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C H A N C E



**UK NET ZERO
STRATEGY –
A CLEARER VIEW OF
THE CHALLENGES
TO 2050**



– THOUGHT LEADERSHIP

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UK NET ZERO STRATEGY – A CLEARER VIEW OF THE CHALLENGES TO 2050

Ahead of its Presidency of COP26, the UK Government has published its Net Zero Strategy to 2050. The Strategy covers all business sectors and some cross-cutting themes. This briefing explores major new elements of policy, some of the major uncertainties, and key challenges faced by business in planning and implementing a path to Net Zero by 2050.

Key issues

- Uncertainty about energy and technology solutions means there are various pathways to achieve Net Zero by 2050.
- Inevitably, each pathway involves major increases in electricity generation and hydrogen production, and in decarbonisation of transport, buildings, and industry, and much greater levels of energy efficiency.
- The ability to scale up greenhouse gas removal, and the role of hydrogen in heating buildings, are major uncertainties.
- Nuclear is likely to play a significant role in the decarbonisation of power.
- The UK Emissions Trading Scheme is at the centre of NZS but with uncertainty over how to deal with 'carbon leakage'.
- UK sustainable finance plans will include Sustainability Disclosure Requirements by 2022 based on the TCFD, and on a new UK Taxonomy based on the EU equivalent.
- Notable omissions include livestock farming and meat-free diets, and a clear approach on 'Just Transition.'

Over the past two years, the UK Government has sought to proclaim its leadership in the climate debate by enacting a Net Zero-by-2050 target in law, and other high-profile targets to reduce greenhouse gas (GHG) emissions by 68% by 2030, and 78% by 2035 (against 1990 levels). However, a robust **UK Net Zero Strategy** (NZS) has been long-awaited by many stakeholders to fill the perceived policy void that would set out the detailed policies and measures needed to achieve these targets. The NZS is also seen as crucial to the Government's credibility to act as COP26 President and successfully persuade other countries to ramp up their commitments and action on climate change.

While some new policies are interwoven into the NZS, in the main it is not ground-breaking, rather bringing together the many recent cross-cutting and sectoral strategies.

Various potential pathways to Net Zero

The NZS recognises that there is a great deal of uncertainty about how energy and technology solutions will play out in the lead up to 2050, and three possible 2050 scenarios are modelled (of course, the reality may lie outside these scenarios):

1. High Electrification: Electricity generation is massively increased to 690 TWh through scaling renewables, nuclear and gas with carbon capture, utilisation and storage (CCUS) and used for transport, industry and building heat; low carbon hydrogen is scaled up to 240 TWh and used for industry and heavy transport. Some reduction in aviation and shipping emissions is achieved by sustainable fuels (from 45 to 35 MtCO₂e). Residual emissions are dealt with by afforestation and engineered GHG removals (GGRs): bioenergy with carbon capture and storage (BECCS), and direct air carbon capture and storage (DACCS) (total removal: 75 MtCO₂e).

2. High Resource: Low carbon hydrogen expands hugely to 500 TWh and becomes the main source for building heat. As a result, electricity generation only needs to rise to 610 TWh. Aviation and shipping decarbonisation follows scenario one above. Residual emissions are dealt with by greater levels of afforestation to compensate for carbon emissions from hydrogen production but there are broadly similar levels of GGRs (total removal: 76 MtCO₂e).

3. High Innovation: More optimistic assumptions on reductions of aviation emissions (sustainable aviation fuels and zero emission aircraft taking emissions down to 21 MtCO₂e) and greater levels of GGR (increasing GGRs to 81 MtCO₂e). As a result, transport, industry and buildings decarbonise less than in other scenarios, and electricity generation (670 TWh) and hydrogen production (330 TWh) are set between the levels in scenarios one and two.

The NZS accepts the inherent uncertainty over these models, which do not take account of many significant factors including future technology costs and availability, wider benefits or risks to the economy from low carbon technologies, and behavioural factors. However, the models and the NZS show a number of key points common to any pathway to 2050:

- Electricity generation and hydrogen production must grow hugely, but energy sources will also need to increase, including biomass and waste, to ensure security of supply. Large-scale energy storage and use of BECCS will also be essential to manage demand peaks.
- Transport, buildings and industry need to decarbonise extensively across all scenarios.
- Significant action on energy efficiency will be required across the economy.
- Innovation in new technologies on the end-use side of the economy will be important (e.g., for zero carbon heating and surface transport).
- Much will depend on the extent to which GGR technology can be scaled up.

- Major investment in infrastructure (e.g., for hydrogen and CCUS) will require £15 billion investment to the end of the UK's 6th Carbon Budget in 2037; significant further investment in a flexible electricity network will also be needed.
- Green investment will need to reach £50-60 billion/yr in the late 2020s and during the 2030s to incentivise early technologies and scale low carbon sectors.
- There will be an increasing need to manage sustainable use of resources (particularly from high-tech manufacturing) and conflicts in land use (e.g., due to greater volumes of energy crops and more afforestation).
- Inevitable need for greater regulation and standards to incentivise green options.

How to get there?

The NZS set out a long list of key policies and measures along with more detail in the individual chapters of the NZS.

We have set out a list of key measures in the Annex to this briefing. We comment on certain key elements below.

Nuclear power

The NZS confirms that the Government wishes to bring forward at least one further large-scale nuclear power plant with a final investment decision being made by the end of this Parliament (2024), and negotiations are already underway in relation to the proposed Sizewell C plant. However, this is subject to 'clear value for money', and funding for new plants is expected to be provided through a Regulated Asset Base model (and a Nuclear Energy (Financing) Bill has just been introduced to Parliament to facilitate this). Further decisions will be made during the next Parliament on additional projects, which could include further large-scale plants.

The NZS also supports smaller nuclear plants coming forward in the form of Small Modular Reactors (SMR) and, potentially, Advanced Modular Reactors (AMR). If two or three additional 1GW+ plants are brought forward along with SMR and AMR projects, nuclear energy will play a very significant role in the decarbonisation of the UK power system.



Removing dirty fossil fuels will require the transformation of every sector of the global economy. It means no longer burning fossil fuels for power or heating; it means new ways of making concrete, cement, steel; it means the end of the petrol and diesel engine.



NET ZERO STRATEGY

UK Emissions Trading Scheme and carbon leakage

The NZS puts the UK Emissions Trading Scheme (UK ETS) centre stage of its net zero policy (a major turnaround from Government policy in the run-up to Brexit when a move to a Carbon Tax seemed to be the preferred option). The current UK ETS follows the structure of the EU Emissions Trading System (EU ETS) but with a cap on emissions set at 95% of the UK's notional share of emissions under the EU ETS. The NZS provides that the Government will look to extend the UK ETS to two thirds of uncovered emissions to put the UK ETS on a net zero-consistent track by 2023 or 2024 (a consultation is expected in the coming months). The UK ETS will also be key to the introduction of a new GHG removals policy (see below).

Heavy industrial users are currently provided with free allocations of allowances under the UK ETS to compensate for carbon leakage, a problem where some domestic products cannot compete with cheaper, more carbon-intensive goods manufactured elsewhere. A similar problem is being targeted in the EU with the proposed introduction of a carbon border adjustment mechanism (CBAM) (See our **July 2021 briefing**). There has been much speculation as to how the UK will deal with carbon leakage following Brexit and whether it would propose a corresponding similar CBAM. HM Treasury's **Net Zero Review** (accompanying the NZS) analyses the potential impacts of carbon leakage, acknowledging that there is a potential problem to be resolved. While no firm decision has been made, the review concludes that an international solution to the problem would be preferable to a CBAM, although it does not rule out a CBAM. This review is ongoing and the evolution of the debate will be keenly watched. The Government is also currently considering the linked issue of free allocations as part of its broader review of the UK ETS.

Engineered Greenhouse Gas Removals

The NZS underlines a new emphasis on engineered greenhouse gas removals (GGRs) to deal with residual emissions by 2050, particularly in the *high innovation* scenario mentioned above. The combination of bioenergy and carbon capture and storage (BECCS) is supported as one of the key GGR techniques, in particular for clean electricity generation, and potentially in industry (e.g., for cement manufacture) and the production of hydrogen. BECCS can result in negative emissions, since the growing of the original feedstock soaks up CO₂ from the air, as well as CO₂ being captured upon later combustion. Significant deployment of BECCS is anticipated by 2030, including retrofit projects in the power and industrial sectors. The Government will publish a biomass strategy in 2022 to consider how BECCS can play its part.

Another supported solution is the emerging technology of Direct Air Carbon Capture and Storage (DACCS). The Government has committed £100 million innovation funding to DACCS. As more nascent technology, significant DACCS deployment is likely to be later than BECCS (in the 2040s).

There are a few key challenges with any pathway relying on BECCS and DACCS:

- Their growth is largely dependent on the CCUS infrastructure being facilitated under the Government's wider CCUS programme, and industries/applications being available for connection in the areas supported by that infrastructure. Having sufficient businesses in place to locate BECCS in those areas is not guaranteed.
- Funding to support GGRs could be provided by extending the UK ETS to recognise GGRs, thereby allowing a market in GGRs and allowing them to be traded. The Government will consult on this in the coming months and more broadly on other business models to provide incentives to support GGRs in Spring 2022. However, the success of GGRs in achieving UK emission reductions and delivering a credible

market for them will depend on the level to which removals can be verified and confidence that the CO₂ will remain permanently sequestered.

The Government has committed to exploring options for robust monitoring, reporting and verification of GGRs to address this, possibly using an independent audit function.

- Environmental issues will need to be managed to allow sustainable BECCS deployment. These include, in particular, air quality issues from combustion of biomass, and intensive land use for growing bio crops causing land use conflicts and impacts on biodiversity. The Government commits to considering these issues in its 2022 Biomass Strategy.

Key role for hydrogen

Hydrogen will play a key role in the NZS, as one would expect given the Government's August 2021 Hydrogen Strategy which set out its ambitions for 5GW of low carbon hydrogen production capacity by 2030. There are a number of uncertainties about exactly what role hydrogen will play and the level of production that can be achieved.

The NZS assumes a combination of production methods involving electrolysis from renewable energy (green hydrogen), natural gas methane reformation with CCUS (blue hydrogen), and BECCS, each of which have different projected costs and timelines for potential commercial deployment. There are also other potential methods of production being studied. Given the currently high costs of hydrogen production, in August 2021 the Government consulted on a low carbon hydrogen business model to provide producers with more certainty on costs based on a Contract for Difference (CfD)-type mechanism, supporting both blue and green hydrogen projects. The NZS confirms that up to £100 million will be available to award contracts of up to 250 MW electrolytic hydrogen production in 2023, with a further allocation in 2024. This is in addition to various other sources of funding including a £240 million Net Zero Hydrogen Fund which will launch in 2022 and provide co-investment for new low carbon hydrogen up to 2025.

A major uncertainty is the exact make-up of likely end-uses moving towards 2050. Hydrogen has many potential uses: as an alternative fuel in transport (particularly heavy road and rail transport, aviation and shipping) and industry, and as a flexible fuel source and energy storage tool (through power-to-gas and gas-to-power electrolysis) in the power sector.

Another major uncertainty flagged in the NZS is the use of hydrogen in the heating of buildings (to replace natural gas). As mentioned in the 2050 scenarios above, 17GW of production by 2035 might be needed if hydrogen is the solution of choice for heating buildings in future, but only 10 GW if other electrification technologies win out; see further below. The Government will make a decision on the place of hydrogen in the heating of buildings by 2026, including a decision on conversion of the gas grid to hydrogen. Before that, a decision on trials to blend hydrogen into the gas grid would be made by 2023 (up to 20% in the gas distribution network, and 2% in the gas transmission network).

It is clear that the Government's hydrogen strategy (in particular, its focus on blue hydrogen projects and BECCS) will be dependent on the development of CCUS infrastructure and the Government's CCUS cluster programme. It is welcome that the NZS confirms that two CCUS projects (HyNet, and the East Coast Cluster) will be Track 1 clusters which will be supported for deployment in the mid-2020s, with a Scottish cluster as back-up if needed.

Heat and buildings

Despite numerous regulatory and incentive measures in recent years, the real estate sector stubbornly remains a high source of GHG emissions (17% of the UK total, not including emissions relating to embodied carbon in buildings). Heat in buildings is one of the intractable issues. A new UK **Heat and Buildings Strategy** was published alongside the NZS setting out plans for long-term building decarbonisation.

Improving the energy performance of buildings is a given in all scenarios, and the NZS notes that the Government

will respond later this year to its recent consultation on raising the Minimum Energy Efficiency Standard (MEES) for leased non-domestic properties to a 'C'/'B' rating by 2027 / 2030 (respectively) and for performance-based ratings for offices (see further our **March 2021 briefing**). Beyond this, the NZS confirms that the Government will consult on regulating owner-occupied non-domestic buildings and whether they should align to the MEES.

The NZS also provides for long-term minimum energy performance standards for new homes through the Future Homes Standard with a new interim uplift in emission standards from June 2022. The Government plans also to ramp up the MEES for leased homes to be consistent with net zero (as part of its response to consultation on proposals for a mandatory EPC 'C' rating by 2025 for new tenancies, and by 2028 for all tenancies). The Government is also looking at how to deal with owner-occupied homes, and will consider an ultimate backstop measure to ensure all homes meet net zero by 2050.

The other key part of the equation is how to replace gas as the primary source of heating for buildings. Chief among measures announced is a commitment to phase out new and replacement gas boilers by 2035, and ensuring that all boilers by 2050 will be low carbon-compatible. As a possible key alternative to gas, the NZS promotes the use of heat pumps powered by electricity. However, despite their efficiency, there are currently a number of barriers to mass deployment of heat pumps including their cost, the potential need to carry out significant building works to properties to accommodate them (e.g., insulation), and heat pumps being unsuitable for some properties (e.g., with lack of space for relevant equipment). High-profile measures to lower the cost of heat pumps to allow 600,000 installations per year have been announced to kick-start the market, including grants to homeowners and a market-based mechanism applying to manufacturers. The other main alternative to electrification with heat pumps is the use of hydrogen to replace gas in boilers,

if hydrogen provides cost-effective and is otherwise suitable for the mass heating of buildings. The NZS details plans for a village scale trial by 2025 and a possible 'hydrogen town' by 2030. A decision in 2026 would determine whether hydrogen heating would go mainstream.

It is surprising that the Heat and Buildings Strategy does not contain anything substantive on reducing emissions relating to embodied carbon in buildings through the construction process, suggesting that this can be left simply to broader industrial policies in the NZS. It would be preferable to have a more joined-up approach on this and possibly include proposals for mandatory reporting of embodied carbon emissions and, ultimately, firm reduction targets.

Sustainable finance

As part of its cross-cutting actions for the transition in the NZS, the Government has taken the opportunity to make some key announcements about the future of sustainable finance. The detail is provided in a new HM Treasury Report, **Greening Finance: A Roadmap to Sustainable Investing**. Key announcements include:

- UK Sustainability Disclosure Requirements will be put in place by 2022, including disclosure requirements for corporates, asset managers and asset owners, and investment products, based on Taskforce on Climate-related Financial Disclosure (TCFD) and taxonomy reporting.
- Confirmation that the UK Environmental Sustainability Taxonomy will be based on the EU taxonomy structure and six environmental objectives. The Government will consult on draft Technical Screening Criteria (TSC) for the climate mitigation and adaptation objectives in Q1 2022 (with legislation by the end of 2022) and the report hints at initially closer alignment with the EU Taxonomy TSC than had previously been indicated. The government expects to consult on the expansion of the climate TSCs and standards for the remaining four environmental objectives during Q1 2023.

- The FCA is working with HM Treasury on the development of a sustainable investment labelling regime.
- The government will adopt and endorse International Financial Reporting Standards (IFRS) Foundation-issued standards for sustainability reporting and build them into regulation.
- ESG data and rating providers may be brought under FCA authorisation and regulation; further detail will be provided next year.

The NZS also confirms the provision of at least £1.5 billion of funding to support net zero innovation projects, and for the UK Infrastructure Bank to support more than £40 billion of additional investment (as cornerstone investor or guarantor).

Final Comments

While the NZS and associated documents contain a vast number of policies, measures and commitments, there are a couple of notable omissions. There is nothing in the NZS about movements away from livestock farming or meat-heavy diets, which is surprising

given the Climate Change Committee's clear recommendation for policies encouraging less meat and dairy consumption in its advice to the Government on the 6th Carbon Budget. It is also notable that the NZS does not include a clear approach to a 'Just Transition' to the low carbon economy, an imperative of the Paris Agreement. While the NZS contains numerous predictions about creation of new low carbon jobs, and 'levelling up' areas, throughout the document, its social section on the wider impacts of the transition focuses only narrowly on energy prices and fuel poverty.

It is notable from the NZS that there are a number of potential routes to net zero which depend on many technological, economic and societal unknowns and uncertainties along a net zero path to 2050. Whether the NZS will be sufficient to persuade other, potentially hesitant, nations to commit to detailed plans for net zero paths around COP26 remains to be seen.



Annex – Key Net Zero Strategy policy commitments

Sector	Commitment
<p>Power</p>	<p>By 2035, the UK will be powered entirely by clean electricity, subject to security of supply.</p> <p>Secure a final investment decision on a large-scale nuclear plant by the end of this Parliament, and launch a new £120 million Future Nuclear Enabling Fund, retaining options for future nuclear technologies, including Small Modular Reactors, with a number of potential sites including Wylfa in North Wales.</p> <p>40GW of offshore wind by 2030, with more onshore, solar and other renewables – with a new approach to onshore and offshore electricity networks to incorporate new low carbon generation and demand in the most efficient manner that takes account of the needs of local communities like those in East Anglia.</p> <p>Moving towards 1GW of floating offshore wind by 2030 to put us at the forefront of this new technology that can utilise our North and Celtic Seas – backed by £380 million overall funding for our world-leading offshore wind sector.</p> <p>Deployment of new flexibility measures including storage to help smooth out future price spikes.</p>
<p>Fuel Supply & Hydrogen</p>	<p>We have set up the Industrial Decarbonisation and Hydrogen Revenue Support (IDHRS) scheme to fund our new hydrogen and industrial carbon capture business models. We will be providing up to £140 million to establish the scheme, including up to £100 million to award contracts of up to 250MW of electrolytic hydrogen production capacity in 2023 with further allocation in 2024.</p> <p>Introducing a new climate compatibility checkpoint for future licensing on the UK Continental Shelf and regulating the oil and gas sector in a way that minimises greenhouse gases through the revised Oil and Gas Authority strategy.</p>
<p>Industry</p>	<p>Following the Phase 1 of the Cluster Sequencing process, the Hynet and East Coast Clusters, will act as economic hubs for green jobs in line with our ambition to capture 20-30 MtCO₂ per year by 2030. This puts Teesside and the Humber, Merseyside and North Wales, along with the North East of Scotland as a reserve cluster, among the potential early SuperPlaces which will be transformed over the next decade.</p> <p>Future-proofing industrial sectors, and the communities they employ through the £315 million Industrial Energy Transformation Fund (IETF), (£289 million for England, Wales and Northern Ireland, £26 million for Scotland).</p> <p>Incentivise cost-effective abatement in industry at the pace and scale required to deliver net zero, through the UK ETS by consulting on a net zero-consistent UK ETS cap (in partnership with the Devolved Administrations).</p>
<p>Heat and Buildings</p>	<p>An ambition that, by 2035, no new gas boilers will be sold.</p> <p>A new £450 million three-year Boiler Upgrade Scheme will see households offered grants of up to £5,000 for low-carbon heating systems so they cost the same as a gas boiler now.</p> <p>A new £60 million Heat Pump Ready programme that will provide funding for pioneering heat pump technologies and will support the government’s target of 600,000 installations a year by 2028.</p> <p>Delivering cheaper electricity by rebalancing of policy costs from electricity bills to gas bills this decade.</p> <p>Further funding for the Social Housing Decarbonisation Scheme and Home Upgrade Grants, investing £1.75 billion. Additional funding of £1.425 billion for Public Sector Decarbonisation, with the aim of reducing emissions from public sector buildings by 75% by 2037.</p> <p>Launching a Hydrogen Village trial to inform a decision on the role of hydrogen in the heating system by 2026.</p>

Sector	Commitment
Transport	<p>A zero emission vehicle mandate to improve consumer choice and ensure we maximise the economic benefit from this transition by giving a clear signal to investors. This will deliver on our 2030 commitment to end the sale of new petrol and diesel cars, and 2035 commitment that all cars must be fully zero emissions capable.</p> <p>Further funding of £620 million for zero emission vehicle grants and EV Infrastructure, including further funding for local EV Infrastructure, with a focus on local on-street residential charging.</p> <p>Allocating a further £350 million of our up to £1 billion Automotive Transformation Fund (ATF) to support the electrification of UK vehicles and their supply chains.</p> <p>Building on the success of our £20 million zero emission road freight trials, we will expand these to trial three zero emission HGV technologies at scale on UK roads to determine their operational benefits, as well as their infrastructure needs.</p> <p>£2 billion investment which will help enable half of journeys in towns and cities to be cycled or walked by 2030.</p> <p>£3 billion to create integrated bus networks, more frequent services and bus lanes to speed journeys.</p> <p>Transformation of local transport systems, with 4,000 new zero emission buses and the infrastructure to support them, and a net zero rail network by 2050, with the ambition to remove all diesel-only trains by 2040.</p> <p>Building on the success of the Clean Maritime Demonstration Competition, we will be extending this to a multi-year programme, delivering real-world demonstrations and technology trials of clean maritime vessels and infrastructure to decarbonise the maritime sector. This is part of our commitment to a UK Shipping Office for Reducing Emissions.</p> <p>Significant investment in rail electrification and city rapid transit systems.</p> <p>Aim to become a world-leader in zero emission flight and kick-starting the commercialisation of the UK sustainable aviation fuel so people can fly, and connect without guilt. Our ambition is to enable delivery of 10% SAF by 2030 and will be supporting UK industry with £180 million funding for the development of SAF plants.</p>
Natural Resources, waste and fluorinated gases	<p>Supporting low carbon farming and agricultural innovation through the Farming Investment Fund and the Farming Innovation Programme to invest in equipment, technology, and infrastructure to improve profitability, benefit the environment and support emissions reductions.</p> <p>We will boost the existing £640 million Nature for Climate Fund with a further £124 million of new money, ensuring a total spend of more than £750 million by 2025 on peat restoration, woodland creation and management – above and beyond what was promised in the manifesto. This will enable more opportunities for farmers and landowners to support Net Zero through land use change.</p> <p>Restoring approximately 280,000 hectares of peat in England by 2050 and trebling woodland creation rates in England, contributing to the UK's overall target of increasing planting rates to 30,000 hectares per year by the end of the Parliament.</p> <p>£75 million on net zero related R&D across Natural Resources, Waste & F-gases, to inform our pathway to 2037.</p> <p>To support our commitment to explore options for the near elimination of biodegradable municipal waste to landfill from 2028, we are bringing forward £295 million of capital funding which will allow local authorities in England to prepare to implement free separate food waste collections for all households from 2025.</p>

Sector	Commitment
Greenhouse Gas Removals	<p>Delivering £100 million of investment in GGR innovation could enable further deployment of GGRs, which in turn will leverage private investment and demand for transferrable engineering expertise from the UK's oil and gas sector.</p> <p>Explore options for regulatory oversight to provide robust monitoring, reporting and verification (MRV) of GGRs, following the recommendations of the BEIS-led MRV Task & Finish Group involving experts from industry and academia.</p>
Supporting the transition with cross-cutting action	<p>Deliver at least £1.5 billion of funding to support net zero innovation projects.</p> <p>Use the UK Infrastructure Bank (UKIB) to crowd in private finance, support more than £40 billion of investment, and pull through low carbon technologies and sectors to maturity and scale.</p> <p>Introduce a new Sustainability Disclosures Regime, including mandatory climate-related financial disclosures and a UK green taxonomy.</p> <p>Reform the skills system so that training providers, employers and learners are incentivised and equipped to play their part in delivering the transition to net zero.</p> <p>Publish an annual progress update against a set of key indicators for achieving our climate goals.</p>

Extracted from the UK Net Zero Strategy

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