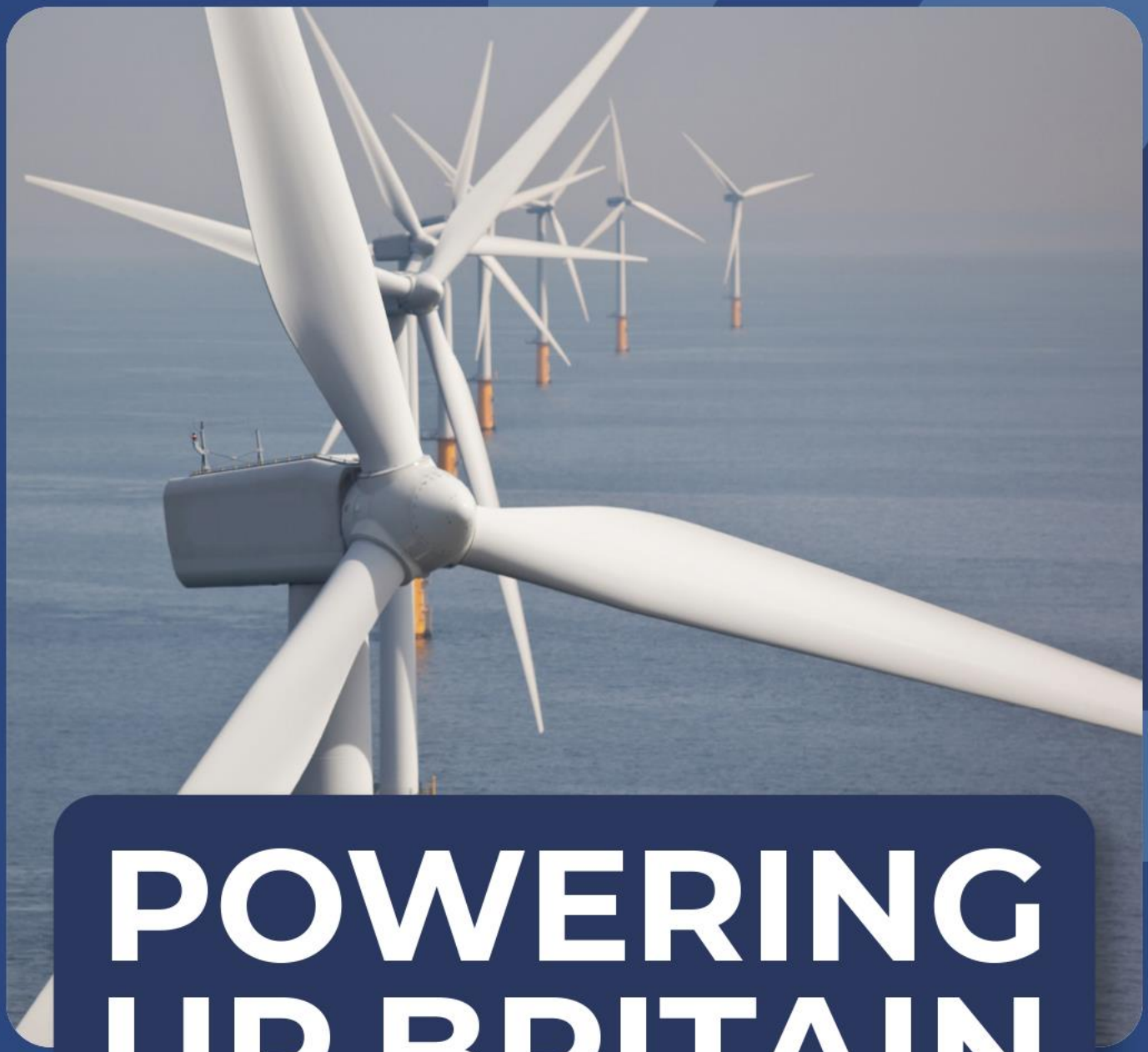
HM Government



POWERING UP BRITAIN

THE NET ZERO GROWTH PLAN

March 2023

This publication is available at www.gov.uk/official-documents

Any enquiries regarding this publication should be sent to us at NZhub@beis.gov.uk

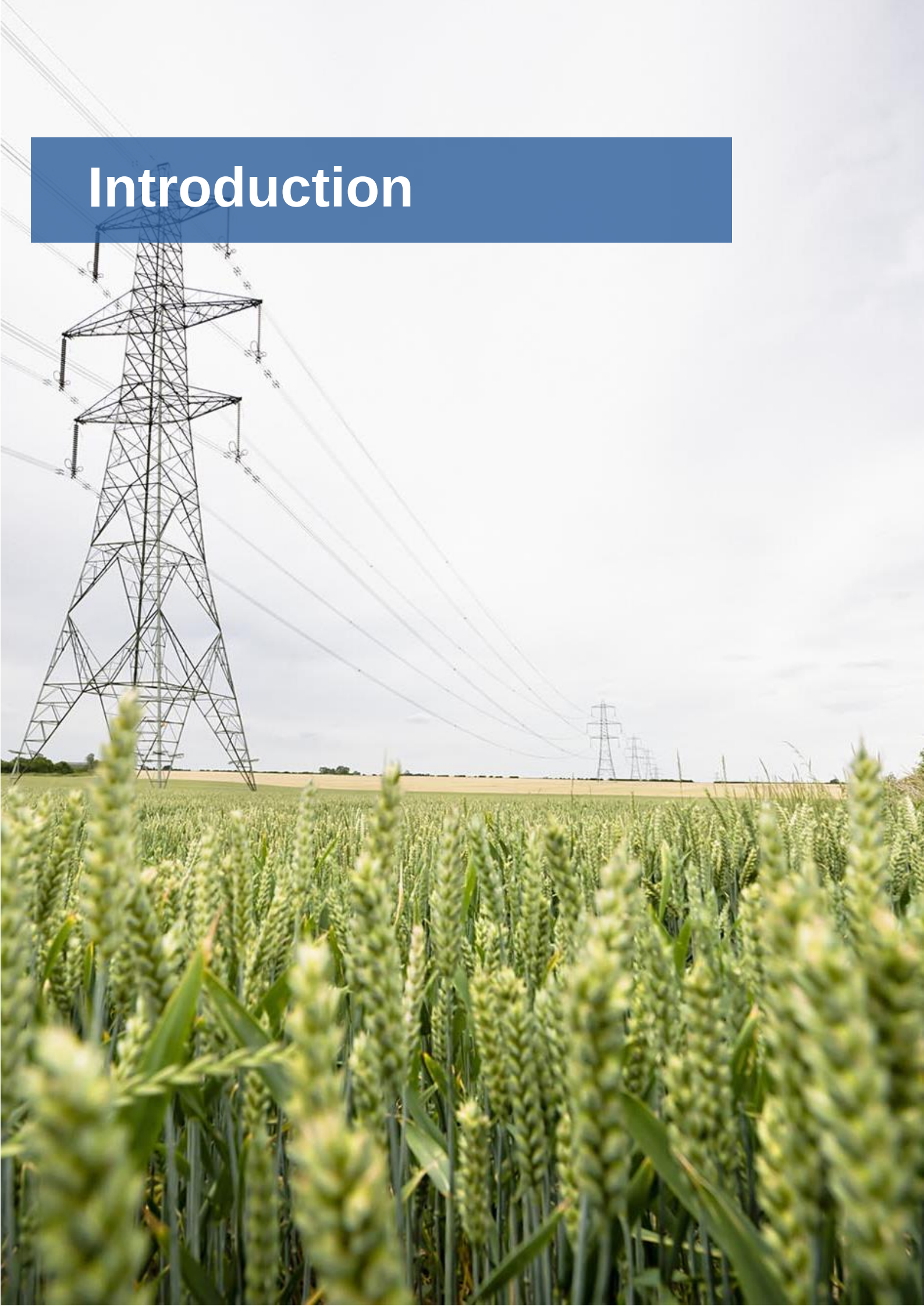
ISBN 978-1-5286-4019-0

E02888048 03/23

Printed on paper containing 40% recycled fibre content minimum

Printed in the UK by HH Global on behalf of the Controller of His Majesty's Stationery Office

Introduction



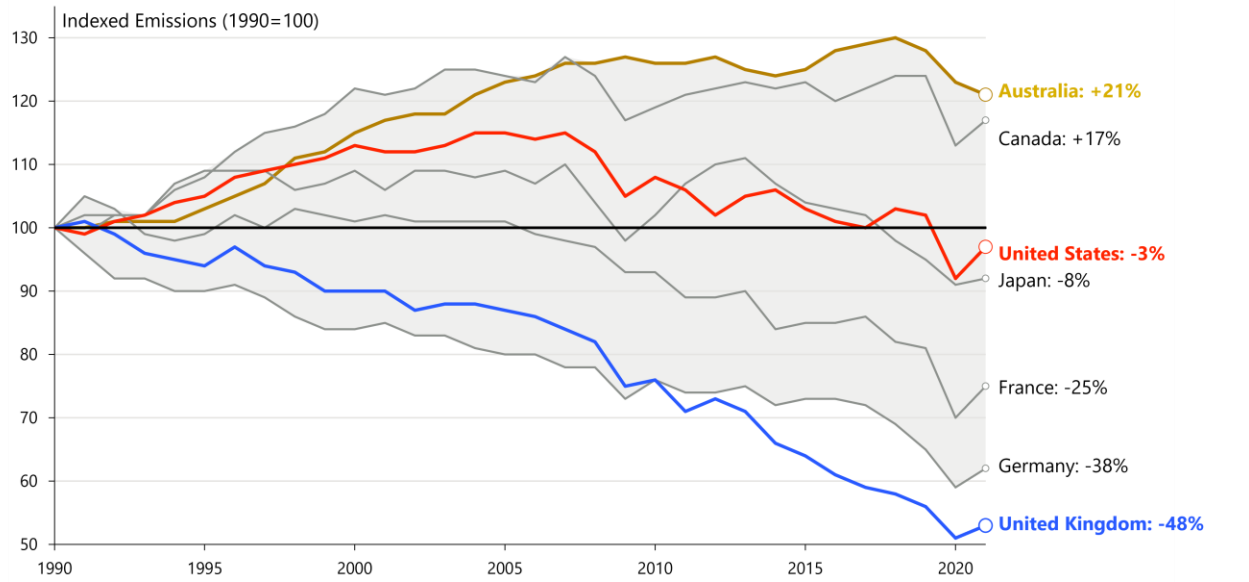
Introduction

Energy security and net zero are two sides of the same coin. The energy transition and net zero are among the greatest opportunities facing this country and we are committed to ensuring that the UK takes advantage of its early mover status. Global action to mitigate climate change is essential to long term prosperity – the overall costs and risks of global warming to be equivalent to losing between 5% and 20% of global GDP each year.[1]

After decades of reliance on imported fossil fuels, the new Department for Energy Security and Net Zero's mission is to replace them with cheaper, cleaner, domestic sources of energy. In response to high household energy bills resulting from Putin's invasion of Ukraine, the government stepped in, paying around half of the average household's energy bills over winter and around half of wholesale energy costs for some businesses. But the way to maintain lower cost energy for everyone is to move to cleaner and cheaper energy to protect us from volatile international energy markets, while underpinning our clean energy transition, so the UK becomes a net zero economy by 2050. It will also help us make sure Britain has among the cheapest wholesale electricity prices in Europe by 2035.

The UK has already made huge progress in decarbonising its economy and decoupling emissions from economic growth. Thanks to the Climate Change Act (2008) and Environment Act (2021), we have a strong legal framework for reaching net zero emissions by 2050. Between 1990 and 2021, we have cut our emissions by 48%, decarbonising faster than any other G7 country, whilst growing the economy by 65%. The UK was also the first G7 country to sign net zero greenhouse gas emissions by 2050 into law.

Figure 1: Greenhouse Gas emissions for the UK and major economies, 1990 – 2021



Note: GHG excluding LULUCF.
Figures may differ slightly from official inventory submissions.

PRIMAP-hist national historical emissions time series, 2022.

Our transition to a green and sustainable future will provide new opportunities to grow and level up the UK economy and support hundreds of thousands of green, high skilled jobs, whilst ensuring the environment is in a better state for the next generation. The policies and ambitions we have committed to will help leverage around £100 billion of private investment as we develop new industries and innovative low carbon technologies, and our ambitions will support up to 480,000 jobs in 2030.

The *Net Zero Strategy*, published in October 2021, was the first document of its kind for a major economy. It set out the government's vision for a market-led, technology-driven transition to decarbonise the UK economy and reach net zero by 2050.

The path to net zero outlined in the strategy is still the right one; developments in the last 18-months have only reinforced that view. Putin's illegal war in Ukraine and high global energy prices only strengthen our resolve to propel ourselves away from expensive fossil fuels towards a cheaper, cleaner, greener economy. There has been further evidence, at home and abroad, of the potential consequences of not keeping the 1.5°C Paris Agreement goal in reach, for example, record-breaking temperatures across the UK and devastating floods in Pakistan. While we accelerate our efforts to reach net zero, we are also ensuring that the country is prepared for the effects of climate change that we are already experiencing. The Third National Adaptation Programme, which we will publish in 2023, will set out the actions we are taking across government to increase our resilience to climate change.

Our ambition is to hit our net zero targets while delivering among the cheapest wholesale electricity prices in Europe. This is why the Prime Minister pledged at COP27 to achieve our ambitious net zero commitment and Nationally Determined Contribution (NDC), create new high-wage jobs and protect UK energy security.

Further, as the Prime Minister set out at COP27, 'there can be no solution to climate change without protecting and restoring nature'. In January this year, we set out our vision in the *Environmental Improvement Plan*, providing a blueprint not just to halt the decline of nature in our country, but to reverse it. As a principle, we will pursue options that leave the environment in a better state for the next generation and benefit our health by improving biodiversity, air quality, water quality, natural capital, and resilience to climate change. To help achieve these aims, we are publishing our Nature Markets Framework which sets out government's approach to supporting and accelerating growth in nature markets, a key mechanism to help deliver our joint nature and climate goals. Protecting our natural environment and adapting to climate change, including through investing in nature-based solutions such as tree planting and peatland restoration, goes hand in hand with our net zero future and government will continue to take an integrated approach to ensure co-benefits are maximised.

With this *Net Zero Growth Plan*, we are bolstering our delivery. This plan:

- **Responds to the expert recommendations made in the *Independent Review of Net Zero* report**, the outcome of the independent review into net zero, chaired by the Rt Hon Chris Skidmore MP, which explores how we can achieve net zero in the most pro-growth, pro-business way;
- **Demonstrates the actions we will take to ensure the UK remains a leader in the net zero transition**, by ensuring we drive investment into key green industries like offshore wind, carbon capture, usage and storage (CCUS), and nuclear;
- **Strengthens delivery** with a focus on the action we can take today to keep us on track to meet our carbon budgets, acting as our annual update against the *Net Zero Strategy*, both on a national and local level;
- **Meets our statutory obligations** under the Climate Change Act (2008) to:
  - Respond to the Climate Change Committee's (CCC's) *2022 Progress Report to Parliament*; and
  - Provide a Carbon Budget Delivery Update that sets out a package of proposals and policies that will enable us to meet carbon budgets.

Capitalising on green growth

In autumn 2022, the government commissioned an *Independent Review of Net Zero*. Led by former Energy minister the Rt Hon Chris Skidmore MP, the *Independent Review of Net Zero* was tasked with assessing the government's approach to net zero, to ensure it was pursuing the most economically efficient path to meeting its climate change commitments, given the changed economic context.

The *Independent Review of Net Zero* concluded that the transition to net zero will provide the economic opportunity of the 21st century, driving economic growth and opportunity across the UK. *Mission Zero: Independent Review of Net Zero*, published in January 2022, was unequivocal in its assessment that the plan set out in the Net Zero Strategy was the right one, whilst providing recommendations to strengthen our delivery. The CCC's *2022 Progress Report to Parliament* further confirms our approach.

The global transition to net zero will see trillions of pounds reallocated to new low carbon products and services. McKinsey estimates a global market opportunity of £1 trillion for British businesses in the period to 2030.[2]

We are not alone in recognising the economic benefits the transition will bring. Through our COP26 presidency, we encouraged an increase in net zero pledges from 30% to more than 90% of global GDP.[3] Since the publication of the *British Energy Security Strategy* and *Net Zero Strategy* we have seen the US take decisive action through the Inflation Reduction Act and the EU has set out its ambitious plans to grow green industries through the Green Deal Industrial Plan.

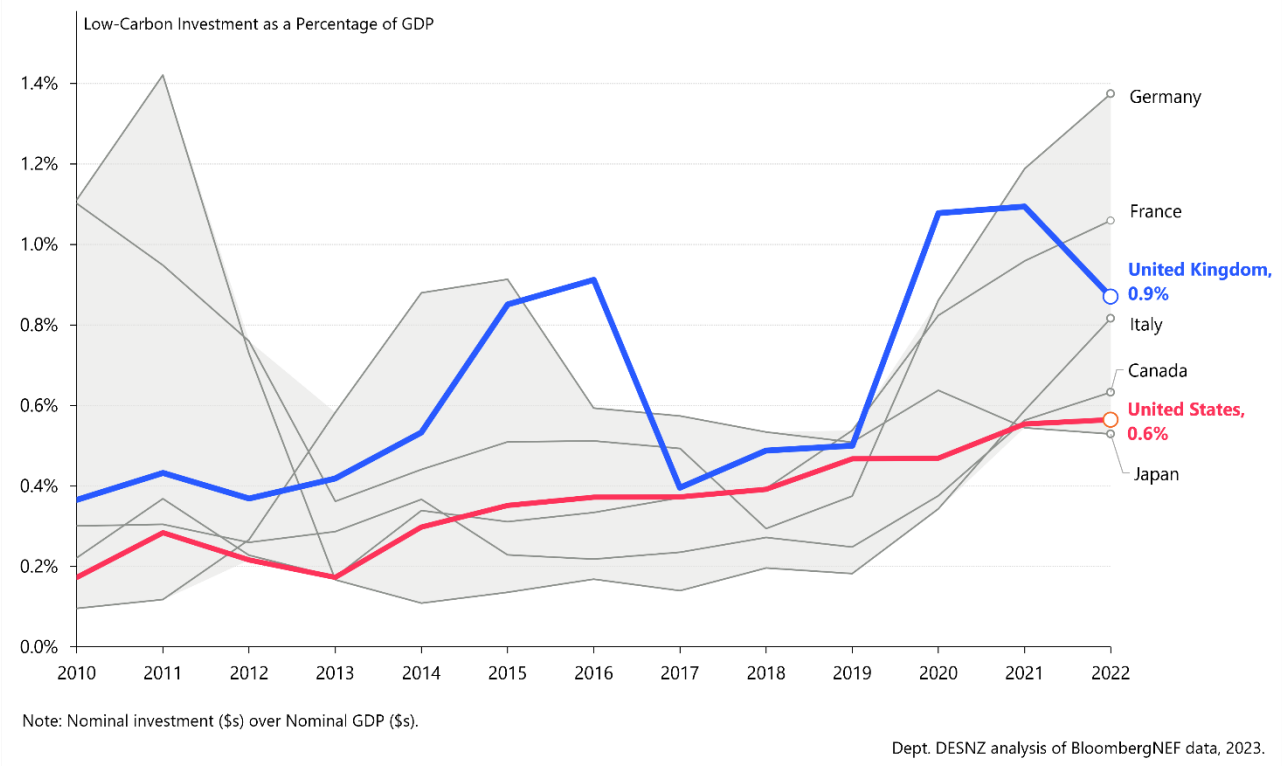
The UK welcomes increased ambition on climate change. All economies will need to take decisive steps to reduce global emissions. Indeed, increased investment in net zero technologies globally will unlock innovation and drive costs down, as well as create opportunities for UK exports (e.g., for CCUS and Hydrogen).

Alongside our partners and allies, we remain convinced that a multilateral approach is necessary to tackle climate change. We will continue to work with partners to ensure that the clean transition does not come at the expense of our trusted global supply chains and the rules-based international system. We do not wish to participate in a discriminatory subsidy race, which will be harmful to many nations' intentions to transition. Our focus is on responding to investor and industry calls to provide the long-term certainty, strategic de-risking, and confidence, they need to invest in the technologies and infrastructure necessary to deliver our energy security and net zero objectives.

Investment is the key to delivering our energy security, carbon targets and seizing the economic benefits – the jobs, exports, and productivity gains – of the transition. We need investment at scale across a range of sectors to rapidly rollout existing

technologies and bring through transformative new technologies. Established technologies, such as offshore wind turbines, need to be constructed at pace to meet our ambitions for decarbonising power and delivering wholesale UK electricity prices that rank among the cheapest in Europe by 2035. Meanwhile, a significant proportion of technologies we will need for 2050 are currently at the demonstration or prototype phase.[4] Innovation is central to our approach and creates opportunities to develop new technologies, business models and systems to reach net zero and facilitate investment to support further development.

Figure 2: Low carbon-investment as % of GDP



The UK has demonstrated that green and growth go hand in hand over the last decade and we are determined to build on this. Between the first Contracts for Difference (CfD) renewable allocation round in 2015, and the fourth in 2022, the per unit (MWh) price of offshore wind fell by almost 70%.[5] We have delivered the second highest amount of recorded low-carbon investment cumulatively across Europe over the last 5 years and estimate that since 2010, the UK has seen £198 billion of investment into low carbon energy, through a mixture of government funding, private investment and levies on consumer bills.[6] Between 2021 and 2022 alone, it is estimated that £50 billion of new investments have been made in low-carbon sectors in the UK. This investment has had an impact across renewables, hydrogen, CCUS, nuclear, sustainable materials, energy storage, electrified transport and clean heat.[7]

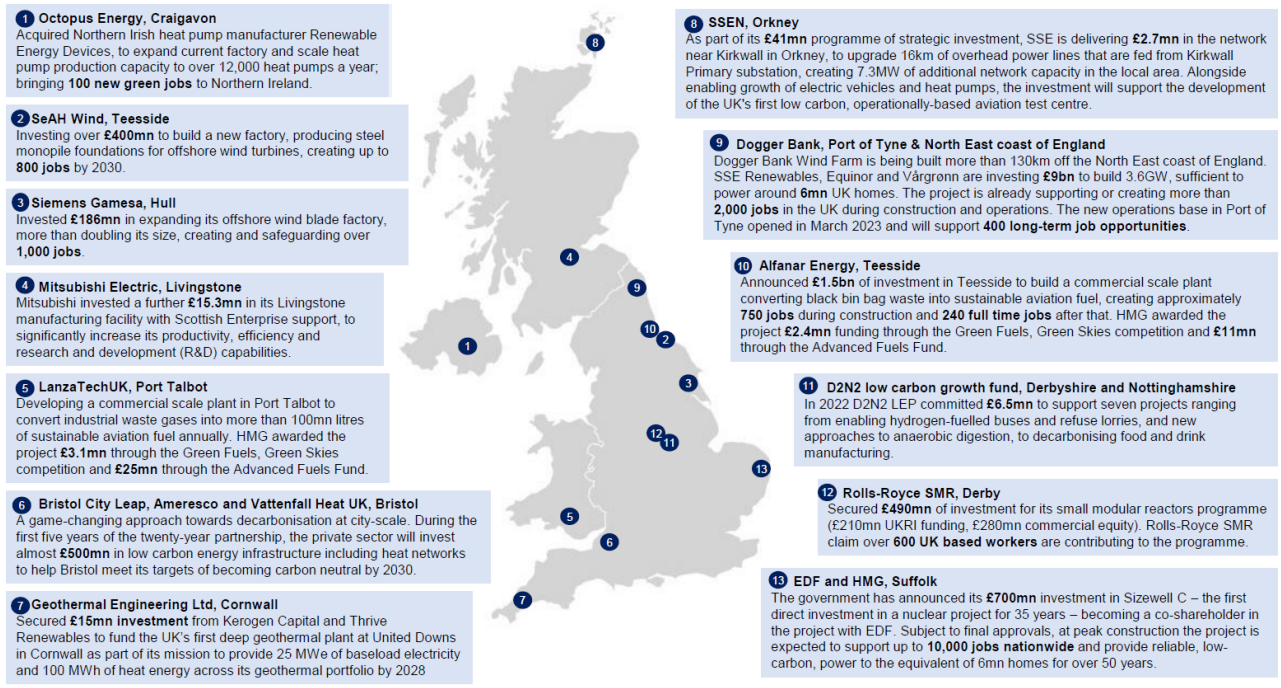
Government policy and funding commitments are already leading to real outcomes. Government committed £30 billion of domestic investment for the green industrial revolution at Spending Review 2021, £6 billion for energy efficiency for 2025-28 at the Autumn Statement 2022, and up to £20 billion for CCUS announced at Spring Budget 2023. Since November 2020, over 80,000 green jobs are currently being supported or are in the pipeline across the UK economy as a result of new government policies and spending. We are targeting public funding strategically, as different green technologies and infrastructure require different financial support depending on its maturity.

This is supported by investments from across the UK's public financing institutions. There are roles for the UK Infrastructure Bank (UKIB), British Business Bank (BBB), and UK Research and Innovation (UKRI) – as outlined in our *2023 Green Finance Strategy*. The UKIB alone has £22 billion of financial capacity and a central mission to tackle climate change and promote economic growth across the UK. The UKIB expects clean energy to be the largest sector in its portfolio and is building a strong pipeline of opportunities in areas such as hydrogen, CCUS, electricity storage and clean transport. The BBB, the government-owned economic development bank, supported £505 million of equity investment in clean technology companies between 2014 and end of August 2022.

Our vision for a transition to a green and sustainable future will provide new opportunities to grow and level up the UK economy and support hundreds of thousands of green jobs. The low carbon transition should be fair and affordable and not negatively impact businesses. In fact, world leading hydrogen hubs in places like Teesside, are bringing back investment to areas that experienced significant decline during the 20th century. Through our North Sea Transition Deal, we're helping to decarbonise oil and gas and protecting thousands of existing jobs. If we don't support the economy wide net zero transition, not only will we miss our carbon targets, but we will miss out on the opportunities green growth presents business and consumers.

Investments have been made across the UK, providing a substantial boost to regional growth.

Figure 3: Investments contributing to net zero across the UK since autumn 2021



We will continue to stay at the forefront of the economic transformation to net zero and retain our edge to unlock further opportunities to invest and grow green industries in the UK. The UK is among the most exciting countries in the world for green industries with one-in-six of all Foreign Direct Investment (FDI) backed cleantech projects in Europe in 2020.[8] This plan and the accompanying plan, *Powering Up Britain – Energy Security*, delivers policy and funding measures to cement the UK as a prime destination for long-term investment, growing our green industrial base and unlocking export opportunities for British businesses. These plans will see us build on our strengths and our comprehensive track record across a range of sectors.

- **Offshore wind** – We currently have the world's largest operational offshore wind farm project, Hornsea 2, and the second, third and fourth largest operational offshore wind farm projects in the world. Our innovative policy instruments like the CfD scheme make the UK a world leader in offshore wind.
- **Nuclear** – Nuclear energy has been used reliably and safely in the UK for over 60 years and we have extensive experience of the full nuclear life cycle, from front-end design through to decommissioning. One of the world's most advanced nuclear technologies is being developed here in the UK, with up to £210 million awarded to Rolls-Royce SMR Ltd in November 2021 to develop further their design for one of the world's first Small Modular Reactors (SMRs). We are matching the global competition and scaling-up our nuclear programme by having launched GBN, responsible for driving delivery of new nuclear projects, backed with the funding it needs.

- **CCUS** – The UK has one of the greatest CO2 storage potentials of any country in the world, the UK Continental Shelf, with potential storage capacity estimated at 78 billion tonnes providing substantial opportunities for growth through international trade.[9] The Government will provide up to £20 billion of funding for early deployment of CCUS to unlock private investment and jobs. Government is making an ambitious series of announcements on CCUS, following the £20 billion funding announced at Spring Budget 2023, including announcing the eight projects to progress to negotiations to form the first two CCUS clusters, in the North East and North West. These projects are not the extent of our ambition. Later this year we will set out a process to launch the next expansion of Track-1, and we have now launched Track-2. A major CO2 storage licensing round was launched last year, and we are developing a longer-term vision to set out how CCUS will support net zero.
- **Hydrogen** – The UK's natural assets and technical expertise means we can be an early mover in both electrolytic 'green' hydrogen and CCUS-enabled 'blue' hydrogen production. There are over 200 companies working on hydrogen and fuel cell technologies in the UK, and we consistently feature in the top ten countries globally for hydrogen technology patent rates. We are announcing a shortlist of projects for due diligence and confirming further details on electrolytic hydrogen allocation rounds.
- **Electric Vehicle uptake and infrastructure** – In 2022, the UK had the second highest battery electric car sales in Europe, bringing the total number of plug-in vehicles on UK roads to over one million licensed, of which around 60% are battery electric.[10] Charging infrastructure is also speeding ahead: public charging devices have more than tripled from 10,300 devices in January 2019 to over 38,700 in March 2023. We are building on that by publishing a final consultation on an ambitious Zero Emission Vehicle mandate, requiring an increasing percentage of new car and van sales to be zero emission.
- **Green Finance** – Behind every new net zero investment, sits a team of financial, legal, data and accountancy experts, presenting a huge opportunity for the UK financial sector and professional services. The UK's financial sector is already leads in green project financing and investment analytics. We set out how we will capture this opportunity in the 2023 *Green Finance Strategy*.
- **Research and Tech sector** – The UK is a leading science superpower. We are widely recognised as global leaders in cutting edge areas like the most promising fusion energy technologies, and boast a world-class research base, with three of the top 10 universities globally.[11] This means we are one of the best places to conceive, develop and deliver green technologies, putting us in a strong position to capitalise on the opportunities of a net zero economy.

There are significant opportunities for UK industry the whole way through the supply chain. We want UK companies to continue playing a key role in green supply

chains, from nuclear to CCUS and electric vehicles. For example, nuclear power plant Hinkley Point C has spent over £4.1 billion with suppliers in the Southwest to date and EDF anticipate that 64% of the construction value of the project will be spent with UK firms, with over 22,000 people nationwide currently working on the project.[12]

We are supporting the development and growth of resilient UK supply chains and targeting public funding strategically for key industries. Our Floating Offshore Wind Investment Scheme will provide up to £160 million to kick start investment in port infrastructure projects, supporting the growth of wind power manufacturing in the UK. To secure the economic opportunities of the transition to clean heat, £30 million will be provided through the Heat Pump Investment Accelerator, leveraging up to £270 million of private investment into manufacturing and associated supply chains.

We will continue to anchor and support the development of those supply chains critical to delivering our net zero and energy security ambitions, while promoting the rule-based international system. Following publication of the Critical Minerals Strategy in July 2022 and the Critical Minerals Refresh in March 2023, we will go further with a semiconductor strategy to be published as soon as possible.

For the automotive sector, government has already committed to supporting the transition to electric vehicles with over £800 million capital funding made available at the last spending review. We want the UK to be one of the best locations in the world to manufacture electric vehicles, with an end-to-end zero emission vehicle supply chain. Our ambitious ZEV mandate will put UK manufacturers at the forefront of the electric revolution, supported by delivery of charging infrastructure that government is funding in partnership with industry to boost demand and by our capital allowances reforms to boost investment with the introduction of full expensing for 3 years. In addition, the Automotive Transformation Fund and the long-term Advanced Propulsion Centre R&D programme are supporting the development and commercialisation of cutting-edge automotive technologies. In the coming months, after engagement with industry, the Government will build on these interventions to take decisive action to ensure future investment in zero emission vehicle manufacturing.

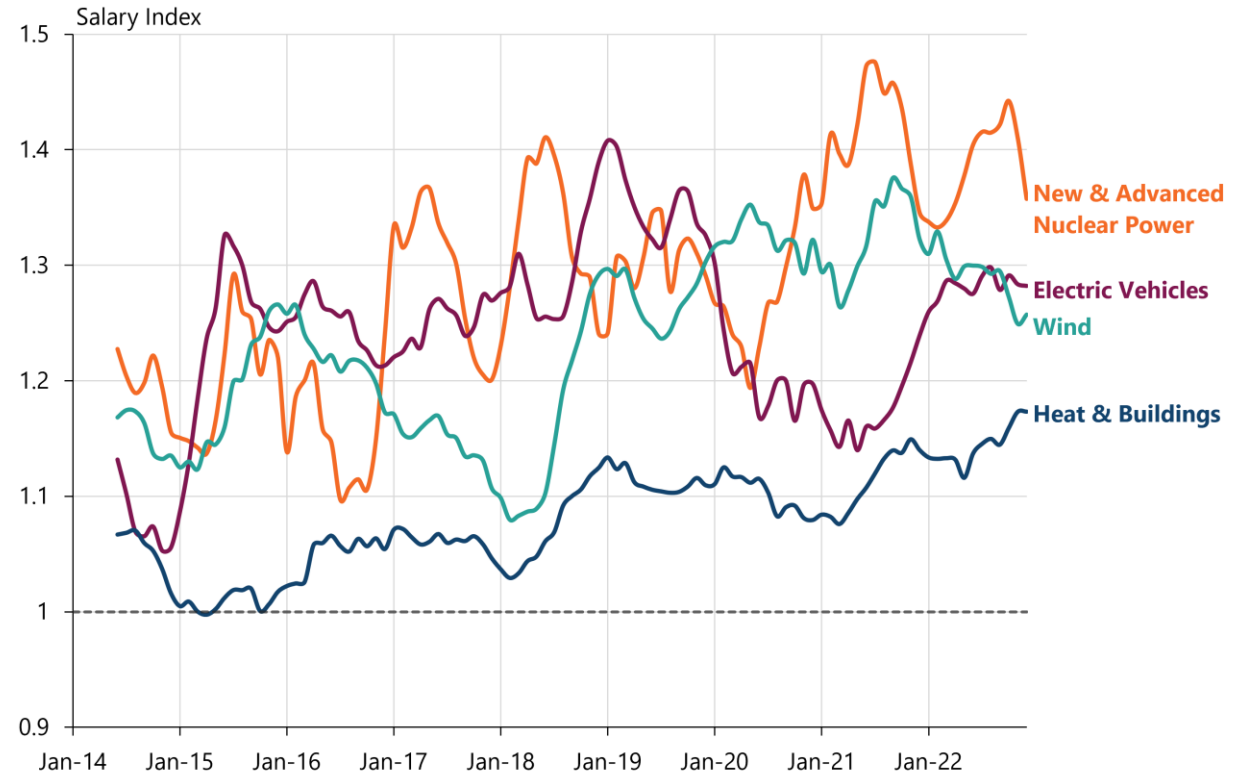
We are also supporting UK industry to increase their exports. The global transition to net zero creates a major market opportunity with exports within low carbon and renewable energy industries growing significantly faster than exports from the broader economy. In 2021, it is estimated exports from these sectors increased by 67% from 2020, compared to total exports which increased by 6%.[13] We are supporting UK firms to export through UK Export Finance (UKEF). In 2021-2022 alone, the economic impact of the new loans, insurance and guarantees provided by UKEF across the whole economy was up to £4.3 billion of UK Gross Value Added (GVA) and an estimated up to 72,000 UK jobs – 40,000 directly employed by exporters and a further 32,000 jobs supported indirectly through the UK supply chain. We are increasing UK Export Finance's maximum exposure limit from

£50 billion to £60 billion. This provides additional capacity for UKEF to support exporters, including in green industries, to win contracts, fulfil orders and get paid.

The transition to net zero also opens up opportunities to create well-paid and high-skilled jobs, support levelling up and reinvigorate our industrial heartlands. It is estimated that since November 2020, over 80,000 green jobs are currently being supported or in the pipeline across the UK economy as a result of new government policies and spending. [14] North East and North West England, Yorkshire and the Humber, the Midlands, Scotland, Wales and Northern Ireland will each have unique benefits from the transition.

The ONS estimate a 16% increase in direct employment in low carbon businesses across the economy from 2020 to 2021. Separately, new analysis of green jobs advertisements by the Department for Energy Security and Net Zero suggests that within some parts of the green economy, jobs advertised offer higher salaries compared to the UK average.

Figure 4: Advertised salary index by net zero sector using online job advert data, UK, 2014 to 2022. Average salary index by sector (6-monthly rolling average).



Note: Salary index is the monthly average salary of job adverts for select net zero sectors relative to the monthly average salary for all UK online job adverts.

Dept. DESNZ experimental analysis of Lightcast online job advertisement data, 2023.

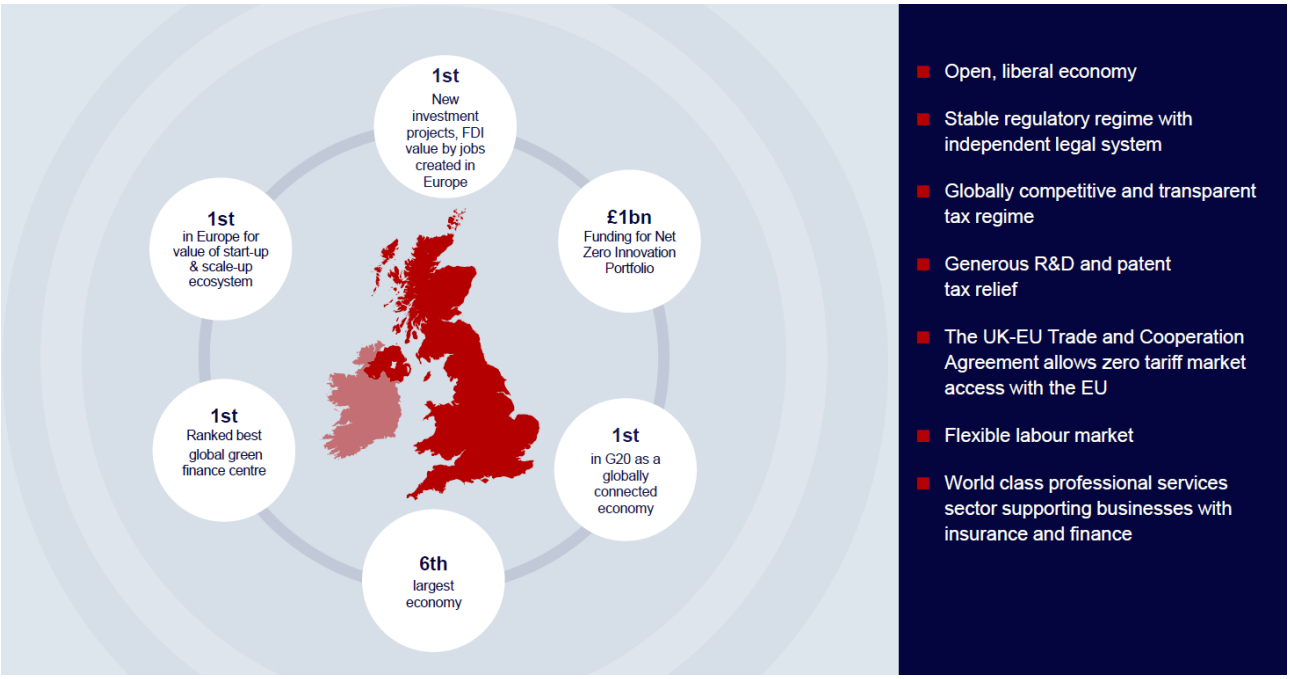
The government is working closely with industry and the financial sector to understand any barriers to investment they are facing, and communicate the support, incentives and opportunities available to investors.

- Government has published the 2023 *Green Finance Strategy*, setting out how Government will utilise all the levers available to mobilise the private investment needed to deliver net zero as well as how the UK will deliver on its ambition to become the world's first Net Zero-aligned Finance Centre, and how government will help cement the UK's status as a world-leading green finance centre.
- The measures in the 2023 *Green Finance Strategy* set out a pathway to deliver on this commitment along with reforms to the UK pensions and insurance sector that will leverage the UK's deep capital markets to invest in the net zero transition and green industries in the UK. For example, through Solvency UK, we will provide incentives for insurers to increase investment in long-term productive assets, including innovative green assets and renewable energy infrastructure.
- We are responding to feedback from investors on the need for government to provide clarity on how we are making new net zero technologies and sectors investable. Throughout 2023, we will develop and publish a series of net zero investment roadmaps. These will articulate investment needs by sector and summarise the relevant government policy and opportunities to support investment decisions. We have published a roadmap on offshore wind, and will shortly publish a roadmap on heat pumps, as well as updated roadmaps on CCUS, and hydrogen. We will also publish a roadmap to guide nature positive investment in key sectors by 2024.
- The 2023 *Green Finance Strategy* sets out how policies in this plan will work alongside interventions by the UK's public finance institutions, including UKIB, to address financing barriers and accelerate the deployment of net zero technologies.
- Government is establishing a new partnership to work with key leaders across business and finance to support the delivery of our net zero target, forming a shared view of the actions needed across government and industry to secure the substantial economic opportunities for the UK from net zero through a new Net Zero Business & Investment Group. Addressing significant appetite from the business and finance communities, the group will provide a structured cross-cutting forum to help accelerate decarbonisation in key business sectors and strategically address the barriers business sectors face in reducing their emissions.

To achieve our ambitions, we are setting out in these plans a range of different levers at our disposal which play to the unique strengths of the UK. From tax to regulation through planning reform, targeted spending and international collaboration, our policy is tailored to secure private investment.

- **A strong and supportive business environment**: the government is committed to making the UK the best place in the world to start and grow a business and we are ensuring the UK's tax system is one of the most competitive of the world's major economies. At Spring Budget 2023, we announced reforms to capital allowances which give the UK the joint most generous capital allowance regime in the OECD. We introduced full expensing for three years to support business investment, with a commitment to make the reform permanent when the fiscal conditions allow; and increased tax reliefs for R&D intensive Small and Medium Enterprises (SMEs). Together, these ensure the UK business tax system is one of the most competitive of the world's major economies.
- **Long-term policy certainty and agile and smart regulation to drive investment**: we are setting a clear policy framework on energy security and net zero, so businesses can plan and invest with confidence. Smart and agile regulation, including the Zero Emission Vehicles mandate, the consultation on the Sustainable Aviation Fuels mandate as well as in areas such as building efficiency and heat pumps, will help drive demand for new products and services and accelerate innovation and investment. Sir Patrick Vallance's Pro-Innovation Regulation of Technologies Review on green industries demonstrates we can move quickly to ensure regulation supports innovation and investment. Government will break down the barriers to deployment, to allow projects and investment to happen more quickly.
- **Revenue models, financing mechanisms and market frameworks**: in emerging sectors we are establishing clear market frameworks (including through the Energy Bill), so the private sector can invest with confidence. This includes revenue models that give investors more certainty about the returns they will make: from CfDs and business models for hydrogen, through to the Nuclear Regulated Asset Base (RAB) model and models for CCUS. To complement this, our green finance policy framework seeks to ensure sufficient private capital is available to finance our net zero objectives.
- **Targeted public investment**: Public spending has a role to play where industry and households cannot invest, for instance making our schools and hospitals greener through the Public Sector Decarbonisation Scheme (PSDS). Further, in areas where investors face greater risk due to the novelty or scale of a project, government can co-invest alongside the private sector to ensure good projects happen. Government does this directly, for example through the Advanced Fuels Fund for Sustainable Aviation Fuels, or through our major public finance institutions, including the £22 billion UKIB. We have set out the role of these institutions in detail in our 2023 *Green Finance Strategy*. We also continue to provide significant public investment in research and innovation, with £4.2 billion in net zero research and innovation over the period from 2022-25.

Figure 5: The UK's attractive business and investment environment.



The road to net zero: delivering long term certainty through the Net Zero Strategy 'delivery pathway'

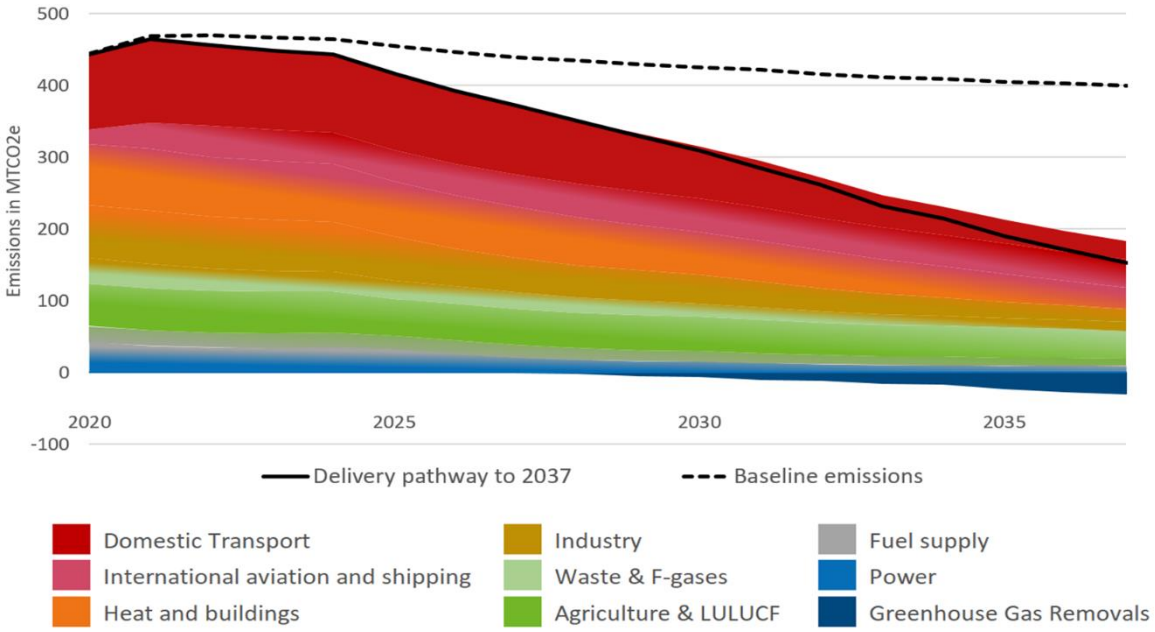
The *Net Zero Strategy* set out an indicative 'delivery pathway' of emissions reductions to meet our climate targets up to Carbon Budget 6 (2033-37) and stay on track for net zero by 2050. This draws on insights from modelled 2050 net zero scenarios, exploring the range of potential energy and technology solutions, and is designed to drive progress while preserving options and allowing room for change, recognising the level of uncertainty in long-term plans of this kind. It is based on our understanding today of the potential for each sector to decarbonise, considering the balance between sectors that is optimal for the entire economy in terms of delivery and cost.

Broken down by sector, our pathway outlines the progress we expect across the economy. Sectors have the potential to make progress at different rates, depending on the availability and deployment of technological solutions, development of supply chains, financing, and infrastructure and a variety of upside and downside risks. For example, the costs of solar, offshore-wind and batteries have consistently fallen faster than expected.[15] Similarly, consumer behaviour and trends are unpredictable and can catalyse realisation of carbon savings sooner than expected. For instance, recent sales of battery electric vehicles have been exceeding expectations. These indicative sector pathways, presented as ranges for residual emissions to reflect the inherent uncertainty, help to drive change and to plan how we can remain on track for the unique economic and institutional

environment of the UK to provide long-term certainty and direction for mobilising investment to meet our targets.

We welcome the CCC's view and new evidence from the *Independent Review of Net Zero* that this pathway represents a clear and credible range for emissions reduction in each sector of the economy. The figure below shows emissions reductions based on central assumptions, but these should not be viewed as predictions or targets: the precise emissions savings ultimately contributed by each sector are likely to change. The Technical Annex provides further detail on these uncertainties.

Figure 6: Indicative delivery pathway to 2037 by sector, from the Net Zero Strategy.



Delivering the Net Zero Strategy: Highlights from the past 18 months

Nearly 18 months on from the Net Zero Strategy, we have made strong progress. The CCC's 2022 Progress Report to Parliament and the *Independent Review of Net Zero* have highlighted areas where we have made particularly strong progress over the past year – and substantial achievements have been made in a number of areas across our delivery pathway. Our proposals and policies, detailed in our Carbon Budget Delivery Plan, are a dynamic long-term plan for a transition that will take place over the next 15 years, setting us on course to reach net zero by 2050.

We committed to…	Since then, we have…
Fully decarbonise the power system by 2035, including: • Up to 50GW of offshore wind by 2030, including 5GW of floating offshore wind. • A final investment decision on a large-scale nuclear plant.	• In 2021, the share of generation from renewables reached 40%, including from bioenergy, wind and solar, and 15% from nuclear. • Reached 14GW of offshore wind installed. Round 4 will deliver 7GW of additional offshore wind by 2027 with future Allocation Rounds expected to bring even greater capacity. • Launched Great British Nuclear. • Invested approximately £700 million to take a 50% stake in Sizewell C in November 2022.
Drive the growth of Low Carbon Hydrogen and deliver the North Sea Transition Deal (NSTD), including: • 10GW of hydrogen production capacity by 2030 • Industrial Decarbonisation and Hydrogen Revenue Support (IDHRS) scheme to fund new hydrogen and industrial carbon capture business models • The NSTD will achieve a 60Mt reduction in UK greenhouse gas emissions which puts the sector on a path to deliver a net zero basin by 2050.	• Launched the £240 million Net Zero Hydrogen Fund in April 2022 and the first electrolytic hydrogen allocation round in July 2022, and published the Heads of Terms for the Hydrogen Production Business Model in December 2022. • Published the *North Sea Transition Deal One Year On* report.
Decarbonise industry and transform our industrial heartlands, including: • Delivering four carbon capture usage and storage (CCUS) clusters • £315 million Industrial Energy Transformation Fund (IETF) to future-proof industrial sectors. • Consulting on a net zero consistent ETS cap.	• Published a package on the Industrial Carbon Capture (ICC) business models in December 2022. • Allocated £150 million in support to industry through the IETF since summer 2020. • Consulted with industry on the ETS cap to incentivise cost effective abatement.

We committed to…	Since then, we have…
Set a path to all new heating appliances in homes and workplaces from 2035 being low carbon, including: • £450 million Boiler Upgrade Scheme to support households to switch to low-carbon heating • £1.65 billion into 'help to heat' schemes, including the Social Housing Decarbonisation Scheme and Home Upgrade Grants.	• Launched the £450 million Boiler Upgrade Scheme, receiving 14,000 voucher applications since it opened on 23 May 2022. • Funded 'Help to Heat' schemes to reduce energy bills and improve energy efficiency, including: − The Local Authority Delivery Scheme (LAD) Phase 1 and 2 allocated £500 million to deliver upgrades worth up to £10,000 per household. These have delivered improvements to circa 36,000 homes, with average annual energy bill savings of approximately £250 per household. − Sustainable Warmth is £502 million programme delivering LAD Phase 3 and Home Upgrade Grant (HUG) Phase 1 to 30 September 2023, targeting delivery of 20-22,000 on-gas grid homes under LAD3 and 5-6,000 off-gas grid homes under HUG 1, with estimated energy bill savings of £300 per household. − Social Housing Decarbonisation Fund (SHDF) have allocated £179 million to upgrade up to 20,000 social homes. Successful bids for SHDF Wave 2.1 were announced in March 2023 with £778 million offered to 107 projects. Match funding from Wave 2.1 applicants provides an additional £1.1 billion.[16]
Accelerate the shift to Zero Emission Vehicles and kickstart zero emissions international travel and shipping, including: • End the sale of new petrol and diesel cars by 2030 • £620 million for zero emission vehicle grants and EV Infrastructure	• Increased the total number of plug-in vehicles on UK roads to over one million licensed, of which around 60% are battery electric.[17] • Published the Cycling and Walking Investment Strategy (CWIS2), including an objective to deliver a world-class cycling and walking network in England by 2040. • Launched the executive agency Active Travel England to support local authorities and oversee extensive funding to develop and build new walking, wheeling and cycling routes.

We committed to…	Since then, we have…
Protect our natural environment and build our resilience to climate change, including: • Pilot our environmental land management schemes and roll them out fully by the end of this parliament. • Support low-carbon farming and agricultural innovation through the Farming Investment Fund (FIF) and Farming Innovation Programme (FIP). • Set a legally binding target to increase tree canopy and woodland cover to 16.5% of total land area in England by 2050. • Work towards restoring approximately 280,000 hectares of peat in England by 2050.	• Published our 'Environmental Land Management update' in January 2023, which sets out how we will support farmers and land managers to sustainably produce food, while delivering benefits for climate and nature. − This included the accelerated roll-out of the Sustainable Farming Incentive (SFI) and announced six new standards, contributing to our target to decarbonise agriculture. − We announced the opening of round two of the Landscape Recovery (LR) scheme which will focus on radical, large-scale projects on net zero, protected sites and habitat creation, including trees and peatland. • Launched the £270 million Farming Innovation Programme (FIP). In partnership with UKRI, the government has already committed £68 million of FIP up to the end of 2022 and is providing further grants of £51 million in 2023. • Launched the £5.6 million Paludiculture Exploration Fund (2022-2025) to support the uptake of paludiculture which offers the opportunity to continue profitable agriculture while managing land in a way that supports net zero.
Develop and deploy Greenhouse Gas Removal technologies at scale, including: • Develop markets and incentives for investment in GGRs • Deliver up to £100 million innovation funding • Launch a call for evidence exploring the role of the UK ETS as a potential long-term market for GGRs	• Published consultations on both a technology-neutral business model for GGRs, and a power BECCS specific business model, with responses due this year. • Provided over £54 million of government funding to the most promising GGR demonstration projects in our innovation programme.

We recognise the importance of the government's own set-up in ensuring successful delivery of net zero. Ensuring that departments are working together to deliver coordinated action consistent with our long-term climate aims has been a priority. Recent progress includes:

- Publishing the net zero and energy security outcome delivery plan (ODP) to provide a clear, joined-up plan for delivery across our domestic and international climate agenda.
- Establishing the Domestic and Economic Affairs (Energy, Climate and Net Zero) Cabinet Committee to drive coordinated action across departments and ensure net zero is at the heart of government decision-making.
- Working with regulators to strengthen their functions to support the net zero transition. This might be through regulation itself, using lighter touch approaches such as Strategy and Policy Statements, or embedding net zero as an internal benchmarking tool.
- Embedding a systems-driven approach to complex policy problems, with a dedicated net zero systems team engaging across government to upskill civil servants in systems approaches.
- Managing interdependencies using systems tools to identify and track risks across the net zero portfolio and understand their wider effects.
- Negotiating several devolution deals since August 2022 which contain shared agreements in relation to net zero, climate adaptation or clean energy, including the deeper devolution deals with Greater Manchester and West Midlands Combined Authorities.
- Partnering with Local Government through our cross-departmental Local Net Zero Forum to address key net zero policy and delivery issues facing local government.

What comes next

This plan is published alongside *Powering Up Britain – Energy Security*. These plans set out our ambitious policies which will ensure we can deliver energy security and increase the UK's international economic competitiveness, while delivering on net zero. There are two sides of this: *Powering Up Britain – Energy Security* is focused on changing decades of reliance on imported fossil fuels, by reducing demand and boosting home grown energy, giving energy resilience the priority it deserves. *Powering Up Britain – the Net Zero Growth Plan* focuses on our long-term decarbonisation trajectory and how it can improve the UK's competitiveness, deliver an industrial renaissance and level up the whole of the United Kingdom. These are complementary and should be read together. While comprehensive, they will continue to evolve and be flexible to adapt to changing circumstances.

Together, these plans provide the long-term certainty, revenue models and frameworks and targeted investment that will accelerate delivery of our objectives.

The subsequent chapters of this plan outline our progress over the past year in greater detail and summarise our next steps to delivering. The chapters are grouped into sectors and enablers, both reflecting the categories identified in the *Net Zero Strategy*:

- **Sectors**: each responsible for a defined range of carbon savings between now and 2050. Sectors cover Power; Fuel Supply & Hydrogen; Industry; Heat and Buildings; Transport; Natural Resources, Waste and F-gases; and Greenhouse Gas Removals (GGRs).
- **Enablers**: each support the transition across the economy covering: Innovation; Green Investment; Net Zero Workforce and Skills; Embedding Net Zero in Government; Local Net Zero; Empowering the Public and Business to Make Green Choices; International Leadership and Collaboration.

Incorporating recommendations proposed by the CCC and the *Independent Review of Net Zero* will turbocharge delivery. Many of the policy announcements have been informed by the CCC analysis of government's progress, contained in their 2022 Progress Report to Parliament. A full response to the CCC recommendations in their 2022 Progress Report to Parliament is covered in a separate annex.

Moreover, we can also confirm that we are partly or fully acting upon 23 recommendations from the *Independent Review of Net Zero* report's 25 recommendations for 2025. This includes expediting the setup of Great British Nuclear, announcing a new taskforce to deliver on our ambitions for solar power, and setting out long-term commitments to CCUS. The Government thanks the Rt Hon Chris Skidmore MP for his contribution to the agenda through his report. The full response to the recommendations set out in the *Independent Review of Net Zero* is covered in a separate annex.

With the announcements, proposals and policies contained within this plan, we will enable carbon budgets to be met. The Carbon Budget Delivery Plan sets out a package of proposals and policies that enable us to meet our next three carbon budgets, up to Carbon Budget 6 in 2037, in compliance with section 14 of the Climate Change Act (2008). Carbon Budget 5 was set on the 80% by 2050 trajectory, before the UK legislated for net zero by 2050. Carbon Budget 6 onwards is set on a net zero by 2050 trajectory, as is the UK's NDC announced in December 2020. This commits the UK to reduce all greenhouse gas emissions by at least 68% by 2030 on 1990 levels. As well as meeting our carbon budgets, the policies set out here will progress us towards the UK NDC target. The UK remains fully committed to its 2030 NDC target, which the CCC has advised is consistent with the Paris Agreement temperature goal.[18] The UK's target is estimated to require the fastest rate of reduction in greenhouse gases between 1990 and 2030 of all major

economies. We will keep our policy package under review and iterate it as circumstances develop.

Finally, updated projections and technical updates to the pathway are included in the Technical Annex.

Reducing Emissions across the Economy

Reducing Emissions across the Economy

Power

Summary

A secure, reliable, cost-effective, decarbonised power sector is critical for a modern industrial economy. In the *Net Zero Strategy*, government committed to have a fully low-carbon power sector by 2035, subject to security of supply, to underpin our net zero ambitions.[19] Both the CCC and *Independent Review of Net Zero* recognise the key role that low carbon electricity plays in delivering a low carbon economy consistent with net zero. They also noted the essential role a resilient and energy secure power system plays in the growing and functioning of the UK's economy and society. To deliver on these goals we need to mobilise significant private investment into low carbon technologies and their associated supply chains, across generation, networks, storage and flexibility.

We have taken major steps since publishing the *Net Zero Strategy*. Our policies and incentives create markets for investment and sector growth, offer targeted funding support

to reduce technology and infrastructure costs, and provide long-term clarity and certainty in terms of future revenue streams. We have delivered the largest Contracts for Difference (CfD) auction for renewable electricity yet. We made a historic decision by investing in Sizewell C, and we are committed to developing a pipeline of new nuclear projects beyond this. We have taken Net Zero Teesside Power forward to negotiation which could be the UK's first ever power CCUS project. We announced a comprehensive Review of Electricity Market Arrangements (REMA) in GB; and we will continue to take forward the landmark Energy Bill which contains measures to deliver a more secure, cleaner, and cheaper energy system and we continue to drive forward on our aims.

We have published *Powering Up Britain – Energy Security*, which sets out the Government's plans to enhance our country's energy security, diversifying through a range of sources; including wind, solar, nuclear and hydrogen. Energy security necessarily entails the smooth transition to low carbon energy in line with Net Zero, even as we acknowledge the vital role natural gas will play for years to come.

Decarbonising the power sector whilst meeting a potential 60% increase in electricity demand, by the middle of next decade, has the potential to bring forward £275 – £375 billion of investment from both the private and public sectors.[20] Investment in the electricity network will support the expected increase in peak demand, bringing forward £50 - £150 billion of investment by 2037.[21] Reinforcing the onshore electricity network could support 20,000-80,000 jobs by 2037, in addition to providing further employment in the supply chain.[22] In addition, measures to increase storage and demand side flexibility could support up to 7,000 jobs across the supply chain by 2030.[23]

Our proposals and policies for growing the offshore wind sector in line with our ambition for up to 50GW could support up to 90,000 direct and indirect jobs.[24] For nuclear, we aim to take one nuclear project to Final Investment Decision this parliament and two in the next parliament, including Small Modular Reactors (SMRs). Each large-scale nuclear power plant could support up to around 10,000 jobs at peak construction, in addition to providing further employment in the supply chain.[25]

The CCC and *Independent Review of Net Zero* set out a series of recommendations for the power sector such as enabling and accelerating the deployment of low carbon technologies, networks, planning and building supply chain, skills, and training.

In some cases, these recommendations are already aligned to government's actions. For instance, we are taking forward most of the renewable electricity related recommendations from both the *Independent Review of Net Zero* and CCC *Annual Progress Report*, to help accelerate renewable deployment. On solar, this includes establishing a new government/industry solar taskforce, developing a solar delivery roadmap, and assessing low-cost finance from retail lenders for homes and small business premises. We are also working to build UK training and certification capability for onshore

wind and solar, exploring measures to incentivise on-site generation at manufacturing facilities and working to publish the Biomass Strategy in 2023.

The Government has accepted the main recommendation of the *Independent Review of Net Zero*. We have established Great British Nuclear and will be producing a roadmap later in 2023. Further details can be found in *Powering Up Britain – Energy Security*. We are also working with the Office for Nuclear Regulation (ONR) and Department for Work and Pensions to evolve business and finance arrangements to better support ONR investment in future capability and resources.

We agree with the *Independent Review of Net Zero's* recommendation on the Review of the Electricity Market Arrangements (REMA) and have set out our plans for the programme in *Powering Up Britain - Energy Security*. We ran our first consultation from July to October 2022 and published the summary of responses in March 2023. We aim to publish a second REMA consultation in Autumn 2023 and will take decisions on shorter-term reforms more quickly where it is viable to do so throughout the REMA programme.

We accept the *Independent Review of Net Zero* recommendation, that Government should commit to outlining a clear approach to gas vs. electricity 'rebalancing' by the end of 2023/4 and should make significant progress affecting relative prices by the end of 2024. Rebalancing will generate the clear short-term price signal necessary to shift both households and businesses to lower-carbon, more energy efficient technologies like heat pumps. This is vital to meet Government's existing decarbonisation commitments, including our goal of 600,000 heat pumps installed per year by 2028.

Indicative emissions pathway to 2037

In 2021, power emissions were around 54 MtCO2e making up around 12% of total UK net GHG emissions (including international aviation and shipping). Natural gas combustion currently makes up the largest share of these emissions.

Power emissions have decreased by 6% since 2019 and 73% since 1990.[26] This decrease has resulted mainly from changes in the mix of fuels being used for electricity generation, including the decline of coal and growth of renewables; together with greater efficiency resulting from improvements in technology.

In line with the sectoral breakdown of the indicative pathway set out in the *Net Zero Strategy*, compared to 2021 emissions levels, GHG emissions could need to fall by 42% to 48% on average over 2023-27, by 69% to 74% by 2030 and 79% to 84% on average over 2033-37. Please see the *Carbon Budget Delivery Plan* for details of our proposals and policies for meeting the carbon budgets.[27]

Progress and delivery

Area	Progress
Raised ambition on renewables and secured record capacity	• Accelerated the Contracts for Difference scheme to drive increased deployment by moving to annual auctions and secured 11GW of new renewable capacity through Allocation Round 4, which was the largest auction to date. • We are launching the Floating Offshore Wind Manufacturing Investment Scheme. The scheme will provide up to £160 million to kick start investment in port infrastructure projects needed to deliver our floating offshore wind ambitions. This will give investors the confidence to back this emerging sector, which will make a vital contribution to the UK's energy security and net zero. • Supported the rollout of rooftop projects by removing Value Added Tax (VAT) on solar panels installed on residential accommodations until 2027. • We launched the Contracts for Difference (CfD) Allocation Round 5 in March 2023, which is the first round to run on an annual basis. This round has the potential to support a range of technologies, including offshore wind, onshore wind, solar, tidal, geothermal, and floating offshore wind. • Taken important steps to cut the time taken to build renewable electricity plants through progressing the range of measures set out in the *British Energy Security Strategy*, including planning measures such as a strong need statement for offshore wind and associated infrastructure in the *Renewable National Policy Statement* which we are publishing for consultation, a fast track process under the *Nationally Significant Infrastructure Projects Action Plan (NSIP)*, and cost recovery powers to enable more capacity into key bodies involved in the planning process. • Improved the resilience of supply chains by making funding available to support major port and manufacturing infrastructure through the Offshore Wind Manufacturing Investment Scheme and strengthening the Contracts for Difference Supply Chain Plan process. • Built on the UK's position as a world-leader in offshore wind by appointing an Offshore Wind Industry Champion, Tim Pick, to spearhead acceleration work and jointly chair the Offshore Wind Acceleration Taskforce (OWAT).

Area	Progress
	• We have published a roadmap on offshore wind, articulating the sectoral investment need, and summarising the government policy and funding, to provide investors with the information they need to support investment decisions.
Set a new aim to deliver up to 24GW nuclear capacity by 2050	• Committed to provide up to £1.7 billion of direct government funding to enable one nuclear project to Final Investment Decision this Parliament, and aim for two projects to Final Investment Decision in the next.[28] • As part of this £1.7 billion funding, government has invested approximately £700 million to take a 50% stake in Sizewell C in November 2022,[29] having provided £100 million to support project development in January 2022.[30] • Announced the launch of Great British Nuclear (GBN). • Supported SMRs and Advanced Modular reactors (AMRs) by investing up to £210 million to develop SMR with Rolls Royce, based in Derby,[31] and provide up to £55 million funding to develop two new Advanced Modular Reactor (AMR) Research, Development and Demonstration Programme reactor designs and provide regulatory support.
Progressed our commitment to deliver at least one power CCUS plant by the mid-2020s	• We will begin negotiations with Net Zero Teesside Power which, subject to successful negotiations, could be the UK's first ever power CCUS project. • Passed the legislation for the Dispatchable Power Agreement (DPA), which will provide the basis for negotiations with power CCUS projects. • Launched a call for evidence on how our future policy framework can support the continued deployment of power CCUS projects beyond Track-1. • Published a consultation on business models for power bioenergy with carbon capture and storage (Power BECCS) and concluded the power BECCS project submission assessment process, we will issue a response to the consultation imminently.
Set an ambition to halve the time it takes to build new transmission network	• Appointed Nick Winser as Networks commissioner to advise how to further accelerate transmission network deployment, on top of ongoing actions including a package to halve delivery times, based on a significant programme of reform.

Area	Progress
infrastructure and begun the transition to a strategically designed network	• Jointly with Ofgem, published the *Electricity Networks Strategic Framework* in August 2022 to set out a shared vision for the transformation of the electricity network required to manage the anticipated increase in electricity demand as we decarbonise. • Worked closely with Ofgem, network companies and connection stakeholders to speed up connections for new generation and demand, with an action plan to accelerate connections to be published in the summer. • Holistic Network Design was published by National Grid Electricity System Operator (ESO), setting out for the first time a strategic, coordinated plan for the electricity network needed to support up to 50GW of offshore wind by 2030.[32] • We have made changes to Ofgem regulation to allow network infrastructure to be built ahead of need. This includes an accelerated regulatory approval process for around £20 billion of transmission projects identified in the Holistic Network Design, which sets out the network infrastructure needed to deliver the Government's ambition for up to 50GW connected offshore wind by 2030. • Jointly with Ofgem, published a consultation response on our decision to establish the Future System Operator (FSO), which will undertake strategic network planning from a whole systems perspective. • Launched the £100 million Offshore Coordination Support Scheme to support well-advanced offshore wind and interconnection projects to coordinate their transmission infrastructure.[33] • We are launching a consultation on a Strategy and Policy Statement for Energy Policy, and a consultation on community benefits for network infrastructure. • Launched a consultation on changes to the energy National Policy Statements, to reflect the strategic importance of and need for network infrastructure and a strategic, co-ordinated approach.

Area	Progress
Delivered on the Smart Systems and Flexibility Plan and Energy Digitalisation Strategy	• Responded to a consultation confirming the outline of a new policy framework for energy smart appliances and demand side response services that will enable the transition to a smart and secure electricity system. • Driven rollout of over 30 million smart and advanced meters in homes and businesses across Great Britain, with 55% of all meters now smart or advanced.[34] • National Grid ESO launched the new Demand Flexibility Service, as an additional tool for them to manage our electricity system this winter. • Announced up to £65 million through the Flexibility Innovation Programme to support innovative solutions to enable large-scale widespread electricity system flexibility, alongside up to £68 million through the Longer Duration Energy Storage programme to accelerate technology commercialisation. • Published the *Electric Vehicle (EV) Smart Charging Action Plan* in January 2023 to maximise the benefits of energy flexibility from EVs, and to make sure the system is ready to respond in time for the upturn in energy demand. • Together with Ofgem and Innovate UK, we have responded to the recommendations of the Energy Digitalisation Taskforce setting out our progress and next steps on delivering digitalisation within the energy sector. • We continue to progress work with Ofgem, the ESO, developers and our European partners to realise our ambition of at least 18 GW of interconnector capacity by 2030 and to bring forward pilot Multi-Purpose Interconnectors (MPIs). • The UK Infrastructure Bank (UKIB) has announced that, following an expressions of interest process, it will appoint managers for equity funds covering both short and long duration electricity storage. UKIB will invest on a matched basis, crowding-in wider sources of finance. Going forward, UKIB expect to make direct investments in the electricity storage sector, which was identified as an investment opportunity in their Strategic Plan.

Upcoming delivery milestones

We continue to drive forward our vision to power the UK through affordable, home-grown, clean energy. We are working to deliver our aim to fully decarbonise the electricity system by 2035, subject to security of supply. Details of the actions government is taking to enhance our country's energy security and deliver a smooth transition to a low carbon system in line with net zero are set out in *Powering Up Britain – Energy Security*. Some of the key actions we are listed below:

- We will set up Great British Nuclear, with the responsibility to lead delivery of the new nuclear programme, backed with the funding it needs.
- We will launch a competitive process to select the best Small Modular Reactor technologies, with first phase commencing in April 2023.
- We intend to consult in 2023 on the need and potential design options for market intervention to support hydrogen to power.
- We will publish an action plan this year in response to Electricity Networks Commissioner Nick Winser's recommendations on halving the development time for transmission network projects.
- We will establish a solar government/industry taskforce and we will publish a solar roadmap setting out a clear step by step deployment trajectory to achieve 70GW of solar by 2035.

Planning

The planning system is central to delivering our ambitious programme of net zero infrastructure development and building out the clean generation and grid capacity that will power our economy. An effective planning system is needed to support both large scale nationally significant infrastructure like offshore wind, nuclear power and carbon capture, and support local decisions on renewable and low carbon energy. That is why in order to support our net zero and energy security goals, the government is committed to ensuring faster, fairer, and more effective planning regimes, including through changes to the National Planning Policy Framework - generally for local plan-making and decisions - the energy National Policy Statements - for nationally significant decisions - and Electricity Act planning.

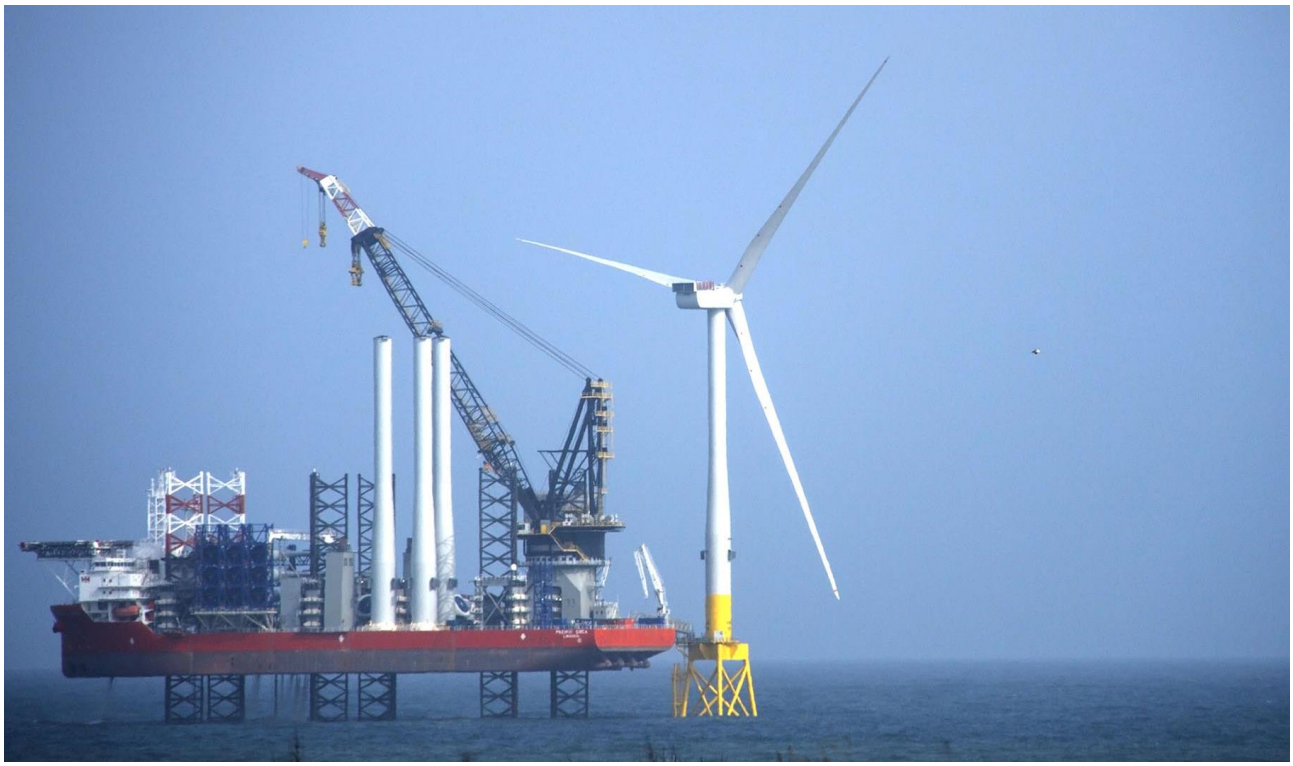
The government has already demonstrated its commitment to reform, by publishing an action plan in February 2023 to improve the Nationally Significant Infrastructure Project planning process, including regulatory and guidance changes to streamline the process, support digital transformation and address capacity shortfalls that can slow the process down. We are now:

- Implementing these reforms as quickly as possible, with powers in Bills currently before Parliament which allow for full cost recovery from developers, allow for shorter statutory deadlines to be set to introduce a fast-track route, and provide for a more strategic and outcomes-based approach to environmental requirements;
- Publishing five revised energy NPS covering renewables, oil and gas pipelines, electricity networks and gas generation, and an overarching Energy Statement for consultation. This includes a new requirement for offshore wind to be considered as “critical national infrastructure”.
- Delivering an Offshore Wind Environmental Improvement Package.
- Recognising that onshore wind is an efficient, cheap and widely supported technology, government has consulted on changes to planning policy in England for onshore wind to deliver a localist approach that provides local authorities more flexibility to respond to the views of their local communities. We will respond to the NPPF consultation in due course.
- Consulting on community benefits for network infrastructure.
- Examining evidence on distribution-level consenting to speed up the connections process for the low-voltage network.
- Developing upcoming proposals on:
  - Addressing pressing local planning bottlenecks energy efficiency in historic buildings.

- Consulting on changes to the existing permitted development rights which allow rooftop solar and stand-alone ground mounted solar in the grounds of domestic and non-domestic buildings.
- Consulting on a new permitted development right for solar canopies on non-domestic car parks, such as supermarkets.
- The proposed approach to siting new nuclear projects, and developing a new nuclear National Policy Statement for nuclear electricity generating infrastructure beyond 2025.

This significant programme of work will speed up the processing of new energy infrastructure and support our clean growth ambitions. However, given the scale and speed of low carbon infrastructure development needed, we expect that more planning reform will be required. We are looking closely at what other countries have done to speed up infrastructure deployment, including recent developments in Europe. This is a global challenge, where managing the balance between local and environmental protection, securing energy supplies in an unstable world, and urgently tackling climate change are an issue for governments across the world.

Fuel Supply and Hydrogen



Summary

Hydrogen

Low carbon hydrogen is a critical component of our strategy to deliver energy security, drive economic growth and support net zero. The CCC and *Independent Review of Net Zero* emphasise the key role that low carbon hydrogen can play in delivering a net zero economy as a versatile replacement for high-carbon fuels used today. It has the potential to help to bring down emissions in vital UK industrial sectors and provide flexible energy for power, heat, and transport. To reach the scale and cost reductions required to help deliver net zero, we are supporting multiple production routes, including CCUS-enabled and electrolytic hydrogen. As the CCC notes, natural gas will be needed to support hydrogen production for the net zero transition.

The *British Energy Security Strategy* (BESS) doubled our ambition: to deliver up to 10GW of low carbon hydrogen production capacity by 2030, subject to affordability and value for money. We anticipate that electrolytic production will deliver at least half of this ambition drawing on the scale up of UK offshore wind, other renewables and new nuclear. Excess renewable electricity can be used to produce hydrogen, which can also be stored over time and used to power the grid when needed. This ambition places us in a leading group of countries and would bring significant economic benefits, with potential to unlock up to £11 billion of private investment across production, transport, and storage,

supporting 12,000 jobs by 2030. This would support economic growth and levelling up across the country and enable cost savings across the UK electricity system. The UK has already built world leading capabilities - for example in electrolyser and fuel cell manufacture. The case for investing in UK hydrogen is clear. We are consistently in the top ten countries globally for hydrogen technology patent rates, have a global reputation for advanced energy infrastructure and expertise, and possess highly developed gas infrastructure that can be redeployed.

We are delivering policies to support deployment of new low carbon hydrogen production, reduce upfront infrastructure costs, and provide greater clarity and certainty around future demand and revenue streams, through our £240 million Net Zero Hydrogen Fund (NZHF) and our Hydrogen Production and Transport and Storage Business Models. Building on this progress, we will take forward the *Independent Review of Net Zero* recommendation to develop a hydrogen production delivery roadmap to show how hydrogen production can be scaled up over the coming decade.

Since publication of the *UK Hydrogen Strategy*, we have made substantial policy and funding progress.[35] The first competition window for Strands 1 and 2 of the NZHF ran April to July last year, aimed at projects which require development or capital costs without revenue support, and the successful applicants have been announced. We intend to launch a second competition window for Strands 1 & 2 of the NZHF in the spring, to be run by UKRI and provide further funding routes for development and capital costs of production projects that do not require revenue support.

The CCC also recommended that government should establish funding mechanisms to support the up to 10GW ambition and finalise production business model design to deliver funding to the first production projects in 2023. We have since launched the NZHF and the first electrolytic hydrogen allocation round (HAR1), which is jointly offering NZHF capex and Hydrogen Production Business Model (HPBM) revenue support to electrolytic hydrogen projects. We also published HPBM Heads of Terms which are intended to form the basis of the Low Carbon Hydrogen Agreement (LCHA) signed with hydrogen producers. We intend to publish the final LCHA for initial projects from Q3 2023 and to award contracts totalling up to 250MW of capacity from HAR1, subject to affordability and value for money. We aim for contracts to be awarded in Q4 2023, with first projects operational in 2025. We have published a shortlist of 20 projects we intend to enter due diligence with alongside this plan. We intend to launch a second electrolytic hydrogen allocation round later this year, to award up to 750MW of contracts. HPBM payments for projects awarded contracts through HAR1 will be funded by government until the hydrogen levy comes into effect.

We have also progressed the development of CCUS-enabled hydrogen. Phase-1 of the CCUS Cluster Sequencing process has now concluded and HyNet and the East Coast

Cluster were announced as Track-1 clusters prioritised for deployment in the mid-2020s. HyNet will support decarbonisation in the North West and North Wales, while the East Coast Cluster will deliver infrastructure to decarbonise industry and drive economic growth in Humber and Teesside. Within these Track-1 clusters, two hydrogen projects have been announced to take forward to negotiations.

Hydrogen transport and storage (T&S) infrastructure could be key to fully realise future hydrogen demand alongside growing production capacity across the UK. We committed in the *British Energy Security Strategy* to design hydrogen transport and storage business models by 2025, and consulted on the design of these business models in 2022. With respect to recommendations from the CCC and the *Independent Review of Net Zero* to deliver hydrogen T&S business models as soon as possible while supporting 'no regrets' projects, and plans for distribution and storage outside our industrial clusters, we aim to respond to our consultation on hydrogen T&S infrastructure in Q2 2023, with any further details on strategic planning to align with the production. To bring forward hydrogen T&S business models, we are aiming to introduce legislative measures when parliamentary time allows, which will be crucial to designing these new business models by 2025. Our consultation response will provide detail on institutional arrangements for hydrogen system planning, noting the *Independent Review of Net Zero* recommendation that the Future System Operator take a hydrogen system planning role.

In July 2022, our *Hydrogen Sector Development Action Plan* set out government and industry actions to maximise the hydrogen economy's benefits, including asking industry to lead a process to voluntarily set UK supply chain ambition. We will work with industry over the course of 2023 to develop supply chain strategies for both Hydrogen and CCUS, and evaluate what additional intervention, if any, might be required.

Oil and Gas

As we transition to net zero, fossil fuels will retain a crucial role in the energy system, until there are credible clean energy alternatives that can replicate their role. As recognised by the CCC, natural gas will play a role for years to come, particularly in the hardest to decarbonise sectors. The upstream oil and gas sector continues to make good progress in decarbonising in line with our North Sea Transition Deal (NSTD) and midstream targets.

Electrification is the primary means to decarbonise the oil and gas sector between 2027 and 2040. There are several electrification projects already in development, and we work closely with regulators and industry to support delivery. We are committed to the World Bank's 'Zero Routine Flaring by 2030' initiative. In 2021, total gas flared and vented gas reduced by 20.1% and 22.2% respectively, relative to 2020.[36] The North Sea Transition Authority (NSTA) issued updated guidance for all operators, whereby all new developments should plan for no routine flaring and venting by 2030.

Last year we published the *Climate Compatibility Checkpoint*, which ensures that the compatibility of new licensing with the UK's climate objectives has been considered before a decision to endorse a new licensing round is made. The NSTA then launched the UK's 33rd oil and gas licensing round in October 2022. Government and industry remain committed to the NSTD target to reduce GHG emissions from production by 50% by 2030. The *Independent Review of Net Zero* and the Climate Change Committee made several recommendations for oil and gas production. With respect to greater data availability and transparency, the NSTA recently published asset level domestic production emissions dashboards and will update gas footprint analysis comparing imports and domestic production this year.[37] We are committed to ensuring that the Climate Compatibility Checkpoint continues to be an effective tool to shape future policy and will consider further the proposal to develop an offshore industries' integrated strategy.

Government is prioritising the delivery of ambitious targets for oil and gas supply decarbonisation, including the electrification of oil and gas facilities and ending routine flaring and venting by 2030. The NSTA already supports industry to build abatement into their facilities and is applying its regulatory powers to require new platforms to include low carbon power, prioritising electrification where technically feasible. We will not accelerate the end to routine flaring from 2030 to 2025 as the 2030 target is already challenging due to the basin's maturity, noting that retrofitting facilities is expensive and technically challenging. The sector committed to accelerate compliance with the World Bank's 'Zero Routine Flaring by 2030' initiative ahead of 2030, and its Methane Action Plan committed to an ambitious 50% reduction in methane emissions by 2030. The government is working with regulators and industry to continue to drive down flaring and venting gas ahead of the 2030 target.

Indicative emissions pathway to 2037

In 2021, fuel supply emissions were around 20 MtCO2e making up around 4% of total UK net GHG emissions (including international aviation and shipping). Upstream oil and gas currently make up the largest share of these emissions. Fuel supply emissions have decreased by 18% since 2019 and 66% since 1990. Since 1990, the largest reductions have been from coal mining and gas leakage.

In line with the sectoral breakdown of the indicative pathway set out in the NZS, compared to 2021 emissions levels, GHG emissions could rise by 8% or fall by 2% on average over 2023-27, fall by 22% to 33% by 2030 and 43% to 52% on average over 2033-37. Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets.[38]

Progress and Delivery

Area	Progress
Raising and beginning to deliver on our up to 10GW hydrogen production capacity ambition	• Doubled our ambition from 5GW to up to 10GW low carbon hydrogen production capacity by 2030, subject to affordability and value for money, with at least half from electrolytic hydrogen. • Launched the £240 million NZHF in April 2022 and the first electrolytic hydrogen allocation round in July 2022, and published Heads of Terms for the Hydrogen Production Business Model in December 2022. • Published a shortlist of 20 projects to invite to the next stage of due diligence for the first electrolytic hydrogen allocation round alongside this document. We have also announced that two hydrogen projects have been taken forward to negotiations under Track-1 Phase-2 of the CCUS Cluster Sequencing Process. • We have now announced that Hydrogen Production Business Model payments for the first electrolytic hydrogen allocation round will be funded by government until the hydrogen levy comes into effect, and announced a funding envelope for Track-1 of the CCUS Cluster Sequencing Process, in line with the *Independent Review of Net Zero*'s recommendation to provide longer-term certainty at the next Spending Review. • Awarded contracts for 23 feasibility studies and five demonstration projects under the £60 million Low Carbon Hydrogen Supply 2 competition. • Published a consultation on a Hydrogen Certification Scheme, as part of our commitment from the *British Energy Security Strategy* to set up a scheme by 2025, building on the Low Carbon Hydrogen Standard, which was published in April 2022 and helps ensure government supports truly low carbon projects only.

Area	Progress
Developing hydrogen transport and storage, end use, and investment opportunities	• We have published a consultation on high level design options for hydrogen T&S business models, along with an independent consultancy study reviewing hydrogen T&S infrastructure requirements up to 2035. • We continue to support strategically important investments by early movers in industry, including through the announcement of an extension to the Industrial Energy Transformation Fund. Subject to business case approval, the government plans to allocate a further £185 million to help industrial sites to adopt decarbonisation technologies. We are encouraging other early use cases whilst bringing forward applications with the greatest strategic potential to support deep decarbonisation of the UK economy as well through further competition rounds of the Net Zero Innovation Portfolio and transport trials, consulting on *Decarbonisation Readiness Requirements* for new build and substantially refurbishing combustion power plants, trials in hydrogen for heating and consulting on boilers being hydrogen-ready from 2026 (see Buildings chapter). • In April 2022, we published the *Hydrogen Investor Roadmap*, articulating the sectoral investment need, and summarising the government policy and funding, to provide investors with the information they need to support investment decisions. This was followed by the *Hydrogen Sector Development Action Plan* in July 2022. We will shortly publish an updated investment roadmap for hydrogen. • We appointed Jane Toogood as UK Hydrogen Champion to help galvanise industry and investors to accelerate the development of the UK hydrogen economy. The Hydrogen Champion has met extensively with stakeholders across industry to assess opportunities and identify barriers to achieving this, making several recommendations in an independent report published on 22 March 2023.

Area	Progress
Continuing to progress measures to reduce GHG emissions from Oil and Gas	• Our *North Sea Transition Deal One Year On* report announced the Government and Regulators Electrification Group (GREG) to explore barriers to electrification, and an industry Task and Finish Group. • In Autumn 2022, the GREG moved to resolve specific barriers to electrification, engaging widely to prioritise issues. We continue to work closely with projects and regulators, including NSTA and Ofgem. • We fulfilled the Net Zero Strategy commitment to launch the Climate Compatibility Checkpoint. • We introduced an 80% investment allowance under the Energy Profits Levy, incentivising industry to invest in upstream decarbonisation. • Crown Estate Scotland and the Scottish Government launched the Innovation and Targeted Oil and Gas (INTOG) sectoral marine plan and seabed leasing round for offshore wind, aiming to power oil and gas assets in Scottish Waters. The outcome of the INTOG round was announced on 24 March, confirming 13 projects. • Several North Sea electrification projects are in development, including large 'hub' solutions which provide power connections to onshore electricity grids and link up to nearby offshore wind - these are critical to wider electrification delivery and the emerging floating offshore wind sector. • The Health and Safety Executive (HSE) -led Iron Mains Risk Reduction Programme (IMRRP) addresses gas distribution network leaks by replacing iron mains with plastic pipes within 30 metres of buildings through to 2032. By 2032, this will deliver a 66% reduction in CO2e GHG emissions since 2014, with c.5% of iron mains remaining.

Upcoming Delivery Milestones

For hydrogen, we will:

- Enter due diligence with 20 projects in the first electrolytic hydrogen allocation round (HAR1), through which we intend to award contracts in Q4 2023 totalling up to 250MW of capacity, subject to affordability and value for money.
- Aim to launch a second electrolytic hydrogen allocation round (HAR2) in Q4 2023 and aim to award contracts to up to 750MW of capacity in early 2025, subject to affordability and value for money, to deliver up to 1GW of electrolytic low carbon hydrogen production capacity in construction or operation by 2025.
- Aim to engage with industry on the draft full form Low Carbon Hydrogen Agreement (LCHA) in Q2 2023 with the intention of publishing the final LCHA for initial projects from Q3 2023.
- Intend to launch a second competition window for strands 1&2 of the NZHF in spring 2023, to be run by UKRI and provide further funding routes for development and capital costs of low carbon hydrogen production projects that do not require revenue support.
- Aim to publish a response to our consultation on the design of business models to support hydrogen T&S infrastructure by the end of Q2 2023, with any further details on strategic planning to align with the production roadmap. To bring forward hydrogen T&S business models, we are aiming to introduce legislative measures when parliamentary time allows, which will be crucial to designing these new business models by 2025.
- Aim to publish a delivery roadmap this year to show how hydrogen production can be scaled up over the coming decade.
- Publish the first revisions of the UK Low Carbon Hydrogen Standard this year.

For oil and gas, we will see:

- Exclusivity Arrangements awarded by Crown Estate Scotland to INTOG projects;
- The first licenses from the 33rd Offshore Oil and Gas Licensing Round in Q2 of 2023;
- Further moves from industry towards our target of ending routine flaring & venting by 2030;
- Future industry investment decisions to deliver the first electrification projects.

Powering Up Britain – Energy Security, published alongside this plan, sets out more information on government's approach to securing cleaner energy.

Carbon capture, Usage, and Storage

Carbon Capture, Usage and Storage (CCUS) is an emerging sector that is of central importance to decarbonising the UK's economy. It will enable the decarbonisation of hard to abate industrial sectors and enable low-carbon hydrogen production and flexible low-carbon electricity generation to complement other forms of low carbon power, along with engineered greenhouse gas removals. CCUS forms part of the most cost-effective route to net zero, and represents a significant economic opportunity, with the potential to support up to 50,000 jobs by 2030 and deliver £4.3 billion in GVA by 2050 through exports.

The UK is the place to invest in CCUS – it is in the top five countries globally for CCUS readiness and has one of the largest potential CO2 storage capacities in Europe. We are committed to deploying CCUS in two industrial clusters by the mid-2020s and four clusters by 2030, with the aim of capturing and storing 20-30Mt CO2 per year by 2030. By 2030, these clusters aim to enable CCUS for 6Mtpa of CO2 from industrial sectors, at least 5Mtpa of CO2 from engineered greenhouse gas removals, the gas CCUS capacity required to keep us on a pathway towards our power sector decarbonisation ambitions and CCUS support for the delivery of up to half of the 10GW ambition of low carbon hydrogen production. CCUS may need to reach storage capacity to store a total of at least ~50 Mtpa CO2 by the mid-2030s.

Significant progress has been made in creating this new sector, and our policies and incentives aim to reduce upfront infrastructure costs and de-risk early investment in a competitive and growing industry. We have:

- Developed business models across the value chain which provide the minimum required initial revenue support to attract private investment, ensuring an appropriate method to wind down government support when industry can self-fund CCUS and hydrogen projects.
- Set out measures in the Energy Bill, that will establish an economic regulatory framework for CO2 networks.
- Selected HyNet (Northwest England and North Wales) and the East Coast Cluster (Teesside and Humber) as the first two clusters. Alongside this document, we are announcing the Track-1 negotiations project list of eight capture projects for these clusters across the hydrogen, power, industry, and waste sectors that have been successful in proceeding to negotiations in the next stage of the programme. Of these, there are three Industrial Carbon Capture, two Energy from Waste, one power-CCUS and two Hydrogen projects.

- The government will provide up to £20 billion funding for early deployment of CCUS. This unprecedented level of funding will unlock private investment and the creation of jobs across the UK, particularly in the East Coast, North West of England, and North Wales, and kick-start the delivery of subsequent phases of this new sustainable industry in the UK. This includes the previously announced £1 billion in capital funding through the CCUS Infrastructure Fund (CIF) to help reduce the capital costs borne by private investors in strategic CCUS infrastructure, transport and storage networks, and industrial carbon capture (ICC) projects.
- Announced an intent to increase the size of the two initial clusters by expanding transport and storage capacity and additional capture projects.
- Launched Track-2 of the CCUS cluster sequencing process to establish two further CCUS clusters.
- Launched the UK energy supply chain taskforce to maximise opportunities, enhanced UK Export Finance's support for attracting investment in CCUS and identified existing infrastructure that could support CCUS; industry is working through the CCUS Council to publish a Supply Chain Strategy in summer 2023.
- The NSTA ran the UK's first ever carbon storage licensing round with 13 potential areas available: 26 bids under evaluation with a view to awarding licences in April 2023. We could need as many as 100 stores to meet our net zero targets.

The above actions provide a clear roadmap to meeting our 2030 commitments. To meet our Carbon Budget 6 commitments, taking into account recommendations from the CCC's *2022 Progress Report to Parliament* and the *Independent Review of Net Zero*, we will also:

- Work with industry to progress development of non-pipeline transport in a timeframe consistent with our Track-2 objectives, supporting decarbonisation of sites away from CO2 stores or industrial clusters suggested in the *Independent Review of Net Zero*.
- Ensure additional clusters identified for 2030 or expansion of the first two clusters can demonstrate options for the delivery of non-pipeline transport projects from 2030.
- Set out a vision for the UK CCUS sector to raise confidence and improve visibility for investors as suggested in the *Independent Review of Net Zero*.
- Shortly publish an updated investment roadmap on CCUS, summarising government policy and funding, to provide investors with the information they need to support investment decisions.

On 15 March 2023, the Chancellor announced that the Government will provide up to £20 billion investment in CCUS to help meet the Government's ambitions. This unprecedented level of funding for the sector will unlock private investment and job creation across the UK, particularly on the East Coast and in the North West of England and North Wales.

The UK Infrastructure Bank (UKIB) has also identified CCUS as an investment opportunity in its first strategic plan. The Bank is engaging the market and projects, focusing on how it can accelerate delivery of the UK's first CCUS clusters. Projects are encouraged to speak to UKIB about their financing needs. Subject to proposals meeting its investment principles, the bank stands ready to invest.

The building blocks for the creation of a new CCUS sector supporting our net zero ambition are in place and the delivery of the first four clusters is underway. This, together with the additional areas outlined above, will enable industry and government to deliver on our net zero and CCUS objectives

Industry

Summary

UK industries combine high-end technology and highly-skilled workers with the ingenuity to make products that are traded all over the world. Through the *Industrial Decarbonisation Strategy*, the UK was the first major economy to set out how we can have a thriving industrial sector aligned to net zero, which also supports jobs, growth, and investment. There is a role for government in helping to increase the rate of adoption of low carbon technologies, particularly when these technologies are not yet fully cost-competitive or price-competitive compared to established practices.

Progress in industrial resource efficiency and energy efficiency (REEE) is key to reaching net zero. REEE measures could contribute up to 12 MtCO2e of annual savings by 2050 (excluding potential additional savings from the Iron and Steel sector).[39] The Energy Efficiency Taskforce will play a vital role in bringing government and business together to deliver ambitious REEE savings. It will advise and work with ministers on the delivery of the government's ambition to reduce, by 15%, the UK's final energy consumption from buildings and industry by 2030, compared to 2021 levels. This applies to domestic and commercial buildings and industrial processes, with a particular focus on the role of the private sector and stimulating investment.

We are also continuing to support Energy Efficiency through the Industrial Energy Transformation Fund (IETF). We are announcing an extension to the Industrial Energy

Transformation Fund (IETF), increasing total grant funding available to £500 million. Subject to business case approval, we intend to open Phase 3 of the IETF for new applications in early 2024, supporting industry to cut their energy bills and carbon emissions through investing in energy efficiency and low carbon technologies. Additionally, as announced at the Budget, we are extending the Climate Change Agreements Scheme by two years, which provides reduced Climate Change Levy rates for eligible businesses in over 50 industrial sectors worth an estimated £300 million a year. We are also publishing a consultation on the detail of the extension and views on any potential future Climate Change Agreements scheme.

We will replace 50TWh of fossil fuels per year by 2035 to support industrial fuel switching. Electrification has the potential to reduce annual industrial greenhouse gas emissions by between 7 and 19 MtCO2e, contributing between 15% and 40% of the necessary carbon abatement in industry by 2050.[40] The level of electrification uptake will depend on a secure supply of electricity, grid access, technology innovation, and the relative cost of electricity compared to other fuels. We recognise that there are barriers to fuel switching to electricity, including the relative cost of electricity compared to gas, and we plan to launch a call for evidence in 2023 to seek views on overcoming these challenges.

Low carbon hydrogen could play a role in decarbonising industrial manufacturing. Hydrogen can be used both for indirect heating applications, such as to fuel industrial boilers or combined heat and power (CHPs) plants, and for direct heating processes, such as in a furnace or kiln. Hydrogen, along with other options, can also help decarbonise non-road mobile machinery, another significant source of GHG emissions. By 2050 industry could use between 40-110 TWh of hydrogen as a fuel each year, abating between 4 – 21 MtCO2e per annum, depending on hydrogen availability.[41] Our UK Low Carbon Hydrogen Standard and the Hydrogen Production Business Model are intended to incentivise the uptake of hydrogen across UK industry (see Fuel Supply and Hydrogen chapter for more on our strategy).

CCUS will play a vital role in transforming industrial sectors such as refining, cement, and chemicals. It can also support the transformation of our industrial regions into low carbon manufacturing clusters, creating high value jobs to help level up the economy. We have committed to deploy CCUS in at least two industrial clusters in the mid-2020s, and in four clusters by 2030. This will enable CCUS deployment and support our ambition to capture and store 6 MtCO2 per annum of industrial emissions by 2030 and 9 MtCO2 per annum by 2035. We announced £20 billion of investment in the early development of CCUS in March 2023, and have developed business models to de-risk and incentivise private investment, and we have now announced the Track-1 project negotiation list, including industrial capture projects. We also anticipated that further savings of 1 MtCO2 per annum after 2030 could be delivered. The best mechanism for

delivering these additional savings, including the role of industrial carbon capture, remains under review.

We are determined that our efforts to decarbonise industry and reduce emissions are not undermined by carbon leakage. The consultation *Addressing Carbon Leakage Risk to Support Decarbonisation*, published alongside this plan, is a significant step forward in setting a new framework to mitigate this risk and considers a range of domestic policy options to protect against carbon leakage, including both a carbon border adjustment mechanism (CBAM) and mandatory product standards.

Decarbonising our industrial sector has the potential to unlock £19 billion in public and private investment across the UK in line with our 2037 delivery pathway. This could support up to 4000 jobs directly in industry for the manufacture and installation of on-site energy efficiency measures and up to 50,000 jobs across industry, power and the transport and storage network for the deployment of CCS.

Indicative emissions pathway to 2037

In 2021, industry emissions were around 76 MtCO2e making up around 17% of total UK net GHG emissions (including international aviation and shipping). The largest emissions sources include manufacturing and construction (e.g. iron and steel, chemical, cement), oil refineries and industrial non-road mobile machinery.

Industry emissions have decreased by 3% since 2019 and 52% since 1990. Since 1990, the largest reductions were from manufacturing and construction (e.g. iron and steel) and adipic acid production.

In line with the sectoral breakdown of the indicative pathway set out in the NZS, compared to 2021 emissions levels, GHG emissions could fall by 15% to 25% on average over 2023-27, 41% to 52% by 2030 and 62% to 75% on average over 2033-37. Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets.[42]

Progress and delivery

Metric	Progress
Ambition to deliver 6 $MtCO_2$ per year of industrial CCUS by 2030, and 9 $MtCO_2$ by 2035	• Phase 2 of the Cluster Sequencing process launched in November 2021. Projects to proceed to the due diligence stage of the Phase 2 process have been announced. • Publication package on ICC business models was released in December 2022.

Metric	Progress
	• The Chancellor announced £20 billion of investment in the early development of CCUS in March 2023. • We have now announced the Track-1 project negotiation list, including industrial capture projects.
Developing our REEE measures to support our commitment to reduce the UK's final energy consumption from buildings and industry by 15% by 2030 against 2021 levels	• Completed six application rounds of the £289 million Industrial Energy Transformation Fund (IETF). Successful applications can be found online and came from a diverse range of sectors, locations, and company sizes. • Published the Government Response to our consultation on strengthening the Energy Saving Opportunity Scheme (ESOS) and introduced clauses in the Energy Bill to provide enabling powers to strengthen ESOS. • Responded to the Environmental Audit Committee's report on Building to Net Zero, outlining our intention to consult this year on our approach to the measurement and reduction of embodied carbon in new buildings. • Collaborated with the UKRI-funded National Interdisciplinary Circular Economy Research (NICER) programme to strengthen our evidence base on resource efficiency initiatives. • Progressed work on how consumer labelling can inform consumers of durability, repairability and recyclability, and will incorporate these findings into future work.
Progressed funding and financial incentives to drive industrial decarbonisation whilst maintaining UK competitiveness	• Supporting energy and trade intensive industries through the Energy Bills Discount Scheme • Consulting on proposals to 'rebalance' the costs placed on energy bills away from electricity to incentivise electrification across the economy. • Extending the Energy Intensive Industries (EII) Compensation Scheme for a further 3 years and subsequently announced the British Industry Supercharger. • Continued to support the engineering and technical design elements of decarbonisation projects across industrial clusters through the £210 million Industrial Decarbonisation

Metric	Progress
	Challenge, delivered through UK Research and Innovation (UKRI). • Consulted with industry on implementing a net zero consistent cap for the UK ETS, reviewing Free Allocation policy and expanding the use of emissions trading across the economy. Government has published an initial response covering proposals implemented by 2023. • Responded to our Industrial Carbon Capture (ICC) business model consultation and published the latest contractual drafting underpinning the ICC and Waste ICC business models. • Introduced a spending power in the Energy Bill to provide financial assistance for CCUS, low carbon hydrogen production and hydrogen transportation and storage. This is intended to facilitate payments under the ICC business models, funded through the £1 billion CCS Infrastructure Fund (CIF) and Industrial Decarbonisation and Hydrogen Revenue Support (IDHRS) scheme. We are working with the devolved administrations on those parts of the Bill that are within devolved competence. • Announced £5 million of grants through the Local Industrial Decarbonisation Plans competition. Grants will support industry outside the main industrial clusters (in “local clusters”) to develop strategic decarbonisation plans focused on shared infrastructure and integrated solutions. This UK-wide competition is intended to launch in summer 2023. • Announced £24 million of UKRI funding through the Transforming Foundation Industries challenge for eight innovative, industrially scaled demonstrator projects to transform the sustainability of the UK’s foundation industry companies and supply chains, demonstrating capability of future technologies to address resource or energy efficiency challenges. • Committed to consult on bolstering environmental regulation of industry to ensure it integrates regulation of GHG and other emissions.

Metric	Progress
	• Published a consultation on *Addressing carbon leakage risk to support decarbonisation*. Explores a range of domestic policy options to mitigate the risk of carbon leakage and ensure UK industry has the optimal policy environment to decarbonise.
Responding to the CCC Annual Report and *Independent Review of Net Zero* recommendations for Industry	• Accepted the recommendation for a cross-government strategy to decarbonise non-road mobile machinery (NRMM). We are running research projects and will launch a call for evidence to develop our evidence base on options to decarbonise NRMM. • Consulting on the policy design of measures to drive reductions in demand, in line with the CCC's recommendation. We are consulting on policies to address carbon leakage, including a UK CBAM and/or mandatory low-carbon product standards, alongside our review of policy on free allocations under the UK Emissions Trading Scheme. • Additionally, both the CCC and the *Independent Review of Net Zero* make recommendations concerning policy development of the UK Emissions Trading Scheme (ETS). These have, in part, been addressed in our recent consultation on Developing the ETS, on which the ETS Authority will be publishing a response in due course. • Set out our ambitions for hydrogen (in the 'Fuel Supply and Hydrogen' chapter of this report). Our upcoming call for evidence on industrial electrification will address recommendations regarding the barriers to this decarbonisation technology.

Upcoming milestones

To drive our progress in decarbonising industry, we will:

- Publish the full government response to the UK ETS Develop consultation. We also accept the recommendation that we set out a long-term pathway for the UK ETS and will work within the ETS Authority to publish one this year.
- Launch a call for evidence on Industrial Electrification in 2023.
- We also accept the recommendation that Government should commit to outlining a clear approach to gas vs. electricity 'rebalancing' by the end of 2023/4 and should make significant progress affecting relative prices by the end of 2024.
- Open the £5 million Local Industrial Decarbonisation Plans competition for bids in Summer 2023.
- Respond to feedback received through the consultation on *Addressing carbon leakage risk to support decarbonisation.*
- Extend the IETF, increasing total grant funding available to £500m. Subject to business case approval, we intend to open Phase 3 of the IETF for new applications in early 2024, supporting industry to cut their energy bills and carbon emissions through investing in energy efficiency and low carbon technologies.
- Extend the current Climate Change Agreements Scheme by two years, providing Climate Change Levy discounts in return for meeting energy efficiency or carbon reductions targets.
- Publish the *Biomass Strategy* in 2023. The *Biomass Strategy* will review the amount of sustainable biomass available to the UK and how this resource could be best utilised across the economy to help achieve the government's net zero and wider environmental commitments while also supporting energy security.
- Launch a digital energy advice service for small businesses this year to give impartial, trusted advice on improving non-domestic energy efficiency, reducing their energy use and bills. We will also be piloting a new audit and grant scheme this year enabling small businesses to move from insight to implementation of energy efficiency measures.
- The Government has consulted on proposals for the private rented sector and will publish the Government response in due course. We will also consider how we can further support greater energy efficiency in owner-occupied commercial buildings.

- Publish a consultation to review the current Batteries Regulations in the second half of 2023. This will consider measures to promote the recovery, reuse, or recycling of all battery chemistry types.
- Begin work on an NRMM strategy in 2023, as recommended by the CCC. We intend to launch a Call for Evidence on NRMM decarbonisation options in Autumn 2023.
- Publish a roadmap for increasing the use of timber in construction by summer 2023.
- Consider options to further formalise productive cross-government policy making and joined-up strategy to support resource-efficient circular economy business models in industry. This work will build on existing industry partnerships, cross-government research, and the work of the newly created Energy Efficiency Taskforce.
- Begin negotiations with three industrial carbon capture projects as part of Phase-2 of Track-1 of the CCUS Cluster Sequencing Process.

UK Emissions Trading Scheme

The *Independent Review of Net Zero* recognises that the UK has been a global leader in emissions trading for more than twenty years. Since 2021, the UK Emissions Trading Scheme (UK ETS) has placed the power of the market at the heart of the UK's net zero strategy. The Review sets out an enhanced role for the UK ETS as a foundation for a thriving, decarbonised economy through 2050 and beyond. It shows how, with a long-term commitment to an expanded market, we can unlock investment in UK infrastructure; catalyse innovation in the UK's world-leading science and technology; and support UK businesses with the most cost-effective and flexible means to deliver net zero.

Government will meet this ambition with a vision of a UK carbon market that can meet the opportunities and challenges of the net zero century. Government accepts the *Independent Review of Net Zero's* recommendations that we set out a long-term pathway for the UK ETS; we will work within the UK ETS Authority to do so this year. Subject to agreement within the Authority, this pathway will confirm that:

- We will explore expanding the scheme to more sectors of the economy, including high emitting sectors. We will shortly publish a Government Response to our consultation on initial expansion of the UK ETS's scope to cover energy from waste/waste incineration and domestic maritime emissions.
- We intend to legislate to continue the UK ETS beyond 2030 until at least 2050. It will remain aligned with our net zero target, giving the private sector the certainty they need to invest in decarbonisation.
- We recognise the integrity offered by the UK ETS could unlock investment at scale in the UK's greenhouse gas removal (GGR) sector by providing an integrated market where businesses can make economically efficient choices on how to decarbonise or remove their emissions. We will work within the UK ETS Authority to consider options for integrating GGRs in the UK ETS subject to the outcomes of last year's UK ETS consultation, a robust monitoring, reporting and verification (MRV) regime being in place, and the management of wider impacts - including market stability and the permanence of the emissions stored by the GGRs. Further detail will be provided in the Government Response to the UK ETS consultation.
- We will explore the potential role of emissions trading markets in gas/electricity price rebalancing as we consider options for rebalancing policy costs away from electricity and onto fossil energy use when the current high gas prices fall.
- Using findings from the call for evidence on the role of robust monitoring, reporting and verification (MRV) of greenhouse gas emissions on farms in last year's UK ETS consultation and additional evidence from ongoing research projects, we will develop a harmonised approach for measuring carbon emissions from farms,

which could help unlock new routes to decarbonisation and financial opportunities. We do not propose expanding the UK ETS to agriculture at this time.

Throughout the development of the UK ETS, we will undertake full consultation on our proposals. We are committed to ensuring that carbon leakage risks are mitigated at all stages of the UK's net zero transition. We are currently reviewing our approach to free allocation of ETS allowances, looking at ways to better target free allocations for those most at risk of carbon leakage to ensure they are fairly distributed. We are also considering other potential mitigation approaches – as set out in today's consultation *Addressing carbon leakage risk to support decarbonisation*.

Heat and buildings

Summary

It has never been more critical to ensure secure, affordable heating for households, and accelerate the UK's transition to net zero. Decarbonising our building stock will bolster UK energy security by minimising our exposure to volatile fossil fuel prices. It will drive investment into low-carbon technologies such as heat pumps, heat networks, and potentially hydrogen, while reducing bills for households and businesses.

We have made significant progress since the *Net Zero Strategy*. We are investing over £6.6 billion this Parliament towards improving energy efficiency and low-carbon heating, with targeted regulation and new market-based mechanisms helping to reduce costs for consumers and businesses, attract greater private investment and strengthen supply chain resilience. We are delivering several 'Help to Heat' schemes, such as the Social Housing Decarbonisation Scheme, to support the installation of insulation and heat pumps, with targeted support for low-income households and the least energy efficient homes. We are also increasing public awareness of low- and no-cost actions through the 'It all adds up' campaign.

We have published, following consultation, our plans for a new Energy Company Obligation scheme – the Great British Insulation Scheme. This landmark scheme will support over 300,000 households to improve their energy efficiency through measures

such as loft and cavity wall insulation, keeping homes warmer and more comfortable while saving people money on their bills.

However, we can still go further. That is why we have already committed an additional £6 billion between 2025 and 2028, demonstrating our long-term commitment to driving energy efficiency and clean heat in our building stock. We have launched the Energy Efficiency taskforce to help deliver our ambition to reduce the UK's final energy consumption from buildings and industry by 15% by 2030, relative to 2021 levels. The taskforce will focus on stimulating private investment and increasing green finance options, galvanising supply chains, and increasing public and business engagement with energy efficiency. This will include building public understanding, awareness of support, and uptake of clean heat technologies such as heat pumps. These actions will also unlock bill savings, as a typical household heating their home to a comfortable temperature can be expected to save over £1,000 per year by improving to EPC band C from the worst energy efficiency bands.[43] As well as supporting households we are putting in place measures to reduce demand from large businesses and improve the efficiency of industrial processes.

Our ambition for driving the new green industry of low-carbon heating systems and energy efficiency measures has the potential to add up to £10 billion in Gross Value Added (GVA) per year in the UK and support ~240,000 jobs in 2035. For example, research shows that heat networks could provide for c.20% of total UK heat demand by 2050,[44] up from providing c.3% currently.[45] This represents an investment opportunity of £60 – £80 billion,[46] incentivised through policies such as heat network zoning and capital support schemes. Our social housing programme also leverages co-funding from local authorities and housing associations to maximise investment and benefits.

The *Independent Review of Net Zero* highlights substantial progress so far, with recommendations focused on how to accelerate progress to meet the scale of the challenge. The Review recommended that we provide greater certainty on increasing heat pump installations. The Government is firmly committed to making the UK one of the largest markets in the world for heat pumps, and we can confirm that, as recommended by the Review, the Boiler Upgrade Scheme will be extended until 2028. We are putting in place a combination of regulatory and public spending measures to make heat pumps as cheap to buy and run as fossil fuel boilers, to achieve at least 600,000 heat pump installations a year by 2028.

We have consulted on phasing out new and replacement fossil fuel heating systems for off gas grid properties, and will respond to these consultations. The Government has an ambition to phase out all new and replacement natural gas boilers by 2035 at the latest, and will further consider the *Independent Review of Net Zero* recommendation in relation to this.

We accept the *Independent Review of Net Zero* recommendation that Government should commit to outlining a clear approach to gas vs. electricity 'rebalancing' by the end of 2023/4 and should make significant progress affecting relative prices by the end of 2024.

Indicative emissions pathway to 2037

In 2021, buildings emissions were around 88 MtCO2e making up around 20% of total UK net GHG emissions (including international aviation and shipping). Residential combustion currently makes up the largest share of these emissions (78%), the vast majority of which is from heating.[47] Buildings emissions have increased by 5% since 2019 and decreased by 19% since 1990. Annual buildings emissions are particularly volatile as impacted by external temperatures.

In line with the sectoral breakdown of the indicative pathway set out in the NZS, compared to 2021 emissions levels, GHG emissions could fall by 7% to 17% on average over 2023-27, 25% to 37% by 2030 and 47% to 61% on average over 2033-37. Please see the *Carbon Budget Delivery Plan* annex for details of our proposals and policies for meeting the carbon budgets.[48]

Progress and Delivery

Area	Progress
Delivered domestic schemes, finance and advice to reduce energy bills and increase energy efficiency, particularly of low-income households, strengthened by a new Energy Efficiency Taskforce	• Launched a new Energy Efficiency Taskforce, to accelerate energy demand reduction and drive energy efficiency improvements to bring down bills for households and businesses. • Investing approximately £3 billion this Parliament in domestic energy efficiency upgrades through our decarbonisation schemes, delivering improvements to 230,000 – 290,000 homes, and saving customers between £400 - £700 per annum on their energy bills (based on £2500 price cap). We have also committed £1 billion per annum until 2026, supporting low-income households with energy efficiency measures through the Energy Company Obligation (ECO 4). • Integrated the Simple Energy Advice website into an enhanced government website with tailored advice and consumer options for spend-to-save improvements for people's homes. • We have launched the latest phase of the Home Decarbonisation Skills Training Competition, with £9.2 million

Area	Progress
	funding to upskill people working in the energy efficiency, retrofit and low carbon heating sectors in England.
Set higher energy efficiency standards for new homes and consulted on a more robust approach to monitor energy performance of buildings.	• Introduced an uplift to energy efficiency standards for new homes in June 2022, which must now deliver around 30% fewer GHG emissions compared to previous standards. The uplift is a stepping-stone to the revised Future Homes Standard, which we will consult on in 2023, ahead of legislating in 2024 and full implementation in 2025. • Published a consultation to ensure The Energy Performance of Buildings (England and Wales) Regulations 2012 are fit for purpose and reflect our net zero ambitions. These include changes to make sure Energy Performance Certifications (EPCs) are reliable and trusted, such as considering new civil penalties when certificates are not provided. • Following the 2020 Social Housing White Paper, the 2021 Heat and Buildings Strategy committed Government to consider setting a new regulatory standard of EPC Band C for the social rented sector. We have committed to begin the consultation process on a minimum energy efficiency standard for the social rental sector, within six months of the Social Housing Regulation Bill receiving Royal Assent.
Funded non-domestic schemes to increase energy efficiency in buildings and increase skills	• Made over £1 billion available through Public Sector Decarbonisation Scheme Phases 1 and 2 to support heat decarbonisation and energy efficiency in the public sector. Phase 3 is delivering a further £1.4 billion between 2022-2025 to support a 75% reduction in public sector buildings GHG emissions by 2037. • Provided up to £61 million of decarbonisation skills funding through the Public Sector Low Carbon Skills Fund, supporting the identification and development of decarbonisation projects in the public sector.
Launched programmes to roll out Clean Heat Technologies	• Launched a £450 million Boiler Upgrade Scheme (BUS), with over 15,000 voucher applications so far. BUS has enabled energy suppliers and mortgage lenders to offer low-finance options, and installers intend to ramp up deployment.

Area	Progress
	• Launched a £30 million Heat Pump Investment Accelerator competition in March 2023, to expand heat pump manufacturing. • We have consulted on phasing out new and replacement fossil fuel heating systems for off gas grid properties, and will respond to these consultations in due course. • Implementing the Clean Heat Market Mechanism in 2024, a market-based incentive for manufacturers to increase installation of low-carbon heating systems relative to the sale of fossil fuel boilers. This is through the Energy Bill. • Cut rate of VAT on the installation of heat pumps and insulation to 0% for 5 years in March 2022, to help boost clean heat uptake. • Continued to grow and decarbonise the UK heat network market through the Green Heat Network Fund and the Heat Network Efficiency Scheme. We can now confirm that capital support will be extended to 2028 to facilitate the continued growth of low carbon heat networks, including £220 million for the Heat Network Transformation Programme over 2025/6 and 2026/7. • Supporting industry to deliver a neighbourhood hydrogen heating trial by 2024 and a village scale trial of hydrogen heating by 2025 (location to be announced in 2023) to take decisions in 2026 on the role of hydrogen in decarbonising heating. We are also supporting industry in the development of a hydrogen town plan. In addition, we have consulted on mandating hydrogen-ready boilers and broader heating system efficiencies.

Upcoming Delivery Milestones

- Launch the Great British Insulation Scheme. Based on proposals announced last year as ECO+, this will deliver £1 billion additional investment by March 2026 in energy efficiency upgrades, such as loft and cavity wall insulation. It will extend help to a wider group of households in the least efficient homes in the lower Council tax bands as well as boosting help for those on the lowest incomes. We plan to lay legislation by the summer to take it forward.

- Work with the Energy Efficiency Task Force, which will publish its action plan later this year.

- Extend the Boiler Upgrade Scheme to 2028 and enhance its current marketing campaign, to increase consumer awareness and further encourage take-up.

- Enhance our consumer energy advice service by launching a digital eligibility checker for government funding and a series of pilots for in-person consumer advice across five regional Net Zero hubs in England. We are expanding the service, including a national phoneline, and are developing an eligibility checker to determine if government funding can support installing energy efficiency measures. Following the 2020 *Social Housing White Paper*, the 2021 *Heat and Buildings Strategy* committed Government to consider setting a new regulatory standard of EPC Band C for the social rented sector. We have committed to begin the consultation process on a minimum energy efficiency standard for the social rental sector, within six months of the Social Housing Regulation Bill receiving Royal Assent.

- Publish a summary of responses to the consultation on improving the energy performance of privately rented homes, respond to the consultation on improving home energy performance through lenders. We plan to consult by the end of this year on how to improve the energy efficiency of owner-occupied homes.

- The Government has consulted on proposals for the private rented sector and will publish the Government response in due course. We will also consider how we can further support greater energy efficiency in owner-occupied commercial buildings.

- Publish a full technical consultation for Future Homes Standard and Future Building Standard in 2023.

- Introduce a regulatory framework for heat networks and begin the implementation of heat network zoning by 2025.

- Confirm funding of £15 million for the 2023/24 Home Decarbonisation Skills Competition and have recently confirmed a new £5 million Heat Training Grant for heat pump and heat network skills.

Transport

Summary

Transport is the largest emitting sector and decarbonising it is a key priority. The 2021 *Transport Decarbonisation Plan* and the *Net Zero Strategy* put the sector on an ambitious path to net zero by 2050, and we are making good progress against the CCC and *Independent Review of Net Zero* recommendations. Our plans will deliver wider benefits across the UK - bolstering energy security, unleashing economic growth, and supporting a healthier population and environment. We have provided strong market signals and incentives to drive supply chain development, and this is already unlocking significant private investment. For example, our commitment to zero emission vehicles has led to hundreds of millions of pounds of private investment in charging infrastructure. We are a world leader in the production and use of low carbon fuels, with independent analysis conducted for Sustainable Aviation forecasting the potential for 65,000 jobs to be created by a UK sustainable aviation fuel (SAF) industry by 2050, and £1.9 billion of direct GVA benefit per annum.[49] To accelerate sector growth, we have an ambitious plan to support innovation and deployment of low carbon technologies, reducing costs to households and businesses.

The rapid adoption of battery electric cars has exceeded the CCC's trajectory,[50] with industry statistics showing that nearly 17% of new cars sold in 2022 were battery electric, up from 12% in 2021.[51] We are leading the way internationally with our commitment to deliver the ZEV mandate from 2024, making good on one of the

Independent Review's 25 key actions for 2025. This is supported by our *Electric Vehicle (EV) Infrastructure Strategy action plan*, with major government investment alongside the private sector through our Local EV Infrastructure and Rapid Charging Funds.

We welcome the CCC's recognition of wider progress in reducing emissions from surface transport. This includes consulting on ending the sale of new non-zero emission L-category vehicles and buses, coaches, and minibuses, and announcing phase out dates for the sale of new, non-zero emission heavy goods vehicles (HGVs). Our Zero Emission Road Freight Demonstrator programme will deploy hundreds of zero emission HGVs in multiple technologies on UK roads. Alongside other measures, this will support delivery of the *Independent Review of Net Zero*'s recommendation to accelerate decarbonisation of the wider freight sector.

Progress in decarbonising aviation and maritime continues. Our *Jet Zero Strategy* sets out our plan for achieving net zero aviation by 2050, through rapid technology development, with ambitious targets to achieve net zero in domestic flights and airports in England by 2040. We have also played a leading role in securing agreement for the International Civil Aviation Organization (ICAO) to adopt net zero by 2050. In March 2022 we launched the UK Shipping Office for Reducing Emissions (UK SHORE) with £206 million of funding to accelerate development of clean maritime technologies. The *Course to Zero* consultation will inform development of targets for decarbonising domestic maritime, and the revised *Clean Maritime Plan* in 2023. We are also driving international progress through the International Maritime Organization (IMO) negotiations.

We welcome the *Independent Review of Net Zero*'s recognition of the important role for low carbon fuels (LCFs) in decarbonising sectors such as aviation and maritime, and will deliver on its recommendation to publish a Low Carbon Fuels Strategy this year to provide certainty for industry and investors over the role LCFs will play across modes out to 2050. We continue to make progress delivering on our ambitions for a thriving domestic sustainable aviation fuel (SAF) market, supported by a comprehensive policy package that includes a further consultation on our SAF mandate, responding to the Government-commissioned independent evaluation of developing a sustainable long-term UK SAF industry, and launching a second application window for the £165 million Advanced Fuels Fund.

An accelerated shift to public transport and active travel will support decarbonisation. Our *Cycling and Walking Investment Strategy* aims to deliver a world-class cycling and walking network in England by 2040, in line with the *Independent Review of Net Zero*. The newly launched Active Travel England will provide extensive funding and support local authorities to develop and build new walking, wheeling, and cycling routes across England. On rail, the Great British Railways Team will bring forward costed options to deliver our *Transport Decarbonisation Plan* ambitions. The Government understands

the needs of communities in rural areas differ from those in urban environments - this is why England's long term *National Bus Strategy Bus Back Better*, is explicit about improving connectivity and availability of services in rural areas.

Indicative emissions pathway to 2037

In 2021, domestic transport emissions were around 109 MtCO2e making up around 25% of total UK net GHG emissions (including international aviation and shipping). Road transport constitutes the majority of these emissions. Domestic transport emissions have decreased by 11% since 2019 and 15% since 1990, though 2021 emissions were impacted by COVID-19 and resultant restrictions on movement.

In line with the sectoral breakdown of the indicative pathway set out in the NZS, compared to 2021 emissions levels, GHG emissions could fall by 2% to 8% on average over 2023-27 27% to 39% by 2030 and 61% to 73% on average over 2033-37. Please see the Carbon Budget Delivery Plan annex for details of our proposals and policies for meeting the carbon budgets.[52]

International aviation and shipping were significantly impacted by COVID-19 and resultant restrictions on movement. In 2021, international aviation and shipping emissions were around 20 MtCO2e making up around 4% of total UK net GHG emissions (including international aviation and shipping). In 2019, international aviation and shipping emissions were around 44 MtCO2e making up around 9% of total UK net GHG emissions (including international aviation and shipping).

In line with the sectoral breakdown of the indicative pathway set out in the NZS, compared to 2019 emissions levels due to severely depressed demand in 2021, GHG emissions could fall by 11% or rise by 5% on average over 2033-37. Please see the *Carbon Budget Delivery Plan* for details of our proposals and policies for meeting the carbon budgets.[53]

Progress and delivery

Area	Progress
Phasing out the sale of all types of new non-zero emission road vehicles.	• We published our response to the Green Paper on a new regulatory framework for vehicle CO2 emissions, and a technical consultation on ZEV mandate design in April 2022. We have now launched our final consultation on the ZEV mandate regulations, to apply from 2024, ensuring delivery of our commitment to phase out the sale of new non-zero emission cars and vans. • We consulted on dates to phase out new non-zero emission buses and L-category vehicles. • At COP26 we announced phase out dates for the sale of new non-zero emission HGVs: 2035 for HGVs of 26 tonnes and under and 2040 for HGVs over 26 tonnes. • We completed the first year of the Zero Emission Road Freight Trial programme, including feasibility studies and deployment of twenty battery electric rigid trucks. We are expanding this as part of the Zero Emission Road Freight Demonstrator programme, to demonstrate HGV technologies at scale on UK roads. • We funded more than 3,000 new zero emission buses. To further incentivise the uptake of zero emission buses, we raised the relevant Bus Service Operators Grant rate to 22p/km from April 2022. We also announced indicative funding for 31 areas to deliver local bus service improvements, to encourage bus travel.
Supporting development of the UK's charging infrastructure network	• We supported increased availability of public charging devices, more than tripling in four years from 10,300 devices in January 2019 to over 37,600, including more than 7,500 rapid devices, in February 2023. • We launched the Local Electric Vehicle Infrastructure Fund Pilot (LEVI) which provided £57 million of public and private investment to 25 different local authorities across England. This will deliver almost 4,400 chargepoints and gullies to scale up the delivery of local chargepoints and support drivers without off-street parking.

Area	Progress
	• Following a pilot and initial capability funding, a further £343m capital and £37.8m resource funding has been made available over the next two financial years to scale up the delivery of local chargepoints across England through the Local EV Infrastructure (LEVI) Fund. • In addition, the On-Street Residential Chargepoint Scheme (ORCS), remains available to all UK local authorities. A further £15m is available in 2023/24, following a total of £37m in 2022/23. • Together, our LEVI and ORCS funding means we will be providing £470m of public funding for local electric vehicle charging over three financial years, supporting the installation of tens of thousands of chargepoints in local areas. • To improve the experience of consumers accessing public charging infrastructure, we are regulating to introduce contactless payment at new chargepoints 8kW and above and existing rapids 50kW and above within one year. We are also mandating payment roaming to support fleet electrification, pricing transparency to allow consumers to compare prices immediately and open chargepoint data to support drivers to find the right chargepoint for their needs. Reliability will also be improved as government will mandate 99% reliability for each rapid network and a 24/7 free helpline across the public network. • Alongside disability charity Motability, co-sponsoring the British Standards Institute (BSI) in providing world-first specifications on designing and installing accessible public EV chargepoints. We are continuing to incentivise the purchase of battery electric vehicle company cars by confirming preferential benefit in kind rates out until April 2028.
Increasing levels of cycling and walking	• Last year we launched a new executive agency, Active Travel England, to ensure local authorities invest in effective, high-quality schemes that support our ambitions for half of all journeys in towns and cities in England to be cycled or walked by 2030.

Area	Progress
	• In February 2023 we announced £200 million for new walking and cycling schemes and projects to enable safer and more inclusive active travel. • In July 2022 we published the second *Cycling and Walking Investment Strategy* (CWIS2), which included an objective to deliver a world-class cycling and walking network in England by 2040.
Accelerating aviation decarbonisation	• We published the *Jet Zero Strategy* in July 2022, which introduces a world first in-sector emissions reduction trajectory *that* sees UK aviation emissions peak in 2019. • We have set a 2040 net zero target for domestic aviation and in February 2023 published a call for evidence to seek views on further action required *to* achieve our target for airport operations in England to be zero emission by 2040. • We have committed to having at least five *UK* Sustainable Aviation Fuel (SAF) plants under construction by 2025, supported by the £165 million Advanced Fuels Fund, and to introduce a SAF mandate targeting at least 10% SAF in the UK aviation fuel mix by 2030. We are launching a second consultation on the mandate's design as well as a second window of the Advanced Fuels Fund. • We commissioned an independent review to help understand the conditions needed to create a sustainable long-term UK SAF industry in October 2022, and will imminently respond to its findings, and will work with industry on options to increase revenue certainty for UK SAF plants and options to stabilise the UK market for feedstocks. • We have committed £685 million to support development of new ultra-efficient and zero-carbon aircraft through the Aerospace Technology Institute Programme. As part of this Programme, £113 million of government and industry funding was announced in February to research zero-emission liquid hydrogen combusting jet engines and lightweight batteries for small *aircraft*. In addition, over £4.2 million is committed to research airport preparedness through the Zero Emission

Area	Progress
	Flight Infrastructure project which published new research in March 2023. • The UK Emissions Trading Scheme (ETS) Authority has consulted on aligning the UK's ETS (which covers domestic flights and those to the EU and Gibraltar) with net zero, while reviewing the sector's free allocation and exploring treatment of non-CO2 impacts. • We have led in ICAO negotiations on adopting a 2050 net zero target and maintaining the integrity of the Carbon Offsetting Reduction Scheme for International Aviation. • We have committed to working closely with academia and industry to better understand the science and potential mitigations non-CO2 impacts from aviation.
Accelerating maritime decarbonisation	• We published the *Course to Zero* consultation in July 2022, seeking views and evidence on the optimal pathway to net zero GHG emissions for domestic maritime by 2050. • We published a consultation with the UK ETS Authority including proposals to expand the scheme to domestic maritime. • We launched the *Operation Zero implementation plan*, to deliver zero-emission operations and maintenance vessels in the North Sea offshore wind sector by 2025 and announced the £206 million UK SHORE research and development programme. • We are championing a 2050 zero emissions target for international shipping through a leading role in IMO *negotiations* and launched the Clydebank Declaration at COP26, now with 24 state signatories, committing to support zero emission shipping corridors. As part of the Green Shipping Challenge we have announced agreements on developing green shipping corridors with the U.S., Norway and the Netherlands.

Upcoming Delivery Milestones

- Implement the ZEV mandate in 2024 and bolster charging infrastructure roll-out across the country to accelerate uptake of zero emission vehicles.
- Set an end date for the sale of new, non-zero emission buses and an expectation for when the entire fleet should be zero emission, whilst ensuring bus services, including those serving rural areas, are not adversely affected.
- Launch the Rapid Charging Fund to support the upgrade of electricity capacity on the strategic road network, enabling the roll-out of ultra- rapid electric vehicle chargepoints.
- Progress *Future of Freight* plan actions to decarbonise the wider freight sector, in line with the *Independent Review of Net Zero*'s recommendation and deliver Zero Emission Road Freight Demonstrations for hydrogen fuel cell and battery electric technologies, with vehicles and infrastructure being in place by March 2025.
- Consult on the future regulatory framework to deliver our commitments to phase out the sale of new non-zero emission HGVs and support uptake in the interim period.
- Develop the rail decarbonisation programme with the Great British Railways Transition Team, ahead of Great British Railways becoming formally established.
- Update the *Clean Maritime Plan*, with indicative domestic decarbonisation targets, delivering UK SHORE R&D investment programme initiatives - including trials of battery electric and alternative fuelled vessels and shoreside infrastructure by March 2025 - and considering a potential phase out date for the sale of new non-zero emission domestic vessels.
- Play a leading role on delivering international progress on decarbonising aviation and shipping through the ICAO and IMO.
- Publish our sector-wide *Low Carbon Fuels Strategy* in 2023, providing a clear vision for investment, and legislating to include recycled carbon and nuclear derived fuels in renewables transport fuel schemes, enhancing fuel security and environmental benefits.
- Continue work on potential measures to help address market barriers to the use of fuels with higher biocontent in compatible heavy-duty vehicles.
- Develop long term funding plans for cycling and walking infrastructure and behaviour change programmes up to 2025.
- Aim to complete the review of the *National Networks National Policy Statement* during 2023, taking account of the Government's legal net zero target.

Natural Resources, Waste & F-Gases

Summary

Maximising co-benefits for climate and nature is vital to supporting net zero alongside other priority outcomes, including biodiversity, water quality, climate adaptation and economic growth. The *Independent Review of Net Zero* demonstrated that decarbonising land use sectors and sustainably managing natural resources and broader ecosystems can create sizeable economic opportunities. Delivering on these has the potential to leverage growing demand for investment opportunities in natural capital, supporting the market frameworks needed in this emerging area.

We have made progress on key *Net Zero Strategy* commitments, publishing updates on how environmental land management (ELM) schemes will pay farmers to provide a range of public goods, including actions to reduce GHG emissions.[54] We have also set a legally binding target for tree coverage in England. Our ambitious agriculture measures build on historical progress in reducing emissions. For example, the dairy sector increased milk production by 11% between 2000-2020, with 21% fewer cows and 12% less GHG emissions.

We will build on progress in reducing emissions from agriculture and will set out how farmers will be supported to understand their emission sources through carbon audits by 2024 and take further actions to decarbonise their businesses, including through ELM schemes. We will shortly publish a Government Response to our

call for evidence exploring the role of robust monitoring, reporting, and verification of GHG emissions on farms.[55] Utilising these findings and additional evidence from ongoing research projects, we will develop a harmonised approach for measuring carbon emissions from farms, helping unlock new financial opportunities through carbon markets. We also anticipate entry of high efficacy methane suppressing products to the UK market from 2025 and will explore the role of industry and government to maximise uptake of such products for suitable cattle farm systems at pace, through a phased approach. This will include the ambition to mandate the introduction of products with proven safety and efficacy in compound feeds for cattle as soon as practically possible in England.

We have also made considerable progress reducing emissions from waste, as we drive forward action to deliver the collection and packaging reforms from the *Net Zero Strategy*. The Climate Change Committee has recognised the effectiveness of the Landfill Tax in diverting waste from landfill and consequently reducing emissions. We will shortly issue a call for evidence to support the near elimination of biodegradable waste being sent to landfill by 2028. We will publish an addendum to the *Resources and Waste Strategy* in the summer, which will focus on net zero.

We welcome the recommendations made by the Review and CCC's *2022 Progress Report to Parliament*, including as we prepare to publish our Land Use Framework for England later this year. Taking a systems approach, the Land Use Framework will help set out how we can deliver multifunctional landscapes that are resilient to our changing climate whilst meeting our needs for net zero, food production and environmental recovery. For example, the agricultural sector plays an important role in supporting on-shore renewable energy generation, aiding delivery of the *British Energy Security Strategy*, whilst maintaining domestic food production security.

We agree with the *Independent Review of Net Zero*'s recommendation that we ensure a pipeline on investable nature-based solutions projects. We have established the Natural Environment Investment Readiness Fund with the Environment Agency to develop a pipeline of 86 projects across England to monetise the benefits of nature and develop enabling tools or standards. Our 2023 *Green Finance Strategy* sets out how we will meet HMG's goal of mobilising at least £500 million per year of private finance into nature's recovery by 2027, and more than £1 billion per year by 2030.

Indicative emissions pathway to 2037

In 2021, agriculture and other land use emissions were around 49 MtCO2e making up around 11% of total UK net GHG emissions (including international aviation and shipping). Livestock (particularly cattle) currently make up the largest share of these emissions. Agriculture and other land use emissions have decreased by 2% since 2019 and 25% since 1990. The largest factor in this long-term fall has been an increase in the sink provided by forest land, with an increasing CO2 uptake by trees as they reach maturity, in

line with the historical planting pattern. In line with the sectoral breakdown of the indicative pathway set out in the NZS, compared to 2021 emissions levels, GHG emissions could fall by 1% to 12% on average over 2023-27, 11% to 24% by 2030 and 19% to 37% on average over 2033-37. Please see the Carbon Budget Delivery Plan for details of our proposals and policies for meeting the carbon budgets.

In 2021, waste and F-gas emissions were around 30 MtCO2e making up around 7% of total UK net GHG emissions (including international aviation and shipping). The largest emissions sources include landfill and air conditioning and refrigeration. Waste and F-gas emissions have decreased by 11% since 2019 and 66% since 1990. The reduction since 1990 is primarily due to reductions in emissions from landfill and halocarbon production. In line with the sectoral breakdown of the indicative pathway set out in the NZS, compared to 2021 emissions levels, GHG emissions could fall by 23% to 31% on average over 2023-27 43% to 51% by 2030 and 56% to 65% on average over 2033-37. Please see the Carbon Budget Delivery Plan for details of our proposals and policies for meeting the carbon budgets.[56]

Progress and delivery

Area	Progress
Natural Resources	• We published our *Environmental Improvement Plan* (EIP), updating on our progress on delivering the 25 Year Environment Plan and setting out our future ambitions for land use to support net zero alongside nature, biodiversity and climate adaptation goals. • Published our recent *Environmental Land Management Update*, which sets out how we will support farmers and land managers to sustainably produce food, while delivering benefits for climate and nature. • We are accelerating the roll-out of the Sustainable Farming Incentive (SFI) scheme in 2023 and confirmed the full range of future payable actions across the SFI and the Countryside Stewardship scheme. • We also announced the opening of round two of the Landscape Recovery scheme which will focus on net zero, protected sites and habitat creation. • We have also established a cross administration UK Blue Carbon Evidence Partnership to produce a roadmap to potential inclusion of coastal wetlands in the UK GHG.

Area	Progress
Agriculture	• Announced six new SFI standards. Actions under these standards will help towards decarbonising the agriculture sector. • In the EIP 2023 we committed to consulting this year on extending environmental permitting to the beef and dairy sectors. • Opened the £270 million Farming Innovation Programme (FIP). In partnership with UK Research & Innovation (UKRI), we have already committed £68 million up to the end of 2022 and will provide further grants of £51 million in 2023 to facilitate the development and adoption of emerging farming technologies that will help reduce GHG emissions.
Peat	• Launched the £5.6 million Paludiculture Exploration Fund (2022-2025) to support the uptake of paludiculture, which offers an opportunity to continue profitable agriculture while managing land in a way that supports net zero. • Announced our intention to ban the use of peat in horticulture, with limited exemptions, in 2024. • Started development of the Natural England Peatland Restoration Plan which will provide a trajectory for peatland restoration up to 2050 and will be published in 2024.
Forestry, agroforestry and hedgerows	• Announced a £124 million boost for the Nature for Climate Fund (NCF), ensuring a total spend of approximately £678 million on woodland creation and woodland management by 2025. • Announced the inclusion of a hedgerow standard in the SFI, due to be rolled out later this year. • Launched the Forestry Commission Development Woodland Officer apprenticeship with the University of Cumbria and the Institute of Chartered Foresters.
Waste and wastewater	• Published the government response to consultations on launching a Deposit Return Scheme for drinks containers.

Area	Progress
	in England, Wales and Northern Ireland and Extended Producer Responsibility for packaging. • Developed plans to improve resource efficiency. See Industry chapter for more detail. • Consulted on improving food waste reporting for large food businesses. • Set a legally binding target through the Environment Act to reduce residual waste (excluding major mineral wastes) kg per capita by 50% by 2042 from 2019 levels.
F – gases	• Published our F-gas assessment report on the effectiveness of the F-gas regulation

Upcoming Delivery Milestones

Natural Resources:

- Continue to roll out our ELM schemes, with all three operating in full by 2024-5.
- Publish a Land Use Framework for England this year.
- Publish a summary of responses to our call for evidence on methane supressing feed products.
- Develop a mandatory methodology for voluntary food ecolabelling,
- Publish a *Biomass Strategy* in 2023. The *Biomass Strategy* will review the amount of sustainable biomass available to the UK and how this resource could be best utilised across the economy to help achieve the government's net zero and wider environmental commitments while also supporting energy security. This includes providing early thinking on domestic biomass production, including short rotation forestry and perennial energy crops.
- Publish a roadmap for increasing the use of timber in construction by summer 2023.
- Publish our response to the Lowland Agricultural Peat Task Force report and continue to work with partners to develop the Peatland Restoration Plan for publication in 2024, ahead of the NCF ending in 2025 and transitioning to the future farm schemes as the main peat delivery vehicle.
- Launch a £6.6 million lowland peat research and development programme and explore options to increase ambition in lowland peatlands, developing infrastructure and collaboration projects to transform our lowland peat water landscapes.

- Respond to the call for evidence on the UK Emissions Trading Scheme (ETS) potential role as a long-term market for nature-based and engineered greenhouse gas removals.

Waste, wastewater and F-gases:

- Deliver our collection and packaging reforms from the *Resources and Waste Strategy*. This includes: publishing our response to our consultation on consistency in household and business recycling in England, introducing a Deposit Return Scheme for drinks containers from October 2025, and implementing packaging Extended Producer Responsibility from 2024.
- Develop a plan to achieve the near elimination of biodegradable municipal waste going to landfill from 2028 following a call for evidence.
- Respond to our call for evidence on the initial expansion of the UK Emissions Trading Scheme to cover waste incineration and energy from waste.
- Publish our response to the consultation on a revised Waste Prevention Programme for England alongside the new programme 'Maximising Resources, Minimising Waste'.
- Publish our response to the consultation on improving food waste reporting for large food businesses.
- Support Water UK's Net Zero Route Map to deliver a net zero water supply by 2030.
- Publish two rapid evidence assessments setting out options to improve our estimates of GHG emissions from wastewater treatment.
- Consult on proposals to amend our existing F-gas legislation, with the aim of further reducing F-gas use and emissions.

Greenhouse Gas Removals

Summary

Removing carbon dioxide from the atmosphere is essential to meet net zero. We intend to capitalise on the economic benefits from this emerging sector, by scaling-up engineered Greenhouse Gas Removals (GGRs) to deliver new export opportunities and high-quality green jobs across the UK, supporting energy security and levelling-up. To deliver this we need to mobilise significant private investment, supporting innovation and providing investors with long-term clarity and certainty on future revenue streams.

Our priority is to reduce greenhouse gas (GHG) emissions from human activities and to only use GGRs to mitigate remaining GHG emissions that are unavoidable. The CCC agrees that nature-based and engineered removals will be needed to mitigate the impact of residual GHG emissions in hard-to-abate sectors, to meet net zero.[57]

The *Net Zero Strategy* established our ambition to develop markets and incentives for engineered GGR technologies to enable deployment of at least 5 MtCO2e pa of engineered GGR removals by 2030, potentially scaling to 75-81 MtCO2e pa by 2050. We welcome the recommendations from the CCC and *Independent Review of Net Zero* for GGR sector policy. These included publishing timings and details of the GGRs business model proposal, detailing plans for monitoring, reporting and verification (MRV) and undertaking legislative changes to ensure engineered removals count towards our carbon budgets. We are already acting on these and the commitments made in the NZS to support the scale-up of engineered GGRs.

We recognise that there is still a financial barrier to scaling the engineered GGR sector. We have taken steps to address this; for example, in 2022 we consulted on both a GGR business model and a specific power bio-energy carbon capture and storage (power BECCS) business models, we intend to respond to the GGR consultation later this year, the power BECCS response will be published imminently. Additionally, we recognise the integrity offered by the UK ETS could unlock investment at scale in the UK's GGR sector by providing an integrated market where businesses can make economically efficient choices on how to decarbonise or remove their emissions. We will work within the UK ETS Authority to consider options for integrating GGRs in the UK ETS, subject to the outcomes of last year's UK ETS consultation.

A robust monitoring, reporting and verification (MRV) framework will be crucial to preserve the integrity of any market for negative GHG emissions and instil public and investor confidence that removals are genuine and verifiable. The *Independent Review of Net Zero* emphasised that government must clearly outline the standards the business models require. We have consulted on the immediate priorities for MRV, including a review of the existing landscape of standards and initiatives that could underpin

business model support for initial GGR projects and proposed principles for determining the legitimacy of a negative emission.

We agree with the CCC that access to CO2 transport and storage infrastructure will be critical for engineered GGR technologies that rely on long-term geological storage, such as direct air carbon capture and storage (DACCS) and bio-energy carbon capture and storage (BECCS). Our work on CCUS clusters is set out in the CCUS section of this document, and in *Powering Up Britain – Energy Security*. As part of this, we are exploring how early GGR projects could be connected to the transport and storage network. Subject to criteria under development, the Government is minded to enable engineered greenhouse gas removals (GGRs) to apply to Track-1 expansion and Track-2.

We also agree with the CCC that understanding and ensuring the sustainability of GGRs is crucial and will differ across the different types of engineered GGR methods. To address this, we have commissioned research on resource intensity for DACCS. Relevant for biomass GGRs, we are committed to publishing the *Biomass Strategy* in 2023. This will review the amount of sustainable biomass available to the UK and how this resource could be best utilised across the economy to help achieve the government's net zero and wider environmental commitments while also supporting energy security. This will outline the role that BECCS can play in reducing carbon emissions across the economy and set out how the technology could be deployed.

Direct Air Capture (DAC) powered by nuclear power plant

The UK Government is funding a variety of innovative GGR technologies, including several first-generation Direct Air Capture (DAC) technologies through the DAC and Greenhouse Gas Removals Innovation Programme. The objective of this programme is to produce several operational pilot plants by 2025, as well as realising investment, jobs, skills, and technology in this nascent sector.

One example of a project being funded is a consortium led by Sizewell C, who are developing an innovative heat-powered DAC demonstrator plant designed to capture low carbon waste heat from a nuclear power plant. This technology could offer increased efficiency and less reliance on electricity, therefore reducing the cost of removing carbon dioxide from the atmosphere. A scaled-up DAC plant linked to Sizewell C could utilise around 400 MW of heat from the nuclear power plant to capture 1.5 million tonnes of CO2 per year.

Indicative emissions pathway to 2037

As set out in the *Net Zero Strategy*, we set an ambition to deploy at least 5 MtCO2e p.a. of engineered removals by 2030, potentially rising to 23 MtCO2e p.a.by 2035.

Headline progress and delivery

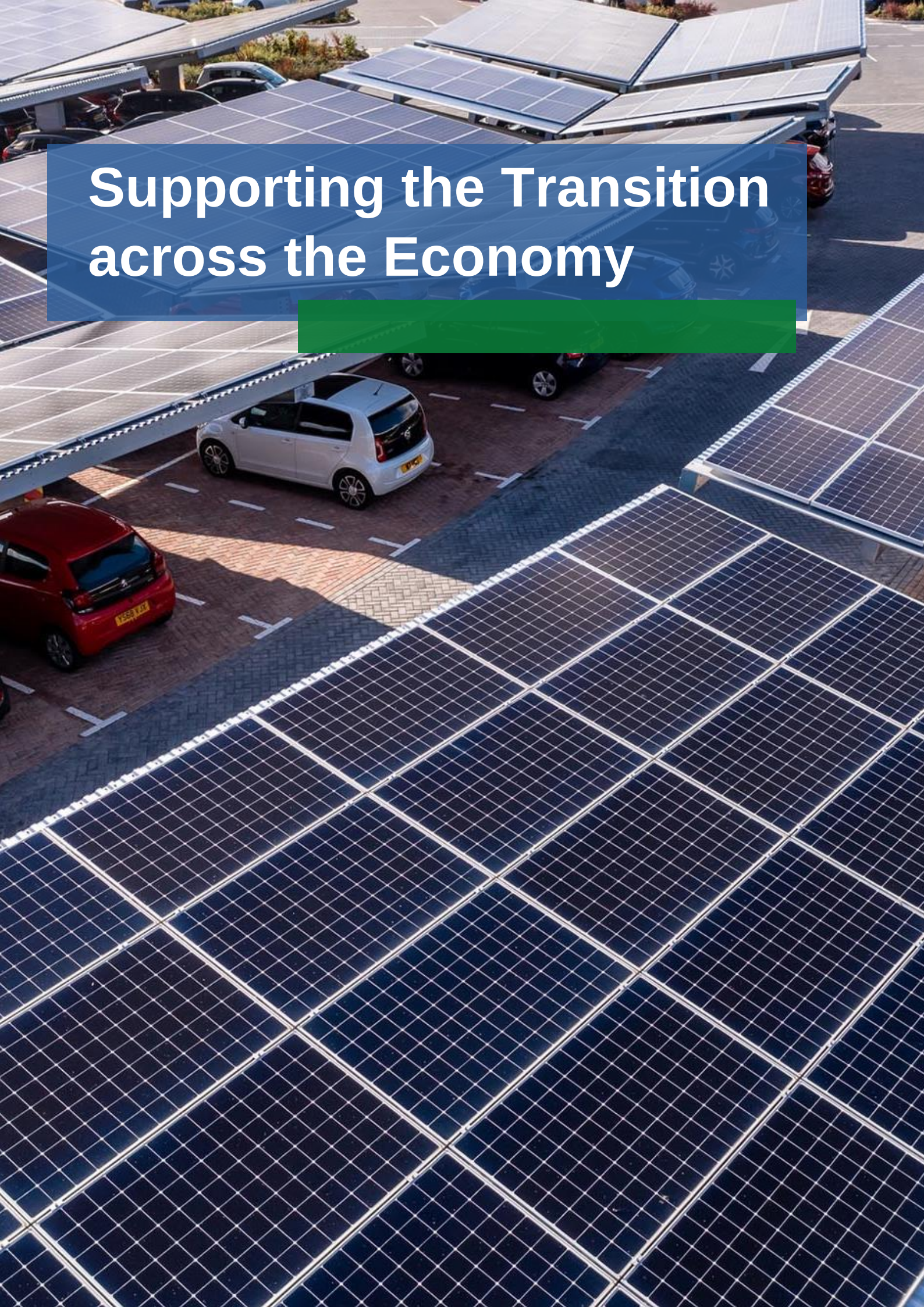
Metric	Progress
To deliver at least 5 $MtCO_2e$ pa of engineered removals by 2030.	• In July 2022 we published our consultation on engineered GGR business models that could support on a technology-neutral basis technologies such as DACCS, seawater CO2 removals, and certain BECCS applications. This included seeking views on the immediate priorities for monitoring reporting and verification (MRV). • In August 2022 we published our power BECCS consultation and project submission process, today we have published the project selection outcome and will publish the consultation response imminently • In December 2022, we published a position on GGR credits for the Industrial Carbon Capture (ICC) Business Model and Waste ICC Business Model • We have set up a GGR Business Model Expert Group to enable government to continue engagement with a broad range of stakeholders across the GGR landscape, drawing on this expertise to inform development of the business model. • In March 2022, the UK ETS Authority launched a call for evidence exploring the role of the UK ETS as a potential long-term market for GGRs. • We have acted on our commitment to seek an amendment to the Climate Change Act (CCA) to enable engineered removals to contribute to UK carbon budgets, by including a clause in the Energy Bill that seeks to broaden the definition of “removals” of greenhouse gases beyond nature-based GGRs to include engineered GGRs. The Energy Bill is currently progressing through Parliament. • Subject to criteria under development, the Government is minded to enable engineered GGRs to apply to Track-1 expansion and Track-2

Metric	Progress
	• The power BECCS project selection process sought to identify projects which could deploy to Track-1 timescales. Two projects passed the deliverability assessment for the power BECCS project submission process, Drax Power Ltd and Lynemouth Power Ltd. They have not been selected for deployment in Track-1, but the Department for Energy Security and Net Zero will engage further with these projects following the assessment outcome. Track-1 is not the extent of our ambition, and the department remains committed to achieving 5Mtpa of engineered greenhouse gas removals by 2030.
To deliver verifiable removal of up to 1000 tCO_2e pa from pilot projects.	• Phase 1 of the £6 million Net Zero Innovation Portfolio DAC and other GGRs Programme delivered 22 feasibility studies across DAC, Enhanced Weathering, Biochar and BECCS technologies. • In phase 2 of the DAC and GGR innovation competition, over £54 million of government funding was awarded to 15 of the most promising demonstration projects.

Upcoming delivery milestones

In the coming year we will:

- Publish government responses and next steps following a review of the GGR business model and power BECCS business model consultation responses. For the GGR consultation response, this includes having reflected on input from our GGR Business Model Expert Group meetings.
- Work within the UK ETS Authority to consider options for integrating GGRs in the UK ETS subject to the outcomes of last year's UK ETS consultation, a robust monitoring, reporting and verification (MRV) regime being in place, and the management of wider impacts - including market stability and the permanence of the emissions stored by the GGRs. Further detail will be provided in the Government Response to the UK ETS consultation in due course.
- Monitor the progress of the DAC and GGR Innovation Programme which will be in the process of building pilot/demonstration projects to be fully operational by March 2025.
- Publish the *Biomass Strategy* in 2023, which will outline the role that BECCS can play in reducing carbon emissions across the economy and set out how the technology could be deployed.



Supporting the Transition across the Economy

Supporting the Transition across the Economy

Innovation

Summary

Delivering net zero will require a step change in the rate of new technologies being developed, deployed to market and adopted by businesses and consumers. The global market opportunity for UK companies from net zero could reach a cumulative £1 trillion to 2030 and supporting innovation could help unlock up to 300,000 jobs and new commercial opportunities in both exports and domestic industries across all parts of the UK.[58]

Since the *Net Zero Strategy*, government have confirmed a portfolio of net zero research and innovation (R&I) investment of approximately £4.2 billion over the period from 2022-25. This reflects delivery of net zero research and innovation programmes being a top priority. The *Net Zero Research and Innovation Delivery Plan*, published alongside this *Net Zero Growth Plan*, outlines this government's support and aligns with the priorities set out in the *Net Zero Research and Innovation Framework*.[59]

We welcome the CCC and *Independent Review of Net Zero's* recommendations on the need to disseminate knowledge and insight from R&I programmes and accelerate the rapid and safe introduction of emerging net zero technologies. The government plans to prioritise several key recommendations from the CCC and *Independent Review of Net Zero* and will continue to deliver our significant research and innovation portfolio. We will:

- Develop a net zero technology roadmap and update the Energy Innovation Needs Assessments;

- Deliver the recommendations around the role of regulators and regulation through the Patrick Vallance-led review of how the UK can better regulate emerging technologies to ensure growth;

- Deliver recommendations on disseminating knowledge and reviewing greater R&D for net zero through existing and planned activity, such as the recently launched consultation on R&D tax relief reform.

Progress and delivery

In the last 18 months, we have made good progress against the commitments set out in the innovation chapter of the *Net Zero Strategy*. This includes:

Area	Progress
Increase government investment in R&D	• At the 2022 Autumn Statement, the Government recommitted to a £20 billion per annum public R&D budget by 2024/2025. This included an additional £1.6 billion for the UK's nine Catapults for 2023-2028. This will allow Catapults to continue supporting innovation and de-risking the transition from research to commercial delivery; accelerating innovation clusters; and stimulating additional private sector investment in R&D.
Publish the UK's first Net Zero Research & Innovation Framework	• The *Net Zero Research and Innovation Framework*, published alongside the *Net Zero Strategy* in October 2021, set out the key research and innovation challenges for the next 5-10 years and a roadmap to 2050. • We've since published a follow-up *Net Zero Research and Innovation Delivery Plan* alongside this plan to outline the Government's net zero R&D programmes for the current Spending Review period 2022-25 and how these are aligned to the priorities in the Framework.
Deliver a government programme of innovation to enable decarbonisation	• Government expects to invest approximately £4.2 billion in net zero research and innovation over the period from 2022-25. This includes £1.5 billion allocated to net zero innovation announced in the *Net Zero Strategy*, as well as net zero research and innovation delivered through other departmental programmes and through UKRI. Further funding from Ofgem's £450 million Strategic Innovation Fund (£263 million during this spending review period) is being invested in innovation relating to the energy networks. • The £1 billion Net Zero Innovation Portfolio (NZIP) and £385 million Advanced Nuclear Fund continues to support priority areas in power, buildings, industry and disruptive innovations over 2021-2025. To date, we have already supported at least 863

Area	Progress
	organisations with NZIP funding and at least 44 programmes have launched so far. • In transport, government is investing in programmes to decarbonise land, sea and air transportation. This includes £20 million in Zero Emission Road Freight Trials (ZERFT), which involved six feasibility studies and the deployment of twenty battery electric rigid trucks into NHS and local authority fleets. We are expanding upon this work with the Zero Emission Road Freight Demonstrator (ZERFD) programme which will see hundreds of Zero Emission HGVs and their infrastructure demonstrated on UK roads. • The *Net Zero Strategy* committed at least £75 million on research into natural resources, waste and F-gases. The Department for Environment, Food and Rural Affairs continue to push forward key programmes in these sectors and are in the concluding stages of finalising a partnership with UKRI and the Devolved Administrations called Building a Great Future – Transforming Land Use for Net Zero, Nature and People.
Take a leadership role in Mission Innovation 2.0	• As a leading member of Mission Innovation, we have cemented Mission Innovation as the leading forum for international clean energy innovation and global collaboration. The UK leads the Mission Innovation Secretariat and helps shape the overall strategy of the initiative through our role on the Steering Committee. • The UK now co-leads the Green Powered Future Mission and the Clean Hydrogen Mission, as well as the Heating and Cooling Innovation Community. The UK also participates in four other Missions.

Upcoming delivery milestones

- We will continue to award funding and deliver projects across the £4.2 billion portfolio of net zero R&I. We intend to publish an update on the programmes set out in the *Net Zero Research & Innovation Delivery Plan* by the end of the Spending Review in 2025.

- Addressing the CCC's recommendation, we will continue to encourage dissemination of the outputs of funded innovation programmes. This includes through publishing programme updates such as the forthcoming *NZIP Progress Report* and sharing best practice through the cross-government Net Zero Innovation Board.

- Addressing the *Independent Review of Net Zero* recommendations, we will take forward several new commitments including the development of a net zero technology roadmap and an update of the Energy Innovation Needs Assessments.

Case Study: Lapwing Reverse Coal Project: Novel engineering of a natural solution will enable the removal of CO2 from the atmosphere to lock it back in the ground.

The Lapwing Estate sits on lowland peat which has been historically drained and farmed for food production. This has degraded the soil and led to GHG emissions as the peat oxidises (lowland peat is responsible for 3% of UK GHG emissions).

Reverse Coal was awarded nearly £3 million through the NZIP. To capture carbon dioxide and abate existing emissions, they will rewet the peat and establish fast growing willow crops which will be chipped and dried and then fed into a high temperature pyrolysis plant. This plant converts the willow (biomass) into a solid form of carbon akin to coal, called ‘biochar'. The biochar is buried underground for long term stable carbon storage with the heat and power directed into controlled environment agriculture for more sustainable and secure food production. This first-of-its-kind project is exploring an innovative new way to sustainably intensify production of high quality, healthy food, whilst at the same time supporting the government’s target for net zero by 2050.

Fusion Energy

Fusion has potential to be the ultimate clean power solution, delivering low-carbon, safe, continuous and sustainable energy without the issue of very long-lived, high-level radioactive waste. The UK is a recognised global leader in this technology, with the world record for fusion energy production being broken at the Joint European Torus facility in Oxfordshire, and unique capabilities in the technologies like robotics and fuel handling needed to develop fusion commercially.

We have an opportunity to capitalise on our position to create a new fusion energy technology sector in the UK, creating jobs, economic growth and export potential even before fusion energy is on the grid.

In 2021, the *UK Fusion Strategy* set out ambitious objectives to demonstrate the commercial viability of fusion by building a prototype fusion power plant capable of providing energy to the UK grid by 2040, and to build a world-leading fusion industry with high-export potential.

The UK Government has already committed £222 million for the first five years of UKAEA's Spherical Tokamak for Energy Production (STEP) programme. STEP aims to design, develop, and build the prototype fusion power plant. This will not only demonstrate a path to the commercial viability of fusion energy, but will help create a skilled fusion supply chain and provide learning and experience for the UK fusion sector as a whole.

The Government has also provided £42 million for the Fusion Industry Programme. This initiative will galvanise commercial fusion innovation through a challenge fund, designed to support UK businesses to solve common technical issues facing fusion, as well as encourage R&D investment into this growing industry.

This supports the Fusion Cluster, a newly created community of public organisations and businesses working together at the Culham Centre for Fusion Energy to share knowledge and drive fusion energy from theory to reality. Members have access to cutting edge technical facilities, start-up business support and experienced peers.

Progress so far

The Government has already identified and announced a site for the STEP power plant, which will be bult in West Burton, transforming the site of an existing coal power plant into a green energy cluster. It has set up the company that will deliver this power station and begun developing the commercial relationships need to build it.

The UK is the only country in the world to develop and legislate for a proportionate regulatory regime for fusion that encourages innovation whilst putting safety at the heart of our fusion sector.

Taken together, the Government's clear strategy and investment in fusion energy R&D, regulation and development of the sector has already made the UK the best place in the world to do fusion innovation. Fusion companies from around the world are interested in collaborating with the UK and several companies have made announcements about plans to build new facilities or experiments in the UK because of the unique programme started by the UK.

Green Finance and Investment

Summary

The global transition to net zero will see trillions of pounds reallocated and invested in new projects, products and services. The UK's world-renowned finance sector can be at the forefront of this global green future.

Unlocking the potential of green finance is integral to the delivery of the *Net Zero Growth Plan*. It is also vital to delivering on the vision set out in the Chancellor's 2022 Autumn Statement, and 2023 Spring Budget, for both financial services and green industries to be key growth sectors for the UK.

Alongside this plan, government has published the 2023 *Green Finance Strategy.* This sets out how we will deliver on our ambition to become the world's first net zero-aligned financial centre, how we will utilise all levers available to mobilise the private investment into energy security and net zero, and how we will support industry to capture the opportunity of being a world-leading green finance centre. As we are clear that there is no pathway to net zero without protecting and restoring nature, the strategy explicitly incorporates nature and climate adaptation into our green finance policy framework.

The UK's COP26 Presidency in 2021 generated historical momentum in the numbers of businesses, cities, regions and investors seeking to align with climate and environmental goals, with over 90% of global GDP now covered by national net zero targets. In the financial services sector this was exemplified through the commitment of the Glasgow Financial Alliance for Net Zero, which unites over 550 members across the financial sector committed to align with a net zero future, spanning 50 countries and representing 40% of global private financial assets.

This is a long-term opportunity for UK financial services. It is estimated that global sustainable finance markets are expected to grow to $34 trillion in assets under management by 2026, outpacing growth in the asset and wealth management industry as a whole. Managing this capital is a significant opportunity for UK financial and professional services, but the sector must be supported to secure significant market share. From innovative climate tech solutions seeking venture capital to grow towards their vision, to banks lending to major renewables projects and asset managers allocating capital to support the companies of the future – behind every step of our transition will be our world-leading financial services sector.

The 2023 *Green Finance Strategy* sets out the actions government will take next to develop our green finance policy framework and respond to recommendations made by both the CCC and *Independent Review of Net Zero*. Policy focuses on greening the financial system, through the provision of the right information, data and tools

for real economy and financial services companies to manage risks and seek opportunities; and on financing our green objectives through more efficient and effective mobilisation of private capital.

We are providing further detail on the UK's commitment and framework for becoming the world's first net zero-aligned financial centre. We are ensuring market participants have the information and data they need, for instance by: committing to consult on the extension of transition planning disclosure requirements to the largest private companies, complementing existing requirements in place by the FCA, committing to issue a call for evidence on Scope 3 emissions reporting, and continuing to support the work of the International Sustainability Standards Board and setting up of a framework to address their suitability for adoption in the UK as soon as final standards are published.

We will support industry as it develops the new market frameworks, tools and expertise required to expand green finance activity with an update on the delivery of a UK Green Taxonomy and launching a Transition Finance Market Review on how to make the UK become the best place in the world for raising transition capital.

To support companies and financial institutions to invest in critical net zero sectors and technologies, we set out how the UK Infrastructure Bank, with £22 billion in capital to deploy for net zero and regional and local objectives, British Business Bank, UK Research and Innovation, and the UK's export credit agency, UK Export Finance, support green technologies through to commercialisation.

We also commit to consult on the specific steps and interventions needed to support the growth of high integrity voluntary carbon markets and protect against greenwashing. We are publishing a Nature Markets Framework setting out our approach to accelerating high-integrity markets to enable farmers and land managers to attract investment in natural capital, as well as our plans to develop a comprehensive suite of nature investment standards.

Progress and delivery

Area	Progress
Financing Green	• The UK Infrastructure Bank is now operational and, as of 27th March 2023, has announced 12 deals, investing approximately £1.2 billion and unlocking over £5 billion of private capital. Projects that contribute towards meeting net zero include: − Committing £162.5 million as a cornerstone investor in Next Power UK ESG fund, the UK's largest subsidy-free solar fund. − Investing £150 million, alongside £1 billion from other investors, in the UK portion of finance for the 1.4GW NeuConnect interconnector project. − Providing £10 million to the West Midlands Combined Authority, supporting the introduction of green buses in Birmingham. • Since their launch in 2021, the UK's green gilt programme has raised more than £26 billion from gilts issued by the UK Debt Management Office, and retail Green Savings Bonds sold via NS&I. • To highlight and communicate more widely the net zero opportunities and incentives for investment in the UK, we published four investor roadmaps - covering the UK's automotive, hydrogen, CCUS, and offshore wind sectors. • Last year we hosted the Green Trade and Investment Expo. This event brought together 200 British business leaders and global investors, showcasing investment and export opportunities presented by the UK's net zero transition.
Greening Finance	• In 2022 the UK became the first G20 country to require the largest businesses and financial institutions to disclose their climate-related risks and opportunities under the framework set by the Taskforce on Climate-related Financial Disclosure. Through our G7 presidency, we facilitated other jurisdictions to take the same steps. Additionally, we have committed to building on this through the delivery of Sustainability Disclosure Requirements.

Area	Progress
	• Furthermore, the UK launched the Transition Plan Taskforce, a group of industry experts tasked with developing guidance for gold standard transition plans.

Upcoming delivery milestones

By the end of 2023, government will:

- Consult on transition planning disclosure requirements for the UK's largest companies;
- Consult on the UK Green Taxonomy;
- Prepare a framework to assess the International Sustainability Standards Board (ISSB) disclosure standards, subject to their finalisation;
- Consult on specific steps and interventions needed to support the growth of high integrity voluntary markets and protect against greenwashing;
- Receive recommendations from the Transition Finance Market Review;

Net Zero Workforce

Summary

The Government's net zero and environmental goals depend on the UK having the right workforce with the right skills and capacity in the right locations across the UK. In the next 30 years, the net zero transition will drive opportunities for job creation, with existing occupations set to evolve as the UK's economy decarbonises. It will be important to manage this shift, with parts of the country requiring the greatest transition often among low-productivity areas of the UK.

We agree with the CCC and the *Independent Review of Net Zero* that government should take a proactive approach to identifying and working with industry to tackle net zero specific workforce challenges and skills gaps. As the UK transitions to net zero, one in five UK workers will experience shifting demand for skills implying a substantial need to upskill and reskill our current workforce. Alongside that, we need to bring new workers and talent along with us on the transition to net zero.

Delivering a net zero workforce is a joint government, industry and education sector endeavour which is why the Government set up the Green Jobs Delivery Group. The Delivery Group builds on existing work by the Government to prepare the existing workforce for the green economy and boost the pipeline of skilled workers.

Government continues to ensure the skills system is delivering for net zero. This includes the implementation of the Department for Education's *Sustainability and Climate Change Strategy*, which will equip children, young people, and adult learners with the knowledge and skills to contribute to the green economy. As just one example in March 2023, the Department for Energy Security and Net Zero announced an additional £5 million to support low carbon heating training, expected to support around 10,000 training opportunities, which is starting in April 2023 and continuing until March 2025.This is in addition to the £15 million committed to skills in the energy efficiency and low carbon heating sectors since 2020 through the Home Decarbonisation Skills Training Fund, supporting over 16,000 training opportunities for people working in the energy efficiency, retrofit and low carbon heating sectors in England.

A key role for government is to provide industry with certainty and clarity, so that the private sector is better able to address skills challenges through recruitment and training. The Government's commitment to its legally binding carbon budgets and sector specific plans sends an important signal to businesses. We recognise that businesses require greater policy certainty to invest in their workforces and training.

While acknowledging the work done so far, the CCC and *Independent Review of Net Zero* made recommendations on publishing an Action Plan or Roadmap for Net Zero Skills, driving forward delivery of the recommendations of the Green Jobs Delivery Group.

We agree on the need to go further and so are committing to publishing a joint government-industry *Net Zero and Nature Workforce Action Plan* in the first half of 2024, representing the culmination of several sectoral assessments in the coming 12 months. We are beginning with a set of head start actions from the pilot Power and Networks Working Group now, followed by a suite of comprehensive actions for this sector by Summer 2023, which can be used as a template for the other sectoral assessments (more detail set out at the end of this chapter).

We will publish an update with this suite of comprehensive actions, alongside biannual progress updates from the Delivery Group's co-Chairs on its work, later this year.

We agree with the *Independent Review of Net Zero* on the need to develop robust green jobs figures to monitor the transition. We will continue to work closely with the Department for Levelling Up, Housing and Communities and its Spatial Data Unit to ensure this work supports efforts to reduce geographic disparities and level up the UK (see box below for more information).

Another key method to deliver on employers' net zero workforce needs are apprenticeships, where Government has been driving progress. Over 100 standards are currently approved for delivery in areas including sustainability business specialist, smart meter installer, ecologist, metal recycling technical manager, and forest craftsperson. There are also more in development including low carbon heating technician and battery manufacturing technician. These standards have been developed by employers and the Institute for Apprenticeships and Technical Education (IfATE), to ensure that they continue to meet the needs of employers within the sector. In addition, IfATE asks all trailblazer groups to apply their Sustainability Framework when developing or revising apprenticeships so that sustainability is considered in a way that is meaningful to each occupation.

The Apprenticeship Levy is a key part of the Government's reforms to the apprenticeship system and we are committed to making apprenticeships work for businesses. For example, we are helping SMEs to hire apprentices and keeping Standards up to date to support changing workforce demands, like the domestic electrician apprenticeship which was recently updated. The government is committed to improving the apprenticeship system and continues to engage with stakeholders on their ideas. Short, intensive Skills Bootcamps also enable learning in sectors and jobs that support the transition to net zero.

Progress and delivery

Area	Progress
The Green Jobs Delivery Group	Government established the Green Jobs Delivery Group in May 2022, as the central government-industry forum on green jobs and skills, with ministerial membership from BEIS (now the Department for Energy Security and Net Zero), Defra, DfE, and DWP, as well as membership from industry leaders, academia, the skills sector, unions, and local representatives. Following initial investigations into current workforce challenges, four task & finish groups have been established: • **The Power and Networks Group** is tackling near-term workforce challenges facing the power sector. The pilot industry-government working group has already started to conduct a workforce assessment in 2022 which will feed into the overarching Net Zero and Nature Workforce Action Plan in 2024. Emerging actions are set out in the initials steps below and further updates will be provided by Summer 2023. • **The Nature Skills Group** is developing a set of actions to create a pipeline of required nature-based jobs and skills across the economy. • **The Local Capacity Group** brings together place leaders, the business community, skills providers and government to explore the key local challenges and opportunities to delivering net zero though a local lens. • **The Resources and Waste Group** is gathering information on the skills needed to deliver the Resources and Waste Strategy and the move to a more circular economy.
Boosting the skills pipeline for the green economy	• In England, DfE is investing an additional £3.8 billion in skills by 2024-25. This includes funding for programmes to support green skills, including apprenticeships, T levels and Skills Bootcamps - programmes designed to respond to what employers need. We have seen employer demand for skills including retrofit construction, electric vehicle maintenance, wind power, arboriculture, heat pump installation and green heating technologies.

Area	Progress
	• The Institute for Apprenticeships and Technical Education (IfATE) is improving its occupational maps and will be adding a new 'green occupation' filter so that employers and learners can see which apprenticeships and technical qualifications support a green career. For example, a Low Carbon Heating Technician apprenticeship is in development, offering a direct route into the small-scale renewables industry. • The Green Apprenticeships and Technical Education Advisory Panel (GATEAP) has advised IfATE and the employers it works with on strengthening green content within existing standards and introducing new standards where necessary. There are already 100 standards which support green skills. Occupational standards containing green skills include Maintenance and Operations Engineering Technician, offering a Wind Turbine Technician occupational specialism; and a Plumbing and Domestic Heating Technician, including an Environmental Technologies option. • New higher technical qualifications (HTQs) will align with the transition to net zero. This includes HTQs in Digital, Construction, Engineering and Manufacturing, and Agriculture, Environmental and Animal Care. These are all sectors that will require level 4 and 5 skills for the green transition. • The Government is working with industry to establish sector-specific initiatives. For example, a new Forestry Training Fund launched in February 2023 and a research project is being commissioned on workforce growth needed in the peat restoration sector. The Government is also supporting the establishment of a new professional body for the farming industry, the Institute for Agriculture and Horticulture (TIAH), to support the agricultural transition. • The Government will work with partners to ensure that net zero and green careers are considered in all relevant current and proposed careers campaigns across government and industry. This includes the Green Careers Hub and Net Zero Ambassadors, as well as supporting awareness raising of net zero and green careers by disseminating information to careers leaders and careers advisers in schools, colleges and in the community.

Area	Progress
Upskilling the workforce for the green economy	• In England, DfE and industry are working together to train the existing workforce for the net zero transition through programmes including Skills Bootcamps, Free Courses for Jobs, HTQs and apprenticeships. These programmes are helping to upskill more workers so that they can, for example, support greater energy efficiency in domestic and commercial buildings, and work with green technologies that contribute to the lowering of carbon emissions. • These Skills Bootcamps train workers in high demand skills such as electric vehicle charger installation, retrofit, and arboriculture. DfE is continuing to expand Skills Bootcamps, with up to £550 million in funding allocated for financial years 2022-25. • Industry have committed to work with DfE to propose new Skills Bootcamps in FY 2023-24 aimed at addressing immediate workforce skills needs in key low carbon sectors. They will work at pace to identify common skills demands that could be addressed by Skills Bootcamps. By the end of 2023, we will have at least 35 different bootcamp courses across England supporting greener construction, transport, and green energy and industry sectors. • Employers (including those with a role to play in delivering the net zero transition) are encouraged to use the 'find training and employment schemes for your business' website for more information on the full range of government programmes available to help them hire employees, offer work experience, or upskill existing staff (including those which offer financial incentives). • From April 2022, the Government widened the eligibility criteria of Free Courses for Jobs. Any adult in England who is earning under the National Living Wage or is unemployed has free access to these qualifications. Options includes green skills such as the built environment, conservation, and forestry.
Supporting individuals into green jobs	• DWP is continuing to support people into green jobs through jobcentre interventions and a range of different programmes. This includes Sector-based Work Academy Programmes and the Restart Scheme, as well as by referring people to wider skills provision. DWP is increasing knowledge of green jobs across jobcentres and launched a new green jobs toolkit in April 2022,

Area	Progress
	with information on sectors including forestry, wind, recycling and waste, water and building retrofit. • DWP's National Employer and Partnership Team (NEPT) established a green jobs team in December 2021 to ensure green jobs opportunities are accessible to jobseekers. • DWP launched a green jobs single point of contact (SPOC) network in March 2022, with a SPOC in each of DWP's 37 districts helping to improve local feedback and support, promote national messaging and ensure colleagues are aware of green jobs and skills opportunities.

Green jobs and skills data

It is estimated that since November 2020, over 80,000 green jobs are currently supported, or in the pipeline across the UK economy as a result of new government policies and spending. Our ambitions could support up to 480,000 jobs in 2030.

The Government is working with the Office for National Statistics (ONS) to improve data on the green economy. The ONS estimate a 16% increase in direct employment in low carbon businesses across the economy from 2020 to 2021 - reaching nearly 250,000.

However, this is only part of the picture, and the ONS has undertaken work to develop a broader definition of green jobs: *"Employment in an activity that contributes to protecting or restoring the environment, including those that mitigate or adapt to climate change".*

This definition has been developed following extensive engagement with stakeholders. ONS will develop a framework underneath this definition and publish associated experimental statistics for green jobs throughout 2023. It will continue to improve its existing estimates, publish related research articles, and engage with users.

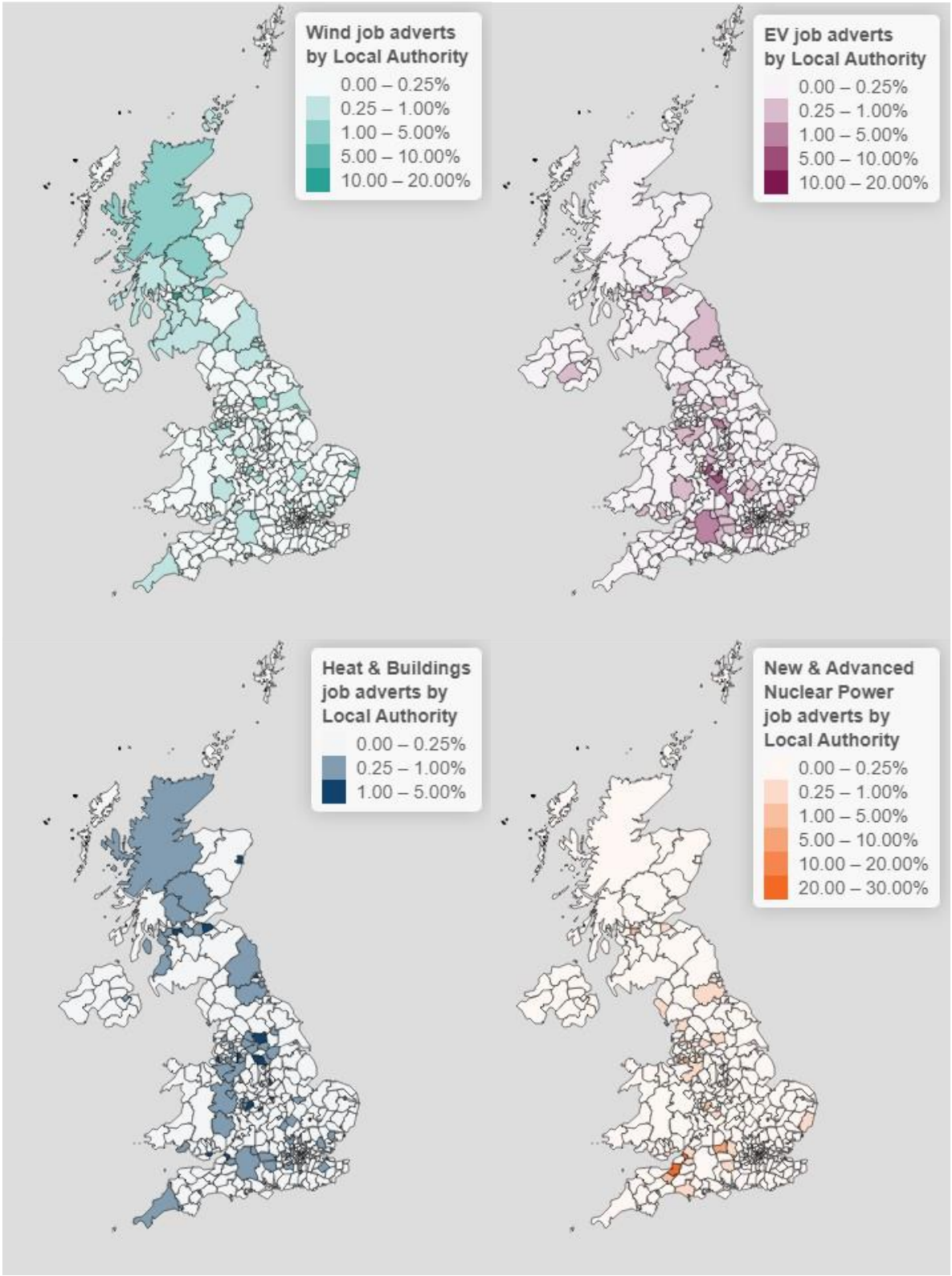
Progress also continues with monitoring jobs in the green economy using experimental government analysis of online advertisements. For four net zero sectors - heat and buildings, electric vehicles, wind, and new and advanced nuclear power - the key trends identified in online job advertisements were examined, showing:

- Their share of UK online job advertisements has increased in recent years (*in Technical Annex*)
- They are spread throughout the UK while individual sectors appear more concentrated in a few, varying geographic areas (*Figure below*)
- They have higher advertised average salaries compared to the UK average salary for online job advertisements (*Figure 4 in introduction*)

This analysis provides insight into part of the demand side of the online jobs market, producing outputs at local authority level, and information about salary levels, to monitor the impact of the net zero transition on the job market. The experimental nature of the analysis means it does not capture all online job advertisements in these four sectors. The **Technical Annex** provides more detail behind this analysis.

Additionally, the Unit for Future Skills (UFS) is building a jobs and skills data ecosystem, which will help identify skills mismatches at an individual, sectoral, and economy-wide level.

Figure 7: Job advert distribution by local authority for select net zero sectors, UK, 2014 to 2022



Source: Department for Energy Security and Net Zero experimental analysis of LightcastTM online job advert data, 2023. Note: The percentage share is the number of online advertisements in that local authority divided by the total number of online advertisements for that sector

Upcoming delivery milestones

- From 2023 the Government will improve data collected from net zero and environmental schemes on supporting green jobs data, including building a granular understanding of the geographic distribution of green jobs and their economic impact on places, and making as much of this information as possible available publicly.

- From Spring this year, the Department for Energy Security and Net Zero will publish the Delivery Group's biannual updates from the co-chairs.

- In 2024, the Delivery Group will publish a *Net Zero and Nature Workforce Action Plan.*

- We also continue to join up across the devolved administrations, who have already made excellent progress, with the Welsh Government having launched their *Net Zero Skills Plan* in March 2023, and the Scottish Government and Skills Development Scotland having launched their *Climate Emergency Skills Action Plan 2020-2025* in 2020.

Pilot government-industry action on the power and networks sector workforce

The Green Jobs Delivery Group is taking action and, as priority, established a pilot power and networks sectors government-industry working group, due to these sectors' importance to delivering on net zero and energy security.

Challenges these sectors face, include issues with the STEM skills pipeline; competition for skills with other sectors; lack of diversity and inclusion in the sector; and an aging workforce. In response, industry has asked for more agile upskilling and reskilling training.

This early work of the power and networks working group has both helped to establish a process, that we will encourage other sector groups to follow, and agreed head start actions which government and industry will make early progress on.

The group will publish a comprehensive suite of actions within the Green Job's Delivery Group co-chair's update by Summer 2023.

Principles of intent:
Process (that we will encourage other sector groups to follow)

1. By summer 2023, industry (led by EDF, with support from Energy and Utilities Skills partnership (EUSP) and the Engineering Construction Industry Training Board (ECITB)) will conduct and collate research on workforce demand and skills gaps within the power and networks sectors, specifically related to net zero. This will cover the skills and workforce picture in England, as well as that of the devolved administrations where relevant.
2. By summer 2023, industry (led by EUSP) will then refine the group's initial assessment of workforce barriers. This will cover skills and workforce in England, and of the devolved administrations where relevant.
3. By summer 2023, industry (led by ECITB, with support from EUSP) will next map and identify gaps in routes to competence, including through apprenticeships, qualifications, and industry schemes. This will draw upon the work of the DfE and Institute for Apprenticeships and Technical Education (IfATE). This will cover skills and workforce in England, and of the devolved administrations where relevant.
4. In autumn 2023, government and industry will work together to identify how best to overcome barriers which threaten the sectors' ability to get people into key occupations in sufficient numbers. For example, DfE will identify opportunities to flex skills programmes in line with the challenges identified via 1 and 2 above.
5. These actions, along with information on how progress towards them will be monitored, will then be included as part of the Net Zero and Nature Workforce Action Plan in 2024.

‘Head start’ actions on power and networks:

1. Building upon this, by autumn 2023, industry (led by National Grid and supported by EUSP), and government will work together to support modular and agile training routes into key occupations within the power and networks sectors.
2. Industry, led by EUSP, will identify where investment in modular or short courses could be increased by developing new Skills Bootcamps. DfE will respond by supporting the roll out of new Bootcamps, through the Dynamic Purchasing System (DPS) or by responding to the local grant holder.
3. By autumn 2023, industry (through EUSP) will work with the IfATE via the Energy and Utility Employer Advisory Panel (EAP) to explore how apprenticeships and modular technical qualifications can best support skills development in sectors.
4. By winter 2023, Industry, led by EUSP, will pilot an approach to maximising the employer training estate, delivering training to an industry standard, aimed at meeting industry rather than individual employer needs. This would involve, for example, industry collaborating on using one another’s training estate to maximise the talent pipeline, and providing training on behalf of other employers where capacity allows. This requires industry to explore agreeing and setting output standards.
5. By spring 2024, DfE will provide communications to industry, to support employers and training providers to engage with recently launched flexi, portable, and accelerated apprenticeships, to boost apprenticeship numbers by maximising use of the variety of progression routes.
6. Industry, led by EUSP, will use its ‘workforce assessment’ to inform regulators of projected workforce demand as part of efforts to ensure sufficient provision for workforce resilience.
7. Industry, led by EUSP, will explore (jointly led with ECITB) potential skills passporting arrangements for the power and networks sectors.
8. By autumn 2023, industry, led by EUSP, will identify opportunities for growth and routes to competence presented by apprenticeships. There are no plans to review the Apprenticeship Levy at present, but we will continue to develop and support a suite of improvements to the apprenticeships system for employers.
9. In 2023, industry (led by IEMA/CIEEM) and IfATE will explore how apprenticeships and other non-degree level routes to environmental management and regulation could be improved or created.
10. The group has discussed wider workforce issues, including attracting people into net zero roles, and addressing diversity and inclusion issues. As a first step, the group is collating and analysing a range of data and evidence available to identify potential actions.
11. Government will work with partners to ensure that net zero and green careers are considered in all relevant current and proposed careers campaigns across government and industry. This includes the Green Careers Hub, as well as supporting

awareness raising of net zero and green careers by disseminating information to careers leaders and careers advisers in schools, colleges and in the community.

In summer 2023, industry and government will add to this initial list, forming a more comprehensive set of actions covering the steps being taken to address both skills and wider workforce challenges. This will then be reflected in the Net Zero and Nature Workforce Action Plan in 2024, alongside actions for other key sectors and the detail of how progress will be monitored.

Embedding Net Zero in Government

Summary

The government has made significant progress in embedding net zero in its processes and decision making. In February, the Prime Minister created the Department for Energy Security and Net Zero, whose focus alongside energy security, is driving overall delivery of net zero and maximising the economic opportunity the transition presents.

Additionally, the creation of the Domestic and Economic Affairs (Energy, Climate and Net Zero) Cabinet committee, ensures a coordinated approach to delivering net zero across government. This Cabinet-level governance is supported by Departmental governance, as well as other groups such as the Net Zero Business and Investment Group, the Green Jobs Delivery Group, and the Jet Zero Council and the Local Net Zero Forum.

We have embedded net zero considerations into our key financial decision-making frameworks including publishing further detail on the environmental impacts of Spending Review 2021 and the methodology for assessing these. We have also laid the final environmental principles policy statement before Parliament. The policy statement sets out how policymakers should interpret and proportionately apply five environmental principles to support environmental protection and sustainable development. Ministers of the Crown will be required to have due regard to the statement when making policy from 1 November 2023.These are two key milestones we committed to in the *Net Zero Strategy*.

All the while we have adopted a whole systems approach, helping us to deal with the inherent complexity of the challenges faced. We continue to embed systems tools and practices to support cross-sector decision making, account for dependencies, and maximise the benefits of net zero.

In the next 18 months we are committed to strengthening governance even further. We will continue to embed net zero into decision-making frameworks and share more information on how we are set-up to deliver net zero within government, directly addressing the themes of enhancing coordination and transparency identified through the *CCC's 2022 Progress Report to Parliament* progress report and *Independent Review of Net Zero*.

We note the CCC's and *Independent Review of Net Zero's* recommendations on increased focus on government coordination and consistency and expanding our suite of public reporting. We have made strong progress in this area to date and:

- In response to recommendations on expanding public reporting and improving transparency of internal government processes, **as part of the government's 2023 response to the *CCC's 2022 Progress Report to Parliament* we will**:
  - **Share further detail on the tools and processes** used to inform internal decisions and policy-making, including publishing a map of the governance landscape.
  - **Publish the findings of a review** that assesses how often we publish data on UK emissions.

- We will work with the UK Regulators Network (UKRN) **to build from their existing cross-regulator Climate Change Network and test the best way to bring-in regulators from beyond the UKRN's core membership.** Committing to confirming proposals for the form and governance of this forum by Summer 2023.

- **We will consider the case for new delivery agencies where they are the right model** - using Great British Nuclear, among others, as case studies for the efficacy of these modes of delivery.

- Improving the quality and coverage of data in decision- making, and ensuring climate and environmental impacts are considered in all fiscal decisions, remains a priority. **HM Treasury will continue to work with departments to build climate impact assessment capability** to ensure that spending decisions and measures at future fiscal events can be made using improved data. HM Treasury received a recommendation to work with the OBR and CCC to set out a process for how HM Treasury considers the climate impacts of fiscal events, and we will engage the OBR and CCC on this.

Progress and delivery

Area	Progress
Reporting	• We promised to report annually against 24 commitments we made in the *Net Zero Strategy*. An account of these commitments is provided by 40 quantitative metrics, which are set out in the Technical Annex.
Governance and other groups	• Established the Domestic and Economic Affairs (Energy, Climate and Net Zero) Cabinet Committee, picking up on the successes of the Climate Action Committees and ensuring net zero continues to have a Cabinet-level forum dedicated to it. • Set-up a Climate Non-Executive Board Members Liaison Forum, which draws on the knowledge and expertise of non-executive

Area	Progress
	board members from across Whitehall to provide strategic insight and support to the implementation of the *Net Zero Strategy* and *British Energy Security Strategy*. • Introduced a new Net Zero Business and Investment Group, which convenes business and finance leaders to accelerate emissions reduction across key sectors and maximise the economic opportunity of net zero. • Created a Local Net Zero Forum which brings together national and local government to provide a single and coordinated engagement route into Government on strategic local net zero policy and delivery issues.
Procurement	• Required suppliers bidding on qualifying central government contracts to commit to achieving net zero and to detail their emissions via a Carbon Reduction Plan. Between September 2021 and the start of February 2023, the measure was applied to 129 procurements, which are valued at c.£187.5 billion over their contractual term. • Published the *Construction Playbook* and associated *Net Zero Carbon and Sustainability Annex*, which include stronger guidance and additional resources on how government construction projects should undertake whole life carbon assessments, and seek to reduce both embodied and operational carbon emissions.
Civil Service capability and skills	• Developed a new training offer available to all civil servants, expanded training for Fast Streamers, and are developing a climate and environment specialism to be embedded in the Civil Service policy profession standards. • Funded carbon literacy courses for the public sector more widely with courses now available for organisations such as the NHS, local government, and universities.
Fiscal decision making	• At Spending Review 2021 (SR21) HM Treasury required departments to assess the climate impacts of major spending bids. Decisions made at SR21 were informed by these assessments and proposals were considered and assessed according to these impact assessments and within the context of the broader suite of policies set out in the Net Zero Strategy. HM

Area	Progress
	Treasury also required departments to provide qualitative commentary against the delivery of the 25 Year Environment Plan. • Since SR21, HM Treasury has continued to work with departments to improve the quality and coverage of their emissions impact data. In December 2022, HM Treasury published further detail on the methodology for assessing environmental impacts at SR21. • HM Treasury and HMRC also carefully considered the climate change and environmental implications of relevant tax measures. The Government incorporated a climate assessment in all relevant Tax Information and Impact Notes (TIINs) for measures at Budget 2021 and has continued to do so. • In January 2023, the then Department for Business, Energy and Industrial Strategy published updated *Supplementary Guidance to the Green Book* to reflect the latest evidence and the UK's net zero target. This provides practical information on embedding carbon methodologies and on the effectiveness of climate change policy.
Decarbonising the public section	• Over £1 billion of funding was made available over 2020/21 and 2021/22 through the Public Sector Decarbonisation Scheme, which provides grants for public sector bodies to fund heat decarbonisation and energy efficiency measures. A further £1.425 billion is currently being invested through Phase 3 of the scheme over 2022/23 to 2024/25. • We provided £15 million in 2021-22 and £14 million in 2022-23 through the Low Carbon Skills Fund to enable public sector organisations to acquire expert skills in order to unlock decarbonisation projects, bringing total funding for this work to £61 million since 2020-21. • We published the *Greening Government* commitments in October 2021, setting out the actions departments and their agencies will take to reduce their impacts on the environment.

Upcoming delivery milestones

- Sponsored by the Department for Energy Security and Net Zero, the **Modern Energy Partners** programme will publish a suite of public sector decarbonisation guidance on the ESC website in spring 2023. This will help to address the capacity and capability barriers that public sector organisations face when they seek to decarbonise their built estates.
- The next application window to the **Public Sector Decarbonisation Scheme**, Phase 3c, is expected to open to applications in Autumn 2023.
- We are developing plans for future phases of the **Low Carbon Skills Fund** and will make further announcements in due course.
- Ministers will be required to have due regard to **the environmental principles policy statement** when it legally comes into force on 1 November 2023.
- We expect the **Procurement Bill to receive Royal Assent**, which would place the National Procurement Policy Statement (NPPS) on a statutory basis. The NPPS sets out clear principles that contracting authorities should follow - tackling climate change and achieving net zero is one of these.
- **HMRC will explore options to further strengthen the analytical approach** to monitoring, evaluating, and quantifying the environmental impacts of tax measures, including their wider impacts.

Local Net Zero

Summary

Local areas play an integral role in supporting the transition to net zero. Local authorities have strong powers, assets, and responsibilities across many of the areas where emissions reductions are needed, and civil society organisations can enable communities to take collective action to accelerate the net zero transition in their neighbourhoods. Local government is also uniquely placed to attract private sector net zero investment that wouldn't otherwise be obtained; maximising the local opportunities the transition will bring, such as the growth of green jobs and skills.

The government has made excellent progress in supporting local areas to deliver net zero. This includes establishing the Local Net Zero Forum, continuing the Local Net Zero Hubs Programme, and establishing Net Zero Go, the UK's free-to-use digital platform providing advice to help local authorities make progress on net zero. We have also agreed devolution deals which contain shared agreements in relation to net zero/climate adaptation and/or clean energy.

We welcome the recognition from the CCC and *Independent Review of Net Zero* of the promising steps central government are making towards harnessing the ambition of local government, including the recognition of the success of the Local Net Zero Forum which has been widely welcomed by local government. The *Independent Review of Net Zero* also affirmed that Government should continue to support the Local Net Zero Hubs Programme, given their role supporting local authorities on capacity and capability building.

We have made excellent progress in this area to date and will continue to **work collaboratively with local actors to progress still further:**

- We will strengthen our support to local authorities on capacity and capability building and ongoing knowledge sharing through our Local Net Zero Hubs Programme, Net Zero Go, and the annual net zero conference for local government that we sponsor with The Association for Public Sector Excellence (APSE).

- We will pilot a devolved approach to buildings' retrofit from 2025 in the devolution deals with Greater Manchester Combined Authority and West Midlands Combined Authority.

- We will strengthen the partnership with local government through ongoing engagement in the Local Net Zero Forum.

- We will look at the opportunities offered by blended finance models, and explore simplification of the net zero funding landscape for local authorities where this will deliver better outcomes for net zero.
- We will continue to work with the Community Energy Contact Group on some of the key policy and delivery issues which impact the sector and support community energy projects through UK-wide growth funding schemes and Ofgem's Industry Voluntary Redress Scheme.
- As announced in the Budget, all new Investment Zones will be required to demonstrate how they will support the UK's net zero target.

Progress and delivery

In the last 18th months, we have delivered against the key commitments we made in the Local Climate Action chapter of the *Net Zero Strategy*.

Area	Progress
Investment	• We are testing new business models for investment into net zero, and to explore simplification of delivery. One approach is using devolution deals to pilot new approaches. We have recently announced wide-ranging devolution deals with Greater Manchester Combined Authority and West Midlands Combined Authority which include first-of-kind pilots for retrofit funding from 2025 (subject to conditions such as outcomes to be achieved) and which provide scope for a greater role to plan new energy infrastructure investment strategically. Alongside this, we have also agreed 6 other devolution deals since August 2022 (in York & North Yorkshire, the North East, Norfolk, Suffolk, East Midlands and Cornwall), all of which contain shared agreements in relation to net zero, climate adaptation and/or clean energy. Government's experience with these deals will inform future devolution deal negotiations. • As announced in the Budget, new Investment Zones will drive local economic growth. Green business sectors are one of the five priority sectors for the Investment Zones, and all Investment Zones are also required to demonstrate their contribution to national Net Zero and environmental targets. • To support local authorities' access to funding and increase investment, we have worked across government to ensure economic growth funding contains a net zero principle; and that

Area	Progress
	clean growth and green job opportunities are highlighted. This includes for example, the £2.6 billion UK Shared Prosperity Fund which states that investment made under this Fund should demonstrate the extent of contribution to net zero and nature recovery objectives. • Government-funded research through 3Ci and Innovate UK is helping to identify opportunities for local areas and local government to work with the private sector to finance the net zero transition. Proposals to develop work on blended finance are set out in the accompanying publication, the 2023 *Green Finance Strategy*. • We are supporting Freeports in England, Wales and Scotland to produce net zero plans.
Engagement	• We have established a Local Net Zero Forum to strengthen our partnership with local government. Alongside the Forum, we have also established the Net Zero Places Stakeholder group to engage directly with non-governmental organisations who work with local authorities.
Capacity and Capacity Building	• We continue to fund our five Local Net Zero Hubs which build capacity and capability in local government, The Hubs support local authorities across England to develop net zero projects and attract commercial investment. • The UK Infrastructure Bank is building its local advisory function to a steady state through 2023, and will also lend up to £4 billion to local authorities at a preferential rate for high value and strategic projects of at least £5 million. • We are funding Net Zero Go, the UK's free-to-use net zero delivery platform for local authorities. It is a one-stop shop which brings together the support and practical tools local authorities need to develop, deliver, and evaluate locally focused net zero programmes and projects.
Sectoral Support	• We are working closely with Local Authorities to deliver practical policy measures across a range of different sectors. For example: − As outlined in the *Transport Decarbonisation Plan*, the new Local Transport Plan (LTP) guidance will provide updated

Area	Progress
	strategic guidance for the development of LTPs and will support places to quantify local transport carbon emissions and assess the carbon impact of planned interventions in their LTP. − The Government's 'Help to Heat' schemes ensure homes will be warmer and cheaper to heat. Working with Local Authorities, the Government will deliver upgrades to over half a million homes in the coming years through our Social Housing Decarbonisation, Home Upgrade Grant Schemes and Energy Company Obligation Scheme.
Innovation	• We are supporting place-based energy system innovation through Innovate UK's £60 million Net Zero Living Programme. There have been two rounds of funding announced to date. This includes: − Net Zero Pathfinders for UK registered businesses and local authorities to apply for a share of up to £2 million to plan for a place-based demonstration of ways to accelerate progress towards net zero. − Fast Followers for local authorities to apply for a share of up to £6 million to build skills and capabilities to accelerate local progress towards net zero.
Community Energy	• Through our Local Net Zero Hubs we are supporting local authorities and community energy groups to work together, this includes funding a pilot programme which provides local authorities with direct support to develop community-led energy groups and projects. We have also established a Community Energy Contact Group to increase engagement with the sector.

Upcoming delivery milestones

- We will continue to invest £5 million/year in the Local Net Zero Hubs Programme and progress our ongoing projects, such as Net Zero Go, to support delivery at the local level.
- We will continue to support the UKIB to build its local advisory function and to work closely with the Local Net Zero Hubs.
- We will support work to promote net zero investment in Freeports.

- We will pilot a devolved approach to buildings' retrofit from 2025 in the devolution deals with Greater Manchester Combined Authority and West Midlands Combined Authority.
- Green business sectors are one of the five priority sectors for the Government's Investment Zone programme announced in the Budget and all Investment Zones will be required to demonstrate how they support the Government's net zero and environmental targets.

Empowering the Public and Business to Make Green Choices

Summary

By choosing green products, services and goods, the public can help grow the green economy and support progress towards reaching net zero. Many of the commitments set out in the *Net Zero Strategy* will require the public to make green choices, with the installation of heat pumps and purchase of electric vehicles playing a particularly important role. As an example of how we will make these green choices easier, we will continue to deliver energy advice to the public on how to reduce their energy use, and in doing so their bills, and explore the case to expand this further, including our digital offer.

We recognise that supporting the public and businesses with green choices must address multiple barriers, e.g., cost, convenience, awareness, and that everyone - government, industry, businesses, and civil society - must work together to achieve net zero to gain the economic benefits and ensure the environment is in a state for future generations. As the CCC acknowledged in their report, we have already included in the *Net Zero Strategy* a clear set of principles for how we will engage and empower the public to make green choices.

Across net zero sectors, we are introducing measures which support these six principles.

- Principle 1 - *Minimise the 'ask' from the public by 'sending clear regulatory signals.'*
- Principle 2 – *Make the green choice the easiest.*
- Principle 3 – *Make the green choice affordable.*
- Principle 4 – *Empower people and businesses to make their own choice.*
- Principle 5 – *Motivate & build public acceptability for major changes.*
- Principle 6 – *Present a clear vision of how we will get to net zero and what the role of people and business will be.*

The public will play a key role in the transition and therefore we will set out further detail on how Government will increase public engagement on net zero. This includes detailing how the government will (i) support public awareness of our actions through our digital platforms, (ii) develop a roadmap setting out plans and proposals under net zero and (iii) construct a guiding framework, in conjunction with partners and trusted messengers, to amplify net zero messaging.

Government is establishing a new partnership to work with business and finance leaders to support the delivery of our net zero target - a new Net Zero Business and Investment Group. The group will look to develop a shared view of market barriers across different sectors to deliver net zero and the respective roles across Government, industry and the finance sector in addressing these.

Progress and delivery

Area	Progress
Advice on Energy Saving Actions	• In July 2022, the government launched an online advice tool that provides high-level trusted, impartial and tailored advice to consumers on how to improve home energy performance and information on retrofit recommendations. In March 2023, we also launched an accompanying phoneline service that provides a digital assist service for the tool. • In December 2022, the Government also launched the 'It All Adds Up' campaign with £18 million funding. This campaign provides advice on simple, low, or no-cost actions that households can take to cut energy use. • A targeted sister campaign to the consumer energy campaign has supported businesses through a period of record high energy prices. With £4.25 million in funding, the campaign is designed to help businesses, in particular small businesses, manage energy bills by improving efficiency and reducing overall consumption. • In 2022, we ran a digital discovery to explore whether there is a user need for new content on net zero on GOV.UK or a new resource to link together different sources of information and support on net zero in a comprehensive platform. We will run an alpha phase later this year.
Supporting UK businesses to meet net zero commitments	• In the year to COP26, the former Net Zero Business Champion, Andrew Griffith MP, engaged large businesses and led Together for Our Planet, a campaign targeting small and micro businesses across the UK. The UK remains a global leader in the global Race to Zero, with almost 4,000 small and medium-sized enterprises (SMEs) and two thirds of the FTSE100 companies signed up to date.

Area	Progress
Environment impact labelling of products, goods and services	• While labels already exist for energy-using products and homes (in the form of Energy Performance Certificates), we are exploring the use of eco-labels for a wider a range of goods and services. • We are exploring the use of product labelling to show the durability, repairability and recyclability of products, as well as their environmental footprint. • We have announced our intention to require recyclability labelling on packaging and will introduce this as part of new regulations on packaging and packaging waste.
Behavioural science and embedding participatory and deliberative processes	• The Department for Energy Security and Net Zero and Defra have bolstered its behavioural research capabilities by launching an Energy & Climate Behavioural Science Framework, a call-off contract that allows us to rapidly procure behavioural research. DfT has launched a similar contract for transport. • We have regularly funded public dialogues on a range of net zero issues and will continue to do so, using the findings to inform policy development. For example, in the past year, the Department for Energy Security and Net Zero has commissioned a public dialogue on biomass and bioenergy with carbon capture and storage to feed into the delivery of the Biomass Strategy in 2023.

Upcoming delivery milestones

- We will set out further detail on how Government will increase public engagement on net zero.
- Government will launch a series of local demonstrator projects, which will test various approaches to delivering in-person advice, with a particular focus on harder-to-treat properties and digitally excluded consumer groups. We will also be reviewing further advice and measures that the ‘It all Adds Up’ campaign can include**.**
- We will continue to pursue the role of ecolabelling across sectors to help consumers make more informed purchasing decisions. We will create a mandatory methodology for eco-labelling which the food and drink industry must follow when providing voluntary information to consumers regarding their food's emission and sustainability claims.

International Leadership

Summary

The UK has been – and will remain - at the centre of global efforts to tackle climate change and transition to a global net zero economy. Collectively, we must reach our target in a way that protects energy security, supports green growth and innovation, and maximises benefits for businesses and consumers. Successfully addressing the challenges of climate change requires an unprecedented level of international action, collaboration, and coordination.

The UK is driving international collaboration and focusing our actions on areas that will have the biggest impact. We are building strategic alliances to accelerate the global net zero transition, championing ambition and driving forward real-world action to keep 1.5 alive, and mobilising finance at scale – whilst maximising opportunities for the UK.

Current global challenges such as Putin's invasion of Ukraine, food and energy security, the rising cost of living and the recovery from the Covid pandemic underscore the urgent need to accelerate climate action. Further action on climate mitigation, adaptation and nature can bolster national and global resilience to current and future shocks and enhance economic stability.

The UK will continue to be a world leader in the drive to net zero. Between 1990 and 2021 we've cut emissions by 48% while growing our economy by 65%. In 2020 there were over 400,000 green jobs in low carbon businesses and their supply chains across the country. However, while countries have increased their emission reduction targets, the science is clear that emissions need to be halved by 2030 to keep 1.5C within reach and reach net zero by 2050. country - including the UK - will face, it also drives down the cost of transition faster by increasing demand for low carbon technologies. As the *Independent Review of Net Zero* made clear, the UK has comparative advantage and stands to benefit from the huge economic opportunities this brings.

The *2030 Strategic Framework for International Climate and Nature Action* will define the UK Government's vision and role in tackling global climate change and biodiversity loss in this critical decade. Taking an integrated approach to climate and nature, the Framework will build on our COP26 Presidency, the outcomes of COP27 and the Convention on Biological Diversity (CBD), COP15. *The UK International Climate Finance Strategy* underpins this, outlining how the UK is delivering on our commitment to provide £11.6 billion of international climate finance between 2021/22 and 2025/26, supporting developing countries to take climate action, and delivering on our international priorities and commitments.

We welcome the recommendations of both the Climate Change Committee (CCC) and the *Independent Review of Net Zero* and full responses can be found in the annexes. As recommended by the CCC and in response to the Glasgow Climate Pact, we revisited our 2030 Nationally Determined Contribution and strengthened it with information on delivery of our target to reduce all greenhouse gas emissions by at least 68% by 2030 on 1990 levels, including plans to expand the territorial scope of the NDC to include the UK's Crown Dependencies and Overseas territories.

Progress and delivery

Area	Progress
During the UK's UNFCCC Presidency – at the COP26 summit and beyond	• Keeping 1.5 degrees alive: Over 90% of the world's GDP, up from 30% when the UK took on the COP Presidency, is now covered by net zero commitments. More than 170 countries have now put forward new 2030 climate plans, known as nationally determined contributions, amounting to around 6 Gts in emissions reductions. • Increasing funding and launching UN work for dealing with climate impacts: To accelerate progress towards achieving the $100 billion goal, the UK secured enhanced public finance commitments from 95% of major donors, showcased in the 'Climate Finance Delivery Plan' launched in Glasgow. In addition at COP26, countries agreed to double 2019 levels of adaptation finance by 2025, the first quantified adaptation finance target, with the UK subsequently pledging to triple its adaptation finance against the same timeline. Record levels of finance to help countries adapt to the effects of climate change were also pledged to the Adaptation Fund and the Least Developed Country Fund under the UK Presidency. An ad hoc work programme towards setting the post-2025 new collective quantified goal on finance was launched, and investor initiatives worth trillions were launched, including the Global Financial Alliance for Net Zero (GFANZ). • Accelerating unprecedented low-carbon transitions of industries such as transport and energy, with commitments covering power, coal, methane, fossil fuel financing, forests and land, transport and sectors, including the first ever agreement to coal phase down in a UN climate decision.

Area	Progress
	• Establishing a new Glasgow Dialogue on Loss and Damage to discuss the arrangements for funding activities to avert, minimise and address loss and damage. • Finalising the Paris Rulebook after 6 years of negotiations, which sets out the instructions and products needed to fully implement the Paris Agreement on climate change. These guidelines build confidence and transparency as countries deliver on their commitments to meet the goals of the Paris Agreement.
Driving progress in COP27	• During COP27 our focus was building on the Glasgow Climate Pact. We welcome the landmark progress made on loss and damage and the agreement to establish a fund to support those most vulnerable to the effects of climate change. We also saw progress on key work programmes launched in Glasgow. This includes the work programme for urgently scaling up mitigation ambition and implementation in this critical decade (known as the mitigation work programme) and the Glasgow - Sharm El-Sheikh work programme on the Global Goal on Adaptation (GlaSS).
Delivering our commitments to developing countries under the Paris Agreement, including our contribution to the $100 billion mobilisation target, through UK International Climate Finance (ICF).	Our results to date demonstrate the transformative impact that UK ICF can have. Between 2011 and 2022, our programmes: • Supported 95 million people to better adapt to the effects of climate change • Improved access to clean energy for 58 million people • Reduced or avoided 68 million tonnes of greenhouse gases • Installed 3.3 gigawatts of clean energy capacity • Avoided deforestation across 410 thousand hectares • Mobilised £5.7 billion of public and £5.2 billion of private finance for climate change purposes • Supported the sustainable management of 910 thousand hectares of land. • We have doubled our International Climate Finance commitment to £11.6 billion between 2021/22 and 2025/26. This will enable a step-change in the UK's impact long-term and supporting developing countries and delivering Glasgow Climate Pact outcomes. This funding increase will be used to: unlock affordable

Area	Progress
	and clean energy; help countries, economies and communities become more resilient; halt deforestation and prevent irreversible biodiversity loss; support the development of sustainable cities and transport systems.

Upcoming delivery milestones

Continuing to drive global ambition and implementation of net zero commitments is vital to the future of our planet and more must be done. The UK will continue to champion international climate action, noting the urgency required in this critical decade to 2030.

Ahead of COP28 we will need to revitalise efforts to keep 1.5°C in reach, including in pushing for emissions peaking before 2025, active follow-up on the phase down of coal, and phase out of all fossil fuels. We must rapidly decarbonise key sectors of the economy, delivering on sector commitments made at COP26, including through the Breakthrough Agenda. We will support the most vulnerable to adapt and build resilience to the effects of climate change, delivering on the Glasgow Climate Pact, and halt and reverse biodiversity loss as agreed through the Kunming-Montreal Global Biodiversity Framework. We will work with partners on the design of the funding arrangements and fund for loss and damage, and to shape the framework for the Global Goal on Adaptation. The Global Stocktake must enable us to genuinely shift gears on delivering the Paris Agreement goals. Beyond COP28, the UK will work with international partners to refine the post-2025 climate finance goal.

The UK will:

- Publish the *2030 Strategic Framework for International Climate and Nature Action* which will set out the priorities for UK action through to 2030.
- Publish the UK's International Climate Finance Strategy. It outlines how the UK's high-profile commitment to spend £11.6 billion on ICF in 2021/22-2025/26 is being spent and is delivering results as part of the promised contributions to the UNFCCC commitment to mobilise US$100billion climate finance a year for developing countries. The strategy also shows how we are delivering on the ICF sub-targets which we have announced publicly, on nature, adaptation, and innovation.

Endnotes

1 HM Treasury, (2006), 'Stern Review: The Economics of Climate Change'

2 McKinsey, https://www.mckinsey.com/capabilities/sustainability/our-insights/opportunities-for-uk-businesses-in-the-net-zero-transition

3 University of Oxford net zero tracker, https://www.bsg.ox.ac.uk/research/research-and-policy-updates/net-zero-tracker-report-finds-major-credibility-gaps-remain

4 International Energy Agency (IEA) (2021), 'Net Zero by 2050: A Roadmap for the Global Energy Sector', https://www.iea.org/reports/net-zero-by-2050

5 Department for Energy Security and Net Zero (2015), Contracts for Difference (CFD) Allocation Round One Outcome https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-one-outcome
Department for Energy Security and Net Zero (2022), 'Contracts for Difference (CfD) Allocation Round 4: results', https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-4-results

6 This includes public and private sources of funding. DESNZ analysis of the BloombergNEF, Energy transition investment dataset converting to 2022 prices, available at: https://www.bnef.com/. The BNEF series captures investments made across different low-carbon technologies and sectors, including power, energy storage, transport, heating, hydrogen, and CCS. Figures should not be taken as fully representative of all low-carbon investments made across the economy and are likely to be a conservative estimate.

7 DESNZ analysis of Bloomberg New Energy Finance data estimated £27 billion was invested in 2021 and £23 billion in 2022. Bloomberg New Energy Finance, Energy Transition Investment Trends 2022

8 EY (2021) Why cleantech investments in the UK are encouraging for future growth, https://www.ey.com/en_uk/attractiveness/21/why-cleantech-investments-in-the-uk-are-encouraging-for-future-growth#:~:text=The%20UK%20attracted%20one%2Din,spread%20of%20cleantech%20investments%20nationwide.

9 Bentham, M., Mallows, T., Lowndes, J. and Green, A. (2014), 'CO2 Storage Evaluation Database (CO2 Stored). The UK's online storage atlas', https://nora.nerc.ac.uk/509387/1/1-s2.0-S1876610214023558-main.pdf

10 European Automobile Manufacturers' Association (acea), (2023), 'Fuel types of new cars: battery electric 12.1%, hybrid 22.6% and petrol 36.4% market share full-year 2022', https://www.acea.auto/fuel-pc/fuel-types-of-new-cars-battery-electric-12-1-hybrid-22-6-and-petrol-36-4-market-share-full-year-2022/

11 Times Higher Education (2023), 'World University Ranking 2023', https://www.timeshighereducation.com/world-university-rankings/2023/world-ranking

12 EDF, (2022), Socio-economic Impact Report, https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/about/realising-socio-economic-benefits

13 Internal DESNZ research, Dataset: Low carbon and renewable energy economy estimates: https://www.ons.gov.uk/economy/environmentalaccounts/datasets/lowcarbonandrenewableenergyeconomyfirstestimatesdataset and UK trade: goods and services publication tables: https://www.ons.gov.uk/economy/nationalaccounts/balanceofpayments/datasets/uktradegoodsandservicespublicationtables

14 DESNZ analysis (2023)

15 BEIS (2020), BEIS electricity generation cost report, https://www.gov.uk/government/collections/energy-generation-cost-projections

16 Department for Energy Security and Net Zero (2023), 'Social Housing Decarbonisation Fund Wave 2.1: successful bids', https://www.gov.uk/government/publications/social-housing-decarbonisation-fund-wave-21-successful-bids

[17] European Automobile Manufacturers' Association (acea), (2023), 'Fuel types of new cars: battery electric 12.1%, hybrid 22.6% and petrol 36.4% market share full-year 2022', https://www.acea.auto/fuel-pc/fuel-types-of-new-cars-battery-electric-12-1-hybrid-22-6-and-petrol-36-4-market-share-full-year-2022/

[18] CCC (2020), Letter: Advice on the UK's 2030 Nationally Determined Contribution (NDC), https://www.theccc.org.uk/publication/letter-advice-on-the-uks-2030-nationally-determined-contribution-ndc/#:~:text=Key%20recommendations&text=We%20encourage%20the%20Prime%20Minister,international%20credits%20to%20do%20so.

[19] BEIS (2021), 'Net Zero Strategy, p19', https://www.gov.uk/government/publications/net-zero-strategy

[20] Internal DESNZ analysis based on DDM Reference Case 2022 - https://www.gov.uk/government/statistics/the-dynamic-dispatch-model-a-fully-integrated-power-market-model

[21] BEIS (2022), Appendix 1: Electricity networks modelling, section 3.2, Electricity networks strategic framework, https://www.gov.uk/government/publications/electricity-networks-strategic-framework.

[22] BEIS (2022), Appendix 1: Electricity networks modelling, section 7, Electricity networks strategic framework, https://www.gov.uk/government/publications/electricity-networks-strategic-framework.

[23] BEIS (2021), p99, 'Net Zero Strategy', https://www.gov.uk/government/publications/net-zero-strategy

[24] BEIS (2022), 'British energy security strategy', https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

[25] BEIS (2022), 'UK government takes major steps forward to secure Britain's energy independence', https://www.gov.uk/government/news/uk-government-takes-major-steps-forward-to-secure-britains-energy-independence

[26] DESNZ analysis of the Final UK greenhouse gas emissions national statistics: 1990 to 2021, https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2021

[27] Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets. The 'Meeting carbon budgets' section of the Carbon Budget Delivery Plan makes clear how we have reached the conclusion that Carbon Budgets will be met. Whilst the indicative pathway set out in the NZS remains our view of the most economically advantageous way to meet the Carbon Budgets, and we therefore continue to use it as a means of developing and testing policy, the pathway plays no role in our conclusion that that Carbon Budgets will be met.

[28] HMT (2021), 'Budget and Spending Review – October 2021: What you need to know', https://www.gov.uk/government/news/budget-and-spending-review-october-2021-what-you-need-to-know

[29] BEIS (2022), 'UK government takes major steps forward to secure Britain's energy independence', https://www.gov.uk/government/news/government-readies-sizewell-c-nuclear-project-for-future-investment

[30] BEIS (2023), Press Release, https://www.gov.uk/government/news/government-readies-sizewell-c-nuclear-project-for-future-investment

[31] BEIS (2021), 'UK backs new small nuclear technology with £210 million', https://www.gov.uk/government/news/uk-backs-new-small-nuclear-technology-with-210-million

[32] National Grid ESO, 'The Pathway to 2030 Holistic Network Design, https://www.nationalgrideso.com/future-energy/the-pathway-2030-holistic-network-design#:~:text=The%20HND%20facilitates%20the%20connection,towards%20our%20net%20zero%20future.

[33] BEIS (2022), 'Offshore Coordination Support Scheme guidance', https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1135467/Offshore_Coordination_Support_Scheme_guidance.pdf

[34] BEIS (2023), Smart Meter Statistics in Great Britain: Quarterly Report to end December 2022, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1143890/Q4_2022_Smart_Meters_Statistics_Report.pdf

[35] July and December 2022 *Hydrogen Strategy update to the market*

[36] North Sea Transition Authority (2022) Emissions Monitoring Report. https://www.nstauthority.co.uk/news-publications/publications/2022/emissions-monitoring-report-2022/

[37] NSTA (2022) Data set, https://www.nstauthority.co.uk/news-publications/publications/2022/

[38] Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets. The 'Meeting carbon budgets' section of the Carbon Budget Delivery Plan makes clear how we have reached the conclusion that Carbon Budgets will be met. Whilst the indicative pathway set out in the NZS remains our view of the most economically advantageous way to meet the Carbon Budgets, and we therefore continue to use it as a means of developing and testing policy, the pathway plays no role in our conclusion that that Carbon Budgets will be met.

[39] This figure has been updated since the NZS publication. DESNZ analysis (2023), 'Net Zero Industry Pathway (N-ZIP) model', https://www.theccc.org.uk/wp-content/uploads/2020/12/N-ZIP-Model.xlsb. For further details see Sector Modelling in Technical Annex.

[40] DESNZ analysis (2023), 'Net Zero Industry Pathway (N-ZIP) model', https://www.theccc.org.uk/wp-content/uploads/2020/12/N-ZIP-Model.xlsb.

[41] DESNZ analysis (2023), 'Net Zero Industry Pathway (N-ZIP) model', https://www.theccc.org.uk/wp-content/uploads/2020/12/N-ZIP-Model.xlsb. For further details see Sector Modelling in Technical Annex.

[42] Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets. The 'Meeting carbon budgets' section of the Carbon Budget Delivery Plan makes clear how we have reached the conclusion that Carbon Budgets will be met. Whilst the indicative pathway set out in the NZS remains our view of the most economically advantageous way to meet the Carbon Budgets, and we therefore continue to use it as a means of developing and testing policy, the pathway plays no role in our conclusion that that Carbon Budgets will be met.

[43] DLUCH (2022), 'English Housing Survey 2019-20 Report', https://www.gov.uk/government/collections/english-housing-survey#2019-to-2020

[44] BEIS (2021), 'Opportunity areas for district heating networks in the UK: second National Comprehensive Assessment', https://www.gov.uk/government/publications/opportunity-areas-for-district-heating-networks-in-the-uk-second-national-comprehensive-assessment

[45] DESNZ internal analysis

[46] Heat Networks Industry Council

[47] BEIS (2021), https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2021. Includes IA&S in total emissions. Consistent with CB6/NZS analysis. Source: BEIS, Energy Consumption in the UK 2021, table U2

[48] Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets. The 'Meeting carbon budgets' section of the Carbon Budget Delivery Plan makes clear how we have reached the conclusion that Carbon Budgets will be met. Whilst the indicative pathway set out in the NZS remains our view of the most economically advantageous way to meet the Carbon Budgets, and we therefore continue to use it as a means of developing and testing policy, the pathway plays no role in our conclusion that that Carbon Budgets will be met.

[49] Sustainable Aviation forecasts based on independent analysis conducted by ICF consulting firm. Analysis assumes UK SAF production costs match or are lower than wider global SAF production costs.

[50] CCC (2022), Progress-in-reducing-emissions-2022-Report-to-Parliament.pdf (theccc.org.uk), pp.112-113

[51] https://www.smmt.co.uk/2023/01/chip-crisis-subdues-new-car-market-but-evs-now-second-only-to-petrol/. December saw battery electric vehicles (BEVs) claim their largest ever monthly market share, of 32.9%, while for 2022 as a whole they comprised 16.6% of registrations, surpassing diesel for the first time to become the second most popular powertrain after petrol.

[52] Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets. The 'Meeting carbon budgets' section of the Carbon Budget Delivery Plan makes clear how we have reached the conclusion that Carbon Budgets will be met. Whilst the indicative pathway set out in the NZS remains our view of the most economically advantageous way to meet the Carbon

Budgets, and we therefore continue to use it as a means of developing and testing policy, the pathway plays no role in our conclusion that that Carbon Budgets will be met.

53 See 44.

54 Defra (2023) Environmental Land Management (ELM) update: how government will pay for land-based environment and climate goods and services, https://www.gov.uk/government/publications/environmental-land-management-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services/environmental-land-management-elm-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services

55 Published within the UK ETS Authority's consultation on 'Developing the UK Emission Trading Scheme': Developing the UK Emissions Trading Scheme (UK ETS) - GOV.UK (www.gov.uk)

56 Please see the Carbon Budget Delivery Plan for details of our policies and proposals for meeting the carbon budgets. The 'Meeting carbon budgets' section of the Carbon Budget Delivery Plan makes clear how we have reached the conclusion that Carbon Budgets will be met. Whilst the indicative pathway set out in the NZS remains our view of the most economically advantageous way to meet the Carbon Budgets, and we therefore continue to use it as a means of developing and testing policy, the pathway plays no role in our conclusion that that Carbon Budgets will be met.

57 Nature-based solutions, such as afforestation, are included in the Agriculture and LULUCF subsector. For further detail, see the Natural Resources, Waste & F-Gases chapter.

58 Internal DESNZ analysis based on Energy Innovation Needs Assessment technology deployment paths (2019): https://www.gov.uk/government/publications/energy-innovation-needs-assessments. Note this data is based on 80% emission reduction target by 2050, not the current net zero (100% reduction) target, hence likely to be an underestimate.

59 BEIS (2021) Net Zero Research and Innovation Framework, https://www.gov.uk/government/publications/uk-net-zero-research-and-innovation-framework-delivery-plan-2022-to-2025

E02888048

978-1-5286-4019-0