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Action and ambition for a global deal in Copenhagen

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Action and Ambition for a Global Deal in Copenhagen[1]

Summary:
This paper sets out an assessment of the latest national positions regarding emission reduction targets and actions going into the forthcoming negotiations in Copenhagen. These targets and intentions are quantified and translated into global emissions to give an understanding of how close we are to a possible agreement consistent with keeping temperature increase below 2℃.

Recent work on the latest science and economics of 2℃ shows that global emissions should be around 44Gt[2] carbon dioxide equivalents in 2020 to be consistent with a 50-50 chance of keeping temperature increase below 2℃. This is in line with the earlier work that underpins the IPCC conclusions.

Existing proposals from developed and developing countries, if delivered, constitute a big step towards a path consistent with the 2℃ goal. Taking countries' highest intentions would take the world to around 46Gt in 2020 a gap of 2Gt, which may be around 80% of the way from business as usual, depending on the interpretation of business as usual.

However, this analysis relies on the following key assumptions:

- Countries moving to or standing by their high intentions which may require the satisfaction of stipulated conditions concerning action from others
- Providing adequate finance and other support for high intentions in developing countries such as Indonesia and Brazil; this should not count offset finance, as this risks double counting, or with offset finance but matched with more stringent targets.
- That surplus emissions allowances from previous commitment periods do not weaken mitigation effort
- A system of rules for how to account for the emissions released and absorbed in the LULUCF sector (Land Use, Land Use Change and Forestry) to ensure the environmental integrity of emission targets

But with the right kind of collaborative spirit it is clearly possible for countries to get to together so that the necessary strong commitments can be made.

Analysing these intentions often relies on relating targets and actions to a concept of business as usual (BAU). BAU is a concept that is difficult to pin down because a group of polices that have been indicated or announced may or may not be included in BAU; further it can depend on what assumptions are made about structural change, for example how rapidly services grow as a share of the economy. Where an analyst uses a higher estimate of business as usual this can lead to a larger estimated gap. It also depends on what is included in these estimates and with significant uncertainty around current and future non-energy emissions there is scope for alternative estimates. We

[1] This is a work in progress incorporating announcements as of 4th December and subject to revision as many country plans are under review and could to change or be clarified, so this assessment will be subject to change. The interpretation of the targets are the authors. Many thanks to Chris Taylor and colleagues at the Grantham Research Institute, LSE and at UNEP for their helpful comments and guidance. Comments are very welcome.

[2] Gigatonne - which is a billion tonnes

suggest an uncertainty range of around -1Gt to +3Gt[3] around our estimate of the gap.

On the basis of the above calculations the gap would be 2Gt (range from 1Gt to 5Gt). Filling the remaining 2Gt gap would require greater ambition (especially from larger emitters in order to deliver required reductions), ideally combined with a contribution to emission reductions from international aviation and maritime sectors which is currently excluded from existing commitments, and greater efforts on REDD.

While there is much to do, we should not downplay how close we are to delivering an effective and credible global agreement.

What is a 'climate responsible' trajectory?

Research[4] by the LSE Grantham Research Institute explored a range of trajectories that result in a reasonable chance of keeping temperature increases below 2℃ and considered the economic implications. Annex 1 provides a more detailed summary. The scientific conclusions are consistent with the ranges in the IPCC. Since it is cumulative emissions over time that matter most to eventual temperature increase, less early action means more costly and sharper reductions to lower emission levels in the future.

The analysis concludes that **emissions should be around 44Gt in 2020**, representing a sensible "climate responsible" target from a cost and risk management perspective[5]. Lower emissions would also be consistent with 2℃ but require very strong action over the next decade. Higher emissions could still reach the same climate outcomes but require more drastic action after 2020 that would be considerably more expensive and may not be feasible. Current emissions are around 47Gt in 2010 (this would be close to 50Gt if it were not for the slowdown).

But how do current intentions collectively compare to 44Gt in 2020? The next section outlines and quantifies the commitments, targets, proposals and intentions of the major emitters[6]. It does not cover the plans for other countries although many of them are ambitious relative to their size such as Norway's commitment to reduce emissions by 40% on 1990 levels and the Maldives pledge to be carbon neutral by 2019.

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[3] This range is skewed to reflect the fact that we are unable to include peat emissions which could currently be around 1Gt to 1.5Gt. Other studies evaluating current intentions can be found at http://www.climateactiontracker.org/ and http://www.project-catalyst.info/

[4] Paper released on 1st December by Dr Ranger and Dr Bowen on the Grantham Research Institute website.http://www2.lse.ac.uk/granthamInstitute/pdf/bowenRangerPolicyBrief.pdf

[5] There is not as yet wide political agreement that such a level is an appropriate benchmark for a 2℃ trajectory. However, in our view this represents an appropriate level for this analysis.

[6] At the time of writing the countries in the more detailed tables are all in the top 20 carbon dioxide emitters and collectively account for more than 80% of global emissions Emission commitments excluded from the detailed tables are included in the overall numbers for developed countries..

Current developed country proposals

Table 1: Annex I - developed countries

Country	Description	Summary for 2020 emissions
US	Recent announcement that the US is prepared to table an emissions commitment of 17% below 2005 levels (3% below 1990[7]). Longer-term goals set out a pathway to an 83% below 2005 levels (80% reduction below 1990 levels) in 2050. Earlier draft legislation had additional provisions to buy 0.7Gt of forestry credits in 2020 and around $3bn for technology and adaptation. Currently emissions are 15% above 1990 levels.	3% below 1990 levels Plus support for reduced deforestation?
EU	Committed to reduce emissions to 20% below 1990 levels (currently 12.5% below) and 30% below 1990 levels as part of an ambitious global agreement. Indicated willingness to pay its share of significant finance flows from developed to developing countries including public finance that could support additional mitigation (including REDD).	20 to 30% below 1990 levels. Public finance for additional mitigation elsewhere
Japan	Japan has committed to reduce emissions by 25% below 1990 levels as part of an effective and comprehensive agreement at COP 15.	25% below 1990 levels
Russian Federation	Russian Federation committed to reduce emissions by up to 25% below 1990 levels. Russian emissions were 36% below 1990 levels in 2007.	25% below 1990 levels
Canada	Committed to reduce emissions by 20% relative to 2006 levels (equivalent to 3% below 1990)	3% below 1990 levels
Australia	Australia proposed to reduce its emissions to 5-25% below 2000 levels (15% to 33% below 1990 levels). Adoption of the most ambitious target of 25% depends on five conditions being met[8]. If not all the conditions are met but there is an international agreement with all major emitters the target would be -15%.	15% to 33% below 1990 levels

Based on authors understanding of existing positions

Some of the intentions have not yet been legislated as national commitments or action plans and others are reliant on particular conditions being met (e.g. on international agreement). Direct quantification of developed country targets is often straightforward as they are related to fixed historical emissions levels (although they tend to get complicated over how emissions and emissions reductions in land use change, afforestation, reforestation and land degradation will affect the target and the degree to which it is intended that international offset credits play a role).

For Tables 1 and 2 we have used emissions excluding LULUCF. In 2005 UNFCCC data suggests that Annex I countries provided a net sink of around 1.8Gt which would further reduce emissions so excluding it from this analysis

[7] The 3% figure is based on a 17% reduction of emissions excluding LULUCF. The target was announced based on emissions including LULUCF which would be 5.5% on 1990 emission including LULUCF. Depending on the accounting rules this is could be equivalent to about a 5% reduction on 1990 emission excluding LULUCF.

[8] http://unfccc.int/files/kyoto_protocol/application/pdf/australia010609.pdf reductions on 1990 levels based on recently revised UNFCCC 1990 data and including LULUCF in line with Australian targets

ignores the potential additional contribution they could make. It is excluded as its treatment is dependent in international rules which have yet to be determined. If it is used to meet targets it could reduce mitigation effort from other sources and possibly increasing emission levels beyond the totals in the next table. The table also excludes the potential for surplus credits from previous commitment periods being used to meet targets which, if permitted, could increase emissions in 2020.

Table 2: Current developed country proposals in 2020 (Gt CO_2e)

	Low intentions	2020 Emissions (Gt)	High intentions	2020 Emissions (Gt)
US	-17% on 2005	5.9	-17% on 2005	5.9
EU	-20% on 1990	4.5	-30% on 1990	3.9
Japan	-25% on 1990	1.0	-25% on 1990	1.0
Other developed countries		5.1		5.0
Developed country total		**16.3**		**15.7**

So current proposals would take developed countries to around 16Gt (and a significant deviation from business as usual) and around 16% below 1990 levels. It is not possible to determine whether such commitments are enough to take the world onto a 44Gt pathway until it is combined with developing country actions; and it would remain open to debate whether it represents an equitable share of the mitigation effort.

Targets and actions announced by developing countries

Table 3: Non-Annex I - developing countries

Country	Description	2020 Summary
China	Announced policies such as the energy intensity target in the current 5 year plan and 2020 targets for renewable and nuclear are set to reduce emissions by around 10% below business as usual (BAU). Recent announcement to set carbon intensity of output to 40% to 45% below 2005 levels by 2020.	Carbon intensity target and existing domestic policies lead to a 10% reduction on 2020 BAU
India	Plans and policies outlined in National Plan and in the 11th 5 year plan. Many are not quantified but domestic policy initiatives with policy targets collectively amount to a deviation from BAU of at least 7%. Recent announcement to set carbon intensity of output to 20% to 25% below 2005 levels by 2020.	Carbon intensity target and existing domestic policies lead to at least 7% reduction on 2020 BAU
Brazil	Announced target reduce its emissions by 36% to 39% on 2020 BAU levels (roughly 1/3 below 1990 levels) conditional on external financing and including significant REDD. Level of finance requirements not yet clear so not certain what is own action and what requires support. Had previously announced a National Action Plan that would reduce emissions by about 25% below BAU.	36% to 39% below 2020 BAU levels with external financial support
Indonesia	Pledged to reduce emissions below BAU by 26% unilaterally and 41% below with international	26% below 2020 BAU unilateral,

	support (around 1/6 to 1/3 below 1990 levels). The 26% target is to be achieved primarily through reduced emissions from deforestation and land use change.	41% below conditional
South Korea	Unilateral pledge to reduce emissions by 30% below their defined BAU (around 4% below 2005 levels).	30% below 2020 BAU
South Africa	Existing domestic policies expected to reduce emissions by about 10% from BAU. Government intention to follow a peak and decline scenario which allows for the initial build-up of base-load capacity, would equate to around 20% below BAU levels.	10% below 2020 BAU
Mexico	National plan (PECC) sets out detailed policies up to 2012 that are being enacted which are likely to reduce emission by around 5% in 2020 relative to BAU. Overall strategy to reduce emissions by 50% by 2050 implies emission being around 20% below BAU in 2020.	5% below 2020 BAU but longer term goals imply greater ambition

Note: Based on authors understanding of existing positions. Where countries have announced both a set of policies and a carbon intensity (or other) reductions we have taken the bigger of the two calculations in terms of reductions. This is of particular relevance to China and India where the announced intensity targets appear to imply lower than the reductions that would follow from announced policies (perhaps because there is some inherent caution on the implementation of the policies).

Again some of the intentions have not yet been legislated as national targets or action plans and others are reliant on certain conditions being met. This is particularly the case for Indonesia and Brazil where delivering on the high ambition targets is dependent on international support. As countries have expanded their scale of ambition they are understandably looking again at what support would be required. This highlights the importance of developed countries delivering substantial financial resources to support the willingness of some developing countries to implement ambitious policies.

Targets in developing countries pose additional challenges for quantification. The targets are usually related to business as usual[9] (BAU) – the path emissions would be likely to follow without further policy action. Reductions are therefore dependent on what assumptions are made about the BAU path. This is easier where countries specify reductions against a specified BAU but where they do not there can be significant variations in BAU estimates from

[9] There remains considerable uncertainty around developing country emissions and, in particular those relating to forestry and land use. The uncertainty in developed country BAU is much lower as targets are generally related to fixed historical points. Developing countries would commit to actions relative to a definition of business as usual. They would be committing to actions not the emission levels set out in this numerical exercise so this would introduce some uncertainty in climate outcomes were significant revisions in BAU to occur. Moreover, business as usual is a slippery concept that is inherently subjective and subject to significant uncertainties. What actions and commitments are included in BAU over time is subjective. It is easier where countries have specified actions against a defined path but other sources of estimates of BAU (largely the International Energy Agency) are used for our calculations where this is not possible. It is better, given its subjectivity, to avoid using BAU where possible. Indeed by combining growth rates, emissions per unit of output and associated mitigation actions, BAU becomes redundant.

different sources. Higher BAU estimates due to stronger economic growth, energy intensity or LULUCF sources would affect to estimates of emission outcomes.

The quantification of reductions in this analysis is predicated on the support provided action to reach higher targets (e.g. Brazil and Indonesia) being accomplished through public finance from developed countries, not carbon market offsets (which would count towards the developed country target) in order to avoid double counting. Offsets by developed countries would shift the balance of actual emissions and would imply finance flows to developing countries. We must be transparent about 'adding up' and avoid double counting, and thus estimate actual emissions after offsets; emissions in country A which buys the offsets are increased relative to the numbers here and emissions in country B which receives the finance flow are lowered (sells the offset). Nevertheless offsets through the carbon market can be a win-win for both developed and developing countries[10].

As a first step Table 4 considers only India and China's domestic policy targets and assumes other developing countries follow a BAU trajectory.

Table 4: Developing country policies (China and India) and the expected emission reductions[11] *See note for Table 3*

Country	Current policies	Savings in 2020 (GT CO2e)	Emissions in 2020 (GT CO2e)
China	Energy Intensity target 20% by 2010	0.5	
	Renewable energy 15% by 2020	0.5	
	Nuclear target 75GW by 2020	0.3	
		Total	11.2
India	Solar Mission 20GW by 2020	0.03	
	Renewable electricity 15% by 2020	0.07	
	Increasing forest cover 6 million hectares by 2017	0.07	
		Total	3.6
Other developing countries			16.7
International aviation and maritime			1.3
Total developing countries and international aviation and maritime			**32.8**

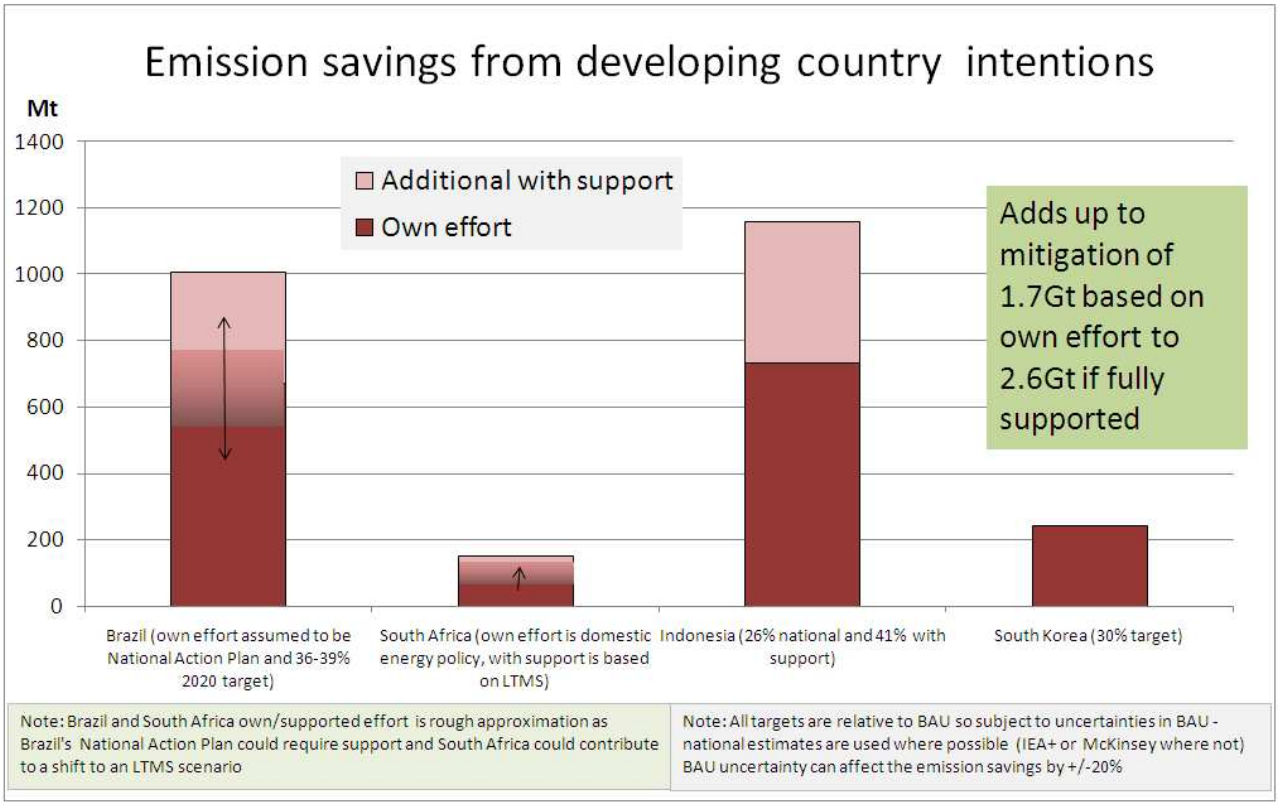
Carbon intensity targets pose additional challenges to quantification. Growth rates are already a key determinant in BAU but directly affect the total

[10] They can provide private finance to foster both the transformation of the energy system in developing countries and the transfer of and domestic development of low-carbon technologies; and they can reduce global mitigation costs.

[11] Estimates in this table are sensitive to uncertainty in business as usual. These estimates are based on assumptions on developing country forestry and energy emissions that are subject to a high degree of uncertainty. Changes in these levels will affect the volume of emission reductions that would need to be delivered. Anthropogenic emissions from peat are excluded and incorporating these would add up to 1.5Gt globally. This would provide an additional argument to go further in mitigation action including specific action to reduce emissions from peat to take advantage of these additional mitigation opportunities. Recent revisions in deforestation estimates may offset incorporating peat emissions to an extent. There should also be increased efforts to clarify current and hence likely future emissions to reduce this uncertainty.

emissions implied by carbon intensity targets. In this analysis it was assumed that China continued strong economic growth of over 8% but that existing domestic policies (emissions intensity target up to 2010 and 2020 nuclear and renewable targets) led to significant emission reductions on BAU. Our analysis suggests this leads to lower emissions than implied by the emission intensity target and hence it is the domestic targets that 'bite'[12] for the purpose of these calculations. The same also applies to India's emission intensity target.

The following graph provides estimates of some of the emission reductions from some of the targets proposed recently by **Indonesia, Brazil, and South Korea** along with those implicit in **South African** modelling[13]. Thus the reductions are additional to those in Table 4. In the case of Brazil they reflect a crude estimation of the share of the target that is "national effort" and the share that is conditional on additional support[14].



If these actions and targets were fully supported allowing Brazil and Indonesia to go to the top end of their targets but without using offset finance (which would lead to double counting) *then they would deliver an additional 2.6Gt mitigation relative to Table 4 taking the other developing countries down to 14.2Gt and the total developing country emissions to 28.9Gt.*

[12] This would imply China did not abandon or loosen existing domestic policies and targets. If economic growth was not as strong (i.e. below 6.5% per annum) then the emission intensity target would start to reduce emissions further. If growth was significantly stronger than has been assumed then this would push emissions up.

[13] Long Term Mitigation Scenarios (LTMS). Strategic Options for South Africa. Pretoria, South Africa: Development of Environment Affaires and Tourism (2007)

[14] As reflected by the graded shading and arrow in the figure below.

Where could these commitments, actions and targets take the world?

These tables show that all the major emitters have shown a willingness to take significant action to reduce their emissions from business as usual (BAU), whilst specific targets reflect a diverse range of national circumstances. The intentions and actions embodied in Tables 2, 4 and from recent developing country intentions are shown in Table 5 and show that **high intentions imply global emissions of just under 46Gt in 2020.** This figure is derived from the high end of the developed country commitments and reductions achieved in developing countries with adequate international financial support (if not using offset credits). **The gap relative to 44Gt in 2020 would be around 2Gt**[15] (or a range of 1Gt to 5Gt)**.** This already represents a saving of around 8Gt on BAU[16] so existing announcements would, if delivered, achieve around 80% of the reductions that are required.

Table 5: Total emissions from high intentions

	2020 total from high intentions
Developed country total	15.7Gt
Developing countries total	28.9Gt
International aviation and maritime	1.3Gt
Global total	**46Gt**
Gap	**2Gt**

However, these estimates rely on countries being satisfied that the conditions are met for them to reach high targets and, in particular, adequate support being provided to developing countries to facilitate their highest intentions. **Strong financial and technical support is essential to deliver these targets.** Furthermore it assumes that double counting through offsets is avoided and that there is no weakening of new targets through lax accounting rules for the LULUCF or surplus emissions allowances from the Kyoto period. Failure on these, or countries resorting to low intentions has the potential to significantly reduce the overall level of ambition calculated here. Clearly there are significant challenges involved in delivering such reductions but none of these are insurmountable and the required reductions could probably be achieved using current technologies and carefully designed policies. Technological progress would open up a further range of options.

Filling the gap

There are many ways in which the remaining gap could be filled and it is essentially a political question to be addressed by countries during the upcoming COP negotiations. The main options include some combination of:

- Developed countries increasing their high intentions.
- Other developing countries, especially larger emitters (given their size), coming forward with plans for further domestic reductions as part of a

[15] Or 3.5Gt if anthropogenic peat emissions continue at current levels to 2020
[16] Our business as usual (excluding peat) is 54Gt in 2020

global deal and/or an indication of what they could do with international support.
- Additional reductions in deforestation and other sources
- Incorporating international emissions from aviation and maritime to deliver additional mitigation[17].

Conclusions

This analysis shows that existing developed and developing country targets and plans can take us most of the way to global emissions of 44Gt in 2020, which is consistent with a 2℃ trajectory. This assumes that developed countries provide finance to support mitigation in developing countries that is not counted as an offset against their mitigation goals (or represents part of more ambitious goals). It shows that agreeing actions consistent with a 2℃ trajectory is feasible in Copenhagen.

This analysis relies on two key assumptions if such a positive vision is to come to fruition. First it assumes that countries are at least able to fully deliver on their stated high intentions and that some of them increase their intentions further. Given that many of these intentions are already ambitious the effort required to deliver should not be understated. Starting strongly on a low-carbon path is surely justified relative to the dire consequences of the alternative, but requires a radical restructuring of how our economies work in the coming decades. Secondly it requires countries to come together and agree to deliver on their intentions and provide the appropriate support to each other to ensure that in Copenhagen we enshrine these intentions as part of an international agreement.

Uncertainty in business as usual (BAU) could lead to larger estimates of the 'gap' if a higher BAU is included or estimates from peat and other LULUCF sources are thought to be higher. This leads us to suggest a range for the gap of 1Gt to 5Gt.

The countries of the world have made considerable progress towards securing a global agreement that delivers emission reductions which are commensurate with the scale of the challenge. All of the major economies understand that every country must act. We must now work together to cement and increase the indicative ambition shown thus far and turn this into a solid set of actions and commitments that will fill the gap and deliver the scale of reductions that are required to keep the temperature increase to below 2℃. The people and politicians of the world, community by community, nation by nation, will now determine whether we can create and sustain the international vision, commitment and collaboration which will allow us to seize this historic special opportunity and to rise to the challenge of a planet in peril.

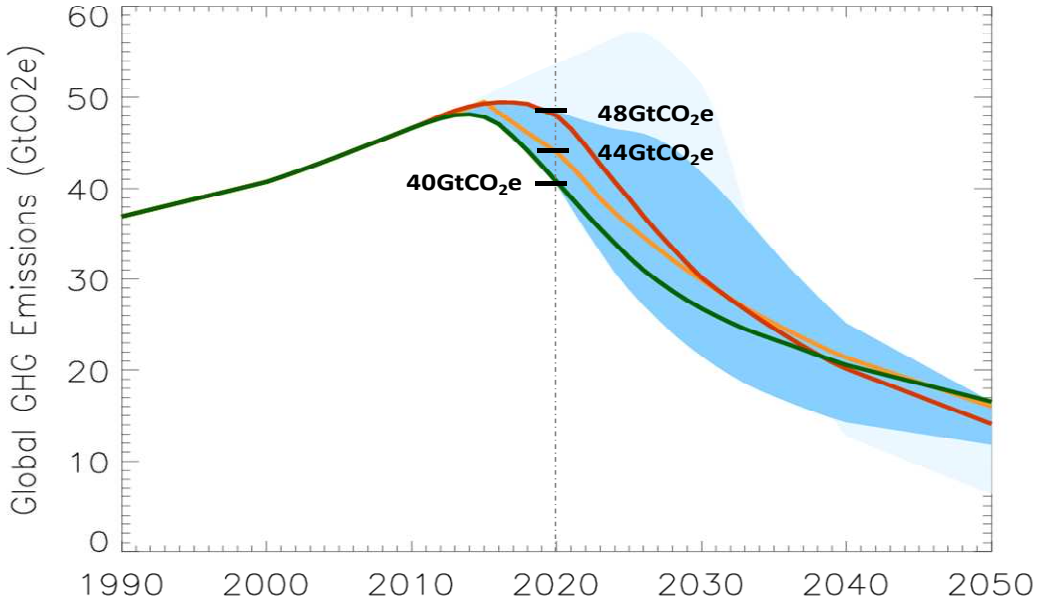
[17] For example, if we set a target of 20% below 2005 levels for international aviation and maritime emissions this would lead to around 0.5Gt of additional mitigation (if any offsets that were purchased were additional to current targets developed countries).

Annex 1: Defining 2020 emissions for a 2℃ goal. [18]

Trajectories that have a reasonable chance of keeping temperature rise to below 2℃

There are numerous trajectories that achieve similar climate outcomes. Since it is cumulative emissions over time that matter most, less early action means sharper reductions to low emission levels in the future. There are paths with emissions below 40Gt in 2020 that are consistent with 2℃ but are ignored as they require global reduction above 2% per annum on average from 2010 to 2020, which is not considered credible given existing structures of production. Trajectories nearer the top of the range in 2020 have to be near the bottom of the 2050 range and vice versa.

Figure 1: Trajectories that give a reasonable chance of temperature rise below 2℃ [19]



Climate responsible trajectories

A "climate responsible" trajectory is one that has a reasonable chance of avoiding expected temperature increases of more than 2℃, without entailing excessive costs or risks. Current leaders and policy makers are responsible for making a credible start on this trajectory, laying the foundations for greater reductions in the future while not missing low-cost opportunities and not passing much greater costs to future generations. The key points that define a trajectory and hence "climate responsibility" are:

- Emission peak – the sooner and lower the peak in emissions, the smaller the reductions that are required in the future. But it takes time to build the

[18] For more see: http://www2.lse.ac.uk/granthamInstitute/pdf/bowenRangerPolicyBrief.pdf

[19] These results are based on the Hadley Centre climate model MAGICC. There are some key uncertainties. The majority of this uncertainty is in the response of the Earth's system to human GHG emissions and comes from the carbon-cycle feedback, with a smaller contribution from climate sensitivity. This uncertainty, of the order of +5 to -10 Gt (skewed to negative) or more, suggests the need for lower targets to maintain the option to revise downwards if new science warrants stronger action. For 2050, around ±4GtCO2e uncertainty is estimated around the emissions projections themselves due to, in particular, the aerosol emissions and abatement options among different gases. Under a low aerosol scenario emissions must be well below 48Gt with very rapid declines. These trajectories give a 50% probability of 2°C.

domestic political consensus on how to act and implement the required policies and investments to achieve rapid reductions.

- Annual rate of decline – the faster the rate of reductions, the greater the overall costs, as it requires a more rapid deployment of new low-carbon technologies, early retirement of existing assets and a larger impact on energy prices.
- How low emissions go beyond 2050 – achieving very low levels beyond 2050 relies more heavily on technologies to decarbonise to very low levels in all sectors, which may not be feasible and is potentially much more expensive.

Implications for 2020 emissions

Feasible trajectories for keeping a reasonable chance of temperature increases below 2℃ requires emissions to be between 40-48Gt in 2020. As set out in their research this findings is consistent with the analysis that underpinned the IPCC conclusions. A later and higher peak in global annual emissions will mean fewer options subsequently and relying on the rapid emergence of technologies to drive very rapid emission reductions over the longer term, with more 'stranded assets'. This is a higher risk and higher cost strategy as lower-cost near-term options are missed and greater reductions are required in the longer term. 44Gt in 2020 requires global annual reductions of around 3.3% each year after 2020 and annual emissions of around 16Gt in 2050, which is plausible but still ambitious. **The 44GtCO_2e in 2020 path demonstrates the most appropriate balance of risks and opportunities.** It encapsulates the economic benefits of early action, while leaving time between now and 2020 for policies to take effect.

There is some flexibility in the date by which emissions must peak, but a later peak must be compensated for by more rapid reductions thereafter. With levels above 48GtCO2e in 2020, we estimate that the world would need to reduce annual emissions at an average rate of more than 4% per year between 2020 and 2050, to below 14 GtCO_2e in 2050, which would be considerably more expensive than earlier action.

Evidence shows that delays in participation in a global climate change policy regime are likely to increase the costs of hitting the target significantly, without benefiting the late adopters, and may make the target unattainable. Limiting the rise in global temperatures to a 2℃ ceiling above pre-industrial levels is demanding. But, with well-designed policies applied consistently across countries, industries and greenhouse gases, modelling exercises suggest it can be reached and need not cost more than a few percentage points of GDP, against a backdrop of continued strong economic growth. We should not see the route to the low-carbon economy merely or mostly in terms of cost and burden-sharing. These are innovations, investments and opportunities: green technologies could create the most dynamic and innovative period in economic history with many benefits (e.g. energy security, safety, biodiversity) beyond the fundamental one of managing climate change.