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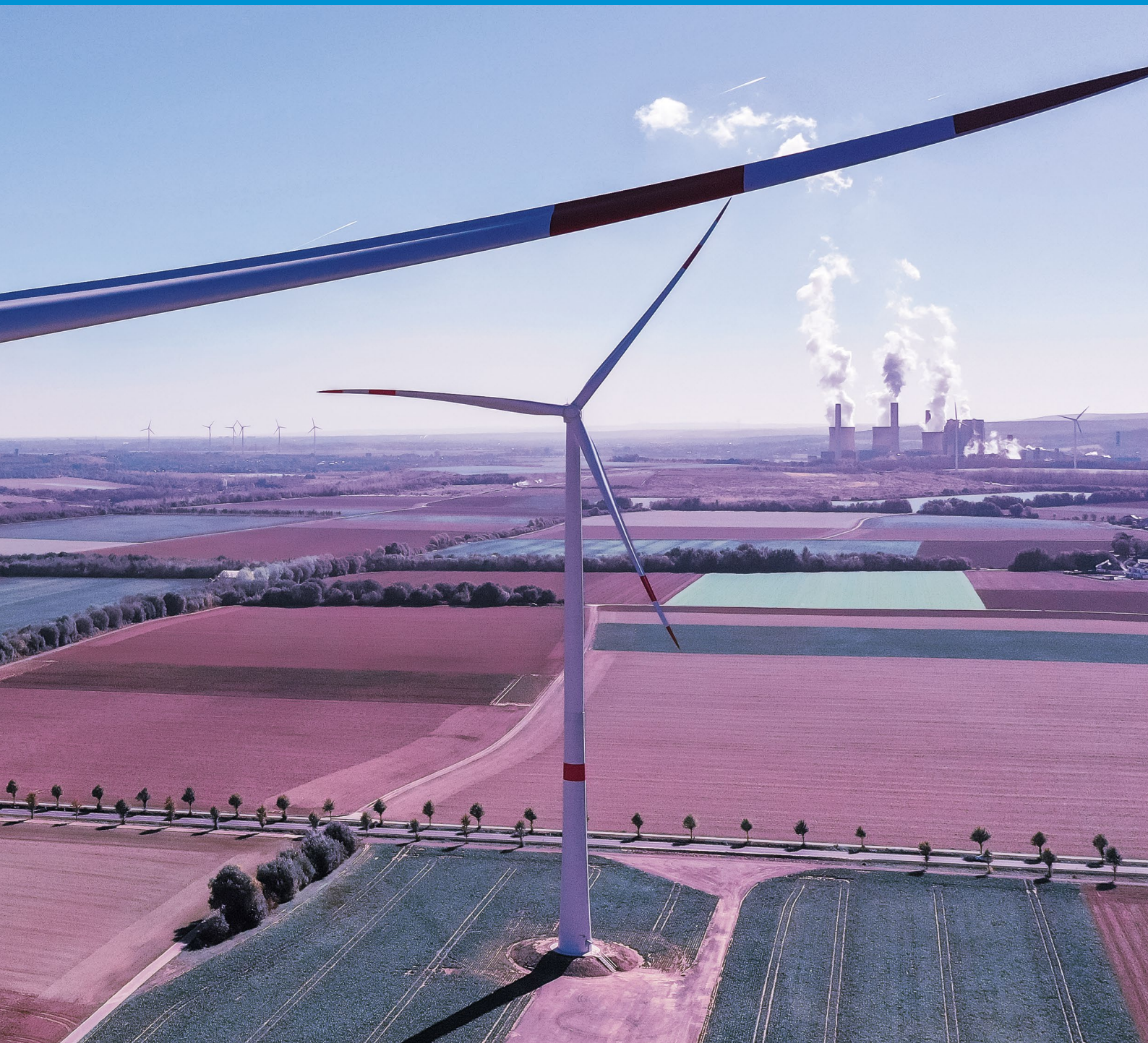
Decarbonising energy

Opportunities and obstacles on the road to Net Zero



Decarbonising energy

As the urgency of tackling climate change continues to climb the political agenda, policymakers and corporations are seeking actionable solutions to a low-carbon energy transition.

Net Zero in numbers

7.6%
ANNUAL REDUCTION IN GLOBAL EMISSIONS REQUIRED TO 2030

2,800
MT CO^2 IN **2020**

100%
REDUCTION IN UK GHGES TARGETED BY 2050 VS 1990 LEVELS

1.5°C
AVERAGE GLOBAL WARMING TARGET (VS PRE-INDUSTRIAL LEVELS) ESTABLISHED BY THE 2015 PARIS AGREEMENT

2.5 million
HEAT PUMPS NEED TO BE ROLLED OUT IN THE UK BY 2030

85%
OF UK HOMES NEED TO BE AT LEAST EPC CLASS C BY 2050

263 GW
INSTALLED GENERATION CAPACITY NEEDED IN THE UK BY

2050, MORE THAN DOUBLE

2020 LEVELS

Sources: United Nations Environment Programme; National Grid; Committee on Climate Change

Opportunities and obstacles on the road to Net Zero

What is Net Zero?

In the wake of the Paris Agreement – the first universal, legally binding global climate change agreement, adopted at the Paris climate conference (COP21) in December 2015 – public interest in the implications of rising global greenhouse gas emissions (GHGEs) has increased significantly.

In June 2019, the UK made history by becoming the first major economy to legislate for Net Zero emissions by 2050. This means the UK is committed to removing or neutralising all domestic GHGEs within the next 30 years.

How can the UK achieve its target?

The scale of change required to deliver Net Zero should not be underestimated.

The reduction in energy demand caused by the Covid-19 lockdown led the International Energy Agency (IEA) to forecast a near 8% decline in global CO2 emissions for 2020 – roughly equivalent to the annual declines required to achieve the 1.5°C average global warming target established by the Paris Agreement, illustrating the scale of change needed to get to Net Zero.

Achieving neutral emissions by 2050 will require wholesale disruption to the functioning of energy systems, industries, individual behaviour and personal lives over the next 30 years, starting now.

What role can renewable energy play?

To get anywhere close to a 100% carbon-free society will require investment in wind, solar, nuclear, energy storage, hydrogen and carbon capture, utilisation and storage (CCUS) technology at an unprecedented scale over the next 30 years.

Renewable power facilitates the decarbonisation of electricity cheaply and at scale and, consequently, increases the electrification of energy use. Other benefits include reduced pollution, enhanced supply security and price stability and lower generation costs.

Opportunities and obstacles on the road to Net Zero
continued

Why is UK renewable energy now (largely) subsidy-free?

The consequence of generous subsidies in developed economies was unforeseen levels of private sector investment, leading to concerns about the larger than estimated impact on consumer bills.

The result was a rapid rewriting of subsidy policies in several economies, which included the closure of the feed-in tariffs (FiT) and renewables obligation (RO) schemes in the UK.

Auctioning renewable capacity is now widely regarded as the most economically efficient means of procuring additional capacity at the lowest practicable cost – as in the UK with the contracts for difference (CfD) regime and, to a more modest extent, the capacity market (CM).

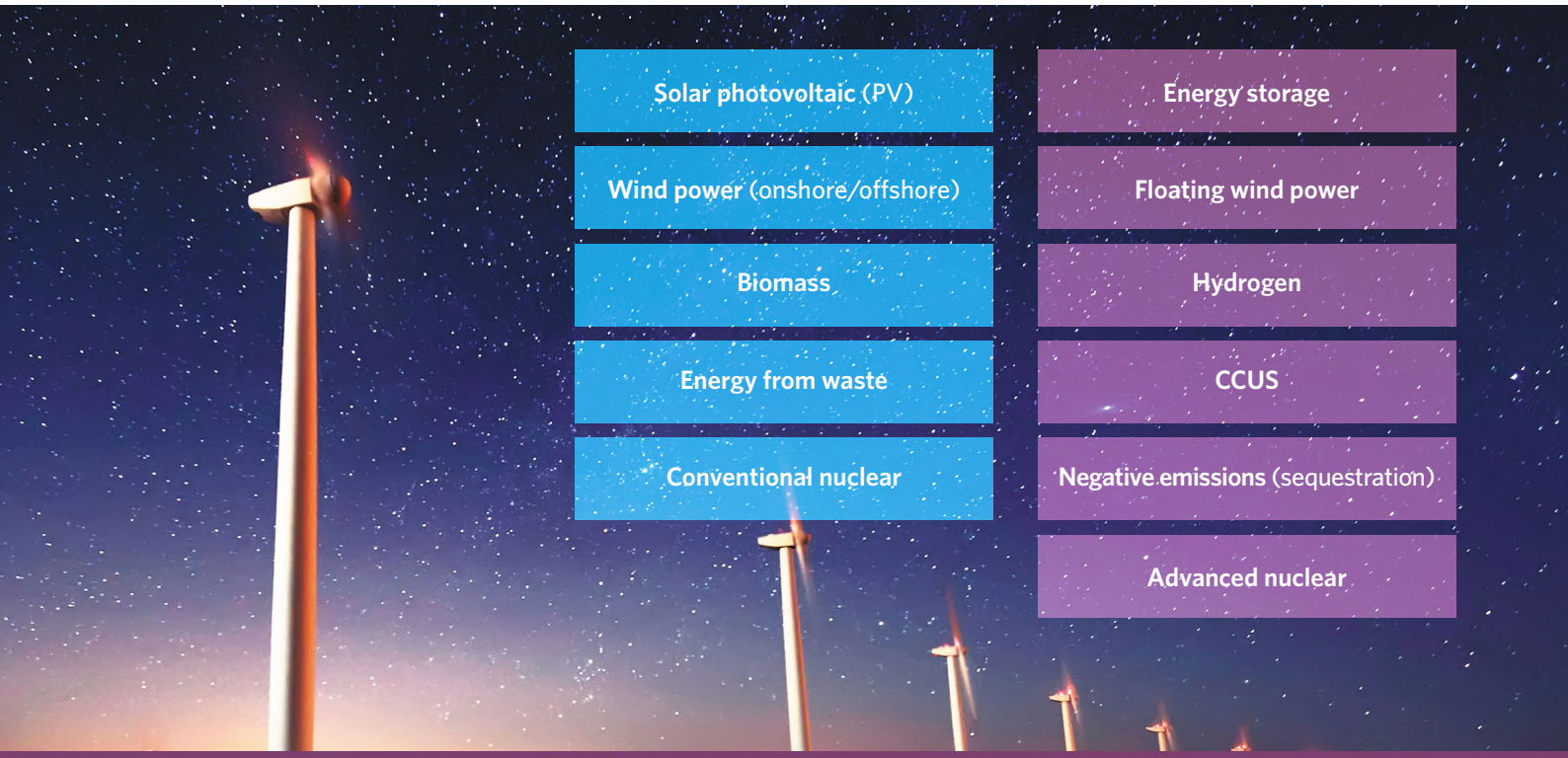
On 2 March 2020, the government reversed its subsidy ban for onshore wind farms and confirmed such projects (and potentially floating wind projects) will be eligible for subsidies under the next phase of the CfD regime from 2021.

But the upshot of rigorous price competition encouraged by winding down subsidies is that, by the early 2020s, all available renewable power generation options will compete head to head with fossil incumbents, and renewable technology is expected to become the cheapest option in many countries.

With growing penetration of renewable generation, it is increasingly important to look beyond the marginal cost of a particular technology to the total system costs (additional costs associated with incorporating a particular technology into the electricity system).

What are the UK's future renewable energy options?

The choice of technology is crucial in driving the transition to low-carbon generation. The UK has several options of technologies to invest in and develop, some of which are more advanced and more suited to the UK than others.



What policy factors affect our ability to reach Net Zero?

UK energy policy has generally not supported swift decarbonisation of energy, having created a tight bottleneck in renewable project developments and, until relatively recently, continuing to significantly favour the fossil fuel industry.

2019 was a watershed year for UK energy policy. The first seven years of the last decade saw a steady stream of renewable energy projects commissioned, but thereafter renewables took a heavy hit from the withdrawal of public subsidy mechanisms.

While the UK government remains committed to oil and gas for the time being, now that Net Zero has become law, the conversation has become about how to deliver it, at what cost and by when.

Based on National Grid's Future Energy Scenario 2019 (FES 19) and wider policy moves to decarbonise energy and reduce emissions, the following should be priority focus areas for future UK energy policy (see the recently published **FES 20** for further detail on how this focus should be applied).

Thermally-efficient homes

Around 18% of the UK's CO2 emissions come from the residential sector (mostly heating and cooking).

National Grid's Net Zero sensitivity analysis anticipates homes will need a minimum of 36% less energy for heating compared to 2020 (due to efficiencies they will have achieved) and that all heating will need to come through green power sources.

Achieving this will require:

- Significant improvements in thermal efficiencies of homes (85% of homes need to be at least EPC class C by 2050);
- Continued improvements in appliance efficiency;
- Immediate and large-scale rollout of heat pumps (2.5 million by 2030); and
- The provision of heat through electric or hybrid heat pumps using zero-carbon electricity and/or decarbonised gas (being either biogas from anaerobic digestion or green hydrogen).

Challenges to enhancing thermal efficiency include the age of much UK residential property and the difficulties and costs of retrofitting insulation.

What policy factors affect our ability to reach Net Zero?
continued

Growth in generation capacity

Peak electricity demand is predicted to be approximately double 2018 levels by 2050.

Total installed generation capacity in the UK stands at 108GW in 2020, and FES 19 predicts this needs to more than double to around 263GW by 2050 to achieve Net Zero. This assumes a six-fold increase in offshore wind generation (from 2018 levels) and the largescale deployment of small modular nuclear reactors (a form of power generation not yet proven at commercial level).

Almost all the existing generation fleet will need to be replaced or repowered, as much of it will have reached the end of its economic generating life by 2050.

Electric vehicles

National Grid proposes that achieving Net Zero requires a total ban on petrol, diesel and hybrid cars by 2050.

The network of batteries within electric vehicles (EVs) will potentially provide grid flexibility and help integrate a higher level of renewable generation on the system (this assumes that over 75% of EVs will use 'smart charging' technology by 2050, which requires behavioural change by drivers).

The Net Zero sensitivity assumes HGVs will use hydrogen as fuel, meaning more demand on hydrogen production through electrolysis or natural gas with CCUS.

Interoperability

National Grid recognises the need for more interaction between gas and electricity markets in new applications (such as heat pumps) – i.e., a 'whole system' approach to energy.

Electricity generation must become entirely low-carbon (as opposed to 53% low-carbon in 2020) and there needs to be a fundamental move away from transmission-connected generation (71% in 2020) in favour of decentralised generation.

Natural gas will need either to become carbon neutral (through CCUS) or be replaced by hydrogen.

Behavioural change

National Grid's Net Zero sensitivity assumes consumers are highly engaged with the need to reduce emissions and will make choices based on this understanding.

It is hoped/anticipated that advances in technology will make these choices more attractive than alternatives.

Interconnectors

Energy imports via interconnectors account for between 5 and 10% of total UK supply (trending upwards as more interconnectors are built and short-term fluctuation in the UK generation mix increases).

Interconnectors provide cross-border transmission capacity connecting different electricity markets, allowing operators to respond to price differences across markets (e.g., those driven by localised weather patterns).

What UK energy regulatory reforms are anticipated?

The UK needs to urgently define and promote a coherent policy framework that can deliver a credible route to Net Zero.

It had been anticipated that the UK government's long awaited 'Energy White Paper' and accompanying transportation decarbonisation plan, heat policy road map, Net Zero consultation, aviation consultation and an English tree strategy would chart a course towards a neutral emissions economy.

Originally due to be published in summer 2019, the White Paper has been postponed numerous times. The most recent target date for publication is autumn 2020, although government has promised to "build back better" as part of a "green recovery" from the economic impacts of Covid-19, which may have implications for the White Paper.

Since it was first mooted, there have been several "teasers" from the government about what the White Paper will cover and focus has not surprisingly shifted with time. It has become apparent that a whole system approach is needed.

Areas that need to be addressed in formulating a policy framework for Net Zero (including the White Paper) include:

- **Heat** – Electricity decarbonisation is the low hanging fruit in making energy greener. Heat is a much harder nut to crack. Both domestic and industrial heat need significant investment and policy support to reduce emissions from this sector. The progress made in decarbonising electricity must also continue.
- **Built environment and energy efficiency** – The UK has a lot of ageing, poorly insulated housing stock and a dominance of gas fired heating. Building regulations need to be overhauled and retrofitting of energy efficiency measures must be facilitated.
- **Planning reform** – There have been recent helpful changes in planning rules for energy storage projects, but there is still a need for planning reform, in particular around EV charging infrastructure and onshore wind.
- **Carbon pricing** – The UK is considering a number of options once it leaves the EU ETS at the end of 2020, including setting up a standalone UK ETS (possibly joined to the EU ETS) and a Carbon Emissions Tax (which it plans consult on later in 2020). This is already causing issues in the forward energy trading markets. A coherent approach to emissions pricing is also required.
- **Carbon Capture Use and Storage (CCUS)** – CCUS is vital in achieving Net Zero, but the government needs to reassure potential investors that it is serious about CCUS. Two previous programmes ended in the government withdrawing support for schemes and investors are understandably nervous. The government needs to show it has listened to investors' concerns. The most recent consultation is encouraging in this regard.
- **Nuclear** – Nuclear is another area where the government needs to provide certainty regarding its approach so that investment can be made with confidence.
- **Regulatory and institutional reform** – There will need to be changes to industry codes, governance arrangements and institutions. These changes are potentially wide-ranging and represent an opportunity to streamline and simplify existing arrangements.
- **Digitalisation** – The smart meter roll out illustrates the challenges of digitalising antiquated systems. Lessons need to be learnt from this experience and the data and privacy implications of digitalisation are becoming increasingly important.

How can businesses and individuals do their bit?

Bottom-up approach

One of the surprising consequences of the UK's Net Zero legislation is that the drive for decarbonisation is currently being driven more by industry and people than government. The ongoing delays with respect to the Energy White Paper are symptomatic of the lack of policy direction.

This has meant that industry is making its own plans:

- **Oil and gas majors** have set their own ambitious Net Zero targets; this will help stimulate and incentivise supply chains to adapt to ensure these are deliverable.
- **The transport industry** is investing heavily in EVs (small cars and vans) and non-conventional fuels (particularly the application of hydrogen to shipping, aviation and heavy goods).
- **Manufacturing and big tech companies** are signing corporate power purchase agreements (CPPAs) to tie-in long-term supplies of renewable energy – a trend that is likely to extend to other large corporate power users.
- **The energy industry** has redirected investment from coal and gas to renewable technologies, mainly wind and solar but also new forms of energy storage, while aggregators have begun collecting smaller generation projects and trading them in the main markets as joined-up portfolios (and virtual power projects).
- **Utilities** are exploring ways of delivering energy as a service rather than a product, promoting flexible intelligent networks and decarbonised local heating systems.
- **The agricultural industry** is taking steps to minimise the "intractable" emissions associated with agricultural techniques and a reliance on meat based diets.
- **Individuals** are appraising their own behaviours, particularly around travel, working practices, shopping habits and diets.

Funding, proving and commercialising new technologies

New kinds of energy technology will be needed to help the UK decarbonise its energy use and neutralise all emissions by 2050.

This is already happening in the emergence of start-ups exploiting opportunities in small nuclear and new nuclear technology; energy storage (including batteries, compressed air, ammonia and molten salt); carbon capture technologies; and electrolysers.

Experience suggests that the most promising technologies will partner with or be acquired by large utilities and energy companies.

What are the opportunities of Net Zero?

Moving from an 80% emissions reductions target to a 100% target means there are no winners or losers in the race to Net Zero. Many technologies and all parts of industry and society have a role to play.

It is accepted that the energy mix will be renewables-based, heavily supported by firm low-carbon power (either nuclear or gas with CCUS) and that fossil fuels cannot be burned without carbon capture technology.

New forms of higher capacity, longer duration energy storage will be required and networks will need to be increasingly flexible to accommodate rapidly shifting generation profiles (due to large contributions from intermittent wind and solar).

Frequency support and inertia will become more important as conventional thermal plants come off-line and electrification of heat (e.g. air source or ground source heat pumps) and transport (EVs) will lead to a significant rise in energy demand.

Efficiency will become as important as generation and every source of electricity production, consumption and storage will be evaluated for its potential to offer flexibility to the grid.

This offers considerable opportunities for new clean technology to provide commercially successful solutions to different aspects of the Net Zero challenge.

This white paper was based on ***"Decarbonising Energy: The Pathway to Net Zero"*** by **Hugo Lidbetter**, a partner in the energy and natural resources team at European law firm, Fieldfisher.