

Reducing UK emissions Progress Report to Parliament

June 2020



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Committee on Climate Change
June 2020

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A wide range of stakeholders who engaged with us or met with the Committee bilaterally.

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The Committee



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Lord Deben was the UK's longest-serving Secretary of State for the Environment (1993 to 1997). He has held several other high-level ministerial posts, including Secretary of State for Agriculture, Fisheries and Food (1989 to 1993). Lord Deben also runs Sancroft, a corporate responsibility consultancy working with blue-chip companies around the world on environmental, social and ethical issues. He is Chairman of Valpak Limited and the Personal Investment Management and Financial Advice Association.



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Baroness Brown of Cambridge DBE FREng FRS (Julia King) is an engineer, with a career spanning senior engineering and leadership roles in industry and academia. She currently serves as Chair of the CCC's Adaptation Committee; non-executive director of the Offshore Renewable Energy Catapult; and Chair of the Carbon Trust. She was non-executive director of the Green Investment Bank, she led the King Review on decarbonising transport (2008). She is a Fellow of the Royal Academy of Engineering and of the Royal Society, and was awarded DBE for services to higher education and technology. She is a crossbench Peer and a member of the House of Lords European Union Select Committee.



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Foreword

The COVID-19 pandemic has changed all of our lives. Its effects are far-reaching – its implications profound. Our 2019 report to Parliament urged Government to act on climate. “Now, do it” was our call. Twelve months on that remains our emphatic message, but with a new determination: we must seize the opportunity to make the COVID-19 recovery a defining moment in tackling the climate crisis. We say to the Government: “act courageously - it’s there for the taking”.

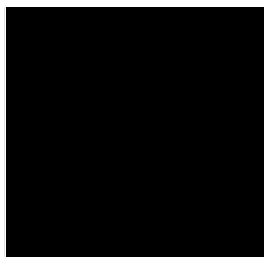
This report provides important new advice to Government on framing a recovery from Covid-19 that both accelerates the transition to Net Zero and strengthens our resilience to the impacts of climate change, whilst driving new economic activity. It builds on the six key principles for a resilient recovery which we outlined in our letter to the Prime Minister in May. We are pleased to see these principles guiding the growing momentum for a green recovery.

This report to Parliament includes our annual review of UK progress in reducing greenhouse gas emissions. The message is clear: action taken in this Parliament will define the pathway towards Net Zero and climate change resilience.

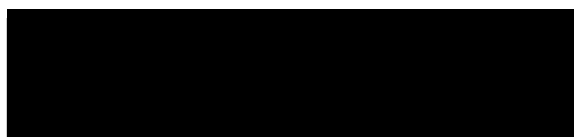
This year, for the first time, we are providing Parliamentarians with new tools to scrutinise progress across Whitehall through an overview of key actions which must be delivered department-by-department. Our hope is that this approach will also prove useful for the Cabinet Committee on Climate Change as it coordinates Government action. We will review the progress of that Committee against our latest recommendations in June 2021.

Strong domestic action will provide the basis for the UK Government’s vital international leadership in the coming year as it takes on the presidency of the COP26 climate summit in 2021. The UK’s international credibility is on the line. The much-anticipated climate conference will be a major test of global cooperation as the world seeks to recover from COVID-19. With strong climate action taking place here at home, the UK will be well placed to guide that global response.

Our report this year is extensive, but the priorities ahead are clear. The most effective and decisive action to secure our recovery from COVID-19 will also accelerate the transition to Net Zero and strengthen our resilience to the changing climate. Unifying these aims is absolutely necessary and entirely possible.



Lord Deben
Chairman, Committee on Climate Change



Baroness Brown of Cambridge
Chair, Adaptation Committee

Executive Summary



COVID-19 is a public health crisis; our recovery from it will reshape how we tackle the climate crisis. Choices in the coming months must steer a recovery that drives vital new economic activity, accelerates our transition to Net Zero and strengthens our resilience to the impacts of climate change. UK domestic climate ambition can be the basis for UK international leadership in 2021, in the Presidency of the delayed UN climate summit in Glasgow (COP26) and in the G7 Presidency.

It is 12 months since Net Zero became law, requiring the UK to reduce net emissions of greenhouse gases to zero by 2050. Initial steps towards a net-zero policy package have been taken, but this was not the year of policy progress that the Committee called for in 2019.

Net Zero has been adopted as a key goal of the Government and the Prime Minister is chairing a Cabinet Committee to deliver it. There were important new announcements on transport, buildings, industry, energy supply, agriculture and land use. But these steps do not yet measure up to meet the size of the Net Zero challenge and we are not making adequate progress in preparing for climate change.

The delay of COP26 to November 2021 provides a window to address this policy deficit and establish a credible internationally-leading position:

- The Buildings and Heat Strategy, due later this year, must take low-carbon heating from a niche market in the UK to the dominant form of new heating installation by the early-2030s. It should be supported by a national effort to improve the energy efficiency of UK buildings along with ensuring their safety and comfort as the climate warms.
- The Government's welcome new ambitions to change patterns of transport demand and decarbonise surface transport still require strong policies to deliver them, especially in the context of COVID-19 recovery and social distancing.
- The goal to substantially expand supplies of low-carbon power must be accompanied by steps in the Energy White Paper to encourage a resilient and flexible energy system.
- Enduring market mechanisms are needed to drive investment in a much wider set of low-carbon industrial technologies and industrial sectors than the piecemeal schemes announced so far.
- The unique opportunity to reform agricultural support and encourage transformational land-use change will be missed unless the Environment and Agriculture Bills are strengthened. They should be backed by a strategic mechanism to fund tree planting and natural carbon storage at a much larger scale while improving the productivity and resilience of our food supply, strengthening flood protection and protecting biodiversity.
- UK leadership also depends on building resilience to climate change, a resilience which no UK sector has yet demonstrated for even a 2°C rise in global temperature. We will publish our updated assessment of the risks and a review of the UK's progress next June, by which time much better plans must be in place.

The Cabinet Committee on Climate Change will be crucial to coordinating and prioritising cross-departmental initiatives and will need to move to frequent, regular meetings.

Success requires that net-zero emissions and improved climate resilience are integral to the COVID-19 recovery. The extraordinary steps taken to slow infections in recent months have created new economic and social pressures. Climate investments will help create jobs and stimulate economic recovery, while changing the course of UK emissions and improving our resilience to climate change for the coming decade and beyond.

The fundamental requirements to achieve Net Zero (set out in chapter 1) are largely unchanged by COVID-19. They include infrastructure investments and reskilling of workers – both of which can help the UK to recover from the COVID-19 crisis.

Meanwhile, the risks of the changing climate continue to mount. A sharp fall in global emissions in 2020 will not address the cumulative problem of rising concentrations of greenhouse gases in the atmosphere. The need to increase the UK's preparedness for future shocks has never been clearer. This is a moment to improve the effectiveness of national planning for the threats from climate change that are already inevitable, as well as the uncharted but potentially catastrophic change if higher levels of warming occur.

This report, required under the Climate Change Act, takes stock of progress in reducing UK emissions. We offer commentary on progress in each sector and the steps that can be taken now to achieve a green and resilient recovery. Our recommendations on emissions reduction are joined by recommendations to improve climate change adaptation to strengthen the UK's resilience to climate risks. For the first time our advice is grouped by Government department to bring extra clarity to the steps required across government and to emphasise that this is indeed a task for the whole Administration, not one limited to a few Departments (Tables 1-14, which follow this summary).

Building a resilient recovery from the COVID-19 crisis

In 2020, global emissions are expected to fall by a record 5-10%, with a potentially larger fall in the UK.¹ But this effect is only temporary. CO₂ emissions must be cut consistently year after year until they reach net-zero globally to slow and halt global warming.

The UK has agreed through the UN to lead a global work stream on ensuring an inclusive and sustainable recovery. This is a tribute to the UK's reputation and will require the UK to be an exemplar in its domestic recovery programme.

The months ahead have huge significance. The steps that the UK takes to rebuild from the COVID-19 pandemic and its economic damage can also accelerate the transition to low-carbon activities and improve our climate resilience. Climate investments can also support the economic recovery and secure good jobs for the long term, while taking advantage of low interest rates.

The pandemic has also demonstrated how quickly social change can occur – and the role of government in driving that change. Early indications show that the public are now more aware of external risks and continue to favour action to tackle climate change.²

These are strong conditions for Government to reinforce the climate-positive behaviours that have emerged during the lockdown, including increased remote working, cycling and walking. Public sector leadership can play a key role in the forming of new social norms and expectations.

¹ The International Energy Agency published a scenario with an 8% drop in global CO₂ emissions in 2020. The Global Carbon Project estimated a global emissions drop of 2-7% if lockdowns are short-lived and 3-13% if restrictions remain globally to the end of the year. Daily emissions in the UK are estimated to have seen a peak fall of 31%, compared to an average peak fall in individual countries of 26%.

² In a poll for IPSOS, 66% of the British public agreed that 'in the long term, climate change is as serious a crisis as COVID-19 is'; 79% of UK Climate Assembly members agreed that the economic recovery 'should be designed to help achieve Net Zero'.

Lessons from the COVID-19 crisis on the importance of planning for systemic risks also apply to our preparations for climate change itself. The Committee has already highlighted a dearth of climate adaptation planning in government. This is a moment to confront the range of climate risks that face the UK, including flooding, over-heating and water shortages, with realistic planning for the inevitable temperature rises ahead.

There are also new threats to delivering the UK's Net Zero goal. Measures to protect public health inevitably will affect the ability to deliver some climate measures (e.g. continued social distancing will hinder a movement towards public transport, and some low-carbon investments will be delayed). Short-term choices aimed at tackling unemployment and inequality, if poorly targeted, could lock in higher emissions in the long-term. Similarly, international choices focused narrowly on short-term economic recovery could undermine efforts to cut global emissions. Planning must be reset across the whole of government (Box 1 sets out principles for this reset):

- In the short term, with the economy operating well below capacity, action by Government must protect workers and businesses, restore confidence, stimulate spending and rebuild a greener economy, particularly for the most affected regions and sectors. These objectives can be strongly complementary to the UK's climate goals and must avoid locking into carbon-intensive activities in the long term.
- For the long term, the UK must invest in key assets to build capacity and enable productive activity in the future. This means investing in climate-resilient low-carbon infrastructure, job creation in low-carbon and climate-resilient industries, training and reskilling of the workforce. It also requires investments in building knowledge, and natural, social and institutional capital. Public money should not support industries or infrastructure in a way that is not consistent with the future net-zero economy or that increase exposure to climate risks.

There is strong evidence, set out in chapter 5, that a range of low-carbon and climate adaptation 'green stimulus' measures fulfil both the short-term and long-term needs. Many can be delivered quickly, have high economic multipliers (i.e. they in turn stimulate further boosts to economic activity), create high numbers of jobs, and boost spending in the UK (rather than overseas). In the long term, a transition to a low-carbon, efficient and resilient economy will bring productivity benefits throughout the economy.

There are clear economic, social, and environmental benefits from immediate expansion of the following measures:

- Investments in low-carbon and climate-resilient infrastructure.
- Support for reskilling, retraining and research for a net-zero, climate-resilient economy.
- Upgrades to our homes and other buildings ensuring they are fit for the future.
- Action to make it easy for people to walk, cycle, and work remotely.
- Tree planting, peatland restoration, green spaces and other green infrastructure.

Greater use of carbon taxes can support the public finances and strengthen incentives to reduce emissions. They are particularly attractive when global oil prices, and therefore consumers' energy costs, are low, as they are now. Particular attention is needed to where the costs and benefits of action fall, given the uneven effects of the COVID-19 crisis.

Chapter 5 sets out detailed advice on the steps to achieve a resilient recovery.

Box 1. Six principles for a resilient recovery

In April 2020, we wrote to the Prime Minister and the First Ministers of Scotland, Wales and Northern Ireland setting out six principles for a resilient recovery from COVID-19:

- Use climate investments to support the economic recovery and jobs.
- Lead a shift towards positive long-term behaviours.
- Tackle the wider 'resilience deficit' on climate change.
- Embed fairness as a core principle.
- Ensure the recovery does not 'lock-in' greenhouse gas emissions or increased climate risk.
- Strengthen incentives to reduce emissions when considering fiscal changes.

Our Costs and Benefits Advisory Group on Net Zero, which we reconvened for this report, endorsed these principles and concluded that "*the economic recovery from [COVID-19] gives the UK a chance to grow back in a way that is fit for the low-carbon future to which it aspires, and that can benefit from the industrial and economic developments that this future offers.*"

Source: CCC (2020) Letter to Prime Minister Boris Johnson on *Building a resilient recovery from the COVID-19 crisis*.

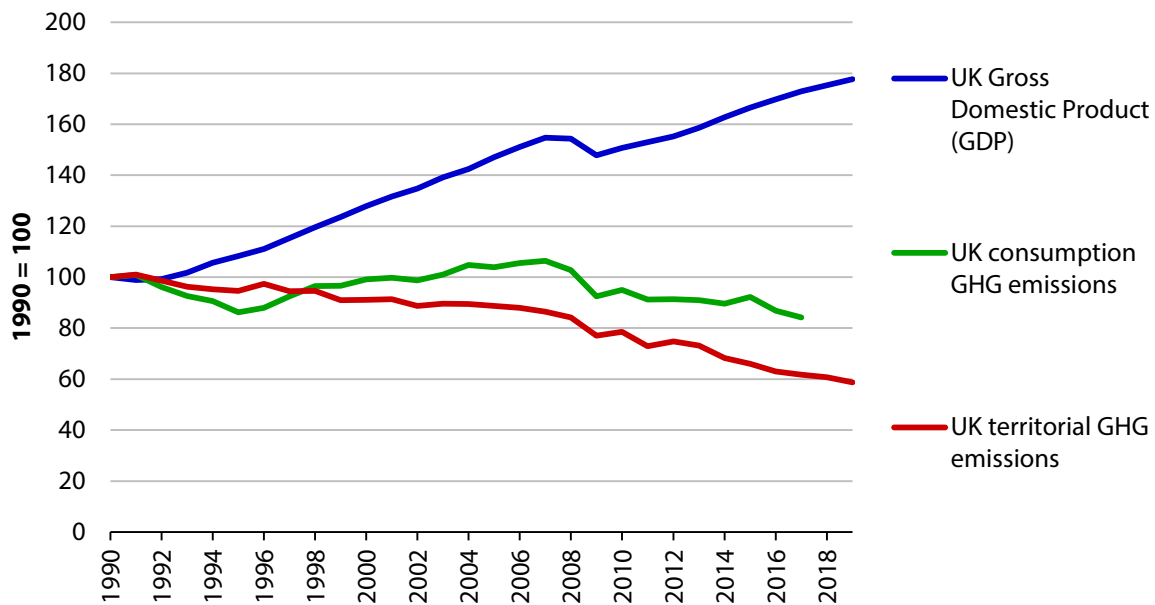
Taking strong UK climate governance to COP26

Next year the UK will host the rescheduled 26th 'Conference of the Parties' climate summit (COP26). 2021 will also see the UK hold the presidency of the G7. The year ahead is a critical moment for global progress on climate change and a major test of global cooperation more generally after COVID-19. The core goal of COP26 is to raise the ambition of countries' targets. As COP President, there will be huge expectations on the UK to do so. It has never been more important for the UK to demonstrate strong climate leadership, both for the world's future and for the UK's standing within it. Since the Climate Change Act was passed in 2008 reductions in greenhouse gas emissions have been driven by some strong sectoral policies (see chapter 2).

- In the period 2008-2019, overall *territorial* emissions have reduced by 30% while the economy grew by 15%. The UK has the strongest record of emissions reduction in the G20 over the last decade, and over a longer period back to 1990. The good performance continued in 2019, with a 3-4% reduction in emissions to 480 MtCO₂e, the seventh year in a row with falling emissions.³
- Under *consumption* accounting – which includes emissions embedded in imports produced overseas but consumed in the UK – despite rising consumption, emissions have also fallen, although more slowly (by 18% from 2008 to 2017, the latest year of available data). This reflects that the same factors driving down UK territorial emissions have also reduced our consumption emissions, with only small contributions from changing consumption and trade patterns over the last decade. Chapter 2 provides new analysis of the UK's overall carbon footprint.

³ These figures include emissions from international aviation and shipping. From 1990 to 2019, emissions fell 41% and the economy grew 78%.

Figure 1. UK emissions have fallen while the economy has grown (1990-2019)



Source: BEIS (2020) *2019 UK Greenhouse Gas Emissions, Provisional Figures*; BEIS (2020) *2018 UK Greenhouse Gas Emissions, Final Figures*; ONS (2020) *Gross Domestic Product: chained volume measures: Seasonally adjusted £m*; Defra (2019) *UK's carbon footprint*; CCC analysis.

Note: International aviation and shipping is included in both the territorial and consumption emissions statistics.

Recent falls in UK emissions are dominated by policy-driven progress in the power sector. While other sectors with weaker policies have made more limited progress, power sector emissions fell 67% from 2008 to 2019 under a well-designed, coherent and effective package of policies to encourage low-carbon investment:

- **A clear direction.** Since the Climate Change Act was passed, it has been widely understood that the power sector would have to decarbonise heavily given its high emissions and to support electrification in other sectors.
- **A stable, predictable carbon price.** The UK introduced a carbon price floor in 2013 to underpin the price in the EU Emissions Trading System.
- **Investable market instruments.** Following initial progress under the Renewables Obligation, long-term contracts for low-carbon power generation were announced in 2011, to be awarded by competitive auction. Emerging technologies (e.g. offshore wind) were explicitly supported in addition to more mature options.
- **Product standards.** European efficiency standards for lights and household appliances drove down electricity use as products were replaced over time with more efficient models.
- **Enabling measures.** Potential blocks on progress were addressed, guided by public-private collaboration, for example, through the Green Investment Bank.

Besides the direct reductions in emissions, this package has driven down costs (e.g. offshore wind has fallen from over £150/MWh to around £40/MWh) and supported industrial activity and boosted regional employment.

The lessons from UK power sector decarbonisation must now be applied in other sectors. This will also bolster the UK's leadership credentials ahead of COP26, providing the strongest platform to encourage a global increase in effort. That can build on the powerful example of phasing out coal for electricity generation while maintaining security of supply.

Comprehensive global leadership on climate policy also requires the UK's progress on emissions to be matched by much stronger climate adaptation planning, which has languished for the last decade.

In chapter 3, we highlight broader lessons from the UK's experience since the Climate Change Act – both successes and failures. The UK COP26 Presidency can emphasise the importance of strong national climate laws and strong climate policy to deliver against them.

The last 12 months: progress since the Net Zero target was set

While policy implementation has not yet met the required ambition, Net Zero has proved to be a strong signal for new policy development across government. We set out the progress in the last year on policy to prepare for Net Zero in chapter 4.

The overall policy framework

Important new parts of the policy framework have been introduced since the target was set a year ago. Most have not yet delivered, however, so must progress in the coming year. Their work should be integrated with the wider COVID-19 recovery strategy.

- The UK Government has instigated a **Cabinet Committee on Climate Change**, chaired by the Prime Minister, as we recommended last year. However, it did not meet until March this year, five months after its creation. The Cabinet Committee should meet regularly (e.g. monthly) and report transparently against its goals "to hold departments to account for their actions to combat climate change" (which should include adaptation actions) and to "co-ordinate" the net-zero strategy.⁴
- A **Treasury Net Zero Review** has commenced to "consider how the transition to Net Zero will be funded and assess options for where the costs will fall", in line with the Committee's recommendation.⁵ A just transition is a crucial part of meeting our Net Zero target. The review should feed in immediately to plans for the COVID-19 recovery and put Net Zero at the heart of the UK's economic strategy.
- The **National Infrastructure Strategy**, due to set a vision for infrastructure development over the next 30 years consistent with Net Zero, has been delayed from Budget 2020. It should prioritise early funding for areas needing public finance that will support the recovery and prepare for Net Zero and require that all new investments should assess and plan for the impacts of climate change. Important priorities include: energy efficiency and avoiding overheating in buildings; electric vehicle charging infrastructure; hydrogen production and carbon storage infrastructure; 5G and fibre broadband; and risk management for flooding and coastal erosion.

⁴ HMG (2019) *PM to chair new Cabinet Committee on Climate Change*.

⁵ HMT (2019) *HM Treasury's review into funding the transition to a net zero greenhouse gas economy: terms of reference*.

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- The **Climate Assembly** was convened by Parliament to explore public attitudes on how the UK should meet the Net Zero target. After initial delay due to COVID-19 it was completed virtually and is due to report this summer. Its findings should inform policy development and wider efforts to engage the public in the Net Zero challenge.
 - Plans for a **UK Emissions Trading System** are developing – the Government has committed to this being more ambitious than the EU scheme from the start and to revising it to align to the net-zero pathway after the Committee advises on that pathway in December.
 - **Energy Innovation Needs Assessments** were published to identify the key innovation needs across the UK energy system. These can guide energy innovation spending, which in 2015 the Government committed to double to over £400 million per year by 2021.

Policies to drive emissions reductions across the sectors

Progress is also underway in developing policies to drive emissions reductions across the largest emitting sectors of the economy. However, these are generally far from complete and leave significant gaps.

- **Policy ambition for cars and vans is strengthening and addressing the right areas.**
 - The Transport Decarbonisation Plan sets bold ambitions on the demand side, which will need to be backed by firm policies. Near-term changes to enable social distancing (e.g. dedicating more road space for walking and cycling) can support longer-term shifts that will improve air quality and public health.
 - The UK Government is consulting on bringing forward the date for phasing out petrol and diesel cars and vans (including hybrids) from 2040 to 2035 or earlier, in line with the Committee's advice. The Committee's assessment is that the date should be brought forward to 2032 at the latest, and backed by detailed policy arrangements to deliver it.
 - Company car tax reforms, alongside purchase grants and preferential tax treatment, are providing a strong consumer incentive to purchase low-carbon vehicles. More could be done with Vehicle Excise Duty to strengthen incentives for all buyers and to discourage the most polluting vehicle purchases.
 - The Department for Transport's expansion plans for the charging network are in line with the requirements identified in the Committee's analysis. Now they must be delivered.
- **Announcements for manufacturing and other industry have been piecemeal and slow.** The Government consulted on mechanisms to incentivise industrial carbon capture and storage and announced a £250m Clean Steel Fund. However, coverage of these policies is far too narrow and progress has been too slow, as has delivery of the existing £600m capital funds for decarbonising manufacturing. There is still no strategic approach to drive change at the required scale and pace.
- **Buildings and heating policy continues to lag behind what is needed.**
 - Provided the final details match its intentions, the Future Homes Standard will mean that new homes must be built to be zero-carbon from 2025. This change is long overdue – since the Climate Change Act was passed, nearly two million homes have been built that are likely to require expensive zero-carbon retrofits and have missed out on lower energy bills.

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- The Government's election manifesto pledged over £9 billion over the next decade for energy efficiency. This is welcome but not enough to match the size of the challenge and has been delayed while awaiting the National Infrastructure Strategy.
 - The Renewable Heat Incentive has been extended and reforms proposed, while a Green Gas Levy has been proposed. While welcome, the current plans are far too limited to drive the transformation required to decarbonise the UK's existing buildings, leaving a lot of work for the Buildings and Heat Strategy that is under development (and to which we return below).
 - There remains a longstanding need to integrate emissions reduction measures in homes with improvements to resilience and indoor environmental quality. Having a policy that considers all of these together is critical to ensure building safety and comfort.
 - **Power sector plans are advancing in line with the large scale required for the net-zero target.** Contracts to construct a further 6 GW of offshore wind were awarded at record low prices in the last year and ambition for 2030 was increased from 30 GW to 40 GW. The Government announced welcome plans to bring large-scale solar and onshore wind back into the system of power auctions. A clear timetable for future auctions would support delivery and development of supply chains.
 - **Agriculture and land use, land-use change and forestry (LULUCF).** The Government has included climate mitigation (i.e. reducing emissions) and adaptation (i.e. preparing for the impacts of climate change) as key 'public goods' to be paid for as part of the UK's overhaul of agriculture and land policy through the Agriculture and Environment Bills. The final legislation and detailed policy design will need to be strong and effective to deliver the transformational change needed – the current voluntary approach has failed to cut agricultural emissions, there has been no coherent policy to improve the resilience of the agriculture sector, and tree planting policy has failed outside of Scotland.

Progress in the last year has reached beyond central and devolved government, with significant new commitments to reduce emissions to net-zero by local authorities and private companies. These demonstrate the broad willingness to take action, provided they are backed with investable policy frameworks to deliver the changes required. There is also an important role for regulators (e.g. Ofgem, whose decarbonisation action plan considers the impact of Net Zero on its activities) and public bodies (e.g. the NHS are developing plans to reach net-zero emissions as soon as possible).

Progress remains significantly off track in adaptation to build climate resilience.

The year ahead: defining the UK's climate credentials

In December, the Committee will publish its recommendation on the level of the Sixth Carbon Budget, the limit on UK emissions for 2033-37. This will present a full pathway to net-zero greenhouse gas emissions by 2050. Government is required to respond to that advice and legislate the new carbon budget by June 2021.

The critical policy and infrastructure decisions for Net Zero will be defined in this Parliament. The broad path is already clear.

- By 2025, a full net-zero policy package must be in place and working effectively. Most areas will have scaled up delivery and the transition must be well underway.

- By 2030-35, almost all new investments (e.g. all new cars and heating systems) should be zero-carbon.
- From 2035 to 2050, emissions will continue to reduce rapidly as investments flow through the economy, but the rate and type of investment will not need to change as much as in earlier years.

The key remaining elements of the net-zero policy package must be put in place in the coming months, early enough to demonstrate the UK's credentials ahead of COP26.

- **Surface transport (which accounted for 24% of 2019 emissions): ambitions must be delivered and extended.** Ambitions for supporting active travel and for decarbonising cars and vans must be translated to action in the Transport Decarbonisation Plan, due later in 2020. For example, there should be a rising mandate for car companies to sell a minimum share of zero-emissions vehicles, reaching 100% by 2032 at the latest. The sort of policy package targeted at the car and van markets must be extended to other vehicles, including heavy goods vehicles.
- **Industry (21% of 2019 emissions)⁶: policy needs to be more strategic and move faster.** The Government must set out a long-term approach to drive change in manufacturing at the required scale and pace alongside a strengthening of UK competitiveness. A funding mechanism is needed for the operational costs of demonstration and early deployment of industrial electrification and hydrogen use as well as carbon capture and storage (CCS). Faster deployment of announced funds would support jobs, skills and the recovery, while enabling crucial progress on decarbonisation.
- **Buildings (18% of 2019 emissions): policy needs a step change in ambition and delivery this year.** It can play a key role in supporting the economic recovery and creating jobs and training opportunities across the UK. Efforts to reduce emissions must be integrated with efforts to improve the safety and resilience of buildings (e.g. to fire, flooding and over-heating), indoor air quality and efforts to tackle fuel poverty. The housing ministry (MHCLG) and the Treasury have key roles alongside the energy department (BEIS).
 - The Buildings and Heat Strategy, planned for later in the year, must set a clear **direction**, backed by standards, towards phasing out installation of new gas boilers by 2035 at the latest and making homes climate-resilient.
 - It should be supported by tax or levy changes that favour low-carbon heating over fossil fuels and **funding** for capital grants (including for hybrid heat pumps) at a much larger scale than existing plans.
 - A set of **enabling measures** is needed to build skills and confidence, to improve the consumer experience and to strengthen monitoring and compliance.
 - Local authorities and network operators should be given key roles in **driving early progress** and planning, backed up by the necessary resources.
 - **Commercial buildings** must also be addressed and the public sector should take a lead. **Embedded emissions**, which include emissions from the construction process and the materials used in buildings, must also be tackled.

⁶ The emissions percentages in this section include construction and fossil fuel supply in industry.

- **Energy supply (the power sector accounted for 12% of 2019 emissions): policy must reach beyond renewable power.** The Energy White Paper, due later in 2020, should address the challenges faced as renewables take an ever larger share: how they will be contracted, how the economic benefits of flexibility will be realised and how energy supply resilience will be ensured. A similarly ambitious policy package should be developed to build supply of and demand for low-carbon hydrogen. **Bioenergy and wastes must be tightly regulated to ensure sustainability and their use should be prioritised in such a way as to maximise emissions savings across the economy.** Any bail-outs for the oil and gas sector should support their transition towards net-zero business models.
- **Agriculture (9% of 2019 emissions) and land (removals of 2%): policy must drive transformational changes.** As the Agriculture and Environment Bills move to implementation there should also be: a strengthened regulatory baseline to ensure low-regret measures are adopted; incentive schemes such as auctioned contracts to drive afforestation; and enabling measures to address issues such as skills, supply chains and barriers for tenant farmers. Policy design must account for the challenges of the changing climate and reflect wider environmental policy, including for biodiversity, to make the most of potential synergies and avoid unnecessary trade-offs.
- **International aviation and shipping should be formally included in UK climate targets when the Sixth Carbon Budget is set, and net-zero plans should be developed.**
 - **Aviation (8% of 2019 emissions).** A policy framework is needed to achieve net-zero emissions by 2050, including demand-side measures, efficiency and low-carbon fuels, with residual emissions offset by verifiable removals. The UK's airport capacity strategy should be reviewed in light of the net-zero target. Action is also needed on non-CO₂ warming effects from aviation.
 - **Shipping (3% of 2019 emissions)** must build on the Clean Maritime Plan to develop incentives for zero-carbon ammonia & hydrogen supply chains.
- **Smaller sources of emissions must also be tackled and plans developed for engineered emissions removals.**
 - **Waste (4% of 2019 emissions).** Policy needs to accelerate the move to a circular economy, with more ambition on waste reduction, re-use and recycling during the 2020s, particularly in England and Northern Ireland. Regulation should be announced this year to ban landfilling of biodegradable waste from 2025 across all UK nations. **Emissions from waste incineration will also need to be addressed.**
 - **F-gases (3% of 2019 emissions).** The UK has introduced legislation to maintain a phased reduction in the use of hydrofluorocarbons (HFCs) to 2030, as previously mandated by the EU. The UK Government should review F-gas regulations this year (in parallel with the European Commission review), and develop new policies to cover medical use and emissions of F-gases not covered by existing legislation.
 - **Greenhouse gas removals (0% in 2019).** The Government should consult on a mechanism and governance principles to bring greenhouse gas removal technologies to market in the second half of the 2020s.

For many of these areas the Government has already announced publications that target the relevant policy areas. The content and ambition of these plans will determine whether the UK can be credibly on track to Net Zero by June 2021, when the Committee will review progress again, four months before COP26. Decisions in the spending review, and government leadership more broadly (e.g. through procurement and estate management), must support development of effective plans. We set out more details on the policy changes that are required in chapter 6.

The Committee will also publish in mid-2021 our latest assessment of progress preparing for the impacts of climate change, and the evidence report for the next UK Climate Change Risk Assessment (CCRA3). Given the importance of adaptation within the UN process (e.g. the need to cover it in the UK's Nationally Determined Contribution) a strong and immediate effort is needed prior to these publications to strengthen the UK's preparedness ahead of COP26.

Next steps

This summary is followed by a set of tables detailing climate policy priorities (covering both Net Zero and adaptation) for each UK Government department. These are not exhaustive or intended to be prescriptive where different means could achieve the same ends. Nor should they be taken as implying that policy can be developed in silos – it must be coherent and reflect interacting risks and opportunities. Rather, they are intended to give a clear list for Ministers and officials to guide their planning, and for the Cabinet Committee to hold departments to account. We will review progress against these recommendations in June 2021.

In the next 12 months we will also provide progress reports to the Welsh and Scottish Governments, and continue to support the Northern Ireland Executive as they develop new climate change targets. Success across the UK will require that reserved and devolved policy (and local/regional policy) is joined up and working together.

It falls to the UK Government in this Parliament to take the major decisions that will guide further progress towards Net Zero and improved climate change resilience. We began this Parliamentary term with an acute public health crisis, and delay to COP26; the UK now has the opportunity to lead a decisive response to the chronic crisis of climate change itself.

The rest of this report is set out in six chapters:

- 1. A review of the climate challenge after COVID-19** – An introduction setting out the new context for climate policy in the UK.
- 2. Progress since 2008** – A look back at progress reducing emissions globally and in the UK since 2008, including territorial and consumption accounting.
- 3. Lessons learned since 2008** – A look back at themes since the Climate Change Act was passed and how they can inform future policy.
- 4. Progress on emissions, indicators and policy in the last year** – A deep dive into developments of the last 12 months.
- 5. Planning a resilient recovery** – The continued need for Net Zero and the role it should play in the economic recovery following the COVID-19 crisis.
- 6. What is needed now – UK climate policy.** The climate policy priorities that need to be tackled across Government and beyond, especially in the coming year.

Recommendations by department⁷

Table 1. Recommendations for the Cabinet Office and N.10	
Recommendation	Timing
<p>Continue to embed Net Zero as a core Government goal and strengthen focus on climate adaptation.</p> <ul style="list-style-type: none"> • Led through the Cabinet Committee on Climate Change, which should meet monthly and report transparently on progress, including adaptation. • Ensure departments and delivery bodies are sufficiently resourced and are taking action as set out in this report. <p>Ensure the COVID-19 recovery plans accelerate the transition to Net Zero and strengthens the UK's resilience to climate risks.</p>	Now and ongoing
<p>Set the Sixth Carbon Budget (covering 2033-2037) in line with the Committee's advice, due in December 2020.</p>	H1 2021
<p>Develop and implement plans towards making all public buildings and vehicle fleets zero-carbon in the long term. Government must set the standard on buildings decarbonisation by accelerating plans to halve direct emissions in the public estate by 2032 at the latest.</p>	Now and ongoing
<p>Cabinet Office should lead a strong cross-government response to the most urgent national risks set out in the third Climate Change Risk Assessment.</p>	H1 2021
<p>Review guidance documents used in policy and business case development (e.g. the Green Book) and ensure these are consistent with the requirements of Net Zero and account for the impacts of climate change.</p>	H1 2021
<i>Continues on the following page</i>	

⁷ These tables are not exhaustive or intended to be prescriptive where different ends could achieve the same means. Nor should they be taken as implying that policy can be developed in silos - it must be coherent and reflect interacting risks and opportunities. They are intended to give a simple list for Ministers and officials to guide their planning, and for the Cabinet Committee to hold departments to account. We will review progress against these recommendations in June 2021.

H1 = first half; Q1 = first quarter. Timings refer to when the Committee expect actions to have occurred by.

Table 1. Recommendations for the Cabinet Office and N.10

Recommendation	Timing
<p>Priorities for all departments:</p> <ul style="list-style-type: none">• Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives.• Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels).• Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future.• Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department.	Now and ongoing

Table 2. Recommendations for the Foreign and Commonwealth Office, the Department for Business, Energy & Industrial Strategy, the Department for International Development & the COP26 Unit

Recommendation	Timing
<p>Demonstrate UK climate leadership at COP26 and the G7, including:</p> <ul style="list-style-type: none"> • Submit a UK Nationally Determined Contribution (NDC) on the basis of the pathway to reach Net Zero by 2050 that the Committee will advise on in December 2020. Deliver an exemplar NDC, reflecting the expectations of the Paris Agreement, including commitments on adaptation and climate finance (on which the Government recently committed to double spend). Choose timing to maximise diplomatic impact. • Update the UK's long-term low greenhouse gas emission development strategy with the UNFCCC to reflect a formulated economy-wide plan needed to achieve Net Zero by 2050. • Support and champion increases in domestic UK action on mitigation and adaptation consistent with reaching net-zero emissions and demonstrating that all departments are planning for a minimum 2°C rise in global temperature with consideration of 4°C. • Work through UNFCCC and other international fora (e.g. ICAO) to support the development of high integrity international carbon markets and strengthened governance for bioenergy and removals, through rule-setting, capacity-building and early market development. • Help support the adoption of raised ambition and Net Zero targets internationally in the year before COP26 to maximise the international impact of the UK Net Zero target. This will help countries onto sustainable development paths, focusing on areas of comparative UK strengths. • Actively utilise the opportunities of the UK's international leadership platforms ahead of COP26 to convene efforts to align global COVID-19 recovery plans with the goals of the Paris Agreement. • FCO: Develop a plan to address the scale of climate risk that the UK faces from climate change overseas, with support from Defra, DIT, DFID and the Home Office. 	<p>To November 2021 and beyond</p>
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> • Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. • Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). • Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. • Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	<p>Now and ongoing</p>
<p>Notes: These recommendations will apply to the Foreign, Commonwealth and Development Office following the merger of DFID and FCO.</p>	

Table 3. Recommendations for HM Treasury	
Recommendation	Timing
Ensure the COVID-19 recovery plans accelerate the transition to Net Zero and strengthen the UK's resilience to climate risks.	2020
Complete the Net Zero Review , which should: <ul style="list-style-type: none"> • Develop a plan for funding decarbonisation fairly and review the distribution of costs for businesses, households and the Exchequer. • Consider near-term as well as long-term decarbonisation funding needs and policy implications for a just transition. 	By Q1 2021
The spending review (s) should ensure departments are fully equipped to deliver the necessary actions across climate change mitigation and adaptation, during the rest of this Parliament and beyond.	2020
Ensure the forthcoming National Infrastructure Strategy is fully consistent with the UK's Net Zero and climate adaptation objectives, in particular on buildings energy efficiency, where funding is likely to be needed beyond manifesto commitments.	2020
Work with BEIS on the Buildings and Heat Strategy, and a strategy for net-zero manufacturing to ensure that relative prices favour a shift to low-carbon technologies that sufficient funding is available and to consider the role of tax incentives (e.g. Stamp Duty differentials). Work with MHCLG and the new buildings safety regulator to ensure that local authorities are properly funded to enforce buildings standards.	2020
Reform Vehicle Excise Duty to provide stronger incentives to purchase zero emission vehicles and halt the shift towards larger, higher emitting cars.	H1 2021
Review guidance documents used in policy development (e.g. the Green Book) and ensure these are consistent with the requirements of Net Zero and account for the impacts of climate change.	H1 2021
Climate adaptation: <ul style="list-style-type: none"> • Reinstate funding for an adaptation support service for businesses and public sector bodies including local authorities. • Develop a plan for funding climate resilience across infrastructure, society and the economy, equivalent to the work currently being undertaken on Net Zero. 	H1 2021
<i>Continues on the following page</i>	

Table 3. Recommendations for HM Treasury

Recommendation	Timing
<p>Priorities for all departments:</p> <ul style="list-style-type: none">• Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives.• Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels).• Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future.• Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department.	Now and ongoing

Table 4. Recommendations for the Department of Business, Energy & Industrial Strategy	
Recommendation	Timing
Ensure the COVID-19 recovery plans accelerate the transition to Net Zero and strengthen the UK's resilience to climate risks.	2020
Deliver a renewed Clean Growth Strategy that is consistent with Net Zero and the Committee's December 2020 recommendations on the Sixth Carbon Budget. Where policies remain under development, there should be clear statements on their plans and ambition.	H1 2021
Review the planned UK Emissions Trading System following the Committee's December advice on the Sixth Carbon Budget and adjust it to align to the Net Zero pathway.	H1 2021
Buildings decarbonisation: produce an ambitious Buildings and Heat Strategy to eliminate emissions from buildings through a clear direction for the next 30 years backed by standards, funding to make low-carbon heat pay, enabling measures (i.e. skills and green passports) and actions to drive immediate progress. The CCC will advise further on heat policy later this summer. (In partnership with HMT, MHCLG and DfES)	2020
Buildings targets and standards: Publish long-awaited policies to deliver Clean Growth Strategy ambitions on retrofit (minimum EPC band C by 2035), the 20% business efficiency target and the public sector targets. This must include a package for able-to-pay homeowners, a delivery mechanism for the social housing minimum standards and support for SMEs.	2020
Carbon Capture and Storage: <ul style="list-style-type: none"> Choose the preferred funding model and mechanism for delivering CO₂ infrastructure by the end of this year, planning for plants to be operational at multiple industrial clusters by the mid-2020s. Support business models for CCS designed for use in industry, electricity and hydrogen production and GHG removals. 	2020 Now and ongoing
<i>Continues on the following page</i>	

Table 4. Recommendations for the Department of Business, Energy & Industrial Strategy

Recommendation	Timing
<p>Manufacturing and construction:</p> <ul style="list-style-type: none"> • Publish manufacturing and construction decarbonisation strategy. Q1 2021 • Decide on preferred mechanism for supporting industrial CO₂ capture and set out plans for awarding support. 2020 • Consult on mechanisms to enable early deployment of industrial fuel switching. Q1 2021 • Agree an ambitious and tight set of Climate Change Agreements with industry to help deliver industrial energy efficiency improvements and set out which policies will deliver the additional 12 TWh of industrial energy efficiency potential identified by the Government. Q1 2021 • Set out a clear plan to develop near-zero emission non-road mobile machinery (NRMM) for applications where these are not yet available and increase deployment for NRMM applications where options are already available. H1 2021 	
<p>Fossil fuel supply:</p> <ul style="list-style-type: none"> • Set out policies to significantly reduce the emissions intensity of fossil fuel production. 2020 • Ofgem to set ambitious requirements for reductions in leakage of methane from the gas grid. 2020 	
<i>Continues on the following page</i>	

Table 4. Recommendations for the Department of Business, Energy & Industrial Strategy

Recommendation	Timing
<p>Electricity generation, transmission and distribution:</p> <ul style="list-style-type: none"> • Deliver plans to decarbonise the power system to reach an emissions intensity of 50 gCO₂/kWh by 2030, with at least 40 GW of offshore wind and a role for onshore wind and large-scale solar power, with a clear timetable of regular auctions. • Continue to improve system flexibility through the implementation of all actions in the Smart Systems and Flexibility Plan, including working with DCMS on cyber security. Develop mechanisms that encourage users of electric heat and electric vehicles to be flexible and ensure that costs of network upgrades are shared among those who benefit from them and negative impacts on existing consumers are avoided. • Develop a strategy to coordinate interconnectors and offshore networks for wind farms and their connections to the onshore network and bring forward any legislation necessary to enable coordination • Consult on the future of the electricity market design as renewables make up an increasing share of generation, including consideration of technology neutrality, subsidy-free renewables, mechanisms for repowering, the need to ensure sufficient energy supply resilience at both national and regional levels, and the role of GHG removal technologies (see GGR below). • Move Advanced Conversion Technologies (ACT), Dedicated Biomass with CHP and large-scale Anaerobic Digestion to CfD Pot 1 for established technologies, and restrict ACT to CHP applications only. 	<p>Now and ongoing</p> <p>Now and ongoing</p> <p>2021</p> <p>2021</p> <p>2020</p>
<p>Hydrogen:</p> <ul style="list-style-type: none"> • Develop a strategy for low-carbon hydrogen use (across power, industry, transport and buildings), production and infrastructure, aiming for large-scale hydrogen trials to begin in the early 2020s. 	<p>H1 2021</p>
<p>Bioenergy:</p> <ul style="list-style-type: none"> • Refresh the UK's Bioenergy Strategy in line with recommendations on governance, monitoring and best-use from the Committee's 2018 biomass report and 2020 Land Use report. To include: consideration of the best-uses of biomass and waste resources to 2050 including wood in construction and the wider bio-economy; the role of CCS and requirements for CCS-readiness, with clear dates for when CCS will need to be integrated across biomass & waste facilities; UK and international governance over biomass feedstocks; support schemes, including for CO₂ removal and sequestration; aviation biofuels and UK production of biomass feedstocks. 	<p>H1 2021</p>
<p><i>Continues on the following page</i></p>	

Table 4. Recommendations for the Department of Business, Energy & Industrial Strategy

Recommendation	Timing
<p>Greenhouse gas removals:</p> <ul style="list-style-type: none"> Launch a consultation on the Government's preferred strategy and long-term requirement for GHG removals, including a proposed market design & set of governance principles. 	H1 2021
<p>Finance:</p> <ul style="list-style-type: none"> Continue to use the Task force on Climate-related Financial Disclosure (TCFD) framework to better report transition and physical climate risks and shift investments away from high-carbon infrastructure. This should include clear deadlines for ensuring listed companies and large asset owners report on climate-related risks and opportunities, as recommended by the Green Finance Taskforce and Environmental Audit Committee. Ensure the duties of economic regulators take into account the Net Zero transition, as well as the physical risks of climate change. 	<p>By 2022</p> <p>Now and ongoing</p>
<p>Research and innovation:</p> <ul style="list-style-type: none"> Drawing on the Energy Innovation Needs Assessments ensure innovation funding (e.g. through UKRI, Catapults, the Industrial Strategy Challenge Funding and BEIS Innovation Programme) drives forward an extensive research and innovation package for delivering a net-zero, climate-resilient future. 	Now and ongoing
<p>Skills:</p> <ul style="list-style-type: none"> Working with DWP, DfE and the Home Office, develop a strategy for a Net-Zero workforce that ensures a 'just transition' for workers transitioning from high-carbon to low-carbon and climate resilient jobs, integrates relevant skills into the UK's education framework and actively monitors the risks and opportunities arising from the transition. This strategy should include the development and roll-out of plans for training and skills, with buildings and manufacturing being priority areas. 	2021
<p>Climate adaptation:</p> <ul style="list-style-type: none"> Ensure the implementation of the Industrial Strategy, and the National Infrastructure Strategy, account for the risks of extreme weather now and in the future. 	H1 2021
<i>Continues on the following page</i>	

Table 4. Recommendations for the Department of Business, Energy & Industrial Strategy

Recommendation	Timing
<p>Priorities for all departments:</p> <ul style="list-style-type: none">• Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives.• Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels).• Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future.• Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department.	Now and ongoing

Table 5. Recommendations for the Department for Environment, Food and Rural Affairs

Recommendation	Timing
<p>Introduce an ambitious new policy framework to drive transformational change in agriculture and land-use, including:</p> <ul style="list-style-type: none"> • A strong regulatory baseline that includes low-cost, low-regret options, including standards for emission reduction through the use of existing (e.g. Nitrates Directive) and new legislation (Clean Air Strategy) and banning extraction of peat and rotational burning. • Establish a comprehensive delivery mechanism to deliver land-scape scale changes, including an increase in afforestation rates (to at least 30,000 ha per year across UK) and peatland restoration that addresses carbon, adaptation and other co-benefits (e.g. flooding, biodiversity, air and water quality). This should include mechanisms for private and public financing, which should also deliver agricultural measures above the baseline and other land-based solutions (e.g. innovative farming options, agro-forestry, production of biomass feedstocks, and hedgerow creation). • Addressing non-financial barriers such as knowledge exchange of low-carbon farming practices, issues for tenant farmers, support upskilling and scale-up of supply chains. • Policies to encourage consumers to shift to healthier diets and reduce food waste, including public sector leadership and development of an evidence-based strategy on diets; and target setting in the public and private sector to reduce food waste. 	2021
<p>Resources and Waste:</p> <ul style="list-style-type: none"> • Legislate (in England via the Environment Bill) for and implement a ban on landfilling of municipal & non-municipal biodegradable wastes from 2025. • Set a target for a 70% recycling rate by 2030 in England within the Environment Bill, and announce new policies to meet this target. • Accelerate investment plans for local authorities to be able to put in place universal municipal waste recycling collections, rolled out across England during 2022-24, along with the required recycling, composting and AD facilities. • Mandatory business food waste reporting, building on WRAP's existing voluntary scheme. Develop further policies to accelerate the Resource and Waste Strategy for England, focusing on encouraging efficiency in manufacturing and construction and reducing consumer demand for products. • Examine the impact of waste targets on the utilisation of (and need for further) energy from waste plants, and issue a set of guidance notes to help align local authority waste contracts and planning policy to these targets. 	<p>2020</p> <p>2020-21</p> <p>2021</p> <p>2021</p> <p>2021</p>
<i>Continues on the following page</i>	

Table 5. Recommendations for the Department for Environment, Food and Rural Affairs

Recommendation	Timing
Consumption emissions: <ul style="list-style-type: none">Continue to monitor consumption emissions. These are important to ensure that action to decarbonise UK-based activities does not result in emissions moving offshore and to track progress in decarbonisation of imports to the UK, which in turn can inform future policy (e.g. border carbon adjustments).	Now and ongoing
Climate adaptation: <ul style="list-style-type: none">Ensure that adaptation measures are rewarded under the ELM scheme and are integrated properly into the 25YEP, Fisheries Bill and Environment Bill.Improve 25-YEP restoration targets for terrestrial and freshwater habitats to include all priority sites.Enable water companies to implement compulsory metering beyond water stressed areas by amending regulations and requiring all companies to consider systematic roll-out of smart water meters.Increase ambition through setting targets for reducing water demand in households and businesses, and reducing leakage (in addition to increasing supply).Introduce compulsory water efficiency labelling of household water products.Commence Schedule 3 of the Flood and Water Management Act (2010) in England.Publish an updated national, long-term, outcomes-based adaptation strategy to address the increasing flood risk identified in CCRA2.Set near-term milestones for the withdrawal of Flood Re.Accelerate uptake of property-level flood protection needed to meet Long-term Investment Strategy/ Flood Re targets.	H1 2021
<i>Continues on the following page</i>	

Table 5. Recommendations for the Department for Environment, Food and Rural Affairs

Recommendation	Timing
<p>Priorities for all departments:</p> <ul style="list-style-type: none">• Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives.• Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels).• Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future.• Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department.	Now and ongoing

Table 6. Recommendations for the Department of Transport	
Recommendation	Timing
<p>Active travel and public transport:</p> <ul style="list-style-type: none"> Invest in walking and cycling infrastructure and strengthen other schemes to support active travel modes. Invest in public transport and other measures to reduce car travel demand (e.g. car sharing and mobility as a service). Improve infrastructure connectivity to lock-in positive behaviours that reduce travel demand (e.g. home-working). 	2020
<p>Cars and vans:</p> <ul style="list-style-type: none"> Confirm bringing forward the ban on new petrol/diesel and plug-in hybrid car/van sales to 2032 at the latest. Apply the same rules to motorcycles. Back up the end date by introducing a Zero Emission Vehicle Mandate requiring increasing shares of sales to be zero-carbon, reaching 100% by 2032 at the latest. Continue to support EV infrastructure to ensure it is not a barrier to high uptake levels including for those without individual off-street parking, and implement recommendations from the EV Energy Taskforce and the Faraday Institute. Set more ambitious UK regulations on new car/van CO₂ to 2030, with more regular intervals than the EU's five years, backed by a rigorous real-world testing regime. 	2020 2020-21 2020-21
<p>Heavy Goods Vehicles:</p> <ul style="list-style-type: none"> Set out and implement a strategy to transition to zero-carbon freight, including stronger purchase incentives, infrastructure plans and clean air zones. Evaluate schemes to reduce HGV and van use in urban areas (e.g. e-cargo bikes and use of urban consolidation centres), to reduce traffic and improve the safety of active travel. Trial zero emission HGVs to establish which is the most suitable and cost-effective technology for the UK. Evaluate existing and increase support for HGV logistics improvement schemes. Strengthen incentives to buy more efficient and zero-carbon HGVs. Include HGV recharging in Project Rapid plans. 	2021 2020-21
<p>Rail:</p> <ul style="list-style-type: none"> Support Network Rail in developing plans to deliver the target to remove all diesel trains by 2040. 	2020-21
<i>Continues on the following page</i>	

Table 6. Recommendations for the Department of Transport	
Recommendation	Timing
<p>Aviation and Shipping:</p> <ul style="list-style-type: none"> Formally include International Aviation and Shipping emissions within UK climate targets when setting the Sixth Carbon Budget. Work with ICAO to set a long-term goal for aviation consistent with the Paris Agreement, and to strengthen the CORSIA scheme. Continue working with the IMO on global shipping policies, and updating their 2050 target. Commit to a Net Zero goal for UK aviation as part of the forthcoming aviation consultation and strategy, with UK international aviation reaching net-zero emissions by 2050 at the latest, and domestic aviation potentially earlier. Plan for residual emissions, after efficiency, low-carbon fuels and demand-side measures, to be offset by verifiable greenhouse gas removals. Build on the Clean Maritime Plan to develop incentives for zero-carbon ammonia and hydrogen supply chains for UK shipping. Monitor non-CO₂ impacts of aviation and shipping and consider how best to tackle them alongside UK climate targets. Review the UK's airport capacity strategy in light of COVID-19 and Net Zero, including a household & business survey of long-term travel expectations. 	<p>H1 2021</p> <p>2020-22</p> <p>2020-22</p> <p>2020-21</p> <p>2020-21</p> <p>2021</p> <p>2021</p>
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	<p>Now and ongoing</p>

Table 7. Recommendations for the Ministry of Housing, Communities & Local Government

Recommendation	Timing
<p>Buildings standards: Implement a strong set of standards that ensure buildings are designed for a changing climate and deliver high levels of energy efficiency and low-carbon heat for new and existing buildings. Including:</p> <ul style="list-style-type: none"> • Commit to a robust definition of the Future Homes Standard which is legislated well ahead of 2025 and ensures no fossil fuels are burnt in new homes. • Work with BEIS on the Buildings and Heat Strategy and use standards to set a clear direction for retrofit across the buildings stock. • Introduce a new standard or regulation to ensure that overheating risk (in both the current and future climate) is assessed at the design stage of new-build homes or renovations. This should ensure that passive cooling measures are prioritised over active cooling. • Ensure that the remit of the new buildings safety regulator covers climate change mitigation and adaptation, and is equipped to monitor and enforce compliance with buildings standards. Work with HM Treasury to ensure that local authorities are properly funded to enforce buildings standards. • Close loopholes allowing homes to be built which do not meet the current minimum standards for new dwellings. Make accurate performance testing and reporting widespread, committing developers to the standards they advertise. 	<p>2020</p> <p>2020</p> <p>H1 2021</p> <p>H1 2021</p> <p>2020</p>
<p>Embodied carbon in buildings:</p> <ul style="list-style-type: none"> • Develop plans to rapidly scale up the levels of wood used in construction and support the assessment and benchmarking of whole-life carbon in buildings. 	<p>2020</p>
<p>Local Government:</p> <ul style="list-style-type: none"> • Support local government to play a full role in the Net Zero transition, including resourcing, guidance, involvement in local area energy plans, statutory reporting on the emissions from their estate and reforming the planning framework to enable delivery of low-carbon and climate resilient measures. 	<p>Now and ongoing</p>
<p><i>Continues on the following page</i></p>	

Table 7. Recommendations for the Ministry of Housing, Communities & Local Government

Recommendation	Timing
<p>Climate adaptation:</p> <ul style="list-style-type: none"> • Set a national target for increasing the area of urban greenspace, and integrate within Defra's 25 YEP metrics. • Clarify how national planning policy will manage the risks and impacts of flooding and coastal erosion. • Review new build regulation standards to allow local authorities to set more ambitious standards for water consumption, especially in current and future water-stressed areas. • Resource and support local authorities to ensure measures are being put in place to increase the area of greenspace and the area of permeable surfacing in all urban areas. • Put in place a statutory consultee for assessing new development in areas of surface water flood risk. • The current ad hoc process of issuing flood recovery grants (MHCLG) and Property-level flood resilience (Defra) schemes should, instead, be triggered by an objective measure. 	<p>H1 2021</p>
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> • Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. • Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). • Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. • Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	<p>Now and ongoing</p>

Table 8. Recommendations for the Department of Education	
Recommendation	Timing
<p>Skills:</p> <ul style="list-style-type: none"> Working with DWP, BEIS and the Home Office, develop a strategy for a Net-Zero workforce that ensures a 'just transition' for workers transitioning from high-carbon to low-carbon and climate resilient jobs, integrates relevant skills into the UK's education framework and actively monitors the risks and opportunities arising from the transition. This strategy should include the development and roll-out of plans for training and skills, with buildings and manufacturing being priority areas. 	2021
<p>Monitor and measure improvements in reducing emissions in schools and public buildings (and associated travel), aiming for zero-carbon buildings wherever possible, and ensure they are resilient to the future impacts of climate change.</p>	Now and ongoing
<p>Consider the wider role of the education system in supporting the transition to a net-zero economy and preparing for the risks of climate change – including the need for greater public awareness and understanding, and the need for technical skills in the workforce.</p>	Now and ongoing
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	Now and ongoing

Table 9. Recommendations for the Department of International Trade	
Recommendation	Timing
Ensure UK trade policy and future trade deals protect against risks of carbon leakage leading to increases in the UK consumption emissions footprint, particularly from trade in agricultural and industrial products, and avoids undermining the required changes to reach Net Zero in the UK.	Now and ongoing
Ensure that future UK trade deals consider the effect of changes to trade on the UK's consumption emissions .	Now and ongoing
Maximise the opportunities to use trade policy to encourage increased ambition on both climate change mitigation and adaptation in other countries, including considering the role for border carbon adjustments.	Now and ongoing
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> • Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. • Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). • Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. • Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	Now and ongoing

Table 10. Recommendations for the Department of Health and Social Care	
Recommendation	Timing
A fully funded plan is needed to address the risks of overheating in hospitals, care homes and care facilities, including consideration of home-based care.	2021
Take actions to improve the carbon efficiency of the NHS by supporting the NHS's forthcoming Net Zero plan, including non-CO ₂ emissions (e.g. F-gases). For example through remote consultations and other actions that can support reduced emissions from users of the health service.	Now and ongoing
Take an active role in climate policy development that also has health benefits , such as active travel, access to green space, air quality, better buildings and healthier diets.	Now and ongoing
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> • Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. • Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). • Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. • Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	Now and ongoing

Table 11. Recommendations for Ministry of Defence	
Recommendation	Timing
<p>Implement plans for a Net Zero consistent, climate resilient estate.</p> <ul style="list-style-type: none"> • Develop and implement plans to make all MoD buildings and vehicle fleets zero-carbon in the long term. Contribute to halving direct emissions in the public estate by 2032 at the latest. • MoD could also share learning related to its Estates Risk Assessment process with other government departments. 	<p>Now and ongoing</p> <p>Now and ongoing</p>
<p>Assess the potential for alternative fuels (such as low-carbon electricity, hydrogen or bioenergy) to be used for land vehicles, ships and aircraft, and consider opportunities to support wider use of low-carbon technologies in civil applications (e.g. through research or demonstration).</p>	<p>Now and ongoing</p>
<p>Provide assurance to the Committee that planning is taking place for domestic and overseas climate-related risks to operations (including risks to personnel and effective operation of equipment) . These plans should include climate-related risks linked to global conflict, mass migration and global governance set out in the UK Climate Change Risk Assessment.</p>	<p>H1 2021</p>
<p>Ensure the department's strategy addresses the potential need for an increased role in climate-related disaster avoidance and relief in the UK and overseas.</p>	<p>H1 2021</p>
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> • Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. • Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). • Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. • Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	<p>Now and ongoing</p>

Table 12. Recommendations for the Home Office and Ministry of Justice	
Recommendation	Timing
Provide assurance to the Committee that planning and action is being taken to address overheating and poor air quality in prisons and detention facilities, and demonstrate that any actions have led to a reduction in risk.	H1 2021
Develop and implement plans to make all HO/MoJ buildings and vehicle fleets zero-carbon in the long term. Contribute to halving direct emissions in the public estate by 2032 at the latest.	Now and ongoing
<p>Skills.</p> <ul style="list-style-type: none"> Working with DWP, DfE and BEIS, develop a strategy for a Net-Zero workforce that ensures a 'just transition' for workers transitioning from high-carbon to low-carbon and climate resilient jobs, integrates relevant skills into the UK's education framework and actively monitors the risks and opportunities arising from the transition. This strategy should include the development and roll-out of plans for training and skills, with buildings and manufacturing being priority areas. 	2021
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	Now and ongoing

Table 13. Recommendations for the Department for Digital, Culture, Media & Sport	
Recommendation	Timing
Ensure plans for a digital transition and fibre rollout can complement changing work patterns and travel behaviours , leading to lower-carbon working. Co-ordinate with DfT to invest in digital infrastructure to lock-in positive behaviours that reduce travel demand (e.g. home-working).	2020
Ensure Ofcom's guidelines take into account best practice in communicating climate change .	Now and ongoing
Work with BEIS on ensuring plans for smart, flexible energy systems are resilient to threats from cyber security .	Now and ongoing
Ensure sport and culture strategies align to other departments' plans for lower-carbon buildings, more active travel and improved public health.	Now and ongoing
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> • Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. • Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). • Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. • Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	Now and ongoing

Table 14. Recommendations for the Department for Work and Pensions	
Recommendation	Timing
<p>Skills.</p> <ul style="list-style-type: none"> Working with BEIS, DfE and the Home Office, develop a strategy for a Net-Zero workforce that ensures a 'just transition' for workers transitioning from high-carbon to low-carbon and climate resilient jobs, integrates relevant skills into the UK's education framework and actively monitors the risks and opportunities arising from the transition. This strategy should include the development and roll-out of plans for training and skills, with buildings and manufacturing being priority areas. 	2021
<p>Develop and implement plans to make all DWP buildings and vehicle fleets zero-carbon in the long term. Contribute to halving direct emissions in the public estate by 2032 at the latest.</p>	Now and ongoing
<p>Priorities for all departments:</p> <ul style="list-style-type: none"> Integrate Net Zero into all policy making, and ensure procurement strategies are consistent with the UK's climate objectives. Ahead of the CCC's next adaptation progress report in 2021, demonstrate adaptation planning for a minimum 2°C and consideration of a 4°C global temperature rise (by 2100 from pre-industrial levels). Follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. Demonstrate actions that address all of the more urgent risks set out in the second UK climate change risk assessment relevant to the Department. 	Now and ongoing

Chapter 1: A review of the climate challenge after COVID-19



Introduction

In June 2019 the Government increased the UK's legislated target for Greenhouse Gas (GHG) emissions reductions from at least 80% to at least 100% by 2050 – an ambition for 'Net Zero' *territorial* emissions by the middle of the century.⁸ The UK is also committed to climate adaptation to address climate risks.

It is not yet possible to foresee the full effect of the COVID-19 crisis, but it is clear that it will have substantial social, economic, and environmental impacts. It has also highlighted the kind of systemic risks that climate change places on society.

Working towards net-zero and a climate resilient society remains the appropriate long-term goal. The broad set of changes required in the long term to deliver Net Zero is likely to be roughly as expected before the COVID-19 crisis. However, the pandemic fundamentally changes the context for tackling climate change, not least the need to integrate net-zero plans in the economic recovery.

This report is written in that context.

1. COVID-19 and the wider context for delivering Net Zero
2. The Net Zero Target
3. COP26
4. This report

1. COVID-19 and the wider context for delivering Net Zero

a) The impacts of COVID-19

The lockdown measures put in place as a response to the COVID-19 pandemic are likely to have different impacts across the short term, medium term and long term. Chapter 5 sets out our analysis of the impacts of the COVID-19 lockdown and what is needed for a resilient recovery.

- **Short-term.** Dealing with the COVID-19 pandemic continues to be the priority. The lockdown imposed in response to the pandemic has a number of short-term effects that are likely to be largely temporary, but which may have impacts that persist in the longer term.
 - One of the most visible impacts of the COVID-19 crisis is the fall in both domestic and international travel, reducing emissions in the short-term, and improving local air quality in cities around the world.
 - The 26th Conference of the Parties (COP26), the UN climate summit that the UK was due to host in Glasgow in 2020, is now delayed to November 2021.

⁸ The Scottish Governments set a Net Zero target for 2045 in line with the Committee's advice. The Welsh Government expressed its intention to a Net Zero target for 2050, but have committed to set a target of a 95% reduction by 2050, in line with the Committee's advice. We will advise on Welsh emissions targets later this year. The Northern Irish Government has written to the CCC requesting advice on an equitable contribution to the UK's 2050 target.

- The crisis is already having an impact on workers, and will inevitably lead to increased unemployment. Investment has also slowed, including in low-carbon industries globally, though emerging evidence suggest low-carbon investments have performed better than high-carbon investments over this period.⁹ Given this, there is consensus around the need for economic stimulus, and a strong desire and potential opportunity to restart the economy and create jobs by building net-zero and climate resilient infrastructure. Furthermore, low oil prices and low interest rates are likely to persist for the immediate future, providing a potential opportunity for Government action to stimulate investment away from high-carbon industries.
- The transition to net-zero and building resilience to climate change requires a clear set of investments. Accelerating these investments can be a key part of the macroeconomic response to COVID-19 at a time when demand across the economy will be suppressed, with wider economic benefits.
- **Medium-term.** Looking beyond the health impacts, COVID-19, and the restrictions to manage its spread, have affected livelihoods and reduced economic output across the globe. Lasting impacts will include many lost lives and livelihoods, economic impacts such as increased public and private debt (e.g. business loans, mortgages) as well as social and cultural impacts related to travel and working behaviours. International relations are also shifting. The UK's medium-term response to the crisis will redraw the path of many aspects of decarbonisation and climate resilience - especially if it emphasises climate-positive behaviours, like remote working and active travel, which have emerged during the lockdown.
- **Long-term,** the UK's climate goals remain unchanged. The actions needed to deliver them are largely as before, though if recent behaviour changes persist they could have a lasting impact on UK emissions.
 - The need to prepare for climate change and to transition to a net-zero economy remains a scientific and economic imperative and provides a positive vision for society. Addressing these priorities, alongside the twin crisis of global biodiversity loss, can lead to multiple benefits through improving the condition of the natural environment and air quality, benefiting biodiversity and public health, as well as improving well-being, and reducing society's exposure to external shocks. The systemic challenges and risks of climate change are increasingly understood and can be mitigated through strong preparations and strategic, flexible policies (see chapter 6).
 - Whether the longer-term impact of the changes materially affect the UK's Net Zero challenge is unclear, but is also dependent on the policy response. Recent changes, such as increased working-from-home and reduced business travel, could, if sustained, lead to some permanent reductions in transport emissions. However others, such as a reluctance to use of public transport in favour of cars, could have the opposite effect (chapter 5). Policy can help new social norms to form and put in place measures to encourage positive and avert negative changes.
 - The COVID crisis is a prescient reminder of how international collaboration can help address global risks, including climate change. Evidence suggests it is better and cheaper to respond to these risks in a co-ordinated way. At COP 26, the UK has an opportunity to renew the international effort on climate change (Section 1.3).

⁹ HSBC (2020) *ESG stocks did best in COVID-19 slump*.

b) A new context

The new Net Zero target, legislated a year ago, requires a strategic shift in climate policy; the pandemic changes the context to implement it. The Committee's forthcoming Sixth Carbon Budget advice, our publication of the next UK Climate Change Risk Assessment Evidence Report, the UK's role as host of the UN's COP26 summit and the 2021 meeting of the G7 countries provide clear milestones for the next steps in the UK's emissions reductions and climate adaptation efforts:

- The UK's domestic emissions have fallen consistently since the Climate Change Act was passed in 2008¹⁰, and continue to fall, though progress towards future carbon budgets remains off track (Figure 1.1). Chapter 2 evaluates emissions trends (including the impact of the COVID-19 pandemic) and Chapter 3 looks at what lessons can be learnt from policy over the last decade.
- Last year's Net Zero target sets a new legal objective for greenhouse Gas (GHG) emissions in 2050, but its ambition exceeds that of the UK's current legislated carbon budgets, which have been set until 2032. The Committee will advise on the new path to the Net Zero target in our advice on the Sixth Carbon Budget (2033-2037) in December.
- The UK will host the COP26 summit and the G7 in 2021, a clear opportunity to demonstrate the UK's climate leadership on both climate change mitigation and adaptation, and to help catalyse the necessary efforts to increase climate ambition around the world.
- The Government's early reaction to our Net Zero advice has been positive: the target was swiftly legislated, Net Zero is increasingly part of central Government policy - including a review by HMT of the costs of the transition - and policies across multiple key areas are under active development (e.g. heat and buildings, CCS, electric vehicles and land use). Additionally, the Net Zero objective has been embraced by business (Section 4.3.c), local authorities (Box 6.1) and the wider public. Together, these are important signs that steps are being taken to deliver the newly agreed target; however, significantly more remains to be done. Chapter 6 outlines our policy priorities across both climate change mitigation and adaptation.
- The UK's exit from the European Union will put the delivery of more environmental goals directly in the UK's hands. This, and the response to the pandemic, will determine how swiftly the UK progresses towards its Net Zero objectives.

¹⁰ Emissions driven by UK demand for products and services, but produced outside the UK (included in so-called 'consumption emissions' accounts) are also considered in chapter 2.

2. The Net Zero target

a) The target

In May 2019, in response to a request by the UK, Scottish and Welsh Governments, the Committee advised that the UK set a target for reducing emissions to 'Net Zero' by the middle of the century, going beyond the existing 2050 target for at least an 80% reduction (on emissions in 1990) required by the Climate Change Act (2008):

- The Committee recommended that the UK should set and pursue an ambitious target to reduce aggregated GHGs to 'Net Zero' by 2050 (i.e. increasing the UK's target to reduce net greenhouse gas emissions for 2050 from at least 80% to at least 100%). Reflecting their respective circumstances, the Committee advised that Scotland should set a Net Zero GHG target for 2045 and Wales should target at least a 95% reduction by 2050 relative to 1990.
- The UK and Scottish targets have since been legislated; the Welsh Government have committed to legislating a 95% target with an ambition to set a Net Zero target.¹¹ The Northern Irish Government has also requested the advice of the Committee on an equitable contribution to the UK's target.
- The Net Zero target means the majority of activities - driving, manufacturing, heating, electricity generation - emitting as close to zero emissions as possible by 2050, with any remaining emissions requiring the equivalent amount of emissions to be removed from the atmosphere (Figure 1.2).
- The path to achieving net-zero emissions by 2050 will require a steeper reduction in emissions over the intervening three decades than is currently legislated in carbon budgets (out to 2032).
 - Current Government projections indicate a significant policy gap between expected emissions and required reductions over this period (Figure 1.1). Projections in the Government's reference scenario see emissions in 2030 declining to 55% below 1990 levels, and reducing by an average of 1% per year between 2020 and 2035.
 - The legislated Fifth Carbon Budget, which was set on the path to the UK's previous 80% target, requires emissions in 2030 to be 57% below 1990 levels.
 - To reach the UK's new Net Zero target emissions will need to fall, on average, by around 14 MtCO₂e every year, equivalent to 3% of emissions in 2019.¹²

As the existing carbon budgets were set on a cost-effective path to achieving an 80% reduction in UK greenhouse gas emissions by 2050, a more ambitious long-term target is likely to require outperformance of the carbon budgets legislated to date.

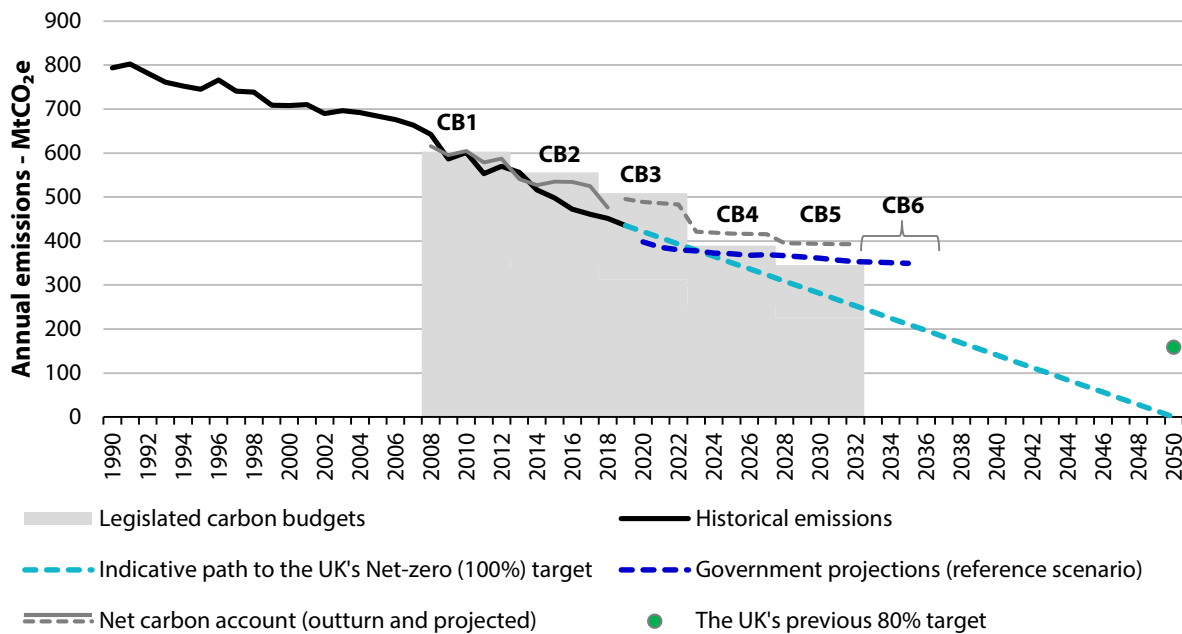
It is not yet possible to definitively say what impact COVID-19 will have on the achievement of the legislated carbon budgets. Emissions will almost certainly fall again in 2020 as a result of the COVID-19 crisis (chapter 5), and this is likely to increase the margin by which the UK meets its Third Carbon Budget (2018-2022). Our recommendation remains that any surplus from the Third Carbon Budget should not be carried forward.

¹¹ We will offer further advice on this in December.

¹² Excluding emissions from IAS for comparison with BEIS's *Energy and Emissions Projections*. Including IAS would mean required reductions are 15 MtCO₂e every year, equivalent to 4% of emissions in 2019.

The Committee will revise its assessment of the appropriate path for emissions over the period to 2050 as part of its advice this year on the Sixth Carbon Budget (covering 2033-2037).

Figure 1.1. Emissions pathways to carbon budgets and the Net Zero target



Source: CCC analysis based on BEIS (2019) *Updated energy and emissions projections 2018*, and BEIS (2020) *Provisional UK greenhouse gas emissions national statistics 2019*.

Notes: 'CB' = Carbon Budget'. The Sixth Carbon Budget period covers 2033-2037. Greenhouse gas (GHG) emissions are shown on a total ('actual') basis, while carbon budgets are assessed against the 'net carbon account' (Box 2.3). Emissions from International Aviation and Shipping (IAS) are not included in this figure, but would either also need to reach zero emissions by 2050 or will have to be fully offset by verifiable removals. Government projections are for total gross UK GHG emissions, not for the 'net carbon account', against which the first five carbon budgets are measured. Outturn GHG emissions are based on the latest BEIS publication and therefore do not account for forthcoming revisions to peatland emissions or global warming potentials.

b) The transition

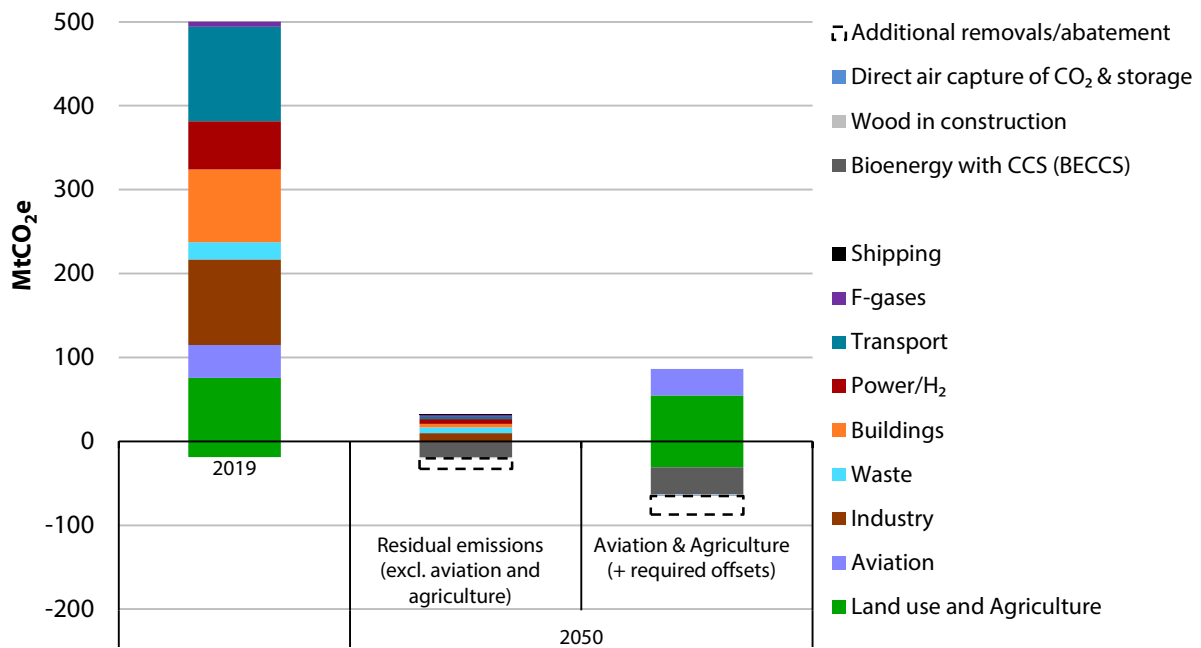
Reaching net-zero emissions in the UK will require all energy to be delivered to consumers in zero-carbon forms (i.e. electricity, hydrogen, hot water in heat networks) and come from low-carbon sources (i.e. renewables and nuclear, plus bioenergy and any fossil fuels being combined with CCS). The transition will also involve choices around how people travel, what people eat and the best use of the UK's land. Although it is impossible to predict the exact mix of technologies and behaviours that will best meet the challenge of reaching net-zero GHG emissions, our 2019 Net Zero report presented a vision of this transition for the UK, in our *Further Ambition* scenario.¹³

¹³ The actions in our *Further Ambition* scenario achieved a 96% reduction in UK GHG emissions by 2050, based on 1990 levels. We identified a range of possible options to reduce the last 4% of emissions, but did not specify precisely how this would be achieved. Our Sixth Carbon Budget scenarios will set out detailed pathways to reducing emissions by 100% by 2050.

This included:

- **Resource and energy efficiency** that reduce demand for energy across the economy. Without these measures, the required amounts of low-carbon power, hydrogen and carbon capture and storage (CCS) would be much higher. In many, though not all, cases they reduce overall costs.
- **Some societal choices** that lead to a lower demand for carbon-intensive activities, for example an acceleration in the shift towards healthier diets with reduced consumption of beef, lamb and dairy products, and an increase in journeys being made by walking and cycling. Societal changes occurring as a result of the COVID-19 pandemic, such as reduced travel and electricity consumption, could, if permanent, reduce demand in these sectors, potentially to a greater extent than that included in our *Further Ambition* scenario. We are considering the implications of this as part of our work on the Sixth Carbon Budget advice.
- **Extensive electrification**, particularly of transport and heating, supported by a major expansion of renewable and other low-carbon power generation. The scenarios involve around a doubling of today's annual electricity demand, with all power produced from low-carbon sources (compared to around 55% today).
 - *A transition to electric vehicles.* The 37m cars and vans and 500,000 HGVs on the UK's roads today will need to switch to low-carbon electricity, or, for HGVs, potentially hydrogen.
 - *A switch to low-carbon heating.* From 2025, all new build homes will need to be built with low-carbon heating. The UK's 29m existing residential dwellings, and all commercial and public buildings, will need to switch away from fossil fuelled boilers towards low-carbon heating sources.
- **Development of a hydrogen economy** to service demands for some industrial processes, for energy-dense applications in long-distance HGVs and ships, and for electricity and heating in peak periods. By 2050, a new low-carbon industry is needed, with UK hydrogen production capacity of comparable size to the UK's current fleet of gas-fired power stations.
- **Carbon capture and storage (CCS)** in industry, used with bioenergy (for GHG removal from the atmosphere), and very likely for hydrogen and electricity production. CCS is a necessity, not an option. The scenarios involve aggregate annual capture and storage of 75-175 MtCO₂ in 2050, which would require a major CO₂ transport and storage infrastructure servicing at least five clusters, and with some CO₂ transported by ships or heavy goods vehicles.
- **Changes in the way we farm and use our land** to put much more emphasis on carbon sequestration and biomass production alongside improving the condition of natural assets to enhance resilience and halt biodiversity loss. Enabled by healthier diets and reductions in food waste, our scenarios involve a fifth of UK agricultural land shifting to tree planting, energy crops and peatland restoration.
- **Emissions removed from the atmosphere** by trees, soils or engineered carbon removal to offset residual emissions in sectors where low-carbon alternatives are limited (predominantly aviation and agriculture - Figure 1.2).

Figure 1.2. Net Zero means close to zero emissions for most sectors, with any residual emissions requiring the equivalent amount of emissions removals



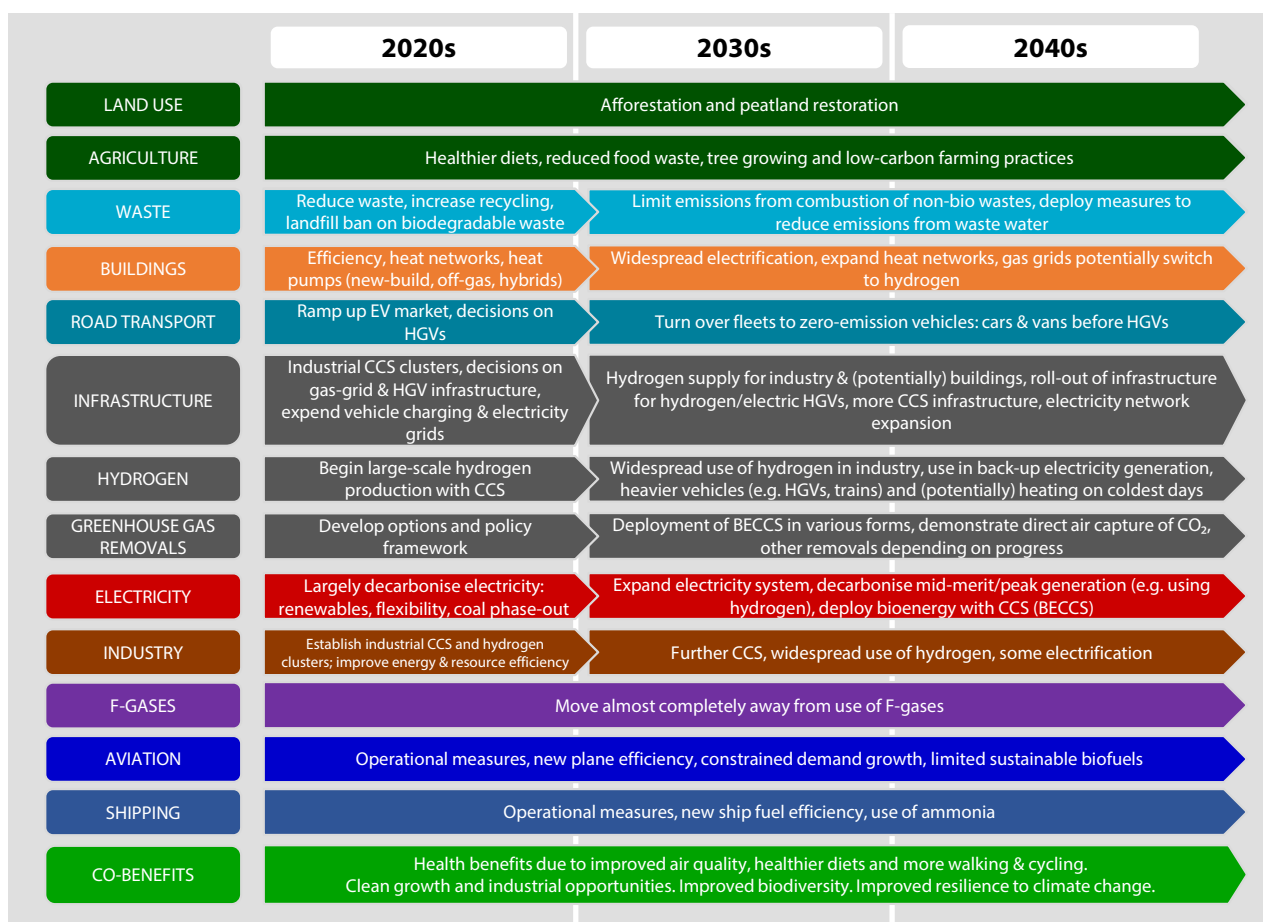
Source: CCC (2019) *Net Zero: The UK's contribution to stopping global warming* and BEIS (2020) *Provisional UK greenhouse gas emissions national statistics 2019*.

Notes: Sectoral emissions and contributions from removals presented for the Further Ambition scenario. The contribution from 'additional removals/abatement' refers to the options to go beyond the Further Ambition scenario and achieve net-zero emissions, which can be achieved with additional removals and/or further reductions of positive emissions. Since our Net Zero advice, estimates for the Further Ambition scenario have been updated to take account of revised bioenergy soil carbon impacts. The current inventory captures less than 1.5 MtCO₂e of peatland emissions in the UK, but all sources of peatland emissions will be included in the inventory by 2022 at the latest. Estimates of all peatland emissions for 2019 are included in this chart.

In many areas the transition is already underway (e.g. electricity, transport, waste), though progress will need to be sustained. In others, decisions will need to be made in the 2020s to allow for a sustained rollout of low-carbon technologies and infrastructure to meet the 2050 target (Figure 1.3). Table 1.1 provides an overview of the near-term milestones required to meet the UK's 2050 target.

Our 2019 Net Zero report (and the *Further Ambition* scenario) presented a snapshot view of emissions in 2050. Our work this year on the Sixth Carbon Budget (2033-37) will explore multiple pathways to the UK's Net Zero target, including scenarios with higher levels of behaviour change and technological innovation. Next year, the Adaptation Committee's UK Climate Change Risk Assessment Evidence Report will highlight the climate risks to net-zero measures, such as water availability for CCS and hydrogen production, and synergies and trade-offs between net-zero and adaptation in the UK.

Figure 1.3. Actions to achieve Net Zero by 2050



Source: CCC (2019) *Progress Report to Parliament*.

Notes: CCS = carbon capture and storage. EV = electric vehicle. HGV = heavy goods vehicle. BECCS = bioenergy with CCS.

Table 1.1. Medium-term milestones to be on track to Net Zero emissions by 2050

Sector	Action	Timing
Transport	Development of infrastructure and policy to enable sales phase-out of petrol and diesel cars, vans and motorbikes by 2032.	Early 2020s
	Decisions about how to switch to zero-emissions (e.g. hydrogen or electric) HGVs will be required in the second half of the 2020s. This will necessitate trial deployments of hydrogen, battery electric, catenary and hybrid HGVs in a variety of fleets prior to this, in the UK or elsewhere.	Second half of the 2020s
Industry	CO ₂ transport and storage infrastructure operational, and hydrogen available, at multiple industrial clusters.	Mid-2020s
	Implement resource efficiency measures in line with the milestones from the Resources and Waste Strategy.	Early 2020s
	Demonstration of a range of industrial fuel-switching technologies including electrification and hydrogen.	Early 2020s
	Award first support for industrial fuel switching and CCS through an incentive mechanism designed to enable widespread industrial fuel switching and CCS.	End 2021
	Enable delivery of substantial improvements in industrial energy efficiency in line with the upper end of ambition in the <i>Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050</i> .	2020s
Buildings	Strategic decisions on the future of the natural gas grid and the future balance between hydrogen and electrification for heating, taking into account the views of the public. Transition to sustainable heat networks market. Targeted deployment of heat pumps must scale up to be able to replace the majority of current gas boiler demand by the early 2030s (around ~1.5m installations a year).	Mid-2020s
	Implement a clear trajectory of standards covering owner-occupied, social- and private-rented homes and non-residential buildings, announced well in advance. Alongside trajectories for energy efficiency, all new heating systems to be low-carbon from 2030 in off-gas properties and 2035 across the building stock.	2020-2035
	Review professional standards and skills across the building, heat and ventilation supply trades with a nationwide training programme to upskill the existing workforce.	2020-2022
	Reform monitoring metrics and certification to reflect real world performance, rather than modelled data (e.g. Standard Assessment Procedure (SAP)). Accurate performance testing and reporting must be made widespread, committing developers to the standards they advertise.	2020-2022
Power	Deliver plans to decarbonise the power system consistent with a level of ambition for an emissions intensity towards 50 gCO ₂ /kWh in 2030, including 40 GW of offshore wind.	2030
	Develop clear plans to ensure adequate resilience of energy supplies as heat and transport become more electrified.	2020
	Continue to improve system flexibility through the implementation of all actions in the Smart Systems and Flexibility plan.	2022

Table 1.1. Medium-term milestones to be on track to Net Zero emissions by 2050

Sector	Action	Timing
Hydrogen	Low-carbon hydrogen production at scale, for use initially in applications that would not require major infrastructure changes (e.g. applications in industry, power generation, injection into the gas network and depot-based transport).	Second half of the 2020s
	Trials and pilot projects to establish the practicality of switching to hydrogen across a range of sectors and applications.	Early 2020s
	It is also necessary to demonstrate that hydrogen production from CCS can be sufficiently low-carbon to play a significant role.	Mid 2020s
Agriculture	To increase the take-up of low-carbon farming practices, develop a strong regulatory baseline that includes low-regret options, with further measures incentivised by the Environmental Land Management System, and a wider policy framework.	Early 2020s
	Innovation and investment in R&D and testing and piloting of options to deliver sustainable agricultural productivity improvements in crops and livestock; low-carbon technologies and options for low-carbon agricultural machinery e.g. tractors and robotics.	Early 2020s
Land use, land-use change and forestry	Ensure the post-CAP framework promotes transformational land-use change and measures for deep emissions reductions including afforestation of at least 30,000 hectares per year and peat restoration.	Early 2020s
	Targeted investment in R&D and innovation to deliver productivity improvements in trees and energy crops.	Early 2020s
	Policies to encourage a shift to less carbon-intensive diets, starting with the public sector.	Early 2020s
Aviation	Demand management policies in place to ensure emissions remain aligned with a net-zero emissions pathway, if efficiency and low-carbon fuels under-deliver.	Early 2020s
	Low-carbon transport fuel support realigned to promote the transition from road to aviation fuels.	Mid 2020s
Shipping	First clean maritime cluster operational, roll-out plan in place for future clusters and shipping fleet engine retrofits.	2030
Wastes	Local authority plans implemented to go beyond 70% recycling rates.	~2030
	Long-term plan announced for diversion of all wastes from landfill, phasing out of waste exports, and plans for methane capture, oxidation and remediation at (legacy) landfill sites.	Mid-2020s
	Waste conversion plants (including incineration, gasification & pyrolysis facilities) start retrofitting CCS, and new plants are built with CCS or 'CCS ready' in regions where the CO ₂ network is soon to expand.	From mid-2020s onwards
Greenhouse gas removals	Initial deployment of engineered greenhouse gas removals (e.g. BECCS in power generation, hydrogen production, industry and/or aviation fuel production), driven by incentives and enabled by CO ₂ infrastructure development.	Second half of the 2020s

3. COP26

The UK (alongside Italy) is set to host the 26th United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP 26) in Glasgow. Originally scheduled for November 2020, COP26 was envisaged as a key moment in efforts to raise global climate ambition with countries expected to resubmit their Nationally Determined Contributions (NDCs) for intended emissions reductions to 2030, and adaptation strategies, before the end of this year. When assessed prior to COVID-19 in 2019, the global emissions expected in 2030 based on current global ambition were not consistent with pathways expected to achieve the Paris Agreement's goal of limiting global warming to well-below 2°C above pre-industrial levels and pursuing efforts to keep it below 1.5°C, but instead with those reaching around 3°C above pre-industrial levels by 2100.

COP 26 has now been postponed by one year until November 2021 due to the ongoing COVID-19 pandemic. The period between now and COP26 represents a crucial period for global climate efforts. The infrastructure constructed around the world over the next few years as part of government responses to COVID-related economic impacts will be critical to the chances of achieving the Paris Agreement long-term temperature goal. Aligning post-COVID investment programmes with the agreed global climate goals of the Paris Agreement will be a core objective for global climate policy over the next 18 months.

As COP26 host and incoming G7 president, the UK can have an important role in shaping efforts to align responses with global climate objectives. There will be several important aspects to this:

- To help coordinate and convene a climate-resilient global response to COVID-19 the UK will need to demonstrate that climate change remains a key domestic and international priority in its own COVID recovery plan.
- The UK has been widely recognised as a climate leader, due to its legally-binding Net Zero target and compatible carbon budgets framework, alongside strong progress made in reducing emissions to date. To maintain this status the UK needs to produce a comprehensive and detailed economy-wide policy programme well in advance of COP26, fully aligned with achieving Net Zero domestically by 2050. This should be informed by the lessons that have been learned from UK climate policy over the last decade.
- The UK will be submitting its own NDC (for UK emissions reductions by 2030) to the UNFCCC, as it will no longer be covered by the EU NDC. This represents a key opportunity to signal a commitment to the ambitious near-term action required by a credible Net Zero transition plan. This new UK NDC should be submitted well in advance of COP26 and be based on the pathway required to reach the Sixth Carbon Budget and net-zero GHG emissions by 2050 that the Committee will advise on in December 2020. The UK NDC should also be broader than just a focus on emissions reductions and include credible and significant commitments to addressing the climate adaptation gaps highlighted by our *Progress in preparing for climate change – 2019 Progress Report to Parliament*.

These actions can together help the UK to maximise the opportunity of its forthcoming G7 and COP presidencies in 2021 to support the higher levels of global ambition needed to achieve the long-term temperature goal of the Paris Agreement and create a climate-resilient world.

4. This report

Our 2020 Progress Report to Parliament comes six months before our advice on the level of the Sixth Carbon Budget (2033-2037). This progress report summarises lessons learnt from the last decade of climate action in the UK, and looks forward at the policy requirements for the next decade in light of the new Net Zero objective, and the COVID-19 pandemic. The intention is to draw out lessons from the past, for the future, and we will continue this approach in our forthcoming advice on the Sixth Carbon Budget in December.

This report is a stocktake on the progress the UK has made to date in reducing emissions, both in the past year, and over the past decade, including both the drivers of emissions reductions (chapter 2) and lessons learnt from policy over this period (chapter 3). Though our reports (in line with the Climate Change Act and reporting requirements from the UN) focus on the UK's *territorial* emissions, this report takes a broader perspective and also includes trends in the UK's *consumption* emissions over the past decade, taking into account the emissions associated with goods and services imported into the UK.

The recommendations in this report are informed by our ongoing analysis for the Sixth Carbon Budget, but do not attempt to pre-empt it. In particular, our December advice will set out more scenarios for meeting the 2050 Net Zero target and the potential pathways towards it, and will go into further detail on the specific actions and policies required.

In responding to our Net Zero report, we acknowledge the Government has put a broad programme of policy into development, including announcements and consultations on low-carbon transport, heat, hydrogen and CCS. Some of this policy development is now, understandably, delayed due to the Government response to COVID-19. However, until the full programme is published it is hard to assess as a comprehensive package. Even then, there will be risks around whether policies deliver sufficiently to meet future carbon budgets. A summary of policy developments over the past year is included in chapter 4, and expectations of what the Government's policy package should include are set out in chapter 6. The departmental tables following the Executive Summary set out our recommendations grouped by each UK Government Department.

This report focuses on progress in reducing emissions, but also includes recommendations on climate change adaptation. Progress in adaptation in England remains off track for the majority of sectors. The Adaptation Committee will publish its next assessment of progress in 2021, but we have included a summary of the current status of progress on adaptation and our recommendations by department alongside those for mitigation in chapter 6.

The rest of this report is set out in the following chapters:

- Chapter 2: Progress since 2008
- Chapter 3: Lessons learned since 2008
- Chapter 4: Progress on emissions, policy and indicators in the last year
- Chapter 5: Planning a resilient recovery
- Chapter 6: What is needed now – UK climate policy

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Chapter 2: Progress since 2008



Introduction

In this chapter, we outline global progress towards tackling climate change and review the UK's progress in the past decade in reducing emissions. We set out our analysis in the following four sections:

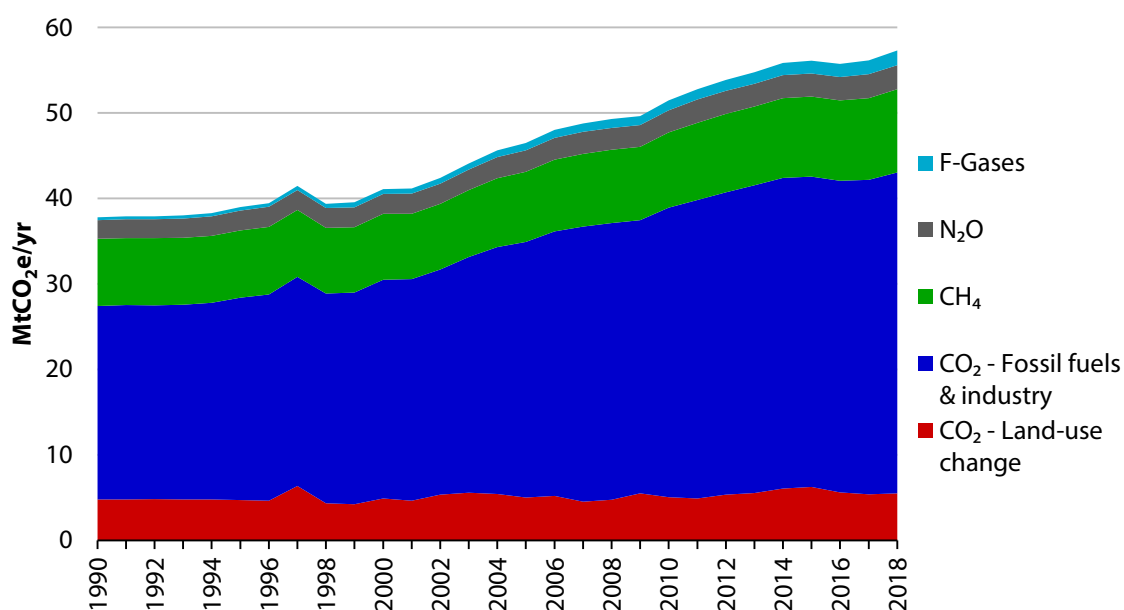
1. Global progress towards tackling climate change
2. Progress in reducing UK territorial emissions
3. Progress in reducing UK consumption emissions
4. Progress reducing emissions in Scotland, Wales and Northern Ireland

1. Global progress towards tackling climate change

a) Global greenhouse gas emissions

Over the 2009-18 period the global population grew by 11% and the global economy by over 42%.¹⁴ Over the same period, global greenhouse gas (GHG) emissions increased by 15%, with this growth almost entirely arising from developing regions.¹⁵ The growth of global emissions in this decade was slower than in the 1999-2008 decade preceding it (Figure 2.1).

Figure 2.1. Global greenhouse gas emissions 1990-2018



Source: PBL (2019) *Trends in Global CO₂ and Total Greenhouse Gas emissions: 2019 report*; Friedlingstein, P. et al. (2019) *Global Carbon Budget 2019, Earth Syst. Sci. Data*, 11, 1783–1838.

Notes: Greenhouse gas emissions are aggregated using the GWP₁₀₀ values from the IPCC Fourth Assessment Report.

¹⁴ World Bank (2020) *World Development Indicators*.

¹⁵ PBL (2019) *Trends in Global CO₂ and Total Greenhouse Gas emissions: 2019 report*.

Underpinning these changes:

- Emissions in many, mostly developed, countries appear to have peaked. By 2010, around 36% of global GHG emissions were produced in countries where national emissions have already peaked, including the UK.¹⁶ Over 2009 - 2018 GHG emissions stopped growing in Bahrain, Ecuador, Japan, Jordan, Malta, North Macedonia, Tunisia, Venezuela and Yemen.¹⁷ If emissions in these countries continue to decline, they will join the 49 countries that peaked before 2010. New Zealand, South Africa and South Korea (around 2.7% of global GHG emissions) are likely to be at or nearing a peak in their GHG emissions based on their latest national inventories.
- The fraction of global energy-related CO₂ emissions arising from advanced economies decreased from 41% in 2009 to 35% in 2018. China has the largest annual emissions in absolute terms, and now has higher per capita GHG emissions than the EU, though it remains significantly below the level of some other big emitters, such as the USA and Russia.
- Global GHG emissions remain dominated by emissions of CO₂ from fossil fuels. Electricity and heat generation remain by far the largest producing sectors of global CO₂ emissions from fossil fuels (~45% of the global total).¹⁸ However, road transportation has been the sector with the largest increase in emissions over the decade.
- Global methane emissions have been rising steadily over the past decade, driven largely by rising emissions from the oil and gas sector and from ruminant agriculture. Nitrous oxide emissions have also been rising, primarily due to increased emissions from agricultural soils, whilst F-gas emissions are rapidly approaching the same magnitude (on a CO₂-equivalent basis) as global nitrous oxide emissions. CO₂ emissions from global land-use change do not show a clear trend over the past decade.

Past trends in the global CO₂ emissions trajectory, expectations for the medium-term, and the short-term effects of the COVID-19 crisis indicate that global CO₂ emissions may have peaked:

- In 2019 global energy-related CO₂ emissions did not increase above their levels in 2018, with several years of very low growth seen over 2014-16.¹⁹
- National commitments for emissions in 2030 were already expected to be consistent with global CO₂ emissions similar to today's levels.²⁰ If the rates of global economic growth and decreases in the emissions intensity of global GDP over the last decade were to continue then global peak CO₂ emissions will be reached around the middle of the 2020s.²¹
- Early indications are that global emissions will fall in 2020, primarily due to the contraction of global economic activity and energy use associated with measures to combat COVID-19 (Box 2.1). However, this does not provide a model for the multi-decadal declines needed to achieve the long-term temperature goal of the Paris Agreement.

¹⁶ World Resources Institute (2017) *Turning Points: Trends in countries' reaching peak greenhouse gas emissions over time*.

¹⁷ Japan is the largest emitter in this group representing around 3% of global GHG emissions.

¹⁸ Peters, G. (2019) *Carbon dioxide emissions continue to grow amidst slowly emerging climate policies*.

¹⁹ Global CO₂ emissions grew more rapidly in 2017 and 2018 due to stronger GDP and energy demand growth in those years.

²⁰ Rogelj, J. et al. (2017) *Understanding the origin of Paris Agreement emission uncertainties*.

²¹ Whether these trends will continue may be sensitive to the global responses to COVID-19 and the continuing declines in renewable electricity costs.

Continued emissions, even at a declining rate, continues to increase the global average temperature and will not reverse the changes in the climate system seen over recent decades (Box 2.2).

Prior to COVID-19, estimates for the global emissions in 2030 were consistent with pathways reaching around 3°C of warming in 2100, with substantial additional ambition needed to close the gap to the Paris Agreement long-term temperature goal.²² Ultimately, whether global emissions have peaked or not, and whether they then decline rapidly, will depend on choices made across the world on climate policy and on the nature of recovery packages following COVID-19.

²² Climate Action Tracker Initiative (2019) *Governments still showing little sign of acting on climate crisis*.

Box 2.1. Emerging COVID-19 impacts on global energy use and emissions

Governments around the world have imposed substantial restrictions on mobility and economic activity to reduce the spread of COVID-19. In many countries these measures are still in place and the longer-term impacts on the global economy are highly uncertain. The lockdown measures are likely to have an impact across three different timescales:

- **Short-term** evidence indicates very substantial reductions in energy use and emissions. An early comprehensive estimate suggests that global emissions declined by over 5% in the first quarter (Q1) of 2020 compared to the same period in 2019, with daily emissions in early April around 17% (11 - 25%) lower than in 2019. This is greater than the decline seen in energy use (a 3.8% decline in Q1 2020 relative to Q1 2019), as matching electricity supply to falling electricity demand was mostly accomplished by reducing output from high-carbon sources such as coal (an 8% decline in Q1 2020 relative to Q1 2019 levels). Projections for the annual emissions in 2020 depend very strongly on the assumed global economic trajectory in the second half of the year – with recent estimates ranging from a 2% to a 13% decline on 2019 levels.
- **Medium-term** impacts will be, in a large part, driven by the carbon intensity of any economic stimulus efforts in countries with large emissions and the longer-lasting structural impacts of the crisis. Investments in new long-life, high-carbon infrastructure could help support high global carbon emissions for many years. The stock of high-carbon infrastructure existing prior to 2020 already implies enough lifetime cumulative emissions (if not retired early) to take the world close to exceeding the Paris Agreement long-term temperature goal without any new high-carbon infrastructure installed through stimulus packages.
- **Longer-term** the prospects for addressing global climate change will be affected by the as-yet unknowable impacts of COVID-19 on investment and attitudes to global collaboration. The possible reductions in global emissions in 2020 are estimated to be similar to the annual reduction rates that would need to be maintained every year for many decades to keep warming to well-below 2°C above preindustrial levels. Maintaining strong collaboration across borders will be essential if the world is to achieve and maintain the scale of annual average reductions required.

Despite the expected record decrease in global emissions in 2020, the likely impacts of COVID-19 measures will not by themselves lead to any appreciable reduction in global temperature or climate impacts from the levels we are already seeing today. CO₂ emissions largely accumulate in the atmosphere, meaning that human-induced warming will only stop increasing once global emissions of CO₂ (and other long-lived GHGs) are brought to net-zero and emissions of shorter-lived GHGs have been stabilised. The impacts of COVID-19 on global and UK emissions are discussed further in chapter 5.

Source: Le Quéré, C. et al. (2020) *Temporary reduction in daily global CO₂ emissions during the COVID-19 forced confinement*; Lui, Z. et al. (2020) *COVID-19 causes record decline in global CO₂ emissions*; IEA (2020) *Global Energy Review 2020*.

Box 2.2. Observed climate changes over the past decade

Over the last decade the climate system has continued to change:

- The 2010-2019 decade was the warmest on record globally. Global average human-induced warming increased by around 0.2°C between 2010 and 2019, to now be around 1.1°C above the preindustrial level. This rate of increase is consistent with that projected by the IPCC Fifth Assessment Report in 2013 (a 0.12 - 0.42°C per decade increase). In the UK, the effects of human-induced warming raised the temperature of the 2008-2017 decade by around 1.1 - 1.2°C above preindustrial levels.
- Global sea levels rose by around 4.6 mm per year over the last decade and are, on average, around 21 cm higher than at the start of the 20th century. This was the fastest decadal rise that has been observed and substantially faster than over the previous decade, particularly due to increased melt from ice sheets on land.

These observed global-level changes in the climate system have continued to produce evidence of new climate impacts emerging from the noise of natural climate variability:

- Changes in the probability of extreme events over the last decade have regularly been linked to human-induced climate change. For example, attribution studies show that the record-breaking concurrent heatwaves that occurred across the northern hemisphere in 2018 (including in the UK) were made two or more times more likely due to human-induced climate change. The increase in the frequency and severity of heatwaves is having clear impacts, including on mortality in the UK. Not all extreme weather events that occurred over the last decade were found to have been made more likely by climate change, with some cold extremes being made less likely and no discernible, or as yet unclear, effects on others.
- Climate related impacts on ecosystems are becoming apparent. For example, the large El Niño that occurred in 2016 temporarily boosted that year's global temperature above the steadily increasing human warming signal, causing unprecedented bleaching on the Great Barrier Reef. These ocean conditions are expected to occur in nearly one-third of years in the current climate and will occur more often with additional future warming.

These climate changes are driven primarily by global cumulative emissions of carbon dioxide since the industrial revolution. This means that even if global emissions start to fall over the 2020s, the climate will continue to warm further until global emissions approach net-zero. With further warming evidence of additional climate impacts will continue to emerge from the background climate variability.

The past few months have also shown how extreme weather can interact with other kinds of risks. For example Cyclone Amphan struck Eastern India and Bangladesh in May 2020 during the midst of the COVID-19-induced lockdown, compounded the challenges in addressing either event. Increasing hazards from particular climate and weather-related phenomena will lead to more complex and frequent interactions with other types of risks with difficult to estimate consequences.

Source: WMO (2020) *Statement on the State of the Global Climate in 2019*; IPCC (2013) *Chapter 11 - Near-term Climate Change: Projections and Predictability*; Hawkins, E. et al. (2020) *Observed Emergence of the Climate Change Signal: From the Familiar to the Unknown*; World Weather Attribution (2018) *Heatwave in northern Europe, summer 2018*; Mitchell, D. et al. (2017) *Attributing human mortality during extreme heat waves to anthropogenic climate change*; King A. et al. (2017) *Australian climate extremes at 1.5°C and 2°C of global warming*.

b) Progress in the global energy system

At the global level, the fraction of primary energy sourced from fossil-fuels remains similar in 2019 (80%) to 2010 (81%).²³ Alongside increasing energy demand, this has led to an overall increase in emissions. This masks a more uneven picture at a sectoral level:

- **Power.** In the power sector, generation from low-carbon sources has expanded over the decade from 33% to 37% of all generation and in 2019 generated more electricity than from coal for the first time. These trends have been more pronounced in advanced economies as a whole, where the share of electricity from low-carbon sources has risen from 39% to 46%, with the share from coal falling from 34% to 23%, alongside a rising share from gas generation. These changes have decreased the global carbon intensity of electricity by over 10% since 2010. Generation from solar PV and wind has risen from around 3.5% of global electricity generation in 2010 to over 9% by 2019. However, the absolute level of generation from coal still increased over the decade, with 500 GW of new capacity added.
- **Transport.** Global passenger transport has slowly started to electrify over the past decade. Although still very small as an absolute share, the fraction of passenger electric vehicles has now reached over 0.6% of the global fleet from essentially zero in 2010 and is growing faster each year, reaching around 2.5% of global sales in 2019.²⁴ However, increasing shares of global car sales from large and energy-intensive Sports Utility Vehicles (SUVs), which have doubled from around 20% to 40% of sales over this decade, have offset the emissions benefits of any electrification. Emissions from SUVs were the second largest contribution (after the growth of electricity demand) to rising global CO₂ emissions over the decade.²⁵
- **Industry.** The global average carbon intensity of energy use in industry has held approximately constant over the decade. The use of electricity as a fuel source increased from 18% to 21% over 2010 to 2018, largely from increased use in non-energy intensive industry, with fossil fuels still providing 69% of industrial energy use in 2018.²⁶ Deployment of carbon capture and storage (CCS) technologies in industry has remained very small with only 19 operational large-scale industrial or fuel-production CCS facilities globally.
- **Buildings.** The total energy used per unit floor area in buildings decreased by 11% over 2010 - 2019, but increases in the global building stock resulted in increased overall energy usage.²⁷ Fossil fuel-based heating systems made up about 57% of new heating system installations in 2019 (60% in 2010). Energy demand for space cooling has increased very rapidly over the decade with the installed stock of air conditioners increasing by around 40%, creating significant impacts on peak power demands in some regions, particularly during heatwaves.

²³ IEA (2020) *Global Energy Review 2019*.

²⁴ EV Volumes (2020) *Global BEV & PHEV Sales for 2019*.

²⁵ IEA (2019) *World Energy Outlook*.

²⁶ IEA (2020) *Tracking Industry*.

²⁷ IEA (2020) *Tracking Buildings*.

Although at the high-level many aspects of the global energy system have remained relatively static, fundamental technological progress over the past decade has transformed the future prospects for more rapid changes in the energy system:

- The cost of new renewable electricity generation has fallen dramatically (Figure 2.2) with the lowest-cost sources of renewables as cheap as, or cheaper than, new fossil-fuel alternatives in countries containing around two-thirds of the world's population according to recent analysis (based on fossil fuel prices in 2019).²⁸ Recent analysis from Carbon Tracker suggests that new renewable power is now a cheaper source of electricity than over half of existing coal plants and will be cheaper everywhere by 2030.²⁹
- The cost of battery packs for electric vehicles has fallen by around 87% over the 2010-2019 period and are likely to be close to the price needed to reach cost-parity with most light internal-combustion vehicles within five years, according to Bloomberg New Energy Finance analysis.³⁰
- Electrification of transport and heating already offers emissions savings compared to fossil fuel alternatives in regions covering 95% of global transport and heating demand.³¹ The continued falls in the costs of renewable electricity and electrification of many end-use sectors is therefore expected to drive emissions reductions around the world.

These trends are having knock-on impacts for the future of the global energy system over the coming decade. The pipeline of planned coal plant construction has shrunk by 78% over 2010-19 and the share of energy system investment going to renewable sources has grown, although it remains below the levels (both relatively and in absolute terms) needed to achieve the goals of the Paris Agreement.³² In 2019 low-carbon generation expanded rapidly enough to meet all of the net additional demand for electricity, a key reason why global energy-related CO₂ emissions held approximately flat in 2019. This contributed to the largest ever drop in coal use and the third drop in the last five years. These are possible signs of the beginning of a rapid global shift away from coal that could take place in the 2020s. Early indications are that renewable energy deployments and investments may be less severely impacted by COVID-19 than fossil fuel-based generation.³³

²⁸ Bloomberg New Energy Finance (2020) *Scale up of solar and wind puts existing coal and gas at risk.*

²⁹ Carbon Tracker Initiative (2020) *How to waste over half a trillion dollars: The economic implications of deflationary renewable energy for coal power investments.*

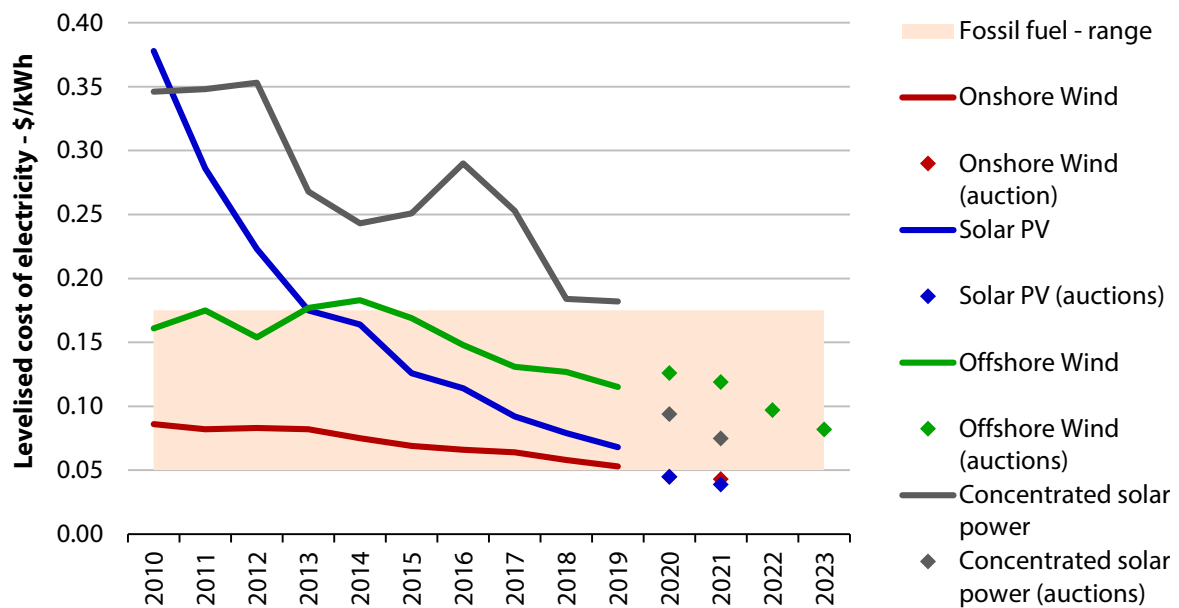
³⁰ Bloomberg New Energy Finance (2019) *Battery pack prices fall as market ramps up with market average at 156 kWh in 2019.*

³¹ Knoblock, F. et al. (2020) *Net emission reductions from electric cars and heat pumps in 59 world regions over time.*

³² Global Energy Monitor (2020) *Boom and Bust 2020: Tracking the Global Coal Plant Pipeline.*

³³ IEA (2020) *Renewable energy market update.*

Figure 2.2. Falling costs of new renewable electricity generation over the past decade



Source: IRENA (2020) *Renewable Power Generation Costs in 2019*.

Notes: Global average levelised cost of electricity are given in constant 2019 US dollars. Costs vary across regions. Dates represent the year of completion of committed projects. Future costs are from renewable power auction databases and will be sensitive to the regional makeup of committed projects in international databases.

c) Progress in international climate policy

The central achievement for international climate policy in the past decade was the signing and ratification of the Paris Agreement in 2015. This represented the first global climate treaty applying to (almost) all countries, with an agreed long-term goal to keep warming ‘well-below 2°C above pre-industrial levels and pursuing efforts to limit the increase to below 1.5°C above pre-industrial levels’. The Paris Agreement also sits within a broader framework of global Sustainable Development Goals (also agreed in 2015) to be achieved by 2030.

Since 2015, international negotiations have focused on the details for the rulebook for the Paris Agreement, climate finance, and a recent move towards setting Net Zero targets as a longer-term climate milestone including in the private sector:

- The rulebook for the Paris Agreement has now been largely completed, although with some exceptions including the rules for international emissions trading, and the Paris Agreement is now in force. The USA (13% of global GHG emissions) has announced its intention to withdraw from the Paris Agreement in November 2020, however the longer-term trajectory of US climate ambition is uncertain with substantial non-federal level action proposed, including Net Zero targets in California and New York states (amongst others).³⁴

³⁴ 19 states have made quantifiable GHG reduction or renewable energy commitments. 16 US state governments have stated their will to pursue the objectives of the Paris Agreement under the US Climate Alliance. This includes California (with an economy of similar size to the UK) which has used an executive order to commit to reduce emissions to Net Zero by 2045. Taken together, the various US coalitions of states, cities and businesses supporting the Paris Agreement make up around 37% of US GHG emissions.

-
- Developed nations committed in 2009 to collectively mobilise \$100 billion per year by 2020 in climate finance from developed to developing nations. This funding is to help developing countries reduce their emissions and adapt to emerging climate impacts. A recent assessment concluded that around \$70 billion per year had been mobilised by 2017, although no universally agreed definitions for climate finance flows exist.³⁵
 - In 2018 the IPCC published its Special Report on Global Warming of 1.5°C. This highlighted the avoided climate risks if warming is kept below 1.5°C compared to 2°C and created substantial international interest in setting Paris Agreement-compatible national, sub-national and corporate 'Net Zero' emission targets around the middle of the century, including in the UK. 120 countries have now proposed a Net Zero target in some form, with the EU (~8.5% of global GHG emissions) proposing a new law to achieve Net Zero GHG emissions by 2050 being the most significant of these.³⁶ When including state and city commitments, around half of global GDP (~25% of global emissions) is now covered by some type of Net Zero target.³⁷
 - The Paris Agreement has created growing private sector interest in mechanisms to report and assess climate-related risks. Large coordinated international initiatives such as the Taskforce on Climate-related Financial Disclosures (TCFD) have been established to provide tools to assess and manage these risks, and there has been growing membership of responsible investment initiatives, such as the UN Principles for Responsible Investment.

The past decade has focused largely on putting the framework for future international climate efforts in place. This has now been achieved. The primary focus throughout the 2020s will need to shift towards increasing ambition in emissions reduction and planning for adaptation to climate risks. A global stocktake of effort is scheduled for 2023, following the resubmission of national climate plans which were requested by the end of 2020.

³⁵ OECD (2019) *Climate Finance Provided and Mobilised by Developed Countries in 2013-17*.

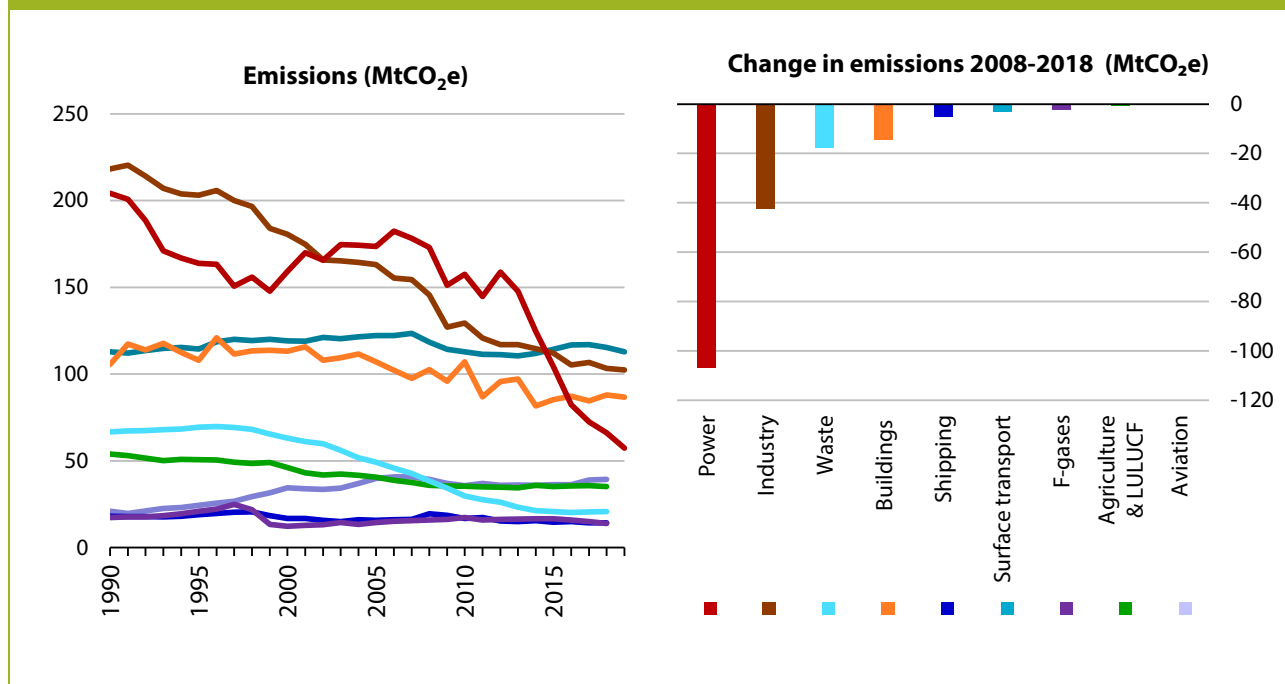
³⁶ Net Zero commitments vary substantially, particularly between sub-national and corporate commitments, regarding the scope of emissions covered and conditions on the use of emissions offsets.

³⁷ ECIU (2020) *Net Zero Tracker*.

2. Progress in reducing UK territorial emissions

Overall, UK territorial emissions fell ~28%³⁸ between 2008 and 2018 (the last date that emissions data for all sectors are available). This is faster than over 1998-2008 which saw an 11% reduction (Figure 2.3). Chapter 4 discusses 2018/2019 trends in detail.

Figure 2.3. UK greenhouse gas emissions by sector 1990-2019



Source: BEIS (2020) 2019 UK Greenhouse Gas Emissions, Provisional Figures; BEIS (2020) 2018 UK Greenhouse Gas Emissions, Final Figures; CCC analysis.

Notes: The chart on the right-hand side shows changes in sectoral emissions between 2008 and 2018 for all sectors. Data are not temperature-adjusted.

Reductions in territorial emissions since 2008 have been achieved alongside GDP growth of approximately 14% over the same period (Figure 2.4). The decoupling of emissions increases from GDP growth can be a powerful message to other countries, and must continue over the coming decades to achieve Net Zero.

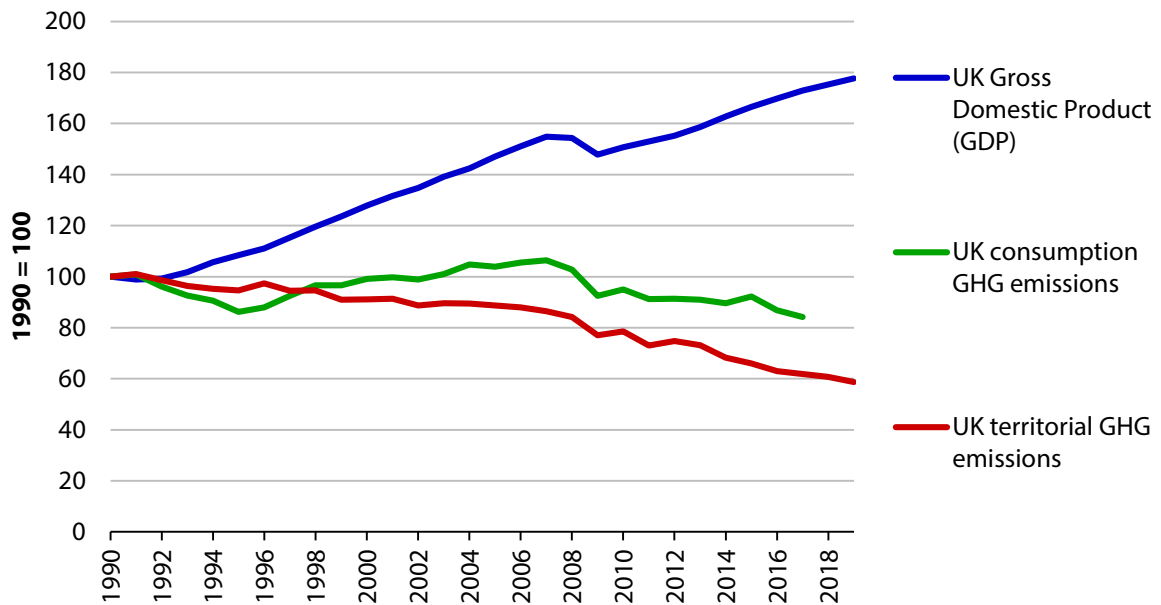
The UK has reduced its greenhouse gas emissions faster than any other G20 economy over the period 2008-2018 (Figure 2.5).³⁹ However, this progress must continue and extend beyond the power sector to meet the net-zero emissions target - emissions fell an average of 19.2 MtCO₂e each year from 2008 to 2018, and must fall on average 15.5 MtCO₂e each year from 2018 to 2050 (Figure 1.1).⁴⁰

³⁸ This includes international aviation and shipping and ignores the impact of EU ETS trading. GHGs are aggregated using global warming potential values from the IPCC 4th Assessment Report. Emissions are excluding revisions to peatland emissions from methods in the IPCC Wetland Supplement to allow consistency across reported years.

³⁹ Percentage reduction from 2008-2018.

⁴⁰ This rate does not account for forthcoming revisions to peatland emissions or global warming potentials.

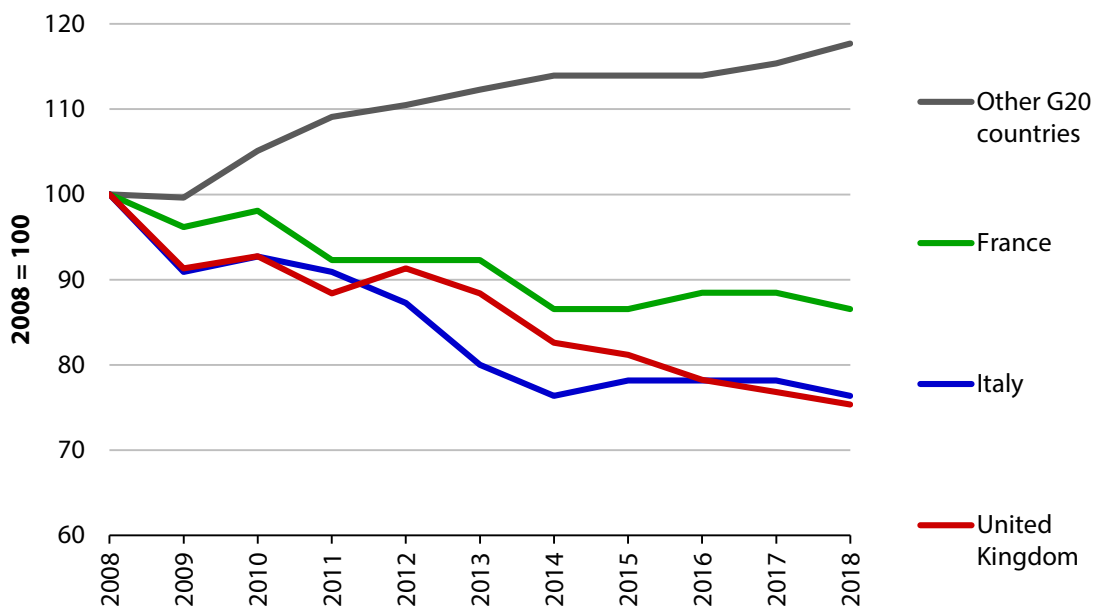
Figure 2.4. Emissions vs. GDP over time



Source: BEIS (2020) 2019 UK Greenhouse Gas Emissions, Provisional Figures; BEIS (2020) 2018 UK Greenhouse Gas Emissions, Final Figures; ONS (2020) Gross Domestic Product: chained volume measures: Seasonally adjusted £m; Defra (2019) UK's carbon footprint; CCC analysis.

Note: International aviation and shipping is included in both the territorial and consumption emissions statistics.

Figure 2.5. Relative GHG emissions of G20 countries (2008-2018)



Source: PBL (2019) Trends in Global CO₂ and Total Greenhouse Gas emissions: 2019 report.

Note: GHG emissions from land-use, land-use change and forestry are not included in the national totals used here.

Beneath these headline figures, performance has been more mixed at a sectoral level:

- **Sectors with decreasing emissions.** Emissions reductions have been predominantly driven by acceleration of power sector decarbonisation, which went from being the highest emitting sector at the beginning of the decade to the fourth highest in 2019. Industry, for which production output remains roughly at 1990 levels, saw significant decreases in emissions over the 2010s, in line with historical decreases in the previous two decades. Emissions from waste, shipping and F-gases have also decreased. Climate policy has been the predominant driver of emissions reductions in power, F-gases and waste, whilst reductions in industry and shipping have been largely due to wider international and economic trends affecting the sector (e.g. low steel prices, relative energy prices - see industry section).
- **Sectors with flat emission trends.** Surface transport saw little to no progress reducing emissions in the past decade. Due to reductions in emissions from other sectors, it is now the highest-emitting sector. The buildings sector too has not decarbonised at the pace of the rest of the economy and has remained relatively flat over the latter half of the 2010s. Agriculture and Land use, land-use change and forestry (LULUCF) have also made little progress. Emissions from aviation fell at the end of the 2000s, with international aviation emissions increasing again during the 2010s with increased flights and passenger numbers.

The UK met its first and second carbon budgets and is on track to meet its third budget, which are assessed through the UK net carbon account (Box 2.3). However, external factors have played a significant role in meeting these budgets.⁴¹ For example, the impact of the 2007-08 financial crisis on economic activity made the first two targets significantly easier to meet, while measures to reduce emissions fell short of our indicator trajectories in a range of areas, only achieving 8 out of 27 indicators in the 2018 Progress Report. For this reason, we recommended that the outperformance of the Second Carbon Budget should not be carried over to help meet future budgets.

Emissions will almost certainly fall again in 2020 as a result of the COVID-19 crisis (chapter 5), and this is likely to increase the margin by which the UK meets its Third Carbon Budget. Our recommendation remains that any surplus from the Third Carbon Budget should not be carried forward. We will analyse the effects of COVID-19 on the UK's emissions in future publications, including our advice on the level of the Sixth Carbon Budget in December 2020.

⁴¹ CCC (2019) *Reducing UK emissions: 2019 Progress Report to Parliament*.

Box 2.3. The net carbon account

Under the Climate Change Act, performance against carbon budgets is measured not by actual emissions but by the 'net carbon account'. The net carbon account is the sum of:

- The allowances allocated to the UK through the EU Emissions Trading System (EU ETS), including domestic aviation.
- Actual emissions from sources outside the EU ETS (i.e. the 'non-traded sector').

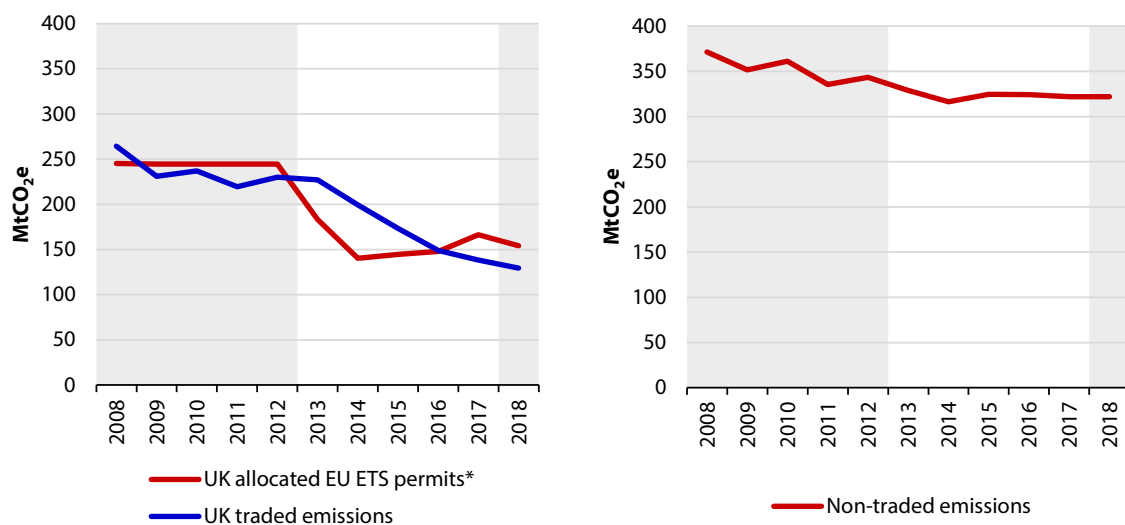
The net carbon account will differ from actual UK emissions as sources of emissions covered by the EU ETS (i.e. the 'traded sector') typically will not equal the UK's share of the EU ETS emissions cap.

The UK's share of EU ETS allowances consists of the free emission allowances allocated directly to UK installations, allowances allocated to the UK Government for auction, and the allowances allocated to new UK entrants to the EU ETS.

The Carbon Accounting (Provision for 2018) Regulations 2020 were introduced in February 2020. Under these regulations, the net carbon account for 2018 was 476.2 MtCO₂e.

There is no definition of how the net carbon account will be calculated beyond 2018, so we have not estimated the net carbon account for 2019. The future of carbon pricing in the UK is currently uncertain, and will have clear implications for the net carbon account beyond 2018.

Figure B2.3. UK GHG emissions in traded (left) and non-traded sectors (right)



Source: BEIS (2020) *Annual statement of emissions for 2018*; BEIS (2019) *Final statement for the second carbon budget*; DECC (2014) *Final statement for the first carbon budget*; CCC analysis.

Notes: Shading represents five-year carbon budget periods. 'Allocated EU ETS permits' includes the UK domestic aviation cap from 2012 onwards, and is adjusted for allowances totalling around 4.5 MtCO₂e that were cancelled from the New Entrant Reserve from 2008-2012. 'Traded emissions' includes domestic aviation CO₂ emissions from 2012 onwards.

a) Progress sector-by-sector

i) Surface transport

Surface transport emissions have been broadly flat over the past decade, falling only 3% between 2008 and 2018. Surface transport has emerged as the single highest emitting sector in the UK since 2015, and the current trend is off track to contribute as required to meeting the fourth and fifth carbon budgets and Net Zero.

- There have been increases in car efficiency for given car classes over the past decade, despite difficulties with the New European Drive Cycle (NEDC) testing process. These improvements have been driven by EU standards and implemented by the UK Government. Overall, emissions per km of new cars have reduced from 158.1 gCO₂/km in 2008 to 122.7 gCO₂/km in 2018.⁴² The lack of progress in reducing new car CO₂ in the last two years is largely due to the significant growth in SUVs from 6% market share in 2008 to 25% in 2019.⁴³
- The number of kms driven has increased notably over the past decade. Total road traffic was 530.6 billion vehicle-kms in 2019,⁴⁴ an increase of 6% since 2008. Car and van journeys make up 83% of the average person's trips that involve a vehicle.⁴⁵

The Government response to the COVID-19 pandemic is an opportunity to reduce the influence of rising demand (e.g. by facilitating and encouraging a move towards home working, see chapter 5), in line with the ambitions set out by the Government in its March publication.

Electric Vehicle (EV) uptake has been slow in the 2010s, but has accelerated in recent years. The first half of the 2010s saw fewer than 25,000 new plug-in cars and vans sold in total (this includes plug-in hybrids and battery electric vehicles (BEVs))⁴⁶. There are now over 300,000 plug-in cars on the road (~1% of total cars) and sales of plug-in EVs in the first three months of 2020 are more than double what they were in 2019.⁴⁷ Policy has supported this change, through a combination of upfront purchase subsidies, preferential tax treatment and support for the charging network.

ii) Industry

Industry has seen significant reduction in emissions, reducing around 29% over the period 2008-2018, and more than halving since 1990. This is a result of reductions across all parts of industry - manufacturing, construction and fossil fuel supply. In the manufacturing sector CO₂ emissions fell 25% between 2009 and 2017 and our decomposition analysis suggests that this is explained by a combination of the changing structure of the UK's manufacturing sector, as well as improved energy intensity and a shift to lower-carbon fuels, but not changes in overall output. More than half of emissions from industry come from refineries, chemicals, construction, iron, steel and cement and lime.⁴⁸

- **Output effects.** These reflect emission reductions associated with a change in overall manufacturing output. Overall, industrial output grew by 10% between 2009 and 2017 so this did not drive a reduction in emissions.

⁴² SMMT (2020) *Internal data shared with the CCC, NEDC test cycle.*

⁴³ SMMT (2020) *Internal data shared with the CCC.*

⁴⁴ DfT (2020) *Provisional road traffic estimates, Great Britain: April 2019 to March 2020.*

⁴⁵ DfT (2019) *Transport Statistics Great Britain 2019.*

⁴⁶ Cumulative sales up until 2014.

⁴⁷ Next Green Car (2020) *Website Statistics.*

⁴⁸ CCC (2019) *Net Zero: Technical Report.*

- **Structural effects.** These reflect the shift within the UK manufacturing sector towards less carbon-intensive subsectors. It accounts for 25% of the emissions reduction between 2009 and 2017, but does not reflect decarbonisation of industrial processes.⁴⁹ Analysis suggests that these shifts are largely as a result of international commodity prices, and relative electricity prices, not as a result of UK climate policy.⁵⁰
- **Energy intensity improvements.**⁵¹ These are emissions reductions associated with energy efficiency improvements, better plant utilisation and changes in product mixes within sectors. These account for 50% of the emissions reduction between 2009 and 2017.
- **Changes in fuel mix.** These are emissions reductions due to a move to lower-carbon fuels or electricity. These account for 25% of the emissions reduction between 2009 and 2017.

iii) Buildings

Buildings saw some limited progress in the past decade, with emissions falling 14% in the period 2008-2018, or 13% after adjusting for above average temperatures. However, after policy-driven success in the first half of the decade, there has been minimal progress in recent years:

- The majority of this decrease occurred over the period 2008-2015, when emissions fell 17%. This was largely driven by strong domestic standards phasing out non-condensing boilers, along with the supplier obligations targeting home energy efficiency which ran from 2008-2012 (CERT and CESP).
- Above average temperatures over the period also contributed to the decrease, with 9 out of the 12 past years recording temperatures above the long-term trend. Accounting for this, emissions fell only 13% over the period, with negligible progress since 2015.
- Strong standards at EU-level led to greater appliance efficiencies such as household white goods. Over the period 2008-2018, temperature-adjusted average electricity use fell 17%, primarily driven by the EU Ecodesign directive.

This means that the bulk of the challenge to decarbonise buildings remains, with the greatest challenge on decarbonising heating and hot water barely yet addressed.

- **Low-carbon heat in existing homes.** The major challenge for the buildings sector remains the need to shift homes away from natural gas to low-carbon heat solutions. The 2010s have seen very little progress in this area. Heat pumps are the heating solution in fewer than 200,000 homes.⁵² Public awareness of the need to move away from natural gas is limited, a recent survey highlighted that 48% of the population were not aware that gas boilers were a source of CO₂ emissions.⁵³
- **Energy efficiency in existing homes.** The major challenge of widespread building renovation and retrofit to increase building heat efficiency has been largely unaddressed. The replacement of the supplier obligations with the Renewable Heat Incentive and the Green Deal has resulted in an order of magnitude fall in the rate of loft and wall insulation.

⁴⁹ CCC analysis.

⁵⁰ For example, Aldersgate Group & UCL (2018) *UK industrial electricity prices: competitiveness in a low-carbon world*.

⁵¹ Energy intensity in this analysis is only a proxy for genuine energy efficiency improvements, since it also includes the effects of changing product mix and utilisation of plant and equipment, but it provides an indication about whether and where industrial energy efficiency is improving.

⁵² Euroserv-er (2019) *19th annual overview barometer*.

⁵³ BEIS (2019) *BEIS Public Attitudes Tracker: Wave 31*.

- **New homes.** The scrapping of the 2016 Zero Carbon Homes standard has meant that energy efficiency progress seen in existing buildings has not been replicated in new buildings. There are now more homes requiring zero-carbon retrofit than there were when the Climate Change Act was passed, with 1.8 million additional homes since 2007 now needing to be fitted with low-carbon heat.⁵⁴

iv) Power

The power sector has been a major success story in the past decade. Emissions have decreased around 62% over the period 2008 – 2018 reflecting real decarbonisation of energy produced in the UK. The carbon intensity of the grid fell from around 500 gCO₂/kWh in 2010 to 246 gCO₂/kWh in 2018.⁵⁵ Electricity generated from renewables was 25 TWh in 2008 (7% of mix), and rose to 100 TWh in 2018 (34% of mix).⁵⁶

- The Government introduced Electricity Market Reform in 2012. This included a host of policies that led to the decarbonisation of the UK's power sector and complemented the existing Renewable Obligation Certificates (introduced in 2002) and Feed-in Tariffs (introduced in 2010). Wind generation in 2019 makes up 23% of generation, with solar and biomass providing 3% and 11% respectively.⁵⁷
- Contracts-for-Difference (CfD) de-risk future returns for low-carbon investors. This gives investors greater confidence to invest in these projects which have high up-front capital costs. This investment, initially catalysed by the Green Investment Bank, has helped drive an increase in renewable generation and reduce the costs of the technology. Offshore wind is now the fastest growing form of electricity generation in the UK.
- Carbon pricing contributed to the decommissioning of coal by making it uncompetitive against natural gas.
- European efficiency standards for lights and household appliances drove down electricity use as products were replaced over time with more efficient models.

This has resulted in a transition from fossil fuel based power to renewables. For example, in Q3 2019, renewables provided more electricity than fossil fuels for the first time in the UK's history.⁵⁸ This has wider importance when considering that electrification will increase demand for electricity over the coming decades.

v) Aviation

Aviation emissions fell in 2009 and 2010 after the financial crisis, then stayed relatively flat in the early 2010s, but have been rising again in recent years. UK aviation emissions in 2018 were therefore the same as in 2008, as falls in domestic and military aviation emissions have been balanced by a rise in UK international aviation emissions. Over the same 2008-2018 period, the total number of UK terminal passengers rose by 24% to reach 292 million in 2018, with a further 2% increase seen in 2019.⁵⁹

⁵⁴ MHCLG (2019) *Table 211 House building: permanent dwellings started and completed, by tenure.*

⁵⁵ BEIS (2019) *provisional and 2018 final emissions data and DUKES (2020) Energy Trends 5.1.*

⁵⁶ DECC (2011) *UK Renewable Energy Roadmap.*

⁵⁷ DUKES (2020) *Energy Trends 5.1, DUKES (2020) Energy Trends 6.1.*

⁵⁸ Carbon Brief (2019) *Analysis: UK renewables generate more electricity than fossil fuels for first time.*

⁵⁹ Civil Aviation Authority (2020) *UK airport data.*

The increase in emissions has been more modest than growth in passengers due to increased plane loadings, decreases in average flight distance (due to faster growth in flights to the EU than other international destinations) and some improvements in fleet efficiency.

vi) Agriculture and land use, land-use change and forestry (LULUCF)

Agriculture emissions have increased over the period 2008-2018 by 2%, whilst the net sink from LULUCF has increased 15% over the same period. The combined effect is that emissions have been broadly flat in the past decade, decreasing 2% over the period 2008-2018. These sectors have repeatedly failed to meet the indicators outlined in the Committee's progress reports (e.g. for tree planting).

In the past decade, agriculture policy to reduce emissions has been dominated by a voluntary approach, centred on supplying advice and information. Afforestation has relied upon money provided under agri-environmental schemes covered under the EU's Common Agricultural Policy. For example, England's Countryside Stewardship Woodland Creation scheme provides £18m annually for the planting of around 2,000 hectares.⁶⁰

Rates of tree planting have varied significantly in England and across the devolved administrations. In 2018/19, Scotland accounted for 80% of new planting in the UK.⁶¹ For the UK as a whole, rates of tree planting have consistently fallen below what is needed to achieve Net Zero by 2050.

vii) Waste

Waste sector emissions have fallen 46% over the period 2008-2018, driven exclusively by reductions in landfill methane emissions. This has primarily occurred due to falls in the amount of biodegradable waste being landfilled, driven by the UK's landfill tax diverting waste away from landfill. Although landfill methane capture rates increased in the early 2010s, these have peaked and are now decreasing. Recycling rates have also plateaued in England, although Wales and Scotland have seen improvement in the past decade. With the significant decrease in landfilling, more local authority waste is now incinerated for energy than recycled or composted in England.

In 2018, there were 6.8 MtCO₂e/yr of fossil-related GHG emissions resulting from the conversion of municipal solid waste and other industrial wastes into power and/or heat across the UK, an increase of 14% from 2017. These emissions are counted within the Power and Industry sectors above, rather than the Waste sector.⁶²

viii) Shipping

Shipping has seen a decrease in emissions of 26% over the period 2008-2018, with a sharp fall occurring after the global financial crisis, and smaller reductions in recent years. Shipping sector emissions are determined by UK maritime fuel bunker sales, which have fallen over the period mostly due to reductions in domestic coastwise and international export shipping. In terms of overall freight tonnages, dry and liquid bulk have seen significant falls (in particular, less coal and crude oil carried by ship), although container and roll-on/roll-off freight has increased.⁶³

⁶⁰ The 2014-20 Rural Development Programme for England (RDPE).

⁶¹ Forest Research (2019) *Provisional Woodland Statistics: 2019 Edition*.

⁶² Defra (2019) *Statistics on waste managed by local authorities in England in 2018/19*.

⁶³ DfT (2020) *Port and domestic waterborne freight statistics: data tables (PORT)*.

ix) F-gases

F-gases have been relatively flat over much of the past decade, although recent years have seen a fall, resulting in a total decrease of 13% over 2008-2018. These reductions are a result of industry pressure as well as strong EU regulation on their use (requiring a reduction of around 80% in emissions of most F-gases by 2050), driving innovation and product shifts.

b) Progress in key technologies and consumer and business behaviours

Aside from emissions and policy, the past decade has also seen varying degrees of progress amongst an array of key technologies and behaviours. Here, we discuss progress across key underlying technologies and behaviours:⁶⁴

- **Offshore wind.** Recent auctions have produced record low prices for electricity generation from offshore wind, and many renewable technologies are now competitive with fossil fuel generation. There are strong signs that this trend will continue in the 2020s. Globally the costs of onshore wind and solar PV have fallen by 39% and 82% respectively since 2010 (Figure 2.2).⁶⁵
- **Battery costs and electric vehicles.** The global Electric Vehicle (EV) market continues to develop and there have been profound changes in the past decade. The average market price for battery packs has decreased 87% in real terms between 2010 and 2019.⁶⁶ In 2010 there were 16 EV models on sale this has risen to ~140 models globally in 2020.⁶⁷ The number of public charge points, covering slow, fast, rapid and ultra-rapid chargers, has grown from a negligible figure in 2010 to over 30,000 in 11,000 locations across the UK.⁶⁸ Whilst these chargers are concentrated in urban areas, coverage UK wide has also increased.
- **Heat pumps.** Electrification of heating remains the main route for decarbonising buildings, whether through heat networks or at a household level. There are 37 million heat pump units installed in EU countries.⁶⁸ Public subsidies have been available since 2011 in the UK, primarily under the Renewable Heat Incentive. However, UK deployment remains below 30,000 units installed a year, or just 2% of annual boiler replacement sales. The attending lack of public awareness and support for low-carbon heating is arguably the single greatest consumer barrier to achieving Net Zero.
- **Carbon capture and storage (CCS)** is a key pillar in achieving Net Zero, requiring significant progress in the 2020s to get on track to meeting the target by 2050. However, it is yet to be developed at scale in the UK and there was little progress in the 2010s. It must be a priority progress area for the 2020s. The Government cancelled two CCUS commercialisation programmes since 2008, halting progress in the sector, though the Government has recently reiterated its commitment to the technology (Section 4.3).
- **Low-carbon hydrogen** has recently emerged as a promising low-carbon fuel, with prospects to enable decarbonisation of the industrial, power, transport and buildings sectors globally.

⁶⁴ This list is non-exhaustive. Technologies selected for discussion based upon their degree of progress and criticality for achieving Net Zero. See Section 2.a for further discussion of progress by sector.

⁶⁵ IRENA (2020) *Renewable power generation costs in 2019*.

⁶⁶ Bloomberg New Energy Finance (2019) *Battery pack prices fall as market ramps up with market average at 156 kWh in 2019*.

⁶⁷ Next Green Car (2020) *Website Statistics*.

⁶⁸ Eurobserv-er (2019) *19th annual overview barometer*.

It will play a crucial role in the future low-carbon energy system, but has not yet been deployed at scale in the UK.

- **Diets.** Meat consumption decreased by 6% between 2000 and 2018. The proportion of fresh meat (i.e. beef, lamb and pork) fell by 23%. However, around 80% of meat consumed is made up of processed meat, which has remained broadly unchanged.⁶⁹ The consumption of dairy products has decreased by 16% during this time. Recent surveys indicate an increase in people classifying as vegan, vegetarian and “flexitarian”.⁷⁰
- **Walking and cycling** behavioural change has had mixed levels of success.⁷¹ The number of walking trips decreased throughout the majority of the 2010s, but distance walked per year increased by 9% from 2015 to 2018 (the latest year that data is available). For cycling, the average number of trips has remained flat over the past decade, but distance has increased over time (9% from 2015 to 2018).
- **Flying.** Total passenger numbers increased 26% over the period 2008-2018, with the largest growth (a 35% increase over the period) being in flights to European destinations.⁷²

3. Progress in reducing UK consumption emissions

Accounting for greenhouse gas (GHG) emissions under the Climate Change Act is done on a ‘territorial’ basis, meaning that a country has responsibility for all emissions produced within its borders. This is consistent with the internationally-agreed approach to GHG emissions accounting under the Paris Agreement, in which all countries are required to make (nationally-determined) commitments to reduce the emissions produced domestically.

An alternative perspective associates emissions caused during the production of goods and services with the country that is the final consumer of those goods and services independent of where in the world those emissions occurred. For the UK this ‘consumption emissions footprint’ (or carbon footprint) is published annually by Defra as an experimental statistic, with the published time series extending back to 1990 for the first time this year.⁷³ Consumption emissions statistics have higher uncertainty than territorial-based emissions due to the large amount of national accounts and trade data needed in addition to GHG inventories to map the global flows of intermediate goods and services which provide inputs for a final product consumed in the UK.

This section describes the composition of the UK's current consumption footprint and the drivers of how it has changed over time, based on the latest statistics published by Defra.

⁶⁹ DEFRA (2019) *Family Food Survey*.

⁷⁰ See for example The Grocer (2018) *Meat-free diets: fad or future of food?* and Eating Better (2019) *Public attitudes to meat consumption*.

⁷¹ DfT (2019) *Walking and cycling statistics, England: 2018*.

⁷² DfT (2019) *Aviation (TSGB02)*.

⁷³ Different formats for that national statistics on production and consumption within the economy mean that there is higher uncertainty in the UK's consumption footprint prior to 1997 compared to after it.

a) Composition of the UK consumption emissions footprint in 2017

In 2017, the most recent year for which estimates are available, the UK's consumption emissions footprint was 772 MtCO₂e. This is larger than the 505 MtCO₂e for the UK's territorial emissions in 2017.

This gap between the UK's consumption emissions and territorial emissions reflects the difference between the imported emissions to satisfy UK consumption and the emissions embedded in UK exports.⁷⁴

This consumption emissions footprint can be decomposed in a number of ways (Figure 2.6):

- **By source.** 73% of the UK's consumption emissions footprint occurs in industrial and waste, transportation and power sectors. Emissions produced by electricity generation (both that consumed directly in the UK and that used to produce the final products and services for the UK) still make up 18% of the UK's consumption footprint, contrasting with the UK's territorial emissions, where power sector emissions are now 13%.
- **By region.** In total 54% of the UK's consumption footprint emissions were produced in the UK and are therefore counted in the UK's territorial account.⁷⁵ An additional 10% are produced in EU countries, meaning around two-thirds of the UK's consumption footprint falls within countries that have legislated or have currently proposed equally ambitious all-economy long-term emissions targets as in the UK. Emissions produced in China contribute 8% of the UK's consumption footprint. The large number of regions that make a significant contribution to the UK's carbon footprint reflects the complexity of current global supply chains.
- **By product.** The UK's consumption of services makes up around 20% of the UK's consumption emissions footprint when indirect emissions (such as from electricity used in powering offices producing services) are allocated along supply chains to the final product. This is now very slightly larger than the emissions embedded in the UK's consumption of manufactured products.⁷⁶ 89% of the emissions associated with the UK's demand for manufactured products occur outside of the UK, but only 55% do so for services.

The UK has a similar consumption footprint to many European countries, with consumption footprint CO₂ emissions per person greater than France, but lower than Germany and significantly lower than non-European developed countries such as the USA, Japan, Russia and Canada.⁷⁷

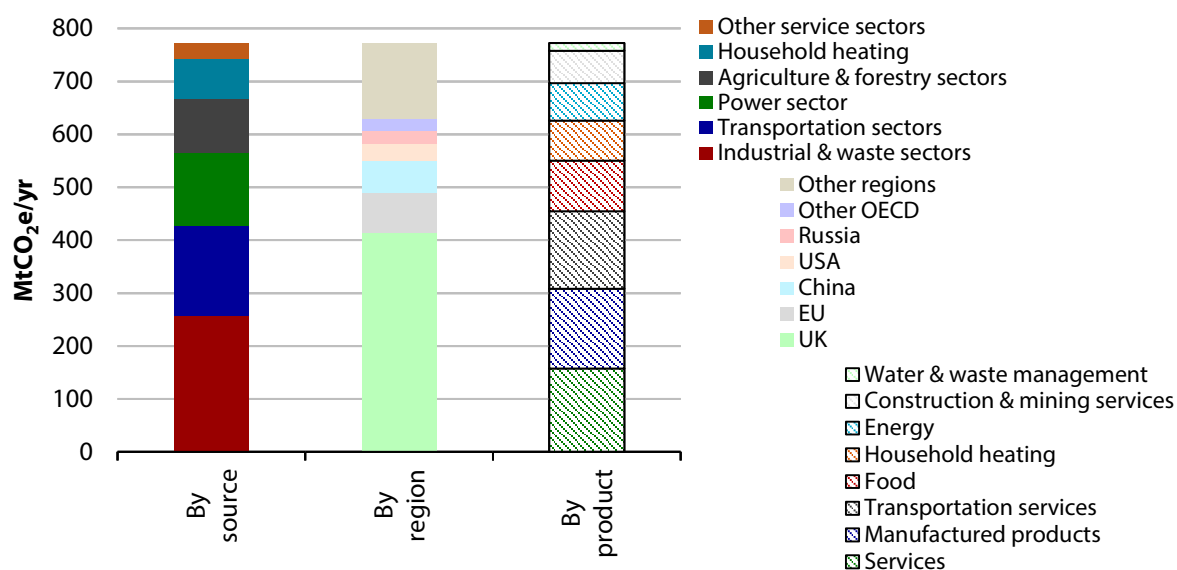
⁷⁴ Differing methodologies between the consumption and territorial emissions accounts make an exact comparison difficult. For example, emissions from land-use, land-use change and forestry are not currently estimated as part of the UK's consumption emissions accounts but are in the territorial emissions accounts.

⁷⁵ This is over 80% of the UK's territorial emissions account. The remaining ~20% of UK territorial emissions are associated with products and services that are consumed outside the UK so do not count towards the UK's consumption footprint.

⁷⁶ The real value of the UK's consumption of services is however three times greater than that of manufactured products, reflecting the lower full supply chain carbon intensity of the services sector.

⁷⁷ Global Carbon Project (2019) *Global Carbon Budget 2019*; Peters, G. et al. (2011) Growth in emission transfers via international trade from 1990 to 2008. *Proceedings of the National Academy of Sciences*, 108 (21), 8903-8908.

Figure 2.6. Decomposition of the UK's consumption emissions footprint in 2017



Source: Defra (2019) *The UK's carbon footprint*; CCC analysis.

Notes: In the regional breakdown the 'Other regions' category refers to the Brazil, South Africa, Rest of Europe, Rest of Africa, Rest of America, Rest of Asia and Rest of Middle East regions from the Defra statistics. The 'Rest of Middle East' region is the largest of these, contributing 38 MtCO₂e in 2017.

b) Changes in the UK's carbon footprint over 2009-2017

In 2017 the UK consumption emissions footprint was 16% below 1990 levels (Figure 2.4). Over the same period, the monetary value of the UK's total consumption of goods and services grew by around 80% in real terms. Between 1990 and 2006 the UK's consumption emissions footprint increased by around 6%. This was driven by increased consumption, rapid increases in globalisation and increasing carbon intensity of energy (particularly coal fired power in China) over the 2000s. The effects of the global financial crisis caused the UK's consumption emissions footprint to decline sharply over 2007-2009. Since 2009 it has steadily declined although at a slower rate than the UK's territorial emissions.

During the period 2009-2017, a combination of drivers related to economic structure and carbon intensity improvements in the UK and overseas underlie the declining trend (Figure 2.7):⁷⁸

- **Increased population.** UK population has increased by 6% over this period, increasing total national consumption and hence consumption emissions independent of any changes in per person levels of consumption.
- **Increased consumption.** The real terms monetary value of per person consumption in the UK increased by around 12% over 2009-2017. Without any changes in the type of goods and services that the UK consumed, or in the structure of the UK and global economy, this would have increased the UK's consumption footprint by 164 MtCO₂e (19%).

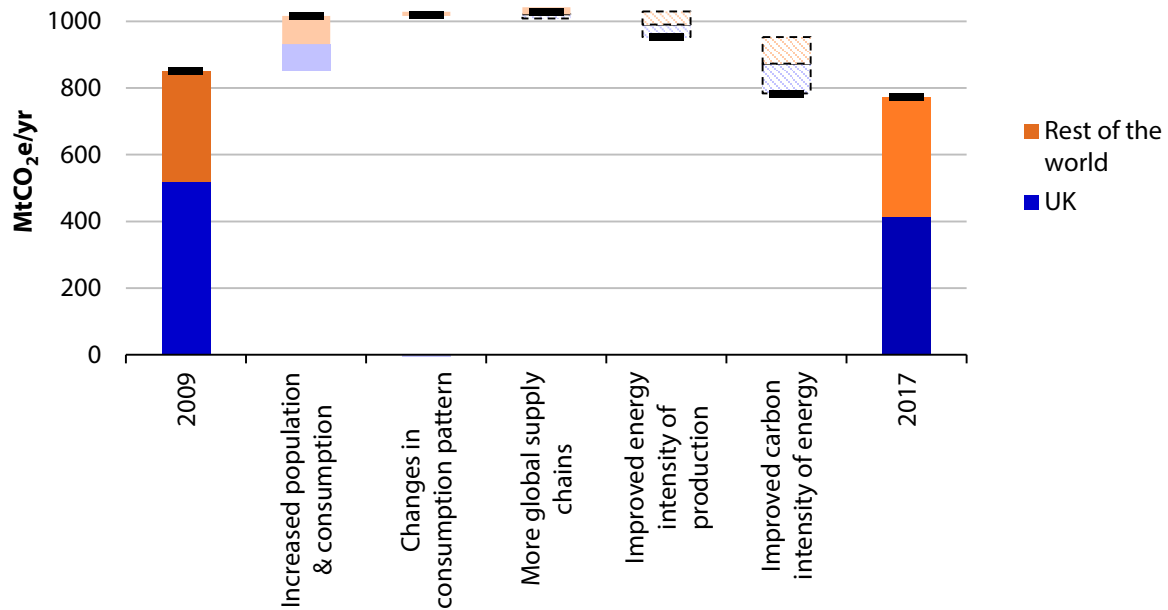
⁷⁸ We focus on this period because of the large effects of the global financial crisis on UK consumption emissions to better isolate the dominant trends since.

- **Changes in consumption patterns.** Since 2009 the structure of UK final consumption has not significantly changed between different groups of products. Those changes that have occurred have only a very small effect on UK consumption emissions, increasing them by 4 MtCO₂e over this period.
- **More globalised supply chains.** A globalisation of supply chains means that a greater fraction of the economic value of UK consumption accrues overseas. Supply chains have generally continued to become more global since 2009, but generally at a lower rate than in the rapid expansion prior to 2007. This increase in globalisation has resulted in more of the economic activity from UK consumption occurring in regions with higher carbon intensities than in the UK, increasing the UK's overseas consumption emissions by 21 MtCO₂e and reduced that occurring in the UK by 12 MtCO₂e. These changes are only a small contribution to the overall change in the UK consumption footprint, indicating that 'offshoring' of UK emissions is not responsible for a large fraction of the changes in either the UK's territorial or consumption emissions seen since 2009.
- **Improved energy intensity.** Improvements in the energy intensity of economic activity both in the UK and elsewhere have helped to offset the GHG emissions impact of increased consumption and more global supply chains. Overall, changes in the energy intensity of economic production contributed to reducing the UK's carbon footprint by 77 MtCO₂e between 2009 and 2017.
- **Decreased carbon intensity of energy.** In the UK, the carbon intensity of the energy has declined, driven primarily by the large improvements in the power sector. This has reduced UK consumption emissions produced in the UK by 89 MtCO₂e. Outside of the UK, the carbon intensity of energy used to meet UK consumption also decreased over the 2009-2017 period, in contrast to the previous decade which saw increases due to the large expansion in global coal fired electricity generation. This contributed to a decrease in the UK consumption emissions footprint produced overseas of 80 MtCO₂e.

Overall, the improvements in the energy and carbon intensity of the UK and global economy over the last decade were sufficient to outweigh the effect of increased overall consumption and changes in the structure of the global economy, leading to an overall 9% decline in the UK's consumption emissions over 2009-2017 (18% relative to 2008 levels). The UK-produced part of the consumption emissions footprint contributed most to this overall decline (a 20% reduction) whilst the emissions produced in the rest of the world rose slightly (8% increase). The overall reduction in the UK's consumption emissions is smaller than the 20% reduction in the UK's territorial emissions account over the same period.

The growing 'gap' between the UK's consumption and production accounts reflects in part the relatively more rapid decarbonisation in the UK compared to the world as a whole as well as the lower carbon intensity of economic activity which occurs in the UK. The UK's consumption emissions footprint in 2017 would have been higher without efforts to reduce emissions in the UK's territorial emissions account, which have not resulted in significant 'offshoring' of emissions over the last decade. For instance, decarbonisation of the power sector in the UK, the main contributor to falling territorial emissions, has also led to reductions in the UK's consumption emissions footprint.

Figure 2.7. Drivers of changes in the UK's consumption emissions footprint (2009-2017)



Source: Defra (2019) *The UK's carbon footprint*; CCC analysis.

Notes: The contributions to the change between 2009 and 2017 are calculated using a unipolar decomposition ordered from left to right. Negative contributions are marked using a dotted black outline and hatching. Net changes in the total consumption emissions footprint is marked by a solid black line. The contributions to change are calculated for the 'indirect' GHG emissions only, with the direct household emissions from travel and heating included only in the 2009 and 2017 bars (these household emissions increased only by 8 MtCO₂e since 2009).

c) Tracking UK consumption emissions

Territorial-based emissions accounting is the established and agreed method under the international architecture of the Paris Agreement. There is unlikely to be support for a shift to consumption emissions accounting internationally, due to both the challenges of producing accurate estimates for many countries and concerns regarding sovereignty over domestic industries from emissions exporters (often large developing countries). Territorial-based accounting is also most closely aligned to the policy levers that national governments have to influence emissions, and therefore remains the right basis on which legally-binding emission targets are set under the Climate Change Act.

However, consumption-based accounting does offer a valuable complementary perspective to territorial-based accounting and should continue to be assessed by the UK Government. It can be helpful in identifying actions that might reduce the UK's territorial emissions but increase emissions elsewhere, as well as highlighting the additional emissions reductions from reduced consumption of GHG-intensive goods that fall outside of the UK's territorial account.

Consumption-based accounting also demonstrates the need for a global approach to help other countries reduce their GHG emissions. The only plausible way to reduce the UK consumption emissions footprint to net-zero is, alongside strong domestic action, to support other countries in setting and achieving economy-wide Net Zero targets themselves.

We will look further at how the UK can best contribute to this as part of our advice on the level of the sixth carbon budget in December and the Committee will continue to report on progress in reducing the UK's consumption emissions in future progress reports.

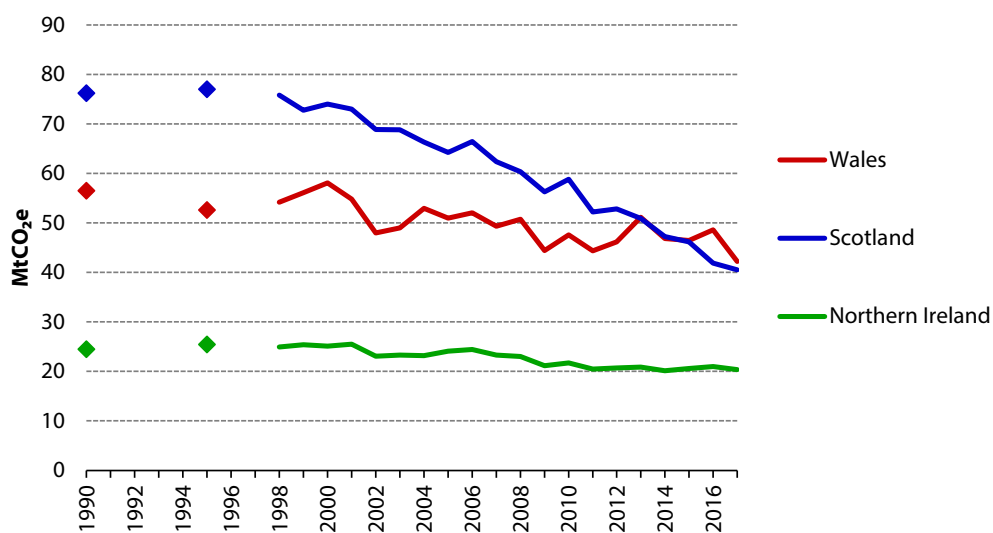
4. Progress reducing emissions in Scotland, Wales and Northern Ireland

The governments of Scotland, Wales and Northern Ireland will have an increasingly important role to play in tackling climate change as progress extends beyond the power sector. The reserved and devolved policy responsibilities are complementary (Box 6.1). The UK cannot achieve its future climate goals without strong statutory frameworks for emissions reduction from Holyrood, the Senedd, or Stormont - and strong policies from the devolved governments to match. Likewise, the nations of the UK will not meet their own climate targets without supporting UK-wide policies.

Emissions data for the devolved administrations are only available up to 2017. New data for 2018 were published on 16 June 2020 but this was too late for inclusion in this report. The Committee will comment in more detail on emissions in 2018 in dedicated Progress Reports for Scotland and for Wales later this year.

Scotland and Wales both have their own legislated climate targets. Both countries were close to being on course to meet their next major climate targets for 2020 (Table 2.1, Figure 2.8), and will now likely outperform them due to the impacts of COVID-19. Northern Ireland's New Decade, New Approach power-sharing agreement included new commitments to introduce legislation and targets for reducing carbon emissions in line with the Paris Agreement.⁷⁹

Figure 2.8. Greenhouse gas emissions in Scotland, Wales and Northern Ireland (1990-2017)



Source: NAEI (2019) *Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2017*.

Notes: Emissions data for the devolved administrations are only available up to 2017, though new data for 2018 were published on 16 June 2020. The Committee will comment on emissions in 2018 in dedicated Progress Reports for Scotland and for Wales later this year. No data are available for 1991-1994 or 1996-1997.

⁷⁹ UK Government and Irish Government (2020) *New Decade, New Approach*.

Table 2.1. Scotland and Wales are likely to outperform their 2020 emissions targets

	2020 emissions targets	Performance in 2017	On track?
Scotland	56% reduction in all greenhouse gas emissions by 2020 against 1990 levels.	Scotland's emissions were 51% below 1990 levels on the 'base inventory' against which Scotland's targets are measured.	COVID-19 means Scotland will likely outperform the target. Underlying performance has been strong, but progress has must extend beyond the power sector.
Wales	The first Welsh carbon budget (CB1) requires an average 23% reduction in all greenhouse gas emissions over the period 2016 to 2020 against 1990 levels.	In 2016 and 2017, the average reduction in emissions was 20%. Based on the latest published inventory, average annual emissions will have to be below 42.0 MtCO ₂ e from 2018 to 2020 for Wales to meet its target.	COVID-19 impacts mean Wales will likely outperform the target. Reductions across the budget period to-date have mostly been due to a large drop in the power sector in 2017.

Source: NAEI (2019) *Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2017*.

Scotland has decarbonised faster than the UK as a whole from 2008 to 2017, whereas Wales and Northern Ireland have marginally increased their share of total UK emissions (Figure 2.9):

- Emissions fell by 19.8 MtCO₂e (-33%) in Scotland, at a relatively steady annual decline.
- Emissions fell by 8.5 MtCO₂e (-17%) in Wales. A period of overall increasing emissions from 2009 to 2016 was reversed by particularly strong reductions in 2017, with emissions falling by 13% in a single year.
- Emissions fell by 2.6 MtCO₂e (-12%) in Northern Ireland, despite a 4% increase from their lowest levels in 2014 to a six-year high in 2016.

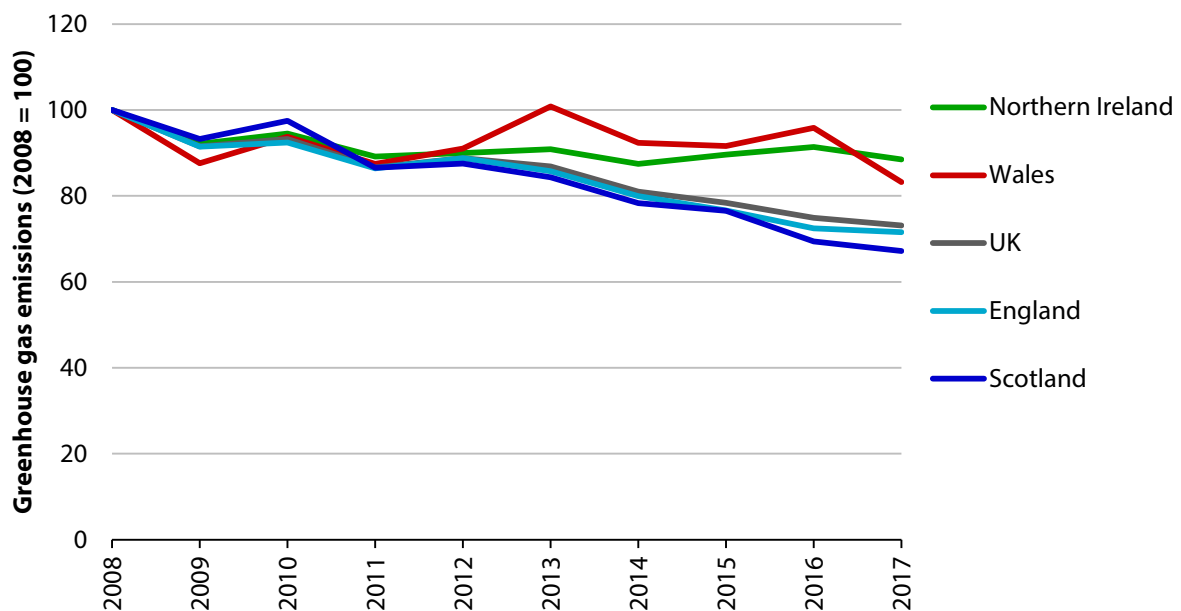
The most significant factor in determining the rate of decarbonisation in Scotland, Wales and Northern Ireland relative to the whole of the UK has been the speed and scale of power sector decarbonisation in each country (Figure 2.10):

- **Scotland** has led the UK on the rate of power sector decarbonisation, and its emissions from power generation were just 1.2 MtCO₂e in 2017. Scotland has substantial capacity for low-carbon generation with renewable energy making up 90% of gross electricity consumption in Scotland in 2019, and has two existing nuclear power stations. The power sector has accounted for two-thirds of all greenhouse gas emissions reductions in Scotland since 2008.
- **Wales** is a net exporter of electricity to the rest of the UK, generating twice as much electricity as it consumes. It has a large natural gas-fired generation capacity and has the lowest proportion of renewables contributing to its total generation compared to the other nations of the UK. However, the recent closure of Wales' last coal-fired power station and further expansion of renewable generation capacity suggests Welsh power sector emissions are likely to continue to fall beyond the 36% drop seen from 2016 to 2017.

Industry emissions have also fallen by 15% in Wales since 2008, though this change will be explained by a combination of the changing structure (and possibly output) of Wales' manufacturing sector, as well as improved energy intensity and a shift to lower-carbon fuels. Wales has made very significant progress in the waste sector over the past decade, with large increases in recycling rates and reductions in the landfilling of biodegradable wastes.

- Northern Ireland** has devolved control of its energy and heat sectors, apart from nuclear energy, and is a member of the all-island Integrated Single Electricity Market (I-SEM) shared with the Republic of Ireland. Emissions from the power sector in Northern Ireland have fallen by 29% since 2008, and renewable generation has increased to 43% of total generation in 2019, one year ahead of their 2020 target of 40%. In May 2020, it was announced that Northern Ireland's last remaining coal-fired power plant, which does not fall under the UK Government's commitment to shut coal plants in Great Britain by 2024, would close.⁸⁰ Waste emissions have more than halved (-56%) in Northern Ireland since 2008, though they remain slightly higher than the UK average per-capita.

Figure 2.9. GHG emissions in Scotland, Wales, Northern Ireland and England 2008-2017

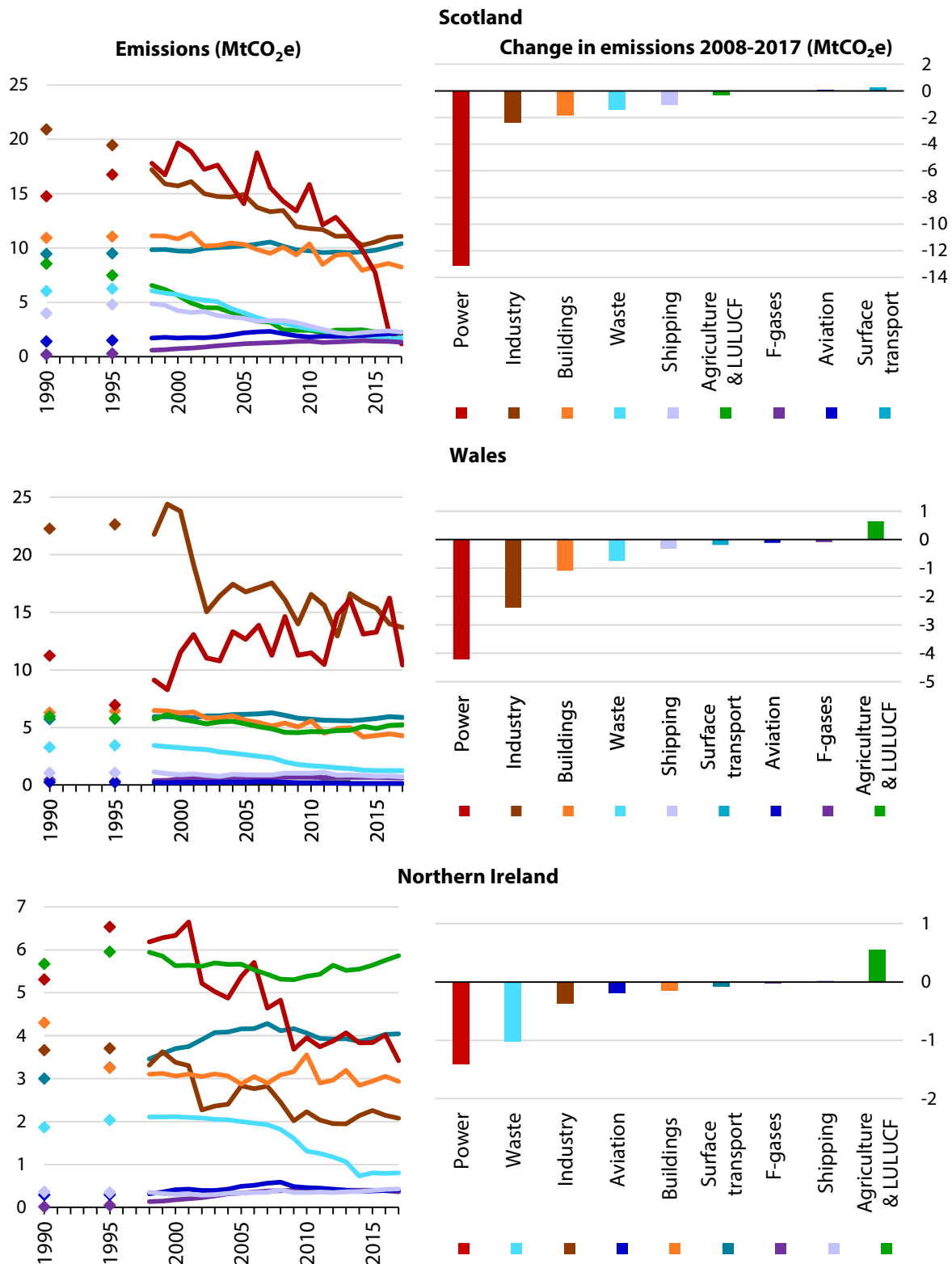


Source: NAEI (2019) *Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2017*.

Notes: Emissions data for the devolved administrations are only available up to 2017, though new data for 2018 were published on 16 June 2020. The Committee will comment on emissions in 2018 in dedicated Progress Reports for Scotland and for Wales later this year.

⁸⁰ Kilroot has secured a ten-year contract for new natural gas generation to replace the existing coal units, see EPUKI (2020) *Comment on T-4 Capacity Market Auction Results*.

Figure 2.10. Greenhouse gas emissions by sector in Scotland, Wales and Northern Ireland 1990-2019



Source: NAEI (2019) *Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2017*.

Notes: Emissions data for the devolved administrations are only available up to 2017, though new data for 2018 were published on 16 June 2020. The Committee will comment on emissions in 2018 in dedicated Progress Reports for Scotland and for Wales later this year. No data are available for 1991-1994 or 1996-1997.

Chapter 3: Lessons learned since 2008



Introduction

This chapter looks back at the period since the Climate Change Act was legislated in 2008, and highlights policy lessons that are relevant to the period ahead. The UK must take the positive lessons from strong performance by the power sector and apply those to the other emitting sectors. The critical challenge is to deliver increased ambition overall to match the Net Zero target.

Over half the emissions reductions since the Climate Change Act was passed have come from the power sector, where there has been a well-designed, coherent and effective package of policies to deliver a high level of ambition on low-carbon investment (Table 3.1). This has clear lessons for other sectors that have not implemented full packages of policy and have not delivered the transformative change required.

Reflecting across the UK experience provides examples of both policy success and failure. These examples, and consideration of the challenges to come, offer insights into how policy must adapt to deliver the Net Zero target. We reflect these in our policy recommendations in chapter 6.

We draw out eight lessons that should be applied to policy development in future:

1. Success is attainable and can be rapid, provided the foundations are in place
2. Direction must be clear and policies must be investable
3. Enabling measures are important, with new challenges approaching
4. Multiple Government departments must work together
5. Fairness must be a key part of policy design
6. Contingency and flexibility are needed – not everything will work
7. National, local and international policy are all needed and can provide good examples
8. The UK can influence international decarbonisation

Table 3.1. Summary of major active policies aimed at emissions reductions over the past decade

Transport	<p>Grants for electric vehicle purchase and electric vehicle charging infrastructure (2011-present)</p> <p>EU new car / van CO₂ 2020/21 regulation which sets decreasing targets on average CO₂ per km for new vehicle sales by manufacturer (2009/2011-present)</p> <p>Renewable Transport Fuels Obligation supports use of low-carbon fuels in road transport (2007-present), with waste-based biofuels receiving doubled incentives from 2011</p>
Industry	<p>EU ETS charges large emitters for the carbon they release, though in practice most large emitters are exempt (2005-present)</p> <p>Various energy taxes introduced including the CRC energy efficiency scheme (2010-2019) and the Climate Change Levy (2001-present)</p>
Buildings	<p>Carbon Emissions Reduction Target (CERT) placed an obligation on the UK's six major gas and electricity suppliers to improve the energy efficiency of existing households (2008-2012). This was replaced by the Energy Company Obligation (ECO, 2012-present).</p> <p>Community Energy Saving Programme (CESP) funded efficiency measures via an obligation on energy suppliers & electricity generators (2009-2012)</p> <p>Green Deal funded subsidised loans for energy efficiency improvements in homes (2013-2015)</p> <p>Renewable Heat Incentive (RHI) reimburses households and small businesses who generate heat through low-carbon sources (2012-present)</p> <p>EU Ecodesign directive improves the product standards of an array of products (2009-present)</p>
Power	<p>Electricity Market Reform introduced Contracts-for-Difference, a capacity market, an emissions performance standard and a carbon price floor (2011-present)</p> <p>UK Green Investment Bank (2012 - 2017) provided investor confidence to invest in low-carbon industries such as Offshore wind</p> <p>Feed-in Tariffs (2009-2017) and Renewables Obligation (2005-2017) provided payments to renewable electricity generators</p> <p>EU air quality standards mandated filtration technologies at large power stations (2001-present)</p> <p>The EU Emissions Trading System caps power emissions across Europe (2005-present)</p>
Agriculture & LULUCF	<p>No major policies introduced. EU Common Agricultural Policy continues to be the main source of funding for tree planting.</p>
Aviation	<p>No major UK policies, but various reforms to Air Passenger Duty (1994-present) have distinguished between long/short-haul flights. Intra-EU flights were included within the EU ETS from 2012</p>
Shipping	<p>No major UK policies. Internationally, IMO's MARPOL Annex VI sets limits on pollution (2005-present) & new ship energy efficiency requirements (2011-present)</p>
Waste	<p>Landfill Tax (1996-present) rates increased rapidly during 2008-2014. Resulting waste gate fees were main driver for expansion in energy from waste plants</p> <p>Renewables Obligation supported energy from waste plants, and provided landfill operators an incentive to capture methane to generate electricity</p> <p>Devolved administrations implemented waste strategies and policies, mainly designed to increase recycling rates and reduce landfilling</p>
F-gases	<p>EU F-gas regulation mandates phase out most of the highest GWP F-gases (2015-present)</p>

1. Success is attainable and can be rapid, provided the foundations are in place

Although not sufficiently widespread, the UK has had notable successes where high ambition has been adopted and backed by a well-designed package of policies. Recent history has demonstrated the effectiveness of regulation, taxes and incentives. The combination of different policies can be especially effective, for example the use of an instrument such as carbon pricing alongside support for technology development (e.g. renewables policy).

Alongside rapid falls in power sector emissions, strong progress has occurred in the costs of key low-carbon technology, appliance efficiency (including boilers) and waste:

- Emissions from the power sector fell by 67% from 2008 to 2019.⁸¹ Coal-fired power generation has fallen from a share of 41% in 2012, the year before the carbon price floor was introduced, to 2% in 2019.⁸² These reductions were driven by an effective policy combination with a clear direction, strong investable incentives and enabling measures.
- Offshore wind costs have fallen from £140-150/MWh for new projects in 2014 to around £40/MWh⁸³ - below the cost of new gas-fired generation - for projects coming online in the mid-2020s. Solar and batteries have also seen rapid cost reductions: PV modules and battery prices have both fallen by over 80% since 2010.⁸⁴ Cost reductions reflect a combination of government policy and industry innovation. Government policy reduced risk and cut finance costs (e.g. by providing long-term contracts for renewable power). Industry innovation benefited from learning-by-doing, making the most of economies of scale and falling financing costs as confidence in new technologies grew with their deployment.
- Energy efficiency improvements have been seen across much of the economy. Product standards at the EU level have reduced the energy intensity of many household and business appliances and lighting. UK regulations on gas boilers have seen efficient condensing boilers rolled out extensively. In combination these have contributed to reductions in household energy bills since 2008, despite increased wholesale costs of gas and costs of supporting renewable generation.
- The past decade has also seen a continuation of the trend of decreasing waste sent to landfill. This has come about primarily as a result of a landfill tax being introduced in 1996, and being significantly increased over time, thereby driving recycling, composting and energy recovery options in the waste sector.

These experiences clearly demonstrate that progress is attainable given sufficient ambition and careful policy design. In fact, where strong action has been taken, progress is often more rapid than expected:

- For example, in our 2011 Renewable Energy Review, the Committee considered offshore wind costs falling only to £75-120/MWh by 2030 (the present price is ~£40/MWh). Power sector emissions have also fallen faster, and coal plants closed more quickly, than expected in the Committee's early reports from 2008.

⁸¹ BEIS (2020) *2019 provisional and 2018 final emissions data*, CCC calculations.

⁸² DUKES (2020) *Energy Trends 5.1*, DUKES (2020) *Energy Trends 6.1*.

⁸³ 2012 prices, Contracts for Difference (CfD) Allocation Round 3: results.

⁸⁴ BNEF (2019) *2019 Battery Price Survey*, IRENA (2020) *Cost-competitiveness of Renewable Energy*.

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- However, other areas, notably low-carbon heat, energy efficiency of buildings and carbon capture and storage (CCS), have progressed more slowly than expected. Although policies existed for these areas they were not part of well-designed packages that addressed the barriers to take-up.

But even where progress has been quick it has not always been immediate:

- Offshore wind costs initially increased before they came down (in part that reflects the fact that the transitional period to the new electricity market arrangements did not involve competitive pressure in the award of contracts).
- While renewable generation increased strongly and electricity demand fell from 2008 to 2012, coal-fired power did not decline and emissions intensity remained high up to 2012. However, the higher and growing level of renewable generation alongside falling demand created the conditions to allow very rapid falls in coal-fired generation and emissions intensity after 2012 as the UK strengthened the carbon price and fossil fuel prices favoured gas generation.

That experience emphasises the importance of putting strong foundations in place and designing policy to drive change over a sustained period. Looking forward, the transport sector appears to be better placed than the buildings sector, despite prevailing emissions trends:

- Surface transport emissions in 2019 were at around the same levels that they were in 2010. That reflects an increase in demand and a move towards larger vehicles offsetting improvements in efficiency. However, progress with electric vehicles in the last decade has laid a foundation from which more rapid progress may be possible.
 - The proportion of new sales that are electric vehicles has risen, from less than 0.1% in 2010 to 3.1% in 2019.⁸⁵
 - A far larger range of electric vehicle models are now available, and those that are available offer better range and a better customer proposition. Customer awareness of electric vehicles is also far higher than a decade ago, and attitudes towards them more positive.
 - A substantial charging network is in place and continuing to grow (which is required).
- Although buildings emissions have fallen 14% from 2008 to 2018, the sector is not well placed for the transition to zero emissions. This emphasises the huge challenge for the buildings sector and the importance of the Government's coming Buildings and Heat Strategy (see chapter 6).
 - New buildings, which will still be standing in 2050, continue to be built with fossil fuel heating. In fact, there are over a million more homes requiring zero-carbon retrofits now than when the Climate Change Act was passed.
 - The uptake of low-carbon heating systems is almost negligible (less than 30,000 installations in 2019, whereas over a million a year will be needed by the early 2030s).

⁸⁵ SMMT (2010, 2019) *Electric Vehicle Registration Statistics*. Note that in May 2020, the proportion, which was affected by COVID-19, was 12%, see Next Green Car (2020) Online Statistics.

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- Supply chains are not yet in place for a rapid scale-up in installations, and numbers of skilled installers are low. Customer experience has too often been poor, both in making the change and in the performance of the installed product. Wider consumer awareness remains low.

Progress also brings wider benefits. For example the value of UK exports of wind and marine energy products and services is now estimated to exceed £500m per year.⁸⁶

However, as set out in the rest of this report, success has not been universal across the UK and significant policy strengthening is required.

2. Direction must be clear and policies must be investable

Policy needs to be robust, clear and long-term to achieve the best results from the market. Once a market has been given clear standards and goals to achieve, and an investable mechanism to deliver it, firms operating within that market can respond in good time.

The UK power sector has seen the strongest policy action in the UK and benefited from global tailwinds such as decreasing technological and financing costs. Progress has resulted from an effective and well-designed package of policies including a clear direction and strong investable incentives:

- **A clear direction.** Since the Climate Change Act was passed, it has been widely understood that the power sector would have to decarbonise heavily (e.g. from 500 gCO₂/kWh in 2010 to 50-100 gCO₂/kWh by 2030).⁸⁷ The Government signalled its desire for offshore wind to play a large part and announced a date for the phase-out of coal-fired generation (originally 2025, now 2024) that went beyond existing European directives placing limits on coal.
- **A stable, predictable carbon price.** The UK introduced a carbon price floor in 2013 to underpin the price in the EU Emissions Trading System (EU ETS).
- **An investable market instrument.** Long-term contracts for renewable power generation were announced in 2011, to be awarded by competitive auction. Emerging technologies (e.g. offshore wind) were explicitly supported in addition to more mature options.
- **Product standards.** European efficiency standards for lights and household appliances drove down electricity use as products were replaced over time.

Alongside this clear direction and investment instruments were a strong set of enabling policies (see below).

The EU's ecodesign directive and UK Boiler Regulations achieved success through direct regulation, driving a steady increase in energy efficiency.

The F-gas sector provides an example of where the market made calls for new regulation targets to reduce use of F-gases with high global warming potentials (GWPs) before governments took action. Since the EU introduced long-term reduction targets on F-gas emissions, there has been innovation from the market, with low-GWP aerosols beginning to be rolled out.

⁸⁶ RenewableUK (2019) *Export Nation: UK Wind, Wave and Tidal Exports 2019*.

⁸⁷ BEIS (2020) *2019 provisional and 2018 final emissions data* and DUKES (2020) *Energy Trends 5.1*; CCC analysis.

The agriculture sector has had a clear objective (to reduce emissions by 3 MtCO₂e by 2022),⁸⁸ but it relied on a voluntary approach to deliver it, which did not provide strong enough incentives to act.

The UK Government is beginning to provide clearer direction for the cars and vans market by consulting on a phase-out date for petrol and diesel vehicles by 2035 or earlier. The Government also pledged 30,000 hectares of tree planting per year in its manifesto. However, the future direction for buildings and industry remains unclear. Furthermore, while a clear direction is important it is insufficient on its own - each of these sectors will also need instruments to drive investment.

By providing more confidence in the future direction of the market, it may be possible to secure benefits for UK industry, encouraging supply chain players to locate in the UK.

3. Enabling measures are important, with new challenges approaching

Part of the success of the power sector reflects a systematic approach to tackle barriers that could otherwise impede progress and to enable actions to speed up progress.

- The Green Investment Bank was set up to plug potential gaps on financing low-carbon technologies such as offshore wind and to 'crowd in' private investors, while making commercial returns.⁸⁹
- Issues such as planning, leasing of seabed sites, radar issues relating to wind farms, were identified and dealt with before impeding progress.
- Alongside instruments to drive deployment of renewables, new approaches were introduced for grid connections and reinforcements (although there remains scope to improve these).
- Public-private groups were convened with industry (e.g. the Offshore Wind Industry Council) to identify blocks and speed up deployment. Knowledge sharing platforms and research centres were also set up to support innovation and its diffusion (e.g. the Offshore Renewable Energy Catapult).

Notable policy failures of the last decade failed to address a wide enough range of barriers. For example the Green Deal tackled finance availability for buildings energy efficiency without tackling other barriers or offering a strong enough incentive to make changes (in part because of high interest rates).⁹⁰ The Renewable Heat Incentive offered generous returns, but was not supported by a package of measures to encourage and enable customers to make changes easily.

To enable progress beyond the power sector and towards the Net Zero target, new challenges will need to be tackled:

- Members of the public will need to be much more actively involved in the transition - buying electric cars instead of petrol or diesel models, installing energy efficiency and low-carbon heating in their homes, and shifting their consumption choices.
- Parts of the workforce will need to move into new jobs and learn new skills to meet the needs of the transition.

⁸⁸ DEFRA (2017) *The Greenhouse Gas Action Plan for Agriculture*.

⁸⁹ Green Investment Group (2015) *UK Green Investment Bank announces first close on world's first offshore wind fund*.

⁹⁰ National Audit Office (2016) *Green Deal and Energy Company Obligation*.

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- Major infrastructure changes will be required, for example for Carbon Capture and Storage CCS and hydrogen.
 - Barriers to change in the land sector must be addressed and greater guidance for people / businesses working in the sector is needed, for example through support for tenant farmers.

Success in tackling these new challenges will be integral to success in meeting the Net Zero target.

4. Multiple Government departments must work together

Decarbonisation is a cross-cutting issue and there are complex interactions between different sectors. To make the necessary changes, there must be increased collaboration and coordination between different Government departments.

One example of success is the joint introduction of the landfill tax in 1996 by the then Department for Environment and HM Customs & Excise - this tax continues today and has led to significant decreases in the amount of waste landfilled.

The Electricity Market Reform that drove progress in the power sector was led by the energy department, but would not have succeeded without sufficient funding being signed off by the Treasury. However, this process has faced difficulties as forecast spend exceeded the Treasury's Levy Control Framework.⁹¹

As deeper decarbonisation continues, the buildings sector offers a good example of the wide range of departments that will need to be engaged and co-ordinated:

- The Department for Business Energy and Industrial Strategy (BEIS) will need to make national-level decisions on how to decarbonise the existing building stock (e.g. the future of the gas grid) and design mechanisms to drive a major scale-up in low-carbon heat and energy efficiency. BEIS will also have a key legislative role in gas sector legal requirements, energy network company licence obligations, gas or electricity market reforms and the legal status of interconnectors.
- HM Treasury will need to determine how these measures will be financed, balancing the financing of costs between taxpayers, billpayers and building owners (e.g. landlords).
- The Department for Education and the Institute of Apprenticeships, along with BEIS, will need to consider how to build the skills in the workforce required to deliver a low-carbon housing stock.
- Devolved Governments and the Ministry of Housing Communities and Local Government will need to implement building standards and energy efficiency policy, ensuring that these take into account safety, climate resilience and indoor environmental factors at the same time, so that an improvement in one is not to the detriment of another.
- Local authorities will need to enforce regulations, deliver low-carbon public housing and ensure the impacts of any new developments on wider local services (e.g. public transport) are considered. They should also have a key role in local area energy planning. Ofgem and the network operators will also have important roles to play.

⁹¹ NAO (2016) *The Levy Control Framework*.

Success in the buildings sector, and indeed all sectors, will require that the different arms of Government increase their co-ordination significantly. This report includes a list of recommendations by Government department covering both mitigation and adaptation.

5. Fairness must be a key part of policy design

Over the past decade, fairness has rightly emerged as a key theme in climate policy. The COVID-19 crisis has further highlighted differential impacts and reinforced the importance of equitable policy design.

Climate policies that fail to consider the need for a just transition and the fair distribution of costs in their formulation, announcement and delivery, risk being derailed due to public concern over regressive impacts (real or perceived):

- This has been seen in the UK, where concern over costs being passed onto energy bills led to a reduction in the funding envelope available for improving the energy efficiency of homes (despite the fact that energy efficiency provides a route to reducing bills in the longer term).
- France offers another warning of the backlash that can occur. In 2018, the so-called *Gilet Jaunes* protested at the introduction of a diesel tax that would have increased the price of fuel. After weeks of protests, the government dropped the proposal and announced it would look into alternative solutions to transition towards lower-carbon fuels.

Work is underway to provide better evidence on these issues in the UK:

- The Scottish Government has established a Just Transition Commission to advise on how fair transition principles can be applied to climate change action in Scotland. The Commission published its interim report in February 2020, identifying the need to: develop transition plans; engage widely with society; develop policy to share costs and avoid unfair cost burdens; and begin acting now to address inequalities.
- The UK Treasury is conducting a review into the costs of transition and how these can be shared fairly, as recommended by the Committee.

The last decade has shown that low-carbon policy costs are not spread evenly across electricity and gas bills, with the majority of the costs passed to consumers through levies on electricity.⁹² This means that consumers who use disproportionately more electricity, often in homes heated with electric resistive heating, have been more adversely affected by these levies. Addressing such inequities in the coming decades will be critical as low-carbon heating is rolled out across the building stock - which at least initially will add costs, and will entail more households using electricity to power their heating systems. Where this cost lies will largely be a policy decision of the Government.

More broadly, low-carbon policy costs are not balanced across the economy – some sectors, such as aviation and shipping, may have to pass a greater degree of decarbonisation costs onto their end customers. International competitiveness in these sectors provides an additional challenge.

It is important to consider not just the socio-economic distribution of costs, but also the regional aspects. Many of the measures that need to be taken will have geographically distributed costs and benefits. For example, the North East of England has benefited from investments in the offshore wind supply chain.

⁹² CCC (2017) *Energy Prices and Bills*.

Many former industrial regions have the potential to become one of the UK's CCS (and potentially hydrogen) hubs, and benefit from the associated increase in jobs and economic activity. It is also apparent that the costs may be higher than average in some regions of the country. Areas where the building stock is particularly old are at risk of incurring higher cost if policy is not well designed and collaboration with local communities and authorities is vital.

The importance of key workers during the COVID-19 pandemic has been clear. The transition to Net Zero, as well as the response to climate change itself, will require its own key workers. For example, huge numbers of installers will be required to retrofit buildings with energy efficiency, low-carbon heating and measures to improve their climate resilience. Some workers in polluting industries will need to be retrained. Landowners and farmers will need to cope with increasingly unpredictable weather and adopt lower-carbon farming practices.

Identifying who these workers are (or could be) and determining the best way to support them needs to be a key consideration in a just transition.

6. Contingency and flexibility are needed – not everything will work

It is inevitable that not every area of policy action can deliver its intended impact and this means that planning for the coming decades needs to be comprehensive and realistic about the risks to success. In practical terms, this means building contingency into decarbonisation plans to allow for areas where progress falls short.

Where shortcomings have emerged over the previous decade, they have tended to fall into one of three categories:

- **Withdrawing policy support.** At times, policy has been withdrawn with minimal notice, or functioning schemes have been scrapped.
 - In 2015, the Government cancelled its CCS Commercialisation Programme, which set back development and was a negative signal to business. There was a re-commitment to carbon capture utilisation and storage (CCUS) in the Government's Clean Growth Strategy in 2017, followed by its CCUS Action Plan in 2018. This plan was welcome but did not re-instate the £1bn of funding previously withdrawn. Much work remains to be done.
 - In the same year, the Government cancelled the UK's Zero Carbon Homes policy.
 - Feed-in Tariffs (FIT) also suffered from cuts to rates with little notice.
 - Energy efficiency installations have been consistently low since changes to policy in 2012, falling over 90% over the period.
 - Withdrawing policies can damage faith in Government policy and reduce business willingness to invest, while also impacting the Local Authorities that may have incorporated the Government policy as a key pillar in their own plans. Policy should be designed to provide certainty to businesses and consumers and frequent changing of policy should be avoided. Where it is agreed that a policy is failing, it should be revised or replaced, not merely scrapped.
- **Initial mis-design and lack of subsequent flexibility.** Some policies have not succeeded due to an initial mis-design, followed by a lack of flexibility. There have been instances where ill-suited policy has been left in place for long periods, when a more flexible approach could have corrected it.

- For example, the level of Renewable Heat Incentive (RHI) tariffs provided a disproportionate incentive for domestic biomass boilers compared to other technologies.⁹³ Similarly, the Feed-in Tariffs (FITs) and Renewables Obligation (RO) policies saw significant increases in deployment as the costs of renewables fell, meaning spend exceeded initial forecasts.
- The Green Deal too suffered from a lack of flexibility after initial poor design, which was heavily criticised at the time.⁹⁴
- Best practice should ensure that policy is well designed up-front and is flexible to changes if needed. A wide pool of stakeholders should be engaged, including local authorities. Where changes are required, they should be done in collaboration with end users and signalled in advance.
- **Compliance issues.** Some regulation has been effective on paper but failed to deliver in the real world.
 - For example, the inadequacies with the New European Driving Cycle (NEDC) testing of vehicles has meant vehicles have not been as efficient in practice as intended by the regulations. A new framework has been introduced; the Worldwide Harmonised Light Vehicles Test Procedure (WLTP). The need to transition between the two makes tracking progress over time more difficult, and holds its own risk of gaming.
 - Energy Performance Certificate (EPC) ratings too have had issues with inconsistent or inaccurate estimations and measurements, leading to the likelihood that homes that do not meet efficiency standards can be rented.⁹⁵

The Government should design policies to be effective as far as possible from the outset and avoid chopping and changing unnecessarily. Ultimately, not everything will work as planned, so the Government must aim for higher than the minimum, be prepared to take action knowing that mistakes may occur, and budget for high costs at times, particularly in areas of emerging technology (e.g. as in the case of offshore wind).

7. National, local and international policy are all needed and can provide good examples

Achieving Net Zero requires action to be taken on multiple levels of governance, ranging from the local level to international. Progress has been made on all fronts, and there are positive examples across different governance levels.

- **Local authorities.** More than two thirds of local authorities have now declared a climate emergency and have set or are setting Net Zero targets. This provides an opportunity for an increased role in delivering the Net Zero transition, provided it is backed up with the relevant resources and support from central Government (see Section 3 of chapter 6).
- **Cities and towns.** Many cities led the national government in their climate ambitions over the previous decade (e.g. London produced its plan to achieve Net Zero ahead of the UK as a whole). Similarly we have seen effective, and often innovative, policies being rolled out at the city level.

⁹³ National Audit Office (2018) *Low carbon heating of homes and businesses and the Renewable Heat Incentive*.

⁹⁴ National Audit Office (2016) *Green Deal and the Energy Company Obligation*.

⁹⁵ BEIS, MHCLG (2018) *Call for evidence Energy Performance Certificates for Buildings*.

- For example, Nottingham introduced a Workplace Parking Levy, and re-invested the revenues into public transport infrastructure, leading to significant decreases in congestion and CO₂ emissions, without reducing the number businesses operating in the area.^{96,97} Warrington has issued a Community Municipal Bond to invest in solar PV.
- **Scotland and Wales** have often led the way within the UK at tackling challenging areas for emissions reduction:
 - Scotland’s Energy Efficient Scotland strategy has set out a long-term plan for decarbonising buildings, with clear standards set well in advance and backed up by regulation. That includes a proposal that all residential properties in Scotland will need to be EPC band C. Measurement of these standards will be key to ensuring success.
 - Scotland's Just Transition Commission was founded in 2019 to advise on how to achieve an inclusive, Net Zero economy.
 - Wales has increased its recycling rates, leading the UK and having one of the highest rates in the world. It is now aiming for 70% recycling by 2025 and recently published its "Beyond Recycling" strategy.⁹⁸
 - The Well-being of Future Generations Act was introduced in Wales in 2015, requiring that select public bodies take into account the long term social, economic, environmental and cultural well-being of Wales.
- **International governance.**
 - The EU has played a key role in developing climate policy that has impacted the UK. Examples of this over the past decade are numerous and span many sectors (e.g. the EU Emissions Trading System, emissions standards for cars and vans, products policy, the Renewables and Waste Directives).
 - While the UK’s future relationship with the EU is yet to be determined, the nature of international markets mean some coordination will still be required. Vehicles cross borders, so will require some coordination of infrastructure solutions (e.g. specifications of electric vehicle chargers). Some product designs will only be influenced by markets larger than the UK alone, so product standards will need some alignment.
 - For globally-competitive industries, policies will be most effective when implemented as widely as possible internationally. For example, the key levers for shipping and aviation are being driven by the International Maritime Organisation and the International Civil Aviation Organisation. Where international sectoral deals cannot be secured, trade policy may have an increasingly important role in policy, for example with carbon border tariffs.
 - International examples can help design of policy elsewhere. For example, the Committee has pointed to the Australian NABERS scheme as good practice policy for decarbonising commercial buildings (Section 6.3.a).

Coordination between different levels of government will be vital to ensure that their policies are aligned and additive. Policy developed and trialled at local or city level provides an opportunity for refinement and evidence to be built, which can then be utilised when determining national policy.

⁹⁶ Centre for Cities (2017) *Funding and financing inclusive growth in cities*.

⁹⁷ Forbes (2019) *Nottingham’s Workplace Parking Levy creates jobs, cuts car use and slashes pollution*.

⁹⁸ Welsh Government (2019) *Beyond Recycling: A strategy to make the circular economy in Wales a reality*.

8. The UK can influence international decarbonisation

The UK currently represents around 1% of global GHG emissions.⁹⁹ Future increases in climate hazards will largely depend on the evolution of global emissions. Therefore, UK decarbonisation must drive significant reductions in global emissions to minimise increases in UK climate hazards. As the UK is a rich country, with a large contribution to climate change from past emissions, there is also an obligation on the UK to support the global effort under the 'common-but-differentiated-responsibilities' of the United Nations Framework Convention on Climate Change and the Paris Agreement.

Climate policy efforts in the UK over the past decade have shown that UK efforts can have an international impact through several mechanisms:¹⁰⁰

- **Creating an example of an effective climate governance framework.** The framework of the Climate Change Act has thus far been successful in helping to maintain widespread political support for action to reduce UK emissions and provide stability for business. Several other countries have followed the UK's example in creating national climate legislation, with some (e.g. New Zealand and Mexico) based directly on the UK model.¹⁰¹
- **Demonstrating that economic growth and decarbonisation are compatible.** Maintaining economic growth to help lift their populations out of poverty is a key priority for many large emitters. The UK's record of achieving emissions reductions in both its territorial and consumption emissions accounts, while growing the economy, is an example with considerable international resonance and can help stimulate further action by other industrial and developing regions at COP26 and beyond.
- **Deploying emerging low-carbon technologies which drive down the costs for the world as whole.** The rapid cost reductions in technologies such as offshore wind have been driven, in large part, through deployment, including in countries such as the UK. These deployment-driven cost reductions make large-scale deployment in big emitters more likely in the future and have contributed to the prospect of global emissions beginning to fall in the near future.
- **Maintaining a proactive international climate policy.** The UK has a strong established reputation as one of the largest development aid donors and is respected for its efforts to help support vulnerable countries dealing with the impacts of climate change. This has helped the UK play an important role in the international climate negotiations (including through the EU) that resulted in the global Paris Agreement on climate change.

As UK domestic emissions continue to reduce on the path to Net Zero, efforts to leverage these reductions internationally will become an ever more important part of the UK's contribution to tackling global climate change. Holding the Presidency of COP26, and in 2021 of the G7, represents an opportunity for the UK to further leverage these key elements from the past decade, as well as to refresh its international approach as it sets out the course towards reaching Net Zero by 2050.

⁹⁹ On a territorial basis.

¹⁰⁰ Betts, P. (2019) *Chair's Summary Report of the International Advisory Group to the Committee on Climate Change in relation to its work on the UK'S Long-Term Emissions Goal*.

¹⁰¹ Averchenkova, A. & Guzman Luna, S. (2018) *Mexico's General Law on Climate Change: Key achievements and challenges ahead*; Fankhauser, S., Averchenkova, A. & Finnegan, J. (2018) *10 years of the UK Climate Change Act*.

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Chapter 4: Progress on emissions, indicators and policy in the last year



Introduction

In this chapter, we review progress in reducing emissions in the last year, track our indicators for each sector and outline recent policy developments.

Total greenhouse gas (GHG) emissions fell by 3.2% in 2019 to 480 MtCO₂e.¹⁰² To achieve Net Zero, the UK needs to achieve an average emissions reduction of around 15.5 MtCO₂e per year¹⁰³ over the next 30 years, similar to the 16 MtCO₂e achieved in 2019.

As was the case for much of the 2010s, the 2019 reduction was predominantly driven by progress in decarbonisation of the power sector. Of the other sectors for which there are provisional estimates of 2019 emissions (industry, surface transport and buildings), all of them have decreased since 2018 between 1-2%. Surface transport emissions fell despite an overall increase in the number of vehicle-miles driven (Table 4.1).

The remaining sectors (which sum to around a quarter of total UK emissions) are assessed on changes between 2017 and 2018 (the latest data). Here the story is more mixed: three sectors had rising emissions (shipping, aviation and waste) and two were falling (agriculture and F-gases). The net sink from land use, land-use change and forestry (LULUCF) increased by 2%.

As future emissions reductions require action now, we also track 21 indicators of progress (Table 4.1). The UK is only on track for four of these indicators, two of which are in the power sector.¹⁰⁴

Policy progress is discussed in this chapter, sector by sector. Most of the progress on the priority policy actions outlined in the 2019 Progress Report has been partial, or policies remain under development, with only two milestones being fully achieved (Table 4.2).

The coming year is therefore crucial. The delay of COP26 to November 2021 provides a window to address this policy deficit and establish a credible internationally-leading position. The key remaining elements of the net-zero policy package must be put in place in the coming months, early enough to demonstrate the UK's credentials ahead of COP26.

We present the rest of this chapter in three sections:

1. Summary of emissions reductions in the last year
2. Key indicators of progress
3. Summary of overall policy developments

¹⁰² This refers to UK territorial emissions plus the UK's share of international aviation & shipping emissions.

¹⁰³ Forthcoming revisions to peatland emissions estimates and global warming potentials will imply that a slightly higher rate of reduction is required.

¹⁰⁴ The number of indicators being tracked this year is fewer than previous years. Industry indicators have been omitted as new indicators are currently being developed.

1. Summary of emissions reductions in the last year

The provisional emissions estimate published by BEIS for 2019 does not include complete estimates of greenhouse gas emissions across each sector of the economy. We therefore use:

- The BEIS estimates of CO₂ emissions in 2019, based on fuel consumption across the major 'energy system' sectors (power, buildings, industry, surface transport and domestic aviation & shipping).
- CO₂ emissions from other sectors are held constant from their final BEIS estimates for 2018 (waste, agriculture, LULUCF).
- Emissions from international aviation & shipping in 2019 are assumed to be equal to the final BEIS estimates for 2018.
- Non-CO₂ emissions are assumed to fall in line with the latest BEIS EEP projections for 2018-19.

These estimates may vary slightly from final BEIS data for 2019, which will be published early in 2021. For example, in our 2019 Progress Report we reported the power sector emitting 65 MtCO₂e in 2018, which was subsequently revised up to 66 MtCO₂e. Similarly, industry was estimated to have 104 MtCO₂e of emissions, which was subsequently revised down to 103 MtCO₂e.¹⁰⁵

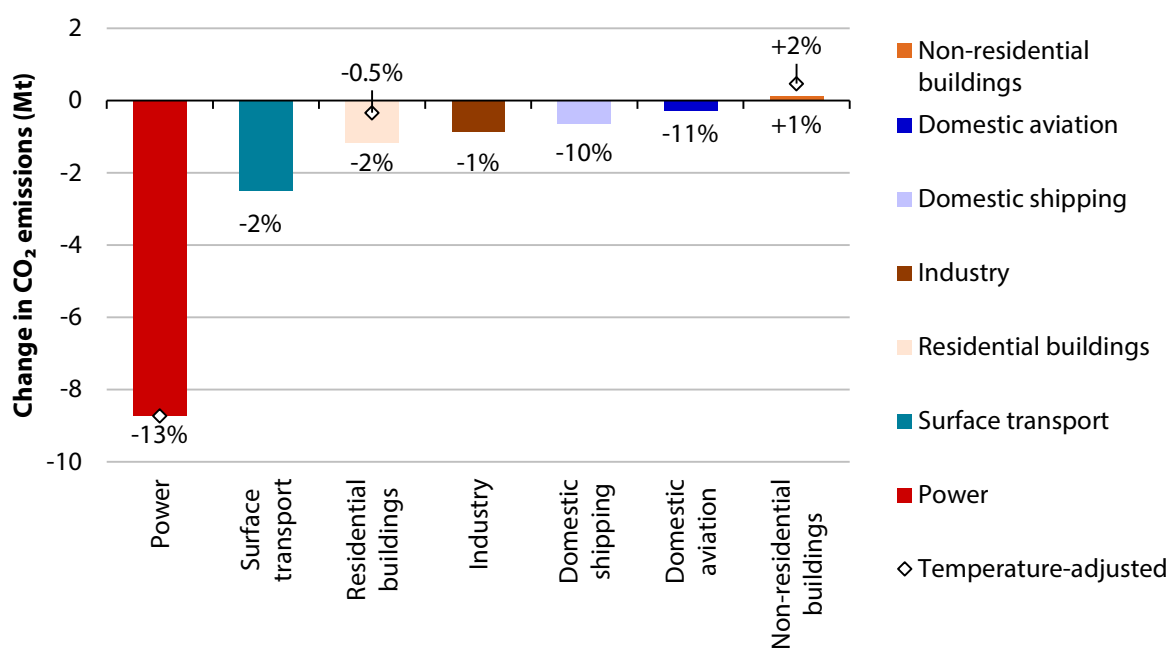
In 2019, for the sixth consecutive year, the sector with the largest percentage reduction in emissions was the power sector (Figure 4.1). Emissions reductions in the power sector accounted for 54% of the overall fall in CO₂ emissions in 2019:

- **Surface transport.** Surface transport is the largest-emitting sector in the UK, accounting for 24% of UK emissions in 2019. Emissions increased between 2014 and 2017, but this trend reversed in 2018, when emissions reduced by 1.5%, with provisional data indicating a further decrease of 2.2% to 113MtCO₂e in 2019. Emissions from all major modes of transport decreased in 2018, with the largest reduction of 1.2 MtCO₂e (-1.8%) from cars. Demand for car travel increased slightly, albeit at a lower rate than previous years, which was more than offset by a combination of improved fleet fuel efficiency and increased use of biofuels.
- **Industry.** Direct GHG emissions from industry, covering both traded and non-traded emissions (i.e. inside and outside the EU ETS), fell by 1% to 102 MtCO₂e in 2019. Emissions were 53% below 1990 levels and continue to account for 21% of all UK emissions. Manufacturing (including construction and waste and water management) contributed to 62% of direct industrial GHG emissions, and fossil fuel supply (i.e. petroleum refining, fossil fuel production and fugitive methane emissions) comprised 38%. In addition to these direct emissions, industry consumed almost a third of UK grid electricity.
- **Buildings.** Actual emissions from buildings decreased by 1.3% to 87 MtCO₂e in 2019, reversing the previous trend. When emissions are adjusted for winter temperatures, in particular the extreme cold weather in February 2018, the underlying change was a 0.1% increase in emissions from buildings. On this temperature-adjusted basis, residential building emissions fell by 0.5% whilst non-residential building emissions increased by 2.3%. This small overall rise of 0.1% follows a 1% fall from 2017-18. As in 2018, emissions from buildings remain higher at present than in 2015 (both on an adjusted and unadjusted basis).

¹⁰⁵ ONS (2020) *2018 UK Greenhouse Gas Emissions, Final Figures*.

- Power sector.** Emissions fell by 13% in 2019 to 57 MtCO₂e and are now 72% below 1990 levels. Emissions intensity continued to decrease, for the seventh consecutive year, reducing 10% to 221 gCO₂/kWh. Low-carbon generation in 2019 (160 TWh) accounted for a record high share of 56% of total UK generation. Specifically, renewable generation increased by 9% to 109 TWh in 2019.

Figure 4.1. Change in CO₂ emissions, 2018-2019



Source: BEIS (2020) 2019 UK Greenhouse Gas Emissions, Provisional Figures; BEIS (2020) 2018 UK Greenhouse Gas Emissions, Final Figures; CCC analysis.

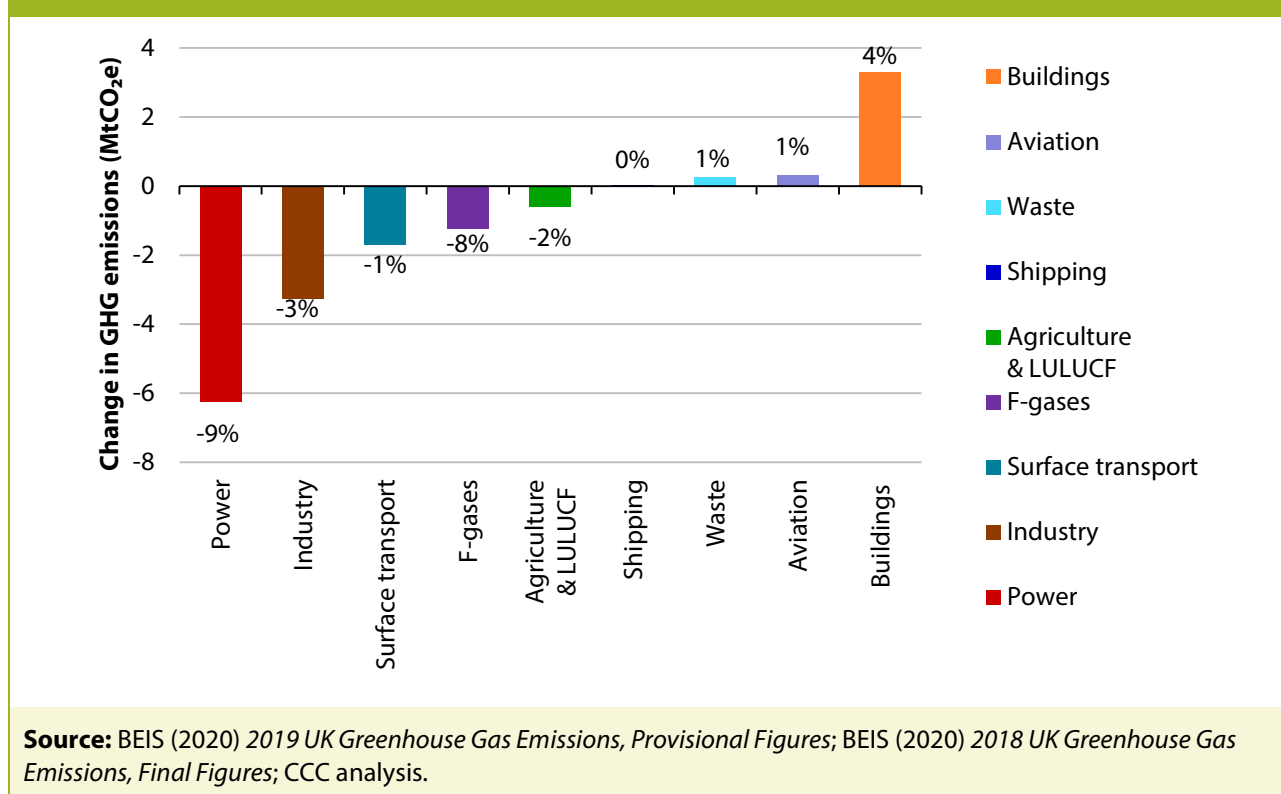
Notes: A provisional estimate of CO₂ emissions in 2019 has not been published for international aviation and shipping (IAS) or the other sectors that are omitted from this chart.

Emissions data for international transport and for sectors with large shares of non-CO₂ greenhouse gas emissions are produced with a one-year lag, so emissions in the following sectors are only available up to 2018 (Figure 4.2):

- Aviation.** Total aviation emissions increased by 0.8% from 2017 levels to 39.3 MtCO₂e in 2018. Within this, emissions from international flights increased by 1.1% to 36.7 Mt, emissions from domestic flights fell by 5.9% to 1.5 Mt, and emissions from military aviation fell 0.6% to 1.1 Mt. Overall, emissions from domestic and international aviation in 2018 were 124% above 1990 levels.
- Shipping.** Total shipping emissions increased by 0.2% from 2017 to 14.3 MtCO₂e in 2018. Emissions from international journeys fell by 0.2% to 7.9 Mt, emissions from domestic journeys increased by 0.2% to 5.9 Mt, and emissions from naval shipping increased 6% to 0.5 Mt. Overall, emissions from domestic and international shipping in 2018 were 17% lower than 1990 levels.

- **Agriculture.** Emissions from agriculture decreased by 1% from 2017 to 45.4 MtCO₂e in 2018 (9% of all UK emissions). Emissions from agriculture were 16% below 1990 levels, but there remains no progress in reducing emissions from agriculture since 2008. Methane accounted for 56% of emissions from agriculture in 2018 and, as in 2017, almost half of total agriculture emissions were from the digestive process of livestock. 31% of emissions are from N₂O.
- **Land use, land-use change and forestry (LULUCF).** The sector is a net carbon sink, which increased by 2% from 2017 to -10.3 MtCO₂e in 2018. The inclusion of emissions from peatland in future inventories is expected to make the LULUCF sector a net source of emissions.¹⁰⁶
- **Waste.** Total emissions from waste increased by 1% from 2017 to 20.7 MtCO₂e in 2018, and were 69% below 1990 levels. 70% of emissions from the waste sector in 2018 were methane from the decomposition of biodegradable waste in landfill.
- **F-gases.** F-gas emissions fell by 8% from 2017 to 13.8 MtCO₂e in 2018. This has been driven by the EU-wide cap on the use of F-gases, particularly in refrigeration and air conditioning units.

Figure 4.2. Change in greenhouse gas emissions, 2017-2018



¹⁰⁶ CCC (2019) Progress Report to Parliament, Box 1.1.

2. Key indicators of progress

We track progress towards meeting carbon budgets and the 2050 target through the use of indicators, which both help to explain progress to date in reducing emissions and provide a guide to likely future reductions. The indicators are based on our assessment of the cost-effective path to meeting the targets, based on the Committee's scenario work.

The indicators are not intended to be prescriptive – as long as sufficient overall progress is made, it may be appropriate to outperform some indicators and underperform on others. However, once behind on an indicator, it can require more effort to get back to the target level.

Progress is generally off-track in most sectors, with only four out of 21 of the indicators on track in 2019 (Table 4.1). This represents no change from the previous year where the same four of the 21 indicators were met. The gap is closing on other indicators, for example F-gas emissions where strict EU regulations and industry innovation are driving progress. 14 of the indicators tracked have moved in the right direction since our last Progress Report, the remaining 7 are worse than the previous year (see red/green arrows in Table 4.1).

The indicators will be revised in next year's Progress Report to align to the new net-zero target for 2050 and our assessment of the sixth carbon budget pathway. This is likely to entail both reassessment of the level of indicators, to reflect the need for more rapid deployment (e.g. of electric vehicles), and a broadening of the indicator set (e.g. on the demand side).

Table 4.1. Assessment of key indicators					
Sector	Measure	2019 Indicator	Actual	Unit	Met?
Transport (24% of emissions in 2019)	New car CO ₂ emissions*	-3.9%	-3.7% NEDC 0% WLTP	% change from previous year	✘ ▼
	New van CO ₂ emissions	149.2	165.9	gCO ₂ /km	✘ ▼
	Electric car registrations	5.3	3.15	% market share	✘ ▲
	Biofuel uptake	7.3	4.0	% of fuel sales by energy	✘ ▲
	Vehicle distance driven	560.2	530.6	Billion-kms	✔ ▲
Industry (21%)	New indicators for the industry sector will be introduced next year.				
Buildings (18%)	Lofts insulated	545,000	27,000	Installations per year	✘ ▼
	Cavity walls insulated	200,000	41,000	Installations per year	✘ ▼
	Solid walls insulated	90,000	11,000	Installations per year	✘ ▼
	Heat pumps installed***	>30,000	26,000	Installations per year	✘ ▲
	Low-carbon heat** ***	7.0	7.0	% of heat demand	✔ ▼
Power (12%)	Grid emissions intensity	314	221	gCO ₂ /kWh	✔ ▼
	Total renewable generation	93	103	TWh	✔ ▲
Agriculture (9%)***	Non-CO ₂ emissions	36.9	39.7	MtCO ₂ e	✘ ▼
	Soil emissions	10.2	11.4	MtCO ₂ e	✘ ▼
	Enteric emissions	20.2	21.2	MtCO ₂ e	✘ ▼
	Nitrous oxide emissions	13.2	14.3	MtCO ₂ e	✘ ▲

Table 4.1. Assessment of key indicators

Sector	Measure	2019 Indicator	Actual	Unit	Met?
	Methane emissions	23.7	25.4	MtCO ₂ e	✗ ▼
Land use & forestry (-2%)	Afforestation****	15,000	13,460	Hectares per year	✗ ▼
Waste (4%)***	Landfill emissions	-77	-61	% change vs 2007 levels	✗ ▲
	Biodegradable waste to landfill	-65	-56	% change vs 2007 levels	✗ ▼
F-gases (3%)***	Emissions	-23	-11	% change vs 2007 levels	✗ ▼

Source: CCC analysis.
Notes: A tick or cross shows whether the indicator has been met. The arrow shows the trend in the measure since the previous year, with a green arrow showing that the measure is moving the correct way, a red arrow showing the measure is moving the wrong way.

All indicators will be revised next year, to align with the Net Zero pathway used in deriving the Sixth Carbon Budget recommendation.

* The test cycle used to measure new car emissions changed from 2018 from the New European Drive Cycle (NEDC) to the Worldwide Harmonised Light Vehicle Test Procedure (WLTP), with the majority of cars tested under the latter procedure in 2019. These produce very different results, therefore comparisons of actual emissions are not possible against our indicator, and percentages changes are shown instead.

**The latest statistics included significant revisions to the 2017 data, such that the 2018 out-turn represents an improvement in the proportion of heat supplied from low-carbon sources relative to last year. However, biomass in homes remains a significant contributor and is not consistent with the long-term best use of finite bioenergy resources. The published data also includes reversible air-to-air heat pumps (RAAHP) in commercial buildings. RAAHP are generally installed for cooling, but can contribute to heating often alongside a boiler. Residential heat pump sales remained below the levels needed.

***2018 data used as this is the latest available.

****2019/20 figures.

3. Summary of overall policy developments

In a year that saw a general election, leaving the European Union and the COVID-19 pandemic, the UK has made some progress towards the policy changes that were required to prepare for the Net Zero target.

In last year's Progress Report, we set out recommended actions for 2019 and 2020, focusing on enabling actions on the 'critical path' to achieving the Net Zero target. We present an assessment of performance against those milestones in Table 4.2.

Overall the Government has only fully achieved two milestones out of the 31 set out in the 2019 Progress Report. However, partial progress has been made in 15 policy milestones which lie predominantly in the transport and industry sectors, while for others policy development is underway:

- **Achieved milestones.** Some milestones have been achieved in the industry and waste sectors. In industry, the UK Government published an evaluation of its Climate Change Agreements. In the waste sector, Wales published its new Waste Strategy.
- **Partial progress.** There have been some important strides towards the target. Net Zero has been adopted as a key overall goal of the current Government. The programme to deliver it has developed across the largest emitting sectors: in transport (where the Government is consulting on bringing forward the phase-out date for petrol and diesel cars and vans); buildings; industry (where funds have been committed for the first zero-carbon industrial cluster); energy supply (where 6 GW of offshore wind has been procured at record low prices, and onshore wind and solar are to be offered new supply contracts); and in agriculture and land use (where the proposed new UK policy has climate change as a key objective).
- **Gaps.** Many gaps remain, albeit some with plans being developed to tackle them.
 - A lot rests on the Heat and Buildings Strategy later this year, which must be ambitious, well-funded and well-designed, alongside the National Infrastructure Strategy.
 - Policy is needed to deliver the cars and vans commitment, and other vehicles such as HGVs must also be addressed.
 - Near-term and longer-term investable mechanisms must be developed for industrial decarbonisation, especially for carbon capture and storage (CCS) and fuel switching.
 - The Agriculture and Environment Bills must progress to implementation and be backed by a mechanism to fund tree planting at the required scale.
 - Progress will also be needed in the smaller emitting sectors such as waste and F-gases.
 - Some challenges were not highlighted in the 2019 Progress Report, such as aviation & shipping, and whilst these sectors both require progress at the global level, UK policy will become increasingly important.

The coming year is therefore crucial. The delay of COP26 to November 2021 provides a window to address this policy deficit and establish a credible internationally-leading position. The key remaining elements of the net-zero policy package must be put in place in the coming months, early enough to demonstrate the UK's credentials ahead of COP26. For a detailed discussion of policy gaps, see chapter 6.

Table 4.2. Delivery of policy action in the last year			
Sector	Action	Timing	Done?
Transport	Bring forward the ban on new conventional vehicle sales to 2035 (or ideally earlier) and clarify that only battery electric (or other zero-carbon) vehicles will be permitted to be sold after this point.	2020	Partly
	Clarify the UK regulatory approach to the EU 2020/21 new car and van CO ₂ targets and set stretching CO ₂ targets for new cars and vans beyond 2020, requiring a high electric vehicle market share. A real-world testing regime must be used alongside standardised tests.	2019	Partly
	Implement policies, including fiscal instruments, to strengthen incentives to purchase cleaner vehicles. Current purchasing trends are undermining new car and van emissions targets and must be reversed.	2019	Partly
	Set stretching targets for CO ₂ emissions reductions from new HGVs to address the rise in emissions and exploit opportunities to improve logistics and increase uptake of eco-driving.	2019	Partly
	Set out policies to address the decline in bus usage and introduce new schemes and measures to increase levels of walking and cycling.	2019	Partly
Industry	Make explicit how current and future policies will achieve a 20% energy efficiency improvement for businesses by 2030.	2019	Partly
	Publish the results of the evaluation of Climate Change Agreements to inform any successor scheme for 2023.	2019	✓
	Consult on mechanisms to incentivise widespread industrial fuel switching and CCS. Alongside this, BEIS should identify when those industrial sites that will require CCS and/or fuel switching would need to install them in order to fit with their refurbishment cycles.	2019	Partly
	Secure (e.g. taxpayer or consumer) funding for mechanism to incentivise widespread industrial fuel switching and CCS.	2020	✗
	Deliver near-term capital support for industrial decarbonisation, through the IEFT and ISCF. Where necessary this should be accompanied by bespoke support for operational expenditure for these projects.	2019	Partly
	Establish a policy to develop near-zero GHG emission technologies for off-road mobile machinery.	2020	Partly
	Establish a policy to reduce levels of methane leakage and venting.	2020	✗

Buildings	Develop a fully-fledged strategy for decarbonised heat. This must be designed to fully decarbonise buildings across the UK in line with the Net Zero goal. HM Treasury must commit to working with BEIS, undertake a review of where the costs of the transition should fall, and allocate sufficient funding to deliver over the full period from now to 2050.	2020	✘
	Strengthen new-build standards to ensure that all new homes built from 2025 at the latest are designed for a changing climate, are ultra-energy efficient and use low-carbon heat. No new homes built from 2025 should be connected to the gas grid. Ambitious standards for non-residential buildings must also be set.	Regulations set by 2020 (with energy/carbon standards in force by 2025 at the latest)	Partly
	Set clear trajectories of standards across the building stock and firm policies to drive delivery. This includes introducing concrete policies for able-to-pay homeowners, addressing the major delivery risks which remain around the Private Rented Sector (PRS) regulations and setting out a trajectory, a delivery mechanism for the social housing minimum standards, and concrete policies to deliver the ambition for non-residential buildings.	Consultation in 2019	✘
	Tackle performance and compliance issues to ensure that new buildings and measures retrofitted in existing buildings perform as they should. This includes consulting on strengthened compliance and enforcement measures which extend beyond fire safety to regulations more widely; funding building control adequately, and incorporating widespread use of testing so as to focus on actual rather than modelled performance; and developing a nationwide training programme to upskill the existing workforce, alongside implementation of low-carbon accreditation.	2019	Partly
	Publish detailed plans to phase out the installation of high-carbon fossil fuel heating in the 2020s, ensuring there is no policy hiatus in 2021.	2019	✘
Power	Develop contingency plans that allow for additional low-carbon generation to be brought forward in the event of delay or cancellation of planned projects, or imports of electricity below projected levels.	2019	✘
	Develop and deliver a plan, in coordination with Ofgem, to upgrade networks in the 2020s to accommodate new electricity demands (e.g. from electric vehicles), and future-proof them in order to limit costs.	2019	Partly
	Outline in the forthcoming Energy White Paper a level of ambition compatible with achieving Net Zero emissions. This should include the outline of a subsidy-free route to market for the cheapest low-carbon generation from 2020.	2019	Partly

CCS	Set out preferred mechanism for CO ₂ transport and storage infrastructure.	2019	✘
	Set out plan to enable multiple CCS facilities to be operational by the mid-2020s.	2019	✘
Agriculture	England's Farm Emissions Reduction Plan and Scotland's updated Climate Change Plan, both due out next year should set out firm policies and an implementation plan to reduce GHG emissions in agriculture.	By mid-2020	✘
	The Industrial Strategy's Transforming Food Production Challenge Fund: ensure the £20m of funding already committed to under the first call made in 2018 and subsequent calls are allocated to projects that deliver supporting emissions reduction and clean growth in the food and agriculture sectors	2019 and 2020	Partly
	Post-CAP framework: ensure the on-going design of the Environmental Land Management System, including the testing and trialling of options will incentivise the take-up of low-carbon farming measures and changes in land use to increase carbon removals.	2020	Partly
Land use, land-use change and forestry	Develop strategies for each part of the UK to increase overall annual afforestation rates to at least 30,000 hectares in the 2020s.	2020	✘
	Publish England's Peatland Strategy to deliver peat restoration, and sustainable management practices for lowland peat that remains in agricultural production.	2019	✘
Waste	In England, set out a commitment to ban the landfilling of most bio-degradable waste streams including food by 2025 at the very latest. In the forthcoming consultation, set out proposals for the mandatory measurement and reporting of food waste in England by all large businesses in the food supply chain (e.g. food retail, caterers and hospitality).	2019	✘
	In Wales, publish a new Waste Strategy including proposals to reduce food waste substantially and regulations requiring that all businesses and public bodies separate recyclable waste at source.	2020	✓
F-gases	Publish a plan to restrict the use of F-gases to the very limited uses where there are currently no viable alternatives.	2019	✘
Public engagement	Develop a strategy – building on the planned Citizens' Assemblies and Youth Steering Group – to engage with the public over the choices they can make, especially on heating, diet and transport, that will reduce emissions and bring other benefits like improved health.	2020	✘

a) UK Government policy

When the Committee recommended the Net Zero target, we emphasised that 'clear, stable and well-designed policies to reduce emissions further' must be introduced across the economy without delay. That process has begun, but is far from yet complete.

i) Cross-economy

There have been several cross-cutting examples of policy development and announcements:

- The Government has instigated a Cabinet Committee on Climate Change, chaired by the Prime Minister, as we recommended last year.
- HM Treasury is undertaking a review on how to fund Net Zero fairly. Originally scheduled for autumn 2020, it may be delayed as resources are deployed to the ongoing COVID-19 crisis.
- The Department for Business Energy and Industrial Strategy (BEIS) has plans to legislate for a standalone UK Emissions Trading Scheme to be set up by 2021. It is yet to be determined whether this scheme will be connected with the EU ETS, pending EU negotiations. The Government has outlined its ambition for the scheme to be made consistent with the UK's Net Zero target, following the Committee's forthcoming advice on the Sixth Carbon Budget.
- In bioenergy, BEIS have consulted on removing coal-to-biomass conversions from future CfD rounds.¹⁰⁷ A new green levy will be established on bills to fund biomethane injection into the gas grid, with up to £150 million available annually via the Green Gas Support Scheme.¹⁰⁸ Proposals have also been set out by the Department for Transport (DfT) to double the amount of bioethanol blended in petrol from 5% to 10% (E10) across the UK during 2021.¹⁰⁹
- Greenhouse gas removals (GGRs) are at an early stage of policy development in the UK – so far, only a September 2019 scoping study by Vivid Economics on potential GGR policy options has been published by BEIS.¹¹⁰ However, UKRI have launched a £31.5 million GGR programme under the Strategic Priorities Fund. This includes a £22.5 million call to support up to 5 pilot projects during 2021-2026, and develop a £6.1 million central coordination hub. £1.5m will also be made available for feasibility studies in 2022.¹¹¹
- In 2019, the Government announced a doubling of its International Climate Finance (ICF) support for addressing climate change in developing countries to at least £11.6 billion over the period 2021/22 to 2025/26. It has also subsequently committed to end financial support to coal mining and coal-fired power plants overseas through the UK's export credit agency (UK Export Finance), although the vast majority of UKEF support for fossil fuels in recent years has been for oil and gas, not for coal.
- Although not led by the Government, the Citizen's Assembly convened by Parliament has been a welcome step towards understanding public attitudes to achieving Net Zero. Similar processes have taken place in Scotland and Wales and at local levels. Efforts to consult and inform the public must continue. One next step could be to consider public attitudes to adaptation through a similar mechanism.

¹⁰⁷ BEIS (2020) *Contracts for Difference (CfD): proposed amendments to the scheme 2020*.

¹⁰⁸ BEIS (2020) *Future support for low carbon heat*.

¹⁰⁹ DfT (2020) *Introducing E10 Petrol*.

¹¹⁰ BEIS (2019) *Greenhouse gas removal policy options*.

¹¹¹ Engineering and Physical Sciences Research Council (2019) *Greenhouse Gas Removal Demonstrators Programme calls and workshop*.

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- The Government's Green Finance Strategy, published in July 2019, outlines important steps to align the financial sector to the UK's (and the world's) climate and environmental objectives.

Alongside this, the UK government brought forward its first budget of the new Parliamentary term in early 2020, which announced two further cross-cutting funds:

- £800 million was committed to the CCS Infrastructure Fund to establish CCS in at least two hubs, the first by the mid-2020s and a second by 2030.
- £640 million was dedicated to a Nature for Climate Fund, to be used for tree planting and peatland restoration.

ii) Transport

The transport sector has seen only partial progress against most of the policy milestones outlined in Table 4.2. Aside from these policy milestones, the Government has made broader progress:

- There has been a strengthening of Electric Vehicle (EV) incentives. Benefit-in-kind taxes have been reduced to 0% for the 2020/21 financial year, rising to 1% then 2% over the next two years. The plug-in car grant has been reduced to a maximum of £3,000 but has been secured to 2022/23. A consultation on Vehicle Excise Duty for EVs has been launched.
- Whilst grants for home-charging reduced to £350 per charge point, Budget 2020 doubled the financial support for on-street charging to £10 million. Government has also pledged £500 million to support the development of rapid charge hubs along the strategic road network and major roads.
- The Department for Transport (DfT) published its Decarbonising Transport report 'Setting the Challenge' for the sector, with a policy document due later this year.

iii) Industry

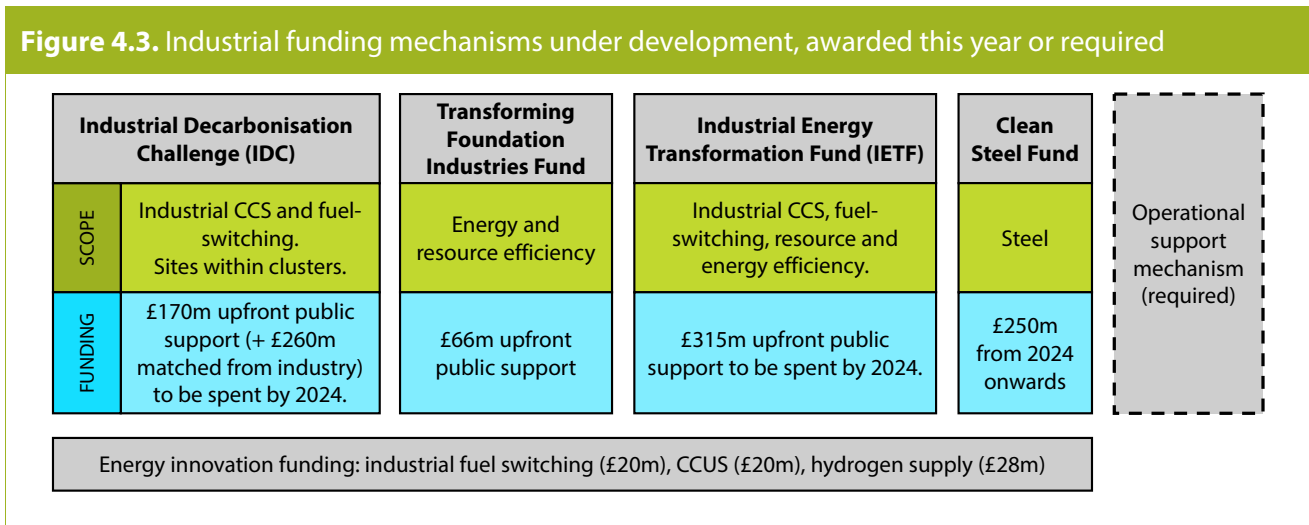
Following a significant increase in industrial decarbonisation policy in 2018/19, progress in 2019/20 has been slow relative to the actions required that we outlined last year.

- A £250 million Clean Steel Fund was launched in August 2019, adding to previous capital support of around £600 million set out for industrial decarbonisation (see Figure 4.3). £70 million has been awarded through the BEIS Energy Innovation Programme and an initial £10 million awarded from the Industrial Decarbonisation Challenge (IDC). However, progress in awarding other support has been slow.
- BEIS consulted on mechanisms to support the operational costs of industrial CCUS in July 2019, partially meeting our recommendation. However, there has been no consultation on mechanisms to support the operational costs of fuel switching, including electrification, hydrogen and BECCS. This is urgently required to enable development of fuel switching technologies, as well as CCS, and to complement capital funding on offer through the Industrial Energy Transformation Fund (IETF) and IDC.
- On energy efficiency, the Government published its evaluation of the Climate Change Agreements (CCA) scheme and extended the scheme by two years.

However, there is still little evidence that policy, including CCAs and the IETF, will provide sufficient support to enable overall business energy efficiency to improve by 20% as set out in the Clean Growth Strategy and detailed in the Government's response to our Progress Report last year.

- On resource efficiency, the Environment Bill was introduced to extend producer responsibilities and provide powers to Government to set minimum requirements for manufacturers to provide information about the resource efficiency of their products.

Other areas still lack firm policy. For non-road mobile machinery (NRMM), the Budget suggested that the Energy Innovation Programme will support the development of near-zero GHG emission NRMM technologies, but this requires further detail. The Budget's removal of red diesel tax relief for industrial NRMM will also encourage deployment. There has been no new policy on reducing methane leakage and venting, but an announcement is expected shortly.¹¹²



iv) Buildings

Whilst none of the policy milestones outlined in our last report have been completed this year, there have been some relevant announcements from the Government:

- The Ministry of Housing, Communities & Local Government published proposals for a 2020 uplift in home standards, including a 30% decrease in emissions (although fabric standards are weaker). This is the first step towards the 2025 Future Homes Standard. Our assessment is set out in our letter to the Secretary of State in February of this year.¹¹³ Additional consultations for overheating and non-residential buildings are still in progress.
- There was a pledge of £9 billion for addressing fuel poverty, social housing and public sector energy efficiency. More details of this funding is due in the infrastructure strategy.
- A new target was proposed for non-residential private rented buildings of EPC band B by 2030 'where cost-effective' - an increase in the ambition set out in the Clean Growth Strategy.

¹¹² As of early June 2020.

¹¹³ Committee on Climate Change (2020) *Letter to Ministry for Housing, Communities and Local Government: Future Homes Standard and proposals for tightening Part L in 2020*.

The Scottish Government consulted on proposals to require a minimum standard of EPC band C for all properties being sold.

- A small extension of the Domestic Renewable Heat Incentive to 2021/22 was announced in the budget, with a further £100m of funding released, which will be spread over 2022/23 and 2023/24. This provides £4,000 grants for households and small non-domestic buildings to install heat pumps (or biomass boilers in limited circumstances). However, this funding is only forecast to support 12,500 residential heat pumps a year - well below what will be required for the phase out of oil boilers later this decade and new gas boilers soon after.
- A £270m Green Heat Network Fund was also committed to support the deployment of low-carbon heat networks, along with the proposed green levy to support biomethane. The UK Government is consulting on regulatory frameworks for heat networks, including: a new regulator, rights and powers for heat network developers (to align with other utilities) and consumer protection measures. The Scottish Government has proposed an approach which includes local concessions reinforced with planning policy in its new Heat Networks Bill and a new Scottish regulator. The UK Government is considering local zoning and concessions amongst other options.

v) Power

Power continues to be the sector that performs best against its indicators. It has outperformed both of its indicators for 2019.

Away from the tracked policies there has been wider policy progress:

- The UK held a third allocation round of the Contracts for-Difference (CfD) auction and cleared a record low energy price of £39.65/MWh for delivery year 2023/24 and £41.61/MWh in 2024/25 (in 2012 prices).
- A consultation has been launched for amendments to the CfD scheme, with floating offshore wind proposed to be included in Pot 2, alongside other design changes.¹¹⁴
- Ofgem announced that networks will have to demonstrate how their business models are compatible with Net Zero.
- In March 2020, the Government announced that onshore wind and solar PV would be included in the next round of CfD auctions, reversing the previous exclusion of these technologies.

vi) Agriculture and land use, land-use change and forestry (LULUCF)

There is still an absence of policy to deliver emissions reduction in agriculture, while the planned publications to increase afforestation and peat restoration (the Tree and Peatland Strategies) have both been delayed:

- The Government has included climate mitigation and adaptation as key 'public goods' to be paid for as part of the UK's overhaul of agriculture and land policy through the Agriculture and Environment Bills. This was confirmed in a policy discussion document published earlier this year, which sets out Defra's initial thinking on the high-level design options for the Environmental Land Management Scheme.¹¹⁵

¹¹⁴ BEIS (2020) *Contracts for Difference (CfD): proposed amendments to the scheme 2020*.

¹¹⁵ Responses to the document have been paused due to COVID-19, and will re-open at a future date.

- Part of the £640 million Nature Climate Fund announced in this year's budget will be used to deliver the Government's manifesto commitment to plant more trees across the UK, rising to 30,000 hectares a year by 2025, and the restoration of 35,000 hectares of peatland in England over the next five years.
- The first reverse auction of Defra's Woodland Carbon Guarantee (WCG) was held in January. Designed to stimulate private sector investment in woodland creation in England, the auction generated bids for 180 hectares of new woodland. Auctions will be on a biannual basis between 2020 and 2025 with £50m committed to the scheme.

vii) Waste

The waste sector has not met its indicators, and the key policy milestone (banning the landfill of biodegradable wastes) has not been addressed in the past year. There have however been some policy developments in England, with further discussion of waste policy in the devolved administrations given in Section b) below:

- In England, the Environment Bill will establish extended producer responsibilities on products, set up deposit return schemes, provide resource efficiency information, and mandate separate collections of recyclable/compostable materials from households and businesses (starting in 2023 and fully rolled out by 2035). These measures are aimed at achieving Defra's Waste & Resources Strategy (WRS)¹¹⁶ target of a 64% recycling rate by 2035 in England.
- The WRS also has a target to ban food waste from landfill by 2030, with an aspiration to ban other biodegradable waste by the same date, and an intention to work towards zero avoidable waste being landfilled by 2050. However, there has been no consultation proposal or legislation introduced to ensure biodegradable waste is banned from landfill by 2025 (for consistency with a Net Zero 2050 pathway) or even by 2030 (as in the WRS). Larger businesses are yet to be mandated to report on their food waste arisings.

viii) Aviation

There are currently no indicators established for aviation, and last year no policy milestones were set by the Committee for 2019-20. However, there have been a number of UK developments:

- The 'Future of Flight Challenge' was announced in August 2019. Funding of £125 million will be provided via the Industrial Strategy Challenge Fund with £175 million from industry, to develop new aircraft technology including electrification.¹¹⁷
- DfT's Aviation & Climate Change Consultation was due out in early 2020, but is currently delayed due to COVID-19. A final Aviation Strategy is due to follow.
- In February 2020, the Court of Appeal ruled the Airports National Policy Statement (ANPS) underpinning expansion at Heathrow airport unlawful due to a failure to consider the Paris Agreement, non-CO₂ impacts and emissions after 2050. This verdict is being appealed in the Supreme Court.

Indicators for aviation will be developed following our advice on the Sixth Carbon Budget later this year.

¹¹⁶ DEFRA (2018) *Resources and waste strategy for England*.

¹¹⁷ Innovate UK and UK Research and Innovation (2019) *Developing the future of flight: take part in the challenge*.

ix) Shipping

There are currently no indicators established for shipping, and last year no policy milestones were set by the Committee for 2019-20. However, there have been some important UK developments:

- The UK's Clean Maritime Plan¹¹⁸ was launched in July 2019, setting up early advisory and research functions. This commits to exploring supporting the transition to zero emissions shipping, beginning with a consultation on the Renewable Transport Fuel Obligation (RTFO) in 2020, and a Call for Evidence on non-tax incentives in shipping.
- A DfT-funded study on zero-emission shipping clusters is also ongoing.

Indicators for shipping will be developed following our advice on the Sixth Carbon Budget later this year.

x) F-gases

The F-Gases sector is behind on its indicator, although the emissions are moving in the right direction. The milestone of publishing a plan to restrict the use of F-gases has not been achieved.

b) Climate legislation and policy progress in Scotland, Wales and Northern Ireland

The past year has been an important year for climate policy in Scotland, Wales and Northern Ireland. Each nation is at different stages in the process of developing and delivering on specific climate change legislation:

- **Scotland** announced two substantial packages of climate mitigation measures in its 2019-20 Programme for Government and Scottish Budget 2020-21. The Scottish Government has had a period of public engagement and consultation ahead of a planned update to the Climate Change Plan. However, with the COVID-19 crisis, the Scottish Government postponed the update. Our 2019 Scottish Progress Report set a series of devolved and reserved milestones for Scotland. We will comment further on progress later in the year.
- **Wales** launched a major climate change mitigation plan (Prosperity for All: A Low Carbon Wales) in 2019, which it has since followed with a major plan for climate adaptation in Wales (Prosperity for All: A Climate Conscious Wales). The Welsh Government plans to update the targets in its climate legislation. It has asked the Committee for advice on its third carbon budget (2026-2030), as required under the Environment (Wales) Act, and also to review its existing emissions targets for 2021-2025, 2030, 2040 and 2050. The Committee will provide advice on these targets later this year and will also review progress towards meeting Wales' First Carbon Budget (2016-2020) in our first ever Progress Report to the Welsh Parliament.
- **Northern Ireland's** 'New Decade, New Approach'¹¹⁹ power-sharing agreement included new commitments to introduce legislation and targets for reducing carbon emissions in line with the Paris Agreement. This includes the commitment to introduce a new Climate Change Act for Northern Ireland.

¹¹⁸ DfT (2019) *Clean Maritime Plan*.

¹¹⁹ UK Government and Irish Government (2020) *New Decade, New Approach*.

Northern Ireland has also engaged directly with the Committee in asking for advice on Northern Ireland's fair contribution to the 2050 Net Zero target, and has taken the welcome step of reconvening its Cross-Departmental Working Group on Climate Change.

In addition to economy-wide legislation, various plans and allocation of resources towards climate measures, there has been progress in areas where the key policy levers are almost entirely devolved. Below, we comment on policy progress in reducing emissions from waste, agriculture and land, but the role of the devolved governments extends far beyond these sectors and can have a significant impact across the economy.

The Committee will comment further on specific sectoral policies from the Scottish and Welsh governments in Progress Reports later this year.

Waste

- Scotland has proposed several 2025 targets for legislation in '*Developing Scotland's circular economy*'.¹²⁰ These include a 70% recycling rate for all wastes (with households achieving a 60% recycling rate), a 15% reduction in total waste (against 2011 levels), a 33% reduction in food waste (per capita against 2013 levels), and no more than 5% of all waste being sent to landfill. However, Scotland's previous commitment to ban the landfill of biodegradable municipal waste by 2021 has been delayed to 2025¹²¹, as many local authorities lacked sufficient processing infrastructure and would have been forced to export their waste.
- Wales have introduced a new circular economy strategy, '*Beyond Recycling*'.¹²² This targets '100% recycling' (no landfill or incineration) by 2050,¹²³ and by 2025, targets 70% recycling and a 50% reduction in food waste (against a 2006-07 baseline). Wales has also consulted on separate collection of recyclable materials from businesses and public bodies, and banning these materials going to incineration or landfill from late 2021.¹²⁴ These actions have resulted in Wales meeting the policy milestone set by the Committee last year. Under its Landfill Allowance Scheme, Wales has reduced the amount of biodegradable municipal waste sent to landfill in 2018/19 by 88% (against a 2005/06 baseline)¹²⁵, but this scheme ended in March 2020, and Wales is yet to implement a complete ban by 2025. Their 2020 target is to landfill less than 10% of all wastes, and less than 5% by 2025.
- Northern Ireland has not introduced new waste management policies in the past year, nor moved to ban all biodegradable wastes from landfill by 2025 (only separately collected food waste is currently banned). Under its Landfill Allowance Scheme, Northern Ireland has reduced the amount of biodegradable municipal waste sent to landfill in 2018/19 by 73% (against a 2005/06 baseline), but this scheme ended in March 2020.¹²⁶

¹²⁰ Scottish Government Environment and Forestry Directorate (2019) *Developing Scotland's circular economy: consultation on proposals for legislations*.

¹²¹ Scottish Government (2019) *Climate Change Plan: monitoring report 2019*.

¹²² Welsh Government (2019) *Beyond Recycling*.

¹²³ Welsh Government (2010) *Towards zero waste: our waste strategy*.

¹²⁴ Welsh Government (2019) *Increasing Business Recycling in Wales*.

¹²⁵ Natural Resources Wales (2019) *Report on the Landfill Allowances Scheme (LAS) Wales (2018/19)*.

¹²⁶ Northern Ireland Environmental Agency (2019) *The Landfill Allowance Scheme (Northern Ireland) Regulations (2004) (as amended) (NILAS)*.

Agriculture and land use, land-use change and forestry (LULUCF)

- No policies have been introduced in the last year to reduce agricultural emissions, while Scotland has yet to set out the future direction of its rural support policy post-CAP.
- The February Scottish Budget announced £20m for peatland restoration with a commitment to invest £250m over the next 10 years. It also increased its 2020/21 annual afforestation target from 10,000 to 12,000 hectares.
- The Welsh Government has committed £5m towards the creation of a National Forest, which was announced in March this year. However, no further detail on the size of this new forest have yet been provided.

c) Broader developments

i) Increased engagement

The past year has been one of 'climate action' for the UK and we have seen a significant increase in the level of engagement with climate change from people and businesses. We have seen various actors becoming increasingly vocal about the importance of decarbonisation:

- Two-thirds of local councils (district, county, unitary and metropolitan) have now declared climate emergencies. These declarations represent cross-party action at the local level and are testament to the increasing engagement with Net Zero at all levels of government. It is important now that this momentum is utilised and local authorities engage with each other, wider government and broader society to translate these statements into accelerated action. There are promising signs that this is happening and that local councils that have declared emergencies are factoring this in to project decisions. For example, Oxford City Council voting against the Oxford-Cambridge Expressway and North Somerset Council opposing Bristol Airport expansion. Greater Manchester's Walking and Cycling Network plans are also being accelerated to aid the COVID-19 recovery.¹²⁷ Local councils should however be carefully considering the fossil emissions from waste to energy plants, and how these plants will retrofit CCS in the future, plus the impact of waste reductions and improved recycling.
- In June 2020, 200 business leaders wrote to the Prime Minister, urging him to continue the UK's commitment to Net Zero.¹²⁸ Also in June, a COP26 campaign, 'Race to Zero', was launched and is backed by around 1,000 businesses with combined revenues in excess of £3 trillion.¹²⁹
- The rising prominence of grass roots protests is also of note. Extinction Rebellion is now a household name, and the student climate strikes in September 2019 were attended by hundreds of thousands in the UK alone.

¹²⁷ Greater Manchester Combined Authority (2018) *Beelines: Greater Manchester's cycling and walking infrastructure proposal*.

¹²⁸ Corporate Leaders Group Letter to Prime Minister (2020).

¹²⁹ BEIS (2020) *COP26 President speech at Race to Zero campaign launch*.

ii) Announcement of targets

This increased level of discourse and support for Net Zero has led to explicit targets being set by many major UK businesses. Many of these commitments have been reaffirmed in the face of COVID-19. Companies around the world are also outlining their Net Zero targets. Globally, this will help raise the levels of ambition in an attempt to better align with the Paris Agreement. In the UK, it will support the Government in meeting its own Net Zero target.

The strength of these targets vary. Some companies have set targets for carbon neutrality, some net-zero emissions, and some carbon net negative; others such as Microsoft have pledged to go even further by removing all of their emissions created since their founding.¹³⁰ Net Zero and carbon neutrality are terms often used interchangeably; however, the term carbon neutrality typically refers to only CO₂ emissions and not other GHGs.¹³¹ Similarly, different companies are committing to being carbon neutral for different scopes of emissions.¹³²

- 81% of FTSE 100 companies have set emissions reduction targets, and 15% have targets to achieve carbon neutrality or Net Zero by 2050.¹³³ The percentage with targets to achieve carbon neutrality is higher in France and Spain (CAC 25: 40%; IBEX 35: 40%) but lower in the US (Dow: 10%).³³
- 47% of FTSE 100 companies have set or have committed to setting Science Based Targets for Net Zero (SBTs) which focus on Scope 1 and 2 emissions; and 32% of FTSE 100 companies include Scope 3 (including wider supply chain) emissions in their targets.³³

There have been several high profile 'Net Zero' announcements of note:

- The National Farmers Union outlined a pathway for agriculture to achieve Net Zero by 2040. It emphasised the need for farming practices such as increased farm woodland and soil carbon storage and to increase farm productivity, along with use of bioenergy with CCS to achieve significant GHG removals.¹³⁴
- The National Trust stated its commitment to being Net Zero by 2030 (without relying on offsets) through a variety of measures including expansion of the number of trees being planted. It also announced it would push its supply chain and tenants to decarbonise.
- There have been notable Net Zero announcements made in the oil and gas sector. In February 2020, BP outlined a Net Zero carbon target which is an ambition to address emissions from both their operations and their upstream oil and gas production by 2050 or sooner. This was followed by an announcement from Shell in April 2020 who committed to having Net Zero operations by 2050, and to reduce the net carbon footprint of the products that they sell. Most recently, Total stated its ambition to have Net Zero operations and energy products by 2050.
- Via the Sustainable Aviation grouping, the UK's aviation sector has committed to achieving net-zero CO₂ emissions by 2050. Their roadmap has high demand growth mitigated by large improvements in efficiency, uptake of sustainable aviation fuels and significant use of market based measures (offsets and removals).¹³⁵

¹³⁰ Microsoft (2020) *Microsoft announces it will be carbon negative by 2030*.

¹³¹ Carbon Trust (2019) *Net zero: an ambition in need of a definition*.

¹³² BEIS (2019) *2019 Government Greenhouse Gas Conversion Factors for Company Reporting*.

¹³³ Eco-Act (2019) *The Sustainability Reporting of the FTSE-100*.

¹³⁴ National Farmers Union (2019) *Achieving Net Zero: Farming's 2040 Goal*.

¹³⁵ Sustainable Aviation (2016) *Sustainable Aviation CO₂ Road-Map*.

- Water UK have committed to achieving net-zero GHG emissions across the water industry by 2030.¹³⁶ This is to be achieved through energy efficiency, reduced direct process emissions, use of onsite renewables and afforestation, purchase of green electricity, export of biomethane to the gas grid and use of EVs.
- The NHS has committed to reaching Net Zero "as soon as possible" and recently commissioned an expert panel to advise on how and when this will be possible.

iii) Operational commitments

Businesses can be a key enabler of net-zero delivery as they not only provide the infrastructure, innovation and business models required, but they can transform their own operations, including the use of EVs, renewables and low-carbon buildings:

- At least 20 companies with operations in the UK have committed to fully electric vehicle fleets by 2030,¹³⁷ and 34 organisations have committed to 100% electric vans by 2028.¹³⁸
- Numerous companies are committed to 100% renewables either through on-site generation or procurement through green tariffs or Power Purchase Agreements; the UK companies that are signatories of the RE100 group procure 4% of the UK's electricity in this manner.¹³⁹
- Companies are committing to occupy as well as construct buildings with high energy efficiency, low-carbon heating and low embodied carbon. 25 companies in the UK have signed up to the WorldGBC Net Zero Carbon Buildings Commitment which require corporate buildings to have net-zero operational emissions and ideally include embodied carbon disclosure.¹⁴⁰

Section 6.3.h. provides further detail on how businesses can help to deliver Net Zero. While the many commitments are welcome and demonstrate the broad willingness to take action, they must still be backed with investable policy frameworks to deliver the changes required.

It must be recognised the immediate threat of COVID-19 has disrupted short term progress in some areas, as governments, businesses and people act to protect public health. The next chapter focuses on how climate-related investments can accelerate the recovery from the pandemic, and areas where efforts to achieve net-zero emissions and avoid the most damaging impacts of climate change can be accelerated.

¹³⁶ Water UK (2020) *Water industry plans to reach net zero carbon by 2030*.

¹³⁷ The Climate Group (2020) *Charging ahead on electric vehicles: 2020 EV100 progress and insights report*.

¹³⁸ Global Action Plan *Clean Van Commitment*.

¹³⁹ CDP (2020) Internal data on UK RE100 electricity consumption in 2018, shared with the CCC.

¹⁴⁰ World Green Building Council (2020) *The Net Zero Carbon Buildings Commitment*.

Chapter 5: Planning a resilient recovery



Introduction

The COVID-19 pandemic has had tragic impacts throughout the world. In the UK, the scale of the impacts is staggering. As the country emerges from the initial phase of the pandemic, we offer recommendations on shaping a recovery that puts the UK on track to net-zero and increases our resilience to the threats from the changing climate.

Climate change also poses a threat to health for the longer term. The World Health Organisation has described climate change as the greatest threat to global health in the 21st century.¹⁴¹

Although global emissions are expected to fall by a record amount in 2020 this effect is only temporary. CO₂ emissions must still be cut consistently year after year until they reach net-zero globally to slow and halt global warming.

The months ahead have huge significance. The steps that the world and the UK take to rebuild from the COVID-19 pandemic and its economic damage can accelerate the transition to low-carbon activities and improve our climate resilience. Short-term choices that lock-in emissions or climate risks must be avoided.

There is strong evidence, set out in this chapter, to support a range of low-carbon and climate adaptation 'green stimulus' measures. Many can be delivered quickly and have high multipliers, high numbers of jobs created, and boost spending in the UK. In the long term, a transition to a low-carbon, efficient and resilient economy will bring productivity benefits throughout the economy.

Lessons from the COVID-19 crisis on the importance of planning for systemic risks also apply to our preparations for climate change itself. The Committee has already highlighted a dearth of climate adaptation planning in government. This is a moment to confront the range of climate risks that face the UK, including flooding, over-heating and water shortages, with realistic planning for the inevitable temperature rises ahead.

We set out the case for building a resilient recovery in the following sections:

1. Net Zero by 2050 and adaptation remains a scientific, economic and social imperative
2. A new context for tackling climate change
3. The economics of a resilient recovery
4. Principles for a resilient recovery
5. Climate policies to deliver a resilient recovery
6. International recovery

¹⁴¹ World Health Organisation (2020) *WHO calls for urgent action to protect health from climate change*.

1. Net Zero by 2050 and adaptation remain scientific, economic and social imperatives

As countries around the world come to terms with the public health risk of COVID-19, there are substantial economic and social impacts, which are only starting to emerge. Pre-crisis norms will not return quickly and some activities may even be changed permanently. Our long-term climate goals remain unchanged by the pandemic.

- As long as human activity continues to add to concentrations of greenhouse gases in the atmosphere, the scale of climate change and the impacts from the risks attached to climate change will continue to increase. The scientific and economic basis for the transition to a net-zero economy, in line with the goals of the Paris Agreement, remains.
- But even if these goals are met, there will be further climate change compared to today, so actions to prepare for the impacts of climate change are required.

In 2019, the UK Government legislated for a net-zero greenhouse gas emissions target in 2050. That remains the appropriate goal. We welcome the Prime Minister's reaffirmed commitments in recent months (including during the COVID-19 crisis) to achieving this target.

The risks of COVID-19 and climate change risks are very different, but there are some important parallels (Box 5.1). Our experience from COVID-19 acts as a reminder of the need to increase resilience and to reduce our exposure to systemic risks through evidence-led planning.

The long-term implications of COVID-19 for the global and UK economies are still unclear. It is unlikely, however, that the pandemic will fundamentally alter the trajectory for emissions. Nor does it change the broad steps that we need to take to reduce our emissions to net-zero (as set out in Figure 1.3 in chapter 1) or to adapt to climate change.

The economic shutdown and restrictions on movement that have slowed infections are not a blueprint for reducing emissions or tackling climate change. Despite the very stringent restrictions placed on individuals and businesses to protect public health, the UK has continued to emit greenhouse gases in 2020 at a rate that, if unchanged, would lead to increased global warming. Achieving net-zero emissions still requires the systematic changes recommended by the Committee in last year's Net Zero Report.

Achieving the UK's climate goals will also deliver better public health, improvements to biodiversity, vastly improved air quality and more comfortable homes. It is also a route to new, highly productive employment, greater domestic energy security, more green spaces, and a reduction in fuel poverty.

The actions required to prepare for the impacts of climate change and to reduce emissions are well-documented (including in this report) and well-understood. A clear lesson from COVID-19 is the value of preparation and the costs when there is insufficient resilience headroom for shocks. Actions to tackle climate change can accelerate the recovery from the pandemic and build back in a more resilient way.

Box 5.1. Parallels and differences between COVID-19 and climate change

Parallels drawn between the challenges of COVID-19 and climate change serve as a reminder of the need for a wide-ranging evidence-based approach to build resilience to future crises:

- **Evidence-based planning and decisive early actions to minimise damages.** Scientific evidence can tell us about the direction of travel and put boundaries around what impacts are likely, but does not enable us to predict the future perfectly and often may not give sufficient information about low likelihood, high impact events. At the same time, the damages of inaction can be hard to comprehend and it is only with hindsight that we can fully understand the consequences of not acting early enough. Building headroom and redundancy into systems to cope better with unexpected shocks, and acting decisively and quickly when impacts happen is key to coping with major shocks.
- **A global solution.** The world's most challenging crises do not respect borders and require strong collaborative global action.
- **Action at all levels of society.** COVID-19 has required individuals, companies and governments to change the way they live, work and travel. Tackling climate change - both by reducing emissions of greenhouse gases and adaptation actions to prepare for the impacts of climate change - will also require changes at all levels of society. However, the lockdowns required in tackling the pandemic are not a model for tackling climate change, for which the required actions can enhance well-being.
- **Protecting the most vulnerable.** The virus, and the measures that have been implemented to protect public health, have had a disproportionate impact on some demographic groups in the UK. Climate change, and action to combat climate change, is likely to have uneven impacts in the UK and around the world across work sectors, regions, demographic groups and resources. There is a need for the transition to net-zero emissions to be delivered fairly and for adaptation to protect the vulnerable.

There are also fundamental differences in the threats posed by COVID-19 and climate change, and the solutions required to tackle them.

- **Timescales.** There is hope for a recovery from COVID-19 as countries take action to slow and reverse the spread of the disease and vaccine trials begin. Human-induced climate change cannot be easily or quickly reversed. Some impacts of climate change are already being felt around the world, and some changes we have already seen in the climate are expected to be irreversible.
- **Scale of response.** There will be no vaccine for climate change and it will not be possible to self-isolate from its impacts. It can only be tackled through a sustained response over decades covering all nations of the world, all sectors of the economy and all parts of society.
- **Climate actions will make lives better.** In order to combat COVID-19, people in the UK have heavily restricted their movement with damaging economic and social consequences. This is not the blueprint for tackling climate change. Unlike COVID-19, many of the actions the UK can take on climate change can bring improvements to our quality of lives - cleaner air, quieter streets, more green spaces, comfortable homes and healthier lifestyles.

2. A new context for tackling climate change

The short-term implications of the current crisis are still uncertain, but it is already clear that they will alter the underlying conditions for reducing emissions and adapting to climate change.

Measures to protect public health, particularly social distancing, will inevitably affect the ability to deliver, physically, some climate measures in the short term. They may also increase support for climate action (Box 5.3), not least because of the common experience of the lockdown: cleaner air, home working, reduced business travel, and greater appreciation of nature and green spaces.

The 'stickiness' of recently-enforced changes in behaviour and the knock-on consequences of these changes to the economy, behaviours and social norms will have profound ramifications for the context in which we tackle climate change.

a) Immediate impacts on greenhouse gas emissions and air quality

Greenhouse gas emissions

Reduced energy demands during the lockdown are expected to cause a record fall in global emissions in 2020. These impacts are likely to be transient, reversing as the global economy reopens and with only a negligible impact on global warming (Box 2.1):

- **Short-term** evidence indicates very substantial reductions in energy use and emissions. An early comprehensive estimate suggests that global emissions declined by over 5% in the first three months of 2020 compared to the same period in 2019, with daily emissions in early April around 17% (11% - 25%) lower than in 2019. Projections for 2020 as a whole depend very strongly on the assumed global economic trajectory in the second half of the year – with recent estimates ranging from a 2% to a 13% decline on 2019 levels.
- **Medium-term** impacts will be, in a large part, driven by the carbon intensity of any economic stimulus efforts in countries with large emissions today and longer-lasting structural impacts of the crisis. Investments in new long-life high-carbon infrastructure could lock in high global emissions for years to come.
- **Longer-term** the prospects for addressing global climate change will be affected by the as-yet unknowable impacts of COVID-19 on investment actions and attitudes to global collaboration.

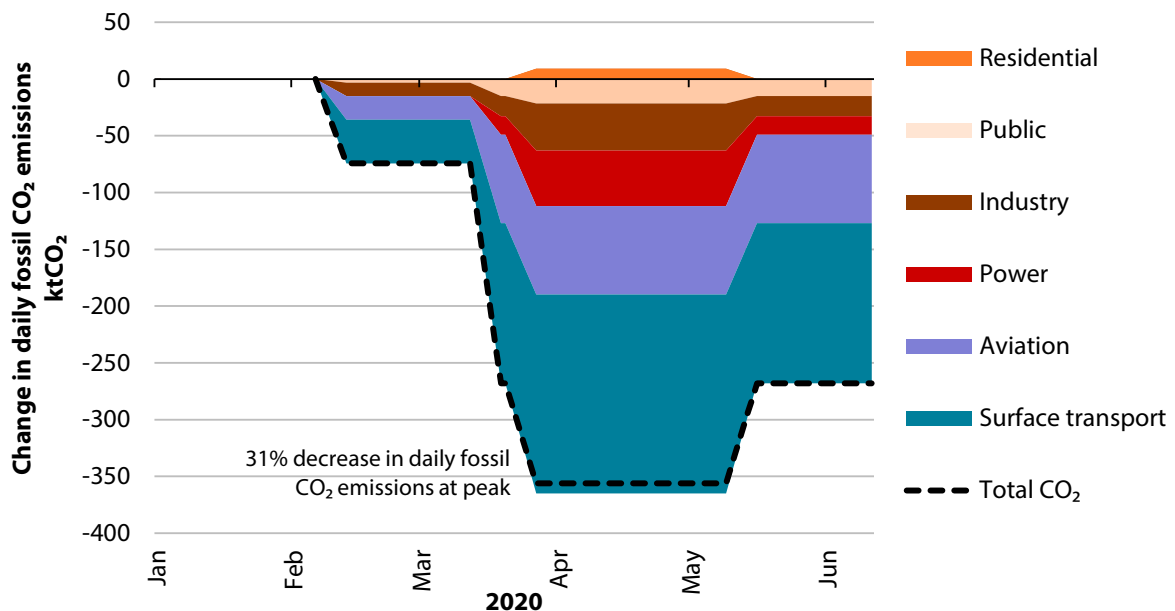
However, global temperature will continue to rise and climate impacts will continue to mount. CO₂ emissions largely accumulate in the atmosphere meaning that human-induced warming will only stop once global emissions of CO₂ (and other long-lived GHGs) are brought to net-zero and emissions of shorter-lived GHGs have been stabilised.

The full impact on UK greenhouse gas emissions is also unclear at this stage - and will depend on the rate at which the economy is able to reopen safely. It is already clear, however, that the lockdown will cause a substantial fall in UK emissions in 2020. In a mid-case estimate, daily CO₂ emissions were around 30% lower than mean 2019 levels in the UK during the peak of the lockdown in April and May 2020 (Figure 5.1).

The changes observed in 2020 are likely to be transient, as they do not reflect structural changes in the underlying economic, energy, transport or land systems. Emissions are likely to rebound in 2021.

The new behaviours that emerge in the UK after the period of lockdown and social distancing have the potential to alter our long-term emissions trajectory in unpredictable ways, but social responses alone will not drive the deep and sustained reductions that are needed to reach net-zero emissions.

Figure 5.1. UK emissions have fallen by almost one third during the peak of the lockdown



Source: Supplementary data to Le Quéré et al (2020) *Temporary reduction in daily global CO₂ emissions during the COVID-19 forced confinement*.

Notes: Mean baseline emissions for the UK are 1.16 MtCO₂/day, taken from the Global Carbon Project using sector allocation from IEA (2019) *World Energy Balances 2019*.

Air quality and air pollutant emissions

Reductions in road traffic, as well as lower fossil-fuelled power generation, industrial combustion, aviation and construction during the lockdown have also contributed to better outdoor air quality:

- Concentrations of nitrogen dioxide (NO₂) have fallen drastically, particularly in urban areas. Ricardo estimated a mean decrease in NO₂ concentration of 37% at roadside sites and 25% at urban background sites from 16 March to 18 April.¹⁴²
- Particulate matter (PM) concentrations have increased compared to the weeks before lockdown due to a range of complex formation and dispersion mechanisms, including winds carrying air pollutants from across Europe.¹⁴³ However they are likely lower than what would have happened in a 'no-lockdown' counterfactual.

¹⁴² Ricardo (2020) *Response to Defra (2020) AQEG call for evidence*.

¹⁴³ Environmental Research Group, King's College London (2020) *Response to Defra (2020) AQEG call for evidence*.

- There may also have been an increase in emissions associated with domestic combustion and the use of household organic solvents, leading to increased exposure to volatile organic compounds (VOCs).¹⁴⁴
- The independent Air Quality Expert Group (AQEG) has launched an urgent call for evidence on the impact of the COVID-19 outbreak on changes in air pollution emissions, concentrations and exposure in the UK, the conclusions of which will be published later this year.¹⁴⁵

Efforts to reduce greenhouse gas emissions will support longer-term improvements to air quality:

- Combustion of fossil fuels generally leads to both greenhouse gases and short-lived air pollution, including from fossil fuel electricity production, industrial manufacturing, space heating, fossil-fuelled transportation, and agriculture.
- Decarbonisation of the road transport fleet will bring very significant air quality benefits, reducing NO₂ and VOC emissions in cities. This will improve air quality overall, particularly at the roadside. However, whilst primary particulate matter (PM) emissions from vehicle exhausts will decrease, PM from tyre and brake wear and resuspension of road dust will remain.¹⁴⁶

Prioritising air quality and health outcomes could imply increased action in some areas of the Committee's recommendations. For example, reductions in car transport and increased walking, cycling and public transport. The Committee has convened an advisory group on health to support our work on the Sixth Carbon Budget, with a focus on identifying the long-term health benefits of taking actions to reduce emissions.

b) Immediate impacts on vulnerability and exposure to climate impacts

Not only have the pandemic and measures to control the spread of the virus had immediate impacts on the environment, they have also had immediate impacts on vulnerability and exposure to climate impacts:

- **Household water use** has risen dramatically, with some areas seeing peak demand of up to 40% above normal for the time of year, an overall increase of more than 2.2 billion litres consumed per day in the UK.¹⁴⁷ Though April and May have been very dry months, reservoir levels have generally been high after the wettest February and the fifth wettest winter on record.¹⁴⁸ However even with sufficient sources, the extra demand has resulted in some areas seeing poor pressure and even loss of supply in evenings as the pipes cannot carry water fast enough to meet the unprecedented demand.^{149,150}

¹⁴⁴ Ricardo (2020) Response to Defra (2020) AQEG call for evidence.

¹⁴⁵ Defra (2020) AQEG Request for rapid evidence: Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK.

¹⁴⁶ AQEG (2007) *Air Quality and Climate Change: A UK Perspective*. Note: an updated paper from AQEG discussing Net Zero and air quality is due for publication in 2020.

¹⁴⁷ Water UK (2020) *Press release: Gardeners urged to ditch the evening sprinkler as peak water demand surges*.

¹⁴⁸ Met Office (2020) *Provisional February 2020 rainfall statistics*.

¹⁴⁹ Severn Trent (2020) *Press release: Severn Trent appeals to everyone to help with saving water*.

¹⁵⁰ South East Water (2020) *Press release: Save water at home this summer*.

- **Environmental charities** are experiencing a far-reaching loss of income.¹⁵¹ The Government has put in place a £750million aid package, but some charities have voiced concerns this will not be sufficient to enable them to carry on frontline work including nature conservation activities that are vital for increasing resilience to climate change. Demand for recreational services and therefore human pressure on the natural environment has also increased.¹⁵²
- **Isolating at home** has led to an increased risk of exposure to overheating and poor indoor air quality. Vulnerable people (for example, those in the Government's shielding group who are confined to their homes), are also more at risk of poor indoor environmental quality through pre-existing conditions like severe asthma or heart conditions.¹⁵³
- **ICT infrastructure.** There has been a vast increase on the reliance of ICT and digital services. To date no severe outages due to extreme weather have been reported, but the edge of networks where diversity is at its lowest are most likely affected by any impacts - typically near low population regions, or remote locations such as islands. Heatwaves or periods of drought in summer months can also affect a range of ICT infrastructure and place additional demands for cooling on energy networks increasing the risk of 'brown out' due to a reduction or restriction in power.¹⁵⁴

c) Immediate economic impacts

The pandemic and the public health response have had far-reaching consequences for the UK and global economy. As economies shut down, the world has seen recessions, lost jobs, higher government debt, and suppressed energy demand:

- **Global recession.** The economic impact of the pandemic is being felt worldwide, with the IMF predicting the worst global recession since the 1930s.¹⁵⁵ The UK is heading for a recession. UK Gross Domestic Product (GDP) fell by 2% for the first quarter of 2020, covering only the very start of the crisis, and by over 20% in the month of April.¹⁵⁶ The latest independent forecasts have, on average, predicted a fall of 8.6% in UK GDP for 2020.¹⁵⁷ The impact on annual GDP depends on how long the shutdown continues and the rate and extent to which the economy can recover without permanent economic scarring. The Office for Budgetary Responsibility (OBR) '*Coronavirus reference scenario*'¹⁵⁸ is not a forecast, but provides an initial assessment of the potential impact of the coronavirus on the economy and public finances.

This scenario illustrates a fast 'v-shaped' economic recovery with little economic scarring that would lead to a 12.8% fall in real GDP in 2020. Other forecasts are more pessimistic, anticipating significant longer-term reductions in GDP.

- **Jobs.** There was a 70% increase in the number of claims for unemployment benefits from March to April 2020. As of 11 May 2020, over 7.5 million people were furloughed under the

¹⁵¹ Wildlife And Countryside Link (2020) *Huge nature, well-being and climate cost of coronavirus*.

¹⁵² Green Alliance (2020) *Blog: We must see our national parks as an agent of positive change after lockdown*.

¹⁵³ Kovats, R.S., and Osborn, D., (2016) *UK Climate Change Risk Assessment Evidence Report: Chapter 5, People and the Built Environment*.

¹⁵⁴ Dawson, R.J., Thompson, D., Johns, D., Gosling, S., Chapman, L., Darch, G., Watson, G., Powrie, W., Bell, S., Paulson, K., Hughes, P., and Wood, R. (2016) *UK Climate Change Risk Assessment Evidence Report: Chapter 4, Infrastructure*.

¹⁵⁵ IMF (2020) *Blog: The Great Lockdown: Worst Economic Downturn Since the Great Depression*.

¹⁵⁶ ONS (2020) *GDP monthly estimate, UK: April 2020*.

¹⁵⁷ HM Treasury (2020) *Forecasts for the UK economy: a comparison of independent forecasts, May 2020*.

¹⁵⁸ OBR (2020) *Coronavirus analysis: coronavirus reference scenario*.

Coronavirus Job Retention Scheme (CJRS), and a further 1.1 million people had claimed from the Self-Employment Income Support Scheme by 14 May.^{159,160} Excluding vacancies in the health and social care sectors, the number of new job vacancies being advertised in the first week of April were 79% below their 2019 levels, and 74% below their 2019 levels in the first week of May.¹⁶¹ Depending on the rate at which people are able to return to their jobs safely and businesses are able to retain their workforce, we may see the UK move from a pre-crisis jobs market where unemployment was at very low levels, to having an underemployed workforce that needs new, productive and future-ready jobs.

- **Distributional impacts.** The pandemic has affected all people in the UK but has highlighted and may increase wealth and health inequality. This can be seen across many demographic groups, including by age, income, ethnicity, employment type, and geography. Mortality rates from COVID-19 in the most deprived areas in England are double those in the least deprived, and are higher in Black, Asian and Minority Ethnic (BAME) groups than in White ethnic groups.¹⁶² The lowest-earning 10% of workers were seven times as likely as the highest earners to work in sectors that have closed, and are also much less likely to be able to work from home.¹⁶³ At the same time, others (particularly in higher-income households who are able to work from home) will have accumulated savings due to reduced opportunities to spend. As well as calling attention to existing inequalities, COVID-19 has opened up new dimensions of inequality that were previously perceived as being less significant (for example the ability to work at home, quality of housing, or access to gardens and green spaces).¹⁶⁴
- **Public finances.** A number of policies have been implemented by the Government and the Bank of England in order to protect businesses and workers. As tax revenues fall and government spending increases, the budget deficit will rise in the next year and is expected to leave a permanent increase in levels of public sector net debt (PSND). However, if the rate of growth engendered by government investment is greater than the (currently very low) interest rate, then the debt/GDP ratio will fall.¹⁶⁵ It is unclear exactly how large the impact on public finances will be, but it will clearly be substantial and have implications for spending in the future. The Office for Budget Responsibility reference scenario would see PSND rise to 96% of GDP in 2020-21.¹⁶⁶
- **Energy and energy commodities.** The shutdown of major economies and travel routes has contributed to excess global oil supply, and prices have fallen dramatically. The impact on natural gas prices has been less clear, in part because it is not used as a transportation fuel, but reduced energy demand, warmer temperatures and contracts linked to the oil price have likely contributed to a fall in prices in the UK. Electricity prices in Great Britain have fallen due to lower natural gas prices and lower electricity demand, leading to a decade-low average wholesale spot price of £23.0/MWh in April 2020 (Figure 5.2).

Lower economic output, and the associated fall in energy demands, will have a direct impact on greenhouse gas emissions in 2020 and beyond.

¹⁵⁹ HMRC (2020) *HMRC coronavirus (COVID-19) statistics*.

¹⁶⁰ ONS (2020) *Labour market overview, UK: May 2020*.

¹⁶¹ IFS (2020) *Job vacancies during the Covid-19 pandemic*.

¹⁶² Public Health England (2020) *Disparities in the risk and outcomes of COVID-19*.

¹⁶³ IFS (2020) *Sector shutdowns during the coronavirus crisis: which workers are most exposed?*

¹⁶⁴ Blundell, R, Costa-Dias, M, Joyce, R, Xu, X for IFS (2020) *Royal Economic Society webinar: Inequality and Covid-19*.

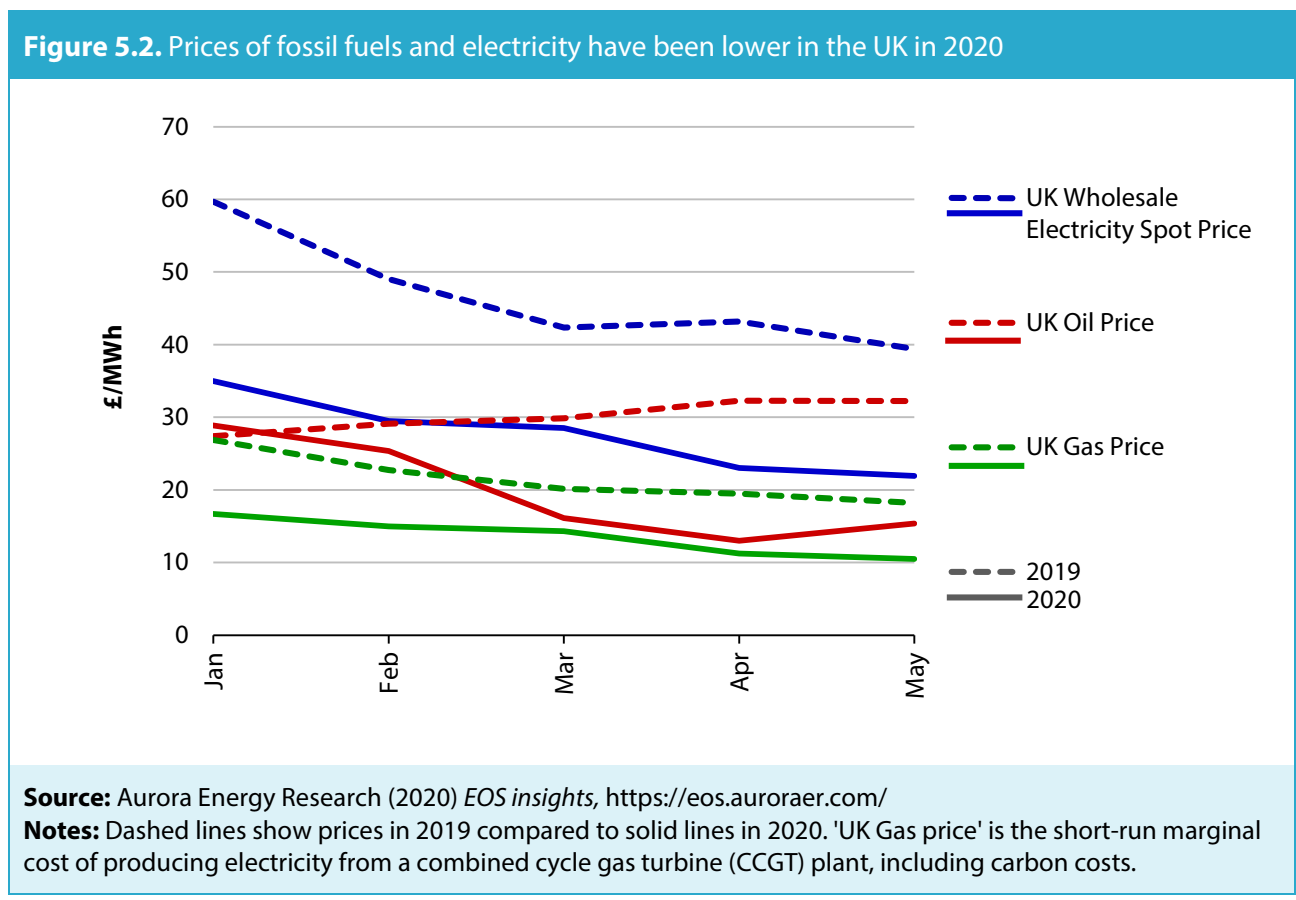
¹⁶⁵ Advisory Group on the Costs and Benefits of Net Zero for the CCC (2020) *Supplementary report*.

¹⁶⁶ OBR (2020) *Coronavirus analysis: coronavirus reference scenario*.

Work that the Committee has previously commissioned shows that changes to GDP growth and energy prices continue to affect UK emissions (Box 5.2). To reach net-zero emissions, economic output must be further decoupled from greenhouse gas emissions.

Any lasting impacts on jobs, inequality and public debt will have clear implications for achieving the right balance of who is most able to invest in the low-carbon transition, who will need to be supported, and where the benefits should be distributed. This challenge is important context for the Treasury Net Zero Review of how the transition will be fairly funded.

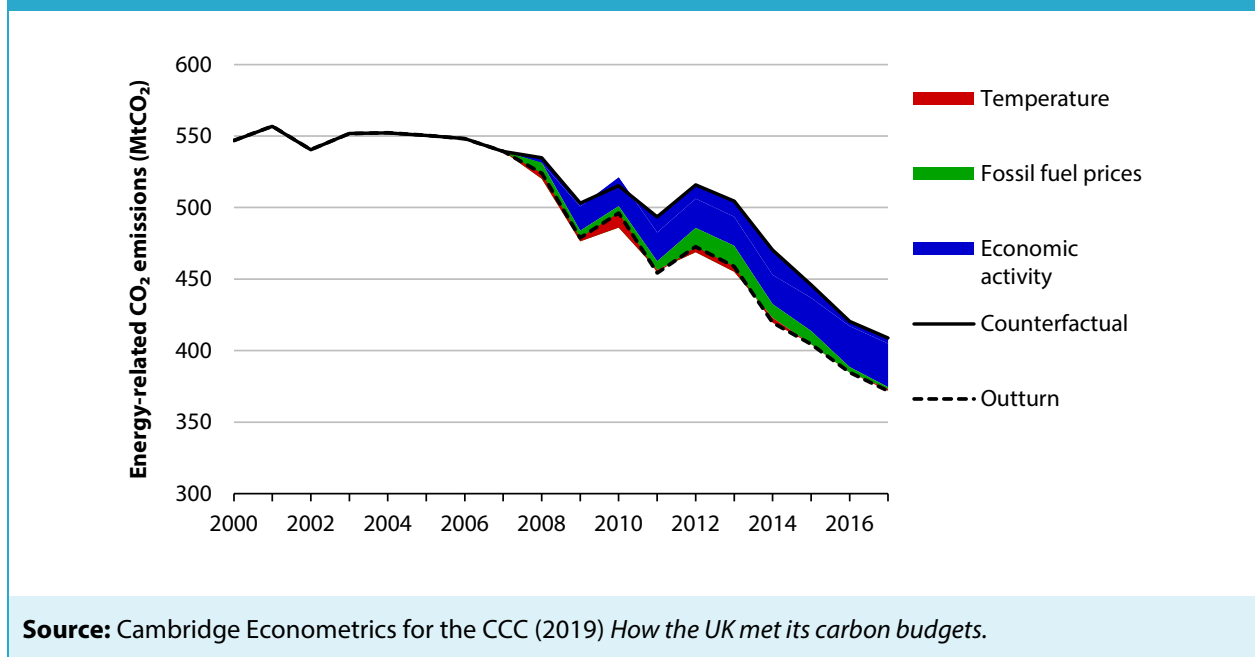
If changes in energy prices are sustained, this will have an impact on the specific details of the climate policies that will be most effective. For example, lower petrol prices may reduce consumer incentives to choose an electric car in the absence of other incentives, but they may also allow Government to raise additional revenue and put an appropriate carbon price on emissions without harming consumers (Box 5.6).



Box 5.2. Historical impact of lower growth on UK emissions

UK economic activity was much lower than expected as a result of the global financial crisis, and the subsequent recession and slow recovery which significantly lowered energy-related CO₂ emissions. UK GDP was 14.5% lower by 2017 than the government expected when the carbon budgets were set in 2009. Manufacturing output was 22% lower. Work we commissioned in 2019 estimated that the impact of lower economic activity was to reduce CO₂ emissions by around 281 MtCO₂e over the ten years of the first and second carbon budgets, compared to a counterfactual scenario where the recession did not take place and growth was in line with the government's assumptions.

Figure B5.1. Key factors causing UK emissions to be lower than expected in 2008



d) New ways of living, attitudes and values

The pandemic has forced the UK population to change how they live their daily lives. In particular, ways of working and travelling have changed rapidly:

- **Working from home and reduced business travel.** Nearly half (49%) of all employed adults reported they worked from home in the first half of April 2020, compared to around 5% who mainly worked from home in 2019.¹⁶⁷ Organisations have had to rapidly change the way they work, with increased reliance on video- and tele-conferencing. However, this impact has not been spread equally across all sectors, and not all businesses are capable of making these changes and need more support. There are parallels to the net-zero transition here, where some industries and vulnerable workers will need more support as structural changes to energy, transportation, and land systems take place.
- **Active travel and green spaces.** The number of people using parks in the UK initially remained lower than pre-crisis levels, but their use did not see nearly as sharp a decline as other recreational activities and was above the pre-lockdown baseline by May as the weather improved (Figure 5.3).

¹⁶⁷ ONS (2020) *Coronavirus and the latest indicators for the UK economy and society*: 4 June 2020.

Surveys of attitudes have shown a greater appreciation for nature,¹⁶⁸ but also an increase in wildlife crimes as fewer police and conservation workers are present to spot illegal activity.¹⁶⁹ People have turned to walking and cycling for exercise and transportation in line with social-distancing guidelines. Levels of cycling have more than doubled across Great Britain (Figure 5.4). A survey carried out on behalf of Sport Wales found that 67% of people who cycled for leisure have done more than usual, while data from Scotland show that cycling has increased during lockdown, particularly where cycling levels were previously low.¹⁷⁰ The Transport for London (TfL) 'Streetspace' programme plans to accommodate a possible ten-fold increase in cycling and five-fold increase in walking when lockdown restrictions are eased.¹⁷¹

- **Public transport.** Public transport use has fallen by more in the UK than the use of private vehicles, with demand down by more than 85% for buses and over 95% for national rail at the peak of the lockdown (Figure 5.4). Health concerns over using public transport, particularly at peak times when services are crowded, could lead to a more permanent reduction in demand once restrictions are lifted. Public transport still has clear benefits for reducing greenhouse gas emissions and improving air quality, due to lower emissions per passenger and for its role in reducing road congestion. The Government's Transport Decarbonisation Plan earlier this year set out a vision where public transport is a 'natural first choice'. The pandemic will make a switch from private to public transport more difficult to achieve.
- **International travel.** As international borders have closed, the number of flights has fallen drastically. There was a two-thirds drop in total global scheduled flights during April and May 2020 compared to a year earlier, and more than a 90% fall in flights to and from the UK.¹⁷² A perceived increase in the risks of air travel,¹⁷³ social distancing requirements on aircraft, possible health checks at airports, and the possibility of quarantine upon landing is likely to suppress air passenger demand after restrictions are lifted. Demand is expected to remain below 2019 levels for several years. This may be reinforced by changes in business practices; organisations that have become more used to remote working may be less willing to pay for company flights in future. There could also be a fall in average trip length as consumer preferences shift towards shorter-haul flights.¹⁷⁴

Each of these behaviour changes has the potential to alter the long-term emissions trajectory of the UK. What is unclear is the extent to which these changes are 'sticky', or whether people revert to old ways of working and travelling once restrictions are lifted. The longer changes go on for, the more likely it is that they will be somewhat sticky. Government has a clear role to play in ensuring that positive behaviours can last, while the negatives are avoided as much as possible.

¹⁶⁸ Opinium (2020) *Poll for CPRE and the National Federation of Women's Institutes: Appreciation of green space grows during lockdown.*

¹⁶⁹ Wildlife Trusts (2020) *Love and look after it: Wildfires, vandalism, littering and disturbance to wildlife.*

¹⁷⁰ Transport Scotland (2020) *COVID-19 Transport Trend Data - 4-10 May 2020.*

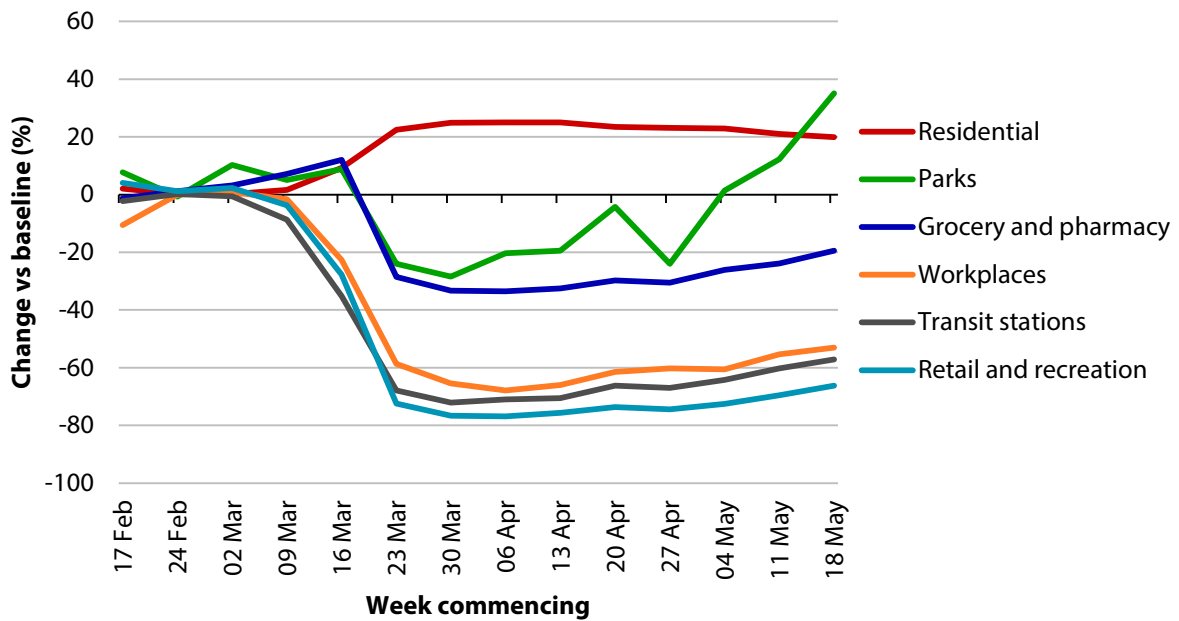
¹⁷¹ Mayor of London and TfL (2020) *Press release: Mayor's bold new Streetspace plan will overhaul London's streets.*

¹⁷² OAG Aviation Worldwide Limited (2020) *Coronavirus airline schedules data.*

¹⁷³ Opinium (2020) *The Political Report 13 May 2020.*

¹⁷⁴ IATA (2020) *Outlook for air travel in the next 5 years.*

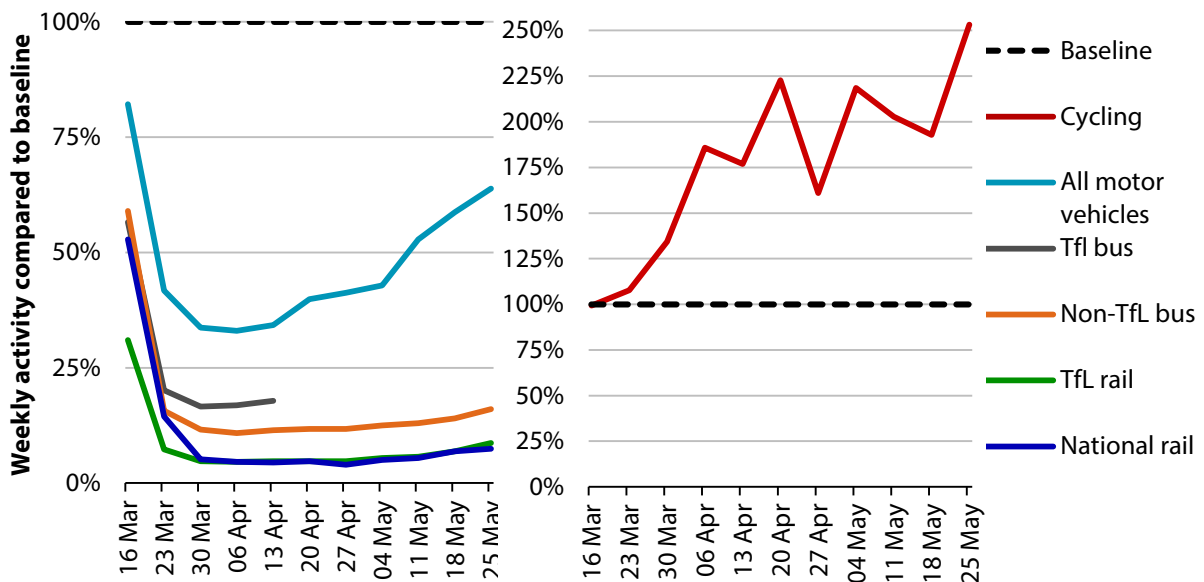
Figure 5.3. Changes in UK mobility patterns in 2020



Source: Google (2020) *Community Mobility Reports*; CCC analysis.

Notes: Data are presented as a weekly average (Mon-Sun). The data show visitors to, or time spent in, categorised places change compared to a baseline day, which represents a normal value for that day of the week. The baseline day is defined as the median value from the 5-week period Jan 3-Feb 6, 2020.

Figure 5.4. Changes in UK transport use in 2020



Source: COBR (2020) *Datasets to accompany coronavirus press conference: 4 June 2020*; CCC analysis.

Notes: Transport data is indexed to the equivalent day in either January or February 2020 (motor vehicles and buses), 2019 (rail) or March 2020 (cycling). TfL=Transport for London.

As well as new behaviours, it is possible that we will see new attitudes and values as we begin to rebuild from the pandemic. The permanence of these changes is similarly uncertain:

- **Recognition of the ability to change rapidly when needed.** The pandemic has highlighted the possibility of rapid and significant changes. One clear example is remote GP consultations. In the four weeks leading up to 12 April, 71% of routine GP consultations were delivered remotely, compared to 25% the previous year. There is still a need for physical consultations, and the Chair of the Royal College of GPs expects some reversal of this change back to an approximate 50% split,¹⁷⁵ but there has been a broad recognition that transitions can happen much more quickly than anticipated as the underlying balance of risks change.
- **Value of clean air, green spaces, and comfortable homes.** The majority (53%) of people say they appreciate local green spaces more since the country adopted social distancing measures and 63% feel protecting local green spaces should be a higher priority for the government when lockdown ends.¹⁷⁶ A majority of people (71%) were concerned about air pollution returning to pre-lockdown levels.¹⁷⁷
- **Public prioritisation of health and the economy.** Polling shows a sustained increase in the share of the public that identified the National Health Service (68%) and the economy (57%) as the most important issues facing the country.
- **Climate change remains a top priority.** Polling shows that two-thirds of British people believe that climate change is as serious a risk as COVID-19 in the long term, and 70% agree that if the Government does not act now to combat climate change, it will be failing the general public.¹⁷⁸ The BEIS Public Attitudes Tracker, carried out throughout March 2020, showed 76% of the UK are 'very concerned' or 'fairly concerned' about climate change.¹⁷⁹ Climate change and the environment remains in the top four priority areas in answer to the questions 'what are the most important issues facing the country' and 'what sector should the UK government spend more on?'.¹⁸⁰ Participants in the UK Climate Assembly overwhelmingly (93%) agreed that the Government, employers and others should take steps as lockdown eases to encourage lifestyles to change to be more compatible with reaching Net Zero (Box 5.3).
- **Risk aversion and value of preparedness.** There is evidence that the tolerance of financial risk decreases in households that report they have lost wealth in a financial crisis.¹⁸¹ We are not aware of any analysis that has considered how the pandemic will alter household perceptions of risk and actions to prepare for risks, including those from extreme weather and climate change. We will revisit this in our 2021 Progress Report.

¹⁷⁵ RCGP (2020) *Press release: Around 7 in 10 patients now receive GP care remotely in bid to keep patients safe.*

¹⁷⁶ Opinium (2020) *Poll for CPRE and the National Federation of Women's Institutes: Appreciation of green space grows during lockdown.*

¹⁷⁷ YouGov (2020) *Survey for Greenpeace 6th-7th May 2020.*

¹⁷⁸ Ipsos MORI (2020) *How does the world view climate change and Covid-19?*

¹⁷⁹ BEIS (2020) *BEIS Public Attitudes Tracker (March 2020, Wave 33, UK).*

¹⁸⁰ Yougov (2020) *Top issues; What sector should the UK government spend more on?*

¹⁸¹ Necker, S. & M, Ziegelmeyer. (2014) *Household Risk Taking after the Financial Crisis.*

These changing attitudes will affect future government climate policy. Individuals may be more willing to accept changes that decrease our exposure to climate risk, improve public health, and have benefits to the natural environment. Government bodies in charge of health and the natural environment can take a more active role in climate policy development that also has health and natural environmental co-benefits, such as active travel, extent of and access to green space, air quality and healthier diets.

Box 5.3. Climate Assembly UK: COVID-19, recovery and the path to Net Zero

"I am very concerned that the COVID-19 pandemic will push the Net Zero target further down the agenda of public policy and this should not be allowed to happen. Net Zero should be at the forefront of the policy priorities going forward and should be woven in to each aspect of the recovery. The benefits of doing this (and the risks of not doing this) should be emphasised to the public and every opportunity so that individuals and employers should also make the best decisions when returning to 'normal' life."

In June 2019, six Select Committees of the House of Commons called a citizens' assembly to understand public preferences on how the UK should tackle climate change. Its 110 members were selected through a 'civic lottery' to be representative of the UK population. The final report 'The path to Net Zero', due later in 2020, will consider how the UK can meet the Government's legally binding target to reduce greenhouse gas emissions to net-zero by 2050.

The final meeting of the assembly was moved online due to the pandemic, and split into shorter sessions across three further weekends in April and May 2020. The assembly was able to discuss COVID-19 and possible links and considerations for climate change, and reported their findings in an interim briefing paper:

- **Lifestyle change.** Assembly members discussed whether or not they felt government, employers and others should take steps as lockdown eases to encourage lifestyles to change to be more compatible with reaching Net Zero. In total 93% of assembly members strongly agreed or agreed that such steps should be taken. Key themes of discussion included: working from home; changes to how we travel; taking the opportunity to create change; and the role of the Government and businesses in promoting positive changes in behaviour.
- **Economic recovery.** Assembly members discussed whether or not they felt steps taken by the government to help the economy recover should be designed to help achieve Net Zero. In total 79% of assembly members strongly agreed or agreed that this should be the case. 9% disagreed. Key themes included limits or conditions to investment in high-carbon industries, rethinking and investing in infrastructure; supporting low-carbon industries; the economic opportunities of Net Zero; taking the opportunity to create change; and the need to tackle COVID-19 and climate change together. In places, this was caveated with cautions around uncertainty and ensuring that actions do not hinder an economic recovery.

Source: Climate Assembly UK (2020) *COVID-19, recovery and the path to Net Zero*.

3. The economics of a resilient recovery

In May 2020, the Committee reconvened its Expert Advisory Group on the Costs and Benefits of Net Zero to consider the macroeconomics of the pandemic and the role of climate change measures in supporting a recovery (Box 5.4). The Group was clear that climate policy should play a central role in the efforts to rebuild from COVID-19.

Building on the evidence provided by the advisory group, we conclude that policies to recover from the pandemic should stimulate confidence in the short run while building productive capacity in the long run:

- In the short term, with the economy operating well below capacity, action by Government must protect workers and businesses, restore confidence, stimulate spending and rebuild the economy. These goals can be strongly complementary to the UK's climate goals.
- For the long term, the UK must invest in key assets to build capacity and enable productive activity in the future. This means investing in climate-resilient low-carbon infrastructure, training and reskilling, knowledge, and natural, social and institutional capital. Public money spent now should not support industries or infrastructure that is not consistent with the future Net Zero economy.

There is strong evidence that a wide range of low-carbon and climate change adaptation 'green stimulus' measures fulfil both of these criteria (Table 5.1):

- In the short run, green stimulus policies can be economically advantageous compared to traditional fiscal stimuli. They tend to have higher short run multipliers and higher numbers of jobs created¹⁸² and domestic construction projects, (e.g. insulation retrofits or building wind turbines) are less susceptible to offshoring.¹⁸³ Most measures - including peatland restoration, tree planting and improving the condition of green spaces - have high benefit:cost ratios with multiple co-benefits for health and the natural environment as well as the economy.
- In the long run, investments in low-carbon and adaptation technologies can lower costs and help to accelerate deployment and innovation in a 'virtuous reinforcing cycle'. This has been seen in wind, solar and possible battery technology, where costs have fallen rapidly with increasing scale (chapter 2, section 2). This needs to be seen with more emerging technologies, including adaptation technologies such as passive cooling, sustainable urban drainage and property-level flood protection. The long-run benefits from these investments stem from a transition to a low-carbon, highly-efficient and more resilient economy, with productivity and efficiency benefits that pass through to the wider economy. We know low-carbon and climate adaptation investments are consistent with a future net-zero economy; investments in the fossil fuel industry or petrol/diesel car manufacturing would have to be reversed in future.

The 'green' stimulus measures that were introduced in the wake of 2008-09 global financial crisis accounted for only 16% of the total global stimulus at the time.¹⁸⁴

¹⁸² Studies evaluating green packages in the wake of the 2008-09 financial crisis found that green projects, such as renewable energy infrastructure lead to higher numbers of jobs created compared with traditional stimulus. M. Jacobs (2012) *Green Growth: Economic Theory and Political Discourse*.

¹⁸³ Allan, J., Donovan, C., Ekins, P., Gambhir, A., Hepburn, C., Robins, N., Reay, D., Shuckburgh E., and Zenghelis, D. (2020). *A net-zero emissions economic recovery from COVID-19*. Smith School Working Paper 20-01.

¹⁸⁴ Robins, N. et al (2010). *Delivering the Green Stimulus*. HSBC Global Research, New York, 9th March.

A decade later, the UK can be much more ambitious with investments in low-carbon measures, as the options are now cheaper and more readily available, while the risks of stranded high-carbon assets are much higher.¹⁸⁵

Overall, the Committee recommends that investments in low-carbon and climate adaptation infrastructure must be at the heart of measures to restore economic growth following COVID-19.

Box 5.4. Advisory Group on the Costs and Benefits of Net Zero: COVID-19

The Committee established an advisory group on the costs and benefits of Net Zero to provide key evidence for our 2019 Net Zero advice. The Committee asked the group to reconvene in May 2020 and revisit their advice in light of the COVID-19 crisis and its wide-ranging economic impacts.

The supplementary report produced by the Group reiterates their previous recommendations, and concludes that if the 2050 Net Zero target is to be reached at least-cost it is imperative that net-zero policy guides the post-COVID-19 recovery.

The Group also provides new evidence on the resource costs and co-benefits of decarbonisation. It notes continued downward trends in the costs of wind, battery and solar photovoltaic technologies over the last year, and highlights the potential for fossil fuel importing countries like the UK to avoid volatilities in the oil market through the secure supply of low-cost renewables. The Group raises the possibility that the phrase ‘cost of abatement’ could become redundant when abatement of carbon emissions through zero-carbon electricity is actually the cheapest way of delivering energy services.

The new macroeconomic circumstances and principles for the recovery

As part of the Group’s report, individual members contributed supporting annexes.

Annex 1 sets out the new macroeconomic circumstances facing the UK economy following the pandemic and argues that the priority is to restore confidence and channel public and private funds to productive investment. It sets out principles for a recovery across fiscal policy; recovery and investment; monetary policy and liquidity; and guiding long-run expectations.

Annex 2 identifies the key criteria for stimulus that supports both economic recovery and energy transition as: having a material impact in increasing the productive capacity of the economy and stimulating wider economic activity; starting to have an impact within a relatively short period (12-24 months); being time-limited and project-specific; and being administratively easy to implement. This section further identifies four broad categories of green stimulus that fit these criteria:

- **Public investment programmes**, to stimulate economic activity in the near term and enhance the capacity of the economy to grow in the longer term.
- **Fiscal incentives**, to stimulate specific clean-energy investments, technologies, and products.
- **Targeted business support** to the hardest-hit sectors of the economy.
- **Leveraging in private investment**, in strategic sectors, by using the long-term strength of government balance sheets to reduce risks and capital costs for private investment in energy transition-critical infrastructure and technologies.

The section ends with suggested areas for post-COVID-19 investment: offshore wind, carbon capture and storage (CCS), transition of the oil and gas industry to clean energy production; close-to-market green technologies, such as floating offshore wind or advanced aviation biofuels;

¹⁸⁵ Allan, J., Donovan, C., Ekins, P., Gambhir, A., Hepburn, C., Robins, N., Reay, D., Shuckburgh E., and Zenghelis, D. (2020). *A net-zero emissions economic recovery from COVID-19*. Smith School Working Paper 20-01.

Box 5.4. Advisory Group on the Costs and Benefits of Net Zero: COVID-19

electric vehicle infrastructure; natural capital including restoration of carbon-rich habitats and climate-friendly agriculture.

Annex 3 sets out five principles for a COVID-19 recovery that is aligned to net-zero: prioritise public spending and policy on low-carbon programmes; deliver on existing fiscal commitments from the Budget to leverage investment and cut emissions; stimulate a green recovery through smarter regulation and clear policy; build a green economic recovery into plans to support companies recovering from the pandemic; coordinate a global response to the climate crisis.

The annex further identifies priority actions against each of those principles across the economy, including: energy efficiency and heat; renewable electricity; electric vehicles; CCS; carbon pricing; low-carbon infrastructure; low-carbon conditions on bail-outs; skills and retraining; and international leadership.

The report concludes:

'The Advisory Group was asked to reflect on whether the economic circumstances consequent on and subsequent to COVID-19 are likely to have affected the Group's conclusions in its 2019 Report, as set out in Section 2. Our conclusion is that, if anything, our recommendations from that Report have been reinforced by events since.'

'The climate science has not changed, justifying the pursuit of a 1.5 °C target. Low-carbon electricity and storage have become significantly cheaper. So have fossil fuels for the moment, of course, but the volatility of oil markets gives little confidence that this will persist over the recovery. There is now a much greater economic rationale for substantial public investment, and the right measures to crowd in private investment, than there was then. This paper has identified in more detail than the earlier report the options for investment that can be justified in terms of both contributing to the economic recovery and reducing emissions. Without explicitly stimulating the recovery in this direction, there is every likelihood that the economy will grow back into its old, high-carbon trajectory, investments in inappropriate infrastructure will be made, and this will either need to be scrapped at some cost before the end of its life, or the Government's statutory GHG emission reduction target will be missed.'

'COVID-19 has been a terrible tragedy, but the economic recovery from it gives the UK a chance to grow back in a way that is fit for the low-carbon future to which it aspires, and that can benefit from the industrial and economic developments that this future offers. It would be a double tragedy from the COVID nightmare if this opportunity were missed.'

Source: CCC Costs and Benefits Advisory Group supplementary report, available at www.theccc.org.uk

Notes: The group was chaired by Prof. Paul Ekins (UCL) and included Mallika Ishwaran (Shell), Rain Newton-Smith (CBI), Philip Summerton (Cambridge Econometrics), Prof. Karen Turner (University of Strathclyde) and Dimitri Zenghelis (UCL). Prof. Nick Robins (LSE) also attended the meeting to advise on green finance, on which he is chairing a separate advisory group to inform the Committee's Sixth Carbon Budget advice.

Box 5.5. Lessons from the global financial crisis

Caution is needed in drawing comparisons with previous recessions, given the very different circumstances of the COVID-19 crisis and the 2009 global financial crisis. Nevertheless, there are lessons that can be learnt from 2009 around the nature of recovery:

- **Green stimulus measures played a limited role in 2009, but tended to perform well.** Studies evaluating the green packages involved in the recovery from the financial crisis, such as renewable energy infrastructure, have shown that such measures create a higher number of jobs in comparison to traditional stimulus and over the long term can achieve cost savings.¹⁸⁶ Construction projects too, such as insulation retrofits, have advantages over alternative stimulus measures, in particular the fact that they more reliably result in domestic economic activity rather than stimulating activity overseas. Even putting climate change aside, the financial crisis has shown that there is a pragmatic case for prioritising low-carbon and adaptation investments for recovery.
- **Carbon-intensive investments would “lock-in” future climate change, and need to be reversed.** In the wake of the financial crisis, global governments embarked on a variety of green stimulus programmes which amounted to 16% of the total public stimulus, but global subsidies for carbon-intensive industries also continued. Global greenhouse gas emissions quickly rebounded and returned to growth at rapid rates by 2010.¹⁸⁷ Green packages must make up a far higher percentage of stimulus in the wake of COVID-19, to ensure that fossil fuels are not extended beyond their natural commercial life. It is important that fiscal measures that are not explicitly ‘green’ do not make achieving climate change goals more difficult by subsidising greenhouse gas emissions or locking in high-carbon or non-climate-resilient infrastructure for decades to come.
- **Green stimulus must not be followed by green austerity.** The green stimulus money in the wake of the financial crisis was welcome. However the years following cut back public investment into many green activities. If green investments are accelerated, this must not come at the cost of investable and sustained medium-term support.
- **The terms of debt or equity associated with bailouts are important levers.** The Government may have to bail out large organisations, and should consider the terms of its debt or equity. After the financial crisis, the Government took equity stakes in large financial institutions, and still holds much of this stake today (e.g. the Government is still a majority shareholder in RBS). Should the Government make similar bail outs in the coming months, it is likely that it will have a relationship with these companies for many years to come. Using this relationship to promote transition has the potential to be a powerful lever on a Net Zero trajectory.

4. Principles for a resilient recovery

The UK faces a 'resilience deficit' where we are underprepared for even the minimum level of expected impacts of climate change and do not yet have strong plans in place to reduce greenhouse gas emissions to net-zero across the economy. Measures to reduce greenhouse gas emissions and adapt to climate change can support the recovery from COVID-19. It is essential to reset planning across Government for Net Zero and to build better resilience headroom to the climate risks.

¹⁸⁶ Allan, J., Donovan, C., Ekins, P., Gambhir, A., Hepburn, C., Robins, N., Reay, D., Shuckburgh E., and Zenghelis, D. (2020). *A net-zero emissions economic recovery from COVID-19*. Smith School Working Paper 20-01.

¹⁸⁷ Peters, G., Marland, G., Le Quéré, C., Boden, T., Canadell, J., & Raupach, M. (2011). *Rapid Growth in CO₂ Emissions after the 2008–2009 Global Financial Crisis*. *Nature Climate Change*. 2. 2-4. 10.1038/nclimate1332.

In May 2020 we wrote to the Prime Minister and the First Ministers of the UK setting out six principles for a resilient recovery.

1. Use climate investments to support the economic recovery and jobs.

There is a detailed set of investments needed to reduce emissions and manage the social, environmental and economic impacts of climate change. Many are labour-intensive, shovel-ready, spread geographically across the UK and will have high multiplier effects. Government can act to bring these investments forward, often without direct public funding or by co-financing to accelerate private investment, as part of a targeted and timely stimulus package with lasting, positive impacts (Section 4.5).

2. Lead a shift towards positive long-term behaviours.

There is an opportunity to embed the new social norms, especially for travel, that benefit well-being, improve productivity, and reduce emissions. Government can lead the way through its own operations (e.g. encouraging home working and remote medical consultations), through public communications and through infrastructure provision (e.g. prioritising resilient broadband investments over the road network, improving safety for cyclists), and investing in measures to facilitate social distancing on public transport.

3. Tackle the wider 'resilience deficit' on climate change.

This crisis has emphasised the importance of evidence-led preparations for the key risks facing the country. Comprehensive plans to reduce emissions and to prepare for climate change are not yet in place. Strong policies from across government are needed to reduce our vulnerability to the destructive risks of climate change and to avoid a disorderly transition to net-zero. Business must also play its part, including through full disclosure of climate risks. Plans must be implemented alongside the medium-term response to COVID-19 and will bring benefits to health, well-being and national security.

4. Embed fairness as a core principle.

The crisis has exacerbated existing inequalities and created new risks to employment in many sectors and regions, placing even greater priority on the fair distribution of policy costs and benefits. The response to the pandemic has disproportionately affected the same lower-income groups and younger people who face the largest long-term impacts of climate change and will be most affected by the transition to a net-zero economy. The benefits of acting on climate change must be shared widely, and the costs must not burden those who are least able to pay or whose livelihoods are most at risk as the economy changes. It is important that the lost or threatened jobs of today should be replaced by those created by the new, climate-resilient economy.

5. Ensure the recovery does not 'lock-in' greenhouse gas emissions or increased climate risk.

It is right that actions are taken to protect jobs and industries in this immediate crisis, but the Government must avoid 'lock-in' to higher emissions or increased vulnerability and exposure to climate change impacts over the long term. Support for carbon-intensive sectors should be contingent on them taking real and lasting action on climate change, and new investments should be resilient to climate change.

6. Strengthen incentives to reduce emissions when considering fiscal changes.

Changes in tax policy can aid the transition to net-zero emissions. Many sectors of the UK economy do not currently bear the full costs of emitting greenhouse gases. Revenue could be raised by setting or raising carbon prices for these sectors, and low global oil prices provide an opportunity to offset changes in relative prices without hurting consumers. The UK's future carbon pricing mechanism should be designed to ensure that an appropriate price for carbon is maintained even in times of external shocks, for example through a well-designed floor price (Box 5.6).

Box 5.6. Carbon pricing after EU exit

Since 2005, the UK has been a member of the EU Emissions Trading System (EU ETS), widely recognised as a flagship emissions trading policy around the world. The UK also taxes carbon in the power, industrial and business sectors. Leaving the EU presents an opportunity for the UK to align the ambition of its trading scheme to the UK's own circumstances. Furthermore, carbon taxation can drive decarbonisation whilst providing a source of revenue to Government.

- The Government has proposed a UK ETS, intended to link directly to the EU's ETS in future. The Committee agreed with this preference in its advice to Government in August 2019, citing the benefits of increased liquidity and the protection around competitiveness of being part of a larger scheme.
- The Government has committed to this UK ETS being more ambitious than the EU scheme from the start and to revising it to align to the net-zero pathway after the Committee advises on that pathway in December:
 - The UK's share of the EU ETS was expected to be higher than its actual emissions for the foreseeable future. The cap of the linked UK ETS should be set based on the cost-effective path to the UK's new net-zero target. We will provide that trajectory in our advice on the Sixth Carbon Budget (covering 2033-2037).
 - The proposed UK ETS covers emissions from the power sector, large industrial facilities, domestic aviation and flights to Europe. In principle the scope of the scheme could be extended to include nearly all UK GHG emissions. For example, our recent recommendations on agriculture and land use identified the importance of private funding to pay for increased afforestation. That could be achieved by including forestry in the UK ETS (with a tightened cap or alongside emissions from e.g. fossil fuel supply and international aviation). Inclusion of greenhouse gas removals more widely could also be appropriate.
- Several commentators, including our Advisory Group (Box 5.4) have noted that the fall in oil and gas prices as a result of the COVID-19 pandemic has led to a divergence in relative carbon prices across the economy. Introducing carbon pricing can both incentivise low-carbon behaviour and raise revenue for the Exchequer at a time when public finances are extremely stretched (Table 5.2).

However, carbon pricing alone will not provide sufficient decarbonisation to achieve the UK's Net-Zero objective. Whilst carbon pricing is essential it needs to be used as part of a suite of policy instruments, as confirmed by real-world experience internationally.

Source: CCC (2019) and CCC (2020) *Letters on the future of carbon pricing*.

5. Climate policies to deliver a resilient recovery

a) Growing evidence supporting the merits of a green stimulus

Recovery packages, in the UK and elsewhere, following the 2008-09 global financial crisis, included only a relatively small share of green investments. There is now a growing evidence base (Table 5.1) to support that there is a wide range of such investments which can be delivered in a timely way, with significant multiplier effects for growth and jobs. Many would be targeted at, or could be designed to be initially targeted at regions or sectors which have been most affected, in economic terms, by COVID-19.

Table 5.1. Supporting evidence for green stimulus policies	
Source	Evidence
Advisory Group on the Costs and Benefits of Net Zero for the CCC (2020) <i>Supplementary report</i> . www.theccc.org.uk	The Committee established an advisory group on the costs and benefits of Net Zero for our 2019 Net Zero report. The Committee has asked the group to reconvene and update their advice in light of the COVID-19 pandemic. The report contains three Annexes giving evidence in support of a low-carbon recovery and recommendations for delivery (Box 5.4).
Global Commission on Adaptation (2019) <i>Adapt Now: A global call for leadership on climate resilience</i> Source	This report, published prior to the COVID-19 pandemic, suggests adaptation actions bring multiple benefits (a triple dividend): avoided losses; economic benefits; social and environmental benefits. Making infrastructure more climate-resilient is estimated to add only a small amount to upfront costs (around 3 percent), but have benefit-cost ratios of about 4:1.
New Economics Foundation (2019) <i>Recession Ready: A green plan to beat tomorrow's downturn</i> Source	Published prior to the COVID-19 pandemic, this report makes the case for a large green stimulus element within the policy response to the next recession. It proposes criteria to assess potential components of such a package, including: length of lead-in time; absence of barriers to implementation; sequencing requirements (some measures being required to enable others); employment and GVA multipliers; level of emissions abatement; resource cost. Based on assessment against such criteria, measures ranking highly to take forward are: home insulation; EVs and charging network; flood defence and drought resilience; wind and solar; transmissions and distribution infrastructure; reskilling and training; tree planting; walking, cycling and bus infrastructure.
World Bank (2020) <i>Thinking ahead: For a sustainable recovery from COVID-19</i> . Source	Identifies a draft sustainability checklist for contributing to recovery: activate economic stimulus and job creation within 18 months; enable inclusive growth prospects and enhanced resilience beyond 18 months; promote decarbonisation and sustainable growth.
Ecuity Consulting for the Local Government Association (2020) <i>Local green jobs - accelerating a sustainable economic recovery</i> . Source	Provides analysis of the types of jobs required for a net-zero economy in England, where these will be located, and the role that local government could play working with industry to address skills demands. Identifies nearly 700,000 jobs that will be needed in England by 2030, the majority of which are in low-carbon electricity generation (23%), providing low-carbon heat for homes and businesses (23%), and energy efficiency products (21%).

Table 5.1. Supporting evidence for green stimulus policies

Source	Evidence
<p>Hepburn, C., O’Callaghan, B., Stern, N., Stiglitz J., and Zenghelis, D. (2020) <i>Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?</i> Smith School Working Paper 20-02. Source</p>	<p>Surveys 231 central bank and finance ministry officials, and other economic experts from G20 countries, on the relative economic performance of 25 major fiscal recovery archetypes across 4 dimensions: speed of implementation; economic multiplier; climate impact potential; overall desirability.</p> <p>Identifies five policies with high potential on both economic multiplier and climate impact metrics: clean physical infrastructure; building efficiency retrofits; investment in education and training; natural capital investment; and clean R&D.</p>
<p>Allan, J., Donovan, C., Ekins, P., Gambhir, A., Hepburn, C., Robins, N., Reay, D., Shuckburgh E., and Zenghelis, D. (2020). <i>A net-zero emissions economic recovery from COVID-19.</i> Smith School Working Paper 20-01. Source</p>	<p>Sets out an economic argument for using the net-zero transition to contribute to the economic recovery from COVID-19. Identifies measures with high short-term economic impact offering long-term structural change in decoupling greenhouse gas emissions, potential to “level up” and address regional and intergenerational disparities, as affected workers are retrained, and infrastructure/environmental assets improved.</p> <p>Details ten policy recommendations to support the recovery (Energy generation, storage, and distribution; reducing industrial emissions; R&D; climate-smart infrastructure; broadband connectivity; nature-based solutions; electric vehicle conversion; home renovations and retrofits; education and training; conditional bailouts).</p> <p>Provides recommendations on delivery bodies and financial institutions.</p>
<p>IPPR (2020) <i>Faster, Further, Fairer: Putting people at the heart of tackling the climate and nature emergency.</i> Source</p>	<p>The report identifies nine criteria for a resilient recovery: sufficient scale; environmental benefits; promote local sustainable production and consumption; resilience benefits; job creation; targeted investments; timeliness and feasibility; supporting a transformational second phase of the recovery; fair distribution of costs and opportunities.</p> <p>It then identifies potential projects which can help aid the economic recovery and work towards the UK’s climate and nature goals. (Energy efficiency retrofits; heat pumps for homes; peatland restoration and afforestation; flood defences; EV supply and infrastructure; heat networks; bus and rail networks; green urban transport; hydrogen and CCS infrastructure and supply chains). These measures are ranked by environmental benefits, job creation and timeliness.</p>
<p>Energy Transitions Commission (2020) – <i>7 Priorities to help the global economy recover.</i> Source</p>	<p>Identifies priorities to help the global economy recover while building a better economy – invest in renewable power systems; boost construction via green buildings and green infrastructure; support automotive sector while pursuing clean air; make second wave of government support to business conditional to climate commitments; target support to innovative low-carbon activities; accelerate transition of fossil fuel industry; do not let carbon prices and regulation spiral down.</p>

Table 5.1. Supporting evidence for green stimulus policies

Source	Evidence
<p>Vivid (2020) for WWF <i>Building back a resilient and sustainable economy post COVID-19</i>. Source</p>	<p>Sets out a case for a targeted ‘green stimulus’ that can be more resilient in supporting recovery in the long run than ‘brown’ alternatives and will also improve quality of life.</p> <p>The report identifies up to £90bn of annual benefits to the UK from a net-zero transition, and estimates that investment in low-carbon infrastructure can boost long-term productivity and high returns, as every pound spent on low-carbon investment options returns 3-8 times the initial investment.</p> <p>The report highlights five green investments for economic recovery: green buildings; nature and biodiversity; clean energy infrastructure (especially offshore wind and electricity networks); CCS; electric vehicles and charging infrastructure.</p>
<p>WCL (2020) <i>A green recovery: growing back better</i>. Source</p>	<p>Sets out the interconnections between ecological quality and the economy: healthcare and lost productivity due to poor environmental quality; reliance of critical economic sectors on nature including tourism and food; defence against natural risks including flood and drought.</p> <p>The organisation calls for plans to develop nature in the most nature-deprived areas; habitat creation to lock away carbon and increase resilience; investment in natural assets, like soils and fish stocks; and strong targets for nature, including ocean recovery, reduction in environmental footprint, and species loss.</p>
<p>CBI (2020) <i>Letter to the Prime Minister. Build back better: CBI proposals for a jobs-rich economic recovery</i>. Source</p>	<p>Sets out three principles for the a COVID-19 recovery that is aligned to net-zero: make jobs, skill-building and opportunities for young people the top priority; invest in the green economy to create new jobs, investment and a more sustainable future; kick-start demand and unleash competitiveness.</p> <p>Identifies priority actions against each of those principles across the economy, including programmes to increase skills and employment in low-carbon industries; a national retrofit programme for green homes; investment in green infrastructure including electric vehicles, renewable energy and CCS; investment in broadband; targeted support for sectors and places hardest hit by the crisis; investment in research and innovation and support for scale-up businesses.</p>
<p>Aldersgate Group (2020) <i>Seize the moment: building a thriving, inclusive and resilient economy in the aftermath of COVID-19</i>. Source</p>	<p>Calls for an economic recovery plan with climate and environmental criteria at its core that can deliver key public interest benefits, including: addressing regional inequality and unemployment; strengthening the UK’s economic competitiveness and productivity through investment in the sectors and technologies of the future; delivering critical public goods, including clean air, better health and improved resilience to future environmental shocks; building a more resilient financial system fit to withstand future climate shocks; delivering the Global Britain agenda by strengthening the UK government’s influence ahead of the G7 and COP26 summits.</p> <p>The report provides examples of shovel-ready projects, types of investments and policy interventions which will help deliver these benefits, and recognises that putting the UK on track for net-zero emissions and reversing the decline of the environment can be achieved without being overly reliant on public money.</p>

b) Projects to support a resilient recovery

Approach

In our May 2020 letter to the UK Governments we set out the kind of investments and other actions to be included. This covers measures - both for emission reduction and for adaptation - that should be brought forward and will help to boost the economic recovery through the creation of new jobs, upskilling of the workforce and investing in local areas.

For this report, we have considered a wider set of measures and a wider set of evidence (including those above). We have considered the performance of that wider set of measures against the principles set out in the Committee's letter (Section 4), with our assessments set out in Table 5.2.

- **Criteria.** The columns in Table 5.2 relate to the Committee's six principles for building a resilient recovery.
 - Unsurprisingly all measures perform well on tackling the **resilience deficit** since they are taken from our scenarios to reduce emissions and prepare for climate change.
 - In assessing the potential to **support the recovery** we consider: potential for high multiplier effects; labour intensity of the measure; whether projects are 'shovel ready'. For measures with high multipliers and job-intensity we have broadly differentiated between projects that could be underway within around 12 months (Green) and those which require a lead-in time of two years or more (Amber).
 - In assessing the potential to **shift to positive behaviours** we consider: whether the measure reinforces low-carbon behaviour change, or evidence of values, observed during the COVID-19 lock-down; whether the measure could help accelerate changes in behaviour (such as uptake of new or unfamiliar technologies) required for meeting long-term targets.
 - In assessing the potential to **lock in greenhouse gases or increased risk** we consider whether, in the absence of the measure, alternative investments or purchases would tend to be in carbon-intensive assets.
 - Assessing **fairness** is perhaps hardest. We consider whether the measure would tend to have broadly equal benefits across society or could benefit (or could be targeted to benefit) communities, regions or sectors: hardest hit by the economic impacts of COVID-19; likely to be negatively impacted in the transition away from low-carbon activities; with relatively low levels of income.
 - For the purpose of the sixth principle, the measures are assessed against whether **finance** from public funds has already been announced and whether private finance can be leveraged.
- **Judgement.** The assessment necessarily reflects our own judgements based on the evidence:
 - A "Green" rating means that the measure is assessed as consistent with the principle.
 - An "Amber" assessment means that the measure is broadly consistent with the principle. There may be a mixture of impacts, some positive and some negative; and/or, depending on design or targeting, there may be potential to address negative impacts.

-
- A "Red" assessment would imply largely negative impacts, but such measures are not included in the table.

Findings

Our updated assessment identifies many of the priorities identified in our previous letter and expands on it. Retrofits to improve the carbon performance of homes, commercial and public buildings emerge as a clear win-win, along with preparations for that programme through retraining workers and initiating local area approaches. Investments in natural capital, strengthening energy networks, and supporting active travel all emerge strongly as well.

Key priorities in infrastructure investments include:

- **Low-carbon retrofits and buildings that are fit for the future.**
 - Where the skills to develop these measures already exist, these projects can begin now, are labour-intensive and have direct social benefits of more comfortable buildings leading to improved well-being and health. Local planning and regional approaches are likely to be required in any case to drive delivery initially, providing an opportunity to direct early progress to areas in most need of economic stimulus.
 - New buildings must be low-carbon, energy and water efficient and climate resilient, and green energy 'passports' for existing homes and local energy plans could be rolled out across the UK over the next few years.
 - Moreover, deep retrofits to improve carbon- and water-efficiency and protect against overheating can be provided on a targeted basis, for example for the fuel poor or across social housing.
 - As we emerge from the crisis, supply chains must be developed including the roll-out of heat pumps and heat networks, with further funding for heat pumps off the gas grid to 2025.
 - In the immediate term, bringing forward funding for renovating public sector buildings can set an important standard and cut public energy bills - and targeted support for SMEs to improve energy efficiency can help boost productivity.
- **Natural capital investments: tree planting, peatland restoration and green infrastructure.** Our net-zero recommendations call for landscape-scale change across the UK, targeted initially to where they are needed most. These measures can deliver significant benefits for the climate, biodiversity, air quality and flood prevention. Tree planting and peatland restoration can both bolster carbon sequestration and better prepare our environment for future climate change. The importance of urban greenspace to people has been highlighted by the COVID-19 crisis. Restoring parks, urban tree planting, and supporting the green roof and sustainable drainage industries can help to bolster the UK's slow-growing adaptation services sector.
- **Strengthening energy system networks.**
 - Electricity networks must be strengthened across the UK to accommodate electrification of heat and transport. There is also an urgent need to provide for more orderly and cooperative processes for connecting offshore wind to the national grid when it reaches the shore.

- There is an opportunity for governments, regulators and industry to work together to accelerate new hydrogen and carbon capture and storage (CCS) infrastructure which will be needed to support the next phase of the net-zero transition.
- The cost will need to be borne at some point as part of the net-zero transition in any case and can be recovered through modest increases in customer bills over periods of several decades. The next electricity network price control period should be used by Ofgem and industry to push forward low-regret investments in network capacity.
- Government, regulators, local authorities and industry should work together to establish mechanisms by which en route, destination and on street electric vehicle charging can start to fulfil something approaching a universal service expectation, and accelerate investment in charging points to enable it.
- It may be possible to accelerate plans for renewable power generation if contracts can be awarded quickly enough in a competitive way. These would be helpful for the recovery as such investments have high multipliers, but they do not stand out as a current barrier to progress towards a net-zero economy.
- **Infrastructure to make it easy for people to walk, cycle, and work remotely.** Dedicating safe spaces for walking and cycling, more bike parking and support for shared bikes can be tied to new public attitudes towards walking, cycling and green spaces. These measures can be prioritised in the areas of the UK where investment is needed most. Public transport planning must be consistent with social distancing measures and address new concerns about public health. We should ensure that home working remains a widespread option; higher investment in resilient digital technology including 5G and fibre broadband should therefore be prioritised over strengthening the roads network.
- **Moving towards a circular economy.** If source-separation of wastes is implemented across the nations of the UK, there is an opportunity to increase recycling rates rapidly, and ban the landfilling of biodegradable wastes within five years - a key goal for the waste sector to contribute towards Net Zero. Early support for local authorities to invest in waste collection, re-use and recycling infrastructure is required, including diverting food and garden waste to anaerobic digestion and composting facilities. This will reduce landfilling costs, deliver public health benefits and create jobs across the regions.

There are also opportunities from policies to support the transition required by the workforce, shifts to lower-carbon behaviour and innovation to prepare for future challenges.

- **Reskilling and retraining programmes.** The transition to Net Zero, as well as the response to climate change itself, will require its own key workers. New and updated skills are needed in the transition to Net Zero and to adapt to the changing climate. In particular, new support to train designers, builders and installers is urgently needed for low-carbon heating (especially heat pumps), energy and water efficiency, passive cooling, ventilation and thermal comfort, and property-level flood resilience. The ability of a decarbonised UK manufacturing sector to compete in global markets is dependent on having a labour force with the requisite skills, not only in manufacturing products and materials, but also engineering, procurement and construction management services. If suppressed oil prices continue to affect jobs in the North Sea, we must retrain and redeploy this highly-skilled workforce in the UK's future low-carbon industries, including CCS.

- **Leading a move towards positive behaviours.** Current attitudes and the shared experiences of COVID-19 create a window for Government to reinforce the climate-positive behaviours that have emerged during the lockdown, including increased remote working, cycling and walking. Public sector leadership can play a key role in the forming of new social norms and expectations, for example by encouraging remote working and customer service (e.g. consultations in the NHS) in the public sector, through procurement strategies and through public communications.
- **Targeted science and innovation funding.** Research and innovation in low-carbon and adaptation technologies is crucial for achieving our climate goals, the development and diffusion of technologies and supply chains in the UK and internationally, and driving costs down. The importance of research to understand fully the threats and learn how to manage them has also been highlighted by the COVID-19 crisis.

The UK Government has already indicated an intention to deliver a large-scale national infrastructure programme. Many of these projects are critical to preparing for climate change and achieving net-zero emissions. Their acceleration is a priority.

Table 5.2.a Recommended measures to support a resilient recovery - buildings efficiency

	Tackle the resilience deficit	Support the economic recovery and jobs	Shift towards positive long-term behaviours	Do not lock in GHGs or increased risk	Fairness	Finance
Housing retrofits (energy efficiency)	Substantial emissions and water saving potential; protection against over-heating; current number of measures well below requirement to meet Govt. target of all houses EPC Band C by 2035	Can begin now (short lead-in time); labour intensive; geographically distributed	Reduced energy use; greater appreciation of comfort as more time spent at home during lockdown	Quality control issues now managed under TrustMark scheme	Improved well-being and health; can start with fuel poor and social homes; reduced energy use	Finance mechanism needed, but need not add to bills. Potential to leverage private money, but public investment key
Low-carbon new homes (i.e. building homes now to the proposed 2025 standards)	Substantial potential to save emissions and water – scheme must be limited to zero-carbon homes and designed to protect against over-heating. Emissions in construction	Can begin now (short lead-in time); labour intensive; geographically distributed	Opportunity to facilitate sustainable transport choices, and green spaces, and acceptance of low-carbon heating solutions	Building new homes to inadequate standards now will require retrofit later. If weak compliance, emissions could be locked in	Reduced running costs; immediate benefit only to new home buyers	Small increase in build costs can be passed onto housebuilders; reduced running costs for occupants could encourage other spending
Small business energy efficiency scheme	Clear case set out in recent government consultation	Strong recovery benefits and multiplier effect	Businesses looking to cut costs can take behavioural measures to cut energy use	Quality control must avoid poor installations	National level, largest sector impacted is industrial	Options are set out in recent consultation; some are revenue-neutral

Table 5.2.b Recommended measures to support a resilient recovery - low-carbon heating

	Tackle the resilience deficit	Support the economic recovery and jobs	Shift towards positive long-term behaviours	Do not lock in GHGs or increased risk	Fairness	Finance
Low-carbon heating - heat pumps	Annual installations well below required level	Significant scope to increase deployment within current budget; but medium-term expansion supply-chain will be required, and measures to promote consumer demand	Opportunity to increase awareness needed to accelerate required shift away from fossil-based heating systems	Alternative replacement heating systems predominantly gas or oil	Start with homes off-gas grid, social housing and area-based schemes - potential to target areas most affected by job losses	Needs significantly more funding than currently allocated
Low-carbon heating - district heating	Current growth well below required level	Pipeline of early projects exists	Opportunity to increase awareness	Would need to focus on zero-carbon heat sources (i.e. not gas CHP or biomass)	Urban focus - but could potentially target lower-income areas or those most affected by job losses	Some funding already in place along with pipeline
Local area plans & green passports	Needed to broaden buy-in and begin progress	Could be directed to areas in need of stimulus support first. Small scale initially, but can follow up with identified measures	Builds on sense of community during lockdown and buy-in to required changes	Supports the right choices for the local area	Involves local people in energy decisions; can target fuel poverty as well as emissions	Relatively low cost and could be recouped from network charges

Table 5.2.c Recommended measures to support a resilient recovery - natural capital

	Tackle the resilience deficit	Support the economic recovery and jobs	Shift towards positive long-term behaviours	Do not lock in GHGs or increased risk	Fairness	Finance
Tree planting	Landscape-scale change needed to increase UK forestry cover to at least 17% by 2050 for Net Zero. Also an important adaptation measure for shading, natural flood management and improving habitat condition	Start can be made quickly; can be scaled-up with supply chain expansion and further identification of low-risk areas for planting	Recreation and health benefits. May be more valued after COVID-19 experience	Very important that the right trees are planted in the right place at the right times - climatic conditions now and in the future need to support growth	National level; likely increased access benefits	Funding required initially; potential for joint public-private contributions
Peatland restoration	Significant upland and lowland restoration (and sustainable management) needed due to high risk of climate impacts. Wider benefits for recreation, water quality biodiversity.	Start can be made quickly; can be scaled-up with supply chain expansion	Recreation and health benefits	Risk more peatland areas lost with climate change impacts without restoration actions	Social benefits, but limited evidence on distribution	Funding required initially; potential for joint public-private contributions
Urban green spaces	National decline in urban green spaces needs to be reversed	Potential for job creation and industry growth in creation and maintenance, though not currently quantified	Importance highlighted by COVID-19 experience	Development on existing green spaces in urban areas risks irreversible loss	Scope to address lower access in more deprived areas	Needs funding

Table 5.2.d Recommended measures to support a resilient recovery - national low-carbon and adaptation infrastructure

	Tackle the resilience deficit	Support the economic recovery and jobs	Shift towards positive long-term behaviours	Do not lock in GHGs or increased risk	Fairness	Finance
Infrastructure - flood defences	Ambitious flood policy is needed to prevent a doubling of flood risk due to climate change	£5.2 billion investment announced earlier in the year could be front-loaded	Increased investment in infrastructure needed alongside community engagement and awareness raising	Carbon footprint of flood defence schemes relatively small and EA looking to lower further	Residents of more disadvantaged areas tend to have relatively high exposure to flood risk - changes to partnership funding rules should help to address this	Funding for the next 6 years already agreed
Infrastructure - Low-carbon Hydrogen	Demonstration required early 2020s; industrial clusters from mid-2020s	Will require some time to prepare - for second wave of investments	Facilitates change	Would need low-carbon source of production	Locations likely overlap areas most affected by job losses	Some funding required, but also potential to unlock private finance
Infrastructure - CCS	Industrial cluster required from mid-2020s	Will require some time to prepare - for second wave of investments	Facilitates change	Required for long-term decarbonisation of industry and delivering blue hydrogen	Locations likely overlap areas most affected by job losses	Some funding required, but also potential to unlock private finance
Infrastructure - electric vehicle charge-points	Rapid ramp-up of charge points required in 2020s; help address air quality issues	High skilled jobs, geographically distributed, supply chain scaling up.	Crucial to support rapid EV take-up and to address charging anxiety; support improved air quality	Speed up transition from conventional vehicles	Can be scaled up evenly or targeted to ensure benefits of EV transition available to those who can't charge at home; ease UK manufacturing transition to EVs	Available Govt. funding targeted at strategic road network; further funding required elsewhere, but opportunity to leverage additional private sector finance
Low-carbon power - wind; solar	Around 60TWh low-carbon generation , on top of offshore wind deal, required by 2030	High jobs multiplier short-term; helps drive down costs and increase long-term productivity. Delay between auction and time of construction.	Facilitates change in transport and heat markets	Alternative investment in generation capacity likely more carbon-intensive	Low-cost generation; solar PV could be targeted to areas most affected by job losses	Low-cost generation; long-term contracts required
Electricity networks	Accommodate electrification of heat and transport	Early anticipatory investment could avoid higher costs later	Facilitate change in transport and heat markets	Without reinforcement low-carbon generation will not be accommodated	Regulatory decisions impact how network upgrades paid for; but have potential to improve fairness	Some funding required

Table 5.2.e Recommended measures to support a resilient recovery - local infrastructure, skills and training

	Tackle the resilience deficit	Support the economic recovery and jobs	Shift towards positive long-term behaviours	Do not lock in GHGs or increased risk	Fairness	Finance
Reskilling and retraining programmes (e.g. agro-forestry, heat pump installation)	Skills gaps in many sectors (e.g. critical to buildings decarbonisation)	Immediate opportunity with underemployed workforce, but could take some time to set up. Big impacts when up and running	Structure of economy needs to shift towards low-carbon jobs	Without retraining, old supply activities remain entrenched	Can start in areas most affected by job losses associated with COVID-19 and move away from fossil fuels	Some funding required, but also potential to unlock private finance
Separate waste collections and new recycling, anaerobic digestion (AD) & composting facilities	Recycling targets and stopping the landfill of biodegradable waste by 2025 both require alternative waste treatment facilities	Some projects ready to go; others need identification via local authorities	Encourages reduction in waste, more re-use, local sharing, repair and recycling (circular economy)	Increased reuse & recycling needed to prevent lock-in of fossil emissions from waste incineration	Regional needs differ due to starting position; actions would lead to greater equality in regional waste services	Investment via local authorities required
Walking, cycling and remote working	Expansion required for net-zero. Additional benefits are reduced congestion, improved health, air quality, noise reduction	Need to identify locations, but local authorities well-placed to do this quickly	Build on change in behaviour observed in lock-down. Health and air quality benefits	Reduce car use; alternative to more road investment	Can be prioritised in areas where needed most, or to encourage take-up from particular groups.	Some further funding required

c) Ensuring the recovery does not lock in new climate risks

Beyond the measures in the previous section, there are a number of specific actions to improve resilience to climate risks that will be needed. These include:

- Risk assessments for a changing climate. The recovery from COVID-19 will only be resilient overall if it is resilient to current and future climate change impacts. All new investment decisions that are part of the recovery package, whether or not they are 'green' investments themselves, should include an assessment of the risks from climate change and appropriate adaptation measures put in place to safeguard these investments.
- The Government should consider reviewing its methodology for assessing risk through the UK National Risk Assessment, which includes the risk from global pandemics as well as climate-related risks. The Committee will comment on how the Government approaches its assessment of risk for climate change in the Third UK Climate Change Risk Assessment Evidence Report, due out next year.
- A proportion of the agreed five-year £5.2 billion investment in flood defence spending should be brought forward to front-load local schemes that are ready to be implemented.
- The investments to reduce water demand should be implemented as outlined in the Final Determinations for water companies by Ofwat in 2019.

Taking these actions will help to address the resilience deficit that currently exists in relation to climate change. The recovery package must also avoid taking actions that would lock in high emissions or high-carbon activities. Other countries have attached conditions to bail-outs of high-carbon industries to require a shift to lower-carbon business models:

- **France.** The €7 billion bailout of Air France is subject to several environmental conditions, though the penalties for non-compliance are still unclear. This includes achieving a 2% use of alternative fuels by 2025, and the stipulation that Air France achieves a 50% reduction in domestic flight CO₂ emissions by 2025. The French Government indicated that this will mean that only passengers who are transferring to another flight will be allowed to use domestic Air France routes that can be serviced by rail in less than 2.5 hours. The bailout also enforces the same efficiency target (50% improvement in tCO₂ per person-km by 2030, compared to 2005 levels) that Air France voluntarily committed to in October 2019.¹⁸⁸
- **Germany.** Unlike in 2009, when the German automotive sector received financial aid in the form of purchase incentives, no money has been allocated to combustion-engine vehicles in Germany's €130 billion recovery package. Support has instead been targeted at low-carbon areas of the automotive sector. Manufacturers and purchasers of electric vehicles (EVs) will be supported by doubling existing subsidies on electric vehicles, with a combined €8 billion for supply and demand of EVs.¹⁸⁹ In addition to support for EVs, the German Federal Government has invested a combined €40 billion into measures that can support a transition to a low-carbon energy system, including €9 billion for low-carbon hydrogen, over €7 billion for rail and public transport, and €2 billion for buildings renovations.

¹⁸⁸ FlightGlobal (2020) *French government sets green conditions for Air France bailout.*

¹⁸⁹ Federal Government of Germany (2020) *Economic stimulus package 'An ambitious programme'.*

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- **Canada.** Large businesses (with revenues above \$300 million), that apply for Government loans, must publish Annual Climate Disclosure Reports based on the Task Force on Climate-related Financial Disclosures (TCFD) Framework,¹⁹⁰ including commentary on how their future operations will support environmental sustainability and national climate goals.

With careful decisions now, the Government can help drive the recovery and accelerate the transition of UK employers towards actions consistent with the net-zero economy.

d) Institutions, delivery bodies and finance

Delivering the programme of recovery measures required over the next couple of years, consistent with the longer-term requirements of the transition to net-zero emissions, raises a number of questions about whether the necessary institutional framework exists to develop and manage the scale of change that is needed:

- **The Cabinet Committee on Climate Change** should play a central role in rebuilding the economy. The impacts of COVID-19 have been felt across the economy, and the measures needed to meet Net Zero also cross all sectors and regions. The Cabinet Committee must play a comprehensive and leading role in ensuring economic recovery is achieved consistent with the requirements of Net Zero and ensuring resilience to climate change. The Secretary of State for Health and Social Care should be a regular attendee, if not a member, given the resilience and health requirements that must be a central part of the recovery programme.
- **Delivery.** Taking the programme of recovery measures forward will be a huge task. Design of specific measures will rest with the appropriate lead department, but delivery will require co-ordination and actions across the nations and regions of the UK, in conjunction with local authorities, business/industry and regulators. It has been suggested¹⁹¹ that a Net Zero Delivery Body be established, led by BEIS and including representatives from each of these actors, to take this lead responsibility. The Committee has not taken a view on the best delivery vehicle, but it is essential that there should be a robust and co-ordinated structure in place.

The role of the Treasury will also be crucial. The programme will inevitably require public finance, but policy design will need to consider how private finance can best be leveraged. Beyond this, responding to our recommendation in our Net Zero Report, the Treasury has launched a review of how the transition to Net Zero should be financed and where the costs should fall, originally scheduled to be published in the autumn.

The UK Government and devolved administrations have recently (June 2020) announced their intention to establish a UK Emissions Trading System from 2021. They have announced that possible extensions of scope (beyond energy-intensive industries, power generation and aviation) will be considered in a later UKETS review, for implementation of changes - if any - no later than 2026. This is helpful, but aimed at the medium to longer term.

The Treasury review includes consideration of tax levers within its remit and there is a clear requirement to consider how tax policy can be used to help the transition (our sixth principle for a resilient recovery):

¹⁹⁰ Government of Canada (2020) *Press release: Prime Minister announces additional support for businesses to help save Canadian jobs.*

¹⁹¹ Allan, J., Donovan, C., Ekins, P., Gambhir, A., Hepburn, C., Robins, N., Reay, D., Shuckburgh E., and Zenghelis, D. (2020). *A net-zero emissions economic recovery from COVID-19.* Smith School Working Paper 20-01.

- Many sectors of the UK economy do not currently face the full costs of emitting greenhouse gases. There is wide variation in effective carbon prices across emitting activities and sectors, but these prices are generally much lower than required.¹⁹²
- Setting or raising carbon prices for these sectors could help incentivise the actions and investments required, as well as raising revenue. Carbon pricing is not sufficient in itself, and must be combined with appropriate standard setting, investment instruments and support for low-carbon innovation, but a failure to price-in carbon sends entirely the wrong signals. There is also considerable revenue-raising potential, which has been estimated up to £15bn a year over the next decade.¹⁹³ Not all of that would be additional revenue, with some recycling necessary to deal with any regressive impacts, but at a time when public finances are likely to be tight, carbon pricing could provide useful additional funds.
- Current low global fossil fuel prices provide an opportunity to raise carbon prices without increasing the overall burden on consumers in the near term.
- The UK's future carbon pricing mechanism, outside the EU ETS, should be designed to ensure that an appropriate carbon price is maintained in the face of external shocks, for example through the use of a well-designed floor price (Box 5.6).

The challenge of sourcing the additional capital that will be needed to transition to net-zero emissions is complicated by COVID-19. Asset owners will have suffered losses during the crisis, households may be more reluctant to increase pension contributions, and there is renewed pressure on public sector finances.

There is a clear case for a more comprehensive approach to harnessing finance for climate action.

The Government has a role to play in directly supporting the net-zero transition, but also in providing a strategic direction and clear regulatory framework for investors, leveraging private capital as efficiently as possible.

The Committee has convened a new Finance Expert Group as part of its work programme on the Sixth Carbon Budget. This Group had an additional meeting to discuss the implications of COVID-19 on the financing challenge, and will produce an independent report later in 2020.

6. International recovery

The COVID-19 pandemic has occurred at a critical time for global efforts to achieve the goals of the Paris Agreement, with rapid and widespread emissions reductions necessary to keep the long-term temperature goal within reach:

- Global emissions pathways that are consistent with keeping warming well-below 2°C above pre-industrial levels require global emissions peaking around 2020 and declining rapidly to 2030. Pathways that keep warming to 1.5°C with around 50% probability reduce global CO₂ emissions by around 50% from 2020 levels by 2030.

¹⁹² Energy Systems Catapult (2019) *Rethinking Decarbonisation Incentives: Future Carbon Policy for Clean Growth*.

¹⁹³ Burke, J., Fankhauser, S., Bowen, A. (2020) *Policy Brief: Pricing carbon during the economic recovery from the COVID-19 pandemic*.

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- The existing global carbon-intensive capital stock would already produce sufficient emissions, if run for their full lifetimes, to take the world close to exceeding the Paris Agreement long-term temperature goal without any new high-carbon infrastructure installed through stimulus packages.¹⁹⁴

Keeping the Paris Agreement long-term temperature goal within reach necessitates that economic stimulus packages around the globe are aligned with the need to rapidly start to reduce global emissions in a way that can be sustained over several decades to reach Net Zero.

The Presidency of the delayed COP26 and the 2021 G7 Presidency present an opportunity for the UK to play an important role in efforts to align COVID-19 stimulus with the Paris Agreement. COP26 was already envisaged as a key point in the Paris Agreement timeline where global climate ambition would need to be raised. It will now come at the end of an 18-month period where governments around the world aim to stimulate their economies as COVID-related lockdowns are released.

It is essential that the UK uses the opportunity of its presidencies to work directly with countries prior to COP26 so that these stimulus packages are fully integrated with the need for countries to submit enhanced Nationally Determined Contributions, for emissions reductions and adaptation actions, from the outset. This cannot wait until COP26 takes place and will need to begin from today to avoid the risks of locking in new high-carbon infrastructure that will keep global emissions high for decades and put the Paris Agreement long-term temperature goal beyond reach. This is particularly important given the key moments approaching for the world's two largest emitters (covering 40% of global GHG emissions), with the next Chinese 5-year plan (for 2021-25) due to be finalised in early 2021 and the US presidential election in November 2020.

Climate impacts are already being felt around the world, particularly in vulnerable developing countries. The economic impacts of COVID-19 are likely to further restrict available finance for reducing exposure and vulnerability to these impacts. The UK needs to be an exemplar in continuing to provide climate finance to these regions and engage diplomatically so other countries continue to meet and increase their contributions to the \$100 billion per year in climate finance for developing countries that developed countries have committed to provide by 2020.

¹⁹⁴ Tong, D. et al. (2019) *Committed emissions from existing energy infrastructure jeopardize 1.5°C climate target*.

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Chapter 6: What is needed now – UK climate policy



Introduction

Our advice later this year on the Sixth Carbon Budget (2033-2037) will present detailed potential pathways towards net-zero emissions in 2050, and a critical path for policy decisions required over the next decade. This Parliamentary term (to 2024) must deliver a full policy package to put the UK on track to the Net Zero target.

This report has also touched on progress to date in climate change adaptation and how perceptions and planning for climate-related risks may change in the context of COVID-19. The Adaptation Committee will be publishing both its next progress report on adaptation in England, and the Evidence Report for the third UK Climate Change Risk Assessment next year.

Historically, climate action has been led by the energy and environment departments of Government. Increasingly, action on reducing emissions towards net-zero and ensuring policies are resilient to climate change will need to be led by all departments and driven from the centre of Government.

The Government has already taken important steps to embed this as core Government policy, by introducing a Cabinet Committee on Climate Change and as host of COP26, for example. Similarly, across Government, multiple departments are building policy and delivery capability in key areas such as transport decarbonisation, heat in buildings, manufacturing policy and low-carbon energy, though less significant change is being seen on adaptation. An integrated and ambitious strategy is now required to ensure co-ordinated progress across all areas, and by all parties, to set the UK up for a decade of delivery of climate ambition.

The following sections summarise the Committee's current policy priorities:

1. Net Zero needs to be integrated into all Government policy
2. Adaptation needs to be integrated into all Government policy
3. Departments must work together to deliver ambitious policy

1. Net Zero needs to be integrated into all Government policy

In recommending a Net Zero target for 2050, the Committee noted the need for the Net Zero challenge to be embedded and integrated across all departments, at all levels of Government and in all major decisions that impact on emissions. The Governments of the UK and Scotland quickly enacted the Net Zero target as law, and the Governments of Wales and Northern Ireland have expressed their intentions to align to the UK's net-zero objective.

Initial steps towards a net-zero policy package have been taken, but the last year was not the year of policy progress that the Committee called for in 2019. That is in part a result of the public health crisis taking priority in recent months, but policy development had already been delayed ahead of the general election. Net Zero has since been adopted as a key overall goal of the incoming Government, but much more will be required from Government in this Parliament.

a) Net Zero as core Government policy

Net Zero requires cross-government action, led by the centre and integrated to economic strategy. The Government response to COVID-19 presents an immediate opportunity to integrate climate ambition with broader economic objectives. Beyond this, the Cabinet Committee on Climate Change should oversee a review of the Government's core strategy, funding and planning, working across departmental silos to ensure sustained progress in climate change mitigation and adaptation.

- **Government responses to the COVID-19 pandemic** will be a clear barometer of climate ambition across all levels of Government. As chapter 5 sets out, there are multiple synergies between climate ambition and the economic response to the COVID-19 pandemic.
 - An immediate economic stimulus can be complementary to the UK's climate goals, by investing in infrastructure that reduces emissions and increases climate resilience whilst delivering macro-economic benefits.
 - For the long term, the UK must invest in key assets to build capacity and enable productive activity in the future. This means investing in climate-resilient low-carbon infrastructure, training and reskilling, knowledge, and social and institutional capital. Public money spent now should not support industries or infrastructure that are not consistent with the future net-zero economy, and all new investments should be resilient to a minimum 2°C rise in global temperature. Greater use of carbon taxes can support the public finances.
- Increasingly, **all policy and infrastructure decisions** will need to be checked against their consistency with the UK's Net Zero target and the need to adapt to the impacts of climate change. Government planning documents should be reviewed (e.g. Green Book, National Planning Policy Framework) to ensure consistency against this objective. Some commentators also suggest a need for new institutions, such as a Net Zero delivery body, and/or a National Investment Bank, to help the delivery of these objectives – the Committee will consider these in our Sixth Carbon Budget advice.¹⁹⁵
- The new **Cabinet Committee on Climate Change** shows clear intent to deliver Net Zero by working across departmental silos, but, having first met five months after it was set up, will need to meet more regularly and demonstrate it is driving sustained progress.

¹⁹⁵ See, for example, UCL (2020) *A net-zero emissions economic recovery from COVID-19*, and Oxford Smith School of Enterprise and the Environment (2020) *A net-zero emissions economic recovery from COVID-19*.

As much as possible, barriers to delivering Net Zero should be systematically reviewed and removed. Since many of the solutions cut across systems, fully integrated policy, regulatory design and implementation is crucial. That may require new frameworks, for example to ensure that departments, across Government, sufficiently prioritise net-zero GHG emissions. Systems thinking will be required to deliver change in a complex and changing landscape.

- The **National Infrastructure Strategy**, which is due to set a vision for infrastructure development over the next 30 years consistent with Net Zero, was delayed from Budget 2020. It should prioritise early funding for areas needing public finance that will support the recovery and prepare for net-zero and the impacts of climate change. Important priorities include energy efficiency in buildings, electric vehicle charging infrastructure, heat networks, hydrogen production and carbon storage infrastructure, 5G and fibre broadband, and risk management for flooding and coastal erosion.
- The Government should ensure that the next decade is a decade of delivery for climate ambition and building resilience. The **forthcoming Spending Review(s)** provide an opportunity to reassess prioritisation of climate objectives within departments, and ensure departments and local Governments are sufficiently resourced to deliver the change that's required. Tables 1-14 following the Executive Summary provide an illustration of what will be required of departments.
- **Government can lead by example**, by reducing emissions and ensuring climate resilience across its estate, using zero-carbon vehicles, ensuring Departments report on progress in reducing their own emissions, and assessing climate risks, in line with best practice in the business community.
- Plans for a **UK Emissions Trading System** are developing – the Government has committed to this being more ambitious than the EU scheme from the start and to revising it to align to the Net Zero pathway after the Committee advice on that pathway in December.
- **Climate adaptation is also a priority**. Across multiple areas, and in particular on buildings and land use, there are benefits to thinking holistically about how policy can reduce emissions, whilst ensuring it improves resilience to the UK's changing climate. Like Net Zero, climate adaptation will also need to be integrated into core Government policy (Section 6.2)

The Government's 2017 **Clean Growth Strategy** was designed around the UK's previous climate targets. Some of the proposed policies have already been made more ambitious, such as the ambition to phase out fossil fuelled cars and vans, and stop new homes connecting to the gas grid. A new strategy is required to demonstrate how the Government's plans overall are being brought in line with the new Net Zero target.

- The Government's **2017 Clean Growth Strategy** set out policies, proposals and pathways for emissions reductions towards the fifth Carbon Budget (2028-2032) and the previous 80% GHG reduction target for 2050.
- Since then, **evidence has improved in multiple areas** (e.g. offshore wind costs, hydrogen, low-carbon heat), and despite the ongoing pandemic, important Government announcements in these areas (and including heat, transport and land use) are still expected, albeit delayed.
- A renewed vision from Government, via a **new 'Net Zero Strategy'**, can take into account recent progress and the new context dictated by the pandemic.

This should include emissions reduction pathways and strategies for areas which will require co-ordinated Government effort (e.g. hydrogen, public engagement), and note the increase in effort required to deliver an additional 20% reduction in emissions by the middle of the century.

- It is a legal requirement **to legislate for the Sixth Carbon Budget** by June 2021, following our advice in December 2020, and produce a strategy on how to meet the budget as soon as is practicable. Both the setting of the budget and the publication of the strategy should be well ahead of COP26 and can be used as a platform to enable the UK to take a leadership role in encouraging higher ambition globally. The Government should also consider publishing a higher-level strategy ahead of our Sixth Carbon Budget advice. A clear statement of intent would have significant value in the midst of the policy challenges and uncertainty of the post-lockdown period.

The Treasury has commenced a review of how the transition to Net Zero will be fairly funded, as recommended by the Committee. The change in fiscal circumstances as a result of the COVID-19 crisis places fresh importance on the need for a systematic look at how to fund Net Zero including the distribution of the costs of reducing emissions, the role of public spending in leveraging private spending, and taxation.

- The strategic levers at HMT's disposal, **including public spending and taxation**, will be fundamental in driving the transition to net-zero emissions. Though the fiscal position is significantly strained, often Government can act to bring investments forward without direct public funding or by co-financing to accelerate private investment. The recently announced £40m public-private Clean Growth Fund is a good example of this.¹⁹⁶ The need for economic stimulus and the current low interest rate environment can provide an opportunity to accelerate, at low cost, some of the investments envisaged in our scenarios, outlined in chapter 5.
- The review provides an opportunity to **embed fairness as a core principle of policy design**. The crisis has exacerbated existing inequalities and created new risks to employment in many sectors and regions, placing even greater priority on the fair distribution of policy costs and benefits. The response to the pandemic has disproportionately affected the same lower-income groups and younger people who face the largest long-term impacts of climate change. The benefits of acting on climate change must be shared widely, and the costs must not burden those who are least able to pay or whose livelihoods are most at risk as the economy changes.
- The review, and the response to the pandemic provide an opportunity to **strengthen incentives to reduce emissions when considering fiscal changes**. Many sectors do not currently bear the full costs of emitting greenhouse gases. Carbon pricing can be used, alongside other policies, to incentivise emissions reductions across the economy. Similarly, changes in tax policy can aid the transition to net-zero emissions. Revenue could be raised by setting or raising carbon prices (or other taxes, such as VAT) for these sectors. Low global oil prices and improved energy efficiency provide an opportunity to offset changes in relative prices without raising consumer bills.

¹⁹⁶ BEIS (2020) *Government launches new £40 million Clean Growth Fund to supercharge green start-ups*.

b) COP26 as a platform for climate leadership

Hosting an ambitious COP can help cement a low-carbon and climate-resilient response to the COVID-19 pandemic. As governments respond to the pandemic, ensuring that any new global infrastructure that is constructed is low-carbon and climate resilient will be critical to the chances of achieving the Paris Agreement's long-term temperature goal. As COP26 host and incoming G7 president, the UK will have an important role in shaping efforts to align responses with global climate objectives. Key elements of this leadership will include:

- **Demonstrating that climate change remains a key domestic** priority through the submission of a UK Nationally Determined Contribution (NDC) for emissions reduction in 2030 set well in advance of COP26, and based on the pathway required to reach net-zero GHG emissions by 2050 that the Committee will advise on in December 2020. The UK can also play an important role in setting the standard by incorporating a set of ambitious commitments on adaptation and resilience in its NDC.
- **Supporting a cooperative and open approach to tackling and adapting to climate change.** The Government should take a lead on all aspects of the Paris Agreement, including finance, technology transfer and capacity building. Access to both capital and emerging low-carbon technologies will be essential to the major transition in the global energy system needed to keep to the Paris Agreement long-term temperature goal. COP26 can play an important role in making sure that Governments do not turn away from cooperative approaches to this global problem and should prioritise accelerating the international flows of clean technology, knowledge and climate finance that will be required.
- **Making the case for a green recovery from COVID-19 and that global emissions can be reduced strongly alongside economic growth.**
 - The UK has agreed through the UN to lead a global work stream on ensuring an inclusive and sustainable recovery. This vital role is a tribute to the UK's reputation and will require the UK to be an exemplar in its domestic recovery programme.
 - The developments of technologies such as renewable power means that low-carbon technology is increasingly becoming the most economically efficient option. As COP host the UK should make the case that international ambition for emissions reductions by 2030 can be stepped up and should be engaging through the formal negotiations and through bilateral channels to help countries do so.
- **Leadership on hydrogen and CCUS**, by following on from the 2018 global Carbon Capture and usage and storage (CCUS) summit with concrete and funded plans for deploying CCUS in the mid-2020s, and developing a strategy for low-carbon hydrogen production and use consistent with the need for hydrogen to meet Net Zero and the vision other countries have shown.
- **Considering the opportunities to use trade policy to encourage increased ambition in other countries.** UK trade policy and future trade deals must also protect risks of carbon leakage from trade in agricultural and industrial products and avoid undermining the required changes in UK land management.

Climate change will only be tackled successfully with a strong and coordinated global response. Helping to steer that response is strongly in the UK's self-interest, both as the only way to avoid the worst impacts of climate change and as the first opportunity to define the UK's place in the world after leaving the European Union.

As was experienced with the Paris Agreement, the potential success of COP will be built on the many months of diplomatic efforts ahead of the summit, which are already underway and must continue with vigour right up to November 2021.

The core goal of COP26 is to raise the ambition of countries' targets. As COP President, there will be huge expectations on the UK to do so. It has never been more important for the UK to demonstrate strong climate leadership, both for the world's future and for the UK's standing within it.

c) Net Zero applies to Governments at all levels

The Governments of Scotland, Wales and Northern Ireland must make full use of the policy levers available to them and work with the UK Government closely to ensure delivery in those areas that are not devolved. This means making particular use of devolved policy levers on the demand side even where supply-side policies are reserved to the UK government (e.g. encouraging walking and cycling), providing 'soft' support (e.g. advice on buildings retrofits) to support UK Government policies, and use of planning and procurement powers to drive decarbonisation.

Delivering net-zero emissions by 2050 in the UK will require a strong policy framework at all levels of government. The rapid transition is made more complex by the fact that some of the relevant policy levers are devolved to varying degrees to the Scottish, Welsh and Northern Irish governments, while others are held by the UK Government (i.e. they are reserved). While all sectors will require a significant degree of interdependent policy from both the UK and devolved governments, the nature of the devolution agreement means that the balance of policy action between governments varies across different areas of the economy. This balance can be broadly classified in three ways (Table 6.1):

- Areas where powers are largely devolved and devolved governments can make progress, supported by UK Government;
- Areas where some key powers are reserved, but devolved governments can still make significant progress using devolved policy levers;
- Areas where decarbonisation is most contingent on UK Government policy, but devolved government policy is needed.

The UK Net Zero target will only be achieved if the governments of Scotland, Wales and Northern Ireland, and the parts of the UK Government which relate only to England, contribute to reducing emissions. For example, Scotland's contribution to the UK target is particularly important due to its enhanced ability to use land to sequester carbon. The UK cannot achieve Net Zero in 2050 without strong policy from its devolved partners across key areas including planning, agriculture, land use, housing regulations, and local government.

Similarly, climate targets in Scotland and Wales, and any future target legislated in Northern Ireland, are likely only to be feasible with action from the UK Government, particularly across reserved areas such as fiscal policy, vehicle standards, energy production, and heavy industry.

Achieving our climate goals will require much closer co-ordination between Westminster, Holyrood, the Senedd and Stormont to ensure that policy frameworks support each other. The Republic of Ireland will also play an important role in delivering a decarbonised electricity network across the all-island system.

Table 6.1. Balance of devolved and reserved powers

<p>Areas where policy levers are largely devolved. Devolved governments can demonstrate leadership, contingent on appropriate support and funding.</p>	<p>Areas where certain key powers are reserved. Success is most dependent on coordination. Devolved governments can still make substantial progress using devolved policy levers.</p>	<p>Areas where progress is most dependent on UK Government and/or international policy. Devolved policies will still be required to supplement and facilitate decarbonisation in these sectors.</p>
<ul style="list-style-type: none"> • Planning and consenting • Local government • Public engagement • Education and training • Agriculture, forestry and fisheries • Waste 	<ul style="list-style-type: none"> • Power (Northern Ireland, excluding nuclear) • Buildings • Surface transport • Infrastructure (including EV charging infrastructure, CCS, hydrogen and engineered removals) 	<ul style="list-style-type: none"> • Economic and fiscal** • Power (Scotland and Wales) • Industry • F-gases* • Aviation • Shipping
<p>Notes: *Powers are devolved, but a UK-wide regulatory system is planned from 2021. **In some cases certain economic and fiscal powers are reserved.</p>		

Where powers are reserved to the UK level, the devolved administrations have an important role in ensuring that the emissions reductions take place. In particular, the devolved administrations should focus on the following areas:

- **Planning.** Planning frameworks are another useful lever over infrastructure that needs to be well aligned to objectives for emissions reduction in devolved administrations (e.g. through encouraging walking, cycling and use of public transport, ensuring readiness for or installation of electric vehicle charging points in new developments, and a favourable planning regime for low-cost onshore wind).
- **Procurement.** The public sector in devolved administrations can use procurement rules positively to help drive emissions reductions in a number of areas (e.g. uptake of ultra-low emission vehicles, energy efficiency and low-carbon heat in buildings, low-carbon products).
- **Convening role.** It is important the devolved administrations maximise their potential to bring stakeholders together, and facilitate dialogue and strengthen relationships, to enable the development of mutually-beneficial projects that contribute to decarbonisation.
- **Working with the UK Government** to ensure that UK-wide policies work for devolved administrations.
- **Access to UK-wide funding.** The devolved administrations should seek to ensure that households and businesses have good access to UK-wide funding opportunities where possible and appropriate.
- **Communication and public engagement** of climate risks, and the options and choices available to reduce emissions across the UK.

2. Adaptation needs to be integrated into all Government policy

a) A UK Net Zero goal does not preclude the need to adapt to the changing climate

The changing climate poses risks to meeting most of the Government's economic, social and environmental goals. The UK's National Risk Register for the next five years places flooding, severe weather (including storms, heatwaves, cold snaps, wildfire) and human and animal diseases among its top risks to the country.¹⁹⁷ All of these risks are increasing due to the changing climate.

Alongside the global average temperature increase of over 1°C, UK average temperature has increased around 1.2°C, compared to the pre-industrial period.¹⁹⁸

Temperatures will rise further, even with strong action to reduce emissions in the UK and worldwide in line with the requirements of the Paris Agreement. This is due to the fact that it will take time for the world to reduce emissions down to net-zero and the world will continue to warm during that time.

If the world succeeds in meeting the goals of the Paris Agreement, the latest UK climate projections suggest the country will experience an additional warming of around 0.6°C between now and 2050.¹⁹⁹ This is the minimum change we must adapt to.

Along with this rise in temperature, by the middle of the century we can also expect around another 3 to 37cm of sea level rise for different parts of the UK, a 10% increase in heavy rainfall, and a 50% chance of each summer being hotter than that experienced in 2018.

In the absence of the required very rapid global decarbonisation, UK annual mean temperatures would likely increase by a further 2 to 3°C from today (up to 4°C above pre-industrial levels) by the end of the century. Sea level rise, rainfall patterns and severe weather would also see similarly more extreme changes. This brings with it very severe threats to the country, including from climate change impacts overseas.

b) The changing climate brings significant risks to the UK

The short-term and long-term range of potential impacts are assessed as part of the Government's five-yearly UK Climate Change Risk Assessment (CCRA). The Committee is currently collating evidence for the third UK CCRA, which will be published next year.

Key risks to the UK include both direct risks from the physical effects of climate change and systemic risks for our environment and the economy. As well as rising temperatures, rainfall patterns are projected to become more extreme in the UK, both through heavier and more prolonged rainfall in some seasons or years, and much less rainfall in others, leading to a higher risk of both flooding and drought. Sea levels around the UK will also continue to rise over centuries.

¹⁹⁷ Cabinet Office (2017) *National Risk Register of Civil Emergencies, 2017 Edition*. Severe threats to the world's climate also account for all of the top long-term risks in the World Economic Forum's 2020 Global Risks report, even above the risks from a global pandemic.

¹⁹⁸ This is an observed change reported in the UKCP18 Science Overview Report. Present levels is defined as 2008 – 2017. See page 11. UK human-induced warming relative to pre-industrial is estimated using the method of Hawkins et al (2020) *Observed Emergence of the Climate Change Signal: From the Familiar to the Unknown*

¹⁹⁹ Calculated from the UK Climate Projections and reported in the CCC's blog on inevitable change. See CCC (2020) *How much more climate change is inevitable for the UK?*

These changes will lead to a variety of risks (Table 6.2):

- **Impacts on people's health and well-being:**
 - **Flooding.** Wetter winters, sea level rise and more intense rainfall are projected to lead to increasing flood risk to people across the UK. Flooding can lead to injury and loss of life; has significant effects on mental health; and damages homes and other assets.
 - **Overheating.** Higher temperatures, particularly in the summer months could lead to a three-fold increase in the number of heat-related deaths by 2050 as well as exacerbating cardiac and respiratory illnesses.
- **Impacts on nature.** Higher temperatures will have a range of impacts on wildlife; species' movements will be complex and may lead to new species emerging as well as local extinctions. Plant growth could increase with higher temperatures and CO₂, but will be heavily constrained by water availability. Peatland degradation is projected to increase significantly in hotter, drier conditions, particularly if the landscape is already degraded which makes the case even more strongly for widespread peatland restoration to also contribute to Net Zero. The risk of wildfires becoming established and spreading is likely to go up.
- **Pests and diseases.** New and emerging diseases have the potential to cause severe and increasing impacts on people and nature as the climate changes in the UK and overseas. COVID-19 has shown how large an impact diseases can have globally. Climate change is likely to increase the risk from vector-borne diseases in particular those carried by insects. Pests and invasive non-native species may also increase in number and range in a warmer, wetter atmosphere. There are risks from an increase in the prevalence of diseases that are already present in the UK such as Lyme Disease, and from new pathogens arriving from overseas, though there are very large uncertainties.
- **Economic shocks.** Climate change poses risks to economic growth in the UK. Financial institutions have both assets and investments that will be vulnerable to direct impacts from extreme weather. Sectors such as manufacturing are at risk from reduced water availability, flooding and drought. Imports from overseas will be subject to supply chain impacts, and overheating is likely to lead to reductions in productivity in the workplace and potentially in schools.
- **Interruptions to our food supply and increased food costs.** Both climate change in the UK and overseas will impact on the UK's ability to maintain a secure food supply. While the risk of food shortages in basic staples is considered to be low from climate change alone, there is a high risk of food price shocks arising from extreme weather, which would have a disproportionate effect on lower income households. Climate change may also pose risks to food safety due to faster rates of spoiling and pathogens such as salmonella.
- **Global disruption affecting UK interests.** Other impacts from climate change overseas will be imported to the UK through the price and safety of commodities, changes in the patterns of trade, disruption to global supply chains, and risks to overseas investments. The UK is likely to be called upon to provide more resources for humanitarian assistance, and efforts to build state stability and long-term resilience could be undermined.

Without additional action to prepare for these risks over and above what is happening today, the UK faces significantly worsening impacts from climate change over coming decades (Table 6.2).

Table 6.2. Range of climate risks for the UK

Variable	Present Day	2°C Warming by 2100		4°C warming by 2100	
		2050s	2080s	2050s	2080s
Annual mean temperature (°C)	8.8°C	+0.3 to +2.2	+0.3 to +2.6	+0.6 to +2.9	+1.9 to +6.3
Heatwaves (probability of temperatures as hot as 2018)	10-25%	50%	50%	50%	90%
Flooding (no. people living in significant risk areas, England only)	1.4 million	2.1 million	2.6 million	2.8 million	3.7 million
Water availability (supply demand deficit in litres per day, England only)	0	1.1 billion litre deficit	1.8 billion litre deficit	3 billion litre deficit	5.7 billion litre deficit
Heat mortality (number of excess deaths from overheating)	2,000	5,000	No data	5,000	10,700
Impacts on agriculture from drought (percentage change in Agricultural Land Classification grade 4 (poor quality) National Soil Inventory sites, England and Wales only)	2.2%	25%	36%	43%	66%

Source: UK Climate Change Risk Assessment (2017).

c) UK plans have failed to prepare for even the minimum climate risks faced

Under the Climate Change Act, the Committee reports every two years on progress in adapting to climate change impacts in England. Our last progress report on adaptation was published in July 2019, and the next will be in July 2021.

Our 2019 report assessed adaptation progress in England around two questions:

- Are plans being put in place that consider a minimum 2°C rise in global temperature by 2100?
- Are actions taking place that are demonstrably reducing vulnerability and exposure to climate risks?

Thirty-three ‘adaptation priorities’ summarising adaptation needed in the natural environment, infrastructure, health and built environment, or business were scored between 1 and 9, with higher scores showing better progress. Figure 6.1 summarises these scores.

Overall the assessment demonstrated that the UK Government has placed insufficient priority on the need to prepare for the changing climate:

- 12 priorities (over a third) have no long-term plans in place that consider climate change.
- Only the water, energy, rail and major road sectors include plans that consider a minimum 2°C rise on global temperature, with consideration of up to 4°C above pre-industrial levels.
- No sector showed good progress in demonstrating reductions in vulnerability and exposure to climate risks through adaptation actions.

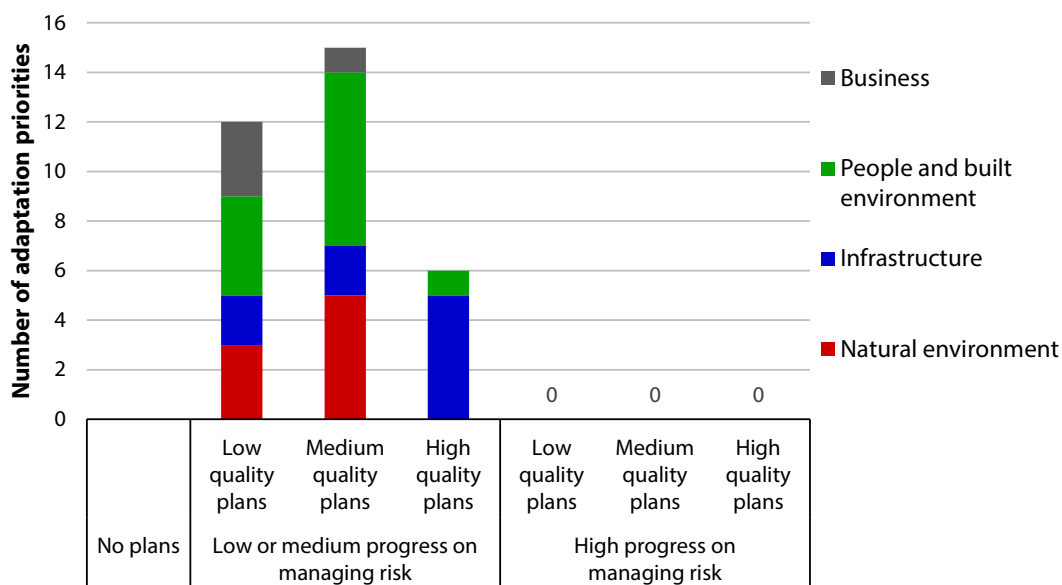
In the last year the Government have taken some steps to improve the UK's preparedness for climate change (Figure 6.1), in particular by allocating £5.2 billion over five years from 2021 for flood defences and including climate adaptation as a key goal for the Environment and Agriculture Bills.

Further steps have also been taken to address current and future water availability, including the EA's National Framework and Ofwat's decision to allow English companies and competitively appointed providers to invest £2.6 billion in protecting customers and the environment from the risks of extreme weather conditions (such as drought and floods) and critical asset failures.

There continues to be encouraging progress in the finance sector. The Bank of England announced that it would use its 2021 biennial scenario to explore the financial risks posed by climate change. The Financial Reporting Council and Financial Conduct Authority also announced reviews to improve the quality of climate-related disclosures and reporting.

However, much more remains to be done.

Figure 6.1. CCC Adaptation Progress Scores 2019



Source: CCC (2019) *Progress in preparing for climate change*.

Notes: Chart shows scores given to 33 different adaptation priorities across four sectors (natural environment, infrastructure, people and built environment, business) based on the quality of plans and demonstration of risk reduction. High scores for planning were given if plans considered a range of climate change scenarios, had specific, measurable and time-bound goals, effective monitoring and evaluation mechanisms; links from the plan to relevant actions and were up to date. High scores for risk reduction were given if good evidence was provided showing the impacts of actions on risk, including that vulnerability and exposure were reducing at an appropriate rate and/or were in line to meet goals. More details on the scoring criteria are given in CCC (2019).

d) Effective policy should reduce risks and support those that are worst affected

Our recommendations to improve the UK's preparedness for climate change are included in Tables 1-14 after the Executive Summary. They cover actions by Government to reduce risks and to provide support where risks remain. All recommendations seek to achieve the following:

- **Transparency.** A full assessment of climate risk and appropriate adaptation measures are required if wider goals are to be delivered. An effective climate response begins with a thorough understanding of the risks faced and the UK's exposure to those risks. The Adaptation Programmes for England, Northern Ireland, Scotland and Wales need to address all of the risks identified in the CCRA. But the need for adaptation goes beyond actions by Government, and should for example include mandatory implementation of the recommendations from the Taskforce on Climate-related Financial Disclosure (TCFD). Government has a key role more generally in developing the research base and issuing clear guidance.
- **Enabling policies.** Many of the actions to prepare for the changing climate will be taken by households and businesses. Government policy should enable these, for example by ensuring that all households are aware of their level of risk from flooding, water scarcity and overheating. Support services for adaptation have been eroded over the past ten years and the Government ceased funding for the Climate Ready support service in 2016.
- **Incentives and investments to strengthen resilience.** Many adaptation measures have some up front cost and significant net benefits that accrue over the longer-term. Incentives, particularly for households, need to drive early uptake to avoid lock-in and significant damage costs down the line. Incentives are notably missing for property-level flood protection, passive cooling, sustainable urban drainage, and urban greening.
- **Ensuring that all policies, regulations and standards include climate resilience.** Adaptation is needed to deliver on a large range of other government goals. It needs to be integrated into policies to ensure they can be met in the face of climate change, and not added on as an after-thought or simply mentioned in passing. With this approach, the Government is unlikely to meet the majority of its 25-Year Plan targets for instance.

As set out in chapter 5, adaptation actions can also support the UK's economic recovery from COVID-19 and must be integrated in the recovery package if the recovery is to be resilient.

The UK's plans for reaching net-zero emissions must also be resilient to the changing climate. There are particular overlaps in buildings (e.g. where the overheating risk must be managed alongside improvements to energy efficiency and a shift to low-carbon heating systems) and land use (e.g. where new forests and bioenergy crops must be suited to the future climate). The large infrastructure programme required to reach net-zero emissions must be designed to prosper under the coming changes.

We will explore these overlaps further in our December advice on the Sixth Carbon Budget.

3. Departments must work together to deliver ambitious policy

Policy decisions made by Government departments last multiple years, if not decades. Net Zero means that climate objectives can no longer be led by the department for Business Energy and Industrial Strategy (BEIS) and the Department for Environment, Farming and Rural Affairs (Defra) alone, but will require all departments to review how their policies interact with the UK's Net Zero target. This will require a co-ordinated effort led from the centre of Government and leadership across Government. Policy teams across departments must also be sufficiently resourced to develop and implement the changes required.

As noted already in this report (chapters 2 and 3), progress in reducing emissions from power and waste has been strong, with policy led BEIS and Defra respectively, in co-ordination with Her Majesty's Treasury (HMT). Other departments, such as the Department for Transport (DfT), have announced ambitious emissions reduction policies such as an earlier phase-out date for the sale of fossil fuelled vehicles, though more action will be needed to ensure this is delivered.

However, significant policy gaps remain. BEIS, the Ministry of Housing, Communities and Local Government (MHCLG) and HMT will need to work together to implement ambitious plans to decarbonise the UK's building stock, supported by the Department for Education (DfE) on skills policy. Defra will need to ensure the Agriculture and Environment bills lead to implementation of low-carbon land use policies, and be backed by a mechanism, developed with HMT and BEIS, to fund tree planting at much larger scale. BEIS and Defra will need to work together on resource efficiency, whilst BEIS takes the lead on delivering low-carbon energy at scale, across multiple vectors, including for use in UK manufacturing.

Across Government, emissions reduction must be embedded meaningfully in the objectives of the key Ministerial departments - and at each level of government in the UK - including local government, regulators and public bodies - so that policy decisions can have the greatest impact. It must also be integrated with businesses and society at large.

While extensive, reflecting the size of the challenge, the recommendations in this chapter and in Tables 1-14 earlier in the report are not exhaustive. Nor are they intended to be overly prescriptive where different means could achieve the same ends.

Priorities for the next year include:

- a) Transforming the UK's buildings, via the Buildings and Heat Strategy** - *recommendations for BEIS and MHCLG.*
- b) Decarbonising transport: getting there sooner and other transport priorities** - *recommendations for DfT.*
- c) Helping industry to cut carbon and promoting resource efficiency** - *recommendations for BEIS and Defra.*
- d) Delivering low-carbon land use and reducing waste by strengthening the Agriculture and Environment Bills** - *recommendations for Defra and devolved counterparts in Scotland, Wales and Northern Ireland.*
- e) Priorities for the energy White Paper:** accelerated electrification, CCS, hydrogen, bioenergy and a more flexible energy system - *recommendations for BEIS.*
- f) Delivering a low-carbon and resilient Government estate** - *recommendations for the Cabinet Office, all departments and public landowners.*
- g) Getting the rules right:** the role of the regulators and public bodies.
- h) Government leads, others act:** the role of people, business, local government, and the need for a just transition.

a) Transforming the UK's buildings via the Buildings and Heat Strategy – recommendations for BEIS and MHCLG, supported by HMT and DfE

The Net Zero target makes it clear that the UK's buildings will need to move entirely over to low-carbon heating systems by 2050. Given boiler lifetimes of around 15 years, that implies a need to scale up markets and supply chains for low-carbon heating to cover all new installations by the mid-2030s at the latest. The higher costs currently expected for low-carbon heating point to the need for energy efficiency to improve more quickly. At the same time, further innovation and investment is required to drive down installation costs whilst continuing to improve quality. As these changes are taking place, resilience measures also need to be included to make homes safe and comfortable in the changing climate, including passive cooling, water efficiency and flood protection.

The Committee set out comprehensive thinking on this challenge in our reports on *Next Steps on Heat Policy* (2016) and *Housing - Fit for the Future* (2019). We will update this in a policy note following this progress report.

The Government has committed to publishing a Buildings and Heat Strategy later this year. It must set a clear direction towards phasing out oil and gas boilers, make low-carbon heating and energy efficiency pay across the housing stock, provide a set of enabling measures to support delivery and take immediate steps to drive much faster take-up in the near term, likely founded around local action.

- **A clear direction.** BEIS, in collaboration with HMT and MHCLG, should produce an ambitious strategy which sets the direction for the next 30 years, reaching zero emissions from buildings by 2050. A clear, loud and stable signal of the future market is vital to unlocking the overall challenge.
 - There should be clear trajectories of standards across the housing stock for efficiency and carbon performance, culminating in a phase-out of the installation of new oil and gas boilers, by the late-2020s and mid-2030s at the latest, respectively. Some exemptions may be suitable, for example where an area has a clear and costed plan to switch over to low-carbon hydrogen.
 - Electrification, alongside district heating schemes where viable, should offer the primary route to zero-carbon heating systems, with a possible supplementary role for hydrogen in providing flexibility for different regional solutions and/or for managing peak demand. BEIS should signal how it, alongside Ofgem, intends to manage decisions over the future of the gas grid.
 - Hybrid heating systems (e.g. with a heat pump installed alongside a gas boiler) can play a useful role both on and off the gas grid, at least over the next decade and possibly beyond.
 - Standards should encourage holistic building designs and retrofit opportunities that incentivise low-carbon heat and energy efficiency, whilst ensuring buildings are resilient to the future impacts of climate change.
- **Making low-carbon heat cost-competitive.** HMT must work with BEIS to ensure that households and businesses installing energy efficiency and low-carbon heating are left financially better off.

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- Residential electricity currently faces higher taxes and levies than gas and oil. Some rebalancing of these costs is required to support the shift to electrification and to ensure that hybrid systems are primarily used in heat pump mode.
 - The Government's proposed move to grant funding for low-carbon heat installations is welcome. However, funding and ambition is inadequate as it would only support deployment of 12,500 heat pumps per year – which is the current level under the Renewable Heat Incentive (RHI). Targeted deployment should be at least an order of magnitude higher: there are 1.5 million oil and LPG boilers that will be phased out from later this decade, and the market must scale up to be able to replace the majority of current gas boiler demand by the early 2030s (around 1.5 million installations a year). Hybrid heat pumps should be eligible under future schemes (unlike proposals in the recent BEIS consultation). Plans are needed to support larger heat pumps in non-residential applications.
 - Differential rates of stamp duty and/or council tax could also be used to further incentivise take-up of efficiency measures, and potentially reduce the required grant funding of heat pumps.
 - The Government should accelerate plans for rapid scale up of the developing market for green mortgages and other financial products, given the higher upfront cost of energy efficiency and low-carbon heating systems.
 - The overall financial package should consider how to support vulnerable customers, including through higher subsidies for energy efficiency measures. Any change to taxes and levies should also consider the effect on other non-residential energy consumers.
 - **Enabling measures.** There are a set of barriers that must be tackled to reach higher quality and quantity of installations.
 - Retraining packages and certification schemes are required to increase the availability of skilled installers and to give consumers confidence in low-carbon technologies.
 - Performance measurement must develop to reflect real-world energy use and real-world performance of buildings and heating systems. This can be achieved in homes by rolling out digital Green Building Passports across the stock. The passports should build on proposals from the Green Finance Taskforce,²⁰⁰ and extending to cover water efficiency, flood resilience and other resilience measures should be considered. In new buildings, accurate performance testing and reporting must be made widespread - going beyond airtightness testing - to hold developers to the standards they advertise. For non-residential buildings, plans to introduce a scheme based on the Australian NABERS model should be accelerated.
 - The planning system must be fit for purpose. This means closing loopholes allowing homes to be built which do not meet the current minimum standards for new dwellings and tightening rules around permitted development rights relating to change of use.
 - The compliance and enforcement framework should be overhauled so that it is outcomes-based (focussing on performance of homes once built), places risk with those able to control it, and provides transparent information and a clear audit trail, with effective oversight and sanctions.

²⁰⁰ Green Finance Taskforce (2018) *Accelerating Green Finance*.

- Innovation support should be provided, both to drive down the costs of key technologies like heat pumps and hydrogen and to develop the consumer offering (e.g. through 'heat as a service' business models and smart heating controls).
- Consumer education will be important, to increase familiarity with and confidence in low-carbon heating systems and understanding of the need to switch. Support guiding people through the retrofit process is key - building on the example of the Scottish Home Renewables Advice service. This could be done through more rapid mainstreaming of the retrofit coordinator role under PAS2035.²⁰¹
- **Driving near-term progress.** Heat policy must deliver immediate actions to drive more rapid near-term progress.
 - The Future Homes Standard requires deployment of energy efficiency and low-carbon heat in new build homes. Policy should also drive early progress in the social housing and private rented sector and homes off the gas grid. However, to drive the rates of uptake required, owner-occupiers and on-gas-grid homes must also be included, emphasising the importance of hybrid heat pumps, which have fewer consumer barriers and generally lower upfront costs than heat-pump-only solutions.
 - The new green levy for biomethane will ensure a stable market for biomethane through the next decade. It is essential that the proposed new market framework for heat networks achieves the same respective outcome. Government should harness the planning framework (e.g. through zoning and concession arrangements) to manage demand risk and unlock investment at scale.
 - Home retrofit plans (e.g. as part of 'Green Building Passports') should be rolled out as soon as possible across the full housing stock, setting out a clear path to reaching zero emissions. These should be integrated with widespread local energy planning, with local authorities and network operators to broaden awareness and support broader decision making, particularly around heat infrastructure.²⁰²
 - Trials, pilots and demonstrations must all progress in the near-term, at sufficient scale to inform future policy making and to build consumer confidence.

As well as reducing emissions, the heat and buildings strategy must also tackle the challenges of fuel poverty and wider issues of housing condition, including overheating, poor indoor air quality and sustainable drainage.

Policy must cover all buildings, not just homes.

- For commercial buildings, there is a need to step up the pace on plans to introduce an in-use performance programme based on the NABERS model,²⁰³ which together with the new ambitious standards for the private-rented sector, can drive carbon efficiency improvements through the stock.

²⁰¹ 'PAS 2035 - Specification for the energy retrofit of domestic buildings' was introduced as a result of the 2015 'Each Home Counts' review, with the backing of industry and BEIS.

²⁰² Energy Systems Catapult (2020) *Local Area Energy Planning: Supporting clean growth and low carbon transition*; Energy Systems Catapult (2020) *Net zero carbon buildings: Towards an enduring policy framework*; Association for Decentralised Energy (2019) *Zoning for Heat and Energy Efficiency – A framework for decarbonisation to net zero for domestic and non-domestic buildings*.

²⁰³ See: <https://www.nabers.gov.au/>

There is also scope to phase out fossil fuel boilers and reach zero emissions earlier in non-residential buildings. Finally, plans for targeted support for SMEs need to be scaled up.

- The public estate can play an important role in driving the wider market and showing leadership through the mandatory targets for a 50% reduction in emissions by 2032, with central Government leading the way through a new set of ambitious Greening the Government targets. This must be supported with adequate funding from Central Government and/or permission for public bodies to raise finance. Local authorities should be supported to monitor and report emissions from their own estate and local areas and report on climate resilience.

This programme of renovation and improvement must take a broader view of buildings safety and performance, including water efficiency, adequate levels of ventilation and thermal comfort and improved resilience.

b) Decarbonising transport: getting there sooner and other transport priorities – recommendations for DfT, supported by HMT and BEIS

The COVID-19 pandemic is already changing how people travel, and provides an opportunity to encourage sustainable behaviours such as working-from-home and active travel (e.g. walking and cycling). Some cities are already redesigning streets to encourage walking and cycling instead of car use. Without Government support in these areas there is a risk of lower use of public transport and increased use of cars, in the short-term.

The Government is currently consulting on bringing forward its 'Road to Zero' ambition to phase-out the sale of petrol and diesel cars. Our assessment is that the date should be brought forward to 2032 at the latest, as currently planned in Scotland. In the near-term, purchase subsidies should be maintained and planning for a transition to fiscally neutral incentives should begin now, for example through Vehicle Excise Duty (VED) that is more highly differentiated by CO₂. Electric vehicle charging infrastructure will also require targeted support to continue.

Separately, a comprehensive framework for decarbonising HGVs, covering financial incentives, regulation and infrastructure is needed for the 2020s and should be planned for now.

The Government should:

- Strengthen schemes to support walking, cycling and public transport to reduce demand for higher carbon travel, and to lock in changing travel habits in response to the COVID-19 pandemic. The public sector should lead the shift to other positive behaviours that reduce travel demand e.g. encouraging homeworking, facilitated through prioritising broadband investments over road network expansion.
- Confirm the earlier phase-out of new petrol/diesel and plug-in hybrid car and van sales by 2032 at the latest, in the next phase of the Transport Decarbonisation Plan later this year. A policy package is required to deliver on that goal:
 - Strong consumer incentives exist already to purchase zero emission vehicles and should continue: purchase subsidies, preferential company car tax, no fuel duty and lower vehicle excise duty (VED). VED rates could play a larger part in this package, with potential for purchase subsidies to scale down over time as battery costs fall.
 - A mandate requiring car manufacturers to sell a rising proportion of zero emission vehicles (i.e. a 'ZEV mandate' as used in California and China) would strengthen investment signals for manufacturers and ensure enough vehicles are supplied.

- Public investment in the charging network will remain important. Project Rapid has the right ambition for the strategic road network. More progress is needed to support home charging for those without off-street parking, for shared car parks and renters.
- We support the recommendations of the Electric Vehicle Energy Taskforce to enable the efficient integration of electric vehicles in the wider energy system.²⁰⁴
- Increase the ambition of UK efficiency standards for new car/van CO₂ for 2025 and 2030.
- Set out plans for large scale trials of zero emission HGVs to establish which is the most cost effective and feasible technology for the UK. Evaluate existing and increase support for HGV logistics improvements schemes. Reflect the need for HGV recharging on the strategic road network in Project Rapid. As for cars and vans, a full package of policy will be required to drive progress.
- The Government should deliver on its commitment of 100% of the central Government car fleet being ultra low emission by 2030, set out in the Road to Zero strategy, and extend it to cover all Government vehicles.

These policies are needed to drive the UK market for zero emission vehicles. They will also strengthen the case for investments in the supply of these vehicles in the UK, and the batteries that they will require. Government policies directed at that supply and in supporting innovation to improve performance and reduce cost are also welcome.

Though decarbonising aviation and shipping are longer-term priorities, action now is required. The Government should:

- Continue to work via the International Civil Aviation Organisation (ICAO) and International Maritime Organisation (IMO) to reduce International Aviation and Shipping (IAS) emissions, setting ambitious long-term goals and developing robust mechanisms to achieve these.
- Formally include IAS emissions within the UK's climate targets as set out in our September 2019 letter.²⁰⁵ Our Sixth Carbon Budget advice will again consider and make recommendations as to the inclusion of IAS emissions within UK Carbon Budgets.
- Building on the UK's Clean Maritime Plan, develop incentives for new low-carbon ammonia and hydrogen supply chains and accompanying port infrastructure, with the UK's first clean maritime cluster built by 2030.
- Commit to an ambitious Net Zero goal for UK aviation in the forthcoming Aviation & Climate Change Consultation, with UK international aviation reaching net-zero by 2050, and domestic aviation potentially before 2050. Efficiency and low-carbon fuel measures should be supported, with demand-side policies also introduced to ensure emissions stay on track to net-zero given the availability of verifiable GHG removals.
- Monitor non-CO₂ impacts of aviation and shipping and consider how best to tackle them alongside UK climate targets.
- Review the UK's airport capacity strategy in light of COVID-19 and the Net Zero transition. This should include a survey of UK households, businesses and public-sector organisations to gauge how leisure and business travel expectations have changed post-COVID, and the likely permanence of these changes.

²⁰⁴ The Low-Carbon Vehicle Partnership (2020) *Electric Vehicle Energy Taskforce*.

²⁰⁵ Welsh and Scottish targets already include IAS emissions. CCC (2019) *Letter from Lord Deben to Grant Shapps*.

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- Over time, residual emissions will need to be offset by using verifiable, scalable engineered GHG removals (GGRs). DfT will need to work with BEIS in proposing a preferred mechanism for supporting GGRs in the UK, including consultation on the market design and governance principles, plus any interaction with international credits.

c) Helping industry to cut carbon and promoting resource efficiency – recommendations for BEIS, Defra and Ofgem, supported by HMT

Our Net Zero report analysis demonstrated that UK industry can be decarbonised to near-zero emissions without offshoring. Government must now implement an approach to incentivise industries to reduce their emissions through energy and resource efficiency, fuel switching, CCS and reducing methane leakage and venting, in ways that do not adversely affect UK industry's competitiveness and that support the UK's economic recovery.

- **Support the recovery.** Government should seek to support and create jobs through its industrial decarbonisation policies, especially in regions with high reliance on industrial jobs. A number of funding schemes are already preparing to open (or have recently completed and may have potential for extension - see Figure 4.3) and can both support jobs and urgent priorities, including: demonstration of industrial fuel switching and CCS technologies, development of industrial decarbonisation projects and the creation of a skilled workforce and strong supply chain. Government should take this dual opportunity, by ensuring prompt award through these schemes and increased ambition.
- **Avoid 'lock-in'.** Wider recovery support must not 'lock-in' industrial sectors to higher emissions. Any bespoke oil and gas sector recovery support should be contingent on deep upstream emissions intensity reductions and clear plans for a just transition for workers and moves towards a net-zero business model.
- **Set a clear strategy.** Government has launched a number of new industrial decarbonisation policies in the past 18 months, but these do not all fit together, do not set a long term vision of enduring policies and there are gaps in the approach. Government should publish a comprehensive manufacturing and construction decarbonisation strategy in early 2021, following our Sixth Carbon Budget advice, to set out a clear vision of the long term policy mechanisms for industrial decarbonisation, and integrated with policy development in hydrogen and CCUS, where manufacturing is likely to be an early adopter.
- **Fill policy gaps on fuel switching, fossil fuel production and non-road mobile machinery (NRMM).**
 - There are no plans for operational support for industrial electrification, or use of hydrogen and bioenergy (with CCS), but some mix of these will be required to decarbonise industry and early deployment is needed urgently. Government should consult on mechanism(s) to enable early deployment of these technologies. It should also decide on its preferred mechanism for supporting industrial CO₂ capture and set out plans for awarding support.
 - Government should also set out policies for significant reductions in the emissions intensity of fossil fuel production. Emissions from fossil fuel production have barely fallen since 2008, while emissions from flaring and venting are up over the same period.

- Government should set out a clear plan to develop near-zero emission NRMM for applications where these are not yet available, and seek to encourage the UK's potential first-mover advantage.²⁰⁶ It should also increase deployment for NRMM applications where options are already available.
- Increase ambition of existing policies on resource and energy efficiency.
 - Government should agree an ambitious and tight set of Climate Change Agreements with industry to help deliver industrial energy efficiency improvements. It should also set out which policies will deliver the additional 12 TWh of industrial energy efficiency potential identified in the Government response to our 2019 Progress Report, specifically detailing how these will total 12 TWh.²⁰⁷
 - Defra and BEIS should work together to develop further policies to support the Government's Resource and Waste Strategy for England, with a particular focus on policies for encouraging efficiency within manufacturing and construction and reducing consumer demand for products.

d) Delivering low-carbon land use and reducing waste by strengthening the Agriculture and Environment Bills - recommendations for Defra and devolved counterparts in Scotland, Wales and Northern Ireland, supported by BEIS and HMT

The UK's Net Zero target and climate resilience will not be met without changes in how we farm and use our land. Our scenarios for deep reductions in land-based emissions balance the need to reduce emissions with other essential functions of land, including maintaining food production (which will help prevent the off-shoring of emissions), climate change adaptation and biodiversity. They require rapid changes in farming practices, a shift to less carbon-intensive diets and sustainable improvements in crop yields, such that around one-fifth of agricultural land is released by 2050 for actions that reduce emissions and sequester carbon. The Agriculture and Environment Bills provide an early opportunity to shape changes in the UK's land, and the new Office for Environmental Protection can ensure low-carbon land use practices are adhered to.

- Defra, BEIS and HMT should build on the Agriculture and Environment Bills to bring forward a new policy framework to incentivise emissions reductions across UK land, and wider environmental co-benefits:
 - Strengthen the regulatory baseline to ensure low-cost, low-regret options are taken up, including banning the burning of peat, peat extraction and the use of peat in compost.
 - Develop mechanisms for both private and public finance to support land based solutions. Develop a market mechanism (e.g. trading scheme or auctioned contracts) to incentivise afforestation and energy crop planting, and ensure that post-CAP public funds (e.g. ELMs) incentivise low-carbon farming practices, agroforestry, peat restoration and non-carbon benefits of afforestation. This should also support the clear co-benefits for wider environmental goals, including climate change adaptation and encompassing flooding, biodiversity and air quality, amongst others.

²⁰⁶ Vivid Economics (2019) *Energy Innovation Needs Assessment (Sub-theme report Road transport)*.

²⁰⁷ BEIS (2019) *Leading on clean growth: government response to the Committee on Climate Change 2019 progress report to Parliament - Reducing UK emissions*.

- Introduce new schemes to address non-financial barriers to change such as retraining and awareness raising, tackling tax treatment of woodland creation and tenancy and landlord constraints.
- Policies to encourage consumers to shift to lower emission diets and reduce food waste, starting with the public sector.
- Reducing emissions and increasing carbon sequestration sit alongside many other public interest objectives for UK land, including adaptation to climate change and biodiversity. The 25-year Environment Plan provides the over-arching framework for land policy that covers these wider objectives. Policies to increase carbon sequestration should be implemented in a way that also supports these wider objectives, for example by aligning the timing and security of payments for different environmental goods.

Achieving significant emission reductions in the waste sector requires a step-change towards a circular economy, moving away from landfill and incineration (and the associated methane and fossil CO₂ emissions), and towards a reduction in waste arisings and collection of separated valuable resources for re-use and recycling. This applies at local, regional and national levels. Wales is setting a leading example in the UK, but there are also several decades of experience in a number of other countries (e.g. Germany, Austria, South Korea) to draw upon.

- The transition to universal collection of separated food waste, garden wastes and other recycling across England planned in the Environment Bill should be significantly accelerated and rolled out over 2022-2024 (instead of over 2023-2035), so that all regions of the UK can legislate this year to ban both municipal and non-municipal biodegradable wastes from landfill by 2025.²⁰⁸ Local authorities and private waste management firms need to urgently invest in collection infrastructure and new recycling, composting and anaerobic digestion facilities. There must be sufficient treatment capacity made available before the landfill ban for biodegradable wastes comes into force, so that increases in incineration or exports are avoided.
- Achieving a 70% recycling rate at the latest by 2030 in England (with this target to be included in the Environment Bill) and in Northern Ireland, and by 2025 as already proposed in Wales and Scotland, will be key to phasing out waste exports and limiting fossil emissions from energy from waste plants. Defra should also plan how waste reduction and higher recycling rates will impact the utilisation of (and need for further) energy from waste plants, and via a set of guidance notes, help align local authority waste contracts and planning policy to these findings.
- Fossil emissions from energy from waste plants are growing rapidly (currently at 6.8 MtCO₂e/yr), and will continue to do so in the near term.^{209,210} Once built, the main emissions mitigation option from these plants will likely be CCS, even at modest plant scales.²¹¹

²⁰⁸ To date, only Scotland has legislated for a landfill ban on municipal biodegradable wastes by 2025 (delayed from 2021). Northern Ireland banned landfilling of separated collected food waste in 2015, but is yet to ban other waste streams. No country in the UK has yet legislated for a landfill ban on non-municipal biodegradable wastes.

²⁰⁹ Including Energy from Waste (EfW) incineration along with other waste to power/heat conversion technologies, such as gasification and pyrolysis plants classified as 'Advanced Conversion Technologies' (ACT) by BEIS.

²¹⁰ 44 EfW & ACT plants have been built since 2010, taking total current operating capacity up to 1.32 GWe across 66 plants. There are 0.56 GWe currently under construction (which could increase emissions by 3 MtCO₂e/yr), with a further 0.47-1.38 GWe (up to an additional 7.1 MtCO₂e/yr) granted planning permission (range due to some planning expiry dates not being specified). See BEIS (2020) *Renewable Energy Planning Database*.

²¹¹ Energy Systems Catapult (2020) *Energy-from-waste plans with carbon capture*.

When regional CO₂ infrastructure becomes available, operational plants above a certain scale should be incentivised or required to retrofit CO₂ capture. New plants (and plant expansions) above a certain scale should only be constructed in areas confirmed to soon have CO₂ infrastructure available, and should be built 'CCS ready' or with CCS.²¹² These retrofit dates and capacity thresholds should to be set as part of the UK's new Bioenergy Strategy, and aligned with BEIS' CCS infrastructure plans.

- Mandatory business food waste reporting would help achieve reductions in food waste, building on the current voluntary approach,²¹³ alongside reductions in household food waste. The UK achieving its Courtauld 2025 targets and the UN's Sustainable Development Goal 12.3 (halving per capita food waste by 2030) could also free up more UK land.
- Local councils should be carefully considering the fossil emissions from waste to energy plants, and how these plants will retrofit CCS in the future, plus the impact of waste reductions and improved recycling.

e) Priorities for the energy White Paper: accelerated electrification, CCS, hydrogen, bioenergy and a more flexible energy system - recommendations for BEIS, supported by HMT and Ofgem

The forthcoming energy White Paper is an opportunity for the Government to reflect on the success of electricity market reform over the past decade (see chapters 2 and 3), and apply the same ambition to delivery of low-carbon electricity, CCS, hydrogen and bioenergy during the 2020s and 2030s. Thinking about these elements together can provide a whole systems view of system flexibility.

- **Renewables** can now be deployed at scale in the UK with no or little expected average subsidy over their lifetime. However, the high development and capital costs of renewables and uncertainties around future revenues in a wholesale market with high penetration of low short-run cost generation mean that Government should take advantage of the cost reductions in renewable electricity over the past decade and should continue to use the Contracts-for-Difference (CfD) auction mechanism to deliver ambitious power sector decarbonisation during the 2020s, consistent with plans for electrification of transport and heat.
 - The objective should be to deploy enough low-carbon generation to reach an emissions intensity of 50 gCO₂/kWh by 2030, through annual CfD auctions, including for 40 GW of offshore wind. This will allow for increased electricity demands from low-carbon heat and transport that are expected in the 2020s to be met by low-carbon electricity.
 - Any proposed market reforms should demonstrate that they are better than available alternatives, ensure arrangements are tailored to both present and future system needs and allow projects to access returns that reflect their value to system operation and resilience, whilst acknowledging that some of the principles of EMR are likely to endure.

²¹² DECC (2009) *Carbon Capture Readiness (CCR)*.

²¹³ WRAP (2020) *Food Waste Reduction Roadmap*.

- Under ongoing changes to the CfD scheme, Advanced Conversion Technologies (ACT),²¹⁴ dedicated Biomass with CHP and large-scale Anaerobic Digestion should be moved into Pot 1. These technologies are now commercially mature, and have potentially limited roles in contributing to achieving net-zero emissions by 2050 if they cannot be subsequently fitted with CCS. Moving them out of Pot 2 will ensure that technologies that are of more strategic value to achieving Net Zero (e.g. floating offshore wind) will have greater access to support.
 - Support for gasification technologies should be focused on those that provide a development route towards production of low-carbon fuels (e.g. hydrogen and advanced biofuels). The criteria for support for ACT are unlikely to drive these developments. As Energy from Waste incineration support under Pot 1 is only available for plants with CHP, ACT support in Pot 1 should also be restricted to only ACT plants with CHP.
 - Construction of new biomass combined heat and power plants that are not required to be 'CCS ready' (i.e. below the current threshold of 300 MW_e) may lead to construction of capacity that is inconsistent with the best use of biomass in meeting the Net Zero target, which would require biomass energy generation with CCS (i.e. BECCS).²¹⁵
 - For anaerobic digestion, priority should be given to injection of biomethane into the gas grid, in line with BEIS recent 'Future Support for Low Carbon Heat' proposals.²¹⁶
- Offshore wind power is the fastest growing source of electricity in the UK, with further potential for more than 75 GW of offshore wind farms to be operational by 2050. BEIS should develop a strategy to coordinate interconnectors and offshore networks for wind farms and their connections to the onshore network.
- **Carbon Capture and Storage** is a necessity, not an option, for the UK's net-zero objectives. Plans should be delivered for CCS to be operational at multiple industrial clusters from the mid-2020s, with ambition for scaling up infrastructure beyond this.
- **Low-carbon hydrogen** is critical to achieving Net Zero, and needs to be deployed at scale during the 2020s. Given the potential of the fuel across multiple sectors, a cross-cutting vision and strategy for a hydrogen economy will be required from Government, with production and use starting from the early 2020s. Risk sharing mechanisms for the first users and producers of low-carbon hydrogen are likely to be required, in order to develop a market for low-carbon hydrogen.
- Publish a new cross-department **Bioenergy Strategy**, aligning policy with the best-uses of biomass and wastes to 2050 (maximising sequestration and displacement of emissions).

²¹⁴ As defined by BEIS, 'Advanced Conversion Technologies' (ACT) are gasification and pyrolysis conversion plants that convert waste (or biomass) into a syngas and/or a liquid oil, before combustion to generate electricity (and heat). There are minimum thresholds for the syngas efficiency and syngas calorific value to be met in the CfD scheme, but these are not onerous, and are not sufficient to develop gasification/pyrolysis technology suitable for advanced biofuels or hydrogen production. The majority of ACT plants use refuse derived fuel to generate electricity, therefore fulfilling a similar role in the energy system as EfW incineration, and with similar fossil emissions.

²¹⁵ CCC (2018) *Bioenergy in a low-carbon economy*.

²¹⁶ BEIS (2020) *Future support for low carbon heat*.

- Map the potential and economic feasibility of retrofitting CCS to all UK bioenergy and waste facilities producing power, heat, fuels, gases and/or chemicals.
- Set capacity thresholds for new facilities (not just in power) to be built as 'CCS ready', and set dates beyond which all facilities must be built with CCS or must retrofit CCS, based on the regional roll-out of CCS. These measures will be required to avoid lock-in of infrastructure incompatible with Net Zero.
- The new Strategy should also consider UK and international governance over biomass feedstocks, the current uncertainty and variability in lifecycle GHGs of emerging bio-economy uses (such as bio-based plastics), as well as support schemes for biogenic CO₂ capture and sequestration, aviation biofuels and UK feedstock production.
- Alongside this, Government and Ofgem should continue to **improve system flexibility** through the implementation of all actions in the Smart Systems and Flexibility Plan. Longer-term, plans should ensure the flexibility available from the interactions between sectors (e.g. electric vehicles, electrified heat) and vectors (e.g. power, hydrogen, energy storage) is used.

The decarbonisation of the power sector has been a strong UK success story. Policy will still have an important role in future to ensure the market delivers sufficient scale and flexibility to support the decarbonisation of the rest of the economy.

f) Delivering a low-carbon and resilient Government estate - recommendations for the Cabinet Office, all departments and public landowners

Government departments should follow best practice shown by leading businesses to monitor and verify their paths to a net-zero and climate resilient future. Reducing emissions across the Government estate is a good place to start.

The Government estate is vast, comprising hundreds of thousands of assets, from ports to prisons, railways, schools and hospitals, managed by over one thousand property management organisations. In many areas, public landowners have the purchasing power and co-ordination to drive change in a sector. Government can lead by example via its own procurement strategies, developing low-carbon markets and standards that act to reduce emissions, as well as addressing overheating, green space and sustainable drainage. At a minimum Government should deliver the commitment in the Clean Growth Strategy to halve emissions across the public estate by 2032 at the latest.

The 2018 Government Estate Strategy set out a vision for Government property out to 2022. This strategy should be reviewed and extended, taking into account the new net-zero objective, and the need to adapt to a changing climate. This should include the Palace of Westminster. Departments should adopt a new set of stretching Net Zero targets under the Greening the Government programme for 2025 and 2030, and look to the Ministry of Defence's work on making its estate resilient to future climate risks.²¹⁷

Government departments can also lead action in decarbonising their vehicle fleets (Section 6.3.b).

²¹⁷ MoD (2018) *Global Strategic Trends*.

g) Getting the rules right: the role of the regulators and public bodies

Designing and implemented **rules and regulation** across the economy can ensure that the Government's climate objectives are prioritised equally alongside other objectives such as consumer protection, and economic efficiency. Economic regulators should have climate change as part of their core objectives. Specifically, regulators will also need to help drive the transition to Net Zero emissions and a climate resilient future in a number of areas.

- These most obviously include **Ofgem**, especially on energy networks. Regulatory frameworks may need to evolve as new vectors emerge and with an increasing integration between systems (e.g. hydrogen, which will need to be produced using CCS or renewable electricity and could supply power generation, heating, transport and industry). Ofgem's recent decarbonisation action plan sets out Ofgem's initial thinking on the impact of Net Zero on its activities. Ofgem should also set out ambitious requirements for reductions in leakage of methane from the gas grid.
- There could also be a role for **financial and pension regulators**, for example in requiring and monitoring disclosure of exposure to climate risks and compatibility of investments with a Net Zero target.
- **Ofwat** should include decarbonisation as one of its core principles, in light of the water industry's goal of achieving Net Zero by 2030, and the need to accurately measure the industry's emissions in the UK GHG Inventory. Similarly, Ofwat and the water industry will have a critical role to play in enabling adaptation to the UK's changing climate, and should embed this as a core objective.
- Some, such as the **Oil and Gas Authority (OGA)**, are reviewing their strategies in light of Net Zero. The UK Regulators Network is also considering the implications of Net Zero for its regulator members; several water companies have strategies for net-zero emissions by 2030.
- The **National Audit Office (NAO)** has a role to play in holding Government to account on meeting its climate objectives. Building on a volume of scrutiny of environmental policy over the past decade, the NAO is currently undertaking a review of the Government's response to Net Zero - now delayed until end-October.
- The soon-to-be established **Office for Environmental Protection** will be important in enforcing environmental regulations once the UK has left the EU, including on climate change mitigation and adaptation.

Where Government leads, **public bodies** should follow. The Government's strategy for the 301 public bodies that exist across the UK is due to expire at the end of this year.²¹⁸ This presents an opportunity to refresh the strategy to put plans in place to monitor and reduce the carbon footprint of public bodies - with energy use and transport being priority areas - whilst ensuring their plans are resilient to current and future climate change.

In some areas public bodies are already leading by example, such as the work being done by the NHS on its Net Zero action plan.

²¹⁸ Cabinet Office (2019) *Public Bodies 2018-19*.

h) Government leads, others act: the role of people, business, local government, and the need for a just transition

Public awareness

To date, much of the success in reducing UK emissions has been invisible to the public. Government policy has enabled emissions reductions to proceed in a way that has not required mass engagement, by reducing the 'supply' of emissions into the economy. For example, low-carbon power now provides over 50% of the UK's electricity supply, with no change to the service that electricity provides. Reaching net-zero emissions will require more involvement from people in engaging with the emissions reductions required, and reducing or adapting demand for energy intensive services:

- Over 60% of the abatement in our Net Zero scenarios to 2050 involves at least some degree of change from consumers (e.g. driving an electric car, or installing a heat pump instead of a gas boiler).
- Within this, around 10% is driven by consumer choices - shifting more quickly towards healthier diets, reducing growth in aviation demand and choosing products that last longer and therefore improve resource efficiency.

Though BEIS leads regular monitoring of public attitudes to energy and emissions, and the public are engaged in some policy development, there is currently no Government strategy to engage the public in the transition to a low-carbon and climate resilient economy. This will need to change. People should understand why and what changes are needed, see a benefit from making low-carbon choices and have access to the information and resources required to make the change happen. The engagement strategy should recognise the importance of co-benefits such as improved air quality, comfort and health and the need to adapt to the impacts of climate change, alongside reducing emissions.

It will not be possible to get close to meeting a Net Zero target without engaging with people or by pursuing an approach that focuses only on supply-side changes:

- At the moment, while the public are generally supportive of action to tackle climate change, and 75% of people are concerned about climate change, just 35% of people report having heard of 'Net Zero' as a concept, and only half of people are aware that their gas boiler causes emissions.²¹⁹ People who wish to reduce their impact on emissions are not provided sufficient support to make decisions that achieve this.
- People will need help to make low-carbon choices, both in terms of behaviours and in adopting low-carbon technologies. This will require making low-carbon choices more available and easier to use, provision of information, trials to see what works and policy that learns by doing. Some of the difficult decisions that will be required, (e.g. on the balance of electrification and hydrogen that replaces natural gas heating), will only be possible if people are engaged in a societal effort to reach net-zero emissions and understand the choices and constraints.

²¹⁹ See BEIS (2020) *Public Attitudes Tracker*, and Energy Systems Catapult (2020) *Net Zero: A Consumer Perspective*.

The Citizens Assembly convened by Parliament is an exemplar of public engagement, and should be the beginning of a wider conversation on the Net Zero target. After initial delay due to COVID-19 it was completed virtually and is due to report later in the year. Its findings should inform policy development and wider efforts to engage the public in the Net Zero challenge. By acting on its findings the Government can recognise the importance of this process, and look to integrate it further into policy development. A similar exercise should also be conducted on public engagement with climate change adaptation.

The need for a just transition

Economies are always in transition. The UK energy sector has seen transitions prompted by the industrial revolution, by the decline of UK coal mining and rise of natural gas and oil extraction in the North Sea, by privatisation and most recently by the need to decarbonise.

Broader transitions currently underway include the ongoing digital revolution and the accompanying wave of new disruptive technological developments (often referred to as the 'Fourth Industrial Revolution') including artificial intelligence, automation and robotics. Similarly the COVID-19 pandemic is forcing a reshaping of society.

As the UK moves from setting the Net Zero target to implementing a path that will achieve this goal, greater focus is needed on the wider socioeconomic impacts of decarbonisation. The transition to net-zero will necessitate a shift in employment, away from some inherently high-emitting activities (e.g. fossil fuel supply) to highly-skilled jobs to deliver the emissions reductions required.

The transition to a zero-carbon economy differs from other transitions as much of it will need to be policy-led, rather than a reaction to changing technologies and circumstances. The required speed of the transition is fast and the scale large, spanning across most aspects of the economy.

Like past transitions, the transition to net-zero GHG emissions will result in the creation of new markets and industries and a shift away from old industries, with consequences for employment. It will also bring down costs of some goods and services, while increasing the cost of others.

In many areas a transition to a net-zero and a climate resilient future presents a vision for a positive impact on society, by reducing emissions and improving resilience to the impacts of climate change, but also improving air quality, healthier diets and increased green space, for example. Additionally, chapter 5 notes how climate objectives can lead to wider economic benefits, by creating jobs. This shift should be managed so that burdens and benefits are fairly distributed amongst society, ensuring a just transition.

A strategy will be needed to ensure a just transition across society, with vulnerable workers and consumers protected. The Treasury's Net Zero review will play an important role in informing this, and must include analysis at the regional level and for specific industrial sectors. We note the work already being undertaken in Scotland's Just Transition Commission, and the Welsh Well-being of Future Generations Act (2015) as potential examples of how this can be taken forward.

The role of business

Businesses are committing to Net Zero targets (Section 4.3.c), and can play a key role in delivering the UK's net-zero objectives. Over 120 leading businesses wrote to the Prime Minister in support of the UK's Net Zero target, and more have recently written in support of a green economic stimulus policy to respond to the COVID-19 pandemic.

For companies seeking to begin or accelerate their journey to Net Zero, a key step is to assess and disclose how they will be impacted and the actions they are taking in response to climate change risks and opportunities, including transition risks (mitigation) and physical risks (adaptation), through the Task Force on Climate-related Financial Disclosures (TCFD) as well as the Carbon Disclosure Project (CDP), as many businesses are doing.

- Effective disclosures will include planning for both a '2°C or lower' scenario as stipulated by the TCFD, as well as scenarios involving a greater than 2°C global temperature rise by 2100 (such as 4°C), to address both transition and physical risks.
- Companies must also disclose the metrics and targets they use to manage relevant physical and transition risks and opportunities, including their GHG emissions in line with the GHG Protocol methodology.

Increasingly, businesses will need to ensure they deliver on ambitious climate objectives.

- Currently, this means switching fleets to electric vehicles, purchasing genuine low-carbon energy, and monitoring the emissions resulting from all of their activities.
- In the future this will mean ensuring heating comes from low-carbon sources, heavy goods vehicles run on low-carbon hydrogen or electricity and any remaining emissions reduced to zero as much as possible.
- The market for offsets is likely to be limited in the scale of sustainable offsets available. Where possible, zero emissions should be the goal, with emissions removal offsets used as a last resort.
 - Many businesses include plans for international offsetting of their emissions. The past decade has seen the expansion of the voluntary offset market amongst businesses and individuals (although it remains significantly smaller than the global compliance offset market - the Clean Development Mechanism (CDM)). The market allows actors to purchase offsets for their carbon-intensive activities by funding projects such as reforestation or renewable energy developments. Independent organisations have emerged who aim to verify the credentials of offset projects. This provides more credibility to a market which has historically been difficult to regulate, verify and assess.
 - As business commitments continue to scale up, companies are outlining targets compatible with a 1.5°C pathway, which will require deeper and more challenging reductions in emissions. In the coming years, it is likely ambitions will be ratcheted up further. To be in line with the Committee's recommendations for the UK's Net Zero target, businesses should eliminate or significantly reduce the use of offsets in meeting climate targets, limiting their use to emissions that are otherwise unavoidable.²²⁰

Businesses, local government and other 'non-state actors' will also play an important role in COP26 and are crucial to maintaining momentum in jurisdictions where national governments are not currently prioritising climate action (e.g. the US). We will provide further analysis on the role of business in the UK's climate objectives in our work on the Sixth Carbon Budget later this year.

²²⁰ House of Commons Hansard (12 June 2019) *Net Zero Emissions Target, Volume 661, Columns 673 and 682.*

The role of cities and local authorities

Cities and local authorities are well placed to understand the needs and opportunities in their local area, although there are questions over whether they have sufficient resources to contribute consistently and strongly to reducing emissions (Box 6.1). They have important roles and opportunities in the transition to net-zero:

- They should have a key role in local area energy plans, alongside network operators, especially in relation to building community consensus on plans for decarbonising heating.
- They have important roles on transport planning, including providing high-quality infrastructure for walking and cycling, provision of charging infrastructure for electric vehicles, and ensuring that new housing developments are designed for access to amenities and public transport.
- They can improve health outcomes for people who live and work in the area by implementing clean-air zones that discourage use of polluting vehicles and other technologies.
- They can also put in place plans to ensure their local area is resilient to the future impacts of climate change.

Local and combined authorities are embracing these objectives, with over two thirds of them having declaring 'Climate Emergencies' over the past 18 months, and many are considering how to implement ambitious emissions reductions strategies (Box 6.1). Nonetheless significant gaps remain:

- A lack of resources can mean climate change is one of many competing priorities, with monitoring of local emissions not taking place on a commonly recognised basis, and emissions reductions pathways not being co-ordinated across the country.
- Climate adaptation is not given sufficient attention in local plans, despite significant local powers to improve adaptation.
- The National Planning Policy Framework can also hinder delivery of climate objectives at a local level. Government should incentivise, support and enable local authorities to deliver emissions reductions and climate adaptation measures at a local level. This can only be achieved with nationally supportive, consistently aligned Net Zero policy from all Government departments.

Box 6.1. Local delivery of emissions reductions

The Committee has previously highlighted the good work being done to reduce emissions at a local and regional scale and called for Government to strengthen incentives for action by resourcing and encouraging area wide low-carbon action plans. Local and Combined Authorities have embraced the public enthusiasm for climate action by developing ambitious decarbonisation objectives. However, given competing objectives for limited funds, local authorities are still facing an uphill struggle to place Net Zero at the centre of policy.

- In 2019/2020 at least 280 Local Authorities and Combined Authorities declared Climate Emergencies.
- In many cases these pledges build on strong progress over the past decade, as local authorities delivered programmes to achieve emissions reductions that benefit residents and the local economy. Some examples include:
 - Greater Manchester's Five Year Environment Plan to deliver rapid emissions cuts in energy, buildings, transport, sustainable consumption and the natural environment.
 - Bristol City Council's 'City-Leap': an investment proposal for a low-carbon, smart energy infrastructure programme, delivering building retrofit and heat decarbonisation.
 - Nottingham City Council's workplace parking levy - funding extensions to the city's tram and Linkbus networks.
 - Warrington Borough Council's Green Energy Strategy - including a recent £60m investment in solar farms and battery storage.
- Local authorities are not required to monitor or report their emissions, although many do so. An array of information on possible emissions reductions is available from numerous sources, although there is currently no standard approach for target setting or developing action plans at a local level.
- Some national co-ordination and a framework for local delivery of the UK Net Zero target is required that allows for flexibility in how emissions reductions are delivered at a local level, whilst recognising that some decisions might benefit from co-ordinated scale (county and districts waste reductions, local area energy plans spanning local authority boundaries, or a regional switchover to hydrogen for heat, for example). This should enable local authorities to develop plans appropriate to their local areas but should not hold back those that have already developed plans.

The Committee previously called for local authorities to draw up low-carbon plans which include a high level ambition for emissions reduction by focusing on drivers of emissions over which they have influence (e.g. number of homes insulated, car miles travelled). At the time, we recommended that it would not be appropriate for local authorities to set (or be set) binding carbon budgets given the multiple drivers of emissions, many of which are beyond their control.

This year, as part of our advice on the Sixth Carbon Budget, we intend to produce an accompanying publication on local delivery for local authorities, city-regions and national policy-makers. This will include recommendations for local authorities with data and resources to aid decision-making, including early no-regrets actions for the 2020s and timelines for the 2030s.

Source: CCC analysis. Climate Emergency (2020) *List of Councils*.

Notes: New climate emergency information is being provided by organisations including The Local Government Association, Ashden & Friends of the Earth, APSE/APSE Energy, Core Cities, The Centre for Sustainable Energy, Green Alliance, UK 100, The UK Climate Emergency Network, The Tyndall Centre for Climate Change and SCATTER.

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