



Meeting Carbon Budgets – Implications of Brexit for UK climate policy

Briefing note

Committee on Climate Change
October 2016

The Committee

The Committee on Climate Change (the Committee) is an independent statutory body that was established under the Climate Change Act (2008) to advise UK and devolved administration governments on setting and meeting carbon budgets, and preparing for climate change.

The members of the Committee are the Rt. Hon John Gummer, Lord Deben (Chairman), Professor Nick Chater, Professor Samuel Fankhauser, Professor Sir Brian Hoskins, Paul Johnson, Julia King, The Baroness Brown of Cambridge, Lord John Krebs, Professor Corinne Le Quéré and Professor Jim Skea. The Chief Executive is Matthew Bell.

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Summary

The UK, as part of its contribution to international efforts, has made its own commitments to tackling climate change and set these in domestic legislation. The 2008 Climate Change Act sets carbon budgets that require steady progress in reducing greenhouse gas emissions, taking into account a range of criteria including costs, competitiveness, and climate science.

The carbon budgets legislated so far are at least as challenging as the EU's commitments to tackle climate change. They must continue to be met after the UK has left the EU. New UK policies will be needed to reduce emissions where policies previously agreed through the EU no longer apply or are weakened.

In this note we consider the implications of leaving the EU for the UK's emissions reduction efforts. UK policy has developed over time in an EU context. The Government has stated its intention to initially convert existing EU laws into UK legislation when the UK leaves the EU. Many aspects of EU-level policy will need to be preserved or replicated at the UK level in the longer term in order to meet the UK's carbon budgets. In some areas the Government should take opportunities to improve on EU-level approaches.

Our key messages are as follows:

1. The UK's climate goals have not changed. The UK's 2050 target for reducing greenhouse gas emissions and the legislated carbon budgets (including the fifth carbon budget set in July 2016) remain appropriate as part of a UK contribution to global efforts to tackle climate change, including the Paris Agreement. The actions required to meet the fifth carbon budget (covering 2028-32) remain as expected when the Committee proposed the budget in November 2015.

2. Existing UK commitments need strong new policies that set a clearer direction across the economy, irrespective of Brexit. The fifth carbon budget requires a reduction in emissions of around a third from 2015 to 2030 (a 57% reduction relative to 1990). Current policies, including those agreed to by the UK at the EU level, would at best deliver about half the required emissions reduction. The Government has recognised this policy gap and will set out its plans for meeting carbon budgets in the coming months. That plan should set out expected contributions of different sectors and the key policies needed to achieve them (Table 1 sets out one possible mix). The Government's plan to close the policy gap must be able to meet the UK's carbon budgets whatever the circumstances as the UK leaves the EU.

3. Some policy previously set at EU level should be preserved and strengthened in future. The UK, alongside other Member States, has played a key role in developing EU-level mechanisms to control emissions in some areas, particularly where it makes sense to take a coordinated approach (e.g. because the relevant market is EU-wide). If these mechanisms continue to be strengthened through the 2020s as required by the EU's climate ambition they would cover 55% of the emissions reduction required in the UK to 2030. In areas where these EU-level mechanisms are working effectively, the UK should either remain in these schemes (where coordination continues to make sense) or replicate them at UK level. They include:

- **Product and efficiency standards.** These standards cut costs for consumers, reduce emissions, and create a level playing field for competition. If the UK has weaker standards than the EU that could reduce opportunities for UK manufacturers and lead to a dumping on the UK market of inefficient products with higher running costs and emissions.

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- **New vehicle fuel efficiency standards** require that all manufacturers operating in the EU develop and sell more fuel-efficient vehicles, including electric vehicles. These standards are a key instrument in cutting UK emissions, covering around a quarter of the reduction required across the economy to 2030.
 - **Energy-efficient product standards and labelling** drive up the efficiency of electrical goods on sale and remove the least efficient goods from the market.
 - **The F-gas Regulation** will limit the use of F-gases across the EU. These are a relatively small share of current emissions but offer a significant opportunity for low-cost emissions reduction. Wider international action is also being negotiated under the Montreal Protocol.
 - **The EU Emissions Trading System (EU ETS)** covers emissions from electricity generation and heavy industry and provides a common carbon price across participants.
 - The ETS has the potential to be a least-cost approach without creating competitiveness challenges for industry.
 - Carbon budgets are currently accounted on a ‘net’ basis, allowing for trading in the ETS. If the UK were to leave the ETS an accounting adjustment could be needed to preserve the intent of the budgets. Regardless of the accounting, the UK needs to continue the expansion of low-carbon power generation.
 - **Sectoral targets.** The UK (alongside other Member States) has signed up to some EU targets that are delivered through national policies. These include reducing landfill under the Waste Directive and increasing biofuels uptake under the Renewable Energy Directive. Outside the EU the UK should either adopt these targets domestically or develop alternative approaches that deliver equivalent emissions reduction.
 - **Enablers for emissions reduction.** A range of measures do not directly target emissions reduction but are important enablers for future decarbonisation. These include rules for trading of electricity with other European countries, and research collaboration for developing low-carbon technologies, including access to EU innovation funding.

4. The UK should take opportunities to improve on some EU policy approaches. For example:

- **Common Agricultural Policy (CAP).** The CAP does not directly target greenhouse gas emissions reduction in agriculture although it provides funding for afforestation, which does reduce emissions. A UK-based policy framework should link farming support more closely to actions that would reduce emissions.
- **Policy goals.** Some policy goals could more closely reflect the need to reduce emissions. For example, ensuring heat policy focuses more generally on low-carbon heat, rather than solely renewable heat (e.g. also to include use of waste heat and hydrogen produced using carbon capture and storage).

The interactions between EU and UK legislation are complex. Converting EU laws into UK law will also be complex. Besides the examples covered in this note there will be many other areas where UK legislation will need to develop outside the EU to preserve its existing intent.

We also note that, after leaving, the UK will need to submit a national pledge of effort to the UN climate process, which could be based on legislated carbon budgets. Meeting the UK’s existing targets will be a positive contribution to global climate action.

Table 1. Sectoral contributions to meeting the fifth carbon budget			
Sector	Total 2015-30 reduction (MtCO₂e) Brackets: % reduction from 2015 to 2030	Key EU policies	Share of emissions reduction covered by EU-level policies by 2030
Economy-wide	185 (37%)	--	55%
Power	68 (67%)	EU ETS, single energy market, Renewable Energy Directive (RED)	23%
Buildings	19 (22%)	Product standards & labelling, RED	50%
Industry	26 (23%)	EU ETS, RED, Energy Efficiency Directive	82%
Transport	51 (43%)	New car, van & HGV emission standards, biofuels, air quality	87%
Waste	8 (44%)	Landfill & Waste Directives	100%
F-gases	12 (69%)	F-gas Regulation	100%
Agriculture	8 (15%)	Common Agricultural Policy	0%
Land use & forestry	Afforestation to 15,000 ha/year + agro-forestry	Common Agricultural Policy	76%

Source: CCC analysis based on the Central scenario in CCC (2015) *The Fifth Carbon Budget*.
Note: EU share calculated as share of reduction below a no policy baseline (rather than 2015-30). Land use, land-use change and forestry emissions are expected to increase, but less slowly with increased afforestation (resulting in emissions around 2 MtCO₂e lower than they would otherwise have been). Non-CO₂ sectors relative to 2014.

The rest of this briefing note covers:

1. Implications of Brexit for carbon budgets
2. The role of policies agreed with the EU in reducing UK emissions
3. Continuing UK emissions reductions after leaving the EU

The annex sets out sector-specific issues.

1. Implications of Brexit for carbon budgets

UK action on climate change is based on the 2008 Climate Change Act. The Act is a piece of domestic legislation implemented by the UK Parliament as a contribution to global efforts to prevent dangerous climate change. Those global efforts have been reinforced, and increased, following the Agreement reached in Paris in 2015. The Act stands irrespective of the UK's membership of the EU and as such its main targets and overall approach remain.

In this section we consider the implications of the Brexit decision for the UK's carbon budgets, including their accounting rules, and for the UK's role in international climate negotiations.

The legislated fifth carbon budget remains appropriate

In July 2016 Parliament legislated the fifth carbon budget as 1,725 MtCO₂e over the years 2028-2032. This was in line with advice from the Committee and implies a reduction in greenhouse gas emissions of 57% relative to 1990.

We advised that the budget should be set to require a 57% reduction based on an extensive review of the evidence and detailed consideration of the criteria set out in the Climate Change Act. These require that the budget is set on the cost-effective path to the 2050 target (i.e. at least an 80% reduction from 1990) accounting for scientific understanding, international and European circumstances and a range of broader policy objectives (i.e. competitiveness, fuel poverty, energy security, fiscal circumstances, as well as differences between England, Scotland, Wales and Northern Ireland).

In considering European circumstances, we recognised that as a Member State of the EU the UK would be allocated a contribution towards the EU objective for reducing emissions to 2030. However, our assessment was that the likely contribution that would be required would not prepare the UK sufficiently for the 2050 target, and therefore we recommended a target based on our best assessment of the UK's cost-effective path to the 2050 target.

Following the cost-effective path to the 2050 target, and therefore the fifth carbon budget, remains appropriate whether or not the UK is a member of the EU.

Uncertainty is not a new development

In principle, the decision to leave the EU could imply a change to the cost-effective path to the UK's 2050 target. For example, independent economic institutions (e.g. the Institute for Fiscal Studies and the Bank of England¹) have predicted that Brexit could result in a negative shock to the economy, particularly over the medium and long-term. That could imply less energy use and a lower level of emissions, suggesting that the carbon budget should be lower.

The potential long-term consequences depend on the shape of the final relationship agreed with the EU. Besides GDP impacts, there could be changes in the structure of the economy depending on the nature of trade deals that the UK secures, population projections could change with different migration rules, and interest rates and exchange rates could be affected beyond the changes seen to-date. All of these could affect the level of energy demand, manufacturing and agricultural production and the cost of both high-carbon and low-carbon options.

¹ See for example IFS (2016) *The EU Single Market: The Value of Membership versus Access to the UK*; Bank of England (2016) *Inflation Report, August 2016*

Whilst Brexit is a new development, uncertainty in macroeconomic circumstances is not. In our advice on the fifth carbon budget we recognised these (and other) uncertainties and concluded that our advice was robust in the face of the uncertainties. That remains our view and we do not consider the increased uncertainty to require any change to the carbon budgets at this time. The Act already provides for changes to carbon budgets in the future should unexpected events, from Brexit or otherwise, occur that are directly relevant to meeting the carbon budgets.

The accounting rules for carbon budgets could change if the UK leaves the EU ETS

Under the Climate Change Act, emissions are measured by the Net UK Carbon Account. This means that the part of the budget covered by the EU ETS – power and energy-intensive industry – is set by the UK share of the EU ETS cap rather than actual emissions from these sectors.

If the UK were to leave the EU ETS, then the accounting of carbon budgets would need to change. To preserve the intent of the budget, this is likely to require an adjustment to the budget. For example, in our advice on the fifth carbon budget we suggested that the goal in terms of ‘gross’ (i.e. actual) emissions ought to be to reduce emissions by 61% from 1990 to 2030.

It is possible that the UK would remain as part of the EU ETS even after leaving the EU. Several other countries are members of the EU ETS, but not the EU (e.g. the EEA countries Iceland, Lichtenstein and Norway). More generally, increased linking (rather than delinking) of international carbon trading schemes is desirable in promoting the least-cost international path to reducing global emissions.

Whatever the accounting arrangements, actual emissions need to be reduced. Brexit does not affect the fact that real progress needs to be made to meet the UK’s domestic 2050 target.

If the UK were to leave the EU ETS, the Committee would advise on any accounting adjustments required to carbon budgets at that time.

The UK’s carbon budgets could be the basis for a pledge to the UN negotiations

The UK has played a major role in international climate change negotiations. Most recently that resulted in the Paris Agreement, under which parties to the Agreement submitted pledges to reduce emissions to 2030. Under the Agreement parties must also submit their plans for mid-century decarbonisation by 2050. We set out more detail on the implications of the Paris Agreement for UK climate ambition in a separate report.²

The UK does not currently have its own pledge under the Paris Agreement. Instead it is covered by the EU pledge to reduce emissions by at least 40% across all 28 Member States by 2030. The EU acts as one party to the UN Paris Agreement, although Member States must also ratify independently. The Government has committed to ratify the Agreement by the end of 2016.

As a party to the Paris Agreement outside the EU, the UK will need to submit its own pledge for action and its own mid-century plan. That pledge could be based on legislated carbon budgets. The UK’s target for a reduction of at least 80% by 2050 relative to 1990, and understanding of how this could be met, could also form the basis of a mid-century plan. Meeting the UK’s existing targets will be a positive contribution to global climate action.

² CCC (2016) *UK climate action following the Paris Agreement* available at www.theccc.org.uk/publications/uk-action-following-paris

2. The role of policies agreed with the EU in reducing UK emissions

Between 1990 and 2015 UK greenhouse gas emissions fell by 38%. Some of this reduction has been driven by external factors (e.g. changes in fuel prices and the structure of the economy) and some through low-carbon policies. Some of those low-carbon policies were negotiated and agreed with other countries at the EU level. In this section we consider the relative importance of these factors. Overall, policies and measures negotiated and agreed to by the UK at the EU level have made a significant contribution to the reduction in UK emissions since 1990 (Box 1).

Policies agreed as part of the EU have significantly contributed to emissions reduction

UK policies have developed over time in the context of our membership of the EU. In many cases, EU energy and environmental policies have been developed with strong UK leadership (e.g. the EU ETS and the single energy market). In future UK policies will need to develop to fit the context outside the EU, details of which are not yet known.

To ensure this transition is successful the UK will need to provide both direction (i.e. developing policy based on clear goals for emissions reductions in different sectors) and delivery (i.e. ensuring that action is taken to meet those goals). In the past, policies at the EU level, which have been developed by the UK in partnership with other Member States, have provided some of this direction and delivery:

- **Policy direction** where the overall objective has been agreed by the UK in partnership with other Member States at the EU level, and where the UK is responsible for specific policies to implement these objectives. For example:
 - **EU Renewable Energy Directive.** This was agreed by all Member States in 2009. The UK target is to supply 15% of energy from renewable sources by 2020. This requires deployment of renewables in electricity generation (a 400% increase is expected between 2009 and 2020 through the Renewables Obligation, Feed-in-Tariffs and auctions for Contracts for Difference), renewables in road transport, mainly through biofuels (increasing from 2.5% in 2015 to 10%³ in 2020 under the Renewable Transport Fuel Obligation), and low-carbon heating (through the Renewable Heat Incentive).
 - **The EU Waste and Landfill Directives** set targets for Member States to reduce the amount of biodegradable waste sent to landfill. In the UK it is primarily implemented through the Landfill Tax, supplemented through other initiatives (e.g. the Waste Prevention Programme and the Waste and Resources Action Programme). Since the Landfill Tax was introduced in 1996 emissions from landfill have fallen by around 80%.
 - **EU Large Combustion Plant and Industrial Emissions Directives.** The key objective of these policies was to target air quality rather than greenhouse gas emissions. However, alongside other measures, they have encouraged a shift away from coal use in electricity generation, which is now 43% below 2007 levels.
- **Policies providing direction and delivery** where the UK has agreed the overall objective with other Member States at the EU level, and also that the most effective means of implementation is at the EU level (e.g. because the market is EU-wide):
 - **EU Emission Trading System (EU ETS).** The EU ETS covers emissions from electricity generation and heavy industry, and creates a common carbon price across all

³ This includes double-counting of some sources of biofuels and renewable electricity.

participants. It has the potential to be a least-cost approach without creating competitiveness challenges for industry.

- **EU new car and van CO₂ regulation.** These are EU-wide targets for fuel efficiency (expressed as gCO₂/km) for new cars and vans. They apply to all manufacturers selling vehicles in EU countries. Since their introduction in 2009, average test-cycle new car CO₂ intensity have fallen by 19%. Standards for new van CO₂ were introduced later, in 2011, and intensity has since fallen by 11% on a test-cycle basis.
- **The F-gas Regulation** which limits the total sales of F-gases across the EU, and aims for a reduction in hydroflourocarbons (HFCs) of 79% below current levels by 2030.
- **Products standards and labelling.** These set standards for energy consumption across a wide range of household products (e.g. vacuum cleaners, lighting, televisions, dishwashers, fridges and freezers). These standards help save consumers money while also helping to drive low-carbon product innovation and reducing emissions. They also help consumers make informed decisions.
- **The Common Agricultural Policy (CAP).** This does not directly target greenhouse gas emissions reduction in the agriculture sector. Between 1990 and 2008 emissions reduced by 18% but have since remained broadly unchanged. Under the current CAP, farmers must meet certain environmental standards to be eligible for full payments. In addition, UK afforestation is largely funded through Pillar Two of the CAP via the Rural Development Programme.

Box 1. Contribution of EU-level policies to UK emissions reduction since 1990

UK greenhouse gas emissions have fallen by 38% since 1990. This has been the result of a wide range of factors, including UK-specific policies, policies agreed by the UK in partnership with other Member States at the EU level, and changes in wider market conditions:

- **Power** emissions have fallen by 50% since 1990, primarily as a result of the dash-for-gas in the 1990s, the introduction of renewables under the Renewable Energy Directive agreed through the EU, and the impact of EU air quality regulations which have helped dis-incentivise use of coal.
- **Buildings** emissions have fallen by 17% since 1990, largely due to the impact of UK building regulations on energy efficiency, UK regulations incentivising introduction of more efficient condensing boilers, and the impact of EU product standards in reducing demand for energy.
- **Industry** emissions have fallen 49%, mainly driven by globalisation of industrial production.
- **Transport** emissions have been broadly flat. EU policy has helped improve efficiency of new cars sold in the UK by 19% since 2009, but this has been broadly offset by increasing distances travelled.
- **Agriculture, land use and forestry** emissions have fallen by around a third since 1990, in the context of a policy framework determined by the EU Common Agricultural Policy and other EU environmental legislation (e.g. the Nitrates Directive).
- **Waste** emissions have fallen by 74% since 1990. The main driver of this has been the UK Landfill Tax, which was introduced to meet UK obligations agreed to under the EU's Landfill Directive.
- **F-gas** emissions are broadly at 1990 levels.

Overall, we estimate that policies agreed by the UK at EU-level have contributed around 40% of the reduction in UK emissions since 1990.

UK policies have also contributed to emissions reduction

Alongside policies that have been agreed jointly at the EU-level, policies have been agreed and implemented by the UK alone. These include:

- **Carbon price floor.** This was put in place in 2013 to top-up the low EU ETS price and has, alongside other factors, contributed to significant reduction in coal use in UK electricity generation (down 24% since 2014, compared to a 3% increase in the EU).
- **Incentives for electric vehicles and infrastructure.** Whilst these have been implemented alongside the EU new car and van regulations, they are not specifically required in that legislation and have helped to build the market for electric vehicles in the UK.
- **Building regulations.** The UK sets its own standards for buildings, including for their energy efficiency. This has helped make new builds and extensions somewhat more efficient than older properties. Regulations on new boilers introduced in 2005 require installation of efficient condensing boilers and have helped cut residential energy use (and reduce household bills), even as the population has grown and incomes have risen.
- **Supplier obligations.** Since 1994, the UK has placed obligations on energy suppliers to support improvements to the energy efficiency of homes. The Carbon Emissions Reduction Target (in place from 2008 to 2012) led to a large increase in insulation installation rates, although these have dropped since the scheme finished.
- **UK taxes.** Some parts of the UK tax system work to encourage efforts to reduce greenhouse gas emissions. These include vehicle excise duty and company car tax which shift incentives and purchases towards lower carbon options, the Climate Change Levy and Climate Change Agreements and, until recently, the Carbon Reduction Commitment which taxes business and public sector energy use. Recent changes have reduced these incentives.
- **Devolved levers.** UK policies have been supplemented by action in Scotland, Wales and Northern Ireland. For example, devolved schemes have supported energy efficiency improvements, roll-out of electric vehicle charging infrastructure, reductions in landfill, development of new technologies (e.g. marine renewables), and afforestation.

Overall, we estimate that policies and measures that the UK has negotiated and agreed to at the EU level have made a significant contribution to the reduction in UK emissions since 1990 (Box 1). Some of these were implemented through UK policies and some through EU-level policies. The remaining reduction reflects a combination of external factors (e.g. changes in fuel prices and impact of globalisation on UK manufacturing) and UK-specific policies.

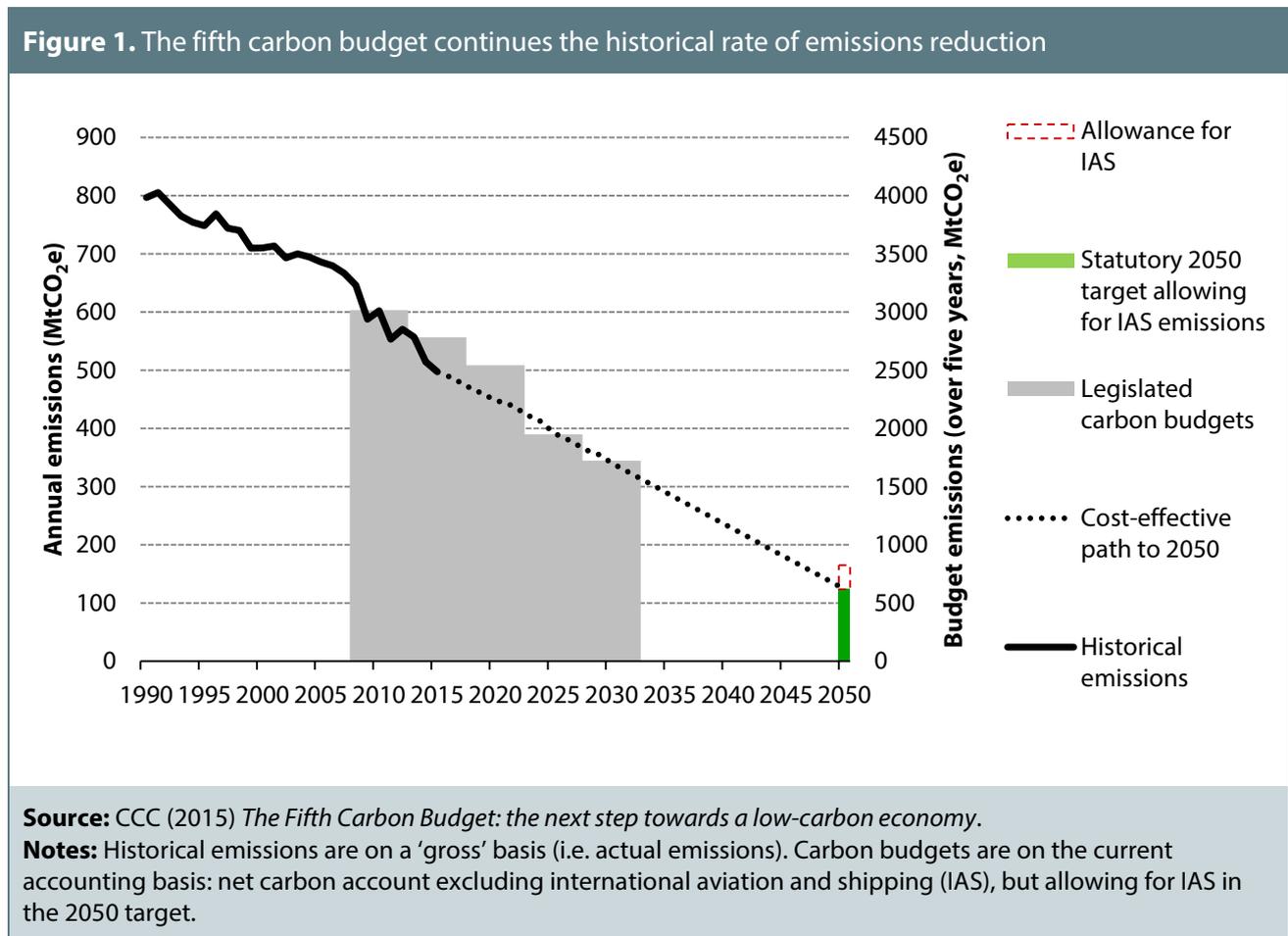
3. Continuing UK emissions reductions after leaving the EU

The fifth carbon budget was legislated by Parliament and the new Government following the Brexit vote. It commits the UK to a 57% reduction in emissions from 1990 to 2030. This requires a continuation of the historical rate of emissions reduction (Figure 1). Meeting the budget will require actions across all sectors of the economy (Box 2).

Whilst we showed in section 2 that policies developed in conjunction with the EU have played a large role in UK emissions reductions to date, the fifth budget must be met in the new context with the UK outside the EU.

Many aspects of EU-level policy will need to be preserved and strengthened in future. New UK policies will be needed to reduce emissions where policies previously agreed through the EU no

longer apply or are weakened. Where there are opportunities to improve on EU approaches, clearly these should be taken. We consider these challenges and opportunities in this section.



There is already a policy gap to the fifth carbon budget

In our 2016 Progress Report to Parliament, published after the Brexit vote, we set out that current policies are likely to deliver at best around half of the required emissions reduction from 2015 to 2030. Existing commitments therefore need strong new policies that set a clearer direction across the economy, irrespective of Brexit.

We classified current policies as either 'low-risk' or 'at-risk', and assessed the size of the policy gap to the fifth carbon budget:

- **Low-risk policies** are those that are already in place, are sufficiently funded, and are well designed to drive low-carbon choices. Our assessment is that these would deliver around 25% of the required reduction from 2015 to 2030 (the green area in Figure 2).
- **At-risk policies** were assessed to have design, delivery, or funding problems. These are targeting around 30% of the required reduction to 2030, but would only deliver that reduction if the issues with design/funding are addressed (the yellow area in Figure 2).
- **The policy gap** covers the reduction for which no current policy exists (the red area in Figure 2). This is around half (45%) of the total reduction required in 2030.

In our 2016 Progress Report we set out how at-risk policies could be strengthened and how the policy gap could be closed.

The policy gap could increase after the UK leaves the EU

In this note, we have identified the specific contribution of policies agreed by the UK at EU-level within the categories above. If these policies continue to be strengthened through the 2020s as required by the EU's climate ambition they would cover 55% of the emissions reduction required in the UK to 2030:

- We estimate that EU-level policies could have contributed around 115 MtCO₂e (55%) of the required emissions reduction to 2030, including closing half of the policy gap (the shaded areas in Figure 2).
 - The majority of the potential contribution of EU-level policies (around 75 MtCO₂e) relates to direct instruments at the EU level. These include new vehicle efficiency standards, energy-efficient product standards, the regulated phase-down of F-gases and industrial efficiency improvements that arise from incentives in the EU ETS.
 - The remainder (around 40 MtCO₂e) relates to EU targets that are implemented through UK policies, including the contributions of the Renewable Heat Incentive and the Renewable Transport Fuel Obligation to increasing uptake of renewables, and the use of the Landfill Tax and other levers to divert biodegradable waste from landfill.
- There is also a range of measures which do not directly target emissions reduction but are important enablers for future decarbonisation, including interconnection through the single European energy market and research collaboration for developing low-carbon technologies, including access to EU innovation funding:
 - **Single energy market.** Interconnection allows electricity to be traded across national borders, which can lower prices and improve security of supply (in 2015 7% of UK electricity was supplied through interconnectors). This will become increasingly important to help balance the electricity system in the 2020s as more renewables are deployed.
 - **EU collaboration and innovation funding.** The UK receives funding from a range of EU sources including through the EU ETS, the LIFE fund and for low-carbon research (e.g. through Horizon 2020, worth nearly €80bn across EU projects from 2014 to 2020), including €1.6bn in funds focused towards the low-carbon economy in the UK and over €300m of funding to UK projects through the NER300 mechanism. Additionally, since 2000, the European Investment Bank has provided loans of over €37bn for UK energy infrastructure, including €6bn towards low-carbon energy projects. The EU approach incentivises collaboration and R&D across countries, which can help increase the impact of funding through knowledge exchange and building collaborative partnerships.
- Table 2 sets out the expected contribution of EU-level policies by sector prior to the vote to leave the EU. It assumes that these would be renewed and strengthened through the 2020s as required by the EU-wide target for a reduction in emissions of 40% by 2030 below 1990 levels (e.g. an extension and strengthening of new car and van CO₂ standards from 2020 to 2030 is currently under discussion). More detail on these is set out in the annex to this note.

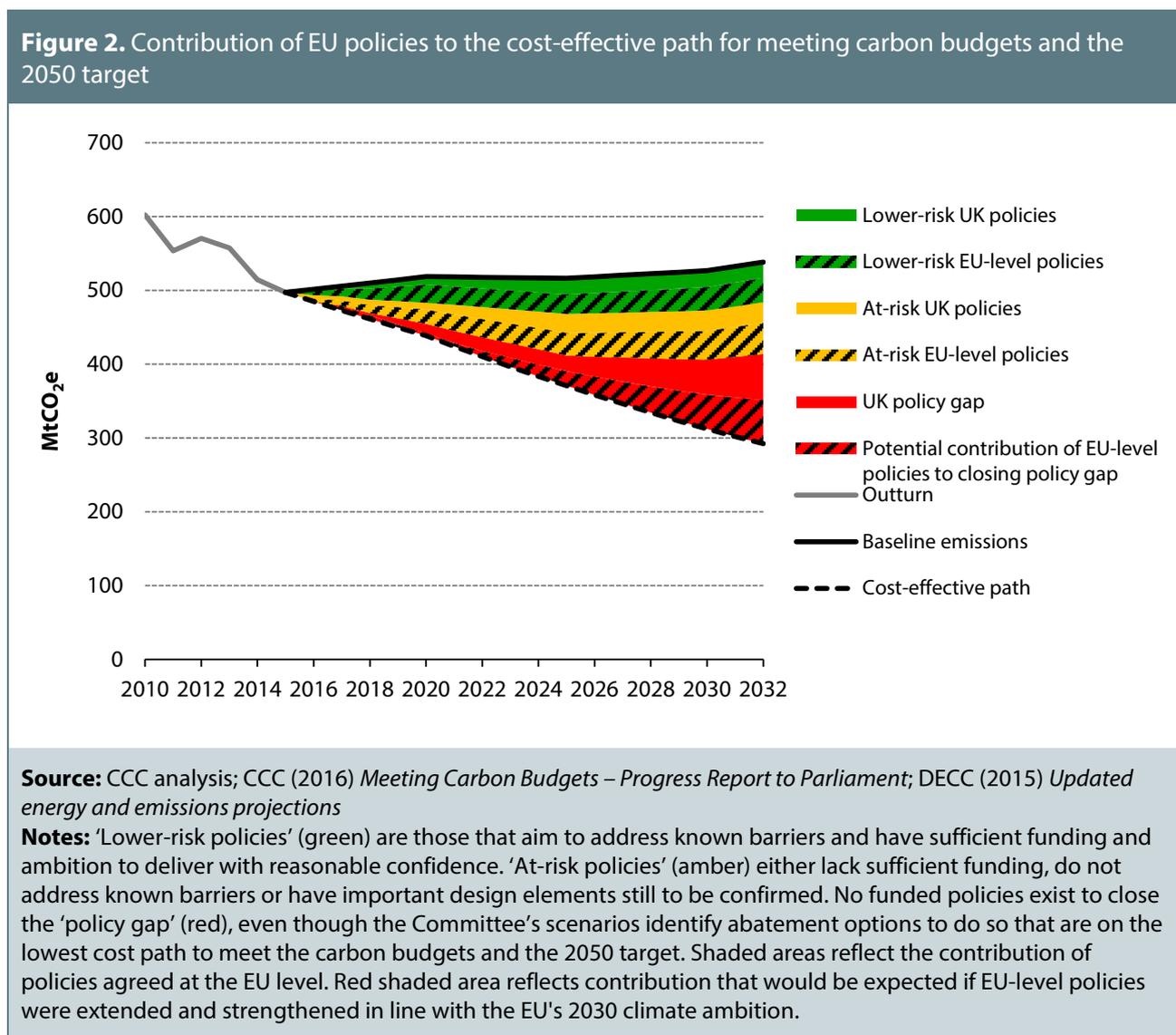
The Government has stated its intention to initially convert existing EU laws into UK legislation when the UK leaves the EU. Different UK legislative mechanisms will be required for this

conversion process, depending on the nature of the EU law and how it has been implemented in UK law to date. This legislative process may be affected by whether the UK remains a member of wider European institutions (e.g. the European Economic Area and the Energy Community).

Many aspects of EU policy will need to be preserved or replicated at the UK level in the longer term. That is likely to be desirable where policies bring clear advantages from coordinated action (e.g. new car and product standards are likely to be more effective at the EU level, since cars and products are generally designed for an EU-wide market).

New UK policies will be needed to reduce emissions where policies previously agreed through the EU no longer apply or are weakened. The Government's forthcoming plan for meeting the fifth carbon budget must be able to do that whatever the circumstances as the UK leaves the EU.

It is also possible that some EU-level policies are extended and strengthened to 2030 and continue to apply in the UK but are not as strong as we would have expected prior to the Brexit vote. For example, the Committee have emphasised the need for EU ETS reform and for stretching new vehicle standards for the 2020s. Again, if EU policies turn out to be weaker than expected, the UK Government will need to ensure that implementation in the UK is consistent with meeting the carbon budgets.

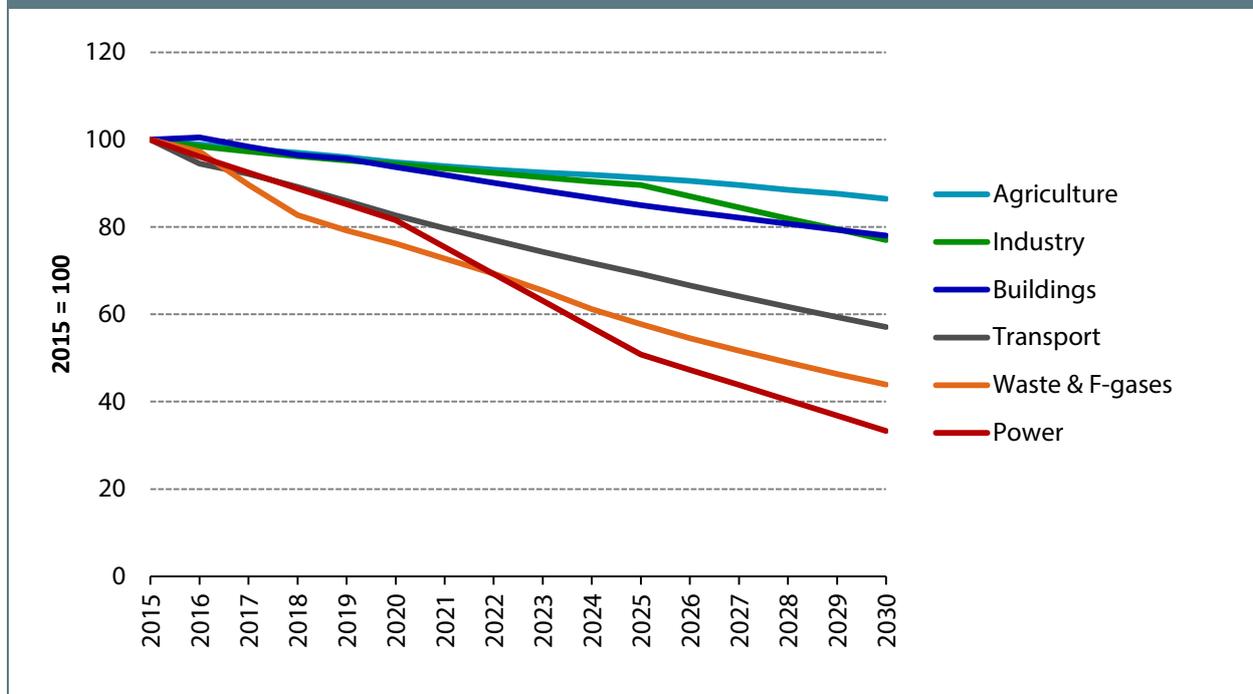


Box 2. Actions required to meet the fifth carbon budget

The fifth carbon budget was legislated in July 2016 and requires a reduction in UK greenhouse gas emissions of 57% below 1990 levels by 2030 (around a third below current day emissions). This will require actions across all sectors of the economy (Figure B1). For example, by 2030:

- **Power.** A 67% (68 MtCO₂e) reduction below current levels by increasing the share of low-carbon power from 45% to 80% by 2030, including replacement of the 20% of generation from retiring nuclear plant and renewables. This implies signing contracts for around 150 TWh of low-carbon generation for delivery in the 2020s. Alongside this, coal plants should close and the flexibility of the system should be significantly increased through interconnection, demand response, storage and flexible back-up capacity.
- **Transport.** A 43% (51 MtCO₂e) reduction below current levels by increasing the share of electric vehicles from 1% to 60% of new car and van sales, and a 30% improvement in the efficiency of new conventional cars and vans.
- **Buildings.** A 22% (19 MtCO₂e) reduction by insulating 7 million lofts, cavity and solid walls and increasing take-up of low-carbon heating (i.e. heat pumps or district heating) to about 4 million homes and around half of non-residential buildings.
- **Other sectors.** Around a 25% (54 MtCO₂e) reduction across industry, agriculture, waste, and F-gases through for example: deployment of carbon capture and storage and bioenergy in industry, improved efficiency of fertiliser use and livestock management in agriculture, fully diverting biodegradable waste from landfill by 2025 in waste, and replacing F-gases with low-carbon alternatives in refrigeration and air conditioning.

Figure B2. Sectoral emissions pathways to meet the fifth carbon budget



Source: CCC analysis based on the Central scenario in CCC (2015) *The Fifth Carbon Budget*.

Notes: Shows the cost-effective path by sector, relative to 2015 outturn levels.

The UK should take opportunities to improve on some EU policy approaches

Government will need to be proactive in deciding the level of ambition it is aiming for where EU policies no longer apply, and in developing UK specific policies to achieve these aims. In both cases, there is an opportunity for the UK to develop more bespoke solutions and to move more quickly. For example:

- The Common Agricultural Policy (CAP) does not directly target greenhouse gas emissions reduction in agriculture although it does provide funding for afforestation, which does reduce emissions. A UK-based policy framework should link farming support more closely to actions that would reduce emissions.
- Some other goals could more closely reflect the need to reduce greenhouse gas emissions, for example by ensuring heat policy focuses more generally on low-carbon heat, rather than solely renewable heat (e.g. to also include use of waste heat and hydrogen produced using carbon capture and storage).

Table 2 summarises the main EU-level policies, their potential emissions savings in 2030, and also sets out priorities for continuing climate action as the UK leaves the EU.

We will continue to monitor progress towards carbon budgets in the context of our annual reports on progress to Parliament. The next report will be in June 2017.

Table 2. Potential impacts of EU-level policies on UK emissions (2030) and priorities for continuing climate action as the UK leaves the EU

Sector	Key EU-level policies	2030 UK emission savings covered by EU-level policies		Priorities for continuing climate action as the UK leaves the EU
		MtCO ₂ e	% of total required	
Power	EU Emissions Trading System (ETS) Energy Union & single energy market Renewable Energy Directive Industrial Emissions Directive	18	23%	<ul style="list-style-type: none"> Remain a part of the EU ETS or aim to stick to the same trajectory for the total UK carbon price. Failing that, increase the Levy Control Framework pot to preserve the amount of low-carbon generation the pot can support. Ensure a level playing field for electricity sold across national borders through interconnection. Ideally involving some equalisation of carbon prices between countries to ensure UK generators are not disadvantaged.
Buildings	Renewable Energy Directive Energy Efficiency Directive Product standards and labelling Directives	11	50%	<ul style="list-style-type: none"> Remain part of EU energy efficiency & labelling standards or replicate these at UK level. Focus on low-carbon heat (i.e. heat pumps or district heating), such that this is installed in about 4m homes and half of non-residential buildings by 2030. Improve building energy efficiency by insulating 7m lofts, cavity & solid walls by 2030.
Industry	EU Emissions Trading System Renewable Energy Directive Energy Efficiency Directive	14	82%	<ul style="list-style-type: none"> Remain a part of the EU ETS or develop new approaches to ensure industry has incentives to become more energy efficient and to invest in low-carbon technologies. Outside EU ETS new approaches should not disadvantage UK competitiveness. Continue support for deployment of low-carbon heat, energy efficiency.
Transport	New car, van & HGV emission standards Biofuels (Renewable Energy Directive) Eco-driving Regulations Air Quality: Framework Directive & National Emission Ceilings	56	87%	<ul style="list-style-type: none"> Remain a part of EU vehicle efficiency and Eco-driving Regulations or replicate these at a UK level, consistent with the cost-effective path (e.g. new cars should reach about 50 gCO₂/km and new vans 65 g/CO₂km on a real-world test-cycle basis by 2030). Maintain or replicate the carbon impact of wider EU-led legislation incentivising uptake of cleaner vehicles (e.g. the Air Quality Framework).
Waste	Landfill and Waste Framework Directives Circular Economy Package	4	100%	<ul style="list-style-type: none"> Continue to aim to reduce waste sent to landfill to very low levels, ideally zero by 2025, and deploy UK levers to achieve this (e.g. through the landfill tax and local incentives/requirements for separate collection of biodegradable waste streams).
F-gases	F-gas Regulation Mobile Air Conditioning Directive	12	100%	<ul style="list-style-type: none"> Remain in the F-gas Regulation or develop equivalent or stronger UK legislation.
Agriculture	Common Agricultural Policy (CAP) Nitrate and Water Framework Directives	0	0%	<ul style="list-style-type: none"> Develop policies linking farming support more closely to actions that reduce emissions.
Land Use & Forestry	Common Agricultural Policy (CAP)	2	76%	<ul style="list-style-type: none"> Preserve and, if necessary, strengthen current incentives for tree planting to achieve the UK's afforestation targets.
Economy-wide		117	55%	<ul style="list-style-type: none"> Continue to support low-carbon innovation and international collaboration

Notes: Table summarises the largest EU-level policies and their potential impact on reducing UK emissions in 2030, relative to a no policy baseline. Interactions between EU and UK legislation are complex and there will be many other areas where UK legislation will need to develop outside the EU to preserve its existing intent or to deliver the savings identified.

Annex: Sector-specific impacts of Brexit

This annex sets out in more detail potential implications of Brexit for UK climate and energy policy, in seven sections:

1. Power
2. Buildings
3. Industry
4. Transport
5. Waste
6. F-gases
7. Agriculture and land use, land-use change and forestry

1. Power

The cost-effective path for the power sector involves a reduction in emissions of 67% (68 MtCO₂e) below 2015 levels by 2030. Overall, policies agreed at the EU level in power cover 23% of the reduction required by 2030.¹

The UK currently has obligations it has negotiated and agreed at the EU level which will influence future emissions from electricity generation, including on emissions trading, the single market for energy, renewable energy, and air quality:

- **EU Emissions Trading System (EU ETS).** This sets a declining cap on emissions from power and energy-intensive industry across the EU, so that reductions can take place where they are cheapest. The price of allowances in the system has historically been low and therefore had limited impact on low-carbon investment, but is expected to rise in future as the cap tightens to meet the EU's 2030 target for an overall reduction in emissions of 40% below 1990 levels.
- **Single market for energy.** The Energy Union aims to build a single market for energy across the EU. An important enabler of this is interconnection, which allows energy to be traded across national borders: this can lower prices and improve security of supply. In 2015 7% of UK electricity was supplied through interconnectors. Flexibility (e.g. interconnection) will become increasingly important to help balance the electricity system in the 2020s as more renewables are deployed.
- **EU Renewable Energy Directive.** The UK has a target for 15% of energy to come from renewable sources by 2020, and has already signed contracts for electricity to 2020 consistent with this. After 2020 there are no binding Member State renewables targets.
- **EU Industrial Emissions Directive.** This is aimed at reducing emissions of pollutants which worsen air quality, in particular from coal. Coal use in the UK has fallen by 43% since its introduction in 2007, as a result of the Directive and worsened economics of coal generation (including the impact of the UK carbon price support). The future impact of the Directive is likely to be limited, given that UK policy is to phase out coal use entirely by 2025.

¹ Measured as the reduction below a no policy baseline.

The EU ETS and carbon pricing more generally has an important role in driving emissions reduction in the lowest-cost way:

- It embodies an important general principle that carbon should be priced to allow markets to uncover the lowest-cost ways to reduce emissions. Linking markets across jurisdictions allows for a lower-cost solution between countries as well and supports emissions reduction from a wider area. If the UK were to leave the EU ETS it could explore opportunities to link to other developing global carbon markets.
- In response to a continued low EU ETS price the UK has introduced its own carbon price floor.
 - The EU ETS emissions cap has proved to be too loose (and not able to respond to changing circumstances), resulting in a carbon price that is too low to drive material emissions reductions.
 - The UK has responded to those failings by introducing its own carbon price floor, using a UK top-up to give a minimum level for the total carbon price, intended to be consistent with the decarbonisation path in UK targets. Continuation of this floor level supports efficient low-carbon choices in the UK, including the balance between coal and gas, and longer-term the use of carbon capture and storage (CCS), the choice of efficiency of back-up plant and the value of storage or demand-side response compared to back-up plant.
- If the EU ETS price were removed and the UK top-up was not correspondingly increased this would require an increase in the funding pot for low-carbon generation (i.e. the Levy Control Framework) to preserve UK ambition. This could have a potential value of around £2 billion per year by 2030, enough to support around 50 TWh of low-carbon generation and represents around 17 MtCO₂e of emission savings.
- The UK receives revenues from auctioning its share of EU ETS allowances. By 2030 this could be worth around £2 billion to the Exchequer. It reflects that EU countries have agreed to tighten the cap by 27% between 2020 and 2030, and that central price projections suggest a doubling of prices over the same period.

Expansion and efficient use of interconnection could depend on continued membership of the Energy Union and single energy market. Interconnection is valuable as it allows sharing of back-up capacity across Europe, and provides a market for UK generators at times when supply is high and demand is low (e.g. overnight on a windy day). If new arrangements reduce the UK's ability to participate in European markets and sharing of EU-wide assets it could result in increased 'spilling' of excess renewable output. That would have negative effects across the Government's three objectives of security of supply, decarbonisation and cost-minimisation.

Opportunities and ways forward

UK policy should aim to reduce power sector emissions by 67% below 2015 levels by 2030 (i.e. to a carbon intensity of below 100 gCO₂/kWh). Leaving the EU may affect how this is delivered:

- Whether the UK remains a part of the EU ETS or not it should aim to stick to the same trajectory for the total carbon price applied in the UK. Failing that, the Levy Control Framework pot should be increased accordingly (or, in the case of the 2020s, set at a higher level) to preserve the amount of low-carbon generation the pot can support.
- The UK should aim to ensure a level playing field for electricity sold across national borders through interconnection. Ideally that would also involve some equalisation of carbon prices between countries to ensure UK generators are not disadvantaged.

2. Buildings

The cost-effective path for the buildings sector involves a reduction in emissions of 22% (19 MtCO₂e) below 2015 levels by 2030. Overall, policies agreed at the EU level in buildings cover 48% of the reduction required by 2030.²

A number of policies agreed by the UK at the EU level influence emissions from buildings, including on renewable energy, product standards and energy efficiency:

- **Renewable energy.** The UK's Renewable Heat Incentive was introduced to contribute to the UK's target under the EU Renewable Energy Directive. This applies to both residential and non-residential properties.
- **Product standards and labelling.** The EU Ecodesign Directive sets standards for energy consumption across a wide range of products including lighting, televisions, cooking appliances, dishwashers, fridges and freezers, and vacuum cleaners. These standards help save consumers money while also driving low-carbon product innovation. The Energy Labelling Directive requires products to display their energy consumption and helps consumers choose energy efficient products.
- **Energy consumption.** The Energy Performance of Buildings Directive puts in place measures to improve knowledge of buildings energy performance, and requires all new buildings to be nearly zero energy by 2020. Under the Energy Efficiency Directive the UK has set its own target for energy consumption by 2020 (around 12% below current levels).

If the EU product standards no longer apply in the UK in future they could continue to have an effect on the UK market. However, this is likely to be reduced without complementary UK policies:

- The market for many products is EU-wide and design of new products sold into the UK could therefore in principle continue to comply with future EU standards.
- However, marketing and pricing strategies can differ by market and manufacturers may choose to sell their least efficient products in the UK in the absence of any requirement not to, especially if these have cheaper up-front costs (but more expensive running costs).

It is therefore important that any future UK policies replacing EU standards retain incentives for manufacturers to sell energy efficient products into the UK market.

Opportunities and ways forward

UK policy should aim to reduce building emissions by 22% below 2015 levels by 2030. Leaving the EU may affect how this is delivered. The UK should aim to:

- Remain a part of EU energy efficiency and labelling standards or replicate these at a UK level.
- Ensure heat policy focuses more generally on low-carbon heat, rather than solely renewable heat (e.g. also to include use of waste heat and hydrogen produced using carbon capture and storage), such that take-up of low-carbon heating (i.e. heat pumps or district heating) increases to about 4 million homes and around half of non-residential buildings.
- Improve energy efficiency of buildings by insulating 7 million lofts, cavity and solid walls.

² Measured as the reduction below a no policy baseline.

3. Industry

The cost-effective path for the industry sector involves a reduction in emissions of 23% (26 MtCO₂e) below 2015 levels by 2030. Overall, policies agreed at the EU level in industry cover 82% of the reduction required by 2030.³

A number of EU policies currently influence emissions reduction in industry, including the EU ETS, and energy efficiency and renewables policy:

- **The EU ETS** sets a cap on total emissions from electricity generation and energy-intensive industry, and the single carbon price provides a level playing field across Europe. Industry particularly exposed to non-EU competition and/or facing significantly higher costs can receive their allowances for free. It also allows UK-based industry to purchase emissions reduction from overseas where reducing emissions in the UK would be more expensive.
- **Renewable energy.** Renewable heat in industry is currently incentivised through the UK's Renewable Heat Incentive, which has been implemented in part to meet the requirements of the EU Renewable Energy Directive.
- **Energy efficiency** in industry will contribute to targets the UK has set itself under the EU's Energy Efficiency Directive to 2020. Some of this will also arise from EU policy on energy efficiency of new products, and some will be incentivised by the price of carbon under the EU ETS.

Opportunities and ways forward

UK policy should aim to reduce industry emissions by 23% below 2015 levels by 2030. Leaving the EU may affect how this is delivered:

- If the UK leaves the EU ETS then new approaches will be needed to ensure that industry has incentives to become more energy efficient and to develop low-carbon technologies. New approaches should not disadvantage UK competitiveness.
- Alongside the EU ETS, the UK should continue support for deployment of low-carbon heat and energy efficiency in industry where these derive from EU-level policies or funding.

4. Transport

The cost-effective path for the transport sector involves a reduction in emissions of 43% (51 MtCO₂e) below 2015 levels by 2030. Overall, policies agreed at the EU level in transport cover 87% of the reduction required by 2030.⁴

The majority of emission reductions from transport derive from regulations negotiated and agreed by the UK at the EU level, and which would be expected to continue and to be strengthened to 2030. The largest of these relate to fuel efficiency of new vehicles, but other policies contribute smaller savings (e.g. biofuels) or provide wider incentives for uptake of cleaner vehicles (e.g. air quality standards):

^{3,4} Measured as the reduction below a no policy baseline.

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- **EU new car, van and HGV emission standards.** Progressively tighter car and van regulations are in place to 2020, and HGV standards are being developed. Negotiations are underway about extending these to 2030, which are a key lever for delivering the UK and EU's 2030 targets. The cost-effective path to the UK's 2050 target includes a 30% reduction in new conventional car and van CO₂ emissions by 2030 compared to 2015 levels (e.g. from 123 gCO₂/km to 86 g on a test-cycle basis for new cars).
 - **Biofuels.** The UK is aiming for 10% of transport energy to come from renewable sources by 2020, mainly from biofuels under the EU Renewable Energy Directive.
 - **Eco-driving.** EU regulation also requires that new cars be fitted with technology to help improve drivers' fuel efficiency, including through use of gear shift indicators and fuel consumption meters.
 - **Wider incentives for uptake of clean vehicles** come particularly from EU air quality legislation (e.g. the EU Air Quality Framework and National Emission Ceilings Directives). These are key drivers for electrification of transport modes in cities, including buses.

Even if the UK is no longer party to new EU emissions standards for 2030 these will continue to have an effect on the UK market. However, this could be reduced without complementary UK policies:

- The market for vehicles is EU-wide and regulations apply to the average of manufacturers' sales across the EU and European Free Trade Association (EFTA) areas (rather than by Member State). Therefore it is likely that the design of new vehicles sold into the UK will continue to comply with future EU standards, to the extent that these require all vehicles to become more fuel efficient.
- However, car marketing and pricing strategies can differ by market and country and manufacturers may sell fewer low-emission vehicles in the UK if these do not count towards compliance with EU standards.
 - Whilst the UK may still benefit from more efficient car designs, manufacturers could shift to marketing and selling larger, less efficient cars in the UK, particularly if their sales of low-emission and electric vehicles to the UK do not count towards the EU targets. This could include fewer electric vehicles, particularly if supply of these is capacity constrained and if opportunities for cross-subsidisation across the EU are not available.
 - Manufacturers may also not include - or may make optional - some efficiency improvements if these are no longer mandated (e.g. gear shift indicators). That could reduce the efficiency at which cars are driven, even if the cars themselves are otherwise identical.

It is therefore important that UK policies replacing EU standards retain incentives for manufacturers to sell ultra low-emission vehicles into the UK car market.

Opportunities and ways forward

UK policy should aim to reduce transport emissions by 43% below 2015 levels by 2030. Leaving the EU may affect how this is delivered. The UK should aim to:

- Remain a part of the EU vehicle efficiency standards or replicate these at the UK level. It may be possible to set stretching standards more quickly than the EU, and/or require a more ambitious level consistent with the Government's aim for 100% of new cars to be electric by 2040. Whichever route is taken it will be important that the target is ambitious and reduces

emissions along the cost-effective path (e.g. all new cars should reach 62 gCO₂/km and new vans 81 g/CO₂km on a real-world basis by 2030).

- Preserve or replicate EU regulations that encourage efficient driving (e.g. through the installation of gear shift indicators and fuel consumption meters in new vehicles).
- Maintain or replicate the carbon impact of wider EU-led legislation to incentivise uptake of cleaner vehicles such as the Air Quality Framework and National Emission Ceilings Directive.

5. Waste

The cost-effective path for the waste sector involves a reduction in emissions of 44% (8 MtCO₂e) below 2014 levels by 2030. Overall, policies agreed at the EU level in waste cover all of the reduction required by 2030.⁵

The approach to reducing waste emissions in the UK to date has largely been driven by targets agreed by the UK at the EU level for 2020. Further targets for 2030 have been proposed but not yet agreed:

- **EU Landfill and Waste Framework Directives.** These incorporate targets for reductions in waste sent to landfill and for higher rates of recycling by 2020. To achieve these the UK has introduced a Landfill Tax and other policies including on methane capture, recycling collection, waste prevention and anaerobic digestion.
- **EU Circular Economy Package.** The European Commission has recently proposed a new set of waste targets to 2030 (e.g. to reduce landfill to a maximum of 10% of municipal waste). However, these have not yet been finally agreed and passed into legislation.

Waste emissions have fallen significantly as a result of current policies, and are now around 75% below 1990 levels. If the UK were to be no longer bound by EU waste legislation, then this could risk undermining progress reducing emissions unless equivalent UK policies were introduced.

Opportunities and ways forward

UK policy should aim to reduce waste emissions by 44% below 2014 levels by 2030. Leaving the EU may affect how this is delivered.

The UK should continue to aim to reduce the share of waste sent to landfill to very low levels, ideally zero by 2025, and deploy UK levers to achieve this. That is likely to include continued use of the landfill tax and local incentives/requirements for separate collection of biodegradable waste streams.

6. F-gases

The cost-effective path for F-gases involves a reduction in emissions of 69% (12 MtCO₂e) below 2014 levels by 2030. Overall, policies agreed at the EU level cover all of the reduction required by 2030.⁶

The UK approach to reducing emissions from F-gases currently relies on regulation negotiated and agreed by the UK at the EU level:

⁵ Measured as the reduction below a no policy baseline.

⁶ Measured as the reduction below a no policy baseline.

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- **F-gas Regulation.** This caps the amount of hydrofluorocarbons (HFCs) that producers and importers are allowed to place on the EU market. The cap reduces over time such that EU emissions of HFCs will be 79% below current levels by 2030, and total F-gas emissions around 66% lower.
 - **The Mobile Air Conditioning Directive.** This focuses on F-gas emissions from air conditioning in new cars and vans, and requires new vehicles to use substances with low global warming impacts from 2017.

Were the UK not to be covered by these policies as a result of leaving the EU then an alternative approach must be developed. Alternative approaches are highly likely to be required given that Parties to the Montreal Protocol (the UN treaty governing ozone depleting gases) have agreed to amend the Protocol in 2016 to govern the phase out of HFCs.

Opportunities and ways forward

The UK should aim to continue its inclusion in the F-gas Regulation or develop equivalent or stronger legislation in the UK. This should be strongly enforced to ensure genuine compliance and a reduction in F-gas emissions of 69% from 2014 to 2030.

7. Agriculture and land use, land-use change and forestry

The cost-effective path for agriculture involves a reduction in emissions of 15% (8 MtCO₂e) below 2014 levels by 2030. The cost-effective path for land use and forestry involves an increase in afforestation to 15,000 hectares per year.

There are no EU policies which directly target the reduction of emissions in agriculture. However, the EU framework - based on the Common Agricultural Policy (CAP) and other environmental legislation – can lead indirectly to emission reductions:

- **The CAP** indirectly funds programmes which can lead to emissions reduction.
 - For example, under Pillar Two of CAP the Rural Development Programme provides funding to improve productivity and efficiency of UK farming. In addition, under Pillar One, farmers must meet a set of environmental cross-compliance conditions in order to qualify for the Basic Payment.
 - Pillar Two also funds afforestation schemes, which could deliver savings of 2 MtCO₂e in 2030 if tree planting reaches the ambition set out by England and the Devolved Administrations.
- **Other EU environmental legislation** (e.g. the Nitrates and Water Framework Directives) have helped indirectly reduce agriculture emissions by changing farming practices. For example, the Nitrates Directive restricts use of fertiliser in vulnerable zones to minimise run-off to soils and water courses.

If the UK were no longer to be part of the CAP then this could affect funding for afforestation programmes but also present opportunities for reform:

- In order to preserve current tree planting rates and achieve the UK's afforestation targets, alternative incentives would need to be implemented given the role of the Rural Development Programme.

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- Outside of CAP there could be a significant opportunity to reform the system of agricultural support to better focus on improving agricultural productivity and incentivise greater emissions reduction.
 - There could also be opportunities for the UK to develop approaches which are currently prohibited within the EU but legal in other markets such as the United States. These include use of ionophores in cattle (which inhibit the production of methane and could save over 2 MtCO₂e in 2030), and use of genetically modified crops and livestock. However, these would have to be considered alongside other concerns such as animal welfare and wider ecosystem impacts.

Opportunities and ways forward

UK policy should aim to reduce agriculture emissions by 15% below 2014 levels by 2030, and increase afforestation to 15,000 hectares per year. Leaving the EU may affect how this is delivered. The UK should aim to:

- Develop a policy framework which links farming support more closely to actions that would reduce emissions.
- Preserve and, if necessary, strengthen current incentives for tree planting to achieve the UK's afforestation targets.