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Comparability of Annex I Emission Reduction Pledges

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EXECUTIVE SUMMARY

Significant commitments to reduce developed country greenhouse gas emissions (GHGs) will be central to the realization of the Copenhagen Accord.

As negotiated in December 2009, the Copenhagen Accord provides a mandate for Annex I Parties that choose to associate themselves with the Accord to register their emission reduction pledges[1] by 31 January 2010. Many pledges have already been put forward by major industrialized countries and economic blocs.[2] These include the European Union (EU), Japan, Canada, and Australia, and the US.

In this analysis, we assess Annex I pledges under the Copenhagen Accord, as well as pledges by Parties that have yet to associate themselves with the Accord (namely Belarus and Ukraine). We do so with the expectation that these countries will associate themselves with the Accord in the near future.

This Working Paper presents a comparative analysis of these pledges, which was performed with two key aims:

- To enable negotiators from all countries to compare the emission reduction outcomes that would result from industrialized countries' pledges; and
- To facilitate efforts to aggregate emission reduction pledges in order to calculate the global impact on the atmosphere.

The absence of details regarding some countries' mechanisms to achieve emission reductions present hurdles to measuring comparability. Countries will need to clarify how they plan to fulfill their pledges, especially with regard to the use of international offsets and inclusion of land use, land use change, forestry (LULUCF) emissions and reductions, if aggregate effort and comparability are to be effectively measured.

Nevertheless, this analysis provides a preliminary picture of where the world is post Copenhagen. Our key conclusions and recommendations are listed below. Most importantly, we found that while developed country emission reduction pledges could have an important and potentially substantial impact, they will not be enough to meet even the lower range of emission reductions required for stabilizing concentrations of CO_2e at 450 ppm and certainly fall very short of goals to reduce concentrations below that level.

1 "Pledge" is used here to define the effort or target offered by a Party. Although the term has been used in the context of voluntary measures, in this paper we use it to refer to a target proposal regardless of the legal form used. The legal form will of course be important, but is not the subject of this paper.

2 Several developing countries have also brought forward emission reduction offers, but they are not analyzed here.

KEY FINDINGS

Conclusion: Existing pledges by developed countries, when added together, could represent a substantial effort for reducing Annex I emissions by 2020 – a 12 to 19% reduction of emissions below 1990 levels depending on the assumptions made about the details of the pledges. But they still fall far short of the range of emission reductions – 25 to 40% – that the IPCC notes would be necessary for stabilizing concentrations of CO_2e at 450 ppm, a level associated with a 26 to 78% risk of overshooting a 2ºC goal (Meinshausen 2005). If the pledges are not ratcheted up even beyond the highest pledges, this analysis shows that the additional reductions required between 2020 and 2050 would be significant, with emissions dropping roughly 2.5% annually to reach a goal of 80% below 1990 levels by mid-century.

> **Recommendation:** Developed countries should implement emission cuts consistent with the higher ranges of their pledges. Second, while the Copenhagen Accord has provided for a periodic science review, if global emission pathways continue to misalign themselves with the science, the review process should mandate more ambitious commitments as the science dictates.

Conclusion: In assessing comparability, the choice of metrics can have profound implications on a given country's ambition.

> **Recommendation:** There is no single perfect way to assess comparability. Factors such as population growth and the use of offsets (as well as their integrity) will impact the effort and environmental effectiveness of a target. While comparability is best assessed by considering multiple dimensions of a target as we do here, we need to bear in mind that absolute emission reductions are ultimately what matters for reducing our impact on the climate.

Conclusion: In our analysis, we make the assumption that emission reductions achieved via international offsets contained in pledges will be real and additional. These assumptions make an enormous difference for the scale of some country's emission reductions, such as that of the United States. Therefore, if international emission reductions play a major role in national targets, and they prove *not* to be real and additional, then some pledges, such as that in the emerging US bill, will fall far short of how they appear at face value.

> **Recommendation:** The implementation of high regulatory standards and the design of robust accounting rules are critical to ensuring that emission reductions are real and additional.

Conclusion: This analysis demonstrated the importance of resolving how LULUCF emissions are to be estimated before final commitments are determined. Emissions from the land use sector can vary significantly from year to year and the choice of including them, as well as the choice of a base year, can make a significant difference in defining the stringency of a given country's target. For example, when Canada's pledge is calculated below a 1990 base year and LULUCF is included, the pledge allows for significant emissions growth.

> **Recommendation:** High and uniform standards for estimating and accounting for land use emissions will be essential if targets set by developed countries are to deliver the ambition and impacts that they claim. If LULUCF emissions are excluded in pledges, it will be necessary to examine the net impact of pledges as well as emissions and sinks from LULUCF in order to provide an accurate measurement relevant to the state of the global climate.

Conclusion: In this analysis, we assume consistent emissions measurement and accounting rules. The Copenhagen Accord calls for accounting for targets that is "rigorous, robust and transparent." If accounting is not also consistent (e.g. if US domestic legislation accounts for emissions from domestic agriculture in a manner that differs from that used by other Parties), comparability exercises will be more difficult and contentious. Furthermore, it will be difficult to assess effort.

> **Recommendation:** Parties should agree to rigorous and consistent estimation and accounting methodologies.

INTRODUCTION

In December 2009, Parties to the UN Framework Convention on Climate Change (UNFCCC) came together to negotiate an international climate agreement, as the Kyoto Protocol's first commitment period is ending in 2012. Central to any multilateral climate regime is a commitment to reduce global greenhouse emissions, as well as agreement on how that mitigation responsibility will be shared among Parties.

At the end of the negotiations session, the UNFCCC took note of the Copenhagen Accord, which was put forward by several Parties and subsequently embraced by many Parties. The Accord stipulates that Annex I Parties commit to quantified economy-wide emission reduction targets.[3] They are to be registered in Appendix I of the Accord, along with the base year of the pledge.

As a number of Parties have now associated themselves with the Accord and have registered their pledges, it is necessary to determine the level of effort under the Accord -- whether the pledges are consistent with what the most recent climate science notes is necessary for stabilizing global temperatures at a level that averts dangerous climate change -- as well as how these emission reduction pledges compare with one another. For the purposes of this analysis, we also include several Parties that have made emission reduction pledges before Copenhagen but have yet to associate themselves with the Accord. We do so with the expectation that they will associate themselves with the Accord in the near future.

Accordingly, the purpose of this WRI Working Paper is to shed light upon two related questions:

- Are the emission reduction pledges by Annex I Parties comparable?
- Do these pledges put Annex I Parties on a path toward meaningful reductions by 2050, e.g. for stabilizing concentrations of CO_2e at 450 ppm or lower?[4]

Definitions

Annex I Party – The industrialized countries listed in this annex to the Convention which were committed to return their greenhouse gas emissions to 1990 levels by the year 2000 as per Article 4.2 (a) and (b). They have also accepted emissions targets for the period 2008-12 as per Article 3 and Annex B of the Kyoto Protocol.

Base year – A historic datum for tracking emissions over time.

Baseline emissions – An estimate of GHG emissions, removals, or storage that serves as the reference period from which the future change in emissions can be calculated.

Carbon dioxide equivalent (CO_2e) – A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential.

Greenhouse gases (GHG) – For the purposes of this analysis, the six gases listed in the Kyoto Protocol: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF_6).

LULUCF – land use, land use change and forestry.

Offset – Discrete GHG reductions used to compensate for (i.e. offset) GHG emissions elsewhere.

Pledge – For the purposes of this analysis, a proposed commitment for emission reductions, to be realized by 2020. Although the term has been used in the context of voluntary measures, we use it to refer to a target proposal regardless of the legal form used.

3 While the Accord also calls for mitigation actions by non-Annex I Parties, these efforts may take a different form and are, therefore, not assessed in this analysis.

4 It is important to note that stabilization at 450 ppm CO_2e is associated with a 26 to 78% risk of overshooting a goal of limiting warming above pre-industrial levels to 2ºC (Meinshausen 2005).

The first question is driven by the Bali Action Plan, which laid out the path for post-2012 climate negotiations and calls for "ensuring the comparability of efforts" among developed Parties. The ability to compare pledges is seen as a vital element of ensuring a fair, equitable, and transparent global agreement. There are many metrics of comparability that one could examine, including level of effort taken domestically versus via international offsets, abatement costs, historical responsibility, among others, and metrics could be combined and weighted differently.

In this Working Paper, we examine three metrics of comparability: absolute reductions; per capita reductions; and reductions in emissions intensity. We did not perform a comparison of domestic versus international emission reductions realized by the proposed pledges, given the lack of information on some Parties' mechanisms for achieving their pledges. Many Parties have yet to indicate the degree to which they will rely upon international emission reductions.

We ask the second question in an effort to determine whether the emission reduction pledges are consistent with the UNFCCC's objective, which is to stabilize atmospheric concentrations at a level that averts dangerous anthropogenic interference with the climate system. The Copenhagen Accord, as well as the Major Economies Forum and G8, have agreed to a goal of limiting the increase in average global temperature to 2ºC over pre-industrial levels.[5] There are numerous trajectories for meeting this goal, as the global community could commit to early action or a steeper trajectory of reductions in future years. This Working Paper helps determine the additional emission reductions that would be needed if Annex I Parties were to commit to early action, as well as the reductions that would be needed in future decades if the emission reduction pledges are not increased. It also sheds light on the degree to which complementary policies – such as those that create incentives for low-carbon behavior (e.g. via subsidies) – that do not result in immediately quantifiable emission reductions will be necessary to lead to transformational change in greenhouse gas-intensive sectors.

5 http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf, http://www.g8italia2009.it/static/G8_Allegato/MEF_Declarationl.pdf; http://www.g8italia2009.it/static/G8_Allegato/G8_Declaration_08_07_09_final,0.pdf

OUR APPROACH

To compare and aggregate the pledges, data were collected on Annex I pledges, historical greenhouse gas emissions, and socioeconomic indicators. To the extent that pledges for emission reduction commitments are to be met through international offsets,[6] we assume these reductions are real and additional.

The Annex I Parties analyzed in this WRI Working Paper represent the majority of Annex I emissions,[7] but it should be noted that the analysis focuses upon larger Annex I emitters and, therefore, does not capture all pledges.

While a 2050 global target is of critical importance, as it provides a long-term vision, emission reduction pledges for 2020 will more readily determine market signals, abatement costs, and emission reductions required in the near term. Accordingly, we focus this analysis on Annex I Party pledges for 2020 emission reductions.

The pledges we assess in this analysis have been collected from a variety of sources. Where possible, we include an official government source. It is important to note that the nature of the pledges varies by country, as **Table 1** shows. Some pledges for emission reductions have been included in announcements by national leaders, but mechanisms for achieving them have yet to be delineated. Others have been mandated by law or are in the process of becoming law. Accordingly, the pledges we assess vary with regard to their legally-binding nature and, accordingly, their durability in shaping policy and behavioral decisions. Thus, we use the term "pledge" without prejudice to whether the pledge is legally binding.

6 Several Annex I emission reduction pledges include the use of offsets. For example, up to one third of emission reductions can be met via international mechanisms for Norway; the EU Emissions Trading Scheme allows for use of the Clean Development Mechanism and Joint Implementation and is thus incorporated into the EU's pledge; the US draft climate legislation includes the use of international offsets; and Japan's reduction pledge may include the use of the Clean Development Mechanism and Joint Implementation.

7 For example, the 1990 emissions of the Parties assessed in this analysis constitute roughly 98% of all Annex I emissions from that year.

Table 1 Emission Reduction Pledges for 2020

"Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.[8]

Party	LOW	HIGH	Baseline	Date ***	Nature of Pledge	Source
AUSTRALIA	-5%	-25%	2000	January 2010	Association with Copenhagen Accord	http://unfccc.int/home/items/5264.php
CANADA	-17%		2005	January 2010	Association with Copenhagen Accord	http://unfccc.int/home/items/5264.php
EU*	-20%	-30%	1990	January 2010	Association with Copenhagen Accord	http://unfccc.int/home/items/5264.php
JAPAN	-25%		1990	January 2010	Association with Copenhagen Accord	http://unfccc.int/home/items/5264.php
NEW ZEALAND	-10%	-20%	1990	February 2010	Association with Copenhagen Accord	http://unfccc.int/home/items/5264.php
RUSSIA	-15%	-25%	1990	February 2010	Associated with Copenhagen Accord	http://unfccc.int/home/items/5264.php
US**	-17%		2005	January 2010	Association with Copenhagen Accord	http://unfccc.int/home/items/5264.php
BELARUS	-5%	-10%	1990	September 2009	Announcement	http://unfccc.int/resource/docs/2009/awg9/eng/10a04r01.pdf
NORWAY	-30%	-40%	1990	January 2010	Association with Copenhagen Accord	http://unfccc.int/home/items/5264.php
UKRAINE	-20%		1990	September 2009	Under consideration	http://unfccc.int/resource/docs/2009/awg9/eng/10a04r01.pdf

***** Because the Kyoto Protocol allows the EU to reduce its emissions jointly, it is treated as a region in this analysis. However, a number of countries within the EU have also put forward pledges to reduce emissions, with differing levels of ambition, although they are not analyzed individually here.

** This is a provisional target, to be finalized in light of enacted US climate legislation.

*** In most cases, the announcement date is listed. In others, because of challenges in finding the original announcement, it is the date of a recent government document (e.g. submission to the UNFCCC) or related media announcement that cites the emission reduction pledge.

8 These Parties' emission reduction pledges are as of February 1, 2010.

The Data

Emissions Data

We rely on the greenhouse gas data that Annex I Parties report to the UNFCCC in their National Communications (at: http://unfccc.int/di/DetailedByParty.do) in this analysis, as submitted by September 2009. Our analysis excludes emissions data from international bunkers (activities that are carried out beyond national boundaries, such as shipping). Our data are reported in gigagrams (Gg) of carbon dioxide equivalent (Gg CO_2e), thus including estimates for the six greenhouse gases recognized under the UNFCCC: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). We use two sets of emissions data: (1) excluding land use, land use change and forestry (LULUCF) data; and (2) including LULUCF data. We do so for two reasons. First, some emission reduction pledges lack specificity regarding whether they include LULUCF data in their baseline data. Second, the two analyses facilitate an evaluation of the degree to which LULUCF data play a role in altering the comparability of pledges. It is important to note that the LULUCF sector can be either a source or sink, and, therefore, emissions can either be of positive or negative value.

Population Data

In this analysis, we calculate per capita emission reductions as one way to compare emission reduction pledges. For population data for 2005, we rely upon: World Bank, 2008 (original source, PPP: World Bank, International Comparison Programme database; estimates are based on regression performed by the World Bank). For 2020 population projections, we rely upon: http://go.worldbank.org/H4UN4D5KI0.

Economic Data

Another metric of comparability we use in this Working Paper is reduction in emissions intensity (emissions output per dollar of GDP). For economic data, we rely on country-level GDP data which is downscaled from global Intergovernmental Panel on Climate Change (IPCC) scenarios. Therefore, these data represent a range of future GDP levels. The source for these data can be found at: Center for International Earth Science Information Network (CIESIN), 2002. Country-level GDP and Downscaled Projections based on the A1, A2, B1, and B2 Marker Scenarios, 1990-2100 at http://www.ciesin.columbia.edu/datasets/downscaled.

HISTORICAL EMISSIONS AND CURRENT REDUCTION PLEDGES

This analysis begins by cataloging historical emissions, the first step of the exercise in quantifying pledges, as the pledges are stated in terms of a percent reduction below historical emissions from a baseline. As **Table 2** shows, Annex I Parties have been steadily increasing emissions since 1990. However, emissions must peak in the next several years if Annex I Parties are successfully to reduce emissions 25% to 40% from 1990 levels by 2020, which the IPCC notes is necessary to stabilize concentrations of CO_2e at 450 ppm.[9]

Table 2 Absolute Emissions (Gg CO_2 equivalent)
Data exclude international bunkers. Source: UNFCCC inventory

		1990	2000	2005
AUSTRALIA	Excluding LULUCF	416,214	494,855	524,635
	Including LULUCF	453,794	404,392	596,239
CANADA	Excluding LULUCF	591,793	717,101	730,967
	Including LULUCF	540,227	636,781	772,380
EU	Excluding LULUCF	5,556,523	5,041,650	5,098,160
	Including LULUCF	5,222,374	4,659,081	4,659,180
JAPAN	Excluding LULUCF	1,269,657	1,345,997	1,357,844
	Including LULUCF	1,195,370	1,265,360	1,272,256
RUSSIA	Excluding LULUCF	3,319,327	2,030,431	2,117,821
	Including LULUCF	3,359,567	2,368,009	2,005,842
US	Excluding LULUCF	6,084,490	6,975,180	7,082,213
	Including LULUCF	5,257,278	6,290,721	5,985,872
BELARUS	Excluding LULUCF	129,129	70,995	77,435
	Including LULUCF	107,101	43,747	52,346
NORWAY	Excluding LULUCF	49,695	53,358	53,701
	Including LULUCF	37,406	36,280	25,781
UKRAINE	Excluding LULUCF	926,033	389,714	417,529
	Including LULUCF	852,887	338,093	382,655
NEW ZEALAND	Excluding LULUCF	61,853	70,598	77,175
	Including LULUCF	43,714	50,626	51,901

9 It is important to note that stabilization at 450 ppm CO_2e is associated with a 26 to 78% risk of overshooting a 2ºC goal (Meinshausen 2005).

ANNEX I EMISSION REDUCTION PLEDGES

We turn our attention to the pledges after collecting the historical emissions data. Please refer again to **Table 1** for a list of pledges assessed in this Working Paper. For some Parties, assessing the pledge is straightforward, as there is only one pledge for emission reductions that the country is considering. However, some Parties are still deciding among multiple pledges, and we represent the lowest and highest pledge in this analysis. For example, Russia has pledged to reduce its emissions between 15% and 25% below 1990 levels by 2020, and, therefore, we use 15% as its "low" pledge and 25% as its "high" pledge.

Also, some pledges are unilateral gestures of a country's willingness to act irrespective of other parties' actions; others are tied to multilateral action. For example, the EU-27 has pledged to reduce emissions by 20% below 1990 levels by 2020 unilaterally, but 30% below 1990 levels by 2020 if a global agreement in which other developed countries make comparable efforts[10] is realized. Thus, for the EU, we also label these two scenarios as "low" and "high" pledges, with the low pledge equating to 20% below 1990 levels by 2020 and the high pledge equating to 30% below 1990 levels by 2020.

HOW COMPARABLE ARE CURRENT PLEDGES?

How comparable are the Annex I Party emission reduction pledges? There are numerous ways to define comparability of effort. As noted in the introduction, we examine three metrics of comparability – absolute reductions; per capita reductions; and reductions in emissions intensity – described below.

I. Absolute Reductions

One could measure comparability of effort in terms of absolute emission reductions from a certain point in time. Few advocate this approach, as it fails to account for differences between Parties with large emission profiles and those with small emission profiles.

Table 3 shows the proposed limits on emissions by 2020, based on current emission reduction pledges

10http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/97&format=HTML&aged=0&language=EN&guiLanguage=en

Table 3 Proposed Limits on Emissions in 2020[11] (Gg CO_2 equivalent)

Data exclude international bunkers. Source: UNFCCC inventory. "Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.

		LOW	HIGH
AUSTRALIA	Excluding LULUCF	470112	371141
	Including LULUCF	384172	303294
CANADA	Excluding LULUCF	606703	
	Including LULUCF	641076	
EU	Excluding LULUCF	4445218	3889566
	Including LULUCF	4177899	3655662
JAPAN	Excluding LULUCF	952243	
	Including LULUCF	896528	
RUSSIA	Excluding LULUCF	2821428	2489495
	Including LULUCF	2855632	2519675
US	Excluding LULUCF	5878237	
	Including LULUCF	4968274	
BELARUS	Excluding LULUCF	122673	116216
	Including LULUCF	101746	96391
NORWAY	Excluding LULUCF	34786	29817
	Including LULUCF	26184	22444
UKRAINE	Excluding LULUCF	740827	
	Including LULUCF	682310	
NEW	Excluding LULUCF	55668	49482
ZEALAND	Including LULUCF	39343	34972

Calculation: The proposed limits on emissions in 2020 were calculated by considering the pledges and associated baseline and historical UNFCCC inventory data. For example, if Country A has established a pledge of 20% below 1990 levels by 2020, 2020 emissions for that country would be calculated as 0.8 X 1990 levels. If Country B has established a pledge of 40% below 2005 levels by 2020, the level of emissions in 2020 is calculated as 0.6 X 2005 levels.

11 Based on these Parties' emission reduction pledges as of February 1, 2010.

Instead of absolute reductions, pledges could be compared with regard to the percent emissions reduction below different baseline years.

Figure 1 shows the percent reductions below a chosen baseline. Negative values constitute a decrease in emissions; positive values constitute a growth in emissions.

Calculation: Once the emissions budgets are determined, the emissions pledges are normalized to different baselines. For example, if Country A has established a pledge of 20% below 1990 levels by 2020, the 2020 emissions level is calculated as 0.8 X 1990 levels. We can then determine what percentage emission reductions off of 2000 and 2006 levels, respectively, equates to 0.8 X 1990 levels.

Choice of Base Year

As demonstrated by Figure 1, the choice of a base year can have significant implications on the magnitude of the emission reduction pledge. For example, RBU (Russia, Belarus, Ukraine) all appear more favorably when a 1990 base year is used than when a later base year is used, as they have growth targets if emission reductions are calculated below 2000 or 2005 base year. This dramatic change can be explained by the economic collapse of RBU countries in the 1990s and resultant decline in emissions. Some advocate a 1990 base year because it would be consistent with the Kyoto Protocol's first commitment period and reward early actors. But others call for the use of a later base year, such as 2006, which can account for required reductions from levels closer to today's, use the most recently available comparable data, provide incentives for Parties which did not engage in early action, potentially incorporate greater data quality, and account for changes in emission profiles since 1990.

Inclusion of LULUCF

Also important to note is the role that LULUCF data plays in the emission reduction pledges for both Canada and Australia. Illustrative of this is Canada's pledge, which is based off of 2005 emissions. When the pledge is calculated below 1990 emissions and LULUCF is included, the pledge is one that allows for significant growth of emissions. This highlights the importance of agreeing on how LULUCF emissions are estimated and factored into proposed targets before they are finalized.

II. Per Capita Reductions

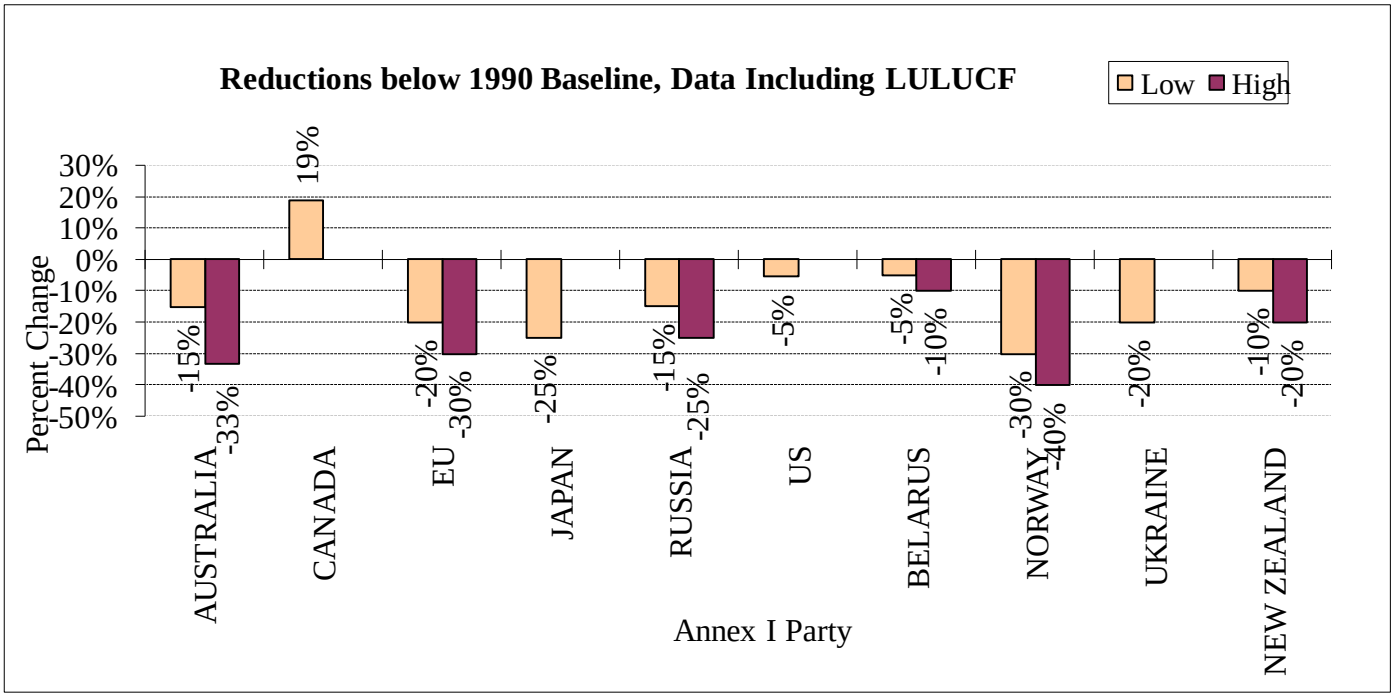
In addition to comparing absolute reductions, Parties could compare emission reduction pledges by assessing reductions in terms of per capita emissions. See **Table 4.**

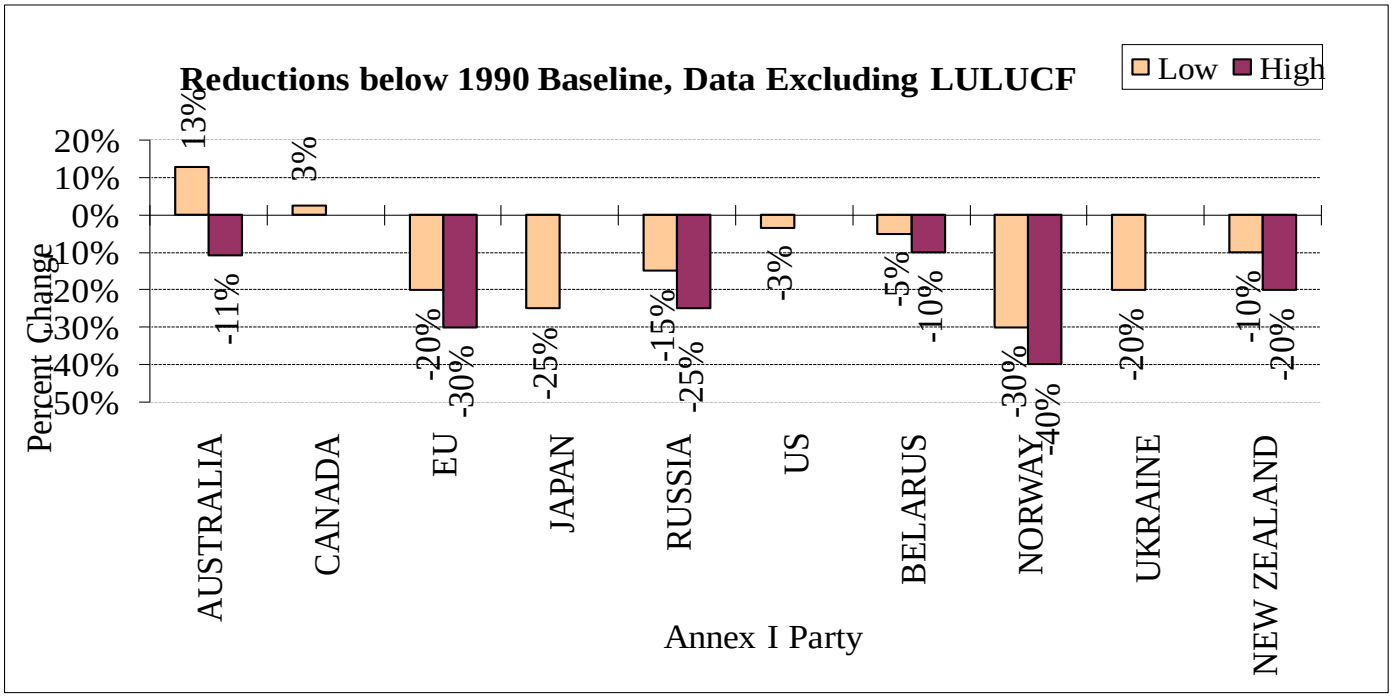
It is interesting to note the divergence regarding per capita emissions among Parties in 2005. Emission reduction pledges for Parties with growing populations (Australia, Canada, New Zealand, and US) appear more stringent when using this metric than those of Parties with more stable populations (EU, Japan). Also, a global goal whereby all Parties 'converge' to a common per capita level would not favor RBU, at least not in the near term, as their per capita emissions are projected to grow by 2020.

The change of per capita emissions over a period of time, e.g. from 2005 to 2020, could also be examined. See **Table 5.** Negative values constitute a decrease in per capita emissions; positive values constitute an increase in per capita emissions. Because emissions in RBU would be growing by 2020 under current pledges, and population would not increase at the same rate, there is a positive percent change in these nations.

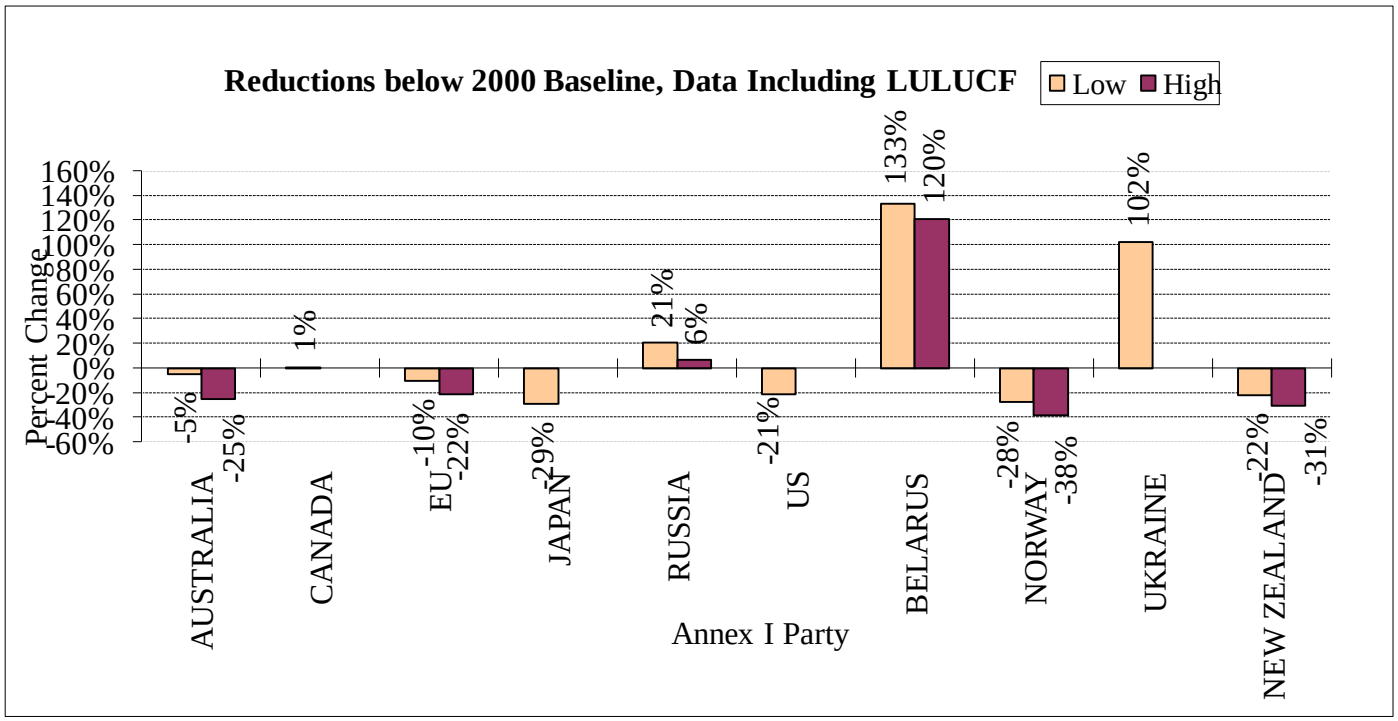
Figure 1 Percent Reductions below a Chosen Baseline[12]

"Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.





12 Based on these Parties' emission reduction pledges as of February 1, 2010.


Reductions below 2000 Baseline, Data Including LULUCF
Low
High
Percent Change
160%
140%
120%
100%
80%
60%
40%
20%
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133%
120%
-28%
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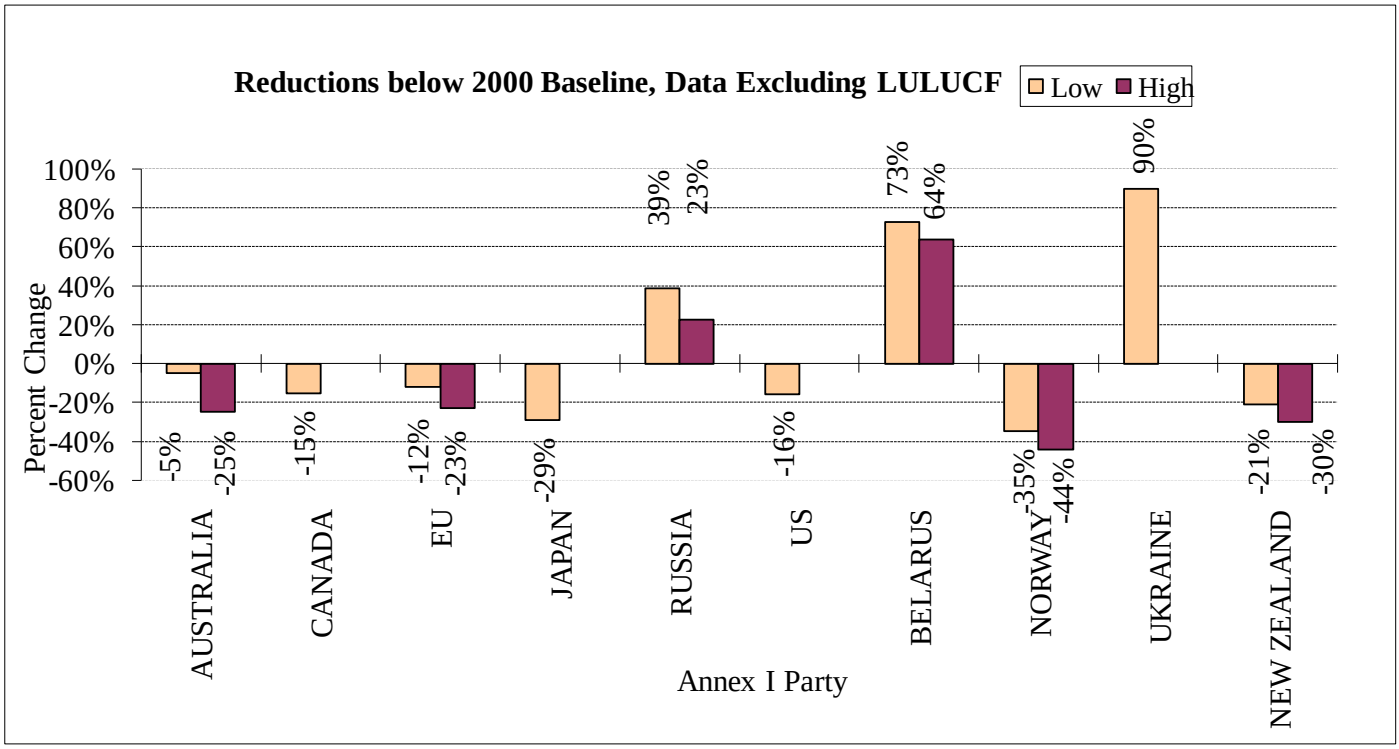
Annex I Party


Reductions below 2000 Baseline, Data Excluding LULUCF
Low
High
Percent Change
100%
80%
60%
40%
20%
0%
-20%
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-5%
-25%
-15%
-12%
-23%
-29%
39%
23%
-16%
73%
64%
-35%
-44%
90%
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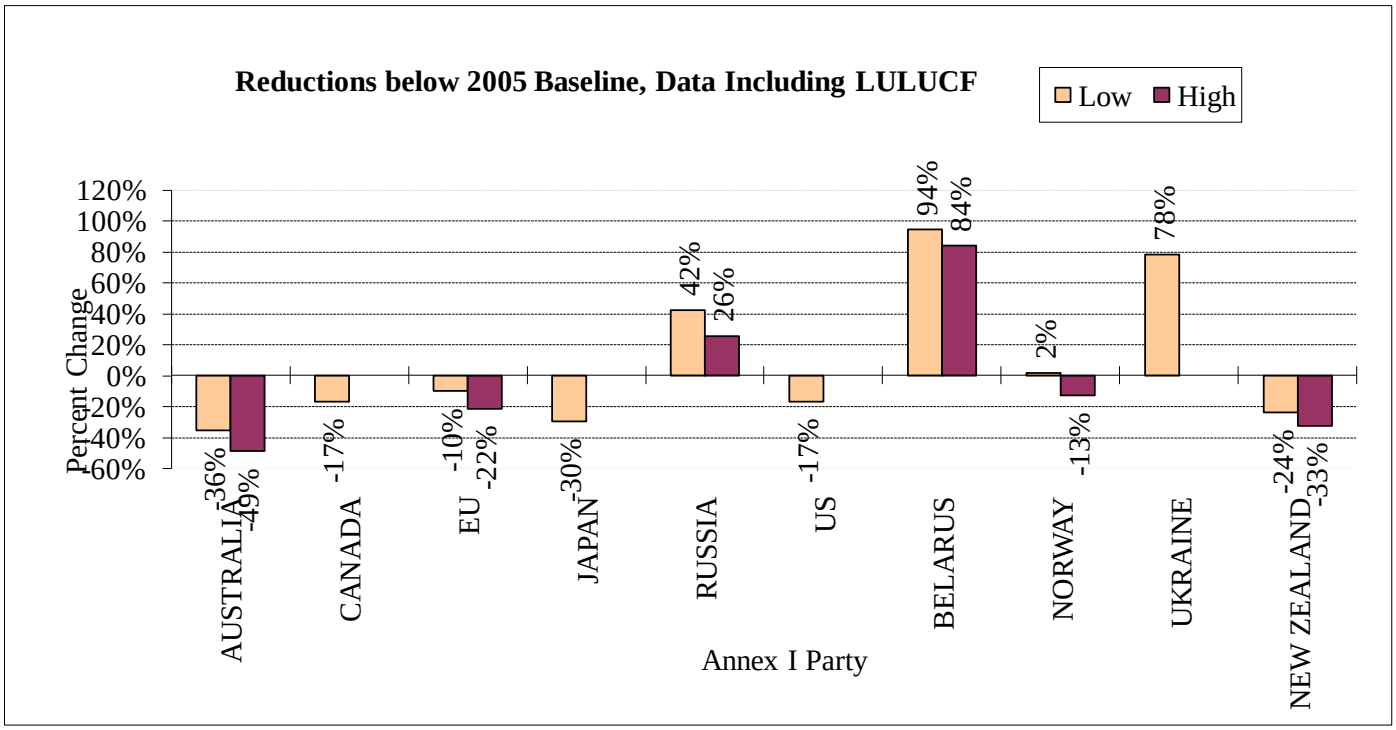
NORWAY
UKRAINE
NEW ZEALAND
Annex I Party


Reductions below 2005 Baseline, Data Including LULUCF
Low
High
Percent Change
120%
100%
80%
60%
40%
20%
0%
-20%
-40%
-60%
-36%
-49%
-17%
-10%
-22%
-30%
42%
26%
-17%
94%
84%
2%
-13%
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Annex I Party

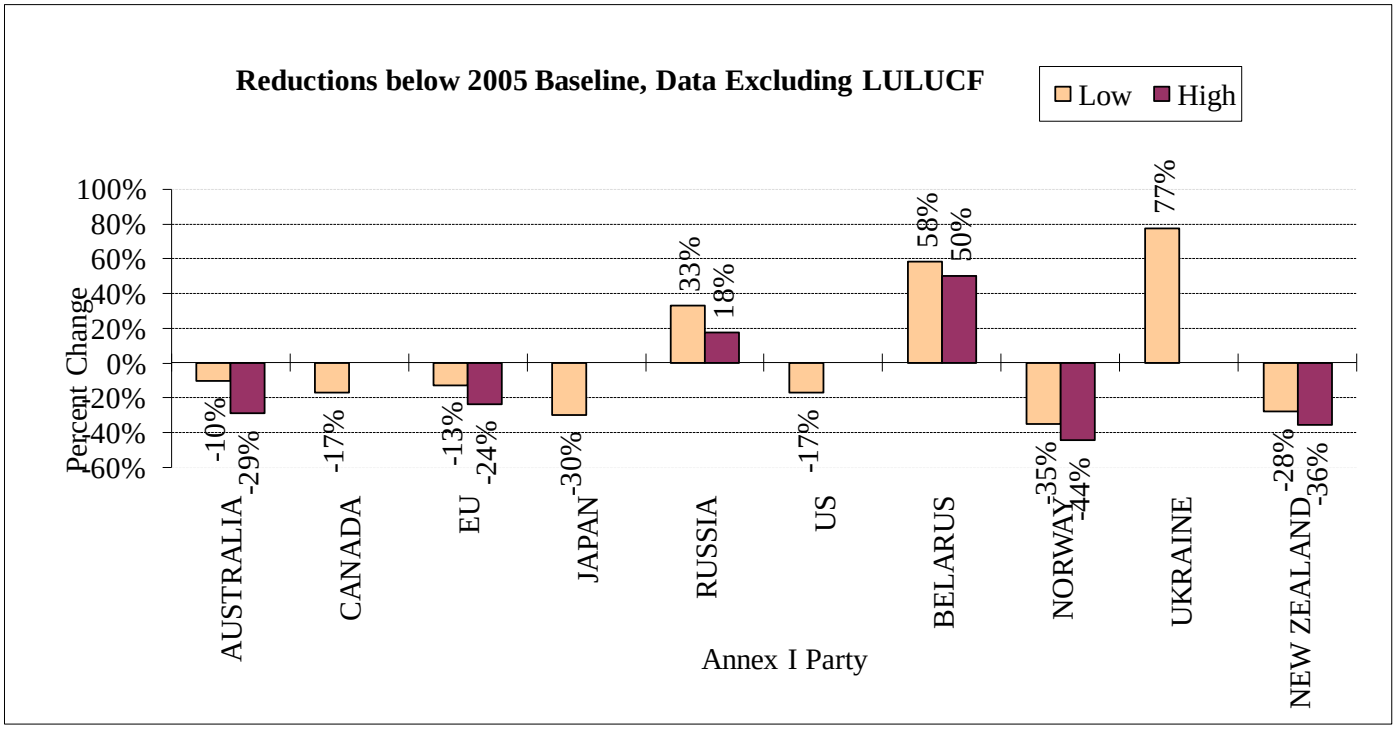

Reductions below 2005 Baseline, Data Excluding LULUCF
Low
High
Percent Change
100%
80%
60%
40%
20%
0%
-20%
-40%
-60%
-10%
-29%
-17%
-13%
-24%
-30%
33%
18%
-17%
58%
50%
-35%
-44%
77%
-28%
-36%
AUSTRALIA
CANADA
EU
JAPAN
RUSSIA
US
BELARUS
NORWAY
UKRAINE
NEW ZEALAND
Annex I Party

Table 4 Per Capita Emission Reductions (metric ton of CO_2 equivalent per person)

Data exclude international bunkers. Emissions data source: UNFCCC inventory; Population data source: World Bank. "Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.

		2005	LOW	HIGH
AUSTRALIA	Excluding LULUCF	25.7	20.0	15.8
	Including LULUCF	29.2	16.3	12.9
CANADA	Excluding LULUCF	22.6	16.5	
	Including LULUCF	23.9	17.4	
EU	Excluding LULUCF	10.4	9.0	7.9
	Including LULUCF	9.5	8.4	7.4
JAPAN	Excluding LULUCF	10.6	7.8	
	Including LULUCF	10.0	7.4	
RUSSIA	Excluding LULUCF	14.8	21.4	18.9
	Including LULUCF	14.0	21.7	19.1
US	Excluding LULUCF	23.9	17.4	
	Including LULUCF	20.2	14.7	
BELARUS	Excluding LULUCF	7.9	13.6	12.9
	Including LULUCF	5.4	11.3	10.7
NORWAY	Excluding LULUCF	11.6	6.9	5.9
	Including LULUCF	5.6	5.2	4.4
UKRAINE	Excluding LULUCF	8.9	17.7	
	Including LULUCF	8.1	16.3	
NEW	Excluding LULUCF	18.7	11.9	10.6
ZEALAND	Including LULUCF	12.6	8.4	7.5

Calculation: To determine per capita emission reductions, we divided emissions by population. Accordingly:

2005 per capita emissions = (2005 emissions)/(2005 population)
2020 per capita emissions = (2020 emissions budget)/(2020 projected population)

Table 5 Per Capita Emissions – Percent Change below 2005 Levels by 2020

Data exclude international bunkers. Emissions data source: UNFCCC inventory; Population data source: World Bank. "Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.[13]

		LOW	HIGH
AUSTRALIA	Excluding LULUCF	-22%	-39%
	Including LULUCF	-44%	-56%
CANADA	Excluding LULUCF	-27%	
	Including LULUCF	-27%	
EU	Excluding LULUCF	-14%	-25%
	Including LULUCF	-11%	-22%
JAPAN	Excluding LULUCF	-26%	
	Including LULUCF	-26%	
RUSSIA	Excluding LULUCF	45%	28%
	Including LULUCF	55%	36%
US	Excluding LULUCF	-27%	
	Including LULUCF	-27%	
BELARUS	Excluding LULUCF	72%	62%
	Including LULUCF	110%	99%
NORWAY	Excluding LULUCF	-41%	-49%
	Including LULUCF	-7%	-20%
UKRAINE	Excluding LULUCF	100%	
	Including LULUCF	101%	
NEW	Excluding LULUCF	-36%	-43%
ZEALAND	Including LULUCF	-33%	-40%

Calculation: To determine the percent change from 2005 per capita emissions reductions by 2020, we compared the 2005 and 2020 per capita emissions values and calculated the percent change as:

(2020 per capita emissions – 2005 per capita emissions)/2005 per capita emissions

13 Based on these Parties' emission reduction pledges as of February 1, 2010.

III. Emissions Intensity Reductions

The third analysis we perform on comparability is one on emissions intensity, which we measure as emissions per GDP. This indicator is a rough measure of how effective one economy is compared to another in terms of the rate of reduction of greenhouse gas emissions. Several factors are imbedded in the GDP metric, such as the size of the country, historical commitments to different fuel types, as well as the efficiency and structure of industry. It has limited ability to capture Parties' transfer of greenhouse gas-intensive processes to other countries. A range of intensities is included because the source for GDP was downscaled IPCC data. Therefore, the range depicts the highest and lowest GDP value when A1, A2, B1 and B2 scenario data are considered.
See **Table 6.**

Efforts to compare pledges could also focus on the change of emissions intensity over a period of time, e.g. from 2005 to 2020. See **Table 7.**

Negative values constitute a decrease in emissions intensity; positive values constitute an increase in emissions intensity.

HOW FAR DO THE CURRENT EMISSION REDUCTION PLEDGES GET US?

Reductions Achieved by 2020

The IPCC Fourth Assessment Report notes that in order to stabilize concentrations at 450 ppm CO_2e, Annex I Party emissions would have to be reduced 25-40% from 1990 levels by 2020 (Box 13.7, Chapter 13).[14] Do the current pledges achieve this level of reductions? In an effort to assess the aggregate reductions that would result from the current pledges – assuming all will be implemented – it is necessary to calculate the absolute reductions and convert to percent emission reductions below 1990 levels.

See **Table 8** for a depiction of aggregate reductions from the pledges proposed thus far and included in this analysis.[15]

14 A 450 ppm CO_2e goal is associated with a 26 to 78% risk of overshooting a 2ºC goal (Meinshausen 2005).

15 In this analysis, as stated above, we only assess a subset of Annex I Parties that have put forward pledges. These emissions represent the large majority of Annex I emissions but not all (e.g. the 1990 emissions of the Parties assessed in this analysis constitute roughly 98% of all Annex I emissions from that year).

Table 6 Emissions Intensity Reductions (Gg CO_2 equivalent/millions of 1990 US dollars)

Data exclude international bunkers**.** Emissions data source: UNFCCC inventory**;** GDP data source: Center for International Earth Science Information Network (CIESIN) downscaled projections based on the A1, A2, B1, and B2 Marker Scenarios. "Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.[16]

		2005	LOW	HIGH
AUSTRALIA	Excluding LULUCF	1.2 - 1.3	0.8 - 1.0	0.6 - 0.8
	Including LULUCF	1.3 - 1.5	0.7 - 0.8	0.5 - 0.6
CANADA	Excluding LULUCF	0.8 - 1.0	0.5 - 0.6	
	Including LULUCF	0.9 - 1.0	0.5 - 0.7	
EU	Excluding LULUCF	0.5	0.3 - 0.4	0.3
	Including LULUCF	0.5	0.3 - 0.4	0.3
JAPAN	Excluding LULUCF	0.3 - 0.4	0.2	
	Including LULUCF	0.3	0.2	
RUSSIA	Excluding LULUCF	3.5 - 5.3	1.8 - 3.3	1.6 - 2.9
	Including LULUCF	3.3 - 5.0	1.9 - 3.3	1.6 - 2.9
US	Excluding LULUCF	0.8 - 0.9	0.5 - 0.6	
	Including LULUCF	0.7 - 0.8	0.4 - 0.5	
BELARUS	Excluding LULUCF	2.1 - 3.2	1.3 - 2.4	1.3 - 2.2
	Including LULUCF	1.4 - 2.2	1.1 - 2.0	1.0 - 1.9
NORWAY	Excluding LULUCF	0.3 - 0.4	0.2	0.1-0.2
	Including LULUCF	0.2	0.1	0.1
UKRAINE	Excluding LULUCF	4.4 - 6.6	3.1 - 5.5	
	Including LULUCF	4.0 - 6.1	2.8 - 5.0	
NEW ZEALAND	Excluding LULUCF	1.2 - 1.4	0.7 - 0.8	0.6 - 0.7
	Including LULUCF	0.8 - 0.9	0.5 - 0.6	0.4 - 0.5

Calculation: Emissions intensities for 2005 and 2020 were determined by the following equation:

2005 emissions intensity = (2005 emissions)/(2005 GDP)

2020 emissions intensity = (2020 emissions budget)/(2020 projected GDP)

16 Based on these Parties' emission reduction pledges as of February 1, 2010.

Table 7 Emissions Intensity – Percent Change below 2005 Levels by 2020

Data exclude international bunkers. Emissions data source: UNFCCC inventory; GDP data source: Center for International Earth Science Information Network (CIESIN) downscaled projections based on the A1, A2, B1, and B2 Marker Scenarios. "Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.[17]

		LOW	HIGH
AUSTRALIA	Excluding LULUCF	-24% to -32%	-40% to -46%
	Including LULUCF	-46% to -51%	-57% to -61%
CANADA	Excluding LULUCF	-35% to -43%	
	Including LULUCF	-35% to -43%	
EU	Excluding LULUCF	-32% to -39%	-40% to -47%
	Including LULUCF	-30% to -37%	-39% to -45%
JAPAN	Excluding LULUCF	-41% to -48%	
	Including LULUCF	-40% to -48%	
RUSSIA	Excluding LULUCF	-16% to -47%	-26% to -53%
	Including LULUCF	-10% to -44%	-21% to -50%
US	Excluding LULUCF	-37% to -43%	
	Including LULUCF	-37% to -43%	
BELARUS	Excluding LULUCF	0% to -37%	-5% to -41%
	Including LULUCF	+23% to -23%	+16% to -27%
NORWAY	Excluding LULUCF	-49% to -54%	-56% to -61%
	Including LULUCF	-20% to -28%	-31% to -38%
UKRAINE	Excluding LULUCF	+12% to - 30%	
	Including LULUCF	+13% to - 29%	
NEW	Excluding LULUCF	-39% to -45%	-46% to -51%
ZEALAND	Including LULUCF	-36% to -41%	-43% to -49%

Calculation: To determine the percent change in emissions intensity from 2005 by 2020, we compared the 2005 and 2020 emissions intensity values and calculated the percent change as:

(2020 emissions intensity – 2005 emissions intensity)/2005 emissions intensity

17 Based on these Parties' emission reduction pledges as of February 1, 2010.

Table 8 Aggregate Reductions from 1990 (Gg CO_2 equivalent)

Data exclude international bunkers. Source: UNFCCC inventory. "Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.[18]

		Emissions	Constraint on emissions by 2020	
		1990	LOW	HIGH
AUSTRALIA	Excluding LULUCF	416214	470112	371141
	Including LULUCF	453794	384172	303294
CANADA	Excluding LULUCF	591793	606703	
	Including LULUCF	540227	641076	
EU	Excluding LULUCF	5556523	4445218	3889566
	Including LULUCF	5222374	4177899	3655662
JAPAN	Excluding LULUCF	1269657	952243	
	Including LULUCF	1195370	896528	
RUSSIA	Excluding LULUCF	3319327	2821428	2489495
	Including LULUCF	3359567	2855632	2519675
US	Excluding LULUCF	6084490	5878237	
	Including LULUCF	5257278	4968274	
BELARUS	Excluding LULUCF	129129	122673	116216
	Including LULUCF	107101	101746	96391
NORWAY	Excluding LULUCF	49695	34786	29817
	Including LULUCF	37406	26184	22444
UKRAINE	Excluding LULUCF	926033	740827	
	Including LULUCF	852887	682310	
NEW	Excluding LULUCF	61853	55668	49482
ZEALAND	Including LULUCF	43714	39343	34972
TOTAL				
	Excluding LULUCF	18404714	16127894	15123727
	Including LULUCF	17069718	14828879	13820624
PERCENT BELOW 1990 LEVELS BY 2020				
	Excluding LULUCF		-12%	-18%
	Including LULUCF		-13%	-19%

Calculation: To determine the aggregate reductions from 1990, we calculated the emissions budgets (low and high pledges) of the Annex I Parties considered in this Working Paper and compared them to aggregate 1990 emissions levels.

18 Based on these Parties' pledges as of February 1, 2010.

High pledges for emission reductions fall short

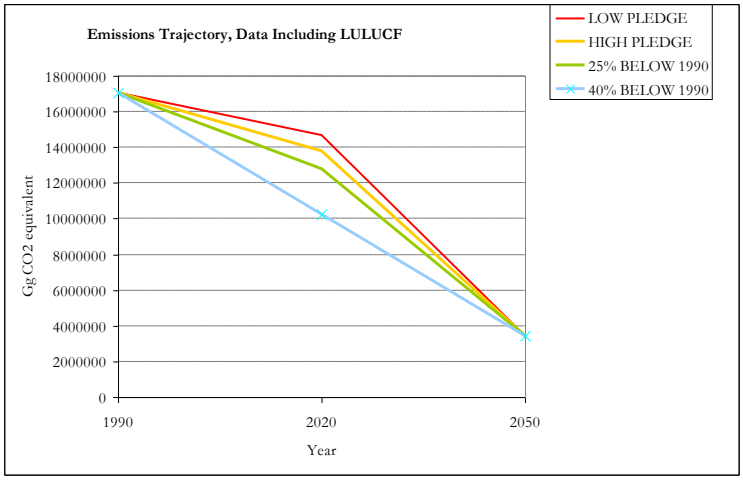
The Annex I Parties' emission reduction pledges assessed in this Working Paper, if realized, would reduce emissions of those Annex I Parties roughly 12-18% below 1990 levels by 2020 excluding LULUCF or 13-19% below 1990 levels by 2020 including LULUCF. Thus, even the highest pledges for emission reduction commitments do not meet the lower end of the IPCC's range of stabilizing concentrations of greenhouse gases at 450 ppm CO_2e or below.

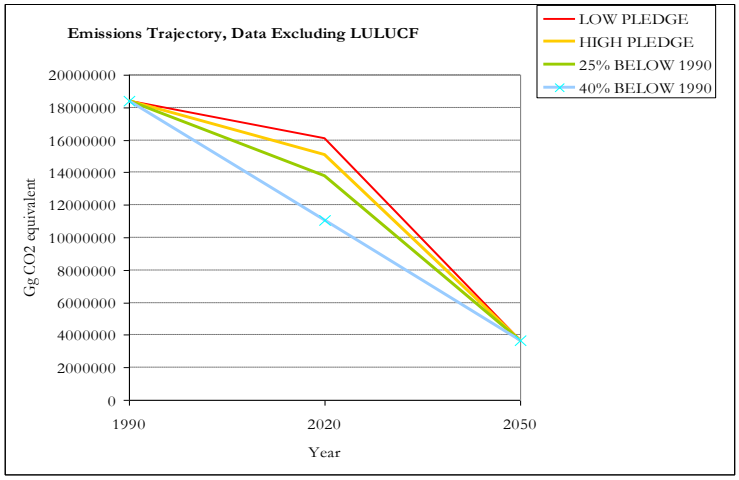
Path to 2050

The IPCC also notes that to stabilize concentrations at 450 ppm CO_2e, Annex I Parties would not only have to reduce emissions between 25-40% below 1990 levels by 2020 but reduce their emissions 80-95% below 1990 levels by 2050 (Box 13.7, Chapter 13).[19] See **Figure 2** which depicts the emissions trajectory associated with the low and high pledges if a goal of reducing emissions by 80% below 1990 levels is obtained by 2050. If Annex I Parties agree to the lower pledges, emissions must be reduced an additional 77% by 2050. On the other hand, if emissions are reduced to 40% below 1990 levels by 2020, emissions must be reduced an additional 67% by 2050. Thus, the emission reduction achieved by 2020 is a significant determinant of the steepness of the trajectory of emissions cuts in later decades.

Figure 2 Annex I Party Greenhouse Gas Emission Trajectory to Reduce Emissions 80% below 1990 Levels by 2050

Data exclude international bunkers. Trajectory is linearly interpolated. Source: UNFCCC inventory. "Low" refers to low emission reduction pledges; "high" refers to high emission reduction pledges, as some countries have put forward multiple pledges.





19 A 450 ppm CO_2e goal is associated with a 26 to 78% risk of overshooting a 2ºC goal (Meinshausen 2005).

CONCLUSION

This analysis has been performed to (1) enable comparability of and (2) facilitate the aggregation of the emission reduction pledges that have been proposed by Annex I Parties.

Regarding comparability, the data demonstrate that the metric chosen to compare emission reduction pledges can lead to very different outcomes. Moreover, the choice of the base year, relative versus absolute reductions, and inclusion versus exclusion of LULUCF can significantly alter the stringency of the proposed emission reductions for any given country. Any exercise in comparability assumes that consistent data will be available among countries. Any move away from a consistent accounting framework, as under the Kyoto Protocol, will inevitably impact the assessment of relevant effort. This also extends to consistent treatment of financing for forest emission mitigation in developing countries, which may be characterized as a financial contribution or a part of Annex I mitigation effort but should not be counted as both.

Absolute Reductions

- Comparability of effort in terms of absolute emission reductions does not account for differences between Parties with large emission profiles and those with small emission profiles. However, if the global community decides to adopt a comparability metric that is not based on absolute emissions reductions, it will be of critical importance to evaluate how much these pledges achieve in terms of absolute emission reductions, as this metric is the only measurement relevant to the goal of stabilizing the global climate.

- When comparing pledges in terms of the percent emissions reduction below different baselines, the choice of a base year can have significant implications on the magnitude of the emission reduction pledge for any given country. Also, this analysis demonstrated the importance of resolving how LULUCF emissions are to be estimated before final commitments are determined. If LULUCF emissions are excluded in emission reduction pledges, it will be necessary to examine the net impact of emissions pledges and emissions and sinks from LULUCF to provide an accurate measurement relevant to the state of the global climate.

Per Capita Reductions

- When pledges are compared in terms of per capita emissions, there is great divergence between Parties with growing populations and those with stable populations. A comparability metric based on the change of per capita emissions over a period of time does not favor those Parties with populations increasing at a faster rate than emissions.

Emissions Intensity Reductions

- While a rough measure of how effective an economy is in reducing emissions, this comparison demonstrates the significant divergence in emissions intensity both in 2005 and 2020 among Annex I Parties, based on current emission reduction pledges.

The exercise in aggregating the emission reduction pledges shed light on additional mitigation that will be required by Annex I Parties in the short term and in later decades. As the data demonstrate, even the high pledges fall short of the lower spectrum of emissions reductions that the IPCC notes is necessary to stabilize at 450 ppm CO_2e. At a minimum, this analysis demonstrates the importance of maintaining the higher pledges. If the pledges are not ratcheted up even beyond the highest pledges, this analysis shows that the additional reductions required between 2020 and 2050 would be quite significant, with emissions dropping roughly 2.5% annually to reach a goal of 80% below 1990 emissions levels by mid-century. In some cases, the potential turnover in capital stock may be well beyond what is technologically or politically feasible in a 30-year time period, based on historical trends.

Lastly, this analysis treated all emission reduction pledges similarly, irrespective of their legally binding nature. Yet it is important to note that for those Parties that announced, rather than legislated, their emission reduction pledge – the majority assessed here – until mechanisms are adopted to carry out these emission reductions, there is a chance that even these lower pledges will not be met. Legally binding mechanisms to achieve reductions signal long-term commitment and will have more durability to withstand changes in the political economy. Also, this analysis included those reductions that would be achieved via international offsets. Even if these reductions prove real and additional, if Annex I Parties rely significantly upon international reductions, the potential for durable domestic transformation of greenhouse gas-intensive activities may be weakened.

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