Appendix 1: Further detail on the four pledge cases and the differences between estimates

This appendix relates to the four pledge cases presented in Chapter 3 and describes: (1) factors included in the construction of the cases, (2) differences between estimates for the same pledge case and (3) important other factors that could affect emissions, but are not included in the four cases.

Table A1 elaborates on the results in Chapter 3 to provide more detail on the findings at an Annex I (industrialized) country and non-Annex I (developing) country level. Estimates for international transport emissions, which are needed to calculate a global total, are also included in the table.

Note that the median results in Table A1 do not simply sum up to the median global results in Chapter 3. The reasons for this are as follows:

1. There are a different number of estimates for Annex I countries than for non-Annex I countries. (the “n” in Table A1) Hence, the medians for Annex I and non-Annex I, respectively, have to be weighted by the number of estimates to obtain a global sum.
2. Some modelling groups omitted emissions from particular sectors (e.g. international aviation and bunker fuel emissions) or countries. As part of the harmonization procedure described in Chapter 3, these missing emissions were added back to individual estimates where they were missing.
3. The sum of global emissions of the different modelling groups were further adjusted in Chapter 3 so that they correspond to a common emissions level in 2005.

The results in Chapter 3 are obtained after these adjustments are made.

Table A1: A detailed account of the range of results found by different groups

$GtCO_2e$	Historic emissions[1]		Emissions in 2020				
	1990	2005	Business-as-usual[2]	Unconditional pledge		Conditional pledge	
				Lenient Rules **(case 1)**	Strict Rules **(case 2)**	Lenient Rules **(case 3)**	Strict Rules **(case 4)**
Annex I (exc. LULUCF emissions)							
n	13	12	11	11	11	13	13
High	20.6	20.5	25.6	25.1	22.9	19.6	17.4
80th	19.5	18.8	21.2	21.2	19.4	18.8	16.7
Median	**19.0**	**18.3**	**20.3**	**20.3**	**19.1**	**18.1**	**16.0**
20th	18.8	18.0	19.3	19.3	18.1	18.0	15.6
Low	17.2	16.9	18.2	18.2	17.2	17.6	15.3
Non-Annex I (inc LULUCF emissions)[3]							
n	*3†*	*5†*	*8*	*8*	*8*	*8*	*8*
High	18.4	26.3	37.7	35.1	35.1	34.2	34.2
80th	17.5	25.0	36.4	34.1	34.1	33.5	33.5
Median	**16.2**	**24.0**	**34.9**	**32.3**	**32.3**	**31.9**	**31.9**
20th	14.5	22.4	33.7	30.8	30.8	30.0	30.0
Low	13.4	22.2	31.1	29.4	29.4	28.8	28.8
International transport							
n	*3*	*2*	*6*	*6*	*6*	*6*	*6*
Median	**0.6**	**1.1**	**1.3**	**1.3**	**1.3**	**1.3**	**1.3**

All emissions in this Figure and Chapter refer to $GtCO_2e$ (gigatonnes or billion tonnes of carbon dioxide equivalents) —the global warming potential-weighted sum of six Kyoto greenhouse gases, that is, CO_2, CH_4, N_2O, HFCs, PFCs and SF_6, including LULUCF CO_2 emissions.

n = number of studies; High = maximum of the range; Low = minimum of the range; 20th-80th = 20th and 80th percentile values of the range
1. Note that there is variation in historical emissions where groups have used different data sources, especially for non-Annex I countries
2 - Most groups did not report business-as-usual emissions for Annex I countries in their publications; many of those shown here were requested separately from the modelling groups
3. There is a smaller sample size for non-Annex I countries as fewer groups covered this and some only provide emissions data excluding LULUCF at a non-Annex I country level.
† - Only a few modelling groups provided 1990 or 2005 data for non-Annex I countries, since these data were not required to estimate the impact of the non-Annex I pledges

1. DIFFERENCES BETWEEN THE FOUR PLEDGE CASES

The following factors have explicitly been taken into account in the construction of the four pledge cases.

Unconditional versus conditional pledges

Many countries' pledges have conditions attached. Sometimes countries have a range of pledges with conditions attached to the high end of the range. Other times conditions are placed on a single target. Most countries are not specific about what would constitute meeting the conditions, making it hard to assess which pledge is most likely to be implemented. The studies reviewed in this assessment dealt with these conditions in a

variety of ways: some reported simply high and low estimates; others assumed that if the conditions were not met then countries would instead follow a business-as-usual path.

In this assessment we do not make a judgement on whether countries will implement these conditional pledges or not. We instead present two types of pledge cases – those in which the (lower ambition) unconditional pledges are implemented (cases 1 and 2) and those in which the (higher ambition) conditional pledges are implemented (cases 3 and 4). In the unconditional pledge cases we have assumed that, if countries specified conditions on their pledge, and did not include a separate *unconditional* pledge, then their unconditional target was equivalent to their business-as-usual path.

We find that if all countries were to implement their higher-ambition conditional pledges emissions could be around 2 to 3 $GtCO_2e$ lower in 2020, according to the median global estimate[1]. Detail on how this splits across industrialized and developing countries is given below. Note that, as explained below, the numbers indicated in the following headings give the range of *median changes* in emissions as a result of moving from pledge case 2 to 4 (i.e., moving to conditional pledges whilst "strict" accounting rules apply).

Conditionality of Annex I (industrialized) countries (0 to -2.7 $GtCO_2e$)[2]

A number of Annex I countries' submissions included a range of pledges with conditions attached. For example, Australia, the European Union and Russia all submitted a range of pledges. Other countries submitted a single target or list of actions but with conditions associated with delivering them. Canada, Japan and the US have conditions attached to their pledges and no alternative unconditional pledge. In this instance, as described above, the business-as-usual emissions were taken in the unconditional pledge cases[3].

From Table A1 it can be seen that if Annex I countries were to move from their unconditional to conditional pledges, emissions could be between 2.2 and 3.1 $GtCO_2e$ lower in 2020, depending on the stringency of the rules applied. This reflects the change in the median Annex I estimate in our sample. However, given the large spread of results at an Annex I aggregate level (shown in Table A1) the median Annex I estimate may not actually reflect the mid-estimate of the *change* in emissions brought about by moving from the unconditional to conditional pledges, as estimated by the modelling groups. Therefore, we have also looked at the median *change* in emissions across modelling groups (rather than the change in the median) as a result of the unconditional to conditional move. Modelling groups find that emissions could be between 0.7-3.2 $GtCO_2e$ lower in the "lenient" cases (i.e. the move from case 1 to case 3), with a median change of 1.8 $GtCO_2e$, and between 2.2-3.6 $GtCO_2e$ lower in the "strict cases" (i.e. the move from case 2 to case 4), with a median estimate of 2.7 $GtCO_2e$.

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[1] Modelling groups find a range of 2-5 $GtCO_2e$ lower emissions as a result of countries moving from their unconditional to conditional pledges.

[2] Numbers will not add precisely to the median estimates in Table A1 as the numbers in this section reflect the median *change* across studies, rather than the change in the median *estimate* which is reflected in Figure 2 in Chapter 3 and in Table A1.

[3] According to our estimates, if the pledges of these countries were treated as unconditional, rather than conditional, the median emissions would be 2.0 $GtCO_2e$ lower in the unconditional pledge cases than currently shown in Chapter 3

Hence emissions in 2020 from Annex I countries could be as much as 2.7 $GtCO_2e$ lower (central estimate) if they were to move from their unconditional to their conditional pledges.

Conditionality of non-Annex I (developing) countries (0 to -0.7 $GtCO_2e$)[4]

As is the case for Annex I countries, some non-Annex I countries (e.g. Mexico) included a range of pledges with conditions attached that, if fulfilled, would lead them to deliver the top of this range. Others submitted a single target or list of actions but with conditions associated with delivering them – for example, whether industrialized countries would provide adequate financial support (e.g. South Africa), technology transfer or capacity building.

For the non-Annex I countries, this is particularly relevant to the pledges of South Africa, Mexico and Indonesia (for that country's higher-ambition pledge[5]) which all have conditions attached.

From Table A1 it can be seen that if non-Annex I countries were to move from their unconditional to conditional pledges, emissions would be 0.5 $GtCO_2e$ lower in the median estimate in our sample (shown by the move from case 2 to case 4). As in the case of Annex I countries, however, this estimate may not actually reflect the mid-estimate of the *change* in emissions from moving from unconditional to conditional pledges, as estimated by the modelling groups. Again, therefore, we have looked at the median *change* in emissions across modelling groups as a result of the unconditional to conditional move. Modelling groups find that emissions could be between 0.5-0.8 $GtCO_2e$ lower with a median estimate of the change in emissions being 0.7 $GtCO_2e$.

Hence emissions in 2020 from non-Annex I countries could be as much as 0.7 $GtCO_2e$ lower (central estimate) if they were to move from their unconditional to their conditional pledges.

"Lenient" and "Strict" rules

As described in Chapter 3, the rules surrounding the pledges and what countries can use to meet them also has a big impact on the level of emissions in 2020. In particular this relates to the accounting rules surrounding LULUCF activities and the use of surplus emission units. Again, we do not make a judgement as to how the negotiations on these issues will develop and we therefore present a range of plausible scenarios – specifically, two cases in which "lenient" rules apply (cases 1 and 3) and two in which "strict" rules apply (cases 2 and 4). As described in Chapter 3, the lenient pledge cases are designed to present an upper bound of emissions expected in this situation.

We find that "lenient" rules would result in emissions being around 1 to 2 $GtCO_2e$ higher than in the hypothetical "strict" case in which the impact of LULUCF credits and surplus emission units is assumed to be zero. Detail on how this splits across industrialized and

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[4] Numbers will not add precisely to the median estimates in Table A1 as the numbers in this section reflect the median *change* across studies, rather than the change in the median *estimate* which is reflected in Chapter 3 and in Table A1

[5] Indonesia's high case commitment of 41 per cent is not included in the Copenhagen Accord but was announced prior to COP15 by the President of Indonesia. Six of the modelling groups reviewed in this assessment have modeled this.

developing countries is given below. The numbers in parentheses show the maximum expected increase in annual 2020 emissions from each of these issues, which is reflected in the "lenient" cases (note numbers are not additive as we assume that aggregate Annex I emissions cannot be higher than business-as-usual projections).

LULUCF accounting rules (0 to +0.8 $GtCO_2e$)

Accounting rules are still being negotiated to determine the extent that LULUCF activities in Annex I countries could be used to meet their targets for the period after 2012. Most Annex I pledges are based on the accounting approach used for targets in the Kyoto Protocol, which excludes LULUCF emissions from emission targets, but does allow the use of LULUCF credits to meet those targets. These LULUCF credits can make up for increased emissions in other sectors (see Box 3b in Chapter 3 for more details).

Importantly, if credits are now given for carbon removals from existing forests or other sinks that would have occurred without policy intervention, then this may have the unintended effect of increasing net emissions to the atmosphere. This is because these credits can be used to meet emission targets, and this would displace mitigation action in other sectors. Hence, some planned mitigation actions may be replaced by credits for forests that would have been planted and taken up carbon in any case. We term this type of credits as "lenient LULUCF credits".

Most proposals in the negotiations would limit the number of LULUCF credits by using historical or reference level baselines[6]. Existing estimates suggest that "lenient LULUCF credits" could potentially be as high as 0.8 $GtCO_2e$ annually or approximately 4.2 per cent of Annex I 1990 emissions[7]. In the creation of the "lenient" pledge cases in Chapter 3 we assume a maximum increase in 2020 emissions of 0.8 $GtCO_2e$.

Carry-over of surplus units from the first commitment period (0 to +1.3 $GtCO_2e$):

Surplus emission units can arise because some countries have exceeded their targets in the first commitment period of the Kyoto Protocol – either due to ambitious policy or for non-climate policy reasons. Where this has occurred countries could (as most with a surplus have argued that they should) carry-over, or "bank" [8], this surplus for use in the next commitment period. Surplus emission units from previous commitment periods, if sold or used domestically to displace mitigation activity up to 2020, reduce the stringency of 2020 emissions and hence increase estimates of 2020 emissions. The total surplus by 2012 at the end of the first commitment period is estimated to be 9 to 13 $GtCO_2e$ of surplus emission units[9]. If fully purchased this

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6 There are also issues around how to account for harvest wood products or remove natural disturbances and extreme events(force majeure) that could potentially provide countries with extra credits.

7 Based on a maximum of the estimates provided by PIK PRIMAP, Woods Hole Research Centre and the Joint Research Centre of the European Commission. This maximum corresponds to 'the party preferred option' for LULUCF accounting rules, as estimated by PIK PRIMAP (October 2010). The full range of estimates from these groups ranged from 0-4.2 per cent of Annex I 1990 emissions

8 Banking units from one commitment period to the next so earlier mitigation activity can be used to meet targets in later years.

9 den Elzen et al., (2010) Point Carbon (2009) Rogelj et al. (2010) Schaeffer (2010).

could, therefore, displace up to 1.3 $GtCO_2e$[10] of mitigation in 2020. In the creation of the "lenient" pledge cases, we assume a maximum impact of 1.3 $GtCO_2e$ on 2020 emissions as an upper bound to the impact of this issue.

Note that the actual implications for 2020 emissions depend not only on how this surplus is used over the accounting period but, more importantly, whether there are any countries willing to buy these surplus emissions units to meet their goals despite questions about their environmental advantages (e.g. den Elzen et al., 2010b). On the other hand, just because surplus units exist does not mean they will be used, as demonstrated by the current commitment period in which countries have, in aggregate, exceeded their targets, leading to the carry-over from this commitment period estimated above. If countries do not sell their surplus units then their emissions will effectively follow the business-as-usual pathway minus any domestic mitigation effort. So their impact would depend on whether those with a surplus could find a willing purchaser that would displace domestic mitigation with allowances often not associated with additional mitigation action. Also, the surplus might not be carried over if a new international regime is adopted which restricts "banking" of earlier surplus credits. Hence the "lenient rules" case represents an extreme situation in which countries use all of the available surplus credits by 2020 to displace mitigation efforts.

Creation of new surplus units in a possible second commitment period: (0 to +1.0 $GtCO_2e$):

Further surplus emission units can arise if countries (such as Russia, Ukraine and Belarus) are allocated emission units significantly above the estimated business-as-usual level in the second commitment period.

Many modelling groups in our sample have not analysed this situation, or they have simply assumed that these new surplus emission units would not have an impact on emissions in 2020 (i.e., would not be traded). The modelling groups that that did analyse this situation[11] found that, if emissions remain above business-as-usual, the use of new surplus emission units by Annex I countries in 2020 could lead to an increase in global emissions up to 1 $GtCO_2e$ (for the "unconditional pledge case). Estimates of different modelling groups range from 0.3-1.0 $GtCO_2e$[12]. For the conditional pledge case, global emissions in 2020 could be up to 0.6 $GtCO_2e$ higher (range: 0-0.6 $GtCO_2e$)[13] . The range reflects different business-as-usual assumptions across modelling groups.

In constructing the "lenient" pledge cases we report what modelling groups themselves have estimated to be the impact of new surplus emission units – i.e., a

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[10] Assumed total AAU carry-over to be equally distributed over 10 years see den Elzen, M.G.J., Roelfsema, M. and Slingerland, S. (2010b) Dealing with surplus emissions in the climate negotiations after Copenhagen: What are the options for compromise?, Energy Policy 38: 6615–6628. Note, the range presented in the subtitle (0 to +1.3 $GtCO_2e$) refers to the full range of possibilities

[11] We have estimates of new (next commitment period) surplus emissions units from the following modelling groups: Climate Action Tracker, FEEM, IIASA (GAINS), Grantham, PBL and Project Catalyst

[12] This is the full range of the estimates of studies that did analyse this issue.

[13] This is the full range of the estimates of studies that did analyse this issue.

range of 0 to 1.0 $GtCO_2e$ on 2020 emissions depending on the study[14], which is reflected in the subheading above.

Note that, as in the carry-over of surplus emissions from the first commitment period, the impact of these new surplus units would also depend on how they were used over the commitment period and whether countries were willing to buy such units. The upper end of the estimates thus represent the more extreme case in which countries use all the surplus allocation by 2020 to displace mitigation efforts.

It should be noted that the above issues are interdependent and will result in different emission reductions depending on the order in which they are implemented. Hence the numbers presented above cannot simply be added together and are, therefore, not easily traceable to the median results reflected in the pledge cases presented in Chapter 3. In the reviewed studies, the total impact from these options (if taken together) would be a reduction in global emissions of 4 $GtCO_2e$ (reflected in the move from Case 1 to 4 in the table), with a full range across studies of 3-8 $GtCO_2e$.

2. DIFFERENCES BETWEEN ESTIMATES FOR THE SAME PLEDGE CASE

Chapter 3 showed a large range of estimates across studies even after separating out the different policy options reflected in the four pledge cases. The range in estimates is largely driven by the following uncertainties (numbers in parentheses give the range of 2020 emission estimates that can be attributed to each of these uncertainties):

LULUCF emissions (± 4 $GtCO_2e$)

At the global level, emissions from LULUCF are subject to a high level of uncertainty and some emission sources or sinks are not always included in national emissions data or targets. The IPCC estimates that the uncertainty around these emissions is ±4 $GtCO_2e$[15] which accounts for a large part of the discrepancy between estimates of the different modelling groups.'

Large uncertainty applies in particular to anthropogenic emissions from peat. Global emissions from peat are estimated to be be about 1.7 $GtCO_2e$, with an uncertainty of around ±1 $GtCO_2e$[16]. This is a particular issue for Indonesia where peat has been incorporated in the country's business-as-usual emissions and planned mitigation actions. Modelling groups need to avoid double-counting these emissions in both their global estimates and Indonesia's emissions. This uncertainty may be partially reflected in the range of estimates in the pledge cases as different modelling groups have made different assumptions about these emissions.

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[14] The 0 $GtCO_2e$ impact reflects those studies that either did not estimate the impact of new surplus units or judged that those new surplus units would not have an impact on actual emissions (e.g., if other countries don't purchase them)

[15] See: http://unfccc.int/methods_and_science/lulucf/items/4122.php note that the uncertainty around the central estimate is in tonnes carbon (1.1 GtC) not carbon dioxide (4$GtCO_2e$)

[16] Joosten, H. (2009) The Global Peatland CO_2 Picture, Wetlands International. http://www.wetlands.org/LinkClick.aspx?fileticket=o per cent2bd per cent2bTaPldLI per cent3d&tabid=56. The uncertainty range is estimate based on an uncertainty bound of 20 per cent applied to the estimate for drained peatland (±0.3 $GtCO_2e$) and the range of estimates of peat fire emissions (±0.5 $GtCO_2e$).

In addition, the treatment of emissions and sinks from LULUCF (and its use for future targets) in Annex I countries is a source of uncertainty which is partially reflected in the range of estimates under each pledge case. Emissions data tabulated by the Secretariat of the Framework Convention on Climate Change (UNFCCC) indicate that Annex I Parties were collectively a net sink of anthropogenic LULUCF emissions of around 1.6 $GtCO_2e$ in 2007. This is attributed mostly to historical forestry policies not undertaken for climate policy reasons. However, it is not always clear which of the sinks included in UNFCCC reporting should be considered as anthropogenic emissions by climate models. For example, there may be an inconsistency between the emission sources considered by the UNFCCC and other institutions, or inconsistent identification of direct and indirect anthropogenic emissions. Some groups estimate that Annex I LULUCF is a net source of emissions[17]. This therefore could lead to a range of about 2 $GtCO_2e$ between those groups that assumed a large net sink from LULUCF emissions in 2020 and those that assumed a small net source.

Note that since the uncertainties in this section are interconnected, they are also not additive. That means that their components cannot be added together to obtain the sum of ±4 $GtCO_2e$ which was quoted at the beginning of this section.

Baseline emissions (-3.4 to +2.4 $GtCO_2e$)

Many non-Annex I countries submitted pledges which specify a percentage reduction below an emissions baseline, but they did not specify the baseline.[18] This leads to a range of results across modelling groups because they estimated different baseline emissions. For those developing countries that measured their target against business-as-usual emissions, the estimates of 2020 emission levels after action varies across studies by -1.4 to +0.3 $GtCO_2e$ (around the median estimate) for the unconditional pledges and -0.9 to +0.2 $GtCO_2e$ for the conditional pledges.

Some countries stated their pledges in terms of carbon intensity targets (measured as improvement in emissions per unit of GDP). This requires further assumptions to determine expected emissions in 2020. For example, if economic growth (or the carbon intensity of growth) exceeds modelling groups' expectations, then emissions would be higher than they have estimated. Conversely, slower or low-carbon growth patterns would lead to lower emissions. This uncertainty means that 2020 emissions could be significantly higher or lower than the projections from different study teams. There is already a large variation in estimates of the business-as-usual in emerging economies (for example, the range in business-as-usual 2020 emissions of China across studies is 4.2 $GtCO_2e$ and for India, 1.2 $GtCO_2e$). A variation of ±2 per cent in the economic growth

[17] Modelling groups have handled the issue of Annex I LULUCF emission in variety of ways. Some groups applied a global LULUCF adjustment to country-level emissions excluding LULUCF emissions. This adjustment often implied a small net source from LULUCF emissions. Other groups applied a separate adjustment for Annex I LULUCF emissions, which again suggested LULUCF emissions were a small net source. Lastly, some groups did not apply any adjustment for Annex I LULUCF emissions.

[18] Since these pledges are not based on a single historical reference point they are sensitive to the various estimates of business-as-usual emissions in 2020 by the modelling groups.

rate assumptions in China and India is estimated by some groups to lead to 2020 emissions being ±2 $GtCO_2e$[19].

Lastly, for Annex I countries there is some uncertainty around the base year emissions against which targets are set. For some cases it is unclear whether the base year includes LULUCF emissions. This factor can add an uncertainty of around 0.1 $GtCO_2e$ to estimates in this report of Annex I emissions.

Taken together these uncertainties can lead to a range around median emissions from -3.4 $GtCO_2e$ to + 2.4 $GtCO_2e$.

Non-covered sectors and countries (-1.1 to +2.7 $GtCO_2e$)

All categories of anthropogenic emissions matter if we are to explore the full impact of emissions on the atmospheric concentration of greenhouse gases. This means that all sources, gases and countries must be included. Where studies were found to exclude a source of emissions, the median estimate from other studies was used. However, considering data scarcity, there is always the risk that studies omit some emissions from some sectors. There is also a risk of emissions being counted twice.

In particular, there are a number of emissions that are not included in the national targets and hence not covered by pledges, such as emissions from international aviation and maritime transport (bunkers). It is important that these be added to the totals, as most studies already do. The median estimate of the different modelling groups was 1.3 $GtCO_2e$ in 2020 with a range from -0.1 to +0.5 $GtCO_2e$ around it

In addition, emissions from developing countries that do not have mitigation pledges are found to have a large variation across modelling groups. We find a range of -1.0 to +2.2 $GtCO_2e$ around the median estimate of business-as-usual emissions in those countries.

Collectively, the uncertainties caused by incomplete coverage of sectors and countries and varying estimates of international aviation and marine transport lead to emission estimates from 1.1 $GtCO_2e$ below to 2.7 $GtCO_2e$ above the median estimate in our four pledge cases.

3. OTHER FACTORS THAT COULD AFFECT EMISSIONS, BUT THAT ARE NOT REFLECTED IN THE PLEDGE CASES

There are a number of other important factors that have not been included in the construction of the four pledge cases, but which could affect emissions in 2020. These are described in detail below (numbers in parentheses give the maximum annual 2020 emissions impact on the four cases):

[19] See Stern and Taylor (2010) and den Elzen et al. (2010a)

Double-counting of offsets (0 to +1.3 $GtCO_2e$)

The potential for "double-counting" of offsets towards both industrialized and developing country targets could lead to higher emissions in 2020 compared to estimates reported in the four pledge cases[20]. If an Annex I country used significant offset credits, such as CDM, from a non-Annex I country to meet their emission target, then emissions in the Annex I country would be higher and emissions in the non-Annex I country would be lower. If the offsets take place in a country without an emissions goal or if the offsets were additional to the pledges to the Copenhagen Accord then the global totals reported in the four pledge cases would be accurate even though emissions took place in different regions. If, however, the offset credits were used to meet Copenhagen Accord goals in *both* the selling *and* buying countries then there would be double-counting in the estimates of the pledge cases, and hence global emissions would be higher than reported in the four pledge cases.

The extent of this risk remains uncertain because neither potential buying nor selling countries have specified whether offsets will be used towards the pledges[21].

The risk of double-counting is not the same for all cases as it depends on the demand for offsets, which relates to the stringency of emission targets in the countries that might purchase them. If other factors, such as surplus units or LULUCF accounting weaken emission targets then there would be less demand for such offsets and less risk of double counting. For example, the pledge cases developed in Chapter 3 show that if countries maximised the use of surplus emission units and "lenient LULUCF credits" there might be little or no demand for offsets, particularly in the case of the unconditional pledges.

A simple estimate of the risk of double-counting can be made by crudely assuming that 33 per cent of the Annex I deviation from business-as-usual is met using offsets and that all of those reductions are also used to meet non-Annex I goals. This would lead to 0.4 $GtCO_2e$ of double-counting in the "unconditional pledge, strict rules" case and 1.3 $GtCO_2e$ in the "conditional pledge, strict rules" case (median estimates). A more detailed assessment would require a forecast of the flow of offset credits and an assessment of the extent to which countries plan on using these to meet national pledges. For the purpose of this assessment, we assume 1.3 $GtCO_2e$ as a reasonable estimate for the maximum potential impact from double-counting of offsets.

It is worth noting that this problem could be exacerbated if the offset credits themselves (e.g., CDM credits) did not represent an "additional" emission reduction compared to business-as-usual activities in developing countries. In that case, even counting them once would increase global emissions. If offsets were both "double-counted" and "non-additional", their impact on global emissions could be even greater than 1.3 $GtCO_2e$. .

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[20] With the exception of Case 1, "unconditional pledges, leniently applied", where Annex I emissions are already found to be close to business-as-usual levels, suggesting very little demand for offsets, and hence little chance of double-counting.

[21] None of the modelling groups assessed in this report have accounted for this risk in their main policy option and to do so robustly would require modelling on the supply and demand for credits and assumptions on countries' policies on additionality. While some groups attempted to make simple assumptions to quantify the extent of this risk most just assumed that emission reductions resulting from Annex I and Non-Annex I pledges would be additional to each other – i.e., no double counting.

Partial or ineffective delivery (0 to +2 $GtCO_2e$)

All of the studies reviewed assumed that countries will meet their targets. Any failure to do so, however, would lead to higher 2020 emissions; this would push emissions back towards business-as-usual levels. Conversely, well-designed policies that spur innovation and investment could allow goals to be exceeded.

A crude assessment of the impact of weak delivery was made by assuming that a certain percentage of global business-as-usual emissions is not delivered. Using 25 per cent would lead to 2020 emissions being about 0.5 $GtCO_2e$ higher in the lowest-ambition pledge case (case 1) and approximately 2 $GtCO_2e$ higher in the most ambitious pledge case (case 4). Exceeding goals by 25 per cent would lead to a symmetrical reduction in forecast 2020 emissions.

International climate finance (0 to -2.5 $GtCO_2e$)

Industrialized countries pledged in the Copenhagen Accord to provide "new and additional" finance of $30 billion for the period 2010-2012 and to mobilise jointly $100 billion a year by 2020 to address the needs of developing countries. This finance would be split between adaptation and mitigation. If delivered, resources on this scale have the potential to fund significant mitigation actions in countries that require support. However, it is not clear whether this financing would meet or exceed the funding required to satisfy the existing pledges contingent on external financing, since these countries have not yet specified the resources they require.

However, the scale of these resources means that they could leverage further reductions beyond existing commitments or deliver mitigation in countries that have not yet specified mitigation actions (representing roughly 20 per cent of global emissions). A recent study by Carraro and Massetti (2010) shows that the impact of climate finance packages depends on different assumptions about the level of mitigation actions in Annex I and non-Annex I countries[22]. The study finds that if 25 per cent of the $100 billion goes to mitigation this climate finance could reduce emissions by between 1.5 to 2.5 $GtCO_2e$ in 2020[23]. Another study (Houser 2010) estimates that the finance could deliver 1.5 $GtCO_2e$ of mitigation potential.

For this report,we estimate that climate finance of the scale mentioned in the Copenhagen Accord could lead to emission reductions in 2020 of up to 2.5 $GtCO_2e$, in addition to the reductions accomplished by the four pledge cases.

Ambitious domestic policy (0 to -1.5 $GtCO_2e$)

Another factor affecting emissions in 2020 are domestic policies or goals in national plans that might lead to a reduction in emissions beyond those of the Copenhagen

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[22] It also analyses the amount of international offsets used by Annex I countries, whether the funding leads to additional non-Annex I actions or not, the rules surrounding Annex I pledges, and the distribution of funding between mitigation and adaptation

[23] The study also assumed that that climate finance only supports additional mitigation actions and that the use of international offsets is limited to 20 per cent of the Annex I target.

Accord pledges. Three modelling groups (Climate Action Tracker, PBL and Project Catalyst) have estimated that domestic climate mitigation plans could lead to global emissions about 1.5 $GtCO_2e$ lower than the four pledge cases.