

On 14 December 2020, the Department for Business, Energy & Industrial Strategy (BEIS) published the long-awaited Energy White Paper,¹ which builds on the prime minister's Ten Point Plan for a Green Industrial Revolution and the National Infrastructure Strategy, and sets out the steps the government intends to take within the next decade to address the transformation of the UK energy system to achieve net zero by 2050.

The Energy White Paper focuses on strategy in six key areas: consumers, power, energy systems, transport, buildings, oil and gas, and industrial energy. In this client alert, Rob Broom (associate), Paul Brennan (consultant) and Ray O'Connor (partner) take an in-depth look at the key announcements in the Energy White Paper affecting electricity and gas consumers, and consider progress since its publication.

1. Background

In May 2019, the Committee on Climate Change (CCC), an independent, statutory body established under the Climate Change Act 2008, published its advice to the UK government on achieving a net zero greenhouse gas (GHG) emissions target by 2050 (i.e. a 100% reduction from 1990 levels) in a report titled, "Net Zero, the UK's contribution to stopping global warming"² (CCC 2019 Report). As commented in our update on the CCC 2019 Report, the report painted a picture of an energy system entirely different to today's. For net zero to be achieved by 2050, the CCC envisaged the scenario illustrated in Figure 1 below would need to be realised, including:

- **Extensive electrification, particularly of transport and heating, supported by a major expansion of renewable and other low-carbon power generation** would involve around a **doubling of electricity demand**, with all power produced from low-carbon sources (compared to 50% today). That could, for example, **require 75GW of offshore wind in 2050**,³ compared to 8GW today and the 30GW target for 2030 (which has been since set by the government under its Offshore Wind Sector Deal⁴).
- The **development of a hydrogen economy to service demands for some industrial processes**, for energy-dense applications in **long-distance heavy goods vehicles (HGVs) and ships, and for electricity and heating in peak periods**. The CCC noted that by 2050, UK hydrogen production capacity of comparable size to the UK's current fleet of gas-fired power stations would be required.
- **Deployment of Carbon Capture and Storage (CCS) in industry, for hydrogen production and in gas-fired and bioenergy fuelled electricity generation to capture and sequester between 75-175MtCO₂ annually by 2050**.⁵ The CCC emphasised that CCS is a necessity not an option, and would require development of major CO₂ transport and storage infrastructure servicing at least five clusters, with some CO₂ transported by ships or heavy goods vehicles.

1 "Energy white paper: Powering our net zero future", 14 December 2020, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf, accessed 2 February 2021.

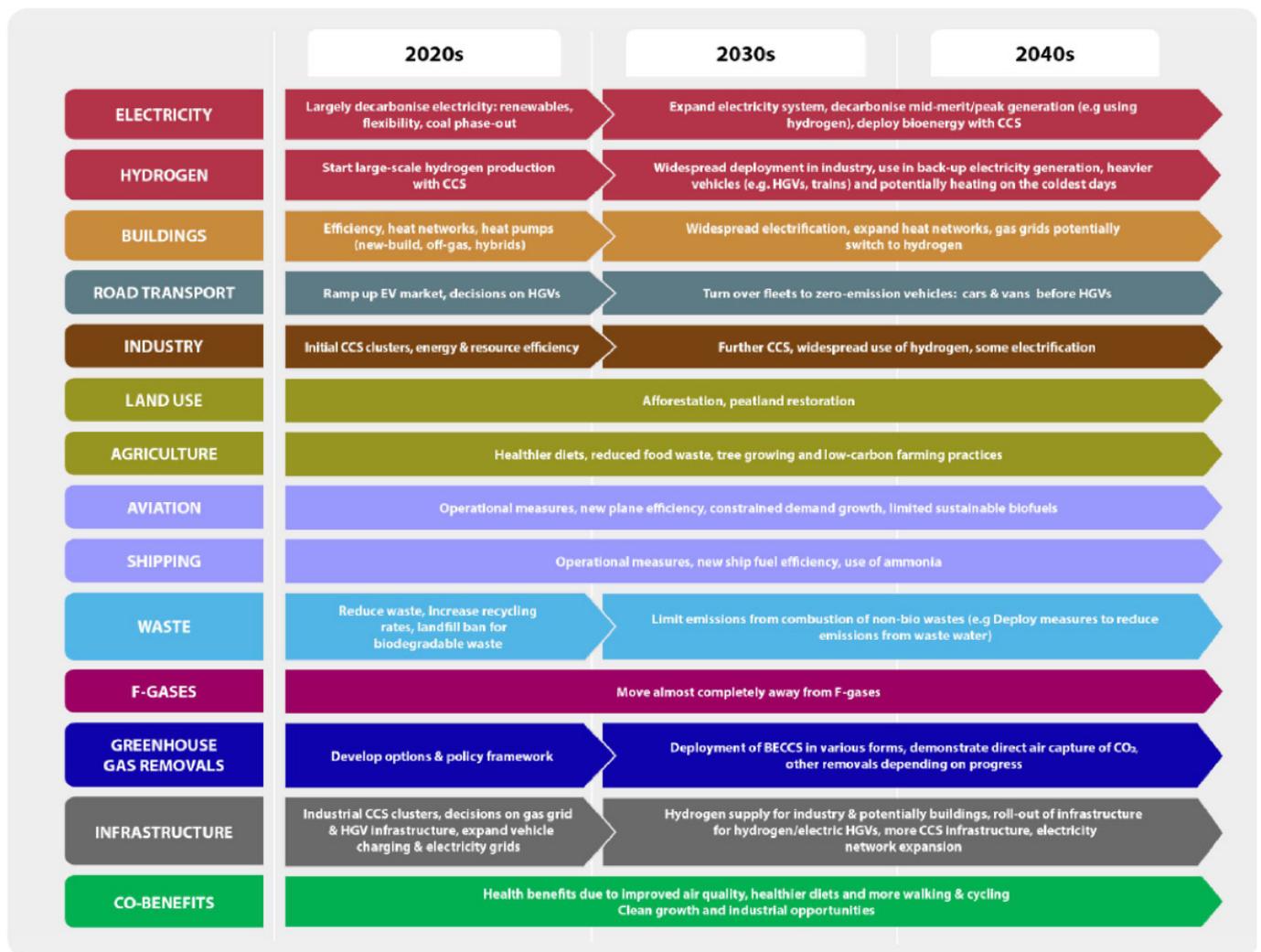
2 UK Committee on Climate Change, "Net Zero, the UK's contribution to stopping global warming", May 2019, available at: <https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf>, accessed 2 February 2021.

3 The CCC further elaborated that 75GW of offshore wind would require up to 7,500 turbines and could fit within 1-2% of the UK seabed, comparable to the area of sites already leased for wind projects by the Crown Estate.

4 HM government, Industrial Strategy, Offshore Wind Sector Deal https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790950/BEIS_Offshore_Wind_Single_Pages_web_optimised.pdf, accessed 1 March 2021.

5 Global CCS Institute "UK Committee on Climate Change highlights crucial role for carbon capture and storage in achieving a net-zero target in the UK", 2 May 2019, available at: <https://www.globalccsinstitute.com/news-media/press-room/media-releases/uk-committee-on-climate-change-highlights-crucial-role-for-carbon-capture-and-storage-in-achieving-a-net-zero-target-in-the-uk/>, accessed 2 February 2021.

Figure 1: UK Net-zero GNG Scenario



Source: CCC analysis.

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

Source: CCC 2019 Report

The Climate Change Act (2050 Target Amendment) Order 2019 came into force on 27 June 2019 and amended the Climate Change Act 2008 by introducing a target for at least a 100% reduction of GHG emissions (compared to 1990 levels) in the UK by 2050. This level of reduction was recommended in the CCC 2019 Report as an appropriate UK contribution to the Paris Agreement. However, the CCC noted achieving this target would only be possible if clear, stable and well-designed policies to reduce emissions further were introduced across the economy without delay.

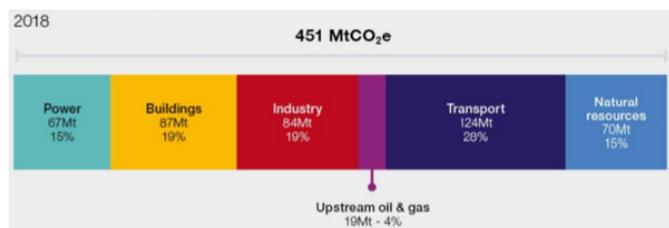
In 2018, the UK emitted 451MtCO₂ (see Figure 2 below) and in the CCC's Sixth Carbon Budget December 2020 Report,^{6 7} the CCC recommended that the Sixth Carbon Budget (i.e. the legal limit for UK net emissions of greenhouse gases over the years 2033 to 2037) should be set at 965MtCO_{2e} in total, implying a 78% reduction in annual emissions from 1990 to 2035 (see Figure 3 for a diagram of the CCC's recommendation) in order to reach net zero by 2050. Since publication of the Energy White Paper, the government adopted the CCC's advice on the Sixth Carbon Budget in the Draft Carbon Budget Order 2021,⁸ scheduled to pass into law by the end of June, thereby creating the world's most ambitious climate change target. In accepting the CCC's advice, the UK government acknowledged that emissions had to fall more quickly than required by the fourth and fifth carbon budgets, covering 2023 to 2027 and 2028 to 2032) to meet net zero (as illustrated in Figure 3 below).

6 CCC's Sixth Carbon Budget December 2020 Report, available at: <https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf>, accessed 28 February 2021.

7 The Climate Change Act, originally established in 2008, requires the UK government to set carbon budgets to act as "stepping stones" towards the 2050 emissions target. These budgets are caps on the amount of greenhouse gases that can be emitted in the UK across a five-year period.

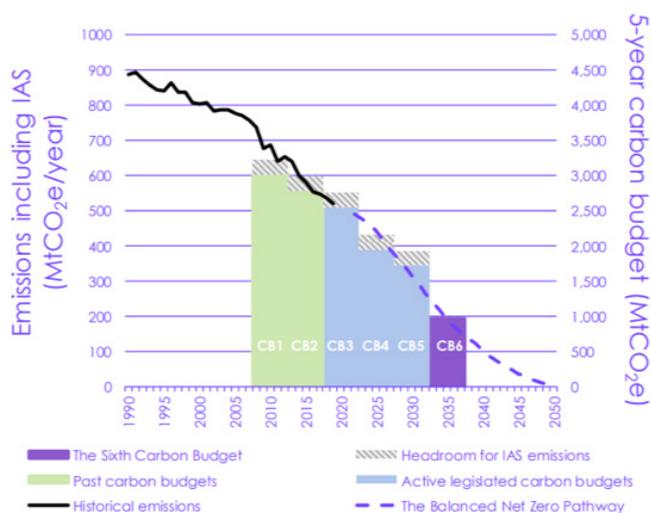
8 At the date of this article, not yet made as a UK Statutory Instrument.

Figure 2: UK Territorial Emissions (2018 Levels)



Source: Energy White Paper

Figure 3: CCC’s Recommended Sixth Carbon Budget



Source: BEIS (2020) Provisional UK greenhouse gas emissions national statistics 2019; CCC analysis
 Notes: Emissions shown include emissions from international aviation and shipping (IAS) and on an AR5 basis, including peatlands. Adjustments for IAS emissions to carbon budgets 1-3 based on historical IAS emissions data; adjustments to carbon budgets 4-5 based on IAS emissions under the Balanced Net Zero Pathway.

Source: The CCC’s Sixth Carbon Budget December 2020 Report

2. The UK Government’s Ten Point Plan

Prime Minister Boris Johnson published the [government’s Ten Point Plan](#) for a green industrial revolution on 17 November 2020,⁹ setting out a series of announcements covering transport, hydrogen, energy efficiency, carbon capture, offshore wind, nuclear and green finance including:

- Phasing out sales of new petrol and diesel cars and vans by 2030 to accelerate the transition to electric vehicles and investing in grants to help buy cars and charge point infrastructure.
- Ambitious policies to mobilise £12 billion of public sector investment and also drive an estimated £42 billion of private sector investments by 2030 across energy, buildings, transport and innovative sectors.
- Increasing existing offshore wind generating capacity to 40GW.
- Targeting 5GW of low-carbon hydrogen production by 2030.
- Targeting new, advanced nuclear power, with the establishment of a £385 million Advanced Nuclear Fund.
- Ambitions to capture 10Mt of carbon dioxide a year by 2030.
- First UK sovereign Green Bond in 2021 of £1 billion, with £1 billion of matched funding and up to £2.5 billion of follow on funding from the private sector.

The National Infrastructure Strategy,¹⁰ published a week after the Ten Point Plan, set out the government’s broader strategy for renewing the UK’s aging infrastructure, including further details on how it intends to deliver the plan. The publication of the Energy White Paper marked the next chapter in UK energy policy development, providing a policy framework to draw in investment to scale up renewables, clean heating, nuclear, energy efficiency, CCS and hydrogen technologies over the coming decade and beyond to set the UK on a course to achieve Net Zero by 2050.

3. Energy White Paper

The Energy White Paper set out specific steps the government intends to take over the next decade to start the transformation of the UK’s energy infrastructure system to meet the UK’s net-zero target.

A. Offshore Wind

The Energy White Paper confirmed the government’s intention of quadrupling the UK’s offshore wind capacity to 40GW by 2030, including the installation of 1GW floating wind turbine capacity, alongside the expansion of other low-cost renewables technologies.

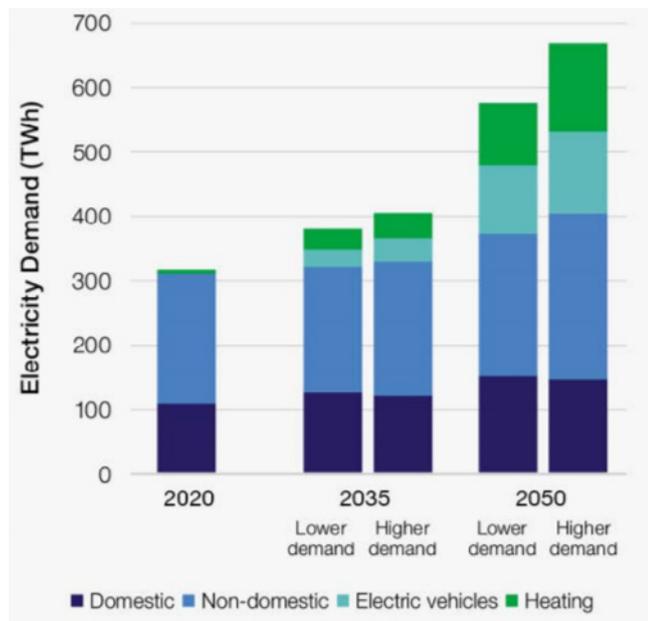
The next Contracts for Difference (CFD) auction in late 2021 will be open to onshore wind, solar photovoltaics and other established technologies, as well as offshore wind. Subject to sufficient projects coming through the planning pipeline to maintain competitive tension, BEIS plans to double the capacity awarded in the last round with the aim of deploying around 12GW of new low-cost renewable generation.

9 “PM outlines his Ten Point Plan for a Green Industrial Revolution for 250,000 jobs”, Gov.uk, 18 November 2020, available at: PM outlines his Ten Point Plan for a Green Industrial Revolution for 250,000 jobs- GOV.UK (www.gov.uk), accessed 2 February 2021.

10 HM government “National Infrastructure Strategy: Fairer, faster, greener”, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938539/NIS_Report_Web_Accessible.pdf, accessed 1 March 2020.

As mentioned in the CCC 2019 Report, a net-zero world will require extensive electrification, with a doubling of electricity demand to be met by new generation from low-carbon sources. The Energy White Paper makes clear that this demand will be driven primarily by power displacing petrol and diesel in cars and, to some extent, gas for heating. See Figure 4 below for demand scenarios (the difference in lower/higher demand scenarios being driven mostly by the extent to which electricity replaces gas for heating or petrol and diesel in cars).

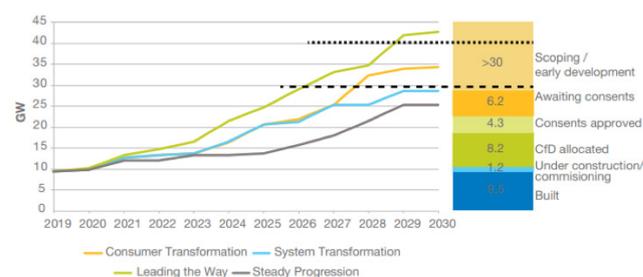
Figure 4: Electricity Demand, Net-zero Scenarios



Source: Energy White Paper

National Grid’s Future Energy Scenarios (FES) Report in 2020¹¹ presented a range of different, credible ways to decarbonise our energy system as the UK strives to meet the 2050 target, forecasting wind capacity increases in all scenarios, mainly driven by growth in offshore wind – the technology of choice due to falling costs, technology development and political support – illustrating the state of development of the 30GW of new capacity required to meet the 40MW target (see Figure 5 below). Meeting the target will, nevertheless, require rapid scaling up of the offshore wind supply chain and further government support. The government has already committed to a £160 million scheme and competitive process to develop major portside infrastructure hubs that it estimates will create approximately 2,000 construction jobs and a further 60,000 jobs in ports, factories and supply chains, manufacturing the next-generation of offshore wind turbines.¹² Under the Floating Offshore Wind Demonstration Programme¹³ launched in April 2021, BEIS is looking to support the development and demonstration of innovative floating offshore wind technologies through the competitive award of up to £17.5 million of capital grants.

Figure 5: Potential Wind Projects by Scenario

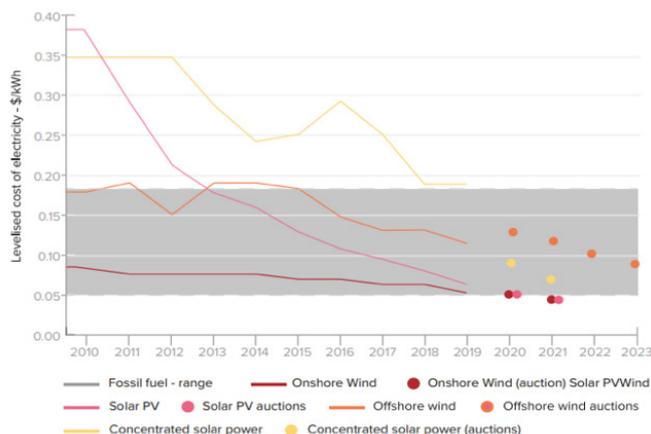


Source: National Grid’s Future Energy Scenarios (FES) Report 2020¹⁴

While BEIS does not outline the generation mix that should meet demand in 2050, noting that “the electricity market should determine the best solutions”, offshore wind, in which the UK is a world leader, will need to be supplemented by substantial contributions from onshore wind and solar as well. Increasingly, developers are looking to repower existing onshore wind farms with larger, more efficient plant, although, due to the ongoing eligibility of the original infrastructure for ROCs, that process will not start in earnest until next year, once the first generation of wind farms cease to qualify for certificates under the Renewables Obligation Scheme.

As the levelised cost of electricity (LCOE) from wind and solar has been decreasing across the globe (see Figure 6 below), continued downward pressure can be expected on the clearing price for the next CFD auction in late 2021. Prices in the most recent CFD allocation round were around £40 per MWh (in 2012 prices). With lower strike prices, developers stand to pay heavily for the price certainty offered by CFDs, and increasingly, they are opting for long-term Corporate PPAs with large creditworthy consumers as an alternative. See our Corporate PPA report titled “[Corporate Power Purchase Agreements: The Preferred Route for Corporates to Secure Renewable Energy Supplies in a Decarbonized World](#)” for further details on Corporate PPAs.

Figure 6: Prices of Renewables Globally



Source: CCC Progress Report 2020¹⁵

11 National Grid’s Future Energy Scenarios (FES) 2020 Report, available at: <https://www.nationalgrideso.com/document/173821/download>, accessed 28 February 2021.

12 Innovation News Networks, “UK invests £160m to upgrade offshore wind energy infrastructure”, 6 October 2020, available at: <https://www.innovationnewsnetwork.com/uk-invests-160m-to-upgrade-offshore-wind-energy-infrastructure/7316/>, accessed 28 February 2021.

13 Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/976150/fow-guidance-notes.pdf, accessed 16 June 2021.

14 National Grid’s Future Energy Scenarios (FES) 2020 Report, available at: <https://www.nationalgrideso.com/document/173821/download>, accessed 28 February 2021.

15 CCC’s Reducing UK emissions: 2020 Progress Report to Parliament, available at: <https://www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament/>, accessed 28 February 2021.

The changes are prompting government to look again at the current support mechanisms for low carbon. In its document “Enabling a High Renewable, Net Zero Electricity System: Call for Evidence”,¹⁶ BEIS is seeking to understand the ways in which developers are securing income streams outside of the CFD framework, and the price cannibalisation caused by the mass deployment of low-marginal cost generation, settled on the basis of contracts for differences, whether struck in the private sector or under the government’s own CFD scheme.

B. CCS Deployment

At the time of the 2019 CCC Report, there were 43 large-scale projects operating or under development around the world, but none in the UK. The CCC estimated that aggregate annual capture and storage would need to be at the level of 75-175MtCO₂ by 2050, which would require major CO₂ transport and storage infrastructure servicing at least five clusters, with some CO₂ transported by ships or heavy goods vehicles. The UK government has ramped its ambition on industrial decarbonisation by committing in the Energy White Paper to delivering four low-carbon industrial clusters by 2030, creating “SuperPlaces” in areas such as the North East, the Humber, North West, Scotland and Wales. The four industrial clusters will include, at least, one power CCS project. To achieve this, £1 billion of funding will be made available over the period to 2025 to facilitate the deployment of CCS in two industrial clusters by the mid-2020s, and a further two clusters by 2030, which, together, should capture 10MtCO₂ per year by the end of the decade.¹⁷

Following a consultation on the selection process for these clusters, the government has published its programme for selecting the first two “Track 1” clusters.¹⁸ The application process is already underway, with a 23 June deadline for applications, with the results scheduled to be announced in October. Phase 2 of the Track 1 process, in which individual industrial, power and hydrogen production projects may apply to be included in a process for the negotiation of support packages, if they can connect into one of the selected clusters or make other credible arrangements for carbon storage, is due to begin in August 2021, with a 1 November deadline for applications. The eligibility criteria include a requirement that the projects will be operational by the end of 2027, which is a little difficult to square with the eligibility requirement for the Track 1 clusters themselves that they should be operational by 2030. Details of the Track 2 process for selection of third and fourth clusters are due to be announced in October.¹⁹

Work on the commercial and regulatory models for the transportation and storage of carbon is well underway. Government published an update on the business model in May 2021,²⁰ with further details to be released by the end of the year. The overall support package looks set to include an upfront capital contribution, mitigation measures against delays in the development of the initial carbon capture projects and financial support in the event of no fault network under-utilisation or carbon leakage from store.

Work is also underway on the commercial framework for carbon capture.²¹ Industrial emitters, or their carbon capture service providers, will be eligible for contracts of up to 15 years under which they are paid per tonne of captured CO₂, to cover operational expenses, transportation and storage fees, and their capital investment in carbon capture equipment. There will also be grant funding for a proportion of the capital costs of the initial carbon capture projects. Emitters will forfeit free allocation UK ETS emissions allowances at a rate proportionate to the percentage of their emissions that are captured. In return, they will receive an index linked payment for those allowances. The first projects will be protected against future reductions in the level of free emissions allocation. Retrofitting of carbon capture technology to existing hydrogen production facilities will be covered by the industrial carbon capture model, but carbon capture for new hydrogen production facilities will be covered by a separate scheme.

The government is contemplating applying the industrial carbon capture model to energy-from-waste and combined heat and power facilities. It is proposed to support carbon capture from conventional power stations through a long-term power agreement (15 years for new plant and 10 years for retro-fitted plant) providing an Availability Payment for low-carbon generation capacity and a variable payment that tops up wholesale market revenue to reduce the effective short-run marginal cost of the power CCUS plant if this is greater than the short-run marginal cost (including carbon pricing) of equivalent unabated plant. The government’s most recent thinking on support for power plant with carbon capture capability is set out in “Carbon Capture, Usage and Storage: An Update on the Dispatchable Power Agreement Business Model”²² BEIS is aiming to complete design of the contractual model for power generation by the end of this year.

16 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/956815/high-renewable-net-zero-electricity-system-cfe.pdf, accessed 28 February 2021.

17 The government’s current thinking on the fund, which will be paid for by energy consumers, is set out in “The Carbon Capture and Storage Infrastructure Fund: An Update on the Design of the CCS Infrastructure Fund”, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984001/ccs-infrastructure-fund-cif-design.pdf, accessed on 15 June 2021.

18 Cluster Sequencing for Carbon Capture Usage and Storage Deployment: Phase-1, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/986007/ccus-cluster-sequencing-phase-1-guidance-for-submissions.pdf, accessed 15 June 2021.

19 Government Response to Carbon Capture Usage and Storage: Market Engagement on Cluster Sequencing, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984020/ccus-cluster-sequencing-consultation-government-response.pdf, accessed 15 June 2021.

20 Carbon Capture, Usage and Storage: An update on the business model for Transport and Storage, available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/983903/ccus-transport-services-business-model-commercial-update.pdf, accessed 15 June 2021.

21 Carbon Capture, Usage and Storage: An update on the business model for Industrial Carbon Capture, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984119/industrial-carbon-capture-icc.pdf, accessed 15 June 2021.

22 Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984402/dpa-update-may-2021.pdf, accessed 15 June 2021.

These commitments are welcome, though it must be said the interactions of various mechanisms to support low-carbon generation and security of supply in the power sector are becoming disconcertingly complex. As highlighted in the 2019 CCC Report, CCS is a necessity, not an option. Capturing carbon dioxide emitted from coal and gas-fired power plants (or other industrial plant) and storing it in geological structures, such as depleted oil fields, is a vital component in the strategy to deliver net zero by 2050; CCS is the only group of technologies that contributes both to reducing emissions in key sectors directly and to removing CO₂ to balance emissions that are challenging to avoid. The government's ambitions go further. It sees the combination of innovative technologies spun out of British universities and the abundance of depleted oil and gas wells for carbon sequestration as creating the opportunity for the UK to become a global leader in carbon capture and storage services.

In addition to working on the commercial and regulatory framework for carbon capture and storage, the government is seeking to stimulate technological advances in this area with the launch of its £20 million Call for CCUS Innovation 2.0.²³ Research work on greenhouse gas removal technologies (GGR), such as direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS), is being funded through the Direct Air Capture and other Greenhouse Gas Removal technologies competition launched in 2020. Alongside that initiative, BEIS ran a call for evidence on GGRs between December 2020 and February 2021, and the National Infrastructure Commission is due to report on GGRs later this year.

While the above measures will go very far in contributing to net zero, there has been little from the government relating to funding and policy announcements on delivering savings from either electrification or resource/material efficiency, both of which make a significant contribution in the CCC's analysis.

C. New Nuclear

The Energy White Paper contained a commitment to bring one large-scale nuclear project to the point of Final Investment Decision by the end of this Parliament (2024).

The government also intends to provide up to £385 million in an Advanced Nuclear Fund (ANF) for the next generation of nuclear technology, aiming, by the early 2030s, to develop a Small Modular Reactor (SMR) design and to build an Advanced Modular Reactor (AMR) demonstrator. Up to £215 million of the ANF will be invested to develop a domestic SMR design that could potentially be utilised in factories, assembled on-site.

With the exception of Sizewell B and Hinkley Point C (the latter of which will deliver around 7% of the country's current electricity needs – enough to power the equivalent of around 6 million homes – which is under construction, all of the existing nuclear power plants are due to have ceased generating by the end of 2030. It is, therefore, no surprise that BEIS' analysis suggests additional nuclear beyond Hinkley Point C will be needed in a 2050 electricity system of very low emissions. Nuclear will inevitably be required as a complementary technology to supplement the intermittent supply from solar and wind.

SMRs and AMRs were already embedded in the government's vision for the UK's low-carbon future in the Ten Point Plan. Things moved forward in May 2021 with the opening of the Generic Design Assessment for advanced nuclear technologies.²⁴

D. Establishing a New UK Emissions Trading System (ETS)

The Energy White Paper provided that the UK will establish an ETS from 1 January 2021 to replace the UK's participation in the EU ETS. Similar to the EU ETS, the UK ETS works on the cap and trade principle (i.e. market participants buy or receive emission allowances within the cap and then trade those allowances with other participants), which provides economic incentives for reducing industrial pollutant production.

The cap is set on the greenhouse gases that businesses can emit (via the total number of allowances in circulation), which will decrease over time. Businesses then buy and sell emissions allowances through government auctions or secondary markets. The UK ETS initially applies to energy-intensive industries, electricity generation and aviation. The UK ETS is set to cover 155 megatonnes of CO₂e in its first year.

The government further commented that the operation of the cap will deliver a robust carbon price signal; giving businesses the confidence to mobilise the scale of capital investment necessary to deploy clean energy technologies; and to capture new trade opportunities on the back of the energy transition.

Currently, around one-third of UK emissions and 1,000 factories and plants are covered by the EU ETS and will be covered under the new UK variant.²⁵ Intercontinental Exchange, Inc. (NYSE:ICE) – the Fortune 500 firm that operates the EU ETS, was appointed to host emissions auctions on behalf of BEIS. The UK ETS is now well underway, with the first auction taking place on 19 May 2021²⁶ with a clearing price of £44/tonne, well in excess of the £22 reserve price.

²³ Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/988631/ccus-competition-eoi.pdf, accessed 15 June 2021.

²⁴ For details, see "Entry to Generic Design Assessment for Advanced Nuclear Technologies: Instructions and Guidance for Requesting Parties"; available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/985597/entry-to-gda-for-ant.pdf, accessed 15 June 2021.

²⁵ Edie Newsroom, "Five things you need to know about the Energy White Paper", 14 December 2020, available at: <https://www.edie.net/news/16/Five-things-you-need-to-know-about-the-Energy-White-Paper/>, accessed 28 February 2021.

²⁶ Businesswire, "ICE publishes auction calendar for UK's new Emissions Trading Scheme", 26 February 2021, available at: <https://www.businesswire.com/news/home/20210226005343/en/ICE-publishes-auction-calendar-for-UK%E2%80%99s-new-Emissions-Trading-Scheme>, accessed 28 February 2021.

Details of the free allocation of allowances to eligible installations were published on 11 May 2021,²⁷ with allowances issued to operator holding accounts on 26 May. With allowances currently trading around £50/tonne, there is every possibility of the Cost Containment Mechanism (CCM) being triggered, whereby the Environment Agency or Secretary of State intervenes in the market so as to bring prices closer to the prices under the EU Emissions Trading Scheme.

E. Hydrogen

The Energy White Paper sets an aim for 5GW of low-carbon hydrogen capacity by 2030, backed by a new Net Zero Hydrogen Fund providing £240 million of capital co-investment out to 2024/25. By 2050, the government expects low-carbon options, such as clean hydrogen and long-duration storage, to satisfy the need for peaking capacity and ensure security of supply at low cost, likely eliminating the reliance on generation from unabated gas.

Development of a hydrogen economy is a must, primarily to service demands for some industrial processes, for energy-dense applications in long-distance HGVs and ships, and for electricity and heating in peak periods. The CCC 2019 Report recommended that by 2050, a new low-carbon industry is needed with UK hydrogen production capacity of comparable size to the UK's current fleet of gas-fired power stations well beyond the government's 2030 5GW target. The exact mix of different end uses for clean hydrogen in 2050 will depend on a variety of factors, including cost, availability and technical application. Current analysis from S&P Global Platts assessed the cost of producing green hydrogen via alkaline electrolysis in the UK (including capex) at £4.56/kg (US\$6.45/kg) on 9 June. Platts assesses the cost of production of hydrogen using PEM electrolysis at £5.64/kg, with the cost of blue hydrogen production from natural gas given as £1.77/kg (including capex and carbon).²⁸

The recently announced North Sea Transition Deal (published 24 March 2021)²⁹ is intended as a catalyst for a homegrown energy transition, delivering on commitments from the prime minister's Ten Point Plan and the Energy White Paper. Under the "deal", the oil and gas sector has committed to investment of up to £14 billion to £16 billion by 2030 in new energy technologies, in return for the government developing a business model to enable CCUS and hydrogen at scale. As part of its promised Hydrogen Strategy, the government will be consulting on a commercial framework to support the funding and development of clean hydrogen projects, aiming for its introduction in 2022.

The White Paper repeats the government's Ten Point Plan commitment of commencing hydrogen heating trials to evaluate the practicalities of converting existing boiler appliances and consumer acceptance of hydrogen as a heat source for their homes and workplaces. A Hydrogen Neighbourhood is planned for 2023 and a Hydrogen Village in 2025, ultimately scaling up to a Hydrogen Town before the end of this decade. Even before the prime minister's Ten Point Plan, Ofgem had awarded £18 million from its annual Network Innovation Competition to support the development of a project led by SGN to build a first-of-a-kind green hydrogen network serving 300 homes in Fife. Meanwhile, BEIS is planning a £60 million Low Carbon Hydrogen Supply 2 (HYS2) competition. The competition will have two streams: one for market entry projects, with up to £6 million available for feasibility studies valued at up to £300,000 per project and a further £24 million for grants of up to £6 million for demonstration projects. Under the second stream, up to £30 million is available in grants of up to £10 million for demonstration projects of more mature technologies.³⁰

F. Biomass

The Energy White Paper provides that by 2022, the government will establish the role that Bioenergy with Carbon Capture and Storage (BECCS) can play in reducing carbon emissions across the economy and, as part of a wider biomass strategy, set out how the technology could be deployed. The government intends to issue a call for evidence: "Biomass for net zero," to inform the development of its strategy – with the role of BECCS to be critical in its decision. Whereas biomass has in recent years been seen as a low-carbon solution to heating, the challenges of capturing and storing carbon from such projects would be formidable and it appears that the government is focussed on the use of bioenergy in large-scale electricity and hydrogen production, and outside of the energy sector in the production of new forms of plastic. Nonetheless, a £4 million Biomass Feedstocks Innovation Programme³¹ is now open for applications and, as indicated above, the National Infrastructure Commission is due to report to government later this year on the scope for energy from biomass with carbon capture and storage.

G. Retail Market

The government estimates that the measures set out in the Energy White Paper could reduce emissions across power, industry and the built environment generally by up to 230MtCO₂e in the period to 2032. However, the cost of the new infrastructure to achieve this will ultimately need to be met by consumers. The White Paper also set out a commitment to protect consumer interests, by:

- (i) Creating a fair deal for consumers
- (ii) Protecting the fuel poor
- (iii) Providing opportunities to make savings on energy bills

27 UK ETS Allocation Table for the 2021 to 2025 allocation period, available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984916/uk-ets-allocation-table.csv/preview, accessed on 15 June 2021.

28 S&P Global Platts, "UK's July hydrogen strategy 'likely to include green CFDs'", 10 June 2021, available at: <https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/061021-uks-july-hydrogen-strategy-likely-to-include-green-cfds>, accessed 12 June 2021.

29 BEIS, "North Sea Transition Deal", 24 March 2021, available at: <https://www.gov.uk/government/publications/north-sea-transition-deal/north-sea-transition-deal-accessible-webpage>, accessed 12 June 2021.

30 See Low Carbon Hydrogen Supply 2: expression of interest, available at: <https://www.gov.uk/government/publications/low-carbon-hydrogen-supply-2-competition/low-carbon-hydrogen-supply-2-expression-of-interest>, accessed 16 June 2021.

31 See <https://www.gov.uk/government/publications/apply-for-the-biomass-feedstocks-innovation-programme>, accessed 16 June.

Quite how extensive the intervention in the energy market will be remains to be seen. The White Paper's proposals for addressing inequities in the retail market are underwhelming, and there has been little progress in this area since its publication. Consultations on the development of mechanisms allowing consumers to opt into collective switching schemes, or to transfer automatically to cheaper competitively procured tariffs at the end of their fixed contract period, promised for March 2021, have failed to materialise. A commitment to assessing changes that need to be made to the market framework to facilitate the development and uptake of innovative tariffs and products that work for consumers and contribute to net zero does little to move things on from the joint BEIS and Ofgem consultation "Flexible and Responsive Energy Markets – Putting consumers at the centre of a smart, low-carbon energy system",³² which closed in September 2019, and to which, as yet, there has been no government response.

There has at least been some action on fuel poverty. The White Paper promised an extension of the Warm Home Discount Scheme and an increase in its value from £350 million to £475 million, supporting an extra 750,000 homes. With the publication of its "Response to Consultation on Updating the Fuel Poverty Strategy for England"³³ and "Sustainable Warmth: Protecting Vulnerable Households in England",³⁴ the government has repeated the commitment given in the Ten Point Plan and White Paper to extend the Energy Company Obligation until 2026, and gone on to increase its value from £640 million to £1 billion a year. The cost of these measures will ultimately be borne by less impoverished energy consumers, and with the government proposing to remove the threshold on customer numbers below which suppliers are currently exempted from the schemes, the changes will put additional pressure on smaller energy suppliers. In the longer term, structural changes are being contemplated, with the government engaging with industry and consumer groups with a view to a formal consultation on changes to the energy market frameworks to align consumer interests with the net-zero target by facilitating the development and uptake of innovative tariffs and energy products or services.

There is little sign that Brexit has led to a reduction in regulation of the energy sector – quite the reverse. The regulatory regime is likely to be extended to cover the wider market covering participants such as energy brokers and price comparison websites. The government also intends to legislate so as to give itself new powers to regulate smart appliances as regards matters such as interoperability, data privacy and cyber security. As for gas, the government will consult on whether to end gas grid connections to new homes built from 2025, in favour of clean energy alternatives.

H. Transforming the Energy System

With increasing dependency on clean electricity, not least for road transport, electricity demand looks set to double between now and 2050, implying profound changes in the physical electricity transmission and distribution system. A move toward decentralised electricity production will need to be complemented by increasingly sophisticated demand-side management and more efficient usage of networks. The White Paper's response to this challenge is less than clear and there has been limited progress since its publication.

A new Smart Systems Plan to be published by BEIS and Ofgem is set to include "a new framework for monitoring flexibility across electricity markets". Ofgem's statutory duties are to be changed yet again, with government seeking to legislate for the introduction of a Strategy and Policy Statement that will impose a duty on it "to carry out its regulatory functions in a manner consistent with delivering a net zero energy system while ensuring secure supplies at lowest cost for consumers". The institutional and governance arrangements for the gas and electricity market look set for further change, with a second consultation on reforming the energy industry codes due later this year. New legislation is to be introduced to enable competitive tendering in the building, ownership and even operation of the onshore electricity network. Meanwhile, BEIS and Ofgem are due to bring forward an Energy Data Strategy to optimise the use of the network and the assets connected to it.

The Minister for Business, Energy and Clean Growth has already written to Ofgem stressing the importance of developing a transparent methodology to support efficient spending to support electric vehicle charging and accommodate low-carbon technologies such as heat pumps in its RII0-ED2 electricity distribution company price control review for 2023 to 2028.

With over 1.3GW of operational plant and a project pipeline of 16GW,³⁵ large-scale battery storage is regarded as a mature technology without need of subsidy support (beyond the Capacity Market). Nevertheless, there are some financial and regulatory obstacles to the technology that BEIS intends to address by legislating for a specific licensable storage activity, allowing for differential treatment between storage and other types of electricity generation and demand – when parliamentary time allows.

More novel storage technologies are eligible to participate in the £68 million Longer Duration Energy Storage Demonstration innovation competition.³⁶

32 Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/819624/flexible-responsive-energy-retail-markets-consultation.pdf, accessed 16 June 2021.

33 Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/960083/fuel-poverty-strategy-for-england-government-response.pdf, accessed 16 June 2021.

34 Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/960200/CCS207_CCS0221018682-001_CP_391_Sustainable_Warmth_Print.pdf, accessed 16 June 2021.

35 Source: Solar Media Market Research/Energy Storage News, 21 May 2021, available at: <https://www.energy-storage.news/blogs/large-scale-battery-storage-in-the-uk-analysing-the-16gw-of-projects-in-dev>, accessed 17 June 2021.

36 Available at: <https://www.gov.uk/government/publications/longer-duration-energy-storage-demonstration/proposal-for-the-longer-duration-energy-storage-demonstration-innovation-competition>, accessed 16 June 2021.

The regulatory regime for natural gas will also come under review, to ensure that the appropriate powers and responsibilities are in place to facilitate a decarbonised gas future. The government recognises that the UK will continue to be reliant on gas for years to come, particularly for heating, and is looking to reduce the carbon intensity of the existing system. A Green Gas Support Scheme (GGSS) for anaerobic digestion biomethane plants, due to run for four years, has been promised for autumn 2021, though BEIS has yet to formally respond to the consultation that closed in September 2020. The government's estimates that the scheme could deliver annual generation of 2.8TWh of renewable heat equivalent to the gas requirements of around 230,000 homes demonstrate the magnitude of the challenge. In addition to work on exploring the feasibility of hydrogen networks, in place of natural gas, BEIS is working with the Health and Safety Executive in the hope that hydrogen may be blended with natural gas in the network to a concentration rate of up to 20%.

4. Conclusion

The year 2050, with its zero emissions target, is considerably closer now than it was when the Climate Change Act 2008 came into force. The UK's new 78% reduction target for 2030, in just nine years' time, is only marginally less than the original 80% target for 2050 under the act. Achieving the world's most ambitious greenhouse gas reduction target will clearly demand bold policy decisions. The challenges are immense. There is little doubt that a fundamental rethink of the commercial and regulatory framework for the UK's energy system, predicated as it was on large centrally dispatched fossil fuel and nuclear power stations and an abundance of gas, is required, though many in the industry will shrug wearily at the prospect of yet more legislative intervention. Time is of the essence and these changes must address the current obstacles to installing the new network infrastructure required to achieve such ambitious targets. For a decarbonised world, electricity distribution will be no less essential than water, and although there is no mention of it in the White Paper, electricity distribution and transmission companies will surely need powers more akin to those of water and sewerage undertakers, if the aspirations in the White Paper are to be met.

Whether or not the UK is capable of rising to the challenge remains to be seen, but the Energy White Paper does at least deliver a vision and direction of travel that will be welcome to investors. The government is placing a good deal of faith in the power of competitive grant funding as a way of bringing forward new technologies. However, funding and developing full-scale commercial projects is a knottier problem. There are a dizzying array of initiatives currently under development, many of which will depend on subsidies, ultimately paid for by energy consumers – voters, who will inevitably demand protection against escalating energy prices. There is, though, little prospect of subsidy free development until carbon is priced out of the market, which would add to consumer costs in areas other than energy, and, in the absence of concerted international effort, further jeopardise the UK's industrial base. As for nuclear and new renewable development, the White Paper stresses that the government's policies to stimulate investment are subject to the proviso that they offer value for money to consumers. But with the Climate Change Committee stressing that "action is required across all areas and all sectors, without delay", there is no credible alternative. Yet, in the medium term, the signs are propitious. With the UK hosting the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow between 1 and 12 November this year, if ever there was a time to press the UK government to match ambitious policy announcements with equally bold action, this is surely it.



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