Chapter 2: Overview of climate science and international circumstances

1. The science of climate change
2. International action to limit climate change
3. The EU and UK share of international climate action
4. Implications for the fifth carbon budget

Under the Climate Change Act we are required to consider scientific understanding of climate change, international and European circumstances in advising on the level of carbon budgets. We published our assessment of these criteria in a separate report in October this year[1]. This chapter summarises our key findings from that report and their implications for the fifth carbon budget.

The main points from this assessment are:

- The evidence that global warming is happening, driven by human activity and with large potential impacts, is supported by many lines of research and agreed by the world's leading scientific bodies.
- The world is acting to tackle climate change. The internationally-agreed 2°C limit requires substantial global emissions reductions by 2030. The UK should continue to play its part.
- The EU's Member States have agreed to reduce EU emissions by at least 40% below 1990 levels in 2030. Our best estimate is that this requires a UK reduction of 53% below 1990 levels, within the range 50-56%.
- To stay on a cost-effective path with a likely chance of meeting to the 2°C limit, more effort will be required across the world than currently pledged, including from the EU.

Other relevant international aspects of recommending the carbon budget are considered elsewhere in the report. These include impacts on the competitiveness of UK industry (addressed in Chapter 4), plus the issues of whether or not to include the UK's share of international aviation and international shipping emissions, and the role of credits in meeting the budget (Chapter 6).

This chapter is set out in four sections:

1. The science of climate change
2. International action to limit climate change
3. The EU and UK share of international climate action
4. Implications for the fifth carbon budget

1. The science of climate change

The evidence that global warming is happening, driven by human activity and with large potential impacts, is supported by many lines of research and agreed by the world's leading scientific bodies[2]. Much of the information presented here is covered at length in the latest assessment by the Intergovernmental Panel on Climate Change (IPCC AR5)[3].

It is clear that the climate is changing as a result of greenhouse gas emissions. This is leading to rising temperatures and sea levels, retreating ice and other changes to the natural environment. Global average temperature has risen around 0.9°C and sea level around 20cm since the late 19th Century:

- The basic fact that greenhouse gases in the air warm the surface of the Earth has been understood for over a century and is well-established.

1 CCC (2015) *The scientific and international context for the fifth carbon budget*. Available at https://www.theccc.org.uk/publication/the-scientific-and-international-context-for-the-fifth-carbon-budget

2 See for instance Royal Society and US National Academy of Sciences *Climate Change Evidence & Causes* (https://royalsociety.org/~/media/Royal_Society_Content/policy/projects/climate-evidence-causes/climate-change-evidence-causes.pdf); and the *Climate Communique* written by 24 UK academic societies (http://www.iop.org/news/15/jul/file_65971.pdf).

3 https://www.ipcc.ch/report/ar5

- Greenhouse gases are being emitted by human activities (principally carbon dioxide from fossil fuel burning) at an increasing rate and are accumulating in the atmosphere. Emissions of other air pollutants have a net cooling influence, partially offsetting greenhouse warming to date.
- Trends in climate are also influenced by natural factors, including solar variations, volcanic eruptions and natural cycles within the climate system (such as El Niño).
- Global average surface temperature is now about 0.9°C above late-19th Century levels. Observed warming is not uniform and has led to many other changes (Figure 2.1) including changes in rainfall patterns, rising sea levels and the loss of ice from Greenland and Antarctica. Carbon dioxide emissions are also acidifying the oceans.
- The pattern of global warming over the 20th Century matches that expected from natural and human factors combined, and not that from natural factors alone. Human activity has clearly been the dominant driver of global temperature rise since at least the 1950s.

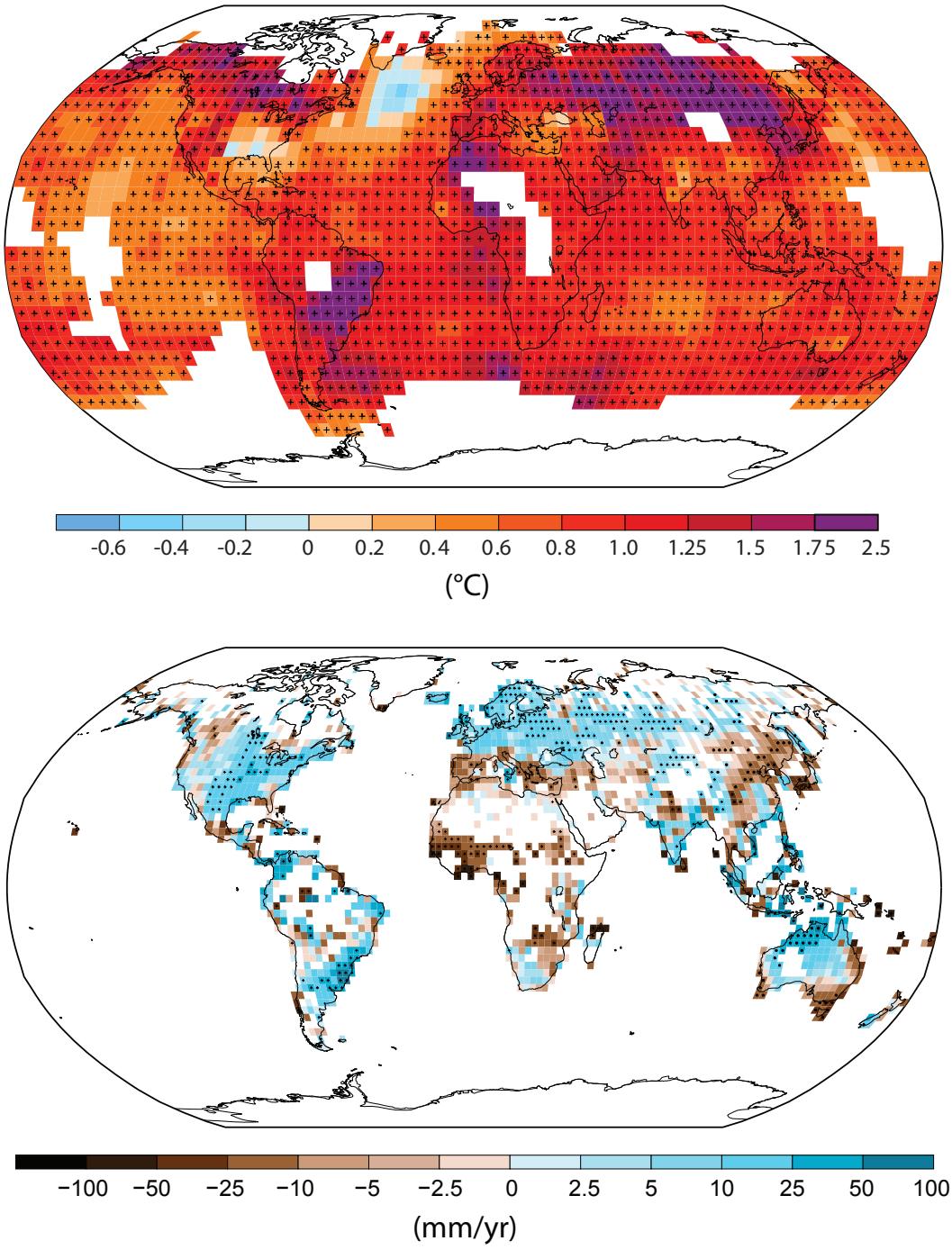
Many impacts are already being detected across the world, from changes in extreme weather and ecosystems to a slowdown in productivity gains for some key crops:

- Scientists are highly confident that, among other impacts, climate change is bleaching coral on reefs worldwide; greening and fruiting trees earlier in the year across Europe; reducing river flows across South Western Australia; forcing plant and animal species towards the poles and to higher elevations around the world; and negatively impacting those living in the Arctic.
- There has been a negative effect on the global growth in productivity of some key crops, with a reduction of 2 %/decade (0-5 %/decade[4]) for wheat, and 1 %/decade (0-3 %/decade) for maize. Some crops in Europe and southern South America have experienced gains due to climate change, while South Asia and wheat in Europe have incurred losses.
- European heat waves as strong as in 2003 (when crop yields fell, power stations were shut down due to overheating and the heat-related death toll ran into tens of thousands) are estimated to have been made at least twice as likely by human activity. A recent update suggests the warming since 2003 now makes it ten times more likely to occur again.
- The coastal surge brought to Manhattan by Hurricane Sandy in 2012 was made 20cm higher by sea level rise, increasing losses in New York by 30%. In addition, the above-average sea surface temperatures at the time increased its wind speeds and rainfall.

These impacts give an indication of the widespread and pervasive nature of climate risks.

4 Brackets indicate 10-90% confidence ranges.

Figure 2.1: Observed patterns of change in surface temperature (top) and precipitation (bottom)



Source: IPCC AR5.
Notes: Temperature changes (top) span the period 1901-2012 while precipitation trends (bottom) span 1951-2010 due to less complete coverage before 1950. Trends are only shown for grid boxes with substantial coverage over the period (other areas are white). Grid boxes where the trend is significant at the 10% level are indicated by a + sign.

Further emissions will lead to further warming and change. With rapid global action to cut emissions, total human-induced warming could be held below 2°C. Under baselines assuming no action, warming could exceed 6°C by the end of the century:

- Under baseline scenarios in which no action is taken, energy system models predict a continued increase in global emissions. As a result global temperature in 2100 would be 2.5-7.8°C (5-95% confidence range) above late 19th Century levels and rising.
- Under an ambitious mitigation scenario considered by the IPCC, in which emissions peak now and decline to zero or further before 2100, global temperature rise would be 0.9-2.3°C.
- Natural variability and other factors will continue to influence climate, especially on shorter timescales and at smaller spatial scales. Large volcanic eruptions, when they occur, will lower global temperature for a year or two. A major downswing in solar activity over several decades, considered possible but unlikely, would also lower global temperature by a few tenths of a degree.

There is no known simple threshold beyond which climate change moves from safe to dangerous. Some disruption and irreversible losses are expected at 2°C. Losses accelerate with warming, and very severe damage is expected in a world reaching 4°C. The impacts will be unevenly distributed and there are currently wide uncertainties about their magnitude:

- In previous CCC advice on the 2050 target and carbon budgets (which predates international agreement on the 2°C limit) we have proposed the world should seek to keep central (i.e. 50%) estimates of global temperature in 2100 close to 2°C above pre-industrial levels, and keep the probability of a 4°C rise to very low levels (e.g. 1%).
- This proposal reflected the fact that there is a range in projected future climate change for any given emissions path. The range comes from uncertainty in accounting precisely for all the processes and feedbacks in the climate system. Research is ongoing to narrow this range, but it remains wide.
- Uncertainty increases when translating climate projections into risks to people and the environment. Estimates point to large potential impacts, especially on the world's poor and vulnerable, but these are incomplete and often based on models which do not capture potentially important nonlinearities and compounding effects.
- IPCC AR5 concluded warming of 1.5°C above late 19th Century levels leads to high risk of damage from extreme weather and of losing sensitive ecosystems (such as those in the Arctic, on mountains and coral reefs). Warming of around 2.5°C brings high risk of large-scale singularities (such as irreversible ice sheet loss, leading to more sea level rise) and severe global impacts on the economy and environment. Warming of around 4.5°C puts global food security in doubt.

The increase in global temperature is determined mainly by cumulative carbon dioxide emissions over time. Annual emissions must therefore fall to near zero in order to limit warming. The allowable cumulative total for a likely chance of staying below 2°C will be exceeded in the mid-2030s if annual global emissions continue at the current rate:

- IPCC AR5 estimated the total carbon dioxide emissions over time consistent with staying below specific global temperature limits. To preserve a 50% likelihood of keeping warming below 2˚C, the total remaining allowable emissions from 2011 is around 1,100 billion tonnes of carbon dioxide ($GtCO_2$). For at least a 66% (i.e. "likely") chance, this total decreases to around 1,000 $GtCO_2$.
- These totals account for projected emissions of other greenhouse gases and particles but apply to global emissions of carbon dioxide only.

- If global emissions continue at the current rate of around 35 $GtCO_2$ per year, the total for a likely chance of staying below 2°C will be exceeded in the mid-2030s, and for a medium chance by the late 2030s.

The nature of climate change risks and the many unknowns make a simple cost-benefit approach to climate action untenable. The internationally-agreed 2°C limit to warming, and the UK's own emissions targets, are based on an approach which seeks to minimise the largest risks. On the basis of the latest climate science we judge that this level of ambition remains broadly appropriate for now.

Remaining uncertainties mean we will keep a watching brief on climate science and periodically review implications for UK emission targets.

2. International action to limit climate change

The UK's carbon budgets are domestic commitments, but set in the context of efforts worldwide to reduce greenhouse gas emissions.

The UN has formally adopted an objective to limit global temperature rise to 2°C, and countries are submitting pledges to reduce emissions beyond 2020. The aim is to adopt a new agreement, with legal status, in Paris at the end of 2015:

- International negotiations on climate change are governed through the United Nations Framework Convention on Climate Change (UNFCCC), to which 195 countries plus the EU are party.
- Under the 2009 Copenhagen Accord countries recognised the goal of limiting global temperature rise to no more than 2°C above pre-industrial levels. 86 countries plus the EU subsequently came forward with pledges to limit or reduce emissions in the period to 2020.
- At the Durban negotiations in 2011 it was agreed to deliver a new and universal greenhouse gas reduction agreement 'with legal force' by 2015, for the period beyond 2020. Key aims for the 2015 negotiations in Paris are a deal governing these post-2020 emissions pledges, financing and adaptation to the impacts of climate change, plus a mechanism to enhance ambition over time.

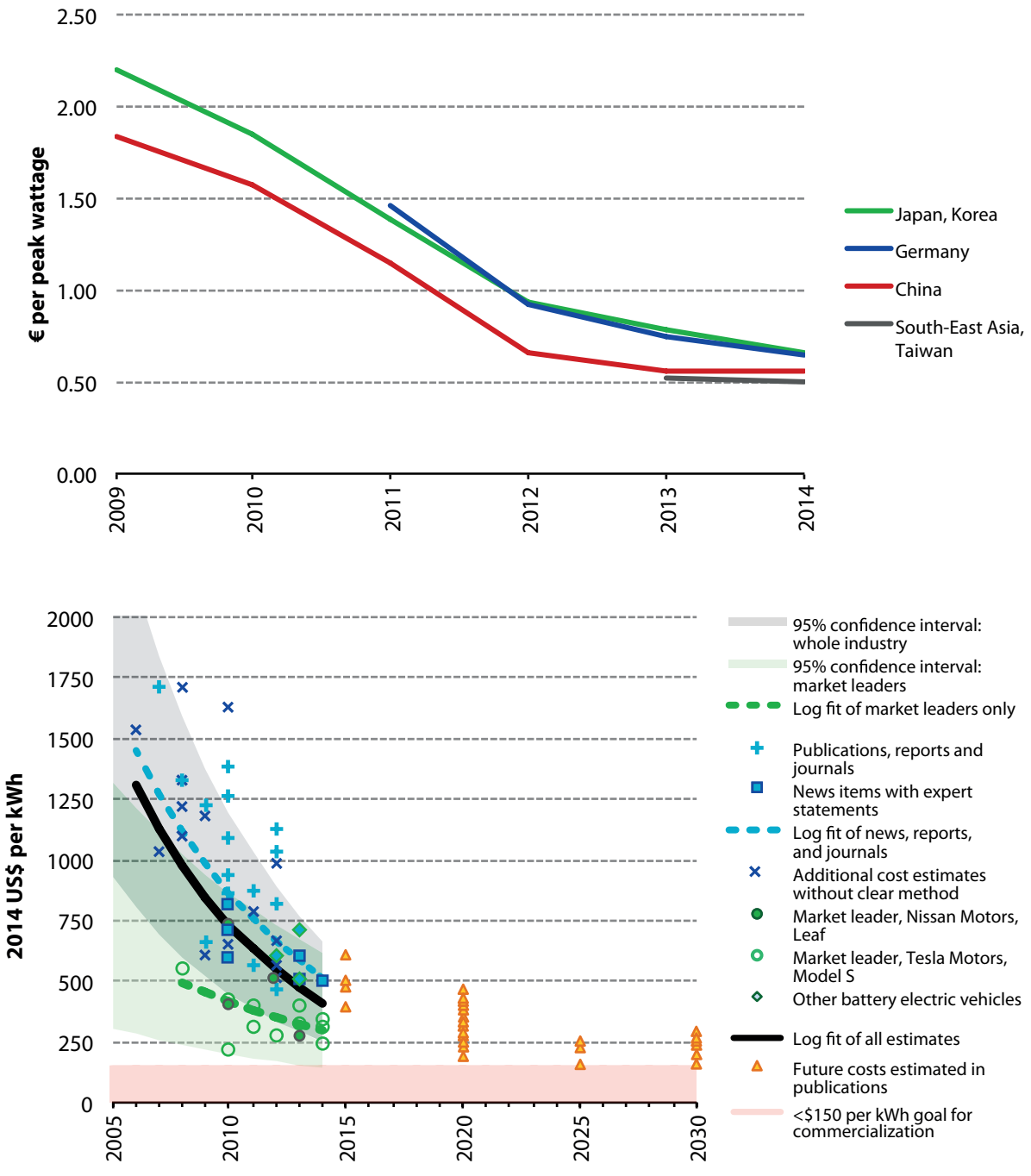
Many countries and sub-national bodies have made commitments for deep emissions reduction and are now delivering against these. Penetration of low-carbon technologies around the world is increasing, although these still account for a relatively small share of global energy production:

- As of November 2015, 162 parties to the UNFCCC had submitted pledges involving intended national actions and emissions targets for the period out to 2030. These currently cover over 95% of territorial emissions (excluding international aviation and shipping)[5].
- In 2013, 18% of global emissions were covered by some form of carbon pricing scheme and 76% of global transport emissions were covered by legislated fuel efficiency/emission standards in 2015.
- Deployment of low-carbon technologies (notably renewables and low-carbon vehicles) is increasing and more large-scale Carbon Capture and Storage (CCS) plants are in development. High deployment rates have led to large cost reductions for some technologies (Figure 2.2). As a result some low-carbon power sources can be cost-competitive with fossil fuel generation in many applications and parts of the world.

5 Correct as of 12 November

Despite these developments, annual global emissions rose 42% during 1990-2012. Fossil fuels are still expected to meet a large share of rising energy demand. Based on the continuation of current policies around the world, the International Energy Agency (IEA) predicts that emissions could grow a further 20% by 2040[6].

Figure 2.2: Developments in solar PV module prices (top) and costs of battery packs for electric vehicles (bottom)



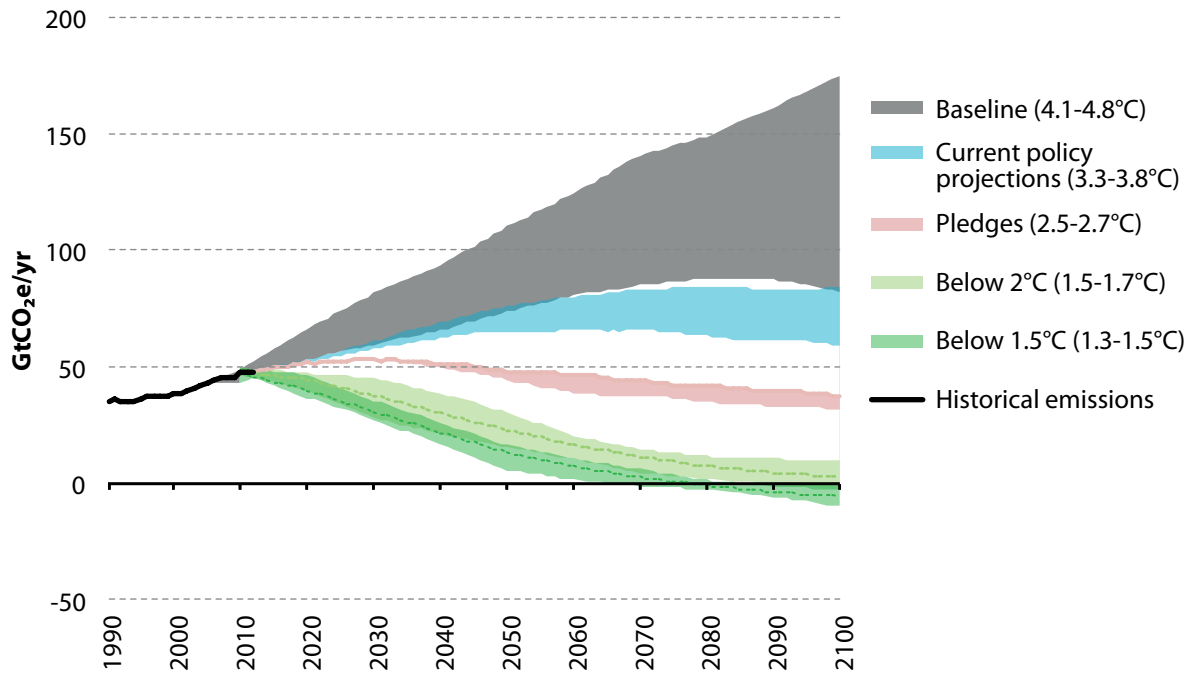
Source: www.pvxchange.com; Nykvist, B. & Nilsson, M. (2015) *Rapidly falling costs of battery packs for electric vehicles*, Nature Climate Change.
Notes: Battery pack costs reflect cost of lithium-ion batteries.

6 IEA (2014) *World Energy Outlook 2014*

Lowest-cost paths with a likely chance of staying below 2°C require global emissions to peak around 2020 with steep reductions thereafter. UN pledges made so far have measurably reduced the forecast of global emissions, but fall short of this lowest-cost path (Figure 2.3). There is scope to reduce the gap through increases in existing ambition and further commitments to reduce emissions beyond 2030:

- IPCC AR5 concluded that pathways likely (i.e. with at a least a 66% chance) to stay below 2°C show a 40-70% reduction in global greenhouse gas emissions by 2050, relative to the 2010 level of 49 $GtCO_2e$, and emissions near zero or below by 2100.
- Of the scenarios considered by the IPCC, those that were likely to stay below 2°C in 2100 but showed limited action to 2020 (consistent with current near-term projections) have emissions in 2030 in the range 29-44 $GtCO_2e$, with a central estimate of 42 $GtCO_2e$.
- Studies by the IEA[7] and the recent Deep Decarbonization Pathways Project[8] confirm such pathways remain technically feasible without changing global economic and development prospects. They do however require very large and rapid changes in energy generation and patterns of investment.
- Analysis of the latest UN pledges by Climate Action Tracker[9] suggests that global emissions are on track to reach 53-55 $GtCO_2e$ in 2030, compared to pre-pledge projections of more than 58-61 $GtCO_2e$. A more recent review by the UN concluded that the pledges add up to 53-59 $GtCO_2e$ in 2030[10].

Figure 2.3: Effect of the UN pledges on long-term global emissions pathway



Source: Climate Action Tracker (2015) *INDCs lower projected warming to 2.7°C: significant progress but still above 2°C.*
Notes: Solid red line reflects best estimate of impact of pledges. Dashed green lines reflect median within 10th to 90th percentile range.

7 IEA (2015) *Energy and Climate Change: World Energy Outlook Special Report*
8 Deep Decarbonization Pathways Project (2015) *Pathways to deep decarbonization 2015 report*
9 Climate Action Tracker (2015) *INDCs lower projected warming to 2.7°C: significant progress but still above 2°C.*
10 UNFCC (2015) *Synthesis report on the aggregate effect of INDCs*

Both the UK and EU have objectives to reduce their greenhouse gas emissions in 2050 to at least 80% below 1990 levels. These objectives remain appropriate in the light of the latest evidence regarding global emissions pathways consistent with 2°C:

- When advising on the UK 2050 target in 2008, we stated it was difficult to envisage a global climate deal which does not involve the UK reducing its emissions to a per person level consistent with the global average needed to meet the climate objective. This is because it will be hard to find other nations much below the average, especially in a world of substantially-declining emissions.
- On the basis of a world population around 9.7 billion in 2050[11], a 40-70% global cut in greenhouse gas emissions below 2010 levels is equivalent to emissions per person of 1.5-3 tCO_2e in 2050.
- Applying this per person average to a projected UK 2050 population of around 77 million[12] equates to a 72-86% reduction below 1990 levels. The UK's 2050 target of at least an 80% reduction is at the centre of this range. This would apply to all emitting sectors including international aviation and shipping.
- Applying the same logic to the EU28 as a whole leads to a 74-87% reduction below its 1990 level (again, including international aviation and shipping).

The UK is an important player in driving forward EU and international ambition. We will continue to monitor closely further international progress, in particular outcomes from the Paris conference and proposals to review and increase ambition post 2030.

11 Medium variant from UN (2015) *World Population Prospects, 2015 Revision*

12 Principal projection from Office of National Statistics (2015) *2014-based National Population Projections*. Note that this is different from the 2013 Low Migration variant projection of 74 million used in our October report.

3. The EU and UK share of international climate action

The EU's Member States have agreed a 2030 target for EU emissions of at least 40% below 1990 levels. This is also the EU's collective pledge for 2030 as part of the UN process. It is currently one of the more ambitious pledges:

- The agreement for at least a 40% reduction in emissions by 2030 compared to 1990 levels (equivalent to 35% below 2005 and 25% below 2012) specifically leaves open the possibility of increasing ambition beyond 40% in light of developments in Paris.
- The target is to be achieved domestically, without purchase of international offset credits.
- A wider set of measures have also been agreed as part of the 2030 framework. These include increases in EU-wide renewable generation and energy efficiency, and introduction of a Market Stability Reserve for the EU Emissions Trading System (EU ETS).

Our best estimate is that the EU 2030 agreement implies a reduction in UK emissions over the fifth carbon budget period of 53% below 1990 levels. The precise UK share cannot be known with certainty until final rules governing Member States' shares are agreed. Reflecting these uncertainties suggests a UK contribution to emissions reductions within a range of 50-56%. This has changed since we published in October an estimate of 54% within a range of 51-57%, to reflect more up-to-date information (Box 2.1):

- We calculate the UK share of the EU agreement in two parts: one part for sectors covered by the EU ETS and another for those not in the EU ETS. The UK share of the EU ETS cap is especially relevant as this is the basis on which participating sectors are currently accounted for in carbon budgets (rather than their direct emissions).
- The share of the EU ETS depends on several elements which make up the cap during the 2020s. Given allocation rules have yet to be finalised the UK share of this is currently uncertain. Our best estimate for the UK's share during the fifth carbon budget period (2028-32) is 590 $MtCO_2e$[13], within a range of 530-650 $MtCO_2e$ (Box 2.1).
- Our estimate assumes the impact of the Market Stability Reserve is neutral over the budget period. To the extent that allowances are placed in or released from the MSR, the UK's share of the cap could differ in specific years.
- The share of the EU agreement for non-traded emissions is subject to legislation that the European Commission is yet to publish, with more detail expected in 2016. Our current best estimate is 1,310 $MtCO_2e$, within a range 1,260-1,360 $MtCO_2e$.
- Countries are free to reduce emissions further than their non-ETS allocation should they deem it cost-effective.

13 All estimates of the UK share of EU action in this section are rounded to the nearest 10 $MtCO_2e$

Box 2.1: UK share of the EU ETS cap over the fifth carbon budget

Final rules have not yet been agreed for the distribution to Member States of the EU pledge to reduce 2030 emissions by at least 40% below 1990 levels. The UK share will depend on allocation rules for each of the traded sectors of the economy (covered by the EU's Emission Trading System – EU ETS) and the non-traded sectors:

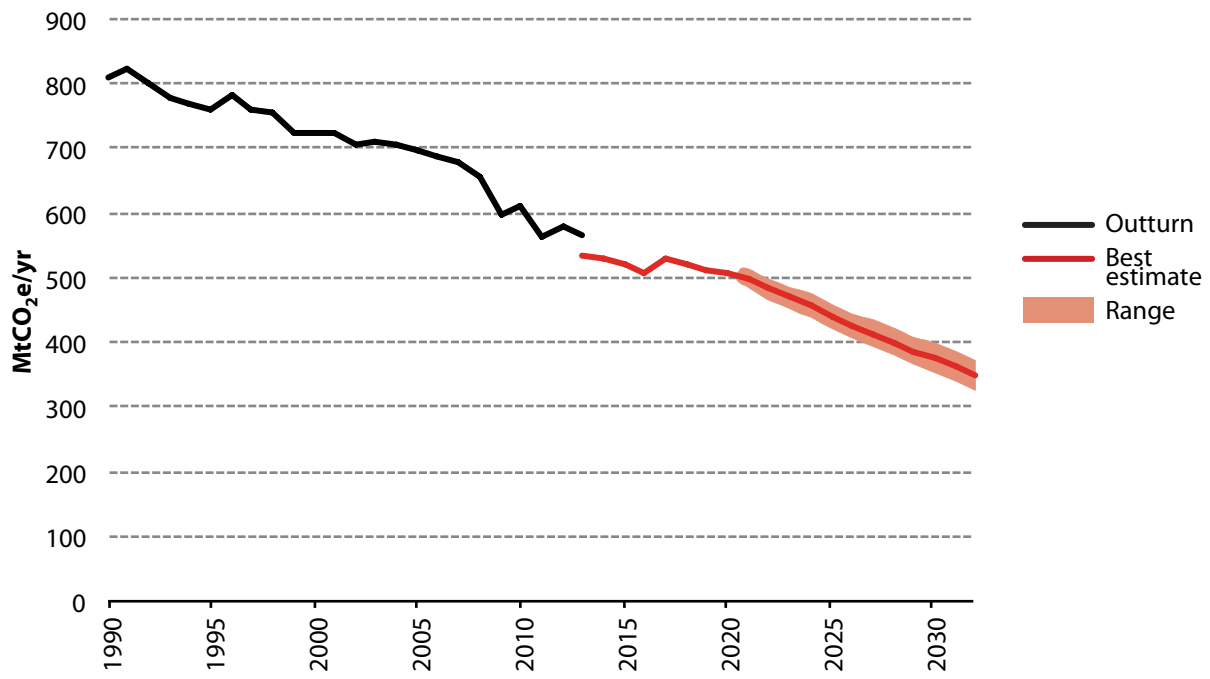
- **The EU ETS traded sectors.** The UK's share of the EU ETS cap – which defines net emissions for the traded sector – is determined by two factors: the level of the EU ETS cap and the proportion of the cap attributable to the UK. The final rules for the fifth carbon budget are unlikely to be known until around 2020.
  - **EU ETS cap.** As part of the agreement to reduce EU emissions by at least 40%, EU Member States have agreed the EU ETS cap will be 43% lower than 2005 levels by 2030. The cap will tighten at a faster rate after 2020 compared to before 2020 (i.e. at an annual linear rate of 2.2% of the average level of the Phase II cap, compared to 1.74% before 2020). The result is that the EU cap, excluding aviation, will reduce from 2,084 $MtCO_2e$ in 2013 to 1,816 $MtCO_2e$ in 2020 and 1,333 $MtCO_2e$ in 2030.
  - **The proportion of the cap attributable to the UK** will reflect the UK's share of each of the four elements which make up the cap in Phase IV: auctioned allowances, freely allocated allowances, and the Innovation and Modernisation Funds. The UK will also have a share of the separate aviation cap (of which only domestic emissions are included in carbon budgets). Auctioned and freely allocated allowances will make up the vast majority of the UK's allocation. The largest uncertainty is around the level of UK free allocation as this depends on: the level of emissions in these sectors across the EU ETS, the efficiency of energy use in industry, and the final rules to allocate allowances. We assume a range around free allocation of ±25% to represent uncertainty in the rules. Our best estimate has the UK's share of the cap falling from 160 $MtCO_2e$ in 2020 to 120 $MtCO_2e$ in 2030, within a range of 110-130 $MtCO_2e$. We assume carbon budgets are set on a neutral basis, with no operation of the Market Stability Reserve.
  - **Timelines for implementation and implications for the fifth carbon budget.** The European Commission has proposed a set of revised rules for Phase IV of the EU ETS. The final implications of these for the fifth carbon budget may not be known until around 2020. Our estimate for the UK's share of the cap for this report is slightly lower than our previous estimate published in October. This reflects changes in the structure of UK industry eligible for free allocation that will affect the level of allowances allocated to the UK over the fifth carbon budget period.
  - **Our best estimate for the UK's share of the EU ETS cap** over the fifth carbon budget period is 590 $MtCO_2e$, within a range of 530-650 $MtCO_2e$.
- **The non-traded sectors.** It has been agreed that EU-wide emissions in sectors not covered by the EU ETS will be 30% below 2005 levels by 2030. It has also been agreed that the maximum required reduction from any Member State will be 40% below 2005 emissions.
  - Our analysis for the UK's likely reduction in non-traded sector emissions under the EU agreement suggests a best estimate of 37.5% below 2005 levels, within a range of 35-40%.
  - The EU 2030 agreement does not include emissions from Land Use, Land-Use Change and Forestry (LULUCF). For consistency with coverage of carbon budgets we therefore add projected LULUCF emissions, based on DECC estimates. However, since our October report these DECC projections have been revised very significantly, from emissions across the five-year budget period of -60 $MtCO_2e$ to +1 $MtCO_2e$.

Box 2.1: UK share of the EU ETS cap over the fifth carbon budget

– Our best estimate for UK non-traded sector emissions over the fifth carbon budget period, based on the EU's 2030 pledge, is 1,310 $MtCO_2e$ (within a range of 1,260-1,360 $MtCO_2e$).

Our overall best estimate for the UK's share of the EU 2030 pledge is a 53% reduction in emissions in 2030 relative to 1990. Reflecting the uncertainties gives a range of 50-56% (Figure B2.1). More detail on the method and assumptions underlying these estimates is set out in Chapter 3 of our report *The scientific and international context for the fifth carbon budget*[14].

Figure B2.1: Range for UK emissions pathway under the EU's 2030 agreement



Source: DECC (2015) *2013 UK Greenhouse Gas Emissions, Final Figures;* CCC analysis.
Notes: Reflects sum of the UK's share of the EU ETS cap and EU non-ETS reduction. Excludes international aviation and shipping emissions. Discontinuity in 2013 due to inventory revisions; we assume this is reflected in EU targets from 2017 onwards.

The EU's agreed 2030 target is at the lower end of ambition compared to the cost-effective path to its 2050 objective of an 80-95% cut in emissions below 1990 levels:

- In 2011 the European Commission published its Low-Carbon Roadmap, which set out its assessment of the cost-effective path to the EU's 2050 goal[15]. This concluded that the aim should be to achieve a 25% reduction in domestic emissions by 2020 and a 40-44% reduction by 2030.
- An independent academic review of energy modelling studies suggests that the median cost-effective path for EU emissions is 48% below 1990 levels by 2030, within a range of 43-52%[16].

14 Available at: https://www.theccc.org.uk/publication/the-scientific-and-international-context-for-the-fifth-carbon-budget

15 European Commission, *A Roadmap for moving to a competitive low carbon economy in 2050*, COM (2011) 112 final

16 Knopf, B. et al (2013) *Beyond 2020 – Strategies and costs for transforming the European energy system*, Climate Change Economics. We add projections of EU non-CO_2 emissions from the EC Low-carbon Roadmap (SEC(2011) 288 final) in order to be comparable to the EU 2030 40% target which covers all greenhouse gases.

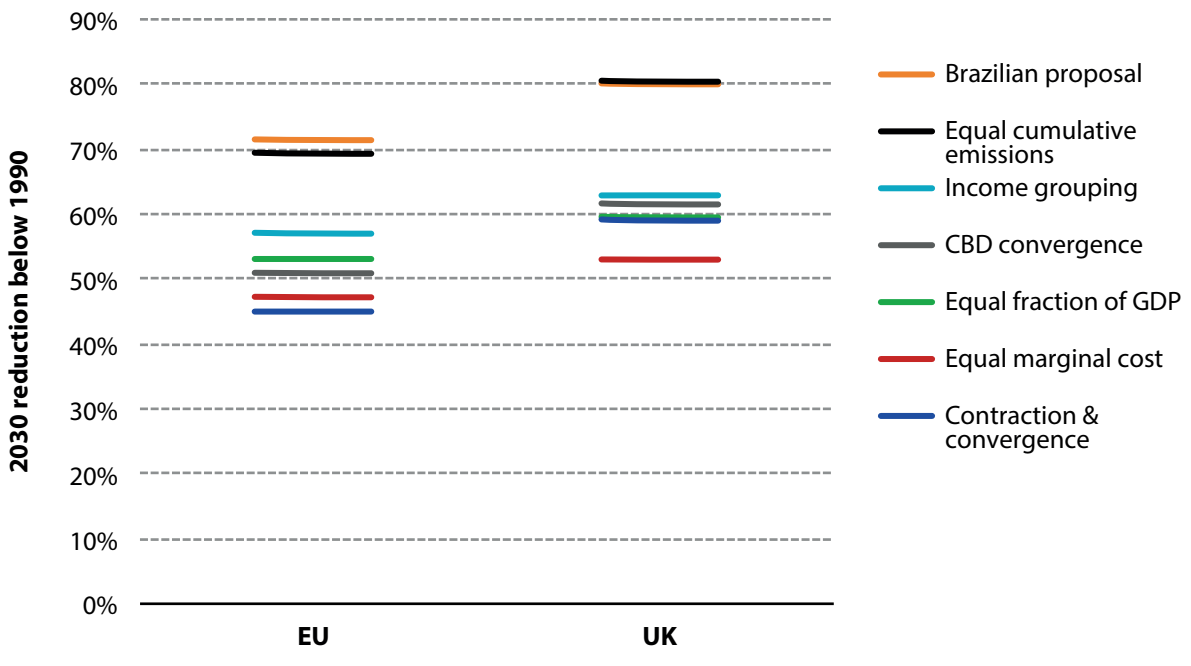
- EU emissions are now likely to substantially outperform the EU's 2020 target of a 20% reduction below 1990 levels. Recent projections suggest EU emissions could fall 24% below 1990 levels by 2020, and possibly close to 30%[17].

The EU 2030 target is also below estimates for a 'fair' EU share of a global 2°C pathway, and the UK's likely contribution is at the low end of ambition compared to its global 'fair' share:

- While there is no single agreed approach to defining a 'fair' share of climate effort between nations, several have been proposed. Each emphasises different dimensions of equity such as economic factors, convergence of emissions and historic responsibility.
- We estimated EU and UK emissions in 2030 under seven different approaches, using the GLOCAF[18] model applied to global emissions of 42 $GtCO_2e$ in 2030 (consistent with a likely chance of staying below 2°C).
- This suggests an indicative range for the EU of 45-71% below 1990 levels, and 53-80% for the UK. The UK takes on a slightly higher reduction than the EU as a whole, given its status as one of the wealthiest nations and high historic emissions (Figure 2.4).
- The results are not evenly distributed across the range. Methods focussing on economic factors and convergence of emissions by 2050 allocate smaller reductions, whereas methods focussing on historical responsibility suggest much larger cuts.

The EU should therefore be prepared to raise its ambition as a contribution to closing a global emissions gap in 2030, alongside similar commitments from other countries.

Figure 2.4: Range for EU and UK 'fair' 2030 reductions under a global 2°C pathway



Source: DECC GLOCAF modelling.
Notes: Excludes international aviation and shipping emissions. Global emissions in 2030 assumed to be 42 $GtCO_2e$. CBD stands for Common But Differentiated. A description of each approach is given in CCC (2015) *The scientific and international context for the fifth carbon budget.*

17 European Environment Agency (2014) *Trends and projections in Europe 2014: Tracking progress towards Europe's climate and energy targets for 2020*; Sandbag (2014) *Is Europe's new climate target a walk in the park?*

18 Averchenkova, A. et al. (2014) *Taming the beasts of "burden sharing": an analysis of equitable mitigation actions and approaches to 2030 mitigation pledges*, Centre for Climate Change Economics and Policy

4. Implications for the fifth carbon budget

Our findings suggest that a fifth carbon budget reflecting current international pledges and EU commitments requires, on a best estimate, a reduction in UK emissions by 2030 of around 53% on 1990 levels:

- **International action.** The world is acting to tackle climate change. The agreement in December 2015, under the UN process, could provide the legal basis for international action beyond 2020. The 2°C limit requires substantial global emission cuts by 2030. The UK should continue to play its part.
- **The EU 2030 pledge.** The EU's Member States have agreed to reduce EU emissions by at least 40% below 1990 levels in 2030. The UK has supported rules for dividing reductions between Member States which imply higher effort from richer countries like the UK, Germany and France. This is a fair, sensible and practical approach. For the current EU agreed pledge our best estimate is that this means a UK reduction of 53% below 1990 levels in 2030, within the range 50-56%.

However, to stay on a cost-effective track to the agreed 2°C objective, guided by the latest climate science, more effort will be required across the world by 2030 than currently pledged, including from the EU:

- **The EU and UK 2050 targets.** The EU and UK targets of at least an 80% reduction compared to 1990 remain an appropriate contribution to global action towards 2°C. The fifth carbon budget needs to be on a path to this target.
- **Expectation of a process beyond Paris to raise ambition.** Current pledges to the UN under the Paris process suggest that, globally, more is needed to limit the risk of going beyond 2°C. There is scope for this in future, given more is possible at low cost and the intention for Paris to include a mechanism to raise ambition. The UK Government has previously suggested a 50% reduction for the EU by 2030, which would entail a greater reduction for the UK.

Given the potential for the Paris conference to produce significant new developments, we will write to the Secretary of State after the Conference to set out if and how this affects our published advice.