target to be within the range of 0 per cent to 7.5 per cent of 1990 emission levels (calculated excluding LULUCF) and considers that most likely the contribution from LULUCF would be zero. In absolute terms, this range translates into a reduction from LULUCF from 0 to 4 Mt CO₂ eq. As noted already, Switzerland is considering a Swiss Government proposal to set a legally binding limit on the use of any mechanisms to 50 per cent of the overall emission reductions, but anticipates that the actual use of mechanisms will account for around one third of these reductions (see para. 18). It is also considering a possible increase in the use of carbon credits when and if it moves to a higher target. However, it does not expect acquisition of assigned amount units through emissions trading from other countries to attain to its target.

31. The United States acknowledges that, in accordance with the full land-based approach, LULUCF contributed around 1,057 Mt CO₂ eq net removals in 2005 (the base year for its target), which is around 15 per cent of the total emissions from all other sectors. It also acknowledges that this contribution comprises a relatively significant portion of the total emissions and removals of the United States.

32. A number of Parties, e.g. Belarus, Croatia, Iceland, Kazakhstan, Liechtenstein, New Zealand, Monaco and Ukraine, have not yet provided quantitative information on the use carbon credits and LULUCF.

33. The use of LULUCF by developed country Parties in achieving their targets and the related rules could influence the level of emission reductions for the other sectors, namely energy, industrial processes, solvent and other product use, agriculture and waste. For example, if changes in rules would lead to a relatively higher contribution from LULUCF, smaller reductions would be needed from the other sectors. However, this is not necessarily the case for all Parties (see para. 27 above for the example of Norway).

34. Similarly, the use of carbon credits by developed country Parties to achieve their 2020 targets can influence the scale of their domestic emission reduction efforts. In a number of cases, for example Australia, the European Union and Switzerland, adhering to a more stringent target from the range that was communicated by them would require a higher level of use of carbon credits compared with a less stringent target.

35. This overview of the implications of the assumptions and conditions of individual Parties and the discussions during the workshop underline the need to enhance further transparency of these assumptions and conditions, as well as to enhance further the understanding of the approaches that have been used or will be used by Parties in accounting for the use of carbon credits and LULUCF. This is linked to a broader question in relation to the targets of developed countries on the coverage of sectors and gases, common metrics to calculate the CO₂ equivalence of GHGs and the methodologies to estimate emissions and removals.

¹⁶ Available at http://unfccc.int/files/essential_background/library/application/pdf/awg_russianfederation.pdf.

IV. Comparison of the level of emission reduction efforts

36. One of the objectives of this paper is to provide information that could facilitate understanding of comparability of the level of emission reduction efforts. Although the topic of “comparability” of emission reduction efforts has been under consideration by the AWG-LCA, methodologies and metrics for assessing comparability have not been agreed within the Convention. This is why, this paper uses an analytical approach to enable Parties to engage in further political discussions on this topic. The metrics and quantitative estimates presented in this paper are intended to be illustrative only and should not be considered as proposals on how to determine comparability of effort.

37. In dealing with the analytical aspect of comparability, several different metrics can be considered, each allowing different factors to be considered. For the sake of simplicity, these metrics and factors are presented in three groups:

- (a) GHG emissions and related emission reductions within selected periods of time;
- (b) GHG emissions in relation to other factors, such as population and economic output expressed through the gross domestic product (GDP);
- (c) Mitigation costs that could be estimated in terms of marginal costs and the total cost of emission reductions.

38. The concept of the national circumstances of individual countries, which is recognized under the Convention, is important when considering comparability, but also complicates such consideration. National circumstances can encompass a wide array of factors, such as climate and geography, population, economic and governmental structure, natural resource endowment, transport systems, energy production and consumption patterns, and trade profile, in particular in terms of trade in energy and fuel. There is no single metric, either those listed above or a combination thereof,¹⁷ that could be used to capture the concept of the national circumstances in a uniform or similar way across countries when considering comparability of effort. Instead, each of these factors and metrics can reveal specific aspects of national circumstances relevant to a discussion on the comparability of emission reduction efforts.

39. Metrics could be used in assessing comparability of effort in accordance with several criteria often referred to in the negotiation process under the Convention when considering action to be taken in responding to the problem of climate change, such as capability, responsibility, early action and mitigation potential. Particular metrics could be associated with these criteria, for example capability could be associated with, but not limited to, GDP per capita and mitigation cost per GDP.

40. Availability of data and their quality is highly relevant when considering the analytical aspects of comparability of effort and related metrics. Over the years, Annex I Parties have reported GHG inventory information which allows to assess emission reductions. This information has been reviewed by teams of international experts and has led to a complete time series of high-quality GHG inventory data. Similarly, high-quality information on populations and GDP is readily available from national and international statistics (e.g. statistics produced by the United Nations, the World Bank, the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA)).

¹⁷ Even in a theoretical case, whereby the metrics are found that could be applied across Parties, it will be extremely difficult to assign a weight factor to each to combine and formulated a composite indicator.

41. For this paper, in considering comparability of effort, in addition to the data referred to in paragraph 7 above, historical information on GDP and populations from the World Bank,¹⁸ OECD National Accounts data, information from the United Nations Statistical Division and data on projected economic growth rates from the IMF's World Economic Outlook¹⁹ were used.

42. In implementing their mitigation policies, and in assessing comparability of effort, Parties may choose to consider not only emission reductions but also the costs associated with them. Cost considerations are important also when considering comparability of effort, since the mitigation potential of Parties is related to the opportunity to use mitigation options with lower costs, and this is strongly dependent on national circumstances such as the opportunity to implement LULUCF actions. However, obtaining data and information on macroeconomic mitigation costs is challenging as estimates are generated from economic models that are run under specific and wide-ranging sets of assumptions that are often not transparently documented. Even when information on cost is available from the literature, cost estimates can vary for any given country within relatively wide ranges. Determining which model results are viewed as the most authoritative is beyond the scope of this paper, and hence costs are not taken into account here. However, this is not to suggest that cost considerations are not important when considering comparability of effort, since the same amount of emissions could be reduced in different countries at different costs and hence with a different level of effort.

43. Consideration of comparability of effort in this paper is limited to the mitigation effort needed to attain the absolute economy-wide emission reduction targets and does not take into account any financial contributions that could be made by developed country Parties to developing countries to facilitate achieving the global goal of limiting global temperatures to less than 2 °C above pre-industrial levels. In addition, comparability of effort in attaining the targets across Parties could be discussed in a more systematic way if there is further clarity on the contribution of the domestic action, carbon credits and action in the LULUCF sector. However, such clarity was not available at the time of the preparation of this paper (see section III). Consequently, the uncertainty associated with LULUCF is addressed by providing two sets of data for the metrics discussed in this paper, one that includes the LULUCF sector and one that excludes it. Also, some overall and very preliminary assessments of the quantitative implications of the use of carbon credits and LULUCF are provided in this section.

44. Finally, comparability of effort is discussed in this paper without taking into consideration possible differences in the coverage of the targets of gases and sectors, even if it is clear that such differences exist. For example, the targets of the European Union and Switzerland include emissions from international aviation. It also does not take into consideration possible differences in methodologies to estimate emissions and removals, as all of these issues are outside the scope of this paper.

A. Comparison of the level of emission reduction efforts on the basis of different times for their starting point

1. Overview of the comparison of the level of emission reduction efforts

45. Emission reductions in relation with the targets for developed country Parties, individually and in aggregate, relative to historical emissions, are presented and discussed

¹⁸ World development indicators <<http://databank.worldbank.org>>.

¹⁹ See <<http://www.imf.org/external/pubs/ft/weo/2011/01/weodata/download.aspx>>. This data set includes projections until 2016, except for Monaco and Liechtenstein. For the years 2017–2020, an average growth rate of the projected data for 2010–2016 was applied for each country.

in this chapter. They are presented in terms of absolute emission levels and relative to emission levels reported by Parties in selected years, including 1990 (the base year under the Convention), 2000 and 2005 (reference years used by some Parties in presenting their targets) and 2008, which is the latest year for which GHG emissions data are available.²⁰

46. Some specific provisions and decisions have been applied to reflect submissions by Parties. For Australia, in accordance with its submission the targets are presented with respect to Australia's net emissions from the sectors and source categories other than LULUCF, but adding net emissions and removals from afforestation, reforestation and deforestation. For Croatia, base year emissions in 1990 were calculated in accordance with the provisions of decision 7/CP.12. Iceland clarified during the workshop its intention to continue to make use of the provisions of decision 14/CP.7 in adhering to its 10 per cent target. This decision affects accounting of emissions in the years of implementation of the target and does not affect the base and reference year emissions; hence it has not been taken into account in presenting the information in this section.

47. Table 2, in the annex, contains information on historical GHG emission trends of Annex I Parties. Table 3 presents emission levels in 2020 in relation to the targets for these Parties, individually and in aggregate. In the event that Parties provided more than two targets or more than one target range, only the two options at the respective extremes are considered here. In the event that Parties provided only one target, it was considered as both the lowest and the highest option. Information is presented for two cases, including and excluding net emissions and removals from the LULUCF sector.²¹ Emission reductions in 2020 for the targets of developed country Parties, expressed in absolute values and in percentages of selected years, are presented in tables 4 and 5, in the annex, respectively excluding and including the LULUCF sector. Emission reductions for these Parties between 1990 and 2008, and between 2008 and 2020 in relation to their targets, are presented in table 6, in the annex.

48. In accordance with the target ranges as communicated by Parties (without taking into account the possible implications of the use of carbon credits and LULUCF), aggregated emission reductions of developed country Parties in 2020 could be 13 per cent to 18 per cent below 1990 levels for the low and high targets, respectively (emission levels excluding LULUCF). The low targets could lead to absolute emission reductions in aggregate for developed country Parties of around 2,369 Tg CO₂ eq, 974 Tg CO₂ eq, 1,372 Tg CO₂ eq and 1,125 Tg CO₂ eq in 2020 relative to the years 1990, 2000, 2005 and 2008, respectively. Similarly, the high targets could lead to absolute emission reductions in aggregate of around 3,382 Tg CO₂ eq, 1,988 Tg CO₂ eq, 2,385 Tg CO₂ eq and 2,138 Tg CO₂ eq in 2020 relative to the years 1990, 2000, 2005 and 2008, respectively. If emissions and removals from the LULUCF sector are included in the calculations, aggregated emission reductions of developed country Parties in 2020 could be 12 per cent to 18 per cent below 1990 levels.

49. A comparison of the emission reduction levels of developed country Parties in relation to their targets for 2020 and of emissions levels in selected years, namely 1990, 2000, 2005 and 2008, highlights differences in the efforts of these Parties over time. Comparison of emission reductions in 2020 relative to 1990 shows the overall mitigation effort across Parties. Higher emission reductions in 2020 relative to 1990 suggest a higher overall mitigation effort over the entire 1990–2020 period, including any early action in the 1990s. On the other hand, comparison of emission reductions relative to 2000, 2005 and

²⁰ The reference years used in this paper are based on the use of such years by some Parties in presenting their targets, including 2000, used by Australia, and 2005, used by Canada and the United States. In addition, Kazakhstan uses 1992 as the reference year.

²¹ For Australia, for the case of including LULUCF, only emissions from afforestation, reforestation and deforestation are included (see paras. 23 and 46).

2008 provides an indication of the mitigation effort made in more recent years and of such effort to be made between now and 2020 to achieve the target.

50. Comparison of the emission reduction efforts of developed country Parties (see figures 1, 2 and 3 in the annex) and their early actions suggest that while Belarus, Croatia, Kazakhstan, the Russian Federation and Ukraine saw a major decline in emissions in the 1990s, they expect their emissions to increase, in accordance with their targets, between 2008 and 2020. On the other hand, Australia, Canada and the United States envisage sizeable emission reductions in 2020 relative to 2000 and 2005, but their emissions increased in the 1990s. This implies that while their emissions increased in the 1990s, these Parties are projecting that their emissions will decline in the future towards the target levels of 2020. For two Parties, Australia (for the low target, excluding LULUCF) and Canada (excluding and including LULUCF), the estimated 2020 target emission levels are higher than their 1990 emissions levels.

51. The European Union saw a decline in emissions in the 1990s and the 2000s and envisages a further decline in emissions between 2008 and 2020 in accordance with the estimated target levels. For the low target the expected decline in emissions between 2008 and 2020 is similar to that observed between 1990 and 2008, and for the high target this decline is two times as high. Japan's emissions remained relatively stable in the 1990s and the 2000s. However, in accordance with its target, Japan envisages achieving major emission reductions between 2008 and 2020. It might be of interest to take note of the absolute emission reductions needed by countries between 2008, a time of economic downturn, and 2020 which is needed to attain to their targets. For example, excluding LULUCF, the United States would reduce its emissions by 1,027 Tg CO₂ eq, while the European Union would need to reduce its emissions by 486 or 1,042 Tg CO₂ eq (for its low and high target, respectively) and Japan would need to reduce its emissions by 330 Tg CO₂ eq when comparing 2008 levels with 2020 levels.

52. This overview of past and future GHG emission trends and the targets of developed country Parties suggests that the choice of the year against which the emission reductions are measured and then compared against has major implications for the consideration of comparability of effort. The same applies for most of the metrics discussed in the remaining part of this chapter.

2. Implications of the use of carbon credits from market-based mechanisms and land use, land-use change and forestry in comparing emission reduction efforts

53. As mentioned in paragraph 15 above, at the time of the preparation of this paper there was little clarity on the use of carbon credits in terms of their source and their contribution to attaining the targets of developed country Parties. Among the concerns expressed during negotiations under the AWG-LCA, including during the workshop, were issues related to additionality of the effort related to the use of carbon credits from market-based mechanisms and possible double counting of such credits and related mitigation efforts.

54. There is a common understanding among Parties that any international project-based mechanism used to generate reductions in emissions and related carbon credits would ensure that such reductions are additional to any that would occur in the absence of the certified project activity. However, operationalization of this requirement has not been an easy task. Also, when carbon credits are generated from project-based mechanisms they could be used and counted towards achieving the targets of developed country Parties. However, given that a large number of developing countries now have their NAMAs recognized under the Cancun Agreements, there is a possibility, depending on accounting rules that are yet to be developed, that the same emission reductions are double counted as reductions of emissions in developed and developing Parties.

55. As mentioned in paragraph 19 above, at the time of the preparation of this paper there was little clarity on the rules that govern the use of LULUCF by developed country Parties to attain their targets under the Convention.²² Consequently, there is no consistent set of estimates of the possible contribution of LULUCF to attaining the targets across Annex I Parties. However, some Parties provided such estimates assuming certain rules. For example, the European Union²³ assessed the contribution from forest management in 2020 to be in the range of 250 to 450 Tg CO₂ eq. The Alliance of Small Island States assessed²⁴ this contribution for Annex I Parties as a group to be in the range of 60 to 940 Tg CO₂ eq in 2020, which is similar to estimates by the United Nations Environment Programme.²⁵

56. While the lack of sufficient data and clarity of rules on carbon credits and LULUCF does not allow for a comparison of effort relating to targets taking into account the contribution of carbon credits and LULUCF across Parties, the available data suggest that overall for developed country Parties this contribution could be sizeable. This underlines the need for more transparency and clarity of the assumptions by Parties and for rules that govern the use of carbon credits and LULUCF in attaining the targets of developed country Parties to ensure that such use leads to the needed emission reductions.²⁶

B. Comparison of the level of greenhouse gas emission reduction efforts on the basis of greenhouse gas emissions, economic output and population size

57. In addition to using GHG emission reductions as a metric for comparability of the effort associated with attaining the targets of developed country Parties, other metrics could be used, such as GDP per capita, GHG emissions per capita and GHG emissions per unit GDP, that can reflect capability, responsibility, early action and the mitigation potential of developed country Parties (see para. 39 above). Information on these metrics for 1990, 2000, 2005, 2008 and 2020 is presented in tables 7–9, in the annex.

1. Gross domestic product²⁷ per capita

58. When GDP per capita is used as a measure of economic output per person and as a metric in the consideration of comparability, the assumption is that over time wealthier

²² The rules for the second commitment period of the Kyoto Protocol are still under consideration by the AWG-KP.

²³ Presentation available at <http://unfccc.int/kyoto_protocol/items/5685.php>.

²⁴ Presentation available at <http://unfccc.int/kyoto_protocol/items/5685.php>.

²⁵ United Nations Environment Programme. 2010. *The Emissions Gap Report – Are the Copenhagen Accord Pledges Sufficient to Limit Global Warming to 2°C or 1.5°C?* Available at <www.unep.org/publications/ebooks/emissionsgapreport>.

²⁶ Also, the possibility to set a cap on the contribution from LULUCF and international offsets is still under consideration in the context of the negotiations on a second commitment period of the Kyoto Protocol.

²⁷ For the purposes of this paper, GDP values were presented in United States dollars at 2005 prices. Purchasing power parities were used instead of market exchange rates, as the former eliminate the differences in price levels between countries. GDP values for the period 1990–2009 were available at market prices from the OECD National Accounts data files for OECD members and from the World Bank World Development Indicators and were converted to purchasing power parities 2005 United States dollars by the International Energy Agency. GDP values in 2020 were estimated using the projections at market value up to 2016 in the IMF's World Economic Outlook and an average growth rate of the projected data for the period 2010–2016 was applied for each country for the period 2017–2020.

nations have more capability to act to address climate change and to make a greater effort. This may not be necessarily true in the short term.

59. Data shown in figure 4, in the annex, suggest that for 1990, 2005 and 2008, Norway, the United States and Switzerland are the top ranking in terms of this metric, followed by Canada, Australia, Iceland, Japan, the European Union and New Zealand. The ranking of Parties in terms of GDP per capita broadly corresponds to the emission reductions expected in 2020 in accordance with the targets when they are compared with 2005 or 2008, but this does not necessarily hold true when compared with 1990. Countries with small values of GDP per capita, such as Belarus, Kazakhstan, the Russian Federation and Ukraine, expect their emissions to increase in accordance with their targets between 2008 and 2020 after having their emissions well below the 1990 levels in the 1990s and 2000s as a result of the transition from centrally planned economies to market economies.

2. Emissions per capita

60. When emissions per capita are used as a metric to assess comparability, the assumption is that this metric captures the specific circumstances of nations with growing populations. Indeed, as shown in figures 5 and 6, in the annex, among the Parties with growing populations, Norway and Iceland expect to reduce their per capita emissions between 2008 and 2020 by around half owing to their ambitious targets. Other Parties with growing populations, for example Australia and New Zealand, had greater emissions per capita declines between 2008 and 2020 than those Parties with stable populations, for example the European Union and Japan. The United States and Canada are also among Parties with growing populations and the decline in their emissions per capita is comparable with that of the European Union and Japan. The Russian Federation, Belarus and Ukraine are expected to keep their emissions on a per capita basis relatively stable despite having declining populations.

3. Emission intensity

61. Comparability can also be assessed in terms of decarbonization, or changes in emission intensity, which is usually expressed in terms of emissions per GDP. Decarbonization of the economy can signify the effectiveness of mitigation efforts in terms of emission reduction per unit of economic output. It can also provide a good indication of the potential for emission reductions, for example through enhancing economic and energy efficiency and to some extent through fuel switching. Within this metric, the GDP itself encompasses many factors relating to national circumstances, such as the size of the country and its economy, which are difficult to separate with the use of this metric.

62. As shown in figures 7 and 8, in the annex, Belarus, Kazakhstan, the Russian Federation and Ukraine are far above other Parties in terms of emission intensity in the period 1990–2020. However, these countries are expected to improve their emission intensity and as a result the values of decarbonization, or changes in emission intensity in 2020 compared with 1990, are broadly the same for a wide range of Parties, except for Croatia and Ukraine.

Annex

Background information, tables and figures

Table 2
Greenhouse gas emission trends for Annex I Parties according to their 2010 submissions of emissions inventories to the UNFCCC secretariat

	<i>GHGs excluding LULUCF (Tg CO₂ eq)</i>				<i>GHGs including LULUCF (Tg CO₂ eq)</i>			
	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>
Australia	418.4	496.2	527.7	549.5	464.5	493.7	569.9	618.1
Austria	78.2	80.3	92.9	86.6	65.0	63.1	75.6	69.3
Belarus	140.4	78.8	84.5	91.1	110.6	43.5	53.7	60.1
Belgium	143.4	144.6	141.5	133.3	140.6	143.0	139.8	132.0
Bulgaria	117.4	71.1	74.4	75.2	104.0	61.4	63.6	64.2
Canada	591.9	717.2	731.0	734.6	540.3	636.8	772.4	721.7
Croatia	31.4	25.9	30.4	31.1	23.1	15.8	19.6	20.0
Czech Republic	195.2	147.5	145.4	141.4	191.6	140.0	138.7	136.7
Denmark	70.4	70.0	65.6	65.6	73.3	71.4	68.0	68.3
Estonia	41.3	18.1	19.3	20.3	35.0	16.7	10.9	10.6
EU-27 ^a	5 567.0	5 062.3	5 116.7	4 939.7	5 223.2	4 663.0	4 716.1	4 529.8
Finland	70.4	69.2	68.5	70.3	54.5	46.6	35.7	34.9
France	566.1	561.1	562.1	532.9	532.8	515.3	492.5	465.3
Germany	1 251.2	1 050.4	1 005.2	983.7	1 231.1	1 028.4	1 040.1	1 013.9
Greece	104.4	126.2	134.3	128.5	102.0	123.2	131.2	125.3
Hungary	97.8	77.3	80.1	73.4	95.8	76.8	75.9	69.8
Iceland	3.4	3.8	3.7	4.9	5.8	6.0	5.8	6.9
Ireland	54.8	67.8	68.8	67.5	55.0	67.9	68.4	66.0
Italy	517.0	549.8	572.6	541.5	452.3	473.9	480.7	454.2
Japan	1 268.7	1 344.3	1 354.6	1 281.9	1 205.3	1 264.0	1 268.4	1 203.1
Kazakhstan ^b	338.2	166.5	214.9	245.9	329.5	159.3	212.7	245.2
Latvia	26.9	10.2	11.4	11.9	8.1	-11.2	-13.9	-16.9
Liechtenstein	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3
Lithuania	51.2	19.7	23.3	24.7	35.6	5.8	9.4	11.0
Luxembourg	13.1	9.9	13.3	12.5	13.5	9.5	12.9	12.2
Malta ^c	2.0	2.6	2.9	3.0	2.0	2.5	2.8	2.9
Monaco	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Netherlands	212.0	214.6	212.4	206.9	214.6	217.1	214.7	209.4
New Zealand	61.2	70.1	77.2	75.1	30.1	38.8	53.4	48.9
Norway	49.7	53.4	54.3	54.4	38.5	40.8	28.2	25.9
Poland	453.3	390.2	390.0	397.0	430.3	365.7	353.7	357.9
Portugal	59.3	81.3	86.6	78.4	63.8	79.9	91.9	75.4

	<i>GHGs excluding LULUCF (Tg CO₂ eq)</i>				<i>GHGs including LULUCF (Tg CO₂ eq)</i>			
	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>
Romania	247.9	140.4	154.2	152.9	212.4	102.4	117.1	116.5
Russian Federation	3 331.0	2 031.9	2 124.8	2 240.0	3 394.7	1 573.8	1 606.1	1 601.6
Slovakia	73.9	49.3	50.2	49.0	71.5	46.9	49.4	46.9
Slovenia	18.5	18.8	20.2	21.3	10.5	10.2	11.7	12.8
Spain	285.1	381.1	435.6	406.4	245.8	334.7	386.6	353.9
Sweden	72.4	68.9	67.7	64.3	41.4	32.7	47.4	49.6
Switzerland	53.2	52.1	54.2	53.4	50.2	53.1	53.4	53.6
Turkey	187.0	297.0	329.9	366.5	142.2	229.4	260.3	285.9
Ukraine	928.1	393.1	423.1	427.8	859.6	341.6	383.0	411.3
United Kingdom	774.7	676.0	658.1	631.7	777.6	675.7	656.2	629.8
United States	6 111.8	7 008.2	7 104.6	6 924.6	5 217.3	6 380.2	6 182.8	6 016.4
Total	19 081.9	17 801.1	18 231.9	18 020.9	17 635.2	15 940.3	16 186.4	15 848.8

Note: The estimates in this table are based on submissions made by the Parties in 2010 under the Convention, which were available on the UNFCCC website on 30 March 2011.

Abbreviations: GHGs = greenhouse gases, LULUCF = land use, land-use change and forestry, NA = not available.

^a The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

^b Kazakhstan is an Annex I Party for the purposes of the Kyoto Protocol in accordance with Article 7, of the Kyoto Protocol, but not an Annex I Party for the purposes of the Convention.

^c Malta became an Annex I Party to the Convention on 25 October 2010.

Greenhouse gas emission trends, and emission levels by developed country Parties, individually and in aggregate, in relation to the quantitative economy-wide emission reduction targets

	<i>GHGs excluding LULUCF</i>				<i>GHGs including LULUCF</i>				<i>Targets in 2020 (per cent of reference year emissions)</i>		<i>Reference year</i>	<i>GHGs excluding LULUCF</i>			<i>GHGs including LULUCF</i>		
	<i>(Tg CO₂ eq)</i>				<i>(Tg CO₂ eq)</i>				<i>Low</i>	<i>High</i>		<i>(Tg CO₂ eq)</i>			<i>(Tg CO₂ eq)</i>		
	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>				<i>Reference year level</i>	<i>Low 2020</i>	<i>High 2020</i>	<i>Reference year level</i>	<i>Low 2020</i>	<i>High 2020</i>
Australia ^a	418.4	496.2	527.7	549.5	548.9	557.9	593.6	589.7	-5%	-25%	2000	496.2	471.4	372.1	557.9	530.0	418.4
Belarus	140.4	78.8	84.5	91.1	110.6	43.5	53.7	60.1	-5%	-10%	1990	140.4	133.4	126.4	110.6	105.1	99.5
Canada ^b	591.9	717.2	731.0	734.6	540.3	636.8	772.4	721.7	-17%	-17%	2005	731.0	606.7	606.7	731.0	606.7	606.7
Croatia ^c	31.4	25.9	30.4	31.1	23.1	15.8	19.6	20.0	-5%	-5%	1990	34.9	33.2	33.2	26.6	25.3	25.3
EU-27 ^d	5 567.0	5 062.3	5 116.7	4 939.7	5 223.2	4 663.0	4 716.1	4 529.8	-20%	-30%	1990	5 567.0	4 453.6	3 896.9	5 223.2	4 178.5	3 656.2
Iceland	3.4	3.8	3.7	4.9	5.8	6.0	5.8	6.9	-15%	-30%	1990	3.4	2.9	2.4	5.8	4.9	4.0
Japan	1 268.7	1 344.3	1 354.6	1 281.9	1 205.3	1 264.0	1 268.4	1 203.1	-25%	-25%	1990	1 268.7	951.5	951.5	1 205.3	904.0	904.0
Kazakhstan	338.2	166.5	214.9	245.9	329.5	159.3	212.7	245.2	-15%	-15%	1992	321.7	273.4	273.4	316.0	268.6	268.6
Liechtenstein	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.3	-20%	-30%	1990	0.2	0.2	0.2	0.2	0.2	0.2
Monaco	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-30%	-30%	1990	0.1	0.1	0.1	0.1	0.1	0.1
New Zealand	61.2	70.1	77.2	75.1	30.1	38.8	53.4	48.9	-10%	-20%	1990	61.2	55.1	49.0	30.1	27.1	24.1
Norway	49.7	53.4	54.3	54.4	38.5	40.8	28.2	25.9	-30%	-40%	1990	49.7	34.8	29.8	38.5	26.9	23.1
Russian Federation	3 331.0	2 031.9	2 124.8	2 240.0	3 394.7	1 573.8	1 606.1	1 601.6	-15%	-25%	1990	3 331.0	2 831.3	2 498.2	3 394.7	2 885.5	2 546.0
Switzerland	53.2	52.1	54.2	53.4	50.2	53.1	53.4	53.6	-20%	-30%	1990	53.2	42.5	37.2	50.2	40.2	35.2
Ukraine	928.1	393.1	423.1	427.8	859.6	341.6	383.0	411.3	-20%	-20%	1990	928.1	742.5	742.5	859.6	687.7	687.7
United States	6 111.8	7 008.2	7 104.6	6 924.6	5 217.3	6 380.2	6 182.8	6 016.4	-17%	-17%	2005	7 104.6	5 896.8	5 896.8	6 182.8	5 131.7	5 131.7
Total^e	18 894.8	17 504.1	17 902.0	17 654.4	17 577.5	15 775.0	15 949.8	15 534.5				16 529.5	15 516.5		15 422.4	14 430.8	
Total in per cent 1990 emissions		-7%	-5%	-7%		-10%	-9%	-12%				-13%	-18%		-12%	-18%	
Total in per cent 2000 emissions			2%	1%			1%	-2%				-6%	-11%		-2%	-9%	
Total in per cent 2005 emissions								-3%				-8%	-13%		-3%	-10%	

Note: The estimates in this table are based on submissions made by the Parties in 2010 under the Convention, which were available on the UNFCCC website on 30 March 2011.

Abbreviations: GHGs = greenhouse gases, LULUCF = land use, land-use change and forestry.

^a In accordance with the definition of Australia's target for 2020, the net emission levels for 1990, 2005, 2008, the reference year (2000) and for 2020, relative to total GHG emissions including LULUCF, include emissions and removals from the sector and source categories included in Annex A of the Kyoto Protocol as well as from afforestation, reforestation and deforestation activities.

^b Canada's estimates for LULUCF include large, highly variable impacts of natural disturbances such as forest fires and forest insect infestations. It is not possible to use these values in estimating Canada's emission reduction target. As a result, the emission levels for 2005 that were used to calculate the target for Canada using total GHG emissions including LULUCF do not include LULUCF.

^c A decrease of 5 per cent in emissions relative to the base year for Croatia, calculated in accordance with decision 7/CP.12, is equivalent to an increase of 6 per cent in emissions excluding LULUCF by 2020 relative to 1990.

^d The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

^e The values of total emissions in this table differ from the values of total emissions in table 2 due to the fact that emissions from Turkey are not included in the total in this table, and to the fact that GHG emissions including LULUCF from Australia as presented in table 2 include the full LULUCF sector, while in this table they only include net emissions and removals from afforestation, reforestation and deforestation activities.

Table 4

Emission reductions for developed country Parties in relation to their quantitative economy-wide emission reduction targets in 2020 excluding land use, land-use change and forestry

	<i>Emission reductions in 2020 relative to selected years (Tg CO₂ eq)</i>								<i>Emission reduction in 2020 relative to selected years (per cent of emissions in the selected years)</i>							
	<i>Low target</i>				<i>High target</i>				<i>Low target</i>				<i>High target</i>			
	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>
Australia	-53.0	24.8	56.4	78.2	46.2	124.0	155.6	177.4	-13%	5%	11%	14%	11%	25%	29%	32%
Belarus	7.0	-54.5	-48.9	-42.3	14.0	-47.5	-41.8	-35.2	5%	-69%	-58%	-46%	10%	-60%	-49%	-39%
Canada	-14.8	110.4	124.3	127.8	-14.8	110.4	124.3	127.8	-3%	15%	17%	17%	-3%	15%	17%	17%
Croatia ^a	1.7	-7.3	-2.8	-2.1	1.7	-7.3	-2.8	-2.1	5%	-28%	-9%	-7%	5%	-28%	-9%	-7%
EU-27 ^b	1 113.4	608.7	663.1	486.1	1 670.1	1 165.4	1 219.8	1 042.8	20%	12%	13%	10%	30%	23%	24%	21%
Iceland	0.5	0.9	0.8	2.0	1.0	1.4	1.3	2.5	15%	23%	22%	41%	30%	37%	36%	51%
Japan	317.2	392.8	403.0	330.4	317.2	392.8	403.0	330.4	25%	29%	30%	26%	25%	29%	30%	26%
Kazakhstan	64.8	-106.9	-58.6	-27.6	64.8	-106.9	-58.6	-27.6	19%	-64%	-27%	-11%	19%	-64%	-27%	-11%
Liechtenstein	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	20%	28%	32%	30%	30%	37%	41%	39%
Monaco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30%	37%	28%	21%	30%	37%	28%	21%
New Zealand	6.1	15.0	22.1	20.0	12.2	21.1	28.2	26.2	10%	21%	29%	27%	20%	30%	37%	35%
Norway	14.9	18.5	19.4	19.6	19.9	23.5	24.4	24.6	30%	35%	36%	36%	40%	44%	45%	45%
Russian Federation	499.6	-799.4	-706.5	-591.4	832.7	-466.3	-373.4	-258.3	15%	-39%	-33%	-26%	25%	-23%	-18%	-12%
Switzerland	10.6	9.5	11.7	10.9	16.0	14.9	17.0	16.2	20%	18%	22%	20%	30%	29%	31%	30%
Ukraine	185.6	-349.4	-319.4	-314.7	185.6	-349.4	-319.4	-314.7	20%	-89%	-76%	-74%	20%	-89%	-76%	-74%
United States	215.0	1 111.4	1 207.8	1 027.7	215.0	1 111.4	1 207.8	1 027.7	4%	16%	17%	15%	4%	16%	17%	15%
Total	2 368.8	974.5	1 372.5	1 124.9	3 381.8	1 987.6	2 385.5	2 137.9	13%	6%	8%	6%	18%	11%	13%	12%

Note: The estimates of emission reductions represent the difference between emission levels in selected years (1990, 2000, 2005 and 2008) and emission levels in 2020 in relation to the targets. The estimates of emission reductions in per cent were calculated by dividing the emission reductions between the selected years and 2020 by emission levels in the selected year.

^a Emissions for Croatia in the base year (1990) were calculated in accordance with decision 7/CP.12.

^b The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Table 5

Emission reductions for developed country Parties in relation to their quantitative economy-wide emission reduction targets in 2020 including land use, land-use change and forestry

	<i>Emission reductions in 2020 relative to selected years (Tg CO₂ eq)</i>								<i>Emission reduction in 2020 relative to selected years (per cent of emissions in the selected years)</i>							
	<i>Low target</i>				<i>High target</i>				<i>Low target</i>				<i>High target</i>			
	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>
Australia ^a	19.0	27.9	63.6	59.7	130.5	139.5	175.2	171.3	3%	5%	11%	10%	24%	25%	30%	29%
Belarus	5.5	-61.5	-51.3	-45.0	11.1	-56.0	-45.8	-39.4	5%	-141%	-96%	-75%	10%	-129%	-85%	-66%
Canada ^b	-66.4	30.1	165.7	115.0	-66.4	30.1	165.7	115.0	-12%	5%	21%	16%	-12%	5%	21%	16%
Croatia ^c	1.3	-9.5	-5.7	-5.3	1.3	-9.5	-5.7	-5.3	5%	-60%	-29%	-27%	5%	-60%	-29%	-27%
EU-27 ^d	1 044.6	484.5	537.6	351.3	1 567.0	1 006.8	1 059.9	873.6	20%	10%	11%	8%	30%	22%	22%	19%
Iceland	0.9	1.0	0.9	2.0	1.7	1.9	1.8	2.8	15%	18%	15%	29%	30%	32%	30%	41%
Japan	301.3	360.0	364.4	299.1	301.3	360.0	364.4	299.1	25%	28%	29%	25%	25%	28%	29%	25%
Kazakhstan	60.9	-109.3	-55.9	-23.4	60.9	-109.3	-55.9	-23.4	18%	-69%	-26%	-10%	18%	-69%	-26%	-10%
Liechtenstein	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	20%	29%	33%	31%	30%	38%	42%	40%
Monaco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30%	37%	28%	21%	30%	37%	28%	21%
New Zealand	3.0	11.7	26.3	21.8	6.0	14.7	29.3	24.8	10%	30%	49%	45%	20%	38%	55%	51%
Norway	11.5	13.9	1.3	-1.1	15.4	17.7	5.1	2.8	30%	34%	5%	-4%	40%	43%	18%	11%
Russian Federation	509.2	-1 311.7	-1 279.4	-1 283.9	848.7	-972.2	-939.9	-944.4	15%	-83%	-80%	-80%	25%	-62%	-59%	-59%
Switzerland	10.0	12.9	13.3	13.5	15.1	17.9	18.3	18.5	20%	24%	25%	25%	30%	34%	34%	34%
Ukraine	171.9	-346.1	-304.7	-276.4	171.9	-346.1	-304.7	-276.4	20%	-101%	-80%	-67%	20%	-101%	-80%	-67%
United States	85.6	1 248.5	1 051.1	884.7	85.6	1 248.5	1 051.1	884.7	2%	20%	17%	15%	2%	20%	17%	15%
Total	2 158.6	352.6	527.3	112.1	3 150.2	1 344.2	1 519.0	1 103.8	12%	2%	3%	1%	18%	9%	10%	7%

Note: The estimates of emission reductions represent the difference between emission levels in selected years (1990, 2000, 2005 and 2008) and emission levels in 2020 in relation to the targets. The estimates of emission reductions in per cent were calculated by dividing the emission reductions between the selected years and 2020 by emission levels in the selected year.

^a In accordance with the definition of Australia's target for 2020, the net emission levels for the selected years and for 2020 include emissions and removals from the sector and source categories included in Annex A of the Kyoto Protocol as well as from afforestation, reforestation and deforestation activities.

^b The emission levels for 2005 that were used to calculate the target for Canada using total greenhouse gas emissions including land use, land-use change and forestry (LULUCF) do not include LULUCF.

^c Emissions for Croatia in the base year (1990) were calculated in accordance with decision 7/CP.12.

^d The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Table 6

Greenhouse gas emission reductions of developed country Parties between 1990 and 2008 and between 2008 and 2020 in relation to their quantitative economy-wide emission reduction targets

	<i>Total GHGs excluding LULUCF (per cent of emissions in 1990 or 2008)</i>			<i>Total GHGs including LULUCF (per cent of emissions in 1990 or 2008)</i>		
	<i>1990–2008</i>	<i>2008–2020</i>		<i>1990–2008</i>	<i>2008–2020</i>	
		<i>Low target</i>	<i>High target</i>		<i>Low target</i>	<i>High target</i>
Australia ^a	–31%	14%	32%	–7%	10%	29%
Belarus	35%	–46%	–39%	46%	–75%	–66%
Canada ^b	–24%	17%	17%	–34%	16%	16%
Croatia ^c	11%	–7%	–7%	25%	–27%	–27%
EU-27 ^d	11%	10%	21%	13%	8%	19%
Iceland	–43%	41%	51%	–19%	29%	41%
Japan	–1%	26%	26%	0%	25%	25%
Kazakhstan	27%	–11%	–11%	26%	–10%	–10%
Liechtenstein	–15%	30%	39%	–16%	31%	40%
Monaco	11%	21%	21%	11%	21%	21%
New Zealand	–23%	27%	35%	–62%	45%	51%
Norway	–9%	36%	45%	33%	–4%	11%
Russian Federation	33%	–26%	–12%	53%	–80%	–59%
Switzerland	0%	20%	30%	–7%	25%	34%
Ukraine	54%	–74%	–74%	52%	–67%	–67%
United States	–13%	15%	15%	–15%	15%	15%
Total	7%	6%	12%	12%	1%	7%

Abbreviations: GHGs = greenhouse gases, LULUCF = land use, land-use change and forestry.

Note: The estimates of emission reductions represent the difference between emission levels in 1990 and 2008 and between 2008 and 2020 in relation to the targets. The estimates of emission reductions in per cent were calculated by dividing the emission reductions between 1990 and 2008 by emission levels in 1990, and by dividing the emission reductions between 2008 and 2020 in relation to the targets by emission levels in 2008.

^a In accordance with the definition of Australia's target for 2020, the net emission levels relative to total GHG emissions including LULUCF for 1990, 2008 and 2020 in relation to the targets include emissions and removals from the sector and source categories included in Annex A of the Kyoto Protocol as well as from afforestation, reforestation and deforestation activities.

^b The emission levels for 2005 that were used to calculate the target for Canada using total GHG emissions including LULUCF do not include LULUCF.

^c Emissions for Croatia in the base year (1990) were calculated in accordance with decision 7/CP.12.

^d The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Table 7

Trends of per capita total greenhouse gas emissions of developed country Parties in 1990, 2000, 2005, 2008 and 2020 in relation to the quantitative economy-wide emission reduction targets for 2020

	Emissions per capita (Gg CO ₂ /1000 inhabitants)												Emissions per capita (change relative to 1990 in per cent)									
	Excluding LULUCF						Including LULUCF						Excluding LULUCF					Including LULUCF				
	1990	2000	2005	2008	Low 2020	High 2020	1990	2000	2005	2008	Low 2020	High 2020	2000	2005	2008	Low 2020	High 2020	2000	2005	2008	Low 2020	High 2020
Australia ^a	24.5	25.9	25.9	25.6	19.9	15.7	32.1	29.1	29.1	27.5	22.4	17.7	-6%	-6%	-5%	19%	36%	9%	9%	14%	30%	45%
Belarus	13.7	7.8	8.6	9.4	14.6	13.9	10.8	4.3	5.5	6.2	11.5	10.9	43%	37%	32%	-7%	-1%	60%	49%	43%	-7%	-1%
Canada ^b	21.4	23.4	22.6	22.0	16.4	16.4	19.5	20.8	23.9	21.6	16.4	16.4	-9%	-6%	-3%	23%	23%	-6%	-23%	-11%	16%	16%
Croatia ^c	7.7	5.7	6.8	7.0	7.7	7.7	5.9	3.5	4.4	4.5	5.9	5.9	26%	12%	9%	1%	1%	41%	25%	24%	1%	1%
EU-27 ^d	11.7	10.5	10.4	9.9	8.8	7.7	11.0	9.6	9.6	9.1	8.2	7.2	11%	12%	16%	25%	35%	13%	13%	18%	25%	35%
Iceland	13.4	13.4	12.6	15.3	7.8	6.5	22.6	21.2	19.6	21.5	13.3	10.9	0%	6%	-14%	41%	52%	6%	14%	5%	41%	52%
Japan	10.3	10.6	10.6	10.1	7.7	7.7	9.8	10.0	10.0	9.5	7.3	7.3	-3%	-3%	2%	25%	25%	-2%	-2%	3%	25%	25%
Kazakhstan	20.5	11.1	14.1	15.6	16.3	16.3	19.9	10.6	14.0	15.6	16.1	16.1	46%	31%	24%	20%	20%	47%	30%	22%	19%	19%
Liechtenstein	7.9	7.7	7.8	7.4	4.7	4.1	7.6	7.6	7.6	7.2	4.5	4.0	2%	2%	7%	41%	48%	1%	1%	5%	41%	48%
Monaco	3.7	3.7	3.3	2.9	2.2	2.2	3.7	3.7	3.3	2.9	2.2	2.2	0%	12%	21%	40%	40%	0%	12%	21%	40%	40%
New Zealand	18.1	18.1	18.8	17.7	11.8	10.5	8.9	10.0	13.0	11.5	5.8	5.2	0%	-4%	2%	35%	42%	-13%	-46%	-30%	35%	42%
Norway	11.7	11.9	11.7	11.5	6.7	5.7	9.1	9.1	6.1	5.4	5.2	4.4	-1%	0%	2%	43%	51%	0%	33%	40%	43%	51%
Russian Federation	22.5	13.9	14.8	15.8	20.9	18.5	22.9	10.7	11.2	11.3	21.3	18.8	38%	34%	30%	7%	18%	53%	51%	51%	7%	18%
Switzerland	7.9	7.2	7.3	7.0	5.4	4.7	7.5	7.4	7.2	7.1	5.1	4.5	8%	8%	11%	32%	40%	1%	4%	6%	32%	40%
Ukraine	18.0	8.0	9.0	9.3	17.3	17.3	16.7	7.0	8.2	8.9	16.0	16.0	55%	50%	48%	4%	4%	58%	51%	46%	4%	4%
United States	23.6	24.0	23.1	22.0	16.8	16.8	20.2	21.9	20.1	19.1	14.6	14.6	-2%	2%	7%	29%	29%	-8%	0%	5%	27%	27%
Total	16.5	14.7	14.7	14.3	13.0	12.2	15.3	13.2	13.1	12.6	12.1	11.4	11%	11%	13%	21%	26%	14%	14%	18%	21%	26%

Abbreviations: LULUCF = land use, land-use change and forestry.

Note: Emissions per capita were calculated by dividing total greenhouse gas emissions in 1990, 2000, 2005, 2008 and 2020 in relation to the targets by total population numbers in the same years. Population numbers and population projections to 2020 are from the United Nations World Population Prospects <<http://data.un.org>> and are presented in table 9. Negative percentages represent increase in emissions per capita.

^a In accordance with the definition of Australia's target for 2020, the net emission levels relative to total greenhouse gas emissions including LULUCF for 1990, 2000, 2005, 2008 and 2020 in relation to the targets include emissions and removals from the sector and source categories included in Annex A of the Kyoto Protocol as well as from afforestation, reforestation and deforestation activities.

^b The emission levels for 2005 that were used to calculate the target for Canada using total greenhouse gas emissions including LULUCF do not include LULUCF.

^c Emissions for Croatia in the base year (1990) were calculated in accordance with decision 7/CP.12.

^d The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Table 8

Trends of greenhouse gas emissions intensity of developed country Parties in 1990, 2000, 2005, 2008 and 2020 in relation to the quantitative economy-wide emission reduction targets for 2020

	Emissions intensity (Gg CO ₂ /million 2005 USD)												Change in emission intensity (reduction from 1990 in per cent)									
	Excluding LULUCF						Including LULUCF						Excluding LULUCF					Including LULUCF				
	1990	2000	2005	2008	Low	High	1990	2000	2005	2008	Low	High	2000	2005	2008	Low	High	2000	2005	2008	Low	High
					2020	2020					2020	2020										
Australia ^a	1.02	0.87	0.79	0.74	0.45	0.35	1.34	0.98	0.89	0.80	0.50	0.40	15%	23%	27%	56%	66%	27%	34%	41%	63%	70%
Belarus	2.11	1.34	1.01	0.81	0.68	0.64	1.66	0.74	0.64	0.53	0.53	0.51	37%	52%	62%	68%	70%	56%	61%	68%	68%	70%
Canada ^b	0.79	0.72	0.65	0.61	0.40	0.40	0.72	0.64	0.68	0.60	0.40	0.40	9%	18%	22%	49%	49%	12%	5%	16%	45%	45%
Croatia ^c	0.55	0.47	0.45	0.41	0.39	0.39	0.42	0.29	0.29	0.26	0.30	0.30	13%	18%	26%	29%	29%	31%	31%	38%	29%	29%
EU-27 ^d	0.57	0.42	0.39	0.35	0.26	0.23	0.54	0.39	0.36	0.32	0.25	0.21	26%	33%	40%	54%	60%	28%	34%	41%	54%	60%
Iceland	0.52	0.45	0.36	0.42	0.22	0.18	0.88	0.71	0.56	0.59	0.37	0.31	14%	31%	19%	58%	65%	20%	37%	33%	58%	65%
Japan	0.39	0.37	0.35	0.32	0.21	0.21	0.37	0.35	0.33	0.30	0.20	0.20	6%	11%	18%	47%	47%	7%	12%	19%	47%	47%
Monaco	2.92	2.07	1.63	1.50	0.85	0.85	2.84	1.98	1.61	1.49	0.84	0.84	29%	44%	49%	71%	71%	30%	43%	47%	71%	71%
New Zealand	0.94	0.81	0.74	0.70	0.41	0.36	0.46	0.45	0.51	0.46	0.20	0.18	14%	22%	25%	57%	61%	3%	-10%	1%	57%	61%
Norway	0.37	0.27	0.25	0.23	0.12	0.10	0.28	0.21	0.13	0.11	0.09	0.08	25%	32%	36%	67%	72%	26%	54%	61%	67%	72%
Russian Federation	1.78	1.61	1.25	1.07	0.98	0.87	1.81	1.25	0.95	0.76	1.00	0.88	9%	30%	40%	45%	51%	31%	48%	58%	45%	51%
Switzerland	0.24	0.21	0.20	0.18	0.12	0.10	0.22	0.21	0.20	0.18	0.11	0.10	12%	14%	23%	49%	56%	5%	10%	18%	49%	56%
Ukraine	2.22	2.16	1.61	1.38	1.93	1.93	2.05	1.88	1.46	1.32	1.79	1.79	3%	27%	38%	13%	13%	9%	29%	36%	13%	13%
United States	0.77	0.63	0.56	0.53	0.34	0.34	0.65	0.57	0.49	0.46	0.30	0.30	18%	26%	31%	56%	56%	13%	25%	30%	55%	55%
Total	0.76	0.57	0.52	0.48	0.36	0.34	0.70	0.52	0.46	0.42	0.33	0.31	24%	31%	36%	53%	55%	26%	34%	40%	52%	55%

Abbreviations: LULUCF = land use, land-use change and forestry, USD = United States dollars.

Note: Emissions intensities were calculated dividing total greenhouse gas emissions in 1990, 2000, 2005, 2008 and 2020 in relation to targets by the gross domestic product (GDP) in the same years. GDP values are expressed in United States dollars at 2005 prices and refer to purchasing power parities (PPP). GDP values for the period 1990–2009 are from the World Bank World Development Indicators. GDP values in 2020 were estimated using the projections of GDP at market value up to 2016 in the International Monetary Fund's World Economic Outlook as drivers and an average growth rate of the projected data for the period 2010–2016 was applied for each country for the period 2017–2020. Information on emissions intensity for Liechtenstein and Monaco is not included in this table because of the lack of data on GDP expressed in PPP from the World Development Indicators for these Parties. GDP values are presented in table 9. Negative percentages represent increase in emissions intensity. Information for Liechtenstein and Monaco is not included in this table because of the lack of data on GDP expressed in PPP from the World Development Indicators for these Parties.

^a In accordance with the definition of Australia's target for 2020, the net emission levels relative to total greenhouse gas emissions including LULUCF for 1990, 2000, 2005, 2008 and 2020 in relation to the targets include emissions and removals from the sector and source categories included in Annex A of the Kyoto Protocol as well as from afforestation, reforestation and deforestation activities.

^b The emission levels for 2005 that were used to calculate the target for Canada using total greenhouse gas emissions including LULUCF do not include LULUCF.

^c Emissions for Croatia in the base year (1990) were calculated in accordance with decision 7/CP.12.

^d The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Table 9

Trends of population, gross domestic product and gross domestic product per capita of developed country Parties

	Population (millions)					Gross domestic product (billions of 2005 USD)					Gross domestic product per capita (thousands of 2005 USD per inhabitant)				
	1990	2000	2005	2008	2020	1990	2000	2005	2008	2020	1990	2000	2005	2008	2020
Australia	17.1	19.2	20.4	21.4	23.7	409.2	570.1	666.9	739.9	1 057.2	23.9	29.7	32.7	34.5	44.7
Belarus	10.3	10.1	9.8	9.7	9.1	66.5	59.0	83.5	112.8	196.7	6.5	5.9	8.5	11.6	21.6
Canada	27.7	30.7	32.3	33.4	37.1	748.7	998.4	1 132.0	1 195.7	1 519.2	27.0	32.5	35.0	35.8	40.9
Croatia	4.5	4.5	4.4	4.4	4.3	64.0	54.7	68.1	76.9	85.1	14.2	12.2	15.3	17.3	19.7
EU-27 ^a	473.8	483.8	492.7	499.6	508.7	9 700.1	12 000.7	13 221.4	14 226.9	17 028.9	20.5	24.8	26.8	28.5	33.5
Iceland	0.3	0.3	0.3	0.3	0.4	6.5	8.4	10.4	11.6	13.2	25.6	29.9	35.0	36.3	35.8
Japan	123.2	126.7	127.4	127.2	123.7	3 227.9	3 630.1	3 872.8	3 996.5	4 590.1	26.2	28.6	30.4	31.4	37.1
Kazakhstan	16.5	15.0	15.2	15.7	16.7	115.9	80.5	131.8	164.1	320.9	7.0	5.4	8.7	10.4	19.2
Liechtenstein	0.03	0.03	0.04	0.04	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Monaco	0.03	0.03	0.03	0.03	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Zealand	3.4	3.9	4.1	4.2	4.7	65.1	86.4	104.6	107.1	135.1	19.2	22.3	25.4	25.2	28.9
Norway	4.2	4.5	4.6	4.7	5.2	136.2	196.0	218.7	234.0	287.8	32.1	43.7	47.2	49.3	55.3
Russian Federation	148.1	146.7	143.2	142.1	135.4	1 872.3	1 260.1	1 696.7	2 096.1	2 885.3	12.6	8.6	11.9	14.8	21.3
Switzerland	6.7	7.2	7.4	7.6	7.9	224.3	249.4	266.1	291.3	354.8	33.4	34.7	35.8	38.3	45.0
Ukraine	51.6	48.9	46.9	46.0	42.9	418.4	181.8	263.0	310.9	384.8	8.1	3.7	5.6	6.8	9.0
United States	258.7	292.0	307.0	315.4	350.7	7 969.5	11 167.7	12 579.7	13 167.5	17 298.7	30.8	38.2	41.0	41.7	49.3
Total	1 146.1	1 193.3	1 216.0	1 231.9	1 270.5	25 024.6	30 543.1	34 315.7	36 731.2	46 157.9	21.8	25.6	28.2	29.8	36.3

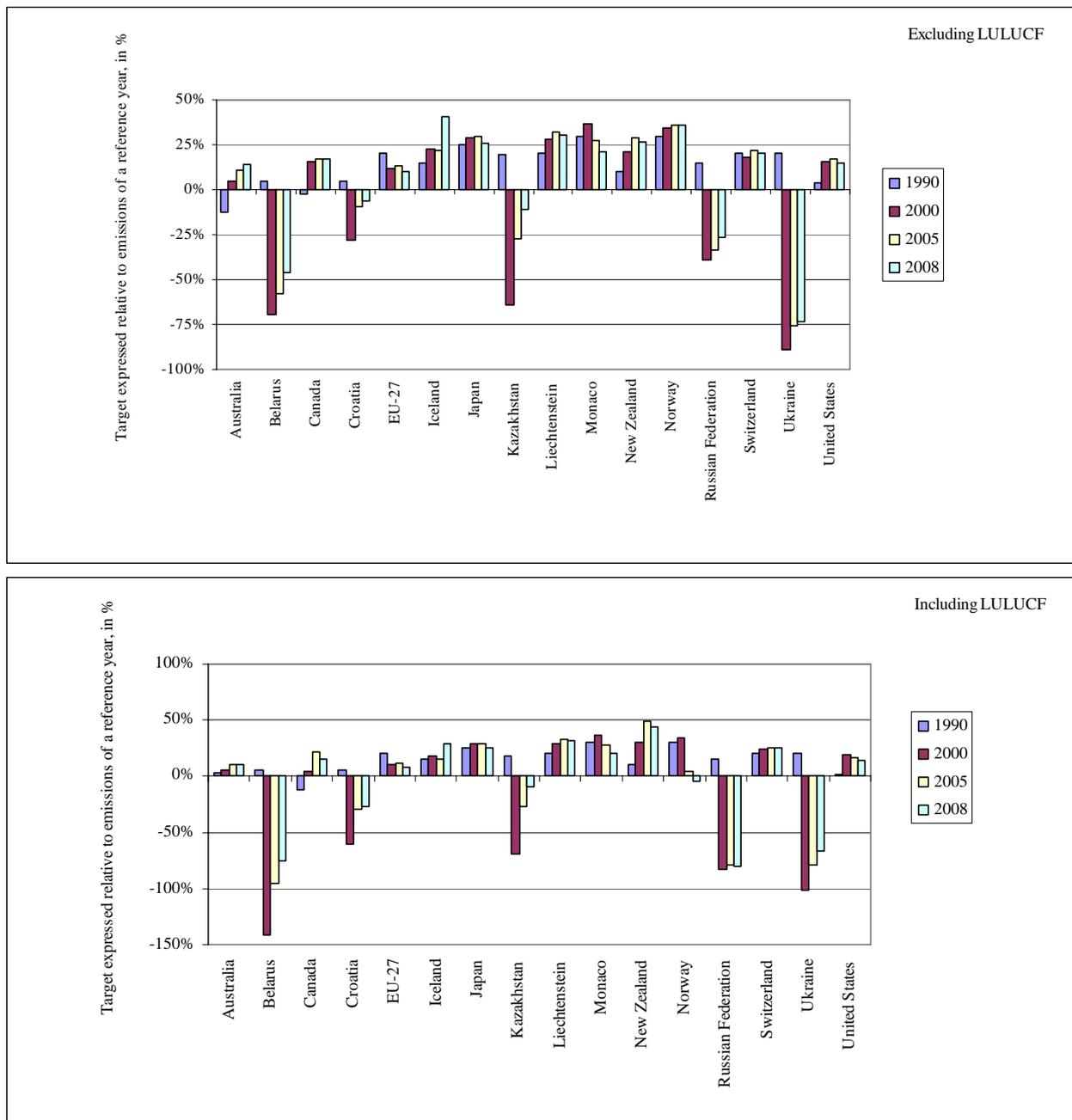
Abbreviations: LULUCF = land use, land-use change and forestry, NA = not available, USD = United States dollars.

Note: Population numbers and population projections to 2020 are from the United Nations World Population Prospects <<http://data.un.org>>. Gross domestic product (GDP) values are expressed in United States dollars at 2005 prices and refer to purchasing power parities (PPP). GDP values for the period 1990–2009 are from the World Bank World Development Indicators. GDP values in 2020 were estimated using the projections of GDP at market value up to 2016 in the International Monetary Fund's World Economic Outlook as drivers and an average growth rate of the projected data for the period 2010–2016 was applied for each country for the period 2017–2020. Information on GDP for Liechtenstein and Monaco is not included in this table because of the lack of data on GDP expressed in PPP from the World Development Indicators for these Parties.

^a The European Union and its 27 member States: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Figure 1

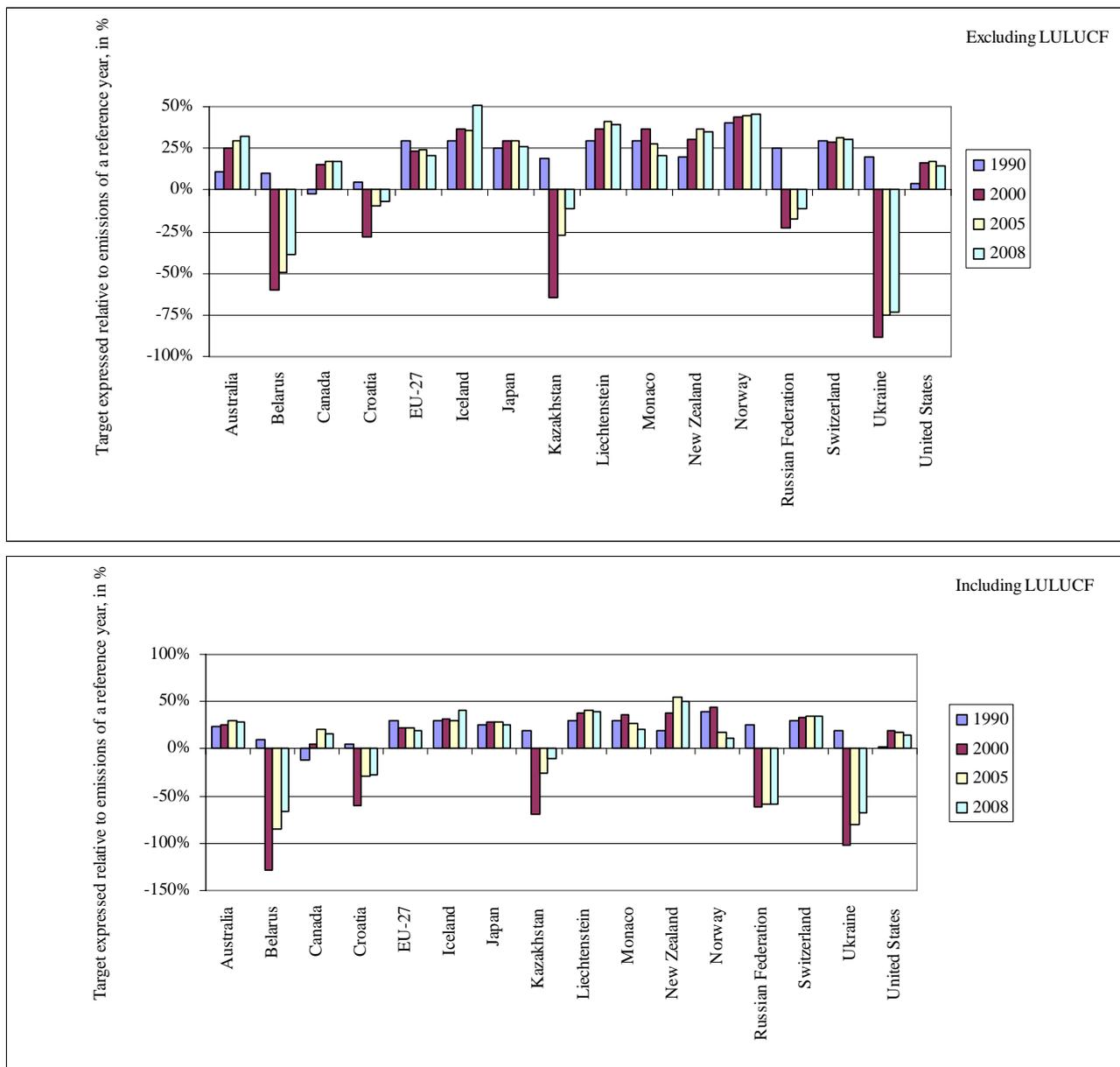
Reduction of total greenhouse gas emissions excluding and including land use, land-use change and forestry between emission levels in a selected year (1990, 2000, 2005 and 2008) and 2020 for low targets presented by developed Parties, expressed as per cent of emissions in the selected year



Note: EU-27 = European Union and its 27 member States.

Figure 2

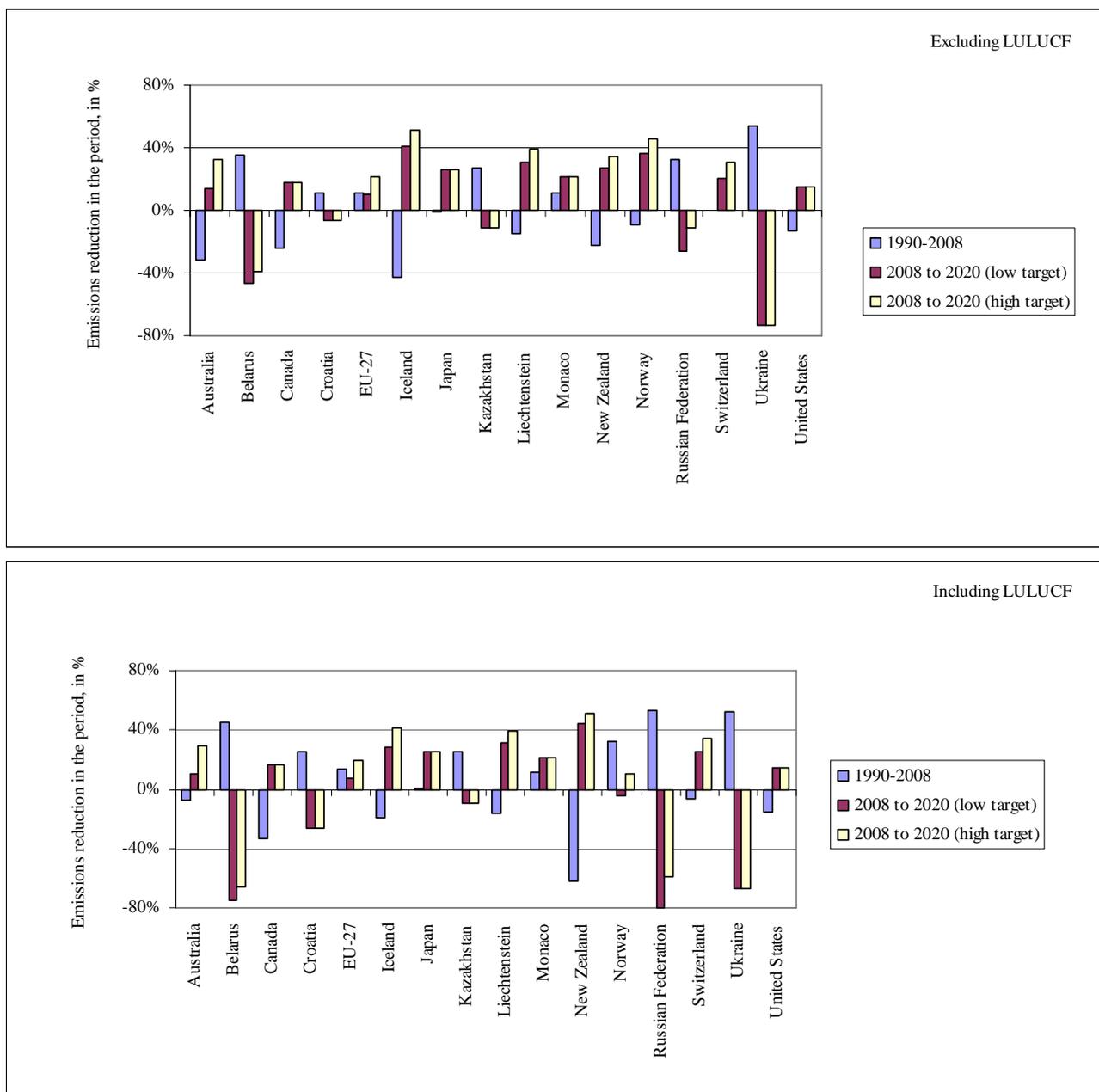
Reduction of total greenhouse gas emissions excluding and including land use, land-use change and forestry between emission levels in a selected year (1990, 2000, 2005 and 2008) and 2020 for high targets presented by developed Parties, expressed as per cent of emissions in the the selected year



Note: EU-27 = European Union and its 27 member States.

Figure 3

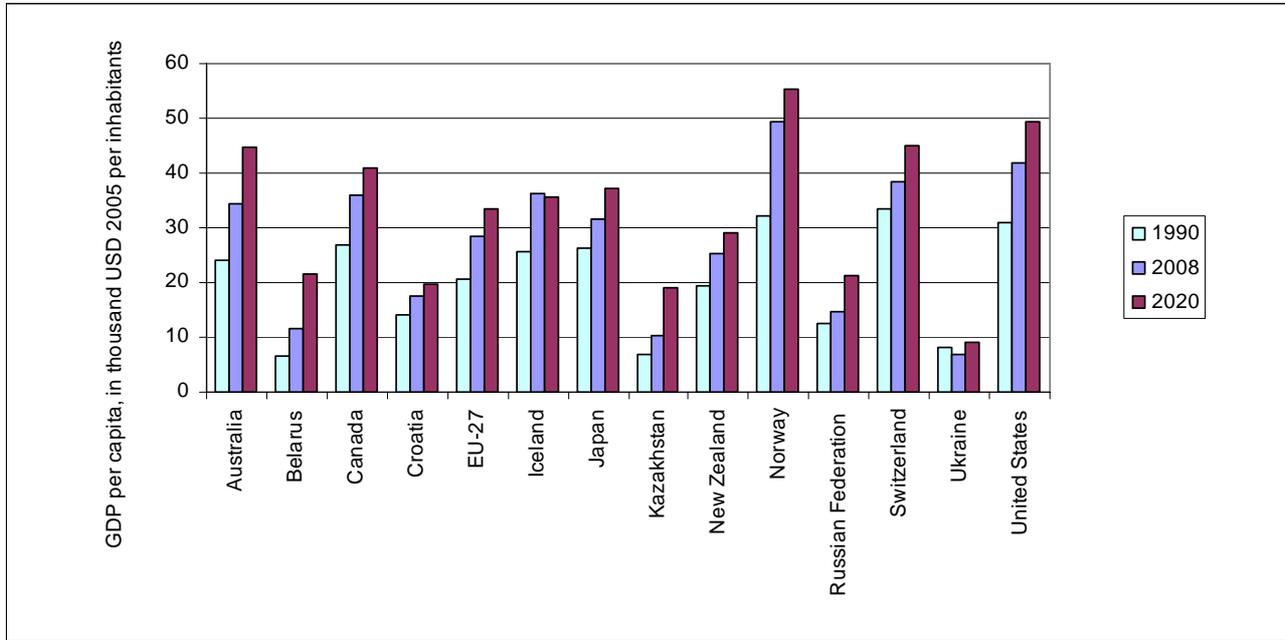
Reduction of total greenhouse gas emissions excluding and including land use, land-use change and forestry between 1990 and 2008 and between 2008 and 2020 for the low and high targets submitted by developed country Parties, expressed as per cent of emission reduction in the initial year of the period



Note: EU-27 = European Union and its 27 member States.

Figure 4

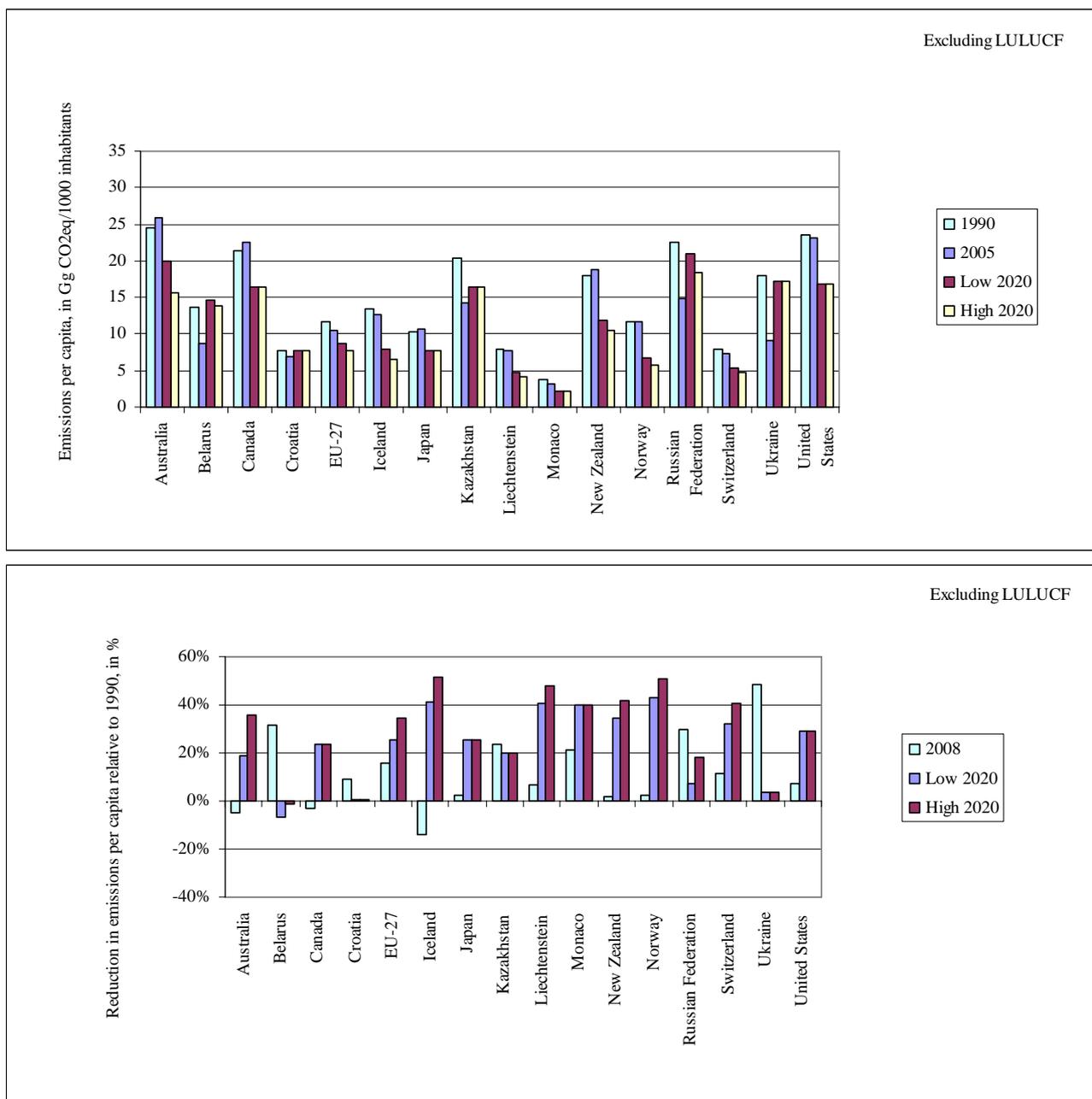
Gross domestic product per capita for developed country Parties, expressed as thousand 2005 United States dollars per inhabitant



Note: EU-27 = European Union and its 27 member States.

Figure 5

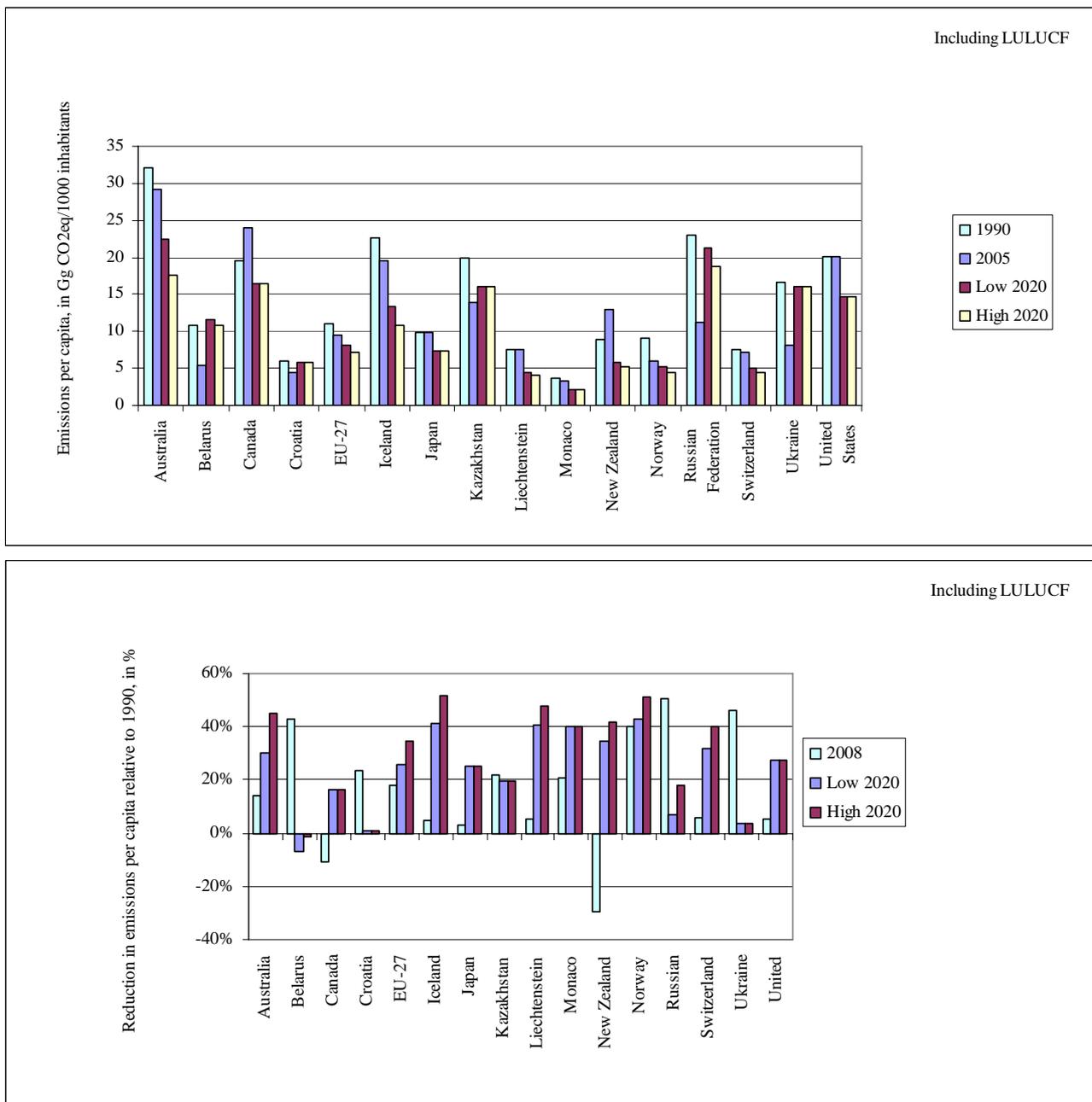
Per capita greenhouse gas emissions excluding land use, land-use change and forestry in 1990, 2005 and 2020 for the low and high targets submitted by developed country Parties, expressed as Gg CO₂ eq per thousand inhabitants, and per cent change in per capita emissions relative to the per capita emissions in 1990



Note: EU-27 = European Union and its 27 member States.

Figure 6

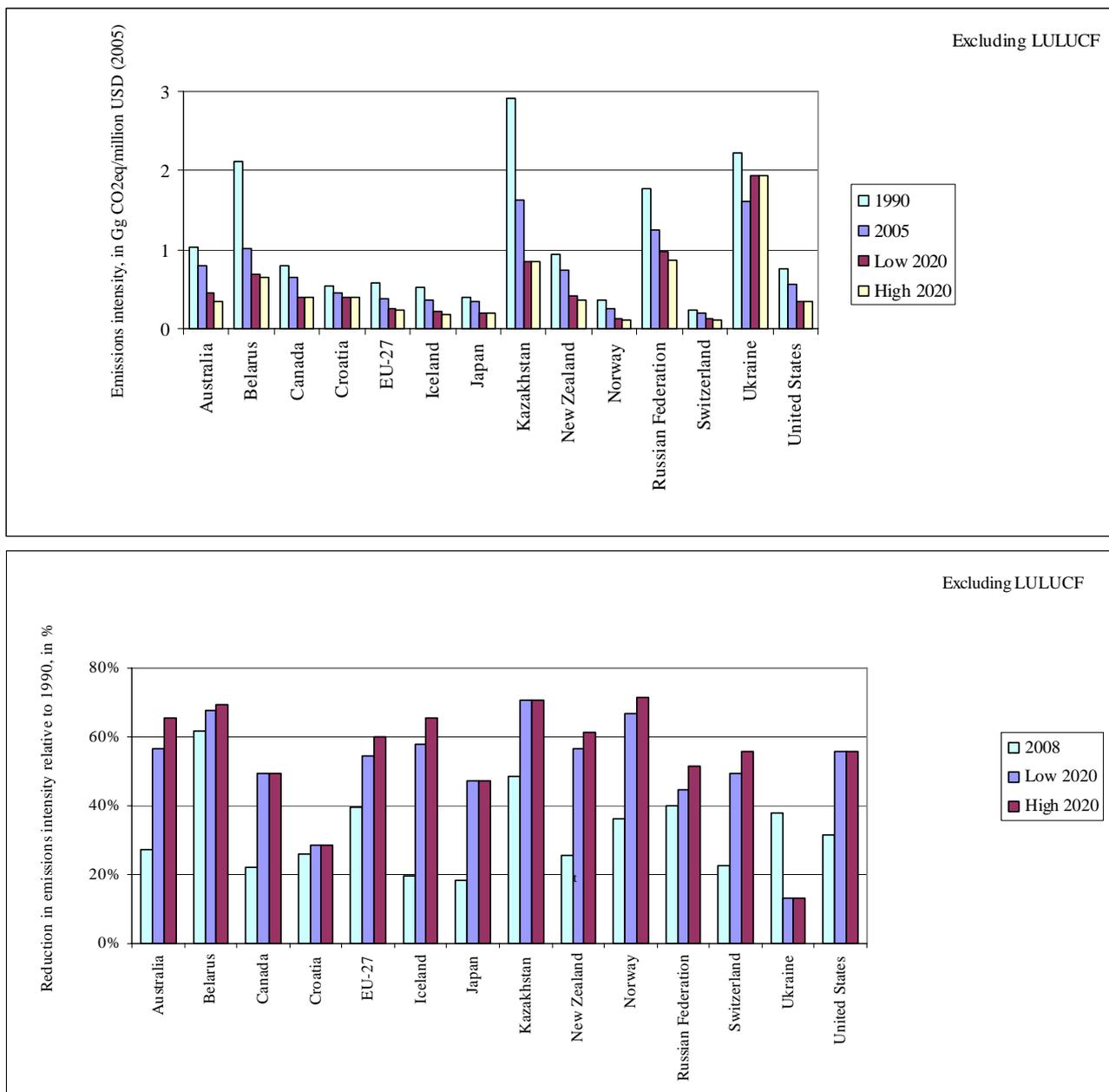
Per capita greenhouse gas emissions including land use, land-use change and forestry in 1990, 2005 and 2020 for the low and high targets submitted by developed country Parties, expressed as Gg CO₂ eq per thousand inhabitants, and per cent change in per capita emissions relative to the per capita emissions in 1990



Note: EU-27 = European Union and its 27 member States.

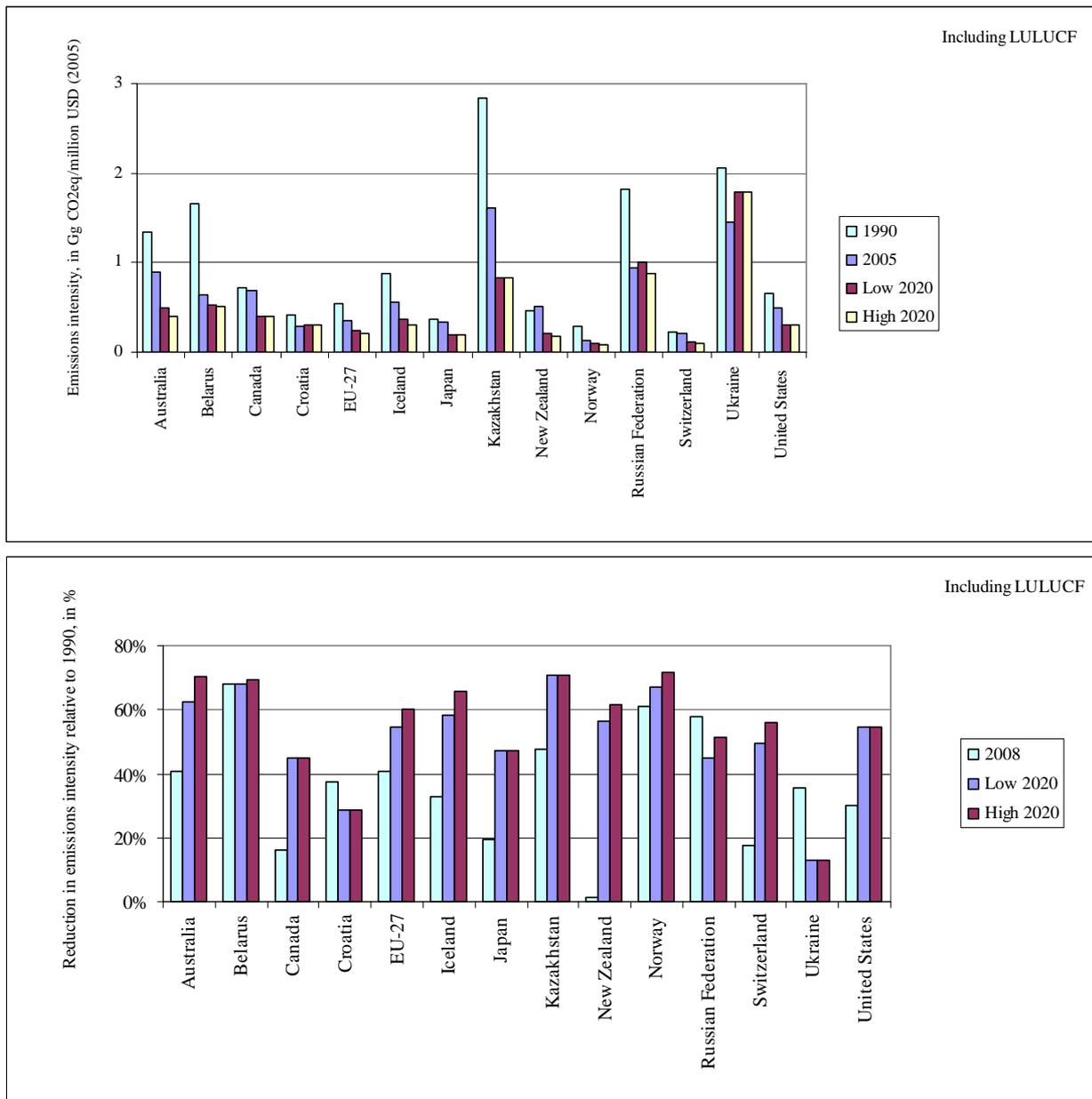
Figure 7

Emission intensity (total greenhouse gas emissions per unit of gross domestic product) excluding land use, land-use change and forestry in 1990, 2005 and 2020 for the low and high targets submitted by developed Parties, expressed as Gg CO₂ eq per million 2005 United States dollars, and per cent change in emission intensity relative to the emission intensity in 1990



Note: EU-27 = European Union and its 27 member States.

Figure 8
Emission intensity (total greenhouse gas emissions per unit of gross domestic product) including land use, land-use change and forestry in 1990, 2005 and 2020 for the low and high targets submitted by developed Parties, expressed as Gg CO₂ eq per million 2005 United States dollars , and per cent change in emission intensity relative to the emission intensity in 1990



Note: EU-27 = European Union and its 27 member States.