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1. Balancing Renewables

Two years after Britain's first coal-free day since the Industrial Revolution, the nation's network operator is readying itself for life without any fossil fuels. (April this year saw the record broken again with a coal-free period lasting more than 90 hours). The grid may start dropping its need for natural gas power for short periods in about 2025, coinciding with coal's complete phase-out. The National Grid Electricity System Operator (ESO) wants the system to be "zero-carbon capable" by then. Today natural gas regularly provides more than half of the U.K.'s electricity, but increasing wind and solar power output means the need for the fossil fuel is sometimes very low, falling below a quarter of usage on windy days. To keep the system balanced, the network may need new technology such as flywheels and supercharged capacitors. Large coal and natural gas power stations give the network more resilience, known as inertia, because they have heavy spinning shafts and turbines, while solar and wind plants reduce grid stability as they are dependent on weather conditions. (1)

ESO's new report says the electricity grid will be able to operate 'safely and securely at zero carbon' by 2025 whenever there is sufficient renewable generation online and available to meet demand. By then, ESO will have transformed the operation of the electricity system and put in place the innovative systems, products and services to ensure that the network is ready to handle 100% zero carbon. This means a fundamental change to how the system was designed to operate; integrating newer technologies right across the system – from large-scale off-shore wind to domestic scale solar panels – and increasing demand-side participation, using new smart digital systems to manage and control the system in real-time. (2)

Renewables' growing share of power generation in the UK holds both challenges and opportunities for system operators, perhaps best evidenced by events in late March when soaring wind and solar generation combined with a collapse in demand sent wholesale prices tumbling into the negative for six straight hours. And such events are only set to become more common, with research and analysis firm Cornwall Insight forecasting that instances of negative pricing in the Balancing Mechanism could spiral by 2034. In spite of those challenges, National Grid insists that it has the right suite of tools to maintain the electricity system. (3)

There will be times of the year when the market could meet the total demand for electricity through renewable generation only and these periods will increase as more and more renewables are connected and more load actively participates in the market. This is very different to the traditional model of power system operation and, to enable all of this low carbon generation to operate unconstrained, requires ESO to address and solve some critical engineering challenges. Today, to manage this system safely and securely, we need to bring on conventional power plants (typically gas or coal plant) to provide key system and balancing services such as voltage control, inertia and frequency response (high and low). ESO's ambition is that, by 2025, it will have transformed the operation of the electricity system so that it can operate safely and securely at zero carbon whenever there is sufficient renewable generation on-line and available to meet the total national load. (4)



100% Renewables

Fossil fuel advocates in the US say the polar vortex which hit parts of the Midwest and Northeast at the end of January bringing temperatures cold enough to cause frostbite on exposed skin in just five minutes, showed how important coal is to energy security – 100% renewable energy would leave people in the lurch in periods of extreme weather. So the Sierra Club asked energy experts how a 100% renewable grid could cope with extreme weather. In general, they agreed, we'll do just fine—as long as we're properly prepared. *"This is straightforward,"* said Mark Jacobson, professor of civil and environmental engineering at Stanford and the guy who created science-based, 100% clean energy roadmaps for the world. All types of energy are vulnerable to extreme weather, so we need to be prepared anyhow. Distributed technologies help reduce peak loads and the need for utility-scale storage. *"Puerto Rico was without power for 11 months and that's because you had 10 centralized fossil fuel plants instead of distributed wind and solar,"* said Jacobson. In the post-Maria rebuilding, however, *"their grid will be largely solarized with batteries, so if one portion goes down, the rest of them are still up."* Increasing the amount of storage capacity will also help, and customers can be incentivised to reduce peak demand. (5)

A new study by the Energy Watch Group in Berlin and Lappeenranta University of Technology (LUT) in Finland outlines a *"technically feasible and economically viable energy pathway for Europe, in which the energy sector (comprising power, heat, transport, and desalination) can reach 100% renewable energy and zero greenhouse gas emissions by 2050"*. The report, launched on the sidelines of the COP climate summit in Poland last December, claimed that the transition could be achieved using existing renewable energy technologies: *"The energy transition is not a question of technical feasibility or economic viability, but one of political will."* What's more, it would create at least one million more jobs in energy and be more cost-effective than the present fossil fuel-based system. (6)

The 4½ year study that examined how to meet the goals of the Paris climate accords without such measures as carbon capture and geoengineering. This historic study models the global energy system on an hourly basis using the real economics of existing renewable energy technologies. A unique first, and essential ammunition for all worried about climate change. It concludes that zero carbon emissions from power, heat transport and desalination is possible by 2050. The study predicts that solar will provide 69% of the energy required. Electricity, increasingly used for heat and transport, provides 90% of primary energy. By 2050 solar PV and wind generate 95% of global electricity. Energy storage meets 23% of electricity demand and 26% of heat demand. The growth of renewable jobs more than compensates for the loss of jobs in fossil fuels. (7)

Responsive Flexibility

Meanwhile the European Marine Energy Centre (EMEC) has announced the first phase of a £28.5m ReFLEX (Responsive Flexibility) project to create a Virtual Energy System in Orkney. The 'first-of-its-kind' project will interlink various energy assets and services into one controllable system. The project is funded by UK Research and Innovation through the Industrial Strategy Challenge Fund and is being led by the EMEC. It also brings together a



consortium of Orkney-based partners, including: Solo Energy, Aquatera, Community Energy Scotland, Heriot-Watt University and Orkney Islands Council. (8)

The scheme includes plans for a locally-powered electric bus and electric bike "integrated transport system" on the islands, as well as the mass roll-out of electric vehicles. Meanwhile, up to 500 domestic and 100 large-scale batteries will be used to store renewable energy, allowing it to be pumped into the grid when winds drop or the sun disappears.

Orkney has a very high level of renewable generation from wind and solar, and other forms of generation such as wave and tidal, but also the highest level of fuel poverty in the UK. Yet community owned wind turbines often sit idle due to a lack of grid infrastructure to export the electricity to the mainland. The ReFLEX project involves deploying battery systems and smart electric vehicle charging to balance the intermittency of renewables. Solo Energy provides the software platform to control battery systems across the grid to respond to the intermittency of renewable generation.

Orkney is already a world-leader in wave and tidal technology and boasts a high uptake of electric vehicles. The latest project aims to deploy up to 600 extra electric vehicles and 100 flexible heating systems, as well as a Doosan industrial-scale hydrogen fuel cell which produces eco-friendly energy and heat. Once demonstrated in Orkney, experts hope the "virtual energy system" - which aims to link up local electricity, transport, and heat networks into one controllable, overarching system - will be rolled out across the UK and internationally. (9)

Robert Leslie, Energy Officer at Orkney Housing Association, describes the gap between 'energy rich' Orcadians — those with the means to invest their own capital in personally owned assets (such as a small turbine, solar panel, or electric vehicle) and the majority of 'energy poor' islanders. The latter pay exorbitant prices for electric heating and at the petrol pump. Of the housing association's 772 tenants, 66 percent are in fuel poverty, with 22 percent in "extreme fuel poverty" where more than 20 percent of their income is spent on fuel costs. (10) There is no gas grid on Orkney and the electrical supply can cost as much as 17p per kWh, making it among the highest in the UK.

Neil Kermode, Managing Director at EMEC said: "This new model will demonstrate how we can better interact with, own and manage our integrated energy systems locally, both at individual and community level. 50% of the project is being funded privately indicating the appetite that exists within the partners to make this project work. Orkney has already demonstrated high commitment for local sustainable energy solutions and the county is well on its way to decarbonising each aspect of the energy system." (11)

The carbon intensity of the electricity that Orkney generates and feeds into the main grid is almost the lowest anywhere in the world, at just 13g CO₂/kWh. Only El Hierro, in the Canary Islands, beats it. Hydrogen is Orkney's latest possible game-changer. Orkney Islands Council, a significant force in the developments, is running a fleet of hydrogen-fuelled vans. EMEC is a key player in these changes. Hydrogen technology has developed in Orkney, in part, because the islands had a problem. This archipelago has more than 500 wind turbines and developing tidal renewables, so it is generating too much electricity for its own needs – it now produces the equivalent of 120% of its electricity demand – and wasn't able to send more down the line to the grid. Communities had erected wind turbines but were not seeing the expected revenue



returns, and were having their generation curtailed, some to just 50% of what they could generate. So great is the problem that currently there is a moratorium on further wind development.

As part of EMEC's European Union and Scottish Government-funded Big Hit project, hydrogen heating boilers are being fitted in a school on the Orkney island of Shapinsay. Meanwhile, a car ferry is under construction which will run on hydrogen, and this year will see the installation of a hydrogen system into one of the ferries currently running between Shapinsay and Kirkwall. (12)

Other demonstrator projects in Oxford, and West Sussex also aim to show how local energy projects can be delivered at scale to forge new business models and provide cheaper, greener energy services to local residents. At the 'Energy Superhub' in Oxford, project lead Pivot Power is planning to install the world's first transmission-connected lithium ion and redox-flow hybrid battery that will help balance electricity demand on the grid. The scheme will also see a network of 320 ground source heat pumps installed for social housing, and AI technology deployed to ensure energy is being used in the smartest, most efficient way possible. In West Sussex the 'Smart Hub SLES' project will deploy hydrogen and electric vehicle charging alongside demand-side response technologies to create a local, flexible and efficient energy system. (13)

The Edinburgh-based energy technology firm Flexitricity will be working on the West Sussex project alongside Honda to help local communities tap into cheaper and greener power. The project will integrate energy management across council housing, private residential properties, transport infrastructure and commercial properties. It plans to use innovative technologies, including a hybrid hydrogen and electric vehicle filling station, alongside more established ones such as heat networks. Flexitricity's technology will be used to establish a virtual power plant which can monitor and respond to energy demand and generation in the local area. Other partners in the project include Connected Energy, ITM Power, Moixa Technology, Passiv-Systems, Switch2 Energy and West Sussex County Council. (14)

Moixa says the virtual power plant could cut energy costs by 10% and save the UK £32 billion if rolled out nationally. (15)

Renewables-plus-storage revolution

Dr David Toke is Reader in Energy Politics in the Department of Politics and International Relations in the University of Aberdeen says three recent developments led by independent companies herald the beginning of the renewables-plus-storage revolution in the UK. Slowly but surely companies using battery technology are edging forward towards what will be a means of balancing very high levels of renewable energy generation without the need of fossil fuel reserve. But it is independent companies that are leading the way

One was the start of the installation of a subsidy free solar plus battery project by the independent sustainable energy company Gridserve. Second is the opening up, by Ofgem, of the electricity balancing market to 'aggregators' who can put together solar pv and battery units in houses to provide balancing services. This will allow companies like Social Energy to use digital technology to link together home solar energy and storage systems to provide not only energy but services that will be equivalent to capacity to increasing portions of the electricity market.



The third development was the start of a programme to build storage systems to substitute for electricity distribution upgrades to provide power for bus depots, again by an independent company called Zenobe. All these developments will not only reduce the need for extra grid and distribution capacity, but also they will reduce the need for peak generating capacity.

A third of our electrical generating capacity (20 GW out of 60) is peak, so potentially we could dispense with most of that peak with storage. Peaks occur, typically (in the UK) at morning and in evening. The peak lasts for 2 hours. So in order to provide storage to cover for this we need, say, 40GWh storage to avoid 20 GW peak capacity for each peak time session. Each Nissan Leaf has 24kWh storage, so if you used only half of that and there were 10 million cars with equivalent batteries, you'd have that's 10 million times 12kWh storage or 100 GWh. And you can have home based or industrially based batteries to do the same and more. In other words the potential is massive.

Toke says renewable energy is rapidly eating up the electricity generation market. Already in 2018 a third of UK electricity was supplied by renewable energy. This week the Government has announced how offshore wind will supply a further 35 per cent by 2030. More should come on top of this of course. What we need is the system to change to balance these supplies using and growing the increasing energy storage options. In fact the big companies, in the main, just issue press releases and spend large amounts of consumers' money on installing so-called 'smart meters' that do little to help. They do not, in practice, deliver the balancing services we ought to be getting, especially allied to storage. But the big electricity companies are being supplanted by innovative information technology age companies based on providing renewable energy and storage. The dinosaurs will go out of business. The only question is: how quickly? (16)

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2. Capacity Market

The UK Capacity Market was established by the Government in 2014. Tempus Energy - a 10-strong technology company, which specialises in unique software that unlocks demand flexibility in its connected customers – successfully challenged the Capacity Market in the European Court on the basis that its design ensured profits for coal, gas and diesel generators, leaving cheaper, cleaner alternatives virtually unable to compete, shutting out more innovative solutions for guaranteeing supply, which are actually cheaper for customers.

Tempus Energy's technology uses artificial intelligence (AI) and smart algorithms to control and optimise when flexible assets use energy. By predicting volatility in carbon intensity and market prices it allows customers to reduce their energy costs - while simultaneously enhancing their use of renewables. Demand flexibility allows more green energy to be utilised when it is available, and mitigates the need for expensive fossil fuel power stations to be kept in reserve for energy spikes. The system moves energy demand to react to available supply.

Tempus Energy challenged the structure of the capacity markets before the first auction even began. The rules were clearly skewed in the favour of polluting fossil fuel generation and four years' worth of auctions since then have demonstrated this. With £5.6bn committed, almost £4.2bn went to fossil fuel generators, around 74% of the total. Almost £800m of these payments were to fund new and existing peaking plants around the country. The vast majority of these peaking plants run on diesel, contributing to both climate change and the air pollution which leads to deaths of up to 40,000 a year in the UK. It is not for a lack of alternatives; analysis of the capacity auction market data shows that polluting technology was incentivised over demand side response and storage programs. A properly designed Capacity Market will fairly incentivise clean, green technology solutions at least as much as it incentivises the extension of old coal and new build of diesel.

Sara Bell CEO of Tempus Energy said the European Court ruling should ultimately force the UK Government to design an energy system that reduces bills by incentivising and empowering customers to use electricity in the most cost-effective way – while maximising the use of climate-friendly renewables. (1)

Nobody thought they would win but the Tempus Energy triumph has rocked the industry to its core. The November court ruling has forced the scheme, which aims to stem the closure of power plants by awarding supply contracts worth £1bn a year, into a legal limbo that could take years to resolve. The move strikes a blow to the heart of the energy system by posing an existential threat to plant operators and a “real and present danger” to the UK's energy security, according to industry lobbyists Energy UK. The back-up capacity sector has been brought to a standstill, wiping hundreds of millions of pounds from the market value of Britain's biggest players at a stroke. (2)

The Telegraph revealed that Greenpeace was one of the financial backers of the Tempus Energy campaign and is now funding further legal action in the English courts that aims to force the Government to comply with the decision by the European Court of Justice.



Dave Toke says the market is a major barrier in the transition to a 21st century renewable energy and energy efficiency based 'new energy economy'. It should be scrapped as soon as possible. The very concept of propping up the 20th century model of centralised power plant delivering power through a vertically integrated system, which is what the capacity mechanism (CM) supports, is fundamentally wrong. The misplaced notion behind the CM is that the state needs to intervene to provide an additional signal (besides existing power markets) to ensure that conventional power plant are brought into to balance the load of so-called 'intermittent' renewable energy sources. Policymakers have mainly identified as combined cycle gas turbines, CCGTs, or nuclear power plant, as supplying the needed 'firm' capacity. This traditional system of course is run by the utilities, whose policy advice the Government have swallowed whole. (4)

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3. Decarbonising Heat

The Chancellor has announced a ban on fossil fuel heating in all new homes from 2025. The move would see green alternatives such as heat pumps being installed as standard in all new homes. “an overdue but positive step forward,” said Friends of the Earth’s head of political affairs, Dave Timms. *“But we can’t continue to neglect our existing housing stock, many of which leak heat and cost a fortune in fuel bills. The Chancellor did nothing to reverse the massive cuts to home energy efficiency programmes which have seen insulation rates plummet to almost zero.”* (1)

Professor Dave Elliott says there is a polarity of views about decarbonising heat and transport – essentially between backers of “pipes” and “wires”. The electric wire lobby says the energy system can best be decarbonized by sending power from wind, solar and other renewables to energy users down wires, including for heating and for charging electric vehicles (EVs). The pipe lobby says that, for heating, it makes more sense to stay with the gas grid and standard appliances but switch over to green gas. That way, you don’t have to make many changes whereas to use electricity efficiently you would have to install expensive heat pumps in every house. Green gas can also be used for vehicles, as compressed natural gas already is. The situation is complicated by the addition of another pipe option — the supply of heat direct to users. In high-density urban environments, district heating can make more sense than individual domestic boilers, and heat networks could supply perhaps half of UK heat.

There is now a growing interest in so-called “power to gas” (P2G) hydrogen options. The P2G grid-balancing approach essentially offers a way to store power until it is needed, with hydrogen or methane storage being much easier than direct electricity storage, for example in batteries. Large volumes can be stored over long times. However, there is another approach; heat can also be stored in bulk over long periods with low losses. Devotees of CHP argue that, if linked to heat stores, it too can offer a grid-balancing option, given that the ratio of power to heat output can easily be changed. When there is plenty of green power, the power output from a CHP plant can be lowered and the heat output stored, if it too is not needed. When power demand rises, the CHP plant power output can be raised, and if heat is needed, it can be supplied from the store. Integrated systems that cross the boundaries between heat and power may prove to be the way forward. But if we are to seek optimal mixes of heat and power, wires and pipes, we must move away from assuming that electricity is always the best option. (2)

Renewable vs Steam Methane Reforming

There are two main ways to make low-carbon hydrogen. The first builds on existing production methods where natural gas is “reformed” into hydrogen and CO₂. Adding carbon capture and storage (CCS) means this CO₂ would not be released to the atmosphere, though this is unlikely to avoid 100% of emissions. The second route is via electrolysis of water using low-carbon electricity. However, this is currently thought to be a more costly alternative than the fossil-fuel-with-CCS route. For these reasons the Committee on Climate Change (CCC) say the potential for using renewable hydrogen in the UK is “limited”.

The CCC recommended the adoption of hybrid heating systems combining electric heat pumps and hydrogen boilers as the best way to decarbonise heat in the UK. Under this model, the heat pumps would meet “baseload” demand throughout most of the year, whilst the hydrogen



boilers would step in to meet peak demand on the coldest winter days. The CCC said low-carbon hydrogen cannot be produced in large enough quantities to completely replace natural gas and that full electrification is not feasible due to the huge amounts of backup generation that would be needed during periods of high demand. (3)

But now a new paper published in Nature Energy challenges this view. There is now a growing body of literature arguing that the falling cost of renewables combined with the significant cost reduction potential of power-to-gas technology could lead to much cheaper electrolytic hydrogen production than many have previously thought. The research says renewable hydrogen will become competitive with current large-scale industrial supplies from fossil fuels in the next decade or so. Hydrogen is “*the single most important remaining question in the energy transition*”, energy commentator Chris Goodall told Carbon Brief in response to the paper. He adds: “*Cost competitive hydrogen from renewables makes full decarbonisation possible through power-to-gas and power-to-liquids.*” (4)

Similarly research by DNV GL suggests that production of hydrogen from surplus renewable electricity will be cost-competitive with natural gas-based hydrogen before 2035. German think tank Energy Brainpool claimed hydrogen produced by surplus wind and solar energy could be cheaper than natural gas as an energy source itself by the 2030s. The researchers expect production of hydrogen from surplus renewable electricity will be cost-competitive with natural gas-based hydrogen before 2035. Hydrogen storage is unlikely to investors' first choice for technological solutions that make use of surplus renewable energy, the researchers predict. Conversion into heat or battery storage is likely to be cost-competitive earlier. The forecasted cost-competitive date of 2035 is also conservative compared to other analyses. In a separate study in April 2018, German think tank Energy Brainpool claimed hydrogen produced by surplus wind and solar energy could be cheaper than natural gas as an energy source itself by the 2030s. (5)

European Climate Foundation

On the other hand a new study from the European Climate Foundation (ECF) says smart electrification supported by improvements in energy efficiency will be the cheapest way to decarbonise heat across Europe. It says the use of hydrogen should be limited to providing seasonal energy storage and meeting peak power demand, even in countries with colder climates such as the UK. The analysis, conducted by Element Energy and Cambridge Econometrics, explored six different scenarios for creating a zero-carbon energy system across Europe by 2050. The results were extrapolated from modelling of six archetype countries, with Germany being the most analogous to the UK due to its high winds and significant existing gas infrastructure.

In half of the scenarios heating is mostly electrified (“High Electrification”), whilst in the other three electrification is more limited and low-carbon gases such as hydrogen meet a substantial proportion of demand (“High Molecules”). Household spending on energy is higher in all but one of the scenarios. It is greatest in the High Molecules scenarios, which would add between €165 and €214 billion to annual costs across Europe in 2050. The change in spending is smaller in the High Electrification scenarios, with one seeing a €23 billion reduction in annual costs by the middle of the century when compared to a continuation of the current policies.



The ECF report found that green hydrogen deployment would require prohibitively expensive infrastructure investment. Smart electrification of space heating and cooling, mobility and industrial processes – combined with energy efficiency measures – could turn out 36% cheaper than green hydrogen at scale. This could save up to €23 billion in European energy spending, which could translate into a 2.1% boost to GDP. With training and retraining programs, around 1.8 million additional jobs could be created by 2050, the report added. (6)

Consumer Backlash

Dermot Nolan, chief executive of Ofgem, has expressed concerns over the decarbonisation of heat, warning there could be a backlash from consumers if they are forced to adopt new technologies such as hydrogen boilers. Speaking at the annual spring forum of Aurora Energy Research, Nolan said he is relatively “sanguine” about the decarbonisation of power and transport but admitted he is “*far more nervous about the issue of heat*”.

Nolan noted there are two main options for decarbonising heat – either electrification or converting gas networks to run on low-carbon hydrogen. He said a hydrogen grid “*would be great*” but has not been demonstrated at scale and would require “*huge*” regulatory changes. He was recently shown a hydrogen boiler and was “*quite impressed*”. But given the “*reluctance*” some people have shown to welcome smart meters into their homes, Nolan worried that consumers would “*react*” badly if they are compelled to install a new type of heating system. At the same time, the electrification of heat would mean abandoning £40 billion of existing gas infrastructure. (7)

Iain Conn, chief executive of Centrica, and Keith Anderson, chief executive of Scottish Power also questioned how the country would turn its heating system green. Iain said the option of switching from natural gas to pure hydrogen was “highly unlikely” to work, and that he did not believe in the “mass use of pure hydrogen” because it was “highly unlikely to be practical”, although he suggested that lower amounts of the gas could be blended into the system. He said three years ago that the idea of electrifying all heating was “mad”. Now, however, Mr Conn is proposing that electric heat pumps would have a role to play and that British Gas would eventually end up installing them. (8)

Smarter Heat

The Journey to Smarter Heat is a new report from the Energy Technologies Institute (ETI) says the UK was the world’s largest market for gas boilers until China overtook us. Replacing gas with low carbon electricity poses the challenge of meeting winter peak morning and evening heating demands without having much more expensive generating, network and heating system assets with a low average utilisation. The scale and complexity of the transition requires an almost immediate start. A typical UK household uses 80% of their energy consumption on the provision of heating and hot water, with an annual cost of approximately £750 per year, using gas. Notionally replacing their gas boiler with a heat-pump and their cars with fully electric ones would add around 5,000 kWh of additional electricity consumption for heat and 3,000 kWh of vehicle charging to the existing 3,100 kWh for other domestic uses of electricity. This level of electrification will present entirely new challenges, outside the historic experience of the current energy industries. (9)



Meanwhile Orsted has pledged to link offshore wind to green hydrogen as it joined an already crowded field of heavyweights in a zero-subsidy tender for the Netherlands' 750MW Hollandse Kust South 3&4 zone. The Danish utility said it will submit a bid for the area in the North Sea and has already taken a final investment decision on the project, with hydrogen production and storage from its Dutch wind farms now part of its plans. (10)

Scottish plan

A new blueprint has been drawn up to turn Scotland into a global powerhouse for green energy – a move which economists and scientists say would be transformative when it comes to the wealth and standing of the nation. The study lays the ground for Scotland to take full advantage of the hydrogen revolution. Renewable hydrogen would not only satisfy all our domestic energy needs, but it could also be exported.

The HIAIba-Idea think tank says Scotland could effectively fuel the proposed European supergrid, and generate so much money for the economy that the nation could establish a Sovereign Wealth Fund, as Norway did with North Sea oil. HIAIba-Idea is run by the economist Professor Ronald MacDonald, and the mathematician, scientist and engineer Dr Donald MacRae. MacDonald is professor of macroeconomics at Glasgow University's Adam Smith Business School. The blueprint is called Hydrogen Scotland: A Route to Export Powerhouse and Maximising Scotland's Wellbeing While Bravely Innovating. MacDonald says the energy revolution would solve the *"tail-off in productivity of the Scottish and UK economy"*, which came about with the shift from manufacturing to services. Renewable hydrogen is *"the big transformative idea"*, he says, which would *"take us back to being a manufacturing economy and an export power house"*.

While Scotland – and Orkney in particular – are making good progress with the technology, Australia has already created a "roadmap" for commercial use of renewable hydrogen. South Korea plans to convert its 26,000-strong fleet of buses to hydrogen, and Australia is eyeing the market for exports. Japan is also moving toward the use of more hydrogen vehicles.

HIAIba-Idea is calling on the Holyrood Government and the big players in the oil industry, who want to move away from carbons to green energy, to work with them to create a Scottish roadmap. Norway is also starting to explore the exploitation of renewable hydrogen. MacDonald and MacRae say that if the new industry is handled properly by the Government, Scotland could also become a centre for manufacturing and exporting the equipment and technology associated with renewable hydrogen, as well as a global hub for the financial services needed to fund it. (11)

Donald MacRae says solid-state ammonia synthesis to produce ammonia directly from air, water and renewable energy is rapidly decreasing in cost. He proposes producing and storing ammonia on disused oil and gas rigs servicing offshore wind farms for conversion to hydrogen then using fuel cells to provide electricity during periods of low winds. He says the proposed outlays of several hundred billion dollars in prolonging the life of North Sea oil and gas would yield a much lesser return on investment than the HIAIba proposal, even by ignoring the vastly greater range of skilled, safer jobs that would be created and avoidance of the ever more critical damage costs of continuing to use carbon-based fuels. (12)



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4. UK Carbon Targets Likely to be Missed

Close to half of the UK's electricity will come from renewable sources by 2025, according to a *Carbon Brief* analysis of new government projections. This marks a significant increase on earlier projections, which as recently as 2016 saw renewables meeting less than a third of demand in 2025. (1)

The upwards adjustment is a reflection of the falling cost of renewables, rather than a change in government policy. Other than continued support for offshore wind, policy has generally become less favourable to wind and solar over the past several years. Renewables could overtake gas as the largest source of UK electricity as soon as this year. The carbon intensity of electricity supplies could fall close to 100 grams of CO₂ per kilowatt hour (gCO₂/kWh) in the early 2020s, years ahead of a 2030 target date.

At the same time, there are further cuts to the outlook for gas-fired electricity generation, which is now set to drop by two-fifths over the next six years. Nevertheless, the projections show the UK missing its legally binding carbon budgets for 2023- 2032 by even wider margins than expected last year. The fifth carbon budget for 2028-2032 is now set to be missed by as much as 20%, according to the new energy and emissions projections from the Department for Business, Energy and Industrial Strategy (BEIS). (2)

These latest projections highlight the large gap between the UK's current climate goals and the policies that would be required to deliver them. They arrive just weeks before the publication of formal advice that is likely to recommend even greater ambition, targeting net-zero emissions in line with the Paris Agreement.

Despite these changes in the electricity sector, the UK is now set to miss its climate goals by even larger margins than expected last year. Broadly speaking, this is because the electricity sector is the only area where significant, continued CO₂ cuts are expected to be made. All other sectors of the economy are projected to see either modest declines or small increases, whereas cuts will be needed in all areas to stay within budget.

BEIS insists that it has additional policies in the pipeline that will help close the gap to meeting future carbon budgets, which it describes as a "projected shortfall".

The projections up to the 2030s point to both the fourth and fifth carbon budgets (from 2023-27 and 2028-32 respectively) being substantially breached unless long-overdue policies emerge. The third five-year carbon budget from 2018 to 2022 is likely to be met comfortably, with headroom of 88MtCO₂e. The fourth carbon budget, in many ways seen as a five-year transition to deeper reductions, now has a projected shortfall of 139MtCO₂e in 2018, up from 94 MtCO₂e in 2017. The fifth carbon budget is intended to play a pivotal role in delivering decarbonisation, particularly of the power sector, with carbon intensity of generation now expected to fall from around 300 grams CO₂e per kWh to just 41gCO₂e/kWh by 2035. Overall, 2030 gross emissions – disregarding carbon trading – are to fall at least 61% relative to 1990. It has to provide the glide-path to meeting the UK's current 80% target for 2050 cost-effectively, with minimum economic dislocation. Yet the latest data reveal a yawning gap in emissions reduction. (3)



The Committee on Climate Change (CCC) is due to recommend even greater ambition for the UK on 2 May when it sets out how and when the country should cut emissions to net zero, in line with the Paris Agreement.

Doug Parr from Greenpeace says the projections have some questionable assumptions. One example of this is the assumption that multiple new nuclear plants will be built between 2025 and 2035. As BEIS noted last year, this is “*not based on developers’ proposed pipeline of nuclear projects*”. Since last year’s projections, another planned new nuclear plant has been cancelled. The projections are fairly un-transparent but a graph of power sources assumes over 60TWh from nuclear in 2030. “Dream on” says Parr. Hinkley Point C and the existing Sizewell B will amount to 35TWh. So there’s over 40MtCO₂ saving gone missing.

- BP’s latest projections show total energy demand growing indefinitely which means fossil fuels will always be needed. But Simon Evans at Carbon Brief shows how these projections contrast starkly with McKinsey’s, who find that the efficiency of renewables will see total energy demand plateau out in the 2030s after more than a century of global energy growth. (4) BP’s outlook does say that renewable energy sources will be the world’s main source of power within two decades and are establishing a foothold in the global energy system faster than any fuel in history. (5)

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5. Target for Offshore Wind could be 50GW rather than 30GW

In March, the UK government signed a deal for offshore wind to produce $\frac{1}{3}$ of the country's power by 2030. Greenpeace's Unearthed spoke with Scottish Power's chief executive Keith Anderson. Though the target in the offshore wind sector deal is significant, concerns over the viability of the nuclear power pipeline has prompted the question: Is it enough?

Anderson isn't calling for a higher target, but insists "*we can do more*" and "*there is more out there.*" He said: "*I think having a target of 30GW by 2030 is good by any stretch of the imagination. Now could you push it harder and further to 50GW by 2050.*" Does that ambition suggest Scottish Power sees the possibility of an all-renewables energy system in the future? "*I think anything is possible,*" he said, "*if you go back 10 or 15 years we used to get people worrying about getting to 10% penetration of onshore wind on the system! Could we deal with 100% right now today? I think we would probably struggle. Do I believe in the future that we'll have the capability of doing it? Yes.*"

Scotland's energy minister says "*patience is running thin*" with the industry - wind power companies need to generate greater return for the local economy. ScottishPower prides itself on its commitment to get 50% of its content from the UK for the most recent projects it has launched. The government has demanded firms go one step further: 60%. Anderson is careful not to criticise a government which has just given him and his industry a real show of confidence, but even he can't pretend the UK has done enough to develop the industry and infrastructure needed for a domestic supply chain, and all the good that comes with that. "*The one thing that absolutely has to happen is that there needs to be investment into some of the supply chain facilities in the UK, into things like harbour facilities, into some of the big fabrication yards,*" he said. "*They are behind the curve in terms of the way we're doing things, the way we're manufacturing things and they need to be competitive.*" (1)

- The chairman of the National Infrastructure Commission (NIC) has called on local businesses and council leaders on Humberside to "*seize the opportunity*" and ensure the region leads the way on green energy. On a visit to Siemens Gamesa's wind turbine facility at Green Port Hull, Sir John Armitt said green energy was already "*a game-changer*" for Humberside as it continued to prove its potential in boosting the local economy and bring high-skilled jobs to the area. The region which is home to several major low carbon and renewables projects, including the Siemens Gamesa site, has already created over 1,000 jobs, with the sector estimating that offshore wind could support 27,000 jobs across the UK by 2030. The site provides blades for Orsted's Hornsea One offshore windfarm, the world's largest of its kind, which is located off the East Yorkshire coast and operated from Grimsby. In July, the NIC published its National Infrastructure Assessment - the first ever for the UK - which recommends that 50% of the UK's electricity should come from renewable sources, such as solar and wind, by 2030. (2)



- Shell Energy’s takeover of First Utility has highlighted the problem with the ‘Renewable Energy Guarantee of Origin’ (REGO) scheme. Suddenly Shell Energy claimed it was supplying all of its 700,000 customers with ‘100% renewable’ electricity. Making it seem awfully easy to switch a big customer base to renewable sourced power. If we look at First Utility’s last published energy mix they sourced just 3.7% of their supply from renewables. But — as if by magic — post takeover from the oil and gas giant Shell they are now ‘100% renewable’. And all of this without a single article showing partnerships or contracts with a renewable provider. The Renewable Energy Guarantee of Origin (REGO) scheme was intended as a simplification, but has become a loophole. It is possible for a supplier to source REGOs without also purchasing the electricity they relate to. This wasn’t a major issue in the early days of the scheme as there was only a small amount of trading in REGOs without their power. However, now this loophole is increasingly being taken advantage of at significant scale, with more suppliers claiming to offer ‘100% renewable’ tariffs, despite holding little or no contracts with renewable generators. (3)

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- (1) Unearthed 27th March 2019 <https://unearthed.greenpeace.org/2019/03/27/interview-scottishpower-ceo-offshore-wind-energy-uk/>
 - (2) Infrastructure Intelligence 27th March 2019 <http://www.infrastructure-intelligence.com/article/mar-2019/humber-has-opportunity-become-green-energy-leader-armitt-says>
 - (3) Good Energy 27th March 2019 <https://www.goodenergy.co.uk/blog/2019/03/27/shell-energy-s-renewable-promise-highlights-the-problem-with-regos/>



6. Nuclear Finance

Philip Hammond appears to be planning to give nuclear power a massive multibillion state funded boost. Clothed in talk of a new means financing infrastructure projects the massive public handout to nuclear power was a key accompaniment to the Spring Budget statement. The notion of 'Regulated Asset Base' (RAB) financing of nuclear power projects is being grotesquely distorted to hide the fact that this is a cover for the Government risking very large sums of money to be lent to nuclear power developers. Put simply, nuclear power projects are expensive so the electricity consumer will lose an awful lot of money and prices will be jerked upwards. Either that or taxpayers will take a hit and funding of public services will suffer big time.

For instance the *Financial Times* describes the use of "RAB" (regulated asset base) financing as similar to the system used to build the Thames Tideway tunnel' Under such schemes the developers are allowed to charge consumers in advance for the capital building projects. What Ministers are not emphasising of course, is that in industries such as water the Government does not lend lots of money to the privatised companies. They raise this on private markets. But in the case of nuclear power plants the bulk of the money needed to build them will be borrowed from the Government.

RAB has been used to try to finance nuclear power plants in the USA, in the states of Georgia and South Carolina recently. The result was disaster and the developing company, Westinghouse, went bust. But this was 'normal' RAB where the developer takes the risk of cost overruns. But in the proposed UK nuclear version it will be the electricity consumer who goes bust when the almost inevitable cost-overruns set in! The nuclear RAB is really a cover for a nuclear bailout. So let's call it a 'nuke bailout RAB'.

What makes this move even more infuriating for green energy supporters is that Hammond offered what amount to a few superficial titbits for green energy in his Spring statement. Meanwhile renewable energy projects will not be able to take part in RAB projects. Not only will nuclear power be funded under much more preferential terms compared to offshore or onshore renewable energy projects but they will be directly funded by government and large parts, if not all, of their liabilities guaranteed by the treasury - again something that does not apply to renewable energy. (1)

According to Harminder Singh, Power Analyst at GlobalData, the RAB model would shift the risk from the developers to consumers, thus raising the electricity bills of consumers. Consumers will be effectively paying for an asset that will come up some time in the future, with all the risks associated with it. Furthermore, with the cost escalations associated with nuclear power projects, there is an additional uncertainty regarding how much it will add to the consumer power bill. The model has so far not been used for projects as expensive as nuclear power plants, which is seen as a key cause for concern. On the other hand, the RAB is a useful tool to attract private investments in the sector, as investors are able to see a fixed rate of return as the project is being built. The key problem that RAB addresses is that of high cost of capital for nuclear power projects. It is revised at regular intervals to take into account increases in capex - subject to regulatory approval. The regulatory protection and government backing means that the RAB is treated as a strong, secure asset. (2)



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 2. Global Data 21st Feb 2019 <https://www.globaldata.com/regulated-asset-base-model-for-financing-of-nuclear-power-plants-may-help-arrest-the-waning-investor-interest-in-the-nuclear-industry-in-the-uk-says-globaldata/>



7. Hunterston – not all it's cracked up to be?

Plans to restart two cracked and ageing reactors at Hunterston B have been delayed yet again. EDF Energy has postponed the restart date for reactor three by two months to 30 June 2019, and for reactor four by one month until 30 April 2019. Critics have reiterated calls for the reactors to shut down permanently. (1)

Reactor 3 was closed in March 2018 for a scheduled outage. EDF Energy subsequently discovered a higher number of keyway root cracks than predicted by its computer models. Consequently in May 2018, it was announced that R3's present shutdown would be extended for further investigation and revised modelling. By the end of December 2018, EDF had "observed around 100 keyway root cracks in Reactor 3". This is from inspecting just over a quarter of the reactor. Using modelling to project the number of cracks across the whole reactor the current number of cracks is estimated at around 370. This takes the core over the operational limit of 350 contained in the existing safety case for that period of operation. (2)

Reactor 4 was closed down on 2 October 2018. Around 30 keyway root cracks have been observed in that reactor which suggests around 200 across the whole core.

ONR was presented with a safety case for a return to service of reactor four in November 2018. But it requested further information from EDF in respect of multiple cracked bricks. A revised safety case was presented in March.

Residents living near Hunterston have been expressing alarm at the proposals to re-start the two reactors, about 35 miles from Glasgow.

Rita Holmes, chair of the Hunterston site stakeholder group chair, said that personally she had no doubt that ONR would take time to scrutinise EDF's safety cases. *"Some people find the delays reassuring because EDF is sparing no expense, leaving no stone unturned, consulting the experts in order to build a robust safety case,"* she said. *"Some feel the opposite – if it takes EDF that long to provide a robust safety case then maybe there is something far wrong. The safety case might or might not satisfy the regulator. I have every confidence that ONR will make the right decision."* (3)

In March EDF released a video of the cracked graphite bricks. According to the company tests and modelling have been undertaken to ensure that an earthquake would not distort the control channels and prevent the power station being shut down. Station Director Colin Weir told BBC Scotland: *"We've carried out one of our biggest ever inspection campaigns on reactor three, we've renewed our modelling, we've done experiments and tests and we've analysed all the data from this to produce our safety case that we will submit to the ONR."*

Nuclear expert Prof Neil Hyatt from Sheffield University said: *"The structural integrity of the graphite core has always been known to be the ultimate limiting factor to the lifetime of these reactors. So, ultimately there may come a point in time where those reactors have to come offline and are not able to restart."* (4)

The BBC article, though, claimed that early decommissioning could cause serious energy supply problems. This is simply not the case. The reality is that Scotland has, if anything, an oversupply of electricity. Both Hunterston and Torness could be closed without causing problems for



Scotland's electricity supplies. The BBC article also states that "*Concerns have also been raised about the consequences for local jobs if Hunterston closed early.*" In fact, few if any jobs would be lost if the reactors Hunterston B were closed permanently: dealing with the immense heat rates from radioactive decay even from closed reactors will guarantee jobs there for the first 2 to 3 years. After that decommissioning could provide more jobs than when the reactors operated, just as is occurring at the closed reactors at Dounreay. (5)

Closing down Hunterston is likely to substantially reduce the amount of wind power that is currently being forced off the grid. There is controversy surrounding Scottish windfarms being paid 'constraint payments' at some times to avoid the Scottish electricity network becoming overloaded. Because it is windfarms that receive the payments, windfarms have, in reports carried by right wing newspapers, been singled out for sole blame for spending money on 'constraint' payments. This is despite the fact that it is the nuclear power stations' inability or refusal to reduce production when the Scottish part of the grid is overloaded which contributes greatly to the problem. This problem of system overload is the reason that the recently completed transmission line linking Wales to Scotland was built. As Jonathan Marshall, Senior Analyst at the Energy and Climate Intelligence Unit put it recently: 'On top of reducing constraint payments, the link will reduce the cost of accommodating Scotland's 2.6 GW inflexible nuclear power stations that work most efficiently when operating at full output'. (6)

Jobs Worry

Concerns have been voiced at a full North Ayrshire Council meeting over the future of jobs if Hunterston is not allowed to re-open. All 33 North Ayrshire councillors are to meet with the nuclear regulator to discuss the issue. Hunterston B is due to close for good in 2023 anyway. A statement from the Conservative group said: "*We also proposed that the council should set up a task force to look at future job prospects for the Hunterston workforce given that at some point in the future the station may stop generating.*" Councillor Alex Gallagher dismissed his fears saying employment would remain steady until we are well into the decommissioning. (7)

Green MSP Ross Greer has called on Scottish ministers to secure work for every worker at Hunterston B Nuclear Power Station ahead of its planned closure. He pointed out that even in the event that current problems can be resolved, the station is due to close in 2023. He said the Scottish Government lead the development of a plan to ensure future employment for every worker and the wider community. The process of shutting down the reactor and making it safe will provide some work for the first few years, but that is no substitute for a long term plan. "*You can't just switch to a greener economy overnight. A Just Transition guarantees employment for all workers, makes use of their skills, provides training to those who need it and promises good wages and conditions. We know that transitioning to green industries will create more jobs than currently exist in industries like nuclear power but only if we put the plans in place now. Otherwise, we risk a repeat of what happened at Longannet, where the power station closed, leaving workers with no real plan for jobs. That's not good enough for me and it's not good enough for the community at Hunterston.*" (8)

Caithness & North Sutherland

The kind of 'social interventions' being looked for in Ayrshire are perhaps best illustrated by what is going on around Dounreay. The Caithness and North Sutherland Regeneration



Partnership has made a range of infrastructure improvements, including to ports and harbours at Wick and Scrabster. It has helped to fund educational facilities. So far it estimates 106 jobs have been created. It expects to see another 160 jobs at the Beatrice Offshore Wind Farm and 250 at the Moray Offshore Wind Farm. The firms involved in the Dounreay Cavendish Partnership have offered all 1,100 employees jobs within partnership companies. And training is available to allow employees to apply for the strongest possible position within local companies. (9)

The proposed £17.5 million spaceport project in north Sutherland would also give a huge boost to the drive to replace the high-quality jobs being lost as the nuclear plant at Dounreay runs down. According to the public sector group paving the way for the venture, there would be other valuable spin-offs for existing businesses, tourism and inward investment. The creation of a vertical launch pad on crofting land at the Moine, near Melness is in line to generate 40 jobs locally by 2023 with a further 400 due to come on stream throughout the Highlands and Moray. Lockheed Martin and Orbex are committed to the enterprise which would see small commercial satellites being launched into space. (10)

Ayrshire Growth deal

A multi-million pound transformational growth deal for Ayrshire has been agreed between the three Ayrshire local authorities the UK and Scottish Governments. It is hoped the deal will create approximately 7000 jobs across a wide range of sectors. The investment will be delivered over a 15-year period. Included in the deal will be £14m tourism investment at Irvine Harbourside and Ardeer Peninsula, £18 million for the Centre for Research into Low Carbon Energy and Circular Economy (CECE) at the Hunterston Strategic West Scotland Industrial Hub and £11 million for a subsea fibre optic cable to have its landing point in Irvine, as well as massive projects in South and East Ayrshire. (11) Turning the Isle of Cumbrae into a major sailing centre is one of the specific projects listed and will provide berthing for a community-run facility, supporting the local economy. (12)

In 2018 it was announced that coal port at Hunterston, vacant since 2015, could be transformed into an oil rig decommissioning site. The Port is a unique economic asset for Ayrshire, offering the unrivalled combination of deep-water, extensive land and transport links. The proposal was hoping to provide hundreds of jobs for local people, but the community appears to be reluctant to accept yet more dirty industry back to the area. The port is a 380 acre brownfield site. But in the summer of 2018 a petition to stop the oil decommissioning gained traction. It expressed concern over the environmental hazards that a decommissioning site would present. A local protest group called the Friends of the Firth of Clyde was set up to demand an environmental impact assessment be carried out, and local marine wildlife experts have voiced concerns. Marine Biologist, David Nairn, says an EIA is necessary particularly because of proposals to dredge a site which is designated as a Site of Special Scientific Interest. The Friends of the Firth of Clyde say the proposals have been 'salami sliced' in order to avoid the need for an EIA. Residents are particularly concerned about the impact the development will have on cetaceans and basking sharks which have begun to return to the area in the last few years. Peel Ports, the port owners, say they do not anticipate any environmental impact from the works. Peel Ports says as many as 500 jobs could be created and expect there to be some skills transfer from Hunterston B as the nuclear station closes. Friends of the Firth of Clyde are highly sceptical



about these job numbers. Many local people would prefer a focus on promoting tourism and are concerned that work done so far will be undone if the oil decommissioning goes ahead. (13)

Making the most of nuclear skills

The plan at the moment for Hunterston B is, once the station has ceased generation, is to prepare the site over the subsequent 10 years for a period of care and maintenance. Final dismantling wouldn't take place until around 2108 – 2118.

The Nuclear Decommissioning Authority says it is increasingly questioning whether the baseline strategy – of deferring reactor dismantling for around 85 years following shutdown -is appropriate as a blanket strategy for all reactors. Deferred reactor dismantling means workers can benefit from radioactive decay enabling dismantling to be undertaken with significant worker access, and reduced dose rates. On the other hand the lengthy deferral period means there is likely to be a loss of skills, knowledge and capability to carry out final site clearance. With advances in robotics that have been made in recent years the lengthy deferral period is no longer necessary. International experience demonstrates that reactors can be dismantled promptly without the need for significant worker access. (14)

It is not clear, yet, what role the NDA might play in the decommissioning of EDF Energy's AGR nuclear stations. Financially speaking it will be in EDF's interests to delay final dismantling as long as possible so that the money they have set aside for decommissioning can accrue in the bank for half a century. But this might not be the best thing for the Ayrshire economy, so could be something the Scottish Parliament wants to look at.

The Nuclear Liabilities Fund (NLF) is worth approximately £9bn to meet cost of decommissioning AGRs & the Sizewell PWR. EDF Energy makes regular payments into the fund. It estimates that the cost of decommissioning its 7 AGRs and one PWR would be £19.9bn. It will rely on accrued interest up to 2090-2100 to fund much of these liabilities. (15)

It's worth noting that the NLF paid for the Sizewell B Spent Fuel Dry Store. (16)

Dounreay Site Restoration Ltd points out that decommissioning requires innovation and great care. The skills and enterprise Dounreay decommissioning fosters are giving many Highland and Scottish companies a platform to seek decommissioning work around the globe. If Hunterston B were to go for prompt decommissioning it could foster a new robotics industry, for instance in Ayrshire. And it would be making the most of the nuclear skills we already have available rather than making those skills redundant and then having to create them all over again in 85 years' time.

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8. Sizewell – is the tide turning?

Is tide turning against Sizewell C? Opponents are feeling encouraged. Campaigners claim the proposals for a new nuclear power station on the Suffolk coast have been “*exposed as entirely inadequate*” – and believe it cannot be built. Together Against Sizewell C (TASC) claim people will decide the evidence is “overwhelming and terminal”.

TASC chairman Pete Wilkinson says the most recent plans shown in the company's stage three consultation for Sizewell C have been “*exposed as entirely inadequate*”. He said: “*Since the delivery of a 1,500-signature petition to the Leader of Suffolk County Council, we have seen a surge in support for our position of outright opposition to Sizewell ... With recent increased media interest in the issue, people are waking up to the sheer scale of the environmental and infrastructure changes the plant will require and they are becoming more and more vocal in opposition. It is very encouraging.*”

TASC has voiced concerns over the suitability of the Sizewell site, claiming it is too small for the proposed development, potential loss of SSSI, visual intrusion, noise and light pollution and the negative impact it will have on the Suffolk Coast and Heaths AONB and Heritage Coast. TASC secretary Joan Girling said: “*Our detailed report clearly demonstrates three things: we require much more information from EDF before we can fully appreciate the impact of their plans; even on the information available, it is clear that the dis-benefits associated with Sizewell C far outweigh the putative benefits, and EDF must plan for a fourth round of consultation.*” (1)

Suffolk councils have said they can't support the latest Sizewell C plans, and have told EDF their plans are still not good enough to support. The Councils are frustrated by the lack of detail in EDF Energy's latest consultation documents and urged the company to work with them to show the project's benefits can still outweigh its disadvantages.

Suffolk Wildlife Trust also complains about insufficient detail on the scope and scale of the development which has severely hampered the making of a robust consideration of the proposal. It is unquestionable that the proposed development will have significant adverse ecological impacts which it will be very difficult to adequately address. The Trust remains disappointed that there is still limited information available on a range of key ecological matters - this shows a lack of acknowledgement of the difficulties associated with the project. (3)

The RSPB said Minsmere nature reserve's status as one of Europe's most important areas for nature and biodiversity could be at risk if EDF fails to adequately mitigate adverse impacts from Sizewell C. The renewal of Minsmere's European Diploma for Protected Areas has been approved in draft on the condition that “*the construction of the new reactor will not be at the detriment of the Minsmere Reserve.*” (4)

Suffolk residents packed out Theberton church to have their say on Sizewell C and voice their dismay about the plans. Residents have long been concerned that the plan will have long-lasting effects on the areas environment and tourist industry, while other issues such as roads, traffic and an anti-nuclear attitude were also voiced in the meeting organised by Theberton and Eastbridge Action Group on Sizewell (TEAGS). The power station's proximity to nationally renowned nature reserve, RSPB Minsmere ruffled feathers with residents concerned for the



safety of the birds, and in turn the effect a downturn would have on the local tourism economy, worth £250 million. Adam Rowlands, the RSPB's Suffolk area manager, said: *"In terms of flora and fauna in the area, this is a matter of international importance."* Another resident said that the plans could see a 'decimated natural environment' left for his children and grandchildren. County councillor Guy McGregor, who was responsible for the council's previous response to the plan, said that although it would see opportunities for employment, the problems outweighed the benefits, highlighting the 'constant stream' of heavy goods vehicles that would create traffic and pollution. EDF's plans could see up to 1,500 HGVs on the county's roads, in addition to the extra traffic that would be created by the construction of a new build town or campus which would house 2,400 workers at Eastbridge. Richard Smith – who is now the county councillor leading negotiations with EDF – praised the efforts of TEAGS and residents, saying: *"There is no better way for a community to voice its concerns like how you have. It sends a huge message to EDF."* Mr Smith did warn however that the authority has 'no direct power', but urged residents to continue their campaign. (5)

The Blackwater Against New Nuclear Group's response to the Sizewell consultation expressed concern that both Sizewell and Bradwell are projects which comprise reactors, waste stores and other buildings which must be accommodated on coastal sites. A second feature is that the sites are hemmed in by areas of environmental significance with many designations, the most notable being the Suffolk Coast and Heaths AONB and Minsmere RSPB reserve in Suffolk and the Marine Conservation Zone in Essex. Thirdly, both are close to substantial populations with Leiston (Suffolk) and West Mersea (Essex) within two to three miles from the sites. Fourth, both sites are vulnerable to coastal processes, in the case of Sizewell, coastal erosion and at Bradwell flooding and storm surges, problems which will only get worse as climate change wreaks havoc on the fragile and low-lying east coast while the operation and decommissioning of the plants continues into the next century and beyond. And, fifth, as the UK's nuclear strategy collapses, Sizewell and Bradwell are the two remaining sites which puts enormous pressure on government, developers, regulators and the Infrastructure Planning Commission IPC to ensure the delivery of the two new nuclear power stations. (6)

Stars including actor Bill Nighy, artist Maggi Hambling and broadcaster Bill Turnbull have signed a letter objecting to a proposed nuclear power station in Suffolk. They say the £14bn Sizewell C project will "lay waste" to swathes of the countryside. A total of 27 actors, writers and business leaders signed the letter, published in the Telegraph. At £14 billion, the cost of building Sizewell C is huge, but there will be a much heavier price to pay on Suffolk's beautiful heritage coast and Area of Outstanding Natural Beauty. The impact on protected sites will be devastating. What is being proposed is of a very different order to what has gone before. Sizewell C is planned to be as big as Sizewell A and Sizewell B put together, with woodland and fields destroyed to make way for it. The celebrities are deeply concerned that landscapes, wildlife and people in this unique part of the British Isles will suffer enormously. For the past six years EDF has said that the materials for this enormous project could be substantially delivered by sea. But the company now says this is not possible due to the potential damage to the marine environment. So up to 1,500 lorries a day could soon be clogging Suffolk's roads, delivering construction materials, disrupting the lives of residents and jeopardising the area's £210 million a year tourism industry for the decade or more that it will take to build the plant. In short, we believe that Sizewell C will industrialise a region known for its beauty, wildness and tranquillity.



If the project cannot be delivered by sea and by rail, without encroaching on Suffolk's Sites of Special Scientific Interest, Minsmere Reserve and the heritage coast, and carving up farms and communities, it should not be delivered at all. (7)

The Nuclear Free Local Authorities (NFLA) submission explains in detail why renewable energy alternatives, with energy efficiency and energy storage, are more effective options than a suite of new nuclear power stations. It also argues for a fundamental reassessment of the 'need' for new nuclear reactors as stated in the UK Government's National Policy Statement. For example, electricity generation in 2018 was some 63TWh (16%) lower than in 2005, a reduction equivalent to 2.5 times the output of the new nuclear plant being built at Hinkley Point C or proposed for Sizewell C. This is despite the UK population increasing by 10% from 60 million to 66 million people. Furthermore, nuclear generation was 72TWh in 2016 or about 21% of electricity produced in the UK. Total installed nuclear capacity is around 8.9GW. Yet an accelerated programme of LED lighting installation alone, for example, could reduce peak electricity demand by almost 8GW. The NFLA outlines many other examples as to why there is no 'need' for new nuclear with far more effective alternative options. (8)

- Planning Inspectorate officials have completed their examination of the proposed new nuclear power station at Wylfa on Anglesey. Officials will rule on a development consent order (DCO) application for the project in three months. If the Planning Inspectorate approves the DCO, the project must also be approved by business secretary Greg Clark before it can go ahead. The decision to continue with the DCO application for Wylfa came despite work on the site being suspended in January when Hitachi struggled to secure additional private investment in the project. (9)

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9. RWM Site Evaluation consultation for a deep underground radioactive waste repository

The Nuclear Free Local Authorities (NFLA) response to the Radioactive Waste Management (RWM) consultation on the factors it will consider in evaluating a site for a deep underground radioactive waste repository says it was remiss of RWM to launch this consultation at the same time as publishing videos of generic geological surveys of English regions, Wales and Northern Ireland. The UK

Government also wrote to Councils in all such areas asking them to consider 'expressing an interest' in hosting a deep underground radioactive waste repository.

NFLA says issuing all three processes concurrently has created a considerable amount of local alarm, confusion, concern, anger and frustration. The two planned workshops in Wales had to be cancelled and replaced with a short 'webinar'. NFLA Welsh member councillors and a number of Welsh non- governmental organisations (NGOs) were therefore prevented from actively participating in this consultation process and understanding more from RWM of the areas being consulted upon. That does not seem to the NFLA to be developing the levels of openness, fairness and transparency that this process is supposed to be delivering, and it could be argued it is antidemocratic in allowing English Councils greater scrutiny of the consultation than their Welsh counterparts.

Furthermore, NFLA notes that RWM did not hold any consultation events in Northern Ireland, despite it being theoretically a possible location for a GDF, and at which RWM did make public an outline geological assessment on its website.

One area of omission highlighted by the NFLA is the transportation issue. If the final site selected is a considerable distance from where most of the existing waste is situated – Sellafield through which waste has to be transported will be affected. NFLA notes that the most recent report of the Office for Nuclear Regulation has indicated over 1000 accidents/ events involving radioactive material in transit within, to or from the UK since 1958. Any creation of a GDF that could involve a considerable level of transport has to consider the potential impacts to any community in the event of an accident involving such a transport.

The NFLA has consistently called for a national debate about whether the objective is to look for the best available geology for the job or whether to use mediocre geology and rely more heavily on engineered barriers. The NFLA contends that this should have taken place before embarking on a National Geological Screening Exercise. (1)

Cumbria Trust (CT) says it has several fundamental concerns. The chief one is that National Parks and other designated areas are not being excluded from consideration. The impact of constructing, operating and closing a GDF are acknowledged, but the document fails to mention the impact on the environment of the investigation phase. A programme of 20-30 deep boreholes, each requiring a 50-100m by 50-100m drilling pad (according to the October 2010



NDA report – Geological Disposal: Generic Environmental and Sustainability Report for a GDF) will have a significant environmental impact. If for example a designated site, such as Ennerdale within the Lake District National Park was chosen, the impact would be particularly significant. Even if the GDF could ultimately be accessed by tunnel from Sellafield, the investigation phase would be very damaging to the Lake District National Park.

CT say that to get around obstacles that contributed to the collapse of previous ill-conceived schemes – all involving West Cumbria – the current process appears to have been devised to restrict the powers of the County Council and to delay opportunities for withdrawal or to conduct tests of public support until it suits RWM.

The group, which is not opposed to deep geological disposal concludes:

“Cumbria Trust is aware that the current storage arrangements at Sellafield cannot be allowed to continue indefinitely and something must be done. CoRWM back in 2006 decided that disposal of legacy waste in a GDF was the best available solution at that time backed up by safe and secure interim storage. We do not disagree with their assessment but there must be no shortcuts or dilution of standards when selecting a site for a GDF. The consequences of constructing a GDF in the wrong location would be totally irresponsible and a betrayal of future generations. Rather than targeting the same locations yet again RWM should turn its attention elsewhere not necessarily on the mainland.” (2)

Allerdale District Council's response was highly critical saying the “*new process ... pretends the UK is starting with a blank piece of paper ... what is needed is a more strategic discussion around all the nuclear related challenges the UK is facing, how those challenges might impact on Sellafield and the Low Level Waste Repository and how we might secure the maximum benefit for this community going forward. We remain disappointed, not to mention confused, that such a discussion is not supported by those responsible within Government and the nuclear industry*”. (3)

Over 70 Welsh Councils so far have, in principle, rejected any request to host a Geological Disposal Facility. This includes 7 of the 22 unitary authorities: Anglesey, Ceredigion, Denbighshire, Neath Port Talbot, Powys, Swansea and Wrexham. (4)

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10. Climate Emergency

The roll-call of local authorities which have passed motions declaring a climate emergency grows day by day. What started in Bristol in November last year has been spreading like a benign virus through council chambers across the land and encouraging councillors of all parties to commit to taking urgent action to cut carbon emissions rapidly to virtually zero, says Simon Roberts, Chief Executive of the Centre for Sustainable Energy.

We know what needs to be done to cut emissions. The problem is that the individuals, communities, businesses and organisations that together make up a local area are not yet doing these actions in sufficient quantities to cut emissions fast enough. There are reasons why this is currently the case and it is those 'reasons' which must be tackled to accelerate progress. (1)

Bristol City Council has recorded a 71% reduction in carbon emissions from its direct activities against a 2005 baseline, surpassing a target to reduce emissions by 65% by 2020. The council will soon propose new targets. The council sourced 21GWh of energy generation from solar, wind and biomass in 2018, enough to power 24,000 homes for a month. Projects including street lighting upgrades, increasing renewable energy stocks, implementing energy efficiency measures and closing certain corporate estate buildings all contributed to the achievement. Bristol City Council is also rolling out city-wide projects to assist with wider carbon reductions outside of its direct impact. Heat networks and a City Leap initiative to transform the city's energy infrastructure and ecosystem have been introduced. The former European green capital has already connected its first private housing development to the heat network, and has saved more than £1m from street light upgrades. (2)

Bristol City Council is to proceed with its 'City Leap' initiative, which is to further the city's renewable energy deployment. The council's cabinet agreed to go-ahead with the initiative to source private sector partners to help fund future green energy projects in the city. The £1 billion plan was first unveiled in May last year and a prospectus of partnership and investment opportunities is said to have attracted enquiries from more than 180 organisations, including tech firms, investors and energy companies. A six-month appraisal was launched, culminating in plans being put before the council's cabinet to partner with the private sector. The prospectus referenced a number of specific focus areas, including much wider adoption of renewables and other energy technologies, including battery storage and Vehicle to Grid (V2G) electric vehicle (EV) chargers, with an estimated investment potential of up to £125 million by 2027. (3)

Greater Manchester has launched an extraordinarily wide-ranging five-year environment plan to squeeze carbon out of the economy by 2038 and move towards sustainability. Much of the heavy-lifting for this long-term goal is contained within the proposed 5-year environment plan, unveiled at the city's second Green Summit on 25 March at Salford Quays. This is a springboard aiming to put Manchester on-track towards a "clean, carbon neutral, climate-resilient city region with a thriving natural environment and circular, zero-waste economy". The plan focuses on five core challenges facing Manchester: mitigating climate change, air quality, production and consumption of resources, natural environment, resilience and adaptation to climate change impacts. Broader aims include the need to create vibrant and sustainable places in the city



region, to increase economic productivity, and to improve health and quality of life of its residents.

On homes, workplaces and public buildings, the priority is to cut carbon emissions and energy use, improve affordability, comfort and cut fuel poverty through deeper insulation of building fabric that "goes well beyond the basic measures" such as loft insulation. This will focus firstly on cutting heat demand through a shift to whole house retrofit by 2024 at the rate of 61,000 homes a year, followed by heat and cooling demand reduction of 22% by 2025 in public and commercial buildings, and finally increased efficiency of new buildings.

Greater Manchester also undertakes to standardise energy efficiency rating of its buildings, including through Display Energy Certificates, and to raise average DEC rating to at least D by 2024, and C or better by 2030 where viable. It also commits to planning permission only for net zero carbon homes by 2028, in social housing and in business, action driving up standards in the private rented sector and optimising the Energy Company Obligation for Manchester. (4)

Greater Manchester wants to be carbon neutral by 2038 and has used the Tyndall Centre to set out a clear pathway for its carbon reductions. Admittedly, all the policy isn't in place yet, but the gaps have been identified with what needs to be done. Despite being positive overall, there are still big questions to be answered if the mayor is to deliver on his vision. City regions are still limited by the powers they actually have and the money to implement what they want to do. Many of the intended actions rely on the UK government granting more powers or providing more funding. Likewise, more explanation is needed for those policies that rely on behaviour change, such as the idea that Mancunians should be more responsible consumers. (5)

Electricity North West has announced plans to decarbonise the entire region within the next 20 years. The 'Leading the North West to Zero Carbon' plan aims to get the region to zero-carbon status by 2038 and already has a number of signatories, including Manchester City Football Club and the University of Manchester. As part of the plan, Electricity North West will invest £63.5 million over the next four years, on top of its existing outlay of £1 million into their power network every day. This money will be used to fund sustainable energy initiatives, where Electricity North West will work with local councils and authorities, such as Manchester City Council and the Greater Manchester Combined Authority, as well as businesses that are investing in the area. Electricity North West will also invest in local and community schemes and initiatives that are helping push towards decarbonisation. These include £71,000 for Community Energy grant funds, £104 million for upgrades to the Greater Manchester power network, and work on a transport strategy that will see a significant switch to electric vehicles alongside Metrolink integration. (6)

- Brighton Energy Coop (BEC) secured 2.5MW worth of feed-in tariff exemptions before the feed-in tariff window slammed shut at the end of March. That pipeline, which is composed of 30 individual rooftop installations with capacities between 50 and 200kW, will allow the firm to continue to install FiT-backed solar in and around Brighton for a further year. BEC used the pre-registration and pre-accreditation elements of the FiT scheme to secure those exemptions and the coop is now seeking community investment to bring the pipeline forward. Will Cottrell, chairman at BEC, said the pipeline was the result of "dogged work" by its project development team. Around 1MW of the pipeline



includes rooftop installations on schools that have been secured in partnership with Brighton and Hove City Council, alongside leisure centres, colleges and local businesses. (7)

- Norwich City Council has announced Roar Power, a partnership between the council and the French energy supplier ENGIE, will launch later this year, offering renewable energy to homes across the region. The scheme will offer customers a range of tariffs with 100% renewable energy offered as standard, as well as an option to choose to receive 100% renewable gas. Cllr Kevin Maguire, Norwich City Council cabinet member for safe city environment said: 'Doing what we can to ensure people can heat their homes affordably shouldn't come at the price of the environment. Climate change is a global issue and one that we all have a responsibility in addressing. (8)
- Nottingham City Council is set to trial new electric vehicle (EV) infrastructure, including battery storage and bi-directional chargers, as part of an EU-funded vehicle-to-grid (V2G) project. Nottingham is one of four European cities that have been selected as pilot sites for CleanMobilEnergy – a project backed by €4.29m of EU funding which will utilise various clean energy systems and V2G technologies to support regional EV rollouts. The Council has purchased 40 new EVs to trial a V2G concept at its Eastcroft Depot site – a waste transfer facility – through an innovative energy management system. The project combines three main elements: solar panels at the Eastcroft Depot to generate electricity, a large battery to store energy until required, and a fleet of EVs for additional storage and operational purposes. The Council has also said that it plans to use the system to bid into ancillary services and trial selling flexible power. The Council is on track to convert over 20% of its fleet to ultra-low-emission vehicles by 2020. The 40 new vehicles will embrace the revolutionary concept of using stationary vehicles as energy stores to resupply the power grid. On average, domestic cars sit idle for 95% of the time, and this project allows them not only to be charged, but also to feed electricity stored within their batteries back to the grid or nearby buildings. (9)
- A new generation of solar-powered charging stations for electric cars is being developed across Britain. Plans have been drawn up for a network of more than 100 forecourts tailored to charge cars, vans and buses quickly. They will have space for 24 charging bays and “airport-style” lounges that motorists can use while they wait. Gridserve, the green energy company behind the plan, said that drivers would be able to reserve spaces in advance using an app to avoid long waits and that smaller vehicles could be charged in less than ten minutes. The company said that it had secured 80 sites on busy roads and near powerful grid connections. Under the plan new solar farms will be built next to most forecourts to supply energy directly. Work is due to start on the first two sites in York and Hull this year. (10)
- In Scotland Flexitricity, Turbo Power Systems, Flexisolar and Smart Power Systems are looking for sites for special solar-powered car parks where electric vehicles can be charged. The consortium of energy experts behind the pioneering project is already considering several potential sites across the country, including council facilities, park and ride schemes, airports, offices and train stations. The group has now secured millions of pounds in funding for the scheme, which will use solar panels and battery



storage to charge cars and buses. Revolutionary vehicle-to-grid (V2G) technology will also be employed at the hubs, allowing charged cars to feed electricity back to the smart grid where it can be used to power homes and businesses. (11)

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