



No.120 December 2019

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1. General Election Notes

British Prime Minister Boris Johnson has pledged to increase the UK's offshore wind target to 40GW for 2030. Johnson said the government will add 10GW to the existing 30GW goal if his Conservative party is re-elected in next month's General Election. The current target was established earlier this year in a joint industry-state sector deal. The PM said the increased 40GW by 2030 ambition would create 9000 new jobs. The Offshore Wind Industry Council welcomed Boris Johnson's commitment, which it said will quadruple the UK's offshore wind capacity from 8.5GW today. Offshore wind is now cheaper than gas, nuclear and coal.

It is worth emphasising the significance of this. It means that offshore wind capacity will at least quadruple over the next decade. The Labour party has a plan to set up a state-backed investment company to support the building of 37 new offshore wind farms in domestic waters by 2030. The 'People Power Plan' would see 52GW of offshore wind online by the end of the next decade, up from the existing 30GW target. (1)

Meanwhile, Labour has shelved a radical plan to deliver net zero emissions by 2030, despite Party members backing the target in a motion passed by the party's annual conference in September. The proposal was hailed as evidence of Labour's commitment to delivering the world's most ambitious decarbonisation programme, but it also sparked fierce criticism from businesses, trade unions, and political opponents, who warned such a rapid rate of decarbonisation was virtually impossible.

Speaking on BBC Radio 4's Today programme this morning, Shadow International Trade Secretary Barry Gardiner appeared to confirm the reports.

"The target that we have already committed to is to make sure that we have a net zero economy well before 2050," Gardiner said. "We will have our power sector 90 per cent powered by renewables by 2030. That's absolutely in line with achieving the overall targets that we have set, which is to make sure that well before 2050 we will have achieved the net zero".

The policy won crucial support from unions including Unite, Unison and ASLEF at Labour's September conference, but was opposed by GMB union, which represents industrial workers. Hitting net zero emissions by 2030 without the support of such as key union would have been a significant challenge for the party. Reports in *The Daily Telegraph* suggested unions demanded changes to Labour's climate policy at a key meeting to confirm the party's manifesto this weekend. The manifesto now promises the UK will make "substantial progress" to net zero emissions in the next decade, the paper said. (2)

Labour activists believed they had struck an achievable compromise, which spoke of a "path" to net-zero emissions in just 11 years' time with the support of most trade unions. However, the key GMB union, which represents workers in the energy sector, remained opposed, fearing rapid timeframe would put jobs in jeopardy. Many saw the 2030 target as impossible, because it



would involve huge intervention to replace fossil fuel power plants and petrol and diesel cars, as well as millions of household gas boilers. (3)

However, Labour has pledged to install solar power hubs on 2,000 buildings around the country. These hubs will be on public spaces like libraries, community centres and one stop shops, and form a key part of the party's Green Industrial Revolution. It says that the hubs will be able to save £3,000 on their bills every year on average, as well as being able to export power to the grid, providing an estimated additional income of £1,080 a year. Subsequently, the participating community hubs will be £8.2 million better off a year, the party has said. (4)

Dr Ian Fairlie, in a letter to *The Guardian*, said although Labour's manifesto contains many progressive ideas, especially on climate change, it is let down by its regressive support for nuclear weapons and yet more nuclear power. The manifesto states, with little or no justification, that Labour will build new nuclear power "needed for energy security". New nuclear power is considerably more expensive than the renewables, and millions of people in fuel poverty will suffer. (5)

Moorside

Sellafield Union leaders welcomed the inclusion of nuclear-new build in the Party's manifesto. After years of delay under the Conservatives, the proposed new nuclear station at Moorside was finally shelved last year, with investors citing a lack of government support as one of the reasons for its failure. However, with Labour vowing to put new-nuclear at the centre of a green energy revolution, Sellafield union chiefs say there is every reason to be confident — should Labour win the election. (6) Sue Hayman and Tony Lywood, Labour's candidates for Workington and Copeland both welcomed the inclusion of nuclear in the manifesto. (7) [The Liberal Democrat candidate for Copeland, John Studholme, supports the idea of a Small Modular Reactor at Sellafield.] Tony Lywood also wants to see a geological disposal facility near Sellafield for High Level Waste But he says "Used nuclear fuel and plutonium could run power for future generations and should not be disposed of." (8)

Wylfa

Anglesey is a three-way marginal seat between Labour, Conservatives and Plaid Cymru which has been held by Labour's Albert Owen for the past 18 years but has now retired. (9) Labour's manifesto states the party will "*work with people on the island to maximise its potential for new nuclear energy, alongside investment in renewables*". (10) Plaid Cymru's policy is to oppose the development of new sites for nuclear power plants. Though most Plaid supporters oppose nuclear power on principle, some haven't wanted to turn away the jobs and investment promised by the proposed replacement of the Wylfa plant on Anglesey - the island seat is one of their top targets. The policy also gives them the wriggle room to support an SMR at Trawsfynydd. (11)



Sizewell

In contrast to Moorside and Wylfa the Labour candidate for Suffolk Coastal, where Sizewell is located, opposes the development of new nuclear capacity at Sizewell. Cameron Matthews says the Sizewell C development cannot be undertaken without unacceptable impacts on the Suffolk Coast and Heaths Area of Outstanding Natural Beauty. It will compromise the future of RSPB Minsmere, and, especially during the construction period, other Sites of Special Scientific Interest and the highly sensitive local environment. It will threaten jobs and prosperity in the visitor and tourist economy, the agricultural sector and food and drink industries. It offers very few new permanent jobs for local people. (12)

On the upside the Labour manifesto pledged to upgrade “almost all” of the UK’s 27 million homes to the highest energy efficiency standards, which the party claims will reduce household energy bills by £417 annually by 2030 while eliminating fuel poverty. [Research by National Energy Action and climate-change charity E3G found that there were 17,000 deaths in the UK due to cold housing conditions last winter. (13)] Labour will also introduce a zero-carbon homes standard for all new homes. Heat pumps, solar hot water, hydrogen and district heat networks using waste heat will be prioritised to finally make progress on decarbonising heat. Labour will also introduce a “windfall tax” on oil companies, to cover the costs of climate change and environmental damage. Under Labour’s plans: a new UK National Energy Agency will own and maintain the national grid infrastructure and oversee the delivery of decarbonisation targets; 14 new Regional Energy Agencies will replace the existing district network operators and hold statutory responsibility for decarbonising electricity and heat and reducing fuel poverty; and the supply arms of the Big Six energy companies will be brought into public ownership where they will continue to supply households with energy while helping them to reduce their energy demands. (14)

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2. Hunterston B

EDF Energy is pressing for the emergency planning zone around its cracked nuclear reactors at Hunterston to be shrunk to a kilometre. The current zone – within which evacuation, sheltering and anti-radiation pills are planned in the event of an accident – is a radius of 2.4 kilometres from the power station. EDF has told North Ayrshire Council that urgent protective measures are only “*justified within a maximum distance of 1km from the site for protection of the public*”. Its assessment was based on the “*most pessimistic*” assumptions, it said.

Campaigners have criticised EDF’s move, warning that an accident could send a plume of radioactive contamination over Glasgow and Edinburgh. They have called for the emergency zone to be expanded, not contracted.

EDF stressed that its advice was that one kilometre was the “minimum” recommended distance. North Ayrshire Council is consulting with local residents before it decides what distance to implement. (1)

Crumbling Cores

The graphite cores of the two reactors have begun to crumble as cracks spread, prompting safety inspectors to impose tough new conditions threatening future operations. Technical reports released by the Office for Nuclear Regulation (ONR) reveal that at least 58 fragments and pieces of debris have broken off the graphite bricks that make up the reactor cores. According to ONR there is “*significant uncertainty*” about the risks of debris blocking channels for cooling the reactor and causing fuel cladding to melt.

ONR warns that it will require “*more robust arguments*” before it agrees to allow the two reactors to restart in 2020. It also highlights concerns about the risk of “*fuel snagging*” from “*multiple cracked bricks*” and says that previous predictions have underestimated cracking.

But EDF Energy insists that graphite debris does not “*pose a risk to nuclear safety*”, and ONR’s additional requirements are about “*theoretical risks which are extremely unlikely to develop*”. (2)

After permitting reactor four to restart for four months ONR posted five detailed technical reports online. One assessing “*structural integrity*” discloses for the first time that some of the graphite bricks in reactors three and four have begun to disintegrate. (3)

This could cause an accident and a leak of radioactivity. The NFLA is urging ONR to close down both reactors at Hunterston. “*These latest alarming revelations about the graphite reactor cores at Hunterston B starting to crumble and potential issues with the fuel make us even more convinced that reactor three should not be allowed to resume operation,*” said NFLA Scotland convener and Glasgow SNP councillor, Feargal Dalton. “*We will be pressing the Office for Nuclear Regulation very hard to examine very carefully any justification which EDF Energy puts forward to reopen reactor four after its initial four month trial, and to be open and transparent about what they find. The precautionary principle would suggest that this reactor too should stay closed.*”



Radiation consultant, Dr Ian Fairlie, described ONR's latest reports as "very worrying". By considering the melting of fuel cladding the regulatory agency was "getting into even more dangerous matters than before". He added: "These reports and their harder language make one wonder why ONR granted a four month extension to reactor four in August. Taken together the new revelations strengthen the calls by local residents to close both reactors at Hunterston B."

Reactor four, which has an estimated 209 cracks, was shut down for over ten months before ONR allowed it to restart in August – but only for four months. EDF is currently planning to shut it down again on 10 December.

New Emergency Planning Arrangements

The UK's regulations for radiological protection and emergency preparedness around nuclear sites are being updated. The new legislation, known as REPPiR 2019: Radiation (Emergency Preparedness and Public Information) Regulations became UK law on 22 May 2019 with local authorities given a year to implement the changes. The new regulations require Local Authorities to determine the size of the Detailed Emergency Planning Zone (DEPZ). The DEPZ is an area around a nuclear facility which requires detailed emergency plans to be prepared. Historically, this area was determined by the Office of Nuclear Regulation (ONR) and is currently delineated by a 2.4km circle around Hunterston. In future the zone will take account of local geography, topography and practical details like roads and settlements and may therefore be more irregular in size and shape – but more reflective of the conditions on the ground. ONR will continue to regulate arrangements under its approved code of practice and nuclear operators, including EDF Energy, will continue to provide technical guidance to Local Authorities for local plans.

As part of the implementation process EDF has submitted a Consequence Report (4) to North Ayrshire Council. This report sets out the technical justification for determining the minimum distance of the DEPZ. The Council is in the process of considering the contents of the Consequence Report, using the technical advice provided by the operator, they have also sought independent advice from Public Health England (PHE) and their own knowledge of the local population, geography and infrastructure. Once all of the information is assessed it will be utilised to determine the DEPZ boundary. In the meantime, the small number of households currently within the DEPZ will continue to receive information and pre-distributed stable iodine tablets to allow them to be prepared in the unlikely event of an offsite release of radiation. (5)

DEPZ

EDF accepts, however, that food restrictions may be required over a much wider area. "It is recommended that advice be issued within 24 hours to restrict consumption of leafy green vegetables, milk and water from open sources/rain water in all sectors of the detailed emergency planning zone and downwind of the site to a distance of 43km," it says.

Dr Ian Fairlie, described EDF's report as "deficient" and "misleading". The suggested emergency zone was "much too small", he argued, and there was a "lack of openness and clarity" that would



leave local people uncertain what to do in the event of a major accident. He added: *“The issue of the pre-distribution of prophylactic potassium iodate tablets is not mentioned. This already occurs in most European countries, and should occur here as well in order to avoid the health consequences of breathing in radioactive iodine which is a gas.”*

Rita Holmes, who chairs Hunterston’s local stakeholder group, pointed out that at the moment only 13 households close to the plant were given iodine tablets in advance. *“It would seem a simple precaution and unwise not to pre-distribute within a wider area”.*

Friends of the Earth Scotland pointed out that seven years after the explosions at the Fukushima nuclear reactors in Japan in 2011, some areas more than 20 kilometres away were still prohibited zones. *“The current Hunterston zone is already very modest in comparison to the very large area which would be affected in the event of a serious accident at the plant,”* said the environmental group’s director, Dr Richard Dixon.

“With increasing worries about the safety of the reactors at Hunterston now is definitely not the time to reduce the level of protection on offer to the local community,” he argued. *“EDF are the last people who should propose what size the exclusion zone should be around their own nuclear sites because it is in their financial and PR interests to make the zone as small as possible.”*

North Ayrshire Council is planning to agree the detailed emergency planning zone for Hunterston in January. *“We can go beyond the operator’s recommendations if there is clear justification based on factors detailed in the regulations,”* said the council’s head of democratic and administrative services, Andrew Fraser.

“To help inform this we are consulting with Public Health England’s centre for radiation, chemical and environmental hazards and also consulting those within the current 2.4km zone. Consultation responses will help inform whether there is a case to go beyond the 1km recommended by EDF.”

EDF Energy insists it is not urging North Ayrshire Council to reduce its emergency planning zone. *“The regulations require that all nuclear operators provide technical advice to each local authority on the minimum distance recommended for the DEPZ. The final decision on the DEPZ rests with the local authority which will consider this report alongside other local factors.”* (6)

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 3. ONR (accessed) 29th Oct 2019 <http://www.onr.org.uk/civil-nuclear-reactors/hunterston-b-graphiteblocks.htm>
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 5. North Ayrshire Council (accessed) 3rd Dec 2019 <https://www.north-ayrshire.gov.uk/community-safety/reppir-2019.aspx>
 6. The Ferret 22nd Nov 2019 <https://theferret.scot/emergency-zone-hunterston-nuclear-reactors/>



3. Dungeness B

Hunterston B isn't the only one of EDF Energy's old AGRs having problems. The two reactors at Dungeness B in Kent were taken off the grid in August and September 2018 for a 'statutory outage', but haven't been back on-line since. It was initially thought the work would take 12 weeks, but inspections revealed cracks and environmental corrosion on pipes. EDF Energy says work is nearing completion and they hope to return the reactors to service in January 2020 (20th and 31st January).

The news comes after a report from the Office for Nuclear Regulation (ONR) revealed a number of breaches at the plant. They were identified during a routine visit at the station, carried out by ONR inspectors quarterly. The breaches related to the Auxiliary Cooling Water (AWC) system and the Reactor Pressure Vessel safety relief valves. But as the reactors were already offline, the risk was deemed minimal. The report states: *"During this reporting period the station identified that the ACW system was judged not to be seismically qualified due to deficiencies in the supporting arrangements of the pipework."* (1)

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1. Kent Online 25th Nov 2019 <https://www.kentonline.co.uk/romney-marsh/news/nuclear-power-station-due-to-come-back-online-217149/>



4. What the World Nuclear Waste Report doesn't say about the UK

The World Nuclear Waste Report, (1) published earlier this year and covered briefly in nuClear News No.119 doesn't quite give readers a view of the full horror of the radioactive waste mess the UK has got itself into.

Waste from New Reactors

The report says the independent Committee on Radioactive Waste Management (CoRWM) reported in 2006 in favour of Deep Geological Disposal (DGD) for all higher activity waste, but doesn't mention that CoRWM's 2006 report emphasised that its recommendations were directed to

"existing and committed waste arisings ... New Build wastes would extend the timescales for implementation, possibly for very long, but essentially unknowable, future periods. Further, the political and ethical issues raised by the creation of more wastes are quite different from those relating to committed – and therefore unavoidable – wastes." (2)

In September 2007 CoRWM re-iterated the point saying: *"To justify creating new spent fuel from an ethical point of view, there must be a management solution that is ethically sound, not just least bad. ... In short, a solution that is ethically acceptable for dealing with existing spent fuel is not necessarily a solution that would be ethically acceptable for dealing with new or changed materials."* (3)

Sellafield's High-Level Liquid Waste

The report says closure of the Magnox stations and the poor and deteriorating state of Sellafield made it clear by the early 2000s that a more coherent policy and higher expenditures were needed to manage waste in the short- and medium-term. The establishment of setting up the Nuclear Decommissioning Authority (NDA) in 2005 was a recognition that Sellafield was the most problematic UK site, containing a huge range of ex-military and ex-civilian buildings and wastes including four so-called Legacy Ponds and Silos, all representing major hazards, as well as being home to virtually all UK spent fuel. But there is no specific mention of the extreme concerns expressed about the liquid High Level Waste tanks, especially after the 2001 terrorist attacks in New York and Washington.

The intensely radioactive liquids known as Highly Active Liquors (HAL) which result from reprocessing spent fuel generate their own heat, so must be stored at Sellafield in special cooling tanks to prevent the waste from boiling. The consequences of a prolonged cooling failure could be 'very severe' leading to boiling after 12 hours, and to the tanks drying out after three days with radioactivity escaping and contaminating the surrounding environment. Consequently, the HLW facility at Sellafield is probably one of the most dangerous nuclear



facilities in the world with the potential to at least force the evacuation of much of northern England and southern Scotland, and cause long lasting contamination well beyond the UK. (4)

The Highly Active Liquor Evaporation and Storage (HALES) area at Sellafield consists of four evaporators A, B, C, the recently commissioned D, (5) and a number of High Activity Storage Tanks (HASTs). There are 21 tanks, some dating back to the 1950's, (6) but the number in use has been reducing since 2009 with only around half in use by 2013. (7)

In the year 2000, the Nuclear Installations Inspectorate (NII) (now part of the Office for Nuclear Regulation - ONR) warned that the High-Level Liquid Waste storage tanks at Sellafield needed to be emptied and the waste solidified "*as soon as reasonably practicable*", reaching a buffer level by 2015. Any shortfall, it said, would be "*publicly unacceptable*" (8). In January 2001, the NII issued the Sellafield operator (at the time British Nuclear Fuels Ltd -BNFL) with a legal requirement to reduce the level of High-Level Liquid Waste down from approximately 1600m³ to a residual or buffer stock of 200m³ by 2015. (9)

Following the 9/11 terrorist attacks a review was undertaken by the Parliamentary Office of Science and Technology (POST) of the impact of similar attacks on vulnerable UK facilities. It found that a terrorist attack on the tanks could require the evacuation of an area between Glasgow and Liverpool, and cause around 2 million fatalities (10). The Massachusetts-based Institute for Resource and Security Studies (IRSS) reported that highly radioactive liquid stored in tanks contained around 2,400 kilograms (kg) of Caesium-137 compared with the 30 kg released during the Chernobyl accident (11).

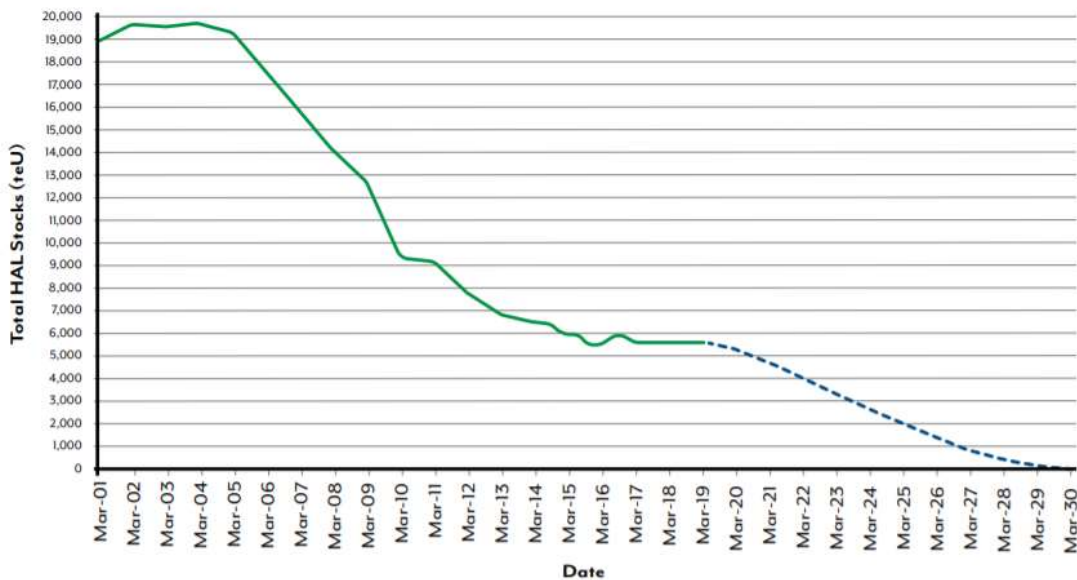
In 2011 the ONR decided to increase the permitted level of HAL stocks to almost three times the limits defined under the earlier legal requirement. (12). This increase to the 'buffer level' was to provide Sellafield with "*the flexibility to accelerate the hazard reduction*". Part of the explanation given for this was that the original legal requirement was set at a time when reprocessing was expected to have been completed by about 2015, at which time a minimal working "buffer stock" level would have been reached. But reprocessing operations had been plagued with problems. THORP is now closed and the Magnox Reprocessing Plant is expected to close in 2020. The 2011 ONR recommendation was that the Steady-State Specification should be set at 5,500 tonnes uranium (teU).

The Chief Nuclear Inspector reported in October 2019 that stocks of Highly Active Liquor at Sellafield currently amount to around 5,750teU. According to the Inspector stock levels have remained steady for the last few years "*due to a number of operational issues, but it is anticipated that HAL stock reduction will now continue*". (13) 5,750teU would be equivalent to around 484m³ – more than double the buffer stock originally expected to be achieved in 2015 by the NII.¹

¹ If 19,000 teU is equal to 1,600m³, 5,750 teU = 484m³



FIGURE 1 - ACTUAL (2019) AND PROJECTED HAL STOCKS TO 2030
(COURTESY OF SELLAFIELD LIMITED)



Scottish Policy

The Report mentions briefly that “Scotland’s policy is different from that of the rest of the UK, and envisages near-surface disposal of all nuclear waste within its borders”. The Scottish Government’s policy, in fact, only refers to Higher Activity Waste. It says that the long-term management of higher activity radioactive waste should be in near-surface facilities. Facilities should be located as near to the site where the waste is produced as possible. The Scottish Government does not support deep geological disposal of radioactive waste. (14)

However, since spent fuel is not classified as waste, spent fuel from Scotland’s remaining operating reactors is still transported to Sellafield. Nor does the policy apply to LLW or VLLW. Scotland does not have a landfill site for VLLW, or an LLW repository outside of Dounreay, so still sends lower level waste to the Low Level Waste Repository at Drigg in Cumbria and English landfill sites at Clifton Marsh in Lancashire and Augean in Northamptonshire. It also continues to send contaminated metal for decontamination and so-called recycling to the Cycliffe plant at Lillyhall in Cumbria.

Dounreay

Dounreay is hardly covered in the report, although the fact that it is a site for LLW disposal is mentioned, despite it being the site of some of our worst horror stories. Dounreay was the UK’s centre of fast reactor research and development between 1955 and 1994 and is now described as Scotland’s largest nuclear clean-up and demolition project.

The Dounreay Fast Reactor (DFR) first achieved criticality in 1958, and operated until 1977. Most of the breeder elements were removed soon after, but almost 1,000 were found to be



swollen and jammed in place. They were left in place until remotely-operated tools could be developed. (15) Recovering the jammed elements began forty years after the reactor closed, and by 2019 half of them were still in place. (16) This spent fuel is being transported to Sellafield for reprocessing in the Magnox fuel reprocessing plant but not all of it will arrive before the plant closes in 2020, so arrangements are being made to dry store the remainder at Sellafield.

The Prototype Fast Reactor (PFR) opened in 1974 and closed in 1994. The site also housed a fast reactor reprocessing plant, as well as a research reactor reprocessing plant. Overseas research reactor spent fuel was imported for reprocessing up until 1974 when it stopped because foreign customers were unwilling to take their waste back. Then in 1992 Dounreay re-entered the research reactor spent fuel reprocessing business with spent research reactor fuel imported, mainly from Germany until it was announced in 1998 that Dounreay would not take on any new contracts. Dounreay was also site of a materials test reactor which operated between 1958 and 1969. The Vulcan submarine reactor test facility is also at Dounreay with one reactor in care and maintenance and another in the process of being defueled and spent fuel being dispatched to Sellafield.

In 1958 the Scottish Office authorised use of an underground shaft – built to remove spoil during construction of a sub-sea effluent discharge tunnel – as a disposal facility for intermediate level radioactive waste. More than 11,000 disposals took place between 1959 until 1977, when a chemical explosion occurred and the practice ceased. Decommissioning the 65-metre deep shaft is a major challenge. A second facility, the intermediate-level waste silo, also needs to be emptied. A concrete-lined box built just beneath the surface, it was used to dispose of waste between 1971 and 1998. Work to retrieve waste from the shaft and silo isn't expected to get under way until around 2023. Preparatory and construction work have to be carried out before the waste can be removed. (17)

Another major problem at Dounreay is the appearance of radioactive particles in the environment. These small fragments of irradiated nuclear fuel have been found on the seabed off Dounreay, on the Dounreay foreshore and on Sandside Beach west of Dounreay, which is open to the public. A fishing ban prohibits the removal of fish, crustaceans and molluscs in an area of 2km (1.2 mile) radius centred on the disused Dounreay discharge point near where the highest density of particles has been detected. (18) It will be around 200 years, before the activities of the larger particles, have decayed sufficiently that they can no longer be considered a potential hazard. Particles will keep polluting public beaches for decades to come, and the environment will never be completely cleaned up. Despite assurances that the risk is low of a member of the public coming into contact with a particle which is a serious hazard to health, it is uncertain that this will continue to be the case. Since 1983 almost 500 radioactive particles have been found including more than 200 on the publicly accessible Sandside beach. (19)

In 2015 new low-level waste vaults at Dounreay started to accept waste. (20) This is the only UK low-level waste 'disposal' facility other than the low-level waste repository at Drigg near Sellafield. Previously low-level waste generated at Dounreay had been dumped in a rather haphazard fashion in the low-level waste pits. The current plan is eventually to retrieve the



waste from these pits, repackage it and then place it in the new vaults. However, the Scottish Environment Protection Agency (SEPA) has told Dounreay that it has been “non-compliant with regard to its obligation not to allow radioactive substance to contaminate the groundwater near the pits”. This may force Dounreay to remove the waste from the pits sooner than originally planned.

- Radioactive water is leaking from a nuclear waste storage building as big as 132 double-decker buses at Sellafield. Sellafield Ltd said there is no risk to staff nor the wider community as the water, which covers the solid radioactive waste in the silo, will remain in the ground “for some time”. The leak is believed to be originating from the six older compartments of the Magnox Swarf Storage Silo, which has 22 compartments in total. However, it is not known how much water has been lost so far. The majority of the radioactive material stored there is fuel cladding, which Sellafield says has an intermediate level of radioactivity. (21)

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5. Net Zero with Existing Technology

Eliminating greenhouse gas emissions in the UK is achievable with current technology, according to a new report from the Centre for Alternative Technology (CAT). Changes to buildings, transport and industry could help slash UK energy demand by 60%. The CAT report - *Zero Carbon Britain: Rising to the Climate Emergency* - also claims making further changes to energy, diets and land use could help provide 100% renewable energy and cut emissions from agriculture and industry. That would mean the UK would not be reliant on "as yet unproven" technologies, such as carbon or air capture.

The report shows how it is possible to supply 100% of the UK's 'powered-down' energy demand with renewable and carbon neutral energy sources, without fossil fuels or nuclear. In the Zero Carbon Britain energy scenario:

- Many different renewable energy sources suited to the UK – solar, geothermal, hydro, tidal and others – are used to produce electricity and heat, with wind energy providing around half of the energy supply.
- Most of the energy in the scenario (around 66%) is provided as electricity.
- Carbon neutral synthetic fuels play an important role where it is not possible to use electricity – for example, in some areas of industry and transport, and as back up for the energy system.

To ensure that energy is available at all times, CAT researchers looked at 10 years of real weather data to examine how much energy could be captured by renewable energy systems. By matching this to 10 years of energy demand patterns, adjusted to take account of the modelled energy savings, researchers were able to plan for possible shortfalls.

The hourly modelling shows a surplus of energy 74% of the time, with energy provided at other times by shifting demand using smart appliances and by storing energy.

Batteries, pumped storage and heat storage can be used for short-term energy storage over hours or days, whilst hydrogen and carbon neutral synthetic gas (which can be dispatched quickly into the electricity grid when needed) can be used for long-term energy storage over weeks or months.

The report highlights the multiple additional benefits that these changes offer, including improvements to health and wellbeing via better diets, more exercise, improved air quality and a reduction in fuel poverty. Other benefits include the creation of green jobs and an increase in biodiversity both through tackling climate change and through freeing up land to allow nature to thrive.



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2. **Executive Summary. CAT 28th Nov 2019**
https://www.cat.org.uk/app/uploads/dlm_uploads/2019/11/Executive-Summary-Zero-Carbon-Britain-Rising-to-the-Climate-Emergency.pdf
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6. Nuclear and the Climate Emergency

If nuclear's 10% of global electricity generation displaced an average mix of fossil-fuelled generation and nothing else, it would offset 4% of fossil-fuel CO₂ emissions. In an era of urgent climate concern, Amory Lovins, former chief scientist at the Rocky Mountain Institute, asks "*should nuclear power continue, shrink, or expand?*"

How should we compare different ways to provide electrical services in a carbon-constrained world? Our society built coal-fired power plants by counting cost but not carbon. Nuclear advocates defend their preference by counting carbon but not cost. But to protect the climate, we must save the most carbon at the least cost and in the least time, counting all three variables—carbon and cost and time. Costly options save less carbon per dollar than cheaper options. Slow options save less carbon per year than faster options. Thus, even a low- or no-carbon option that is too costly or too slow will reduce and retard achievable climate protection. Being carbon-free does not establish climate-effectiveness. Since money and time are both limited, our priorities in providing energy services must be informed by relative cost and speed. Lower cost saves more carbon per dollar. Faster deployment saves more carbon per year. We need both. (1)

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1. Forbes 18th Nov 2019 <https://www.forbes.com/sites/amorylovins/2019/11/18/does-nuclear-power-slow-or-speed-climate-change/#7795297e506b>



7. Hinkley Point C: The view on the ground

Stop Hinkley spokesman Roy Pumfrey questions whether the economic boost from Hinkley Point C (HPC) is worth the cost. Councillors seem easily impressed when they visit the giant incomplete building site that is HPC. Why does Cllr Ann Bown assume that we all think the “biggest economic boost” is necessarily a good thing when it is also hugely problematic and costly for anyone not directly involved?

In our case, economic growth also means a host of problems. There are more traffic jams all around gridlocked Bridgwater. I’d like to travel from Bridgwater to Taunton using the Taunton Road, but that simply adds 30 minutes to the journey time. Air and light pollution (if you live on the ‘Dark Side’ of the Quantocks, try a trip to a summit on a cloudy evening to see what I mean) have increased as a result of HPC. Rents, particularly of one-bedroom properties anywhere close to the HPC bus routes, have gone sky high due to well-paid HPC contractors and one wonders what the seven hotels built or in the pipeline will become after the HPC Gold Rush is history. And it will be electricity consumers from Lands End to John O Groats who will have to fund this excessively expensive project to the tune of around £50bn over the next 35 years. That assumes that HPC ever works, unlike its sister reactors in Finland and France, both massively over-budget and years behind schedule.

Instead of uncritically absorbing EDF’s spin on the project, councillors and council officers should be asking EDF why they pretended for over a year that all was going well when, in fact, they must have known that ‘challenging ground conditions’ and ‘bad weather’ meant that the cost was rising by another £2.9billion and further delay was inevitable.

A massive house retrofit programme across the south-west, for instance, would also be a big economic boost for the region, but a much more sustainable investment with the benefits accruing to ordinary consumers. When Cllr Bown has finished closing her eyes to the problems Hinkley C poses and taking in pro-nuclear fantasies, perhaps she can open them to the reality of the massive hazard an untried new nuclear power station running adjacent to her constituency represents. Building a new nuclear power station with a sixty year life span on a vulnerable coastline with the latest concerns about sea level rise is a gamble. People need to think about the legacy being left for their grandchildren before talking about ‘progress’ and short term ‘economic boosts’. (1)

1. This is the West Country 17th Nov 2019

https://www.thisisthewestcountry.co.uk/news/somerset_news/18041205.letter-economic-growth-hinkley-c-worth-costs/



8. Local Energy Notes

Nottingham's Net Zero Ambition

Nottingham City Council has been named the overall winner in the Guardian's Public Service Awards. The Council announced in January that it intended to become the UK's first carbon-neutral city by 2028. It has already met its 2020 target to reduce carbon dioxide emissions by 26% four years early; more than 40% of all journeys in Nottingham are made on public transport and solar panels have been installed on more than 4,000 council houses. Energy consumption of council buildings has been cut by 39% and it is on track to generate 20% of its energy from low-carbon sources by next year. And last year the Department for Environment, Food and Rural Affairs concluded that the city's air pollution had fallen so much that a Clean Air Zone was not needed.

Making the carbon neutral commitment was only possible, says Sally Longford, the Labour council's deputy leader and portfolio holder for energy and environment, because of the work that had gone before. *"We got a lot of stick over the years. People thought we were anti-car, because we introduced various schemes to try and reduce car usage and congestion."* But it has paid off. *"When I was talking to the officers about how far we could push this they were confident we could go further than other councils because of all the work we'd already done."*

One policy in particular, its workplace parking levy (WPL), was a *"gamechanger"* according to Longford. Introduced in 2012, the WPL is aimed at employers providing 11 or more commuter parking spaces, with an annual rate of £415 per space. It is still the only such scheme in the UK and has not only tackled congestion and pollution but netted the council £61m for improving and *"greening"* public transport. That money has helped with the redevelopment of Nottingham station, an expansion of the tram network that runs on green electricity from the council's own energy company, and the council's fleet of 58 electric buses that has reduced carbon emissions by more than 1,050 tonnes. *"We have a positive attitude to these things because they pay for themselves,"* says Longford. *"We're putting solar panels on anything that doesn't move, really, because it saves us money in the long run and helps support other work we're doing."*

The energy and transport teams have won funding from central government, Europe and other sources, and the savings the energy team generates means it actually makes a profit for the council that can be used to cross-subsidise crucial departments such as children's services. (1)

Net Zero Bristol by 2030

Bristol City Council – controlled by Labour – was the first council in the country to declare a climate emergency in November 2018. That motion was unanimously passed and now acts as the foundations for the City's transformative commitment to become carbon-neutral by 2030.

In 2015, Bristol became the UK's first European Green Capital. And, having already 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 – it now has the lowest carbon footprint of any UK city.

The City's Energy, Transport and Green New Deal Lead Kye Dudd stresses the importance of the unitary authority continuing to lead the climate movement in a way that he hopes will create something of a domino effect of climate action among businesses, citizens and policymakers alike. *"We need to extend our influence into the business sphere and to bring other people with us."*

The Council recently partnered with Manchester-based blockchain technology company EnergiMine to reward council employees who partake in sustainable actions by using the EnergiToken (ETK) platform. ETK uses blockchain to incentivise actions that promote energy reduction, clean transport use and social cause initiatives. Employees can now earn tokens to spend on rewards – or donate the equivalent value to a registered charity – by acting in an environmentally sustainable way.

Great progress has also been made outside of the Council's own operations – particularly in the area of renewable energy. More than £50m has been invested in low-carbon and renewable energy projects in the region since 2012, and to great effect: Bristol sourced 21GWh of energy generation from solar, wind and biomass in 2018 – enough to power 24,000 homes for a month.

Through the Council's City Leap Strategy it hopes to attract a further £1bn of global investment in the city. Local partners already supporting the project include the University of Bristol, University of the West of England, Western Power Distribution, Bristol is Open, Invest Bristol and Bath, Bristol Green Capital Partnership and Bristol Energy. The signs are already looking positive: since its launch last year, the City Leap initiative has already garnered interested from almost 200 local organisations, international firms, investors and energy and infrastructure businesses.

Dudd notes that district heat networks and community renewable energy projects are two areas where smaller local businesses can get involved. A 5MW community-owned solar project, has installed roof-mounted solar panels on public buildings. And a new network of underground pipes that will deliver affordable, low-carbon heat and energy across the city – is already benefitting more than 1,000 social housing properties and is continuing to expand.

The Council voted in October to make Bristol the first UK city to ban public use of diesel cars from its streets to combat air pollution. While still requiring government approval, that scheme is set to start from 2021. Bristol's Eastville Park is the first of four planned charging hub for the region, each hosting four to eight rapid-charge connections that can charge an EV up to 80% from 30 minutes' charging. In total, four local authorities will install 120 new or replacement charge point connections across over the next year. The majority of the charge points will be supplied with 100% renewable energy provided by Bristol Energy. (2)

Sunderland goes for Ground Source Heat Pumps

Residents in 364 homes across seven tower blocks in Sunderland are seeing their gas boilers replaced with heat from ground source heat pumps. There will be a ground source heat pump



for each flat which will also be connected to a district heating system consisting of ambient shared ground loop arrays. An underground aquifer will provide the heat source for the tower blocks, accessed via open loop boreholes drilled to depths of 60m. The ambient system prevents heat losses, overcoming overheating in the tower block communal areas, and boosts the system efficiency. The independent heat pumps mean that tenants can shop around for their electricity deal, whilst reducing carbon emissions by an estimated 420 tonnes or nearly 70% per year and improving local air quality. Gentoo Group is delivering the 'Core 364' project with the support of Engie and ground source heat pump specialists, Kensa Contracting. Work started in October, with all systems expected to be replaced by late Summer 2020.

Gentoo's chief executive officer, Nigel Wilson, said: *"This heating system will provide heat and hot water at a much reduced cost, using natural heat from the ground."* (3)

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 2. Edie 25th Nov 2019 <https://www.edie.net/library/Net-zero-cities--Bristol-s-mission-to-be-carbon-neutral-by-2030/6950>
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9. Citizens' Juries and Climate Assemblies

Members of the Leeds Climate Change Citizens' Jury have announced their recommendations after almost two months of evidence gathering and deliberations. Their recommendations include public ownership of the buses in Leeds, new green funding sources, a city-wide retrofitting programmes for houses, and a stop to the expansion of Leeds Bradford Airport. The 21-strong jury, selected through a process of random stratified selection to represent a "mini public" of Leeds, met for nine sessions and heard from 22 commentators in order to address the question, "What should Leeds do about the emergency of climate change?".

The jurors recommend that "extensive positive action is taken to make the use of private cars a last resort for transportation" in Leeds. Among a raft of other transport-related recommendations are a congestion charge, safe cycle lanes and cycle storage, and increased pedestrianisation. Eighteen of the jurors (86%) also believed that it is the wrong decision to expand Leeds Bradford Airport. (1)

A detailed report on the findings of the Oxford Citizens Assembly on Climate Change, has also been published. The report, which has been produced by experts at Ipsos MORI who independently facilitated the Citizens Assembly on behalf of the City Council, summarises its findings and recommendations.

The majority of Assembly members felt that Oxford should aim to achieve 'net zero' sooner than 2050. There was widespread belief that Oxford should be a leader in tackling the climate crisis. Enhanced biodiversity was central to the overall 'net zero' vision of Oxford with increased flora and fauna in the city centre, along with more cycling, walking, and public transport, and far fewer cars. The buildings sector should adopt improved building standards, widespread retrofitting, and more domestic and non-domestic energy needs being met by sustainable sources. (2)

More than 150 young people discussed how the Republic of Ireland can tackle global warming as they attended the country's first Youth Assembly on climate change. The Youth Assembly's recommendations included a ban the importation of fracked gas and investment solely in renewables. (3)

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1. Leeds Climate Commission 26th Nov 2019 <https://www.leedsclimate.org.uk/leeds-citizens-jury-recommendations-published>
 2. Oxford City Council (accessed) 25th Nov 2019 https://www.oxford.gov.uk/info/20011/environment/1343/oxford_citizens_assembly_on_climate_change/6
 3. BBC 16th Nov 2019 <https://www.bbc.co.uk/news/world-europe-50434646>



10. Renewable Notes

Solar Grid Balancing

A solar farm has provided National Grid ESO with reactive power overnight in what is being lauded as a UK first. Solar inverters at one of Lightsource BP's solar plants were used to provide a reactive power service on Monday 4 November. The solar inverters are capable of providing reactive power – the ability to maintain voltage levels on electricity transmission systems – by reducing or increasing voltage levels. This then delivers the voltage change necessary at the grid point. National Grid ESO said this is the first instance of a solar asset providing the service at night, when a solar farm would ordinarily be inactive. The trial means solar could be providing reactive power overnight, utilising the asset when it would otherwise be sitting idle – a move which would help increase capacity on the network without the need for infrastructure upgrades. (1)

The breakthrough could mean that UK solar farms will soon help stabilise the energy grid at night, and save millions on grid upgrades or building new power plants. “Inverters” at the solar farm are usually used in the process of converting solar energy to electric current. But at night, when the grid is often less stable, the same equipment can adapt grid electricity to a healthier voltage. It has the potential to provide up to 4GW of power capacity in the South East and save energy customers over £400 million by 2050.

The inverter acts like a distortion mirror by reflecting the energy network's voltage back to the grid at a slightly different level. On blustery nights with plenty of wind power but little demand, the solar farm could help prevent the energy grid's voltage from rising too high. It could also prevent the voltage from falling too low during still nights in winter when demand is often high. Lightsource BP will carry out a second trial in December, and it hopes to strike its first commercial deal to help balance the electricity grid with National Grid next year. (2)

Ammonia for storage

Ammonia is looking like being the best means by which wind and solar power can provide ‘firm’ power – that is ensure continuous supply of energy demand from renewable energy 100 per cent of the time, according to Dave Toke, reader in Energy Policy at Aberdeen University. Ammonia could be used as an energy carrier for hydrogen produced from water which has been electrolysed – split into hydrogen and oxygen – by renewable electricity (mainly wind or solar).

The hydrogen can be more or less simultaneously combined with nitrogen from the atmosphere to produce ammonia. The ammonia can be stored, and when needed, it can be burned in conventional-style turbines/engines or used in specially designed fuel cells to generate electricity when required.



Currently much conventional wisdom has it that batteries are only the main means of storing renewable energy. Batteries are very good for evening out balances in daily production and consumption of electricity – so peak demand can be reduced and the amount of firm power reduced. But we also need firm power for those days – under a 100 per cent renewable energy system – when there is little wind or sun. This is where ammonia comes in as a potentially better option for providing firm power. It is not a question of either batteries or ammonia, but simply that they can perform different functions providing short term and longer-term storage respectively. Ammonia (used as a hydrogen energy carrier) has a great advantage over hydrogen itself in that it can be stored much more easily than hydrogen. Ammonia is already stored for lengthy periods whereas long term storage of hydrogen requires development of the use of caverns or depleted gas fields.

One reason why ammonia is likely to emerge as a key part of progress to a 100 per cent renewable energy economy in countries like the UK is simply because ammonia is a very important industrial feedstock. The fertiliser industry, in particular, requires massive quantities of ammonia which are currently derived by a highly energy/carbon intensive process involving the 'reformation' of fossil fuels. The reformation (called the Haber process) releases hydrogen from the fossil fuel (usually natural gas or oil derived) which is then combined with nitrogen to produce the ammonia. The fertiliser industry is going to be under pressure to reduce its carbon footprint by deriving its ammonia from low carbon energy sources. (3)

Onshore Wind Expansion?

ScottishPower has begun drawing up plans for a major expansion of onshore windfarm projects across Scotland in anticipation of a government U-turn on support for wind power projects. The company has already considered almost 100 sites for a new generation of windfarm, using a smaller number of more powerful wind turbines to generate clean electricity. Most of the sites are in Scotland, but the company is also considering plots in Ireland. Scottish Power expects the Conservative party's block on onshore generation to be cast aside in the next parliament due to the growing need for cheap, clean energy to power the UK towards its climate goals. The government's official climate advisers, the Committee on Climate Change (CCC), has said the UK will need to build at least 1,000MW of onshore wind every year for the next three decades if it hopes to meet its target to create a carbon-neutral economy by 2050. This steady rollout is necessary, in addition to building offshore windfarms at four times the present rate. (4)

Tidal Barrages

A multi billion pound project to build a bridge across Morecambe Bay and generate two per cent of the nation's power through tidal power has taken a "major step forward", according to its chief executive. Northern Tidal Power Gateways is pushing for funding and support to make its vision a reality. NTPG's plan would incorporate 130 hydro power turbines along the length of two bridges – one of 14km across Morecambe Bay and another of 5.5km between Barrow and Millom across the Duddon Estuary. (5)



Meanwhile, the Labour Party says it would go ahead with the Swansea Bay tidal lagoon if it wins the General Election. (6) The green energy entrepreneur who wants to build the lagoons is asking investors for £1.2 million to keep the project alive. Mark Shorrock gained planning consent for the first proposed lagoon, in Swansea Bay, in 2015 but failed to persuade the government to offer crucial subsidies for the £1.3 billion project. Labour and Plaid Cymru have expressed support for the proposal but planning permission for the Swansea project is due to lapse in June unless material works have begun. (7)

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1. Solar Power Portal 25th Nov 2019 https://www.solarpowerportal.co.uk/news/lightsource_bp_delivers_night_time_reactive_power_using_solar_in_uk_first
 2. Guardian 24th Nov 2019 <https://www.theguardian.com/environment/2019/nov/24/solar-farms-keep-uk-lights-on-at-night>
 3. Dave Toke's Blog 24th Nov 2019 <http://realfeed-intariffs.blogspot.com/2019/11/how-ammonia-beats-batteries-to-supply.html>
 4. Guardian 24th Nov 2019 <https://www.theguardian.com/environment/2019/nov/24/scottish-power-plans-major-expansion-of-onshore-windfarms>
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 6. BBC 21st Nov 2019 <https://www.bbc.co.uk/news/election-2019-50490159>
 7. Guardian 4th Dec 2019 <https://www.theguardian.com/business/2019/dec/04/swansea-tidal-power-project-launches-11th-hour-1m-fundraising-drive>



11. Some thoughts on Hydrogen

(with thanks to Neil Crumpton)

Earlier this year the Committee on Climate Change (CCC) in its Net Zero report, (1) put forward scenarios which include different levels of future hydrogen production by 2050. Its analysis assumes that demands for hydrogen in the UK is met through UK production, and that the majority of future hydrogen production in the UK is from advanced methane reformation with CCS (53-225 TWh), with a limited contribution from electrolysis in the Further Ambition scenario (44 TWh/yr). It also said production of synthetic fuels for aviation using electrolytic hydrogen, and carbon dioxide produced in the UK could require 200 TWh of additional power generation in 2050. (2)

The Committee viewed most of the production (85%) would be via 'advanced' Natural Gas with CCS and 15 % via electrolysis (presumably using excess supply over demand wind / PV). That said, the Net Zero Technical report (published May 2019) became badly out of date just FOUR months later when on 20th September BEIS unveiled its 3rd Round offshore wind auction prices - of around £40/MWh (3)

The CCC's 2018 Progress Report to Parliament recommended that, in addition to current commitments, a further 50-60 TWh of low-carbon generation would need to be contracted to come online by 2030. The Committee said it is unlikely that this generation will come forward at scale without Government backed contracts, which de-risk investments and reduce project costs.

However, even the Tories have increased their offshore wind target from 30 GW to 40 GW by 2030. (4) This further 10 GW would itself generate 50 TWh/y (assuming 57% Capacity Factor for schemes built in the 2025-2030 period). BEIS does not appear to assume any CCS projects will start before 2035. So, there will likely be more times when there is a surplus of renewable electricity to utilise or waste.

Electrolyser costs are forecast by some to fall only slowly in price even by 2050 e.g. by 50% from £660/kW currently (5). That said, who knows what technical breakthroughs may disrupt that forecast e.g. the Glasgow work using pulsed electricity on a new catalyst (6). AFC Energy's fuel cells are also apparently progressing albeit very slowly to date. They seem to have solved the cell poisoning by 'lower-grade hydrogen' and are going to market (7).

So, the percentage of future hydrogen production which is electrolytic could be much higher than currently expected.

1. Net Zero: The UK's Contribution to Stopping Global Warming, CCC, May 2019
<https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf>



2. Net Zero Technical report, CCC May 2019 <https://www.theccc.org.uk/publication/net-zero-technical-report/>
3. Current News 20th Sept 2019 <https://www.current-news.co.uk/news/offshore-wind-smashes-price-records-in-third-cfd-auction-round>
4. Energy Voice 14th Nov 2019 <https://www.energyvoice.com/otherenergy/212119/boris-johnson-pledges-to-raise-offshore-wind-target-to-40gw>
5. PV Magazine 26th Sept 2019 <https://www.pv-magazine.com/2019/09/26/the-slow-inexorable-rise-of-green-hydrogen/>
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7. H2 View 5th Nov 2019 <https://www.h2-view.com/story/afc-energy-unveils-new-product-lines/>