



# The role of business in delivering the UK's Net Zero ambition

An independent report for the Climate Change Committee.

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# Executive Summary

In order to achieve Net Zero emissions in the UK by the year 2050, major transformation will be needed across all parts of society. The UK Government must set the frameworks for the transition, the private sector must invest and transform their business models, citizens must make low-carbon choices, and the third sector will challenge and support all groups to go further and faster. Recognising the critical role that particularly the private sector has to play, the Committee has prepared this briefing to make its Sixth Carbon Budget Advice recommendations relevant to businesses in the UK. A briefing for local government is also published separately.\*

Companies within the UK and around the world are increasingly setting ambitious carbon reduction and net-zero strategies, often aligned with major frameworks and commitments, and driven by policy as well as other factors such as investor and customer pressure. Yet most of these frameworks are global in nature, and as set out by the CCC in the Sixth Carbon Budget, the UK's transition to Net Zero must be specific to the technological, geographical, political, market, and behavioural context of the UK. This briefing aims to supplement existing frameworks and commitments by setting out the key aspects of the required transition in the UK and detailing contributory actions from businesses. It is also intended to help companies to better understand and better prepare for the future UK policy landscape.

The Sixth Carbon Budget sets out the near and longer-term transition to UK Net Zero. This will have a major influence on the way businesses plan and operate. The Budget recommends the **UK reduces emissions by 2035 to 78% below 1990 levels†** in order to reach Net Zero emissions by 2050. This will require all investments and major purchases – such as cars and heating systems – to be zero carbon by the early 2030s at the latest, with only a very limited number of exceptions.

To be ready for and support the acceleration of the UK's Net Zero objective, many businesses in the UK will need to fundamentally change their operations, their business models, their approach to climate risk assessment and planning, and their relationships with investors and consumers. This briefing provides UK businesses with the principles and information they will need for this transition including:

- An overview of the respective roles of policy and business.
- The frameworks, drivers, and carbon accounting principles impacting upon corporate climate actions.
- The key principles business must embrace to meet the scale and ambition of what is required for a Net Zero transition, such as what to measure, how to contribute to systemic change in the UK, and how to approach offsetting.
- The future UK landscape, sector by sector, including levels of emissions reduction required as well as major technological, policy, behavioural shifts required during the 2020s, 2030s and for 2050.
- The actions that UK businesses should take to help accelerate and prepare for the UK Net Zero transition, sector by sector.

\* See CCC (2020) *Local authorities and the Sixth Carbon Budget*. Available at [www.theccc.org.uk](http://www.theccc.org.uk)

† Including the UK's share of International Shipping and Aviation

Actions by businesses working in partnership with Government will be key to the successful delivery of the UK's Net Zero target by 2050 and the many important nearer-term steps across all sectors underpinning the transition.

It is impossible to provide a single briefing that will address the precise needs of every business or to cover all possible issues of interest. This briefing aims first to set out the context and some general principles for the role of UK business, then to synthesise the opportunities and actions for different emissions sources. It is in two chapters:

1. The role of business in delivering the UK's Net Zero ambition
2. Sectoral requirements and suggested actions for business

## Chapter 1

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# The role of business in delivering the UK's Net Zero ambition

# 1. Introduction

This briefing translates the CCC's Sixth Carbon Budget into a set of insights, principles and actions for the private sector.

While the primary purpose of the Committee is to advise the UK and devolved governments, it recognises that its analysis, scenario planning, and recommendations to Government can be highly valuable to the UK private sector as they are seeking more information and context about the Net Zero transition.

Corporate action is already driving significant change across the UK and internationally, and accelerating this action will enable the policy, technological, behavioural, and business model changes needed for a zero carbon society. Many businesses within the UK are looking for better information and understanding of the future context in which they will operate. This information and context is critical as businesses seek to support the Net Zero transition and manage the risks the transition might bring if they are under prepared. The CCC is keen to help provide relevant context and information to support companies seeking not only to reduce their own emissions to Net Zero, but also seeking to take actions to help set the UK on the most effective and efficient path to Net Zero. The CCC also recognises that access to more information and context surrounding the Net Zero transition can only improve and accelerate support for bold and ambitious UK policy.

This briefing translates the CCC's 2020 Sixth Carbon Budget Advice for the private sector – providing insights into what the low-carbon landscape must look like in decades to come, key principles for businesses to follow for their Net Zero and climate strategies in line with the CCC's approach, and potential actions companies can take to align with the UK's trajectory to Net Zero. The CCC believes that the information found in this report can be valuable to 'UK plc' in a number of different ways, including:

- Informing the levels of ambition and the investment criteria that investors should be seeking if intending to make future investments in line with the level of action and transition needed to reach Net Zero by 2050;
- Enabling long-term strategic planning and decision making at Board level;
- Supporting pressure from shareholders to direct companies to the right actions;
- Enabling corporate analysis to inform which global or even local commitment and disclosure frameworks are most appropriate and supportive of UK based action;
- Providing illustrative transition risk scenarios to enable improved climate risk reporting, such as via the Task Force on Climate-Related Financial Disclosures.

Adaptation monitoring and planning is equally important for businesses.

While the focus of this briefing is primarily on emissions reduction, the role of adaptation and physical risk assessment and reporting will continue to be of utmost importance for UK businesses. Monitoring and planning for the changes brought about by increasing global temperatures will be as important for UK businesses as managing the transition to a decarbonised economy. Furthermore, while the principles and actions suggested are focused on the private sector, many will be applicable to public sector organisations, including local authorities, schools, hospitals and more.

## 2. The context for private sector Net Zero action

For the UK to achieve the transformation to Net Zero by 2050, government policy and UK corporate action must work in concert to bring about the technological, behavioural, business model, and policy changes needed to continue to reduce emissions at rapid pace and large scale. Understanding the respective roles of UK policy and UK corporate action is essential to enabling a coordinated transition to a zero-carbon future.

### a) The intersection of Policy and Private Sector Action

The role of policy is to provide the requisite conditions to enable the private sector action needed to deliver a Net Zero carbon economy:

Government should provide a stable and fair framework for businesses to deliver a Net Zero economy.

- **Providing long-term visibility and certainty:** The more certainty 'UK plc' has on future policy and the context in which it will operate in years to come, the more it can plan strategically for the future. This supports it to more efficiently and effectively enable the transition by helping the country to move in the same direction and avoids working to cross-purposes.
- **Breaking down market barriers as they evolve:** Targeting and addressing specific market barriers can be instrumental in unlocking the innovation and investment needed for the transition. Adjusting policy as some market barriers are unlocked and new ones emerge is also essential to keep pace with the market.
- **Creating a level playing field within the UK and outside:** The government has an essential role to set frameworks which can enable equitable treatment within and between sectors, supporting successful competition while maintaining fairness as well as ensuring that sectors negatively impacted by the shift to Net Zero are supported with a just transition. A level playing field is needed as much as possible within the UK, but also with competition outside of the UK supported by measures to prevent carbon leakage and maintain competitiveness.
- **Encouraging investment in low-carbon options:** Ensuring that low-carbon options are investable through frameworks and incentives, such as regulation, the tax and subsidy system or through market design, while also recognising when private investment is not yet viable and stepping in to provide more direct support or investment.
- **Supporting fairness and spreading the costs and impact of the transition:** In some cases, additional costs may be incurred by the private sector and consumers in the transition to Net Zero. The Government has a key role to play in ensuring that these costs are appropriately spread to avoid unfairly falling onto one particular group.

With the Government providing the right frameworks and supporting policies, the private sector has an essential role to play in the Net Zero transition:

Through its practices and investments the private sector plays an essential role in supporting the Net Zero transition.

- **Decarbonising operations:** Looking across their operations, businesses can reduce their own direct emissions and indirect emissions by switching to low-or zero-carbon alternatives, such as converting fleet vehicles to electric, electrifying and making buildings more energy efficient, and changing electricity supply to renewables.

- **Fostering innovation:** The UK private sector has the ability to develop and deliver innovative technological and business models, including transforming wider supply chains and in some cases completely overhauling traditional and established business practices to enable the needed transition to Net Zero. This includes for example circular economy principles which reduce overall consumption through reuse.
- **Leveraging procurement:** Companies can leverage individual and collective buying power to create the demand for low-carbon products and processes.
- **Manufacturing and production:** the UK will be responsible for shifting manufacturing and production technologies and practices to create the goods and processes needed to reach Net Zero.
- **Nudging employees and customers to make Net Zero decisions:** Companies can empower these groups with information, alternatives and the support to guide lifestyle choices towards Net Zero.
- **Building support for bold policy:** The private sector can demonstrate that ambitious policy is possible and desirable by proving the business case, technological possibilities, and willingness to embrace change.
- **Setting international leadership:** UK companies and global companies operating within the UK can support raised ambitions around the globe by setting ambitious strategies and targets, decarbonising international operations and supply chains, and contributing to wider systemic change around the world.

## b) Private sector commitments and frameworks for climate action

There are a number of voluntary frameworks for private sector climate action, and increasing pressure on businesses to demonstrate their commitment to a low-carbon future.

An increasing number of companies in the UK and around the world have committed to voluntary climate targets. Over 1,100 companies have joined the UNFCCC 'Race To Zero' with commitments to achieve Net Zero by 2050.<sup>1</sup> There are numerous drivers for this increase in commitments, many of which are international in nature and go beyond the policy context in individual countries:

- **Investors and Shareholders.** In 2020, there has been an increasing number of companies impacted by major shareholder motions demanding increased action on climate change (for example US bank JP Morgan and mining group Rio Tinto). Major investors (e.g. Blackrock) are increasingly expecting climate risk disclosure of investees.<sup>2</sup>
- **Consumers.** A study in 2019 found that climate change is now in the top three issues which consumers expect business to take action on (up from 17<sup>th</sup> in 2018); and 84% of the climate efforts disclosed by businesses surveyed were not perceived by consumers as strong enough.<sup>3</sup>
- **Climate competitiveness.** Corporate leaders are striking out with bold moral and competitiveness leadership commitments. Microsoft and Velux's ambitions to remove all historical emissions and Unilever's commitment to carbon footprint labelling across its entire portfolio are strong examples.
- **International Climate Diplomacy.** The elevated role of the non-state actor including companies continues to accelerate each year, with the formation of We Mean Business at COP21 and the Race to Zero in the lead up to COP26.



- **Protection of the bottom line.** In addition to policy drivers, many of the factors above are impacting upon the ability to maintain and protect profit and growth. As investors demand further climate ambition that is more clearly in line with national and international targets, lack of compliance with expectations can lead to loss of investment. As consumers demand increasing transparency and climate commitments, brand loyalty and ultimately sales could be lost to more 'climate ambitious' competitors. Failure to address transition risks as well as physical risks could also leave companies unprepared for significant policy changes relative to their competitors. Ultimately, embracing Net Zero will be needed to protect the bottom line.

Due to the international nature of many of these drivers and the dominance of global corporations, the corporate commitments and associated targets and action plans are most often – but not always – aligned with frameworks that provide prescribed pathways to reach Net Zero in line with best practice global requirements. These include:

- **Disclosure and reporting standards** such as the GHG Protocol Corporate Standard which specifies how to account for emissions reductions across Scope 1, 2 and 3 (Box 1.1), as well as the Task Force on Climate-Related Financial Disclosure (TCFD) which sets out corporate reporting approaches for transition and physical risks;
- **Aligned corporate and sectoral commitments.** A variety of corporate level commitment platforms have been developed internationally. These include Science Based Targets (aligning emissions reduction to a global well below 2 or 1.5°C degree pathway), BCorps Net Zero Target (Net Zero by 2030 for certified BCorps), and the Climate Pledge (adopting a 2040 Net Zero target). There are also sectoral commitments such as the EV100 (committing to 100% EVs by 2030), RE100 (committing to 100% renewable electricity by 2030), the World Green Buildings Council Net Zero Carbon Buildings Commitment (committing to Net Zero Carbon Buildings by 2030), and the Net Zero Asset Owners Alliance (committing institutional investors to transition investment portfolios to Net Zero by 2050). Within the UK, examples include the Better Buildings Partnership Climate Declaration (committing to publish plans to achieve Net Zero buildings), and the Clean Van Commitment (pledging to move to zero emission vans by 2028).
- **Formal and informal investor criteria and principles.** Examples include the Institutional Investors Group on Climate Change Net Zero Investment Initiative (recommended actions, metrics, and methodologies for investors seeking to align with 1.5 degrees), and the EU Sustainable Taxonomy for Finance (setting benchmarks for what constitutes 'green' in order to qualify for green investment).
- **Sectoral Roadmaps and Coalitions** such as the Global Cement and Concrete Association; Fashion Industry Charter for Climate Action, and the British Retail Consortium Net Zero roadmap.

## Box 1.1

### Corporate emissions accounting and scopes of coverage

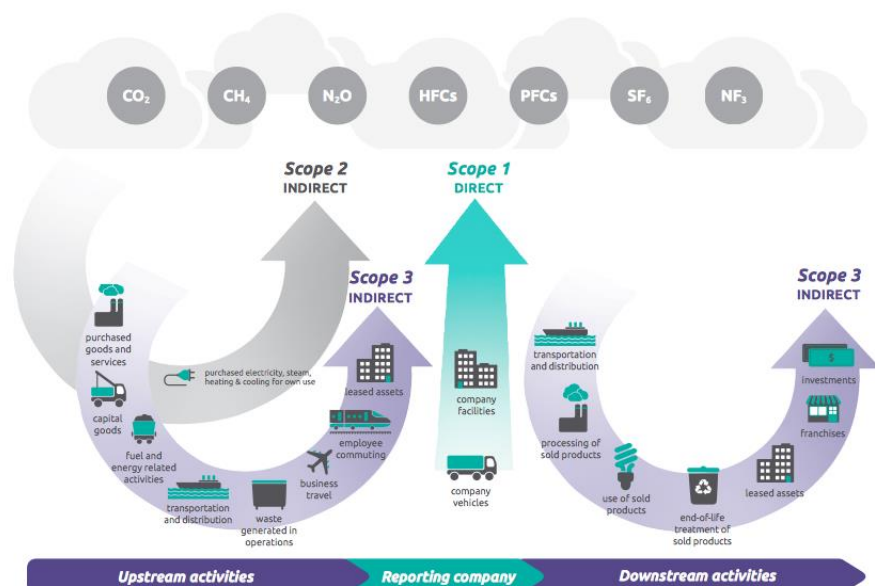
In almost all of these corporate climate action frameworks, determining the responsibility of the corporation in measuring, disclosing and reducing its own emissions is paramount. This determination is guided by the differentiation between 'direct' and 'indirect' emissions, identified as Scope 1, 2 and 3. The definitions of these scopes and the relative composition of a corporation's emissions by scope plays a key role in determining the type of actions a company must undertake to play its part in reducing the emissions for which it is responsible.

#### Scopes of corporate GHG emissions

- **Scope 1.** Direct GHG emissions occur from sources that are owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, or emissions from production in owned or controlled process equipment.
- **Scope 2.** Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.
- **Scope 3.** Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company, for example resulting from the use of a company's product by consumers.

The composition of total emissions from across the different scopes varies sector by sector. The actions taken by companies to reduce the emissions for which they are responsible will depend on whether the majority of their focus is on Scope 1, 2 or 3. For example, a steelmaking company with the majority of emissions within Scope 1 will focus mainly on reducing the emissions of their manufacturing process. A company with a high proportion of Scope 2 emissions may focus on using 100% renewable electricity. A consumer products company will need to look across their entire, and in many cases highly international supply chain, and also develop approaches to influence the practices and buying behaviours of their consumers. A financial services company will likely see the large majority of its emissions from its customers or investments.

Figure B1.1 Diagram of emissions scopes 1, 2 and 3.



Source: Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

# 3. Aligning corporate climate strategies with the UK's path to Net Zero

Actions by businesses to support UK Net Zero may differ from those suggested at a global level.

The existing frameworks and commitments outlined provide the private sector with pathways to follow as they seek to reduce emissions, particularly at a global level. But UK companies may also want to consider which actions should be taken within the UK to most effectively enable the country to meet its Net Zero target. In some cases, this may mean taking actions which are more ambitious or simply different than what may be required to align with global standards and frameworks.

This briefing aims to supplement existing frameworks and commitments by setting out the key aspects of the required transition in the UK and how companies can contribute towards it. It will also enable companies to better understand the future policy landscape, and better prepare for it. It is based on the CCC Sixth Carbon Budget Advice report, recommending a UK emissions budget for the period 2033-2037 which this briefing is published alongside. The Sixth Budget advice builds on recent work from the CCC, notably the 2019 *Net Zero Report* (and accompanying *Net Zero Technical Report*) and the CCC 2020 *Progress Report*, and sits alongside a detailed Sixth Carbon Budget *Policy Report* which outlines the policies Government needs to bring forward in this Parliament.

The Sixth Budget Advice report can provide the UK private sector with critical information and future scenarios as they look to understand the implications of the Net Zero transition on their business, and plan for a new and changed future. The analysis and conclusions outlined inform a number of key principles for UK companies to follow as they seek to support the UK's transition to Net Zero. The analysis also provides key details of the overall policy and technological landscape within which companies will likely operate in the future. The recommendations to the UK Government can translate to critical actions for corporations to consider undertaking as they prepare for the emissions reductions required to reach Net Zero in the UK by 2050.

## a) Key Net Zero transition principles for business

The recommendations CCC has made to the UK Government reflect key principles that are also relevant for corporations considering their climate contributions:

Businesses should address emissions across all scopes, and also look for opportunities to go beyond.

- **Do the basics well – measure, disclose, target, act, and adjust.**
  - While the UK's Net Zero target is for 2050, the CCC regularly emphasises the need for immediate action and ongoing monitoring, reflected in legislated carbon budgets through to 2032 (soon 2037), and annual progress reporting on the UK's actions to meet these budgets.
  - Effective corporate action requires a similar approach with regular measurement that is disclosed and used to set targets, with corresponding action plans developed and implemented, that are then adjusted based on the tracking of progress.

Businesses should measure and disclose their climate impacts and risk exposure, set phased emission reduction plans, and deliver on these commitments.

- In a recent survey of FTSE100 companies, 99% of companies are measuring and reporting their carbon emissions, 67% have set carbon reduction targets (45% Net Zero targets), and 73% are on track to meeting these targets.<sup>4</sup>
  - UK companies, particularly medium and larger ones, should be doing all of the above: measuring all emissions across Scopes 1-3, disclosing publicly these emissions, targeting carbon reduction, and setting then achieving phased emissions reduction action plans.
  - Companies should also disclose climate risk through the Taskforce for Climate-related Financial Disclosure (TCFD), and measure, target and adjust for climate risk adaptation as well as mitigation. In November 2020, the UK Government announced its intention to make TCFD aligned disclosures mandatory across the economy by 2025, with a significant portion of mandatory requirements in place by 2023
- **Adopt the highest possible ambition.** The Paris Agreement requires all parties to adopt and communicate their highest possible ambition. For the UK this means Net Zero for all greenhouse gases from all sectors by 2050 at the latest.<sup>5</sup> However, the UK target will only be met once the latest movers in the hardest to address sectors have reduced emissions to Net Zero. Ambitious companies should look at significantly earlier targets. A recent study in the UK identified 36% of UK businesses as either having or planning to have a Net Zero strategy, with on average these businesses expecting to reach Net Zero in 2029.<sup>6</sup> Companies across the UK should strive for the highest ambition – the earliest date – possible.
  - **Address all emissions including Scope 3 – and go beyond.** The CCC monitors progress and recommends action to reduce both territorial and consumption emissions. For businesses the equivalent approach is to consider and reduce all emissions including Scope 3, which includes indirect emissions from wider supply chains (often reaching international jurisdictions), emissions from the use of their products, and investments. Corporations should increase their focus on Scope 3, and where possible look to go beyond these measured emissions by addressing actions within Scopes 1-3 that can impact wider systemic changes in the UK and abroad, even if there is no measured impact on the corporation's own accounted emissions.
    - An example would include embracing corporate renewables procurement that pays for new low-carbon electricity to be installed, rather than just purchasing existing renewables, with no impact on a corporation's own accounted emissions. Such approaches will involve embracing innovation in technologies and business models, increasing R&D, and persuading consumers and suppliers to change behaviours. A separate briefing note, published alongside this one, suggests key actions businesses can take here.<sup>7</sup>
    - A further example would be accelerated electrification of companies' vehicles fleets. A separate briefing note, published alongside this one, suggests key actions businesses can take here.<sup>8</sup>
    - Companies can also work with other companies, Government and regulators to ensure product standards support decarbonisation. A separate briefing note, published alongside this one, suggests key actions that can be taken here.<sup>9</sup>

Boards must have sufficient climate knowledge and expertise to undertake their duties.

The use of offsets should be minimised and any remaining offsets should transition to more permanent forms of removals.

- Ensure climate change is addressed at the highest levels of corporate leadership.** For companies to achieve the highest ambitions and make sure that targets are met and plans are achieved, climate change must be both a Board and CEO level responsibility. This requires following the key principles of frameworks such as the World Economic Forum Corporate Governance Principles and reporting via the Task Force on Climate Related Financial Disclosures. These include ensuring that there is overall climate accountability on Boards, that there is sufficient climate change knowledge and expertise at the Board level, updating executive incentive schemes to incorporate climate targets, and disclosing transition and physical risks associated with both climate change mitigation and adaptation.
- Minimise the use offsets, aim to phase them out, and where offsetting remains necessary, prioritise permanent forms of removals.** The CCC has recommended that the UK should aim to meet its Net Zero target and the Sixth Carbon Budget without the use of international carbon credits. Businesses should likewise look to minimise their use of offsets, reserving their use only where no alternative is available (the CCC's assessment in Table 1.1 of where residual emissions may be expected provides a guide). All offsets must demonstrate additionality and promote sustainable development, and should transition to more permanent, verifiable forms of GHG emissions removals in the longer term. Permanent removals securely store carbon for the long term, with examples including sustainable Bioenergy with Carbon Capture and Storage (BECCS) and Direct Air Capture of CO<sub>2</sub> with Storage (DACCS), or land-based approaches where there is a robust process for identifying and remediating any carbon lost over time.

	2020s	2030s	2040s	2050
<b>Electricity</b>	No offsets			
<b>Surface transport</b>	HGV, cars/vans with no off-street charging	HGV	HGV	No offsets
<b>Manufacturing &amp; Construction</b>	Some heat and process emissions	Some remote process emissions.	Residual emissions from CCS on non-combustion emissions.	
<b>Fuel supply</b>	Some heat and process emissions	Flaring for safety purposes only.	Small methane leaks from closed coal mines. Residual emissions from CCS.	
<b>Buildings</b>	Heat/cooling, Embodied carbon	Heat/cooling, Embodied carbon	Embodied carbon	No offsets
<b>Aviation</b>	Essential flights	Essential flights	Essential flights	Essential flights
<b>Shipping</b>	Domestic, international.	Domestic, international.	International,	Can use low-carbon fuels, minimal offset required.
<b>Waste</b>	Landfill, energy-from-waste, wastewater treatment	Energy-from-waste, wastewater treatment, legacy landfill	Energy-from-waste, wastewater treatment, legacy landfill	Wastewater treatment, legacy landfill

## b) Sectoral UK Net Zero Requirements and Corporate Action

In planning targets as well as short-term and longer-term Net Zero action plans, companies must have a clear view of the potential future they face and the relevant actions they must take to mitigate emissions, manage the transition and address the physical risks of climate change.

To support companies in doing this, the CCC provides a sector-by-sector summary of the transitions required for the UK to achieve Net Zero by 2050 and meet the Sixth Carbon Budget for the years 2033 to 2037. Furthermore, the CCC has translated its recommended actions for the UK as a whole for companies seeking to understand what actions, at minimum, they must take to support the Net Zero transition. These actions for businesses should be considered as the minimum to achieve alignment. Businesses seeking to follow the principles outlined above should strive to achieve a higher ambition and consider how the overall changes required for the UK can inform leadership strategies that go above and beyond this minimum.

### The Net Zero landscape

Overall, the CCC has concluded that emissions must be reduced by 78% from 522 MtCO<sub>2</sub>e in 2019 to 191 MtCO<sub>2</sub>e by 2035 and further reduced to Net Zero by 2050. The 58 MtCO<sub>2</sub>e of residual emissions remaining by 2050, predominantly in the aviation and agriculture sectors, will need to be addressed through emissions removals, in addition to the nature-based removals already in our scenarios.

In order to achieve these reductions to meet the Sixth Carbon Budget and achieve overall Net Zero, specific actions need to be taken through the coming decades. Tables 1.2 and 1.3 provide an overview of the pathways and the key actions required, and Chapter 2 provides specific information and guidance to companies in each of the sectors of the CCC's analysis.

While the CCC considers the actions presented to be a Balanced Pathway for the UK to reach Net Zero by 2050 this is not the only possible pathway. In the Sixth Budget advice the CCC explored a number of other scenarios with differing assumptions around low-carbon technology and societal changes. Overall, while there are resulting differences in the balance between sectors these highlight the need for substantial transformations across all sectors to take place and the importance of near-term actions in the 2020s to underpin economy-wide decarbonisation.

To be on the pathway to Net Zero by 2050 the CCC advises that emissions must be reduced by 78% in 2035 relative to 1990.

The 2050 pathway actually followed may be different to that presented but will be built upon the same crucial near-term actions.

**Table 1.2**

Key metrics for actions in the Balanced Pathway to meet the Sixth Carbon Budget

		2019	2025	2030	2035	2050	Trend
UK greenhouse gas emissions	UK greenhouse gas emissions (MtCO <sub>2</sub> e)	522	445	316	191	0	
	UK greenhouse gas emissions per person (tCO <sub>2</sub> e/capita)	7.8	6.5	4.5	2.7	0	
Demand reduction	Weekly meat consumption (g) (includes fresh and processed meat)	960	880	770	730	630	
	Weekly dairy consumption (g)	2,020	1,840	1,620	1,620	1,620	
	Plane-km per person	11,700	11,000	11,000	11,400	13,700	
	Car-km per driver	12,900	12,600	12,400	12,200	11,700	
	Remaining waste per person, after prevention & recycling (kg)	490	400	310	280	300	
Efficiency	Carbon-intensity of a new HGV (gCO <sub>2</sub> /km)	680	580	420	20	0	
	Increase in longevity of electronics	0%	30%	80%	120%	120%	
Electrification, hydrogen and carbon capture and storage	Carbon intensity of UK electricity (gCO <sub>2</sub> e/kWhe)	220	125	45	10	2	
	Offshore wind (GWe)	10	25	40	50	95	
	Share of BEVs in new car sales	2%	48%	97%	100%	100%	
	Heat pump installations (thousand per year)	26	415	1,070	1,430	1,480	
	Manufacturing energy use from electricity or hydrogen	27%	27%	37%	52%	76%	
	Low-carbon hydrogen (TWh)	<1	1	30	105	225	
	CCS in manufacturing (MtCO <sub>2</sub> )	0	0.2	2	5	8	
	CCS in rest of the economy (MtCO <sub>2</sub> )	0	0.1	20	48	96	
Land	UK woodland area	13%	14%	14%	15%	18%	
	Energy crops (kha)	10	23	115	266	720	
	Peat area restored	25%	36%	47%	58%	79%	
	Land-based carbon sinks (MtCO <sub>2</sub> )	18	18	20	23	39	
Removals	Greenhouse gas removals (MtCO <sub>2</sub> )	0	<1	5	23	58	

**Table 1.3**

Phase-out dates of high-carbon activities under the Balanced Pathway

Technology/behaviour		
<b>New fossil-fuelled cars and vans</b>	2032 (including plug-in hybrids)	2050
<b>Gas boilers</b>	2033 (in residential homes) 2030-33 (in commercial properties)	2050
<b>Oil boilers</b>	2028 (in residential homes) 2025-26 (in commercial properties)	2050
<b>Gas power generation (unabated)</b>	2030 (no new build of unabated gas plants)	2035
<b>HGVs</b>	2040	Beyond 2050
<b>Biodegradable waste sent to landfill</b>	N/A	2025 no municipal & non-municipal biodegradable waste going to landfill
<b>Energy-from-waste plants (unabated)</b>	From today, new plants and extensions should be built with CCS or CCS ready	2050
<b>Cement</b>	From today, new conventional plants should be built with CCS or CCS ready	By 2040: All cement production near-zero emissions.



## Chapter 2

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# Sectoral requirements and suggested actions for business

# 1. Surface Transport

Surface transport is presently the UK's largest emissions sector. The Sixth Carbon Budget suggests it should be around 90% decarbonised by 2040. The transition away from internal combustion engines accelerates through the 2020s via widespread electrification of passenger and light duty vehicles and testing and rollout of zero emission HGV technologies. Decarbonisation of surface transport will require significant investments in technology and infrastructure but overall these will be more than offset by savings in operational expenditure.

**Table 2.1**

Actions required in surface transport

## UK Sixth Budget advice for the Net Zero Transition

- **Current emissions:** 113 MtCO<sub>2e</sub> 2019 (22% of total UK emissions).
- **Sixth Carbon Budget Pathway:** 32 MtCO<sub>2e</sub> by 2035, 70% reduction from 2019. 1 MtCO<sub>2e</sub> by 2050.
- **Key milestones:**
  - Sales of new passenger vehicle and van fleets fully electric 2032.
  - End new diesel HGV sales by 2040 at the latest to ensure the UK has a near zero-carbon freight industry by 2050.
  - Last date to operate fossil fueled cars and vans 2050 (limited HGVs beyond 2050)

## Additional features of our Balanced Pathway to Net Zero

- Zero-emission vehicles (ZEVs) to make up 96% of new sales of HGVs, buses and coaches by 2035 and 100% by 2040.
- Trials and pilots of zero emission large HGVs and associated refuelling infrastructure from 2020-2025.
- With international coordination, decide on most cost-effective technology option for zero emission large HGVs and build infrastructure by 2030.
- End new diesel bus and coach sales by 2040 at the latest.
- Estimated 170,000 zero-emission HGVs and coaches (approximately 33% of the fleet) in operation by 2035, rising to 67% of the fleet by 2040.
- Significant investment in upfront costs of vehicles and in charging infrastructure starting from now and rising to £12 billion per year in 2035. As EVs are much more efficient than conventional vehicles, these will be offset by lower operational expenditure from around 2030, with annual operating cost savings of around £20 billion in 2035.
- Financial incentives for vehicles continue until cost parity achieved.
- Vehicle and fuel taxation must ensure that zero emission large HGVs are the most cost effective option for fleet operators resulting in nearly 100% market share in 2040.
- 47% of the UK's railways are electrified by 2035. All diesel trains phased out by 2040, in line with current Government target.

## Suggested actions for UK Business

- Incentivise customer and employee travel towards modal shift – away from private vehicles, towards walking, cycling, and public transport.
- Transition all passenger vehicle and van fleets to fully electric.

- Shift HGV use to biofuel or electric in the short term ensuring that biofuel comes from sustainable, advanced feedstocks including waste materials; and longer term hydrogen, electric or cabling.
- Provide opportunities for charging at workplaces and retail, for corporate fleets as well as citizens.
- Freight operators reduce their fuel consumption and emissions through improved logistics, driver training and the use of fuel saving technologies fitted to existing vehicles, such as aerodynamic improvements.
- Manufacturers switch to full EV sales.
- Disclose product life-cycle emissions, including for vehicles but also GHG impacts of transportation for non-vehicle products.

## 2. Buildings

The CCC's advice is that emissions from buildings should be brought to zero by 2050 at the latest. In doing so, they can also be made more comfortable and healthier spaces to be in year round, which are resilient to overheating and other climate risks. Progress in emissions reductions from buildings has broadly flatlined since 2015. In the coming decade rapid progress is needed on buildings efficiency, scale up in deployment of both heat pumps and heat networks, and trials of hydrogen. This requires a major ramp-up from what is happening today in supply chains for insulation, heat pumps and heat networks.

**Table 2.2**

Actions required in buildings

### UK Sixth Budget advice for Net Zero Transition

- **Current emissions:** 87 MtCO<sub>2e</sub> 2019 (17% of total UK emissions).
- **Sixth Carbon Budget Pathway:** Reduce to 47MtCO<sub>2e</sub> by 2035 - a 46% reduction from 2019 (equivalent to reductions of 44% residential/56% non-residential buildings emissions).
- **Key milestones:**
  - Zero emissions from buildings by 2050 at the latest.
  - All new buildings zero-carbon by 2025.
  - 100% of heating system sales off the gas grid are low-carbon from 2028, with exemptions for any buildings in zones designated for low-carbon district heat.
  - 100% of heating system sales are low-carbon from 2033, with exemptions for any buildings in zones designated for low-carbon district heat or hydrogen-conversion.

### Additional features of our Balanced Pathway to Net Zero

- Rented homes and all homes for sale are EPC C by 2028. Homes with mortgages achieve EPC C by 2033.
- All commercial efficiency renovations completed by 2030.
- Emissions from public buildings halve by 2032.
- Phase out date for fossil fuel boiler installations in non-residential buildings are 2025 for high-carbon fossil fuel boilers in public buildings and 2026 in commercial buildings, and 2033 for gas boilers in commercial buildings and 2030 in public buildings.
- By 2030, heat pump sales reach just over 1 million per year in new and existing homes of a total market of 1.8 million boiler installations currently.
- Hydrogen trials are scaled up rapidly in the 2020s to enable rapid grid conversion from 2030 onwards. All boilers are hydrogen-ready by 2025.
- Low-carbon heat networks are built through 2020-2050, with scaling up through to 2028, from which point around 0.5% of total heating demand is converted per year. By 2050, around a fifth of heat is distributed through heat networks.
- We assume that all new district heat network connections from 2025 are low-carbon. All heat networks supplied by legacy CHP schemes convert to low-carbon heat sources by 2040.
- By 2030, 37% of public and commercial heat demand is met by low-carbon sources. Of this low-carbon heat demand 65% is met by heat pumps, 32% district heating and 3% biomass.

### **Suggested actions for UK Business**

- Maximise energy efficiency in all buildings
- Ensure all electricity use is renewable, either on-site or procured to create new renewable generation (see Electricity section)
- Heat strategy focussed on heat pumps and connecting to local heat networks.
- Move from active cooling to passive cooling, improving energy efficiency but also reducing F-gases.
- Assess and disclose embodied carbon as part of wider whole-life carbon assessment.
- Use/look for timber use in buildings and products, to reduce embodied carbon emissions as well as to facilitate carbon removals.

## 3. Manufacturing and construction

The Sixth Carbon Budget sees substantial reductions in manufacturing and construction emissions based on fuel-switching, carbon capture and storage (CCS), improvements to resource and energy efficiency, and materials substitution. To support this Government needs to establish a policy framework to support UK manufacturing to reduce emissions in a way that does not drive manufacturers overseas and that benefits jobs and investment in UK manufacturing.

**Table 2.3**

Actions required in manufacturing and construction

### UK Sixth Budget advice for Net Zero Transition

- **Current emissions:** 66 MtCO<sub>2e</sub> (12% of total UK emissions)
- **Sixth Carbon Budget pathway:** 70% reduction from 2019 level to 19 MtCO<sub>2e</sub> by 2035, 2.8 MtCO<sub>2e</sub> by 2050
- **Key milestones:** Government should set targets for ore-based steelmaking and cement production in the UK to reach near-zero emissions by 2035 and 2040 respectively

### Additional features of our Balanced Pathway to Net Zero

- Improvements in resource and energy efficiency lead to the largest emissions reductions in the early 2020s, with smaller contributions from electrification, biofuel use and material substitution.
- Infrastructures for CCS and hydrogen are deployed from 2025 starting near industrial clusters.
- Improvements in resource and energy efficiency and material substitution reduce emissions by 8 MtCO<sub>2e</sub>, 3 MtCO<sub>2e</sub> 1 MtCO<sub>2e</sub> per year by 2035, respectively.
- Electrification reduces emissions by 9 MtCO<sub>2e</sub> per year by 2035, 14 MtCO<sub>2e</sub> by 2045
- Hydrogen use reduces emissions by 7 MtCO<sub>2e</sub> per year by 2035, 14 MtCO<sub>2e</sub> by 2045.
- Bioenergy use reduces fossil emissions by 2 MtCO<sub>2e</sub> per year by 2035 2.5 MtCO<sub>2e</sub> in 2045
- CCS reduces manufacturing emissions by 6 MtCO<sub>2e</sub> per year in 2035, 9 MtCO<sub>2e</sub> by 2045
- Estimated costs around £1 billion/year in 2030, £2bn/year in 2035 and reaching £4bn/year through the 2040s.

### Suggested actions for UK Business

- Establish at least two CCS clusters in the mid-2020s, at least four by the late 2020s, and further clusters around 2030.
- Develop carbon intensity measurement standards for products and production for potential application to internationally traded products.
- Manufacturers and constructors disclose the carbon intensity / lifecycle emissions of products and production.
- Demonstrate and build confidence in new fuel switching and CCS technologies, including off-road mobile machinery.
- Work with Government to develop minimum standards for more resource efficient consumer products and construction.
- Minerals industries to work with government to develop a detailed joint plan for CO<sub>2</sub> transport from dispersed sites.

- Factor into business models deployment of measures to reduce emissions to zero or very-near zero.
- Install low-emission technologies at industrial sites and implement more efficient practices.
- Build up supply chains and worker skills.
- Work with Government to develop funding mechanisms and reform market mechanisms.

## 4. Electricity generation

The Sixth Carbon Budget sees the complete decarbonisation of electricity generation by 2035, alongside a doubling of demand for electricity by 2050 compared to the present day. This reflects the increasing electrification of the economy. Expansion of renewables, with offshore wind forming the backbone of the system, is complemented by low-carbon dispatchable generation and a more flexible electricity system.

**Table 2.4**

Actions required in electricity generation

### UK Sixth Budget advice for Net Zero Transition

- **Current emissions:** 52 MtCO<sub>2e</sub> (10% of total UK emissions)
- **Sixth Carbon Budget pathway:** Nearly 90% reduction from 2019 level to 6 MtCO<sub>2e</sub> by 2035, 1 MtCO<sub>2e</sub> by 2050
- **Key milestones:**
  - Electricity system 100% low-carbon by 2035.
  - Coal power phaseout by 2024.
  - Unabated gas generation phaseout by 2035.
  - Move to a more flexible electricity system.

### Additional features of the Balanced Pathway to Net Zero

- Carbon intensity of generation falls from 220 gCO<sub>2</sub>/kWh in 2019 to around 50 gCO<sub>2</sub>/kWh in 2030, 10 gCO<sub>2</sub>/kWh in 2035, and 2 gCO<sub>2</sub>/kWh in 2050.
- Variable renewables reach 65% of generation by 2030, 75% by 2035, and 80% by 2050.
- Wind, particularly offshore, is the backbone of the system, providing 265 TWh of generation in 2035 and 430 TWh in 2050.
- Solar generation provides 60 TWh in 2035 and 85 TWh in 2050.
- Development of CCS infrastructure enables deployment of gas CCS and BECCS plants. These could provide 6% and 3% of generation by 2035, respectively.
- Hydrogen can provide a flexible form of dispatchable generation similar to unabated gas. Hydrogen production can also make use of excess generation when demand is low. Some gas plants start to switch to hydrogen in the 2020s. By 2035, hydrogen gas plants provide 20 TWh of generation, meeting 5% of demand.
- Despite retirements of existing nuclear plants in the 2020s, this scenario sees new projects restore generation to current levels (10GW) by 2035.
- Total additional capital investment required (compared to a high-carbon system) rises to around £15 billion in 2035 and £5 billion in 2050.
- Upgrading distribution networks for electrification.

### Suggested actions for UK Business

- Consume 100% renewable electricity through either on-site generation or procurement.
- If procuring, use procurement models which specify creation of new generation.
- Alongside renewables invest in storage – either on-site, through PPAs or green tariffs.
- Use demand response, and over time aim to link use to carbon intensity not just price.
- Track and ultimately disclose GHGs from electricity use.



## 5. Fuel supply

The Sixth Carbon Budget involves a transition from fossil fuel production to low-carbon hydrogen and increasingly best-use of bioenergy. There is an important role for hydrogen produced from fossil gas with carbon capture and storage (CCS) in the medium term. Production of bioenergy resources increases in line with expanding UK production of forestry residues and perennial energy crops with a shift to bioenergy use with CCS to deliver removals during the 2030s. Emissions from oil and gas production, predominantly from offshore platforms and from onshore processing terminals, are decarbonised mainly by fuel switching and measures to reduce methane flaring and venting.

**Table 2.5**

Actions required in fossil fuels production and refining

### UK Sixth Budget advice for Net Zero Transition

- **Current emissions:** 39 MtCO<sub>2</sub>e (7% of total UK emissions)
- **Key milestones:**
  - Reduce emissions from remaining fossil fuel supply by 75% by 2035 from 2018 levels.
  - From 2021 any new plans for offshore oil and gas platforms and associated installations must use low-carbon energy for their operations. As a result, all new oil and gas platforms should have no direct emissions from operational energy use by 2027, at the latest.
  - From 2025, flaring and venting on offshore oil and gas platforms should only be permitted when necessary for safety reasons

### Additional features of the Balanced Pathway to Net Zero

- Fuel Supply transitions from producing 1,100 TWh of fossil fuels and 170 TWh of bioenergy in 2018 to producing 425 TWh of low-carbon hydrogen and bioenergy in 2050.
- Electrolysis comprises 21% of hydrogen supply by 2035, but this rises to 44% by 2050 as costs fall and supply constraints ease. Reforming of fossil gas with CCS provides 60% of hydrogen supply by 2035, it falls into more of a supporting role by 2050, providing 32% of hydrogen supply. Bioenergy with CCS (BECCS) provides 5% of hydrogen supply by 2035 and 11% by 2050.
- BECCS also provides 4% of electricity generation in 2040 while biojet provides 17% of aviation fuel demand by 2050.
- Fuel switching away from petroleum across the economy, such as in surface transport, is the largest emissions reduction action. This reduces oil refining in the UK and the associated emissions by 5 MtCO<sub>2</sub>e/year by 2035.
- CCS is the main emissions reduction measure for the remaining emissions from oil refineries, with 1.5 MtCO<sub>2</sub>e/year of abatement in 2030, 3 MtCO<sub>2</sub>e/year in 2035 and 4.5 MtCO<sub>2</sub>e/year in 2040. Energy efficiency measures also reduce emissions by 0.5 MtCO<sub>2</sub>e/year in 2035.
- Electrification of offshore platforms and processing terminals contributes 5 MtCO<sub>2</sub>e/year of abatement in 2035.
- Measures to reduce methane flaring and venting, such as capturing the gas and selling it, and switching from venting to flaring (where safety requires at least one or the other) save 1.5 MtCO<sub>2</sub>e/year in 2030 and 1 MtCO<sub>2</sub>e/year in 2035.
- Methane leaks from the gas distribution and transmission networks are reduced using a combination of Leakage Detection and Repair (LDAR) technologies and continuous monitoring technologies, resulting in 3.5 MtCO<sub>2</sub>e/year in 2035.

**Suggested actions for UK Business**

- Transition from fossil fuel production and supply to low-carbon fuel supply.
- Oil and gas companies should seek to apply a common Net Zero by 2050 framework fully compliant with pathways to 1.5°C.

## 6. Agriculture and land use

Combined emissions from agriculture and land use see substantial reductions in the coming decades. Delivering this transition requires a transformation in the use of land, with Improvements in agricultural productivity and a trend towards healthier diets key to releasing land for afforestation, peatland restoration and bioenergy crops. This requires investment but brings co-benefits for health and recreation, air quality, flood alleviation and biodiversity. The Sixth Carbon Budget balances the need to reduce emissions from land with other essential functions of land including maintaining food production and adapting to climate impacts.

**Table 2.6**

Actions required in agriculture, land use and forestry

### UK Sixth Budget advice for Net Zero Transition

- Combined agriculture (54.6 MtCO<sub>2e</sub> in 2018) and land greenhouse gas (GHG) emissions were 67 MtCO<sub>2e</sub> in 2018, which fall to 40 MtCO<sub>2e</sub> by 2035 and reach 16 MtCO<sub>2e</sub> by 2050.

### Additional features of the Balanced Pathway to Net Zero

- 20% shift away from meat and dairy products by 2030, with a further 15% reduction of meat products by 2050.
- Increase take-up of low-carbon farming practices and machinery; and improvements in productivity.
- Around 9% of agricultural land transitions to actions to reduce emissions and sequester carbon by 2035, 21% by 2050.
- An increase in afforestation rates to at least 30,000 hectares in 2025 (in line with the Government's commitment) and an average of 40,000 hectares per year in the 2030s.
- Restore 60% upland peat (and where this is not possible, stabilise the peat) by 2035; and restore or stabilise the remaining the area by 2045.
- Re-wet 20% of lowland cropland area and sustainably manage a further 18% by 2035.
- Plant trees on 5% of farmland, extend hedgerows by 20% by 2035.
- Increase in annual planting of energy crops to 30,000 hectares by 2035.
- Investment of £1.5 billion required in 2035 to implement these changes.

### Suggested actions for UK Business

- Encourage reduction of lamb, beef and dairy from employee diets, and set example through canteen provision and hospitality.
- Include carbon labelling (CO<sub>2</sub> lifecycle data) on food products manufactured, consumed or sold.
- R&D and market commercialisation of innovative options (e.g. sustainable increase in energy and food crop yields, low-carbon off-road machinery and livestock breeding measures). Farmers to consider bioenergy crops, increasing carbon sequestration and on-farm measures.
- Support increased afforestation and peatland restoration.

## 7. Aviation

Aviation is one of the sectors in which CCC expect significant remaining positive emissions by 2050, given the limited set of options for decarbonisation. Management of demand, efficiency improvements and sustainable aviation fuels contribute to reducing emissions (after recovery from COVID-19), with the remaining residual emissions needing to be offset by greenhouse gas removals for the sector to reach Net Zero. In 2018, around 20% of UK terminal passengers were flying for business (and a larger share if considering airline revenues), so the business community has an important role to play in decarbonising aviation.

**Table 2.7**

Actions required for aviation

### UK Sixth Budget advice for Net Zero Transition

- **Current emissions:** 39 MtCO<sub>2</sub>e (7.5% of UK emissions, including international flights)
- **Key milestones:**
  - Formally include international aviation emissions within UK climate targets.
  - Work to set a long-term goal via ICAO for global aviation emissions consistent with the Paris Agreement, strengthen and align CORSIA with this long-term goal.
  - Government to commit to a Net Zero goal and trajectory for UK aviation as part of the forthcoming Aviation Decarbonisation Strategy, with UK international aviation reaching Net Zero emissions by 2050 at the latest, and domestic aviation potentially earlier.
  - There should be no net expansion of UK airport capacity unless the sector is on track to sufficiently outperform its net emissions trajectory and can accommodate the additional demand.
  - Monitor non-CO<sub>2</sub> effects of aviation, set a minimum goal of no further warming after 2050, research mitigation options, and consider how best to tackle non-CO<sub>2</sub> effects alongside UK climate targets without increasing CO<sub>2</sub> emissions.

### Additional features of the Balanced Pathway to Net Zero

- Post-COVID, emissions gradually decline over time to reach 23 MtCO<sub>2</sub>e/year by 2050, despite modest growth in demand.
- 25% growth in aviation demand by 2050 compared to 2018 levels, whereas the baseline reflects unconstrained growth of around 65% over the same period.
- Aircraft fleet efficiency improves at 1.4%/year.
- Sustainable aviation fuels (SAF) contribute 25% of liquid fuel consumed in 2050, with around two-thirds of this coming from biofuels.

### Suggested actions for UK Business

- Spearhead cultural shift towards video conferencing and augmented/virtual reality.
- Enact rail travel policies for short-haul routes.
- Put in place carbon budgets for long-haul flights.
- For necessary long-haul flights, choose airlines with Net Zero commitments particularly focused on non-offset solutions such as efficiency and sustainable aviation fuels.
- Disclose Scope 3 emissions and/or product level lifecycle emissions, including from aviation, to raise awareness of the impact of aviation.
- Airlines and manufacturers set Net Zero strategies focused on efficiency, sustainable aviation fuels, and mitigation of non-CO<sub>2</sub> effects.

## 8. Shipping

In the Sixth Carbon Budget scenarios emissions in UK shipping are reduced to close to zero by 2050 through the use of zero-carbon fuels, alongside improved efficiency and electrification. This reduction in emissions goes well beyond the current International Maritime Organisation (IMO) target for a reduction of 50% in global shipping emissions by 2050 from 2008 levels.

**Table 2.8**

Actions required for shipping

### **UK Sixth Budget advice for Net Zero Transition**

- **Current emissions:** 14 MtCO<sub>2e</sub> (2.5% of UK emissions, including international shipping)
- **Key milestones:**
  - Formally include international shipping emissions within UK climate targets.
  - Work to strengthen the IMO's 2050 goal, and put in place a global policy framework to deliver this.
  - Build on the Clean Maritime Plan to set a Net Zero 2050 goal for UK shipping, and develop incentives for zero-carbon ammonia and hydrogen supply chains.
  - Commit to the UK's first clean maritime cluster(s) operating at commercial scale (supplying at least 2 TWh/year of zero-carbon fuels) by 2030 at the latest, with zero-carbon fuels expanding to 33% of UK shipping fuel use by 2035.

### **Additional features of the Balanced Pathway to Net Zero**

- Shipping sector returns to pre-pandemic demand levels in 2022. Thereafter, emissions hold relatively flat to 2030, before reducing to close to zero by 2050 (naval shipping still has residual emissions).
- Domestic shipping decarbonises faster than international shipping, with domestic shipping largely decarbonised by early 2040s.
- Zero-carbon fuels comprise the large majority (87%) of the emissions savings from shipping. In our scenarios, this is assumed to be ammonia, due to the potential to retrofit most ship engines, higher energy density than hydrogen, and lower cost than methanol from direct air capture.

### **Suggested actions for UK Business**

- Choose shipping solutions/ports with high fuel efficiency and ambitious plans/investments in electrification, low-carbon ammonia and/or hydrogen.
- Shipping companies and ports to adopt low-carbon shipping fuels, and use shore power to minimise emissions in port.
- Disclose Scope 3 emissions and/or product level lifecycle emissions, including from shipping, to raise awareness of the impact of shipping.

## 9. Waste

Emissions from waste arise mostly from decomposition of organic matter in landfills, wastewater treatment processes and combustion of residual waste in energy-from-waste plants. In the Sixth Carbon Budget analysis, emissions from waste are reduced through greater waste prevention & recycling, higher landfill methane capture rates, improvements to wastewater treatment and composting facilities, and adding CCS to energy-from-waste plants.

**Table 2.9**

Actions required for waste

### **UK Sixth Budget advice for Net Zero Transition**

- **Current emissions:** 27 MtCO<sub>2e</sub> (5% of UK emissions)
- **Key milestones:**
  - Greater action on manufacturing efficiencies, material substitution, product lifetimes and reduced consumer demands.
  - Implement a ban on landfilling of all biodegradable municipal and non-municipal waste from 2025.
  - Phase out exports of waste by 2030.
  - Raise ambition on recycling rates, to 68% by 2030 in England, 70% in Northern Ireland. Scotland and Wales to go beyond 70% by 2030.
  - Mandatory business food waste reporting to be introduced by 2022.
  - Edible food waste is reduced by just over 50% by 2030 (meeting UN SDG Target 12.3) and just over 60% by 2050, compared to 2007 household or 2011 business levels.
  - All new energy-from-waste plants to be built with CCS or CCS-ready.

### **Additional features of the Balanced Pathway to Net Zero**

- Emissions fall 75% from today's levels to reach 7.8 MtCO<sub>2e</sub>/year by 2050.
- Waste prevention efforts increase to a 33% reduction from baseline scenario by 2037.
- Universal municipal waste recycling collections by mid-2020s.
- UK achieves a blended recycling rate of 68% for all waste by 2030.
- CCS is fitted to 100% of energy-from-waste plants by 2050, starting from early 2040s.
- Landfill methane capture increases to 80% by 2050.
- 21-23% improvement in wastewater and composting emissions by 2030.

### **Suggested actions for UK Business**

- Reduce and eliminate food waste. Separate collections sent to anaerobic digestion or compost, and ensure no biodegradable waste is sent to landfill.
- Focus on separating recyclable materials for collection, sharing recycling bins if required for smaller businesses.
- Adopt circular economy strategies, ensuring waste prevention throughout the product lifecycle. Actions include:
  - Minimising waste through process design, material efficiency and optimising manufacturing processes.
  - Improved design to expand the lifespan of products and to allow materials to be separated, repaired, remanufactured or re-used.
  - Use of schemes to encourage resource efficiency, such as producer responsibility and deposit return schemes.

# 10. F-gases

Fluorinated gases (F-gas) are man-made gases that can stay in the atmosphere for centuries. Major emissions sources are refrigerants, aerosols, solvents, insulating gases, or blowing agents for foams and medical equipment. They can also arise as fugitive emissions from other manufacturing processes. Most of the emissions reduction to 2050 will be driven via F-Gas regulations, with further abatement possible through a faster shift to lower Global Warming Potential (GWP) F-gases, behavioural shifts to Dry Powder Inhalers (DPI) and reduced leakage.

**Table 2.10**

Actions required for F-gases

**UK Sixth Budget advice for Net Zero Transition**

- **Current emissions:** 13 MtCO<sub>2e</sub> (2.5% of UK emissions). Approximately 95% of F-gas emissions are hydrofluorocarbons (HFCs) which are emitted from the production, use and manufacture of refrigeration and air-conditioning equipment; aerosols; foams; metered-dose inhalers; and fire equipment. Sulphur hexafluoride (SF<sub>6</sub>), perfluorocarbons (PFCs), and NF<sub>3</sub> comprise the remaining percentage.
- **Key milestones:** By 2030 phase-out of the most harmful F-gases and restricting the use of all F-gases by 80%.

**Suggested actions for UK Business**

- Deploy equipment that can use lower-GWP refrigerants (e.g. hydrocarbons or CO<sub>2</sub>).

# 11. Greenhouse gas removals

Engineered greenhouse gas removals, such as Bioenergy with carbon capture and storage (BECCS), Direct Air Capture of CO<sub>2</sub> with storage (DACCS) and increased use of Wood in Construction will be required to permanently remove carbon from the atmosphere, in order to offset remaining residual emissions in the UK and achieve Net Zero by 2050. BECCS and DACCS are not currently operating at scale in the UK, although there are demonstration plants operating globally and larger commercial projects proposed. Our scenarios aim to reduce gross residual emissions where decarbonisation solutions exist, maximise the use of land-based carbon sinks, and minimise the need for engineered GHG removals.

**Table 2.11**

Actions required for greenhouse gas removals

### UK Sixth Budget advice for Net Zero Transition

- Government to establish a price signal for GHG removals from the early 2020s, setting out expected requirements for GHG removals over time, a proposed market design and set of governance principles.
- Build on demonstration efforts to allow first commercial-scale plants to be built in the UK from the late 2020s.
- Continued R&D support for a range of newer removal routes, including field experiments and pilots.
- Establish GGR Monitoring, Verification and Reporting (MRV) structures in the UK, with criteria set for sustainable, verifiable GHG removals.
- UK to take an international lead in developing GHG removals governance frameworks.
- Deliver on existing and proposed land-based policies that remove carbon (see section 6). Current and new bioenergy supplies to transition to use with CCS.

### Additional features of the Balanced Pathway to Net Zero

- Total engineered removals of 58 MtCO<sub>2</sub>/year are required in 2050.
- BECCS facilities remove 22 MtCO<sub>2</sub>/year from the atmosphere by 2035, and 53 MtCO<sub>2</sub>/year by 2050
- DACCS starts to scale up from 2040 to reach 5 MtCO<sub>2</sub>/year by 2050.
- Timber use in construction increases from the present 15-28% of total construction materials in new homes to 40% by 2050, removing up to 0.44 MtCO<sub>2</sub>/year by 2050 (in addition to ~1 MtCO<sub>2</sub>/year already accounted for in the Land Use, Land Use Change & Forestry (LULUCF) sector).

### Suggested actions for UK Business

- There will be opportunities in the new greenhouse gas removals sector. Business should work to improve the public's understanding and acceptance of GHG removals.
- Business can contribute through R&D investment in greenhouse gas removal technologies, and for those with sufficient expertise and resources, through direct investment or partnering in initial projects.
- Efforts in some areas will have spill-over benefits, e.g. direct air capture as a necessary component of synthetic aviation fuels.
- When available, the wider business community could also support scale-up of greenhouse gas removals through their purchase as permanent offsets, to increase demand (with a transition in the offsetting market to only permanent offsets).



# 12. Adaptation

The UK has already experienced changes in climate leading to higher average temperatures and increasing weather extremes (e.g. heatwaves and heavy rainfall). Adaptation to address climate change risks is essential to complement emissions reductions, with the CCC recommending undertaking preparations for at least the impacts of 2°C warming and considering the impacts of extreme warming. Adaptation measures are particularly important for any facilities, infrastructures or practices that are expected to operate for multiple decades.

<b>Table 2.11</b> Actions required for adaptation
<p><b>UK actions to adapt to climate change</b></p> <p>The UK must plan and implement measures to adapt to a minimum of 2°C mean global temperature increase, with consideration of more extreme scenarios up to 4°C increase.</p>
<p><b>Additional detail on UK climate change adaptation planning</b></p> <p>Climate risk must be planned for and addressed across 33 different categories, including: farmland habitats &amp; species, agricultural productivity, development – surface water flooding, Infrastructure interdependencies, commercial fisheries and aquaculture, Surface water flood alleviation, health impacts from heat and cold, human pathogens, telecoms, digital and ICT, extreme weather impacts on business, supply chain interruptions, business opportunities, terrestrial habitats &amp; species Development – river or coastal flooding, property-level flood resilience, coastal erosion risk management, Air quality, freshwater habitats &amp; species, marine and coastal habitats &amp; species, water management, commercial forestry, river and coastal flood alleviation Recovery from flooding, Emergency Planning System, Ports and airports, Local road network, Water demand by industry, Design/location of new infrastructure, Water demand - built environment energy sector, rail network, public water supply infrastructure, strategic road network.</p>
<p><b>Suggested actions for UK Business</b></p> <ul style="list-style-type: none"> <li>• Demonstrate adaptation planning for a minimum of 2°C and consideration of a 4°C mean global temperature rise (by 2100 from pre-industrial levels).</li> <li>• Increase ambition through setting targets for reducing water demand and reducing leakage (in addition to increasing supply).</li> <li>• Introduce compulsory water efficiency labelling of household water products.</li> <li>• Assess and plan for supply chain disruptions – particularly for businesses reliant on overseas supply chains, and in regions and sectors expected to be most vulnerable to climate change impacts.</li> <li>• Disclose via Task Force on Climate-Related Financial Disclosures and require disclosure across supply chains.</li> </ul>

# Endnotes

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- <sup>1</sup> UN Race to Zero <https://unfccc.int/climate-action/race-to-zero-campaign>
- <sup>2</sup> Financial Times: Big investors warn companies against backtrack on climate change (April 2020) <https://www.ft.com/content/b019e52e-3555-48b5-ada9-d77655bc4f7d>
- <sup>3</sup> FleishmanHillard Fishburn: Leading With Impact - Authenticity Gap Report 2019 <https://fhflondon.co.uk/2019/07/leading-with-impact-fleishmanhillard-fishburn-launches-2019-authenticity-gap-report/>
- <sup>4</sup> The Sustainability Performance of the FTSE 100 Annual Report 2020, p 41;
- <sup>5</sup> For the link between the Paris Agreement and Net Zero by 2050 see Chapter 7 of the Sixth Carbon Budget advice report.
- <sup>6</sup> Mitie Energy (2020): Survey of UK Business Net Zero Strategies.
- <sup>7</sup> Climate Change Committee (2020): Corporate Procurement of Renewable Energy: Implications and Considerations Corporate Renewables.
- <sup>8</sup> Climate Change Committee (2020): The UK's transition to electric vehicles.
- <sup>9</sup> Climate Change Committee (2020): The Potential of Product Standards to Address Industrial Emissions.



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