



No.119 November 2019

1. Nuclear Finance
2. Time to Abandon Hinkley Point C?
3. Do we really need 40GW of Firm Power?
4. Net Zero Review
5. Electric Vehicles
6. Thirty Recommendations by 2030 – expert briefing for the Labour Party: A critique
7. Geological Disposal
8. World Nuclear Waste Report
9. Hinkley Notes
10. Office for Nuclear Regulation
11. Energy Storage
12. Local Energy Notes



# 1. Nuclear Finance

The Nuclear Consultation Group's submission on the Regulated Asset Base (RAB) consultation (1) says the background for EDF has changed markedly since the Company first mooted the idea as a way of financing Sizewell C. EDF, in its present form with 83% state ownership, is seen as not financially sustainable. Under "Opération Hercule", it is proposed that EDF's nuclear assets be separated into a new company, "EDF Bleu". This would be expected to be renationalised, with the other assets placed in a separate, part-privatised company, "EDF Vert". This reform, if it goes ahead, will face significant regulatory hurdles before it can be completed. At this stage, it is impossible to say whether EDF Bleu would still want to pursue the RAB model.

## Thames Tideway Misleads

The authors say the example of the Thames Tideway Tunnel (TTT) sewerage project, used to show that the RAB model is tried, tested and proven, is misleading. Even if we accept EDF's dubious claim that Sizewell C will be 20% cheaper than the current estimated cost of Hinkley Point C (including the cost of finance), the total construction cost of Sizewell C will be about £32 billion<sup>1</sup> - seven times that of Thames Tideway. All experience with nuclear projects worldwide in recent years suggests it is almost inevitable that costs will substantially exceed estimates, and a total cost of at least £40 billion would be likely. Thames Tideway earns its return on investment simply by being there, there is no output to sell. For a nuclear power station the amount of output to be sold would vary substantially from year to year as would the price. It would require some form of power purchase agreement to provide assurance that all its output (plus any output available but not able to be used) would be paid for. The power purchase agreement would presumably be with a government entity like the Low Carbon Contracts Company, the body set up to buy the output from Hinkley Point C and offshore wind farms, which in turn would, presumably, compel all electricity retailers, including those claiming to sell only renewables, and those operating in Scotland, to buy their share of this output.

Thames Tideway's cost is being paid for by "Thames Water's 15 million wastewater customers through their bills, which will rise by no more than £25 per year." For Sizewell C, its cost would be recovered from all consumers even if they have opted for a supplier that explicitly does not buy nuclear electricity and (as discussed below), if the method is to be viable, the additional cost cannot be capped in the way Thames Tideway seems to be.

## US Experience

In the U.S. electricity customers are expected to pay more than \$10 billion for cancelled nuclear plants and another \$13.5 billion in cost-overruns. So far, no reactors have come online as a result of the use of the U.S. version of RAB known as early cost recovery. Florida and South Carolina have repealed the laws allowing early cost recovery. No states have enacted such laws

---

<sup>1</sup> EDF's latest cost estimate for Hinkley Point C of around £22bn is what is called an 'overnight cost' but this doesn't include financing costs such as interest during construction.



in the last decade. US experience shows that construction risk was shifted from lenders and investors (who charge for bearing such risks) to customers (who bore them without charge). This encouraged imprudent risk-taking by imposing economic risk on those with no project management capabilities or responsibilities.

The consultation document (p 6) claims there will be *“A fair sharing of costs and risks between consumers and investors, set out in an Economic Regulatory Regime (ERR).”* The risks would be allocated via a *“Government Support Package”* (GSP), which would offer *“protection to investors for specified low probability but high impact risks that the private sector would not be able to bear.”* The examples given are: *“risk of cost overrun above a remote threshold; disruption to debt markets; certain risks for which insurance is not available in the market, and political risks.”* All these risks are important but for these purposes, the NCG focuses on the first.

The consultation document states: *“it is envisaged that the threshold capital expenditure amount (the ‘Funding Cap’) would be identified prior to the GSP being issued and set by Government at a level at which there was only a remote chance of construction costs reaching this level. The Funding Cap would be set, based on robust project diligence and global benchmarking of comparable projects.”* However, it is far from clear how high the level of costs over-run would have to be set for there to be only a *“remote chance”* of the cap being exceeded.

The UK government has now proposed three models for financing new nuclear power plants. The model adopted for Hinkley Point C produced very high power prices, and the main recipient of the contract (EDF) does not appear willing to consider this model for follow-on projects. It therefore seems likely this model will not be used again. The second model, proposed for the Wylfa project, involved a significant UK government equity stake, a promise for the government to provide all the required loans and support from the Japanese government to find Japanese investors. Despite this, the expected price of power was too high, investors were not forthcoming and the project collapsed. There is no evidence to show why the cost of capital under RAB would be any lower than it was for the Hinkley Point C project or for the Wylfa project. In both cases, the borrowing would have been fully underwritten by the UK government and would therefore have been at rock-bottom levels. Therefore, any savings can logically only come from the provision to recover costs from consumers at start of construction. U.S. experience shows this to a reckless risk of consumers’ money.

## Cost Overruns

Dr Dave Toke points out (2) that under the RAB system nuclear power would be given a privileged position (certainly not afforded to renewable energy plant) whereby its costs are guaranteed to be paid by the electricity consumer before the plant even starts generating any energy. But not only that, EDF wants the Government to effectively guarantee that anything above cost overruns of 30% are borne by the Government (with the electricity consumer or taxpayer footing the bill). The system is claimed to save consumers’ money by allowing the project to be financed by the consumer (none of which have been asked of course). In reality, if applied to building new nuclear power plant, it is likely to do exactly the opposite and blow a great hole either in Treasury budgets, electricity consumer pockets, or both.



This means that consumers will be paying out increasing amounts once the construction period overruns by more than around 20 months. It should be borne in mind that construction of a similar reactor to that planned for Sizewell C (and also Hinkley C), at Flamanville in France, has already taken getting on for 12 years to build, far longer than the original plan to complete in 5 years. Flamanville already has cost overruns of over 200% compared to the original budget.

Let's assume that EDF choose a slightly less implausible time to build the project at Sizewell C project than they did for Flamanville. Say they chose 7 years. In that case (still implausible compared to what they usually take in the West), then it would take less than 2 years of costs overruns before the Government would be expected to start carrying the can for the cost overruns.

## **BANNG**

The Blackwater Against New Nuclear Group says the case for nuclear providing low cost electricity able to compete with renewables has evaporated. (3) It is now argued that as coal-fired and nuclear plants are retired, there will emerge a hole in energy supply which can only be filled adequately by new nuclear power which is essential for providing baseload (now referred to as 'firm') energy to compensate for intermittency of renewables. All these virtues have been challenged by critics who have firmly established that low carbon energy will be available from other technologies; that nuclear power, post-Fukushima, cannot claim to be secure or safe from physical and cyberattack; and that it is a technology that has proved to be vulnerable to failures, delays and interruptions during construction and operation. As for firm power it has become clear that storage technologies (especially batteries and hydrogen gas) will be at scale and a key part of the mix by the next decade. And, though downplayed by policy makers and the nuclear industry, nuclear has a major drawback compared to rival technologies in that it leaves a legacy of waste that presents risk to communities and a continuing challenge to societies down the generations. Moreover, there is, as yet, no credible and acceptable long-term solution for this.

If all obstacles fall away and subsidies entice state-backed EDF and CGN to come through with the investment, it will be surprising if Sizewell C is operating before 2035 (the revised target date for new nuclear) and Bradwell B later. By that time it will be too late for nuclear to plug the energy gap (if it arises). Instead, nuclear stations, if they become available, will compete in what could become a crowded market and, in the process, may displace cheaper alternatives at cost to consumers and taxpayers.

## **People Against Wylfa B (PAWB)**

PAWB declares that wind power has won the argument - after the last round of bids for offshore wind contracts came in at between £39.65 and £41.61 per megawatt/hour. These wind farms will be built and start operating quickly and will be able to supply electricity to millions of homes. This is in stark contrast to the long time and huge sum of money needed to build new nuclear power stations. The future is clear for Wales. Every chance to develop renewable energy in all its various forms should be taken and dirty, dangerous and extremely expensive nuclear power should be rejected once and for all.



## Nuclear Free Local Authorities

The NFLA argued that no financing model can disguise the fact that nuclear power is hideously expensive, and renewables are winning the price war. (4) The commonly quoted additional cost to consumers for Hinkley Point C is £30 billion though this, oddly, is actually the net present value (discounted) of the total subsidy to Hinkley to be paid by consumers over the 35 years. The actual additional cost to consumers could be as much as £100 billion in today's money.

The regulated asset base (RAB) approach exposes consumers to the cost of overruns, and in effect also requires them to provide financing at zero interest. There are plenty of ways to provide flexible power without resorting to so-called secure "baseload" supplies such as nuclear. In fact what will be required in future will be flexible supplies which can balance cheap renewables. Always on 24/7 baseload supplies will simply cause renewable supplies to be constrained during windy, sunny periods with low demand. Bloomberg New Energy Finance, for instance, is predicting that the cost of producing hydrogen gas with renewables is likely to plummet by 80% by 2030. (5)

## Arguments for "Firm Power" kept secret

Neil Crumpton's request for information 'regarding the basis of advice to ministers on the assertion that the UK 'will require' new nuclear or gas-fired power stations with Carbon Capture and Storage' was refused.

In his last week as Business Secretary Greg Clark disclosed, to industry at a private meeting, estimates of the amount of firm power he thinks will be needed in 2050. He said Britain needs to build a fleet of nuclear or carbon-capture power plants equivalent to a dozen Hinkley Point Cs - up to 40GW of non-intermittent low carbon power stations to hit climate change targets. (6)

The government's justification for claiming that we need 40GW of 'firm power' appears to rest on model simulations run internally, which have not been published. This lack of transparency makes this analysis impossible to judge, says Michael Liebreich of Bloomberg New Energy Finance. He told Carbon Brief:

*"Any case for 'firm' power is essentially valueless without knowing the detail of the assumptions. Firm power which cannot be switched off when you don't need it will be as much of a problem as variable power which cannot be switched on when you do. What is called for is flexibility, in huge quantities and of all types. Does the nuclear power in the government model provide it? We just aren't told." (7)*

Neil Crumpton wanted to know if any scenarios were modelled by BEIS with 100 % renewables with 'Power-to-Gas' (P2G) to provide reliable supply to any Grid demand (plus the existing nuclear schemes and Hinkley Point C if it is not cancelled). P2G obviates BEIS's deemed 'requirement' for 'baseload' nuclear or firm 'gas-fired' (presumably Natural Gas) power stations with CCS. P2G infrastructure does this by storing electrolytic hydrogen, generated by renewable electricity via electrolysis, for fuelling gas-fired power stations (without the need for CCS) as and when required. The RAB Consultation makes no mention of P2G or why it could not fulfil



the functions required for ensuring a firm-flexible, secure (indigenous), low-carbon (generated by offshore wind and sun mainly) reliable electricity supply at affordable prices.

Crumpton believes the 'advice' about 40GW is seriously flawed and hence the Consultation is misleading being based on a false technical premise. The response to his FOI (dated 3rd October) gave me no indication if BEIS has or has not carried out any such P2G scenario modelling (even a simple yes or no would have been very helpful) and stated : *"the public interest in disclosing this information is outweighed by the public interest considerations in favour of withholding the information. Our decision is therefore to withhold the information until it is ready for publication."*

Crumpton says the non-nuclear scenarios or 'counterfactuals' modelled for comparative assessment in the HPC Value for Money (VfM) Assessment were muddled and highly questionable and would hardly have been scenarios most likely to result in a favourable non-nuclear scenario cost comparison. Furthermore, the model only compared the scenarios to 2050 on the advice of the BEIS chief financial adviser. Yet the HPC CfD at £92.50 per MWh runs for 35 years to 2060. So, the HPC VfM Assessment was seriously flawed. The Public Accounts Committee (PCA) and the National Audit Office (NAO) were not impressed and suggested a different funding model should be considered.

Similarly, Dr David Lowry asked to see the background documents prepared by external consultants for BEIS on RAB? BEIS responded saying there are over 500 documents that could fall within the scope of this request, so Dr Lowry asked for a list of the titles of each of these documents, indicating the corporate author in each case. This request was refused.

### **Nuclear makes a loss**

The submission from the Theberton and Eastbridge Action Group on Sizewell reminds us that the Berlin-based German Institute for Economic Research (DIW) recently calculated, after analysis of the 674 nuclear power plants built since the 1950s, that on average they make a loss of 5 billion Euros each, without taking into account the cost of getting rid of their radioactive waste.

Greenpeace says: *"Whether a fair rate of return is paid out from people's pockets relies heavily on the regulator correctly estimating some fairly opaque future scenarios, such as construction length, supply chain costs and prevailing economic conditions and " the (RAB) model has been described as an 'open cheque book'" that allows developers to duck the impacts of delays and cost overruns. Power Engineering said: "the consumer winds up footing the bill no matter how incompetently the developer proceeds".*

TEAGS concludes that RAB loads too much risk onto consumers and lets developers off the hook for delays and overspends. Should the government adopt RAB, it could allow EDF, within two years, to commence construction at Sizewell, a site openly acknowledged to be one of the most environmentally sensitive.



- EDF is ‘melting down’ according to the Bloomberg financial news website. Engineers are struggling to fix eight faulty welds at Flamanville but it’s just the latest setback in the project that’s running a decade late and almost four times over budget. *“We hear every year that there is a new problem”* said Finance Minister Bruno Le Maire. *“It is not acceptable that one of the most prestigious and strategic sectors for our country is facing so many difficulties.”* The Flamanville plant is now slated to be completed in 2022 at a cost of 12.4bn euros. Le Maire has given EDF a month to come up with an action plan. Delays at Hinkley Point C have upped the cost to as much as £22.5bn. EDF also faces mounting costs of maintaining 58 domestic nuclear plants that provide more than 70% of France’s power. Add to the mix the fact that EDF is losing market share. EDF stock has lost 34% this year making it the second worst performing utility stock. (8)

- 
1. The Proposed RAB Financing Method, by Professor Steve Thomas, Peter Bradford, Tom Burke CBE, and Dr Paul Dorfman, NCG, October 2019 [https://www.nuclearconsult.com/wp/wp-content/uploads/2019/10/NCG\\_RAB\\_submission.pdf](https://www.nuclearconsult.com/wp/wp-content/uploads/2019/10/NCG_RAB_submission.pdf)
  2. Dave Toke’s Blog 23 June 2019 <https://realfeed-intariffs.blogspot.com/2019/06/now-edf-want-us-to-pay-for-nuclear.html>
  3. BANNG 11<sup>th</sup> Oct 2019 <https://www.banng.info/consultation-responses/rab-model-for-nuclear-consultation-on-a-rab-model-for-new-nuclear-projects-banng-paper-no-41/>
  4. NFLA Briefing September 2019 [https://www.nuclearpolicy.info/wp/wp-content/uploads/2019/09/NFLA\\_New\\_Nuclear\\_Monitor\\_No58\\_RAB\\_Consultation\\_response.pdf](https://www.nuclearpolicy.info/wp/wp-content/uploads/2019/09/NFLA_New_Nuclear_Monitor_No58_RAB_Consultation_response.pdf)
  5. Bloomberg 22nd Aug 2019 <https://www.bloomberg.com/news/articles/2019-08-21/cost-of-hydrogen-from-renewables-to-plummet-next-decade-bnef>
  6. Times 24<sup>th</sup> July 2019 <https://www.thetimes.co.uk/article/142efc8a-ad84-11e9-b657-11944f524f2a>
  7. Carbon Brief 26th July 2019 <https://www.carbonbrief.org/analysis-does-the-uk-require-new-nuclear-to-reach-net-zero-emissions>
  8. Bloomberg 31st Oct 2019 <https://www.bloomberg.com/news/articles/2019-10-31/the-world-s-largest-nuclear-power-producer-is-melting-down>



## 2. Time to Abandon Hinkley Point C?

The cost of Hinkley Point C (HPC) has increased by as much as £2.9 billion, to £22.5 billion. In addition, it may be delayed by a further 15 months. It is due to be completed in 2025, but may not now be ready until 2027. Writing in *The Times*, columnist Alistair Osborne called for the “nuclear raft” to be scuttled. (1)

Stephen Fitzpatrick, the founder and chief executive of Ovo Energy - soon to be the UK’s second-biggest supplier on the acquisition of SSE’s consumer business - has called for HPC to be scrapped. He says it wastefully expensive and out of date. The industry should instead look to the future with ever-cheaper renewable energy. Fitzpatrick would prefer the industry to invest in restructuring the energy network to handle more renewables. This could be handled in part with a “smart network” using batteries to handle shifting supply and demand. *“If you think about the £39/MWh that was achieved at the last auction for offshore wind, and when Hinkley Point goes live it is going to be about £100 more per MWh sometime in the late 2020s,”* he said. *“If we make smart decisions and focus on value for money and what is best for the end consumer, I am quite sure we can keep costs [of decarbonising the network] under control.”* (2)

Abandoning Hinkley Point C could save electricity consumers between £17bn and £40bn over the first 35 years of its life. (4) These savings could be spent on energy efficiency techniques which could save householders around a quarter of the average energy bill.

- Business and Energy (BEIS) Secretary Andrea Leadsom who was due to give a decision on the Development Consent Order for Wylfa B on 23<sup>rd</sup> October has deferred the decision for six months. She wants more information on environmental and other impacts including biodiversity, visual impact, flooding and construction noise – and any risk to the Sandwich tern, which has a colony nearby. The project was suspended by Hitachi in January after they failed to reach a funding agreement with the UK Government. (4) Dylan Morgan, of People Against Wylfa B, said it was *“obvious the developers are keen to get planning permission in order to try and sell the site. But that’s easier said than done at the moment given the pretty perilous state of the global nuclear industry and the hopeless economics,”* (5)

- 
1. Times 26<sup>th</sup> Sept 2019 <https://www.thetimes.co.uk/article/50b3a652-dfd3-11e9-9f61-dcefea5f5359>
  2. Telegraph 28<sup>th</sup> Sept 2019 <https://www.telegraph.co.uk/business/2019/09/28/scrap-hinkley-point-nuclear-plant-expensive-date-says-ovo-energy/amp/>
  3. Time to Cancel Hinkley? By Professor Steve Thomas, September 2017 <http://www.no2nuclearpower.org.uk/wp/wp-content/uploads/2017/09/Time-to-Cancel-HinkleyFinal.pdf>
  4. Daily Post 24<sup>th</sup> Oct 2019 <https://www.dailypost.co.uk/news/north-wales-news/horizon-nuclear-power-responds-delay-17137774>
  5. BBC 23<sup>rd</sup> Oct 2019 <https://www.bbc.co.uk/news/uk-wales-50139360>



### 3. Do we really need 40GW of Firm Power?

- The Government says we need 40GW of ‘firm power’ – nuclear and gas with carbon capture and storage by 2050, but refuses to say how it has worked this out.
- Bloomberg New Energy Finance says what we really need is flexibility.
- Recent Committee on Climate Change (CCC) advice largely supports the government. But its argument is largely based on cost, but the CCC doesn’t have a good record of estimating future energy costs.
- The CCC has also been bad at forecasting electricity demand, which has fallen by 16% since 2005.
- The National Infrastructure Commission (NIC) says a focus on renewables “looks like a safer bet than constructing multiple new nuclear plants”.
- There are multiple studies which show that a 100% renewable energy system is deliverable. The myth that a very high level of renewables can’t be integrated into the electric grid is being demolished by the clean tech and battery storage revolution.

Government analysis suggests we might need up to 40GW of firm power – nuclear or power plants with carbon capture and storage by 2050. On the other hand, a growing number of studies suggest that with flexibility and ever cheaper renewables it is perfectly possible to run our energy system on 100% renewables.

According to *The Times*, a leaked Government analysis suggests that Britain needs to build a fleet of nuclear or carbon-capture power plants equivalent to a dozen Hinkley Point Cs – up to 40GW of non-intermittent low carbon power stations to hit climate change targets. In its consultation on the nuclear funding model the Government said that while wind and solar energy would provide the majority of low-carbon capacity in 2050, there would still be a role for firm power supplies available when the wind doesn’t blow or the sun doesn’t shine. (1)

*Carbon Brief* says the assertion that the UK “will...require” new nuclear and gas-fired power stations with carbon capture and storage (CCS), in order to meet its net-zero emissions target”, is the basis for the proposed new “regulated asset base” (RAB) funding model for new nuclear plants. The RAB model could also be used to buy the infrastructure needed for gas CCS. The idea that electricity from nuclear and CCS will be required to get to net-zero is broadly in line with advice from the Committee on Climate Change (CCC) and some other research, whereas the National Infrastructure Commission (NIC) recommended a focus on renewables instead. (2)

Unfortunately, the government’s justification appears to rest on model simulations run internally, which have not been published. The lack of transparency makes this analysis impossible to judge, says Michael Liebreich, founder of and now senior contributor to *Bloomberg New Energy Finance*. He told *Carbon Brief*:



*“Any case for ‘firm’ power is essentially valueless without knowing the detail of the assumptions. Firm power which cannot be switched off when you don’t need it will be as much of a problem as variable power which cannot be switched on when you do. What is called for is flexibility, in huge quantities and of all types. Does the nuclear power in the government model provide it? We just aren’t told.”*

Rather than publish a new Energy White Paper – which could not have responded fully to the recent net-zero announcement – the government decided to publish a series of 10 consultations. These cover funding for new nuclear and CCS, reviews of the way the energy market operates and how to create markets for energy efficiency, among other matters. There is one significant omission from this list, which Carbon Brief had expected to feature in the white paper - namely, a move to increase the transparency around the internal BEIS modelling and data, which is used to test and subsequently justify government policy.

Recent Committee on Climate Change (CCC) advice on reaching net-zero broadly supports the internal BEIS analysis but it includes a wider range of sources with different characteristics and levels of flexibility. The CCC’s ‘Further Ambition’ scenario, for instance, sees low-carbon sources providing 100% of power generation in 2050, through a mixture of variable renewables (57%), firm low-carbon power like nuclear or plants fitted with carbon capture and storage (38%) and decarbonised gas such as hydrogen (5%). (3) But as we point out in nuClear News No.118 the reason for the view on firm power in this analysis seems to boil down to cost.

CCC says you can only go so far with the proportion of our energy supplied by renewables before costs start to rise. Yet the CCC doesn’t have a good record of estimating future energy costs. Back in 2008, it estimated that offshore and onshore wind costs would be around £88/MWh and £76/MWh, respectively, by 2020 (expressed in 2008 prices). (4) The cost of power from offshore wind has now plummeted to between £39.65 and £41.61/MWh. (5)

The CCC also suggested that the potential for emissions reductions from solar PV was ‘very small’ within the first three budget periods, because of the high cost. It says the cost of installing new solar PV capacity is now around £56/MWh. In Germany the average price in the October round of its solar capacity procurement was around €50/MWh (£43/MWh). (6)

The CCC currently expects to see nuclear costs fall by 28% by 2050, which given past experience seems highly unlikely.

However, Lord Deben, chair of the CCC is sceptical about the government’s proposals for applying the regulated asset base mechanism to help finance new nuclear projects. He insists that he is not opposed to nuclear, which remains a “necessary part of the mix”, but he says:

*“We have to have the same scepticism about costs because in the end the public are going to have to pay for this. EDF are still quoting figures that are frankly not competitive in today’s world and also figures that one isn’t sure will be met. Like HS2, there’s no harm in having a very close look at the figures, there may be other ways of doing this.”*



He says nuclear is a “transitional” power source. *“By the time you get to the need for the next nuclear power stations, there will be alternative ways of doing this. If we get better at balancing the grid and the amount of baseload energy, the need becomes smaller. Nuclear isn’t the best way of getting that base energy because you can’t turn it on and off: you have to use it all the time. If you are really concerned about what happens when the sun doesn’t shine and the wind doesn’t blow, you install in people’s homes hybrid boilers that can run on electricity or gas.”* (7)

## Electricity Demand

The other thing which the CCC has been bad at forecasting is electricity demand. In 2008 it expected that electricity demand would continue to increase overall, but demand has actually dropped. The CCC now expects a doubling of demand by 2050 due to extensive electrification of heat and transport. As we have reported here many times, the incoming Conservative-LibDem Coalition Government of 2010 was officially planning on the basis of a doubling or possibly even a tripling of electricity consumption by 2050. The 2005 Energy White Paper was expecting that by 2020 electricity consumption would have increased by 15%. In reality it has decreased by 16%. Nowadays primary energy demand is expected to continue falling by a further 11% by 2025. But after that projections revert to the bad old days. Within ten years Government forecasters expect consumption to be 2% more than today. As we point out in nuClear News No.118, it is becoming increasingly clear that car use will still need to be curbed even when all vehicles are powered by clean electricity, In nuClear News No.117 we looked at a report which said the increase in demand as a result of the electrification of transport may only be very limited and won’t dent the trends towards reduced electricity consumption.

Forecasting the impact of heat decarbonisation on electricity demand is much more complex. CCC says low-carbon hydrogen cannot be produced in large enough quantities to completely replace natural gas but this view is being challenged by the falling cost of renewables combined with the significant cost reduction potential of power-to-gas technology which could lead to much cheaper electrolytic hydrogen production than many have previously thought. Energy commentator Chris Goodall told Carbon Brief that *“Cost competitive hydrogen from renewables makes full decarbonisation possible through power-to-gas and power-to-liquids.”* (8) 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. (9) And in the absence of a final decision on the decarbonisation of the gas grid energy efficiency measures, which could save around 130TWh, would be a no regrets option. (10)

The BEIS assertion that up to 40GW of firm power will be “required” by 2050 is more clearly at odds with the views of the National Infrastructure Commission (NIC), which said last year that a focus on renewables “looks like a safer bet than constructing multiple new nuclear plants”. The NIC also gave short shrift to small nuclear plants (“their benefits remain speculative”) and CCS in the power sector (“unlikely to form part of a cost competitive generation mix”). (11)

As Doug Parr, Chief Scientist at Greenpeace, points out there are a number of studies which show that a 100% renewable energy system is deliverable. The myth that a very high level of renewables can’t be integrated into the electric grid is being demolished by the clean tech and



battery storage revolution. (12) *“By 2040, renewables make up 90% of the electricity mix in Europe, with wind and solar accounting for 80%,”* according to projections by Bloomberg New Energy Finance (BNEF) in their annual energy outlook. *“Cheap renewable energy and batteries fundamentally reshape the electricity system,”* explains BNEF. Since 2010, wind power globally has dropped 49% in cost. Both solar and battery prices have plummeted 85%. (13)

Mark Jacobson and his team from Stanford University, reckon that 100% of all global energy can come from renewable sources (with biomass excluded) by 2050 with full grid balancing. (14) A new report by LUT University in Finland and the Energy Watch Group (EWG) in Germany outlines a cross-sector, global 100% renewable energy system. (15)

An article published in Energy in May found that 180 studies on 100% renewables had been published since 2004. The authors of that paper say that six months later the number has jumped to 280. (16)

## Multiple Solutions

A study by Jacobson et al finds multiple solutions for matching demand to wind, water and solar (WWS) supply, including batteries, pumped storage, heat pumps and heat storage. (17) This study matches 2050 power demand with 100% WWS supply, storage, and transmission for 20 world regions encompassing the 139 countries for which 2050 roadmaps have previously been developed. Here we are talking about renewables supplying electricity and direct heat for all energy sectors, including transport. The study assumes efficiency improvements compared with Business As Usual (BAU) and it assumes that all energy, not just electricity, is decarbonized by 2050. Grid balancing solutions include heat storage in rocks and water; cold storage in water and ice; pumped hydropower; batteries; hydrogen storage; and demand response.

Key elements of the solution applicable to different cases are to:

- (1) produce heat directly from solar and geothermal heat resources and from electricity;
- (2) store electricity as heat after current electricity demand is satisfied and electricity storage is full; (3) if thermal energy storage is used, store excess heat in water and underground rocks when current heat demand is satisfied;
- (4) if thermal energy storage is used, produce cold directly from electricity and store excess cold in water and ice;
- (5) produce hydrogen from excess electricity after all electricity and heat storage are full, and store excess hydrogen;
- (6) store excess CSP (Concentrated Solar Power) electricity in a phase-change material and remaining excess electricity either in pumped-hydro storage, as heat in underground rocks, or as hydrogen;



(7) increase the maximum discharge rates of CSP, the number of batteries, or the maximum discharge rate of hydropower (while keeping its annual energy production constant) to help meet peaks in demand;

(8) use heat pumps for cold and low-temperature heat loads wherever possible; and

(9) use demand response for some loads to reduce peaks in load.

The study also concludes that the large number of wind turbines proposed here might, in addition to avoiding fossil fuel emissions, avoid another 3% global warming by reducing water vapour. Although 3% is not large, it occurs much more rapidly than does the temperature reduction due to eliminating fossil fuel emissions.

### The need for inertia

According to a study mainly by LUT in Finland (including Christian Breyer) available RE energy resources are adequate to satisfy current and future power sector demand in every region of the world. The remaining challenges are the stability of an energy system with a low share of rotating generation machinery and the societal acceptance of the RE technologies. An RE-based system will have lower physical inertia and will not be able to mitigate a short-term imbalance of generation and demand. However, a lack of physical inertia in a system with a high RE share can be overcome with the integration of synthetic inertia, essentially improved algorithms of power converters of RE generation and storage capacities.

The LUT team's modelling results show that a 100% carbon neutral RE-based electricity system is possible by 2050. Such an energy system is economically feasible, at a levelized cost of electricity (LCOE) of 52 €/MWh (uncertainty range 45–58 €/MWh), less than the present 70 €/MWh. (18)

Interestingly the Finnish team also looked at the use of vehicle to grid technology (V2G) in a 100% renewable system. They conclude that stored electricity need not only be considered as storage for future use by the grid, but V2G batteries can provide a buffer between generation of intermittent RE and its end-use. (19)

A 2016 study from Aalborg University in Denmark looks at a possible 100% RE scenario for Europe for 2050. The results indicate that by using the Smart Energy System approach, a 100% renewable energy system in Europe is technically possible without consuming an unsustainable amount of bioenergy. This is due to the additional flexibility that is created by connecting the electricity, heating, cooling, and transport sectors together, which enables an intermittent renewable penetration of over 80% in the electricity sector. The cost of the Smart Energy Europe scenario is approximately 10–15% higher than a business-as-usual scenario, but since the final scenario is based on local investments instead of imported fuels, it will create approximately 10 million additional direct jobs within the EU. (20)

Traditionally, significant focus is put on the electricity sector alone to solve the renewable energy integration puzzle. Smart grid research traditionally focuses on ICT, smart meters,



electricity storage technologies, and local (electric) smart grids. In contrast, the Smart Energy System focuses on merging the electricity, heating and transport sectors, in combination with various intra-hour, hourly, daily, seasonal and biannual storage options, to create the flexibility necessary to integrate large penetrations of fluctuating renewable energy. (21)

The Aalborg University team look at how an existing energy system can be transformed into a 100% renewable energy system. The transition is divided into a number of key stages which reflect key radical technological changes on the supply side of the energy system. Ireland is used as a case study, but in reality this reflects many typical energy systems today which use power plants for electricity, individual boilers for heat, and oil for transport. The seven stages analysed are

- 1) reference,
- 2) introduction of district heating,
- 3) installation of small and large-scale heat pumps,
- 4) reducing grid regulation requirements,
- 5) adding flexible electricity demands and electric vehicles,
- 6) producing synthetic methanol/DME for transport, and finally
- 7) using synthetic gas to replace the remaining fossil fuels.

For each stage, the technical and economic performance of the energy system is calculated. The results indicate that a 100% renewable energy system can provide the same end-user energy demands as today's energy system and at the same price. The results suggest that the transition to a 100% renewable energy system can begin today without increasing the costs of the energy system and by creating more local jobs. (22)

In a briefing for the Leonardi Dicaprio Foundation, Mark Jacobson puts the issue in sharp relief:

*“Nuclear power plant takes on average about 14-1/2 years to build, from the planning phase all the way to operation. According to the World Health Organization, about 7.1 million people die from air pollution each year, with more than 90% of these deaths from energy-related combustion. So switching out our energy system to nuclear would result in about 93 million people dying, as we wait for all the new nuclear plants to be built in the all-nuclear scenario. Utility-scale wind and solar farms, on the other hand, take on average only 2 to 5 years, from the planning phase to operation. Rooftop solar PV projects are down to only a 6-month timeline. So transitioning to 100% renewables as soon as possible would result in tens of millions fewer deaths.”*

*“Nuclear advocates claim nuclear is still needed because renewables are intermittent and need natural gas for backup. However, nuclear itself never matches power demand so it needs backup. Even in France with one of the most advanced nuclear energy programs, the maximum ramp rate is 1 to 5 % per minute, which means they need natural gas, hydropower, or batteries, which ramp*



*up 5 to 100 times faster, to meet peaks in demand. Today, in fact, batteries are beating natural gas for wind and solar backup needs throughout the world. A dozen independent scientific groups have further found that it is possible to match intermittent power demand with clean, renewable energy supply and storage, without nuclear, at low cost.” (23)*

- 
1. Times 24<sup>th</sup> July 2019 <https://www.thetimes.co.uk/article/142efc8a-ad84-11e9-b657-11944f524f2a>
  2. Carbon Brief 26<sup>th</sup> July 2019 <https://www.carbonbrief.org/analysis-does-the-uk-require-new-nuclear-to-reach-net-zero-emissions>
  3. Net Zero - Technical Annex: Integrating variable renewables into the UK electricity system. CCC May 2019 <https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-Technical-Annex-Integrating-variable-renewables.pdf>
  4. ECIU 16<sup>th</sup> July 2019 <https://eciu.net/blog/2019/decarbonisation-is-getting-cheaper-why>
  5. Independent 20<sup>th</sup> September 2019 <https://www.independent.co.uk/news/business/news/offshore-wind-power-energy-price-falls-record-low-renewables-a9113876.html>
  6. PV Magazine 21<sup>st</sup> Oct 2019 <https://www.pv-magazine.com/2019/10/21/german-pv-tender-brings-average-solar-price-of-e0-049-kwh/>
  7. Utility Week 23<sup>rd</sup> Sept 2019 <https://utilityweek.co.uk/lord-deben-politicians-finally-grasped-reality-climate-change/>
  8. Carbon Brief 25<sup>th</sup> February 2019 <https://www.carbonbrief.org/renewable-hydrogen-already-cost-competitive-say-researchers>
  9. Wind Power Monthly 12<sup>th</sup> March 2019 <https://www.windpowermonthly.com/article/1578773/green-hydrogen-economically-viable-2035-researchers-claim>
  10. Element Energy for NIC, March 2018 <https://www.nic.org.uk/wp-content/uploads/Element-Energy-and-E4techCost-analysis-of-future-heat-infrastructure-Final.pdf>
  11. Carbon Brief 10<sup>th</sup> July 2018 <https://www.carbonbrief.org/in-depth-uk-can-go-low-carbon-at-no-extra-cost-say-infrastructure-advisors>
  12. Abstracts of 42 Peer-Reviewed Published Journal Articles From 12 Independent Research Groups With 77 Different Authors Supporting the Result That Energy for Electricity, Transportation, Building Heating/Cooling, and/or Industry can be Supplied Reliably with 100% or Near-100% Renewable Energy at Difference Locations Worldwide April 8, 2019 <http://web.stanford.edu/group/efmh/jacobson/Articles/I/CombiningRenew/100PercentPaperAbstracts.pdf>
  13. Think Progress 21<sup>st</sup> June 2019 <https://thinkprogress.org/europe-will-be-90-renewable-powered-in-two-decades-experts-say-8db3e7190bb7/>
  14. Physics World 21<sup>st</sup> April 2018 <https://physicsworld.com/a/jacobsons-new-100-renewables-model-aims-to-rebut-critics/>
  15. Physics World 5<sup>th</sup> June 2019 <https://physicsworld.com/a/a-global-100-renewable-energy-system/>
  16. Energy 15<sup>th</sup> May 2019 <https://www.sciencedirect.com/science/article/abs/pii/S0360544219304967>
  17. Jacobson et al. *Matching Demand with Supply at low cost in 139 countries among 20 world regions with 100% intermittent wind water and sunlight for all purposes*. Renewable Energy 123 (2018) 236 – 248



- <https://web.stanford.edu/group/efmh/jacobson/Articles/I/CombiningRenew/WorldGridIntegration.pdf>
18. Bogdanov, D et al. *Radical transformation pathway towards sustainable electricity via evolutionary steps*, Nature Communications (2019) 10:1077 <https://www.nature.com/articles/s41467-019-08855-1.pdf>
  19. Childs, M et al. *The Impacts of High V2G Participation in a 100% Renewable Åland Energy System*. Energies 2018, 11, 2206; <https://www.mdpi.com/1996-1073/11/9/2206>
  20. Connolly, D. *Smart Energy Europe: The technical and economic impact of one potential 100% renewable energy scenario for the European Union*, Renewable and Sustainable Energy Reviews, Volume 60, July 2016, Pages 1634-1653. <https://www.sciencedirect.com/science/article/abs/pii/S1364032116002331?via%3Dihub>
  21. Mathiesen, B.V. et al *Smart Energy Systems for coherent 100% renewable energy and transport solutions*, Applied Energy Volume 145, 1 May 2015, Pages 139-154 <https://www.sciencedirect.com/science/article/abs/pii/S0306261915001117>
  22. Connolly, D and Mathiesen, B.V. *A technical and economic analysis of one potential pathway to a 100% renewable energy system* International journal of Sustainable Energy Planning and Management Vol. 01 2014 7-28 <http://dconnolly.net/wp-content/uploads/2014/05/GreenPlanIreland-Connolly.pdf>
  23. Seven reasons why nuclear energy is not the answer to solve climate change, Mark Z. Jacobson, Leonardo DiCaprio Foundation, <https://www.leonardodicaprio.org/the-7-reasons-why-nuclear-energy-is-not-the-answer-to-solve-climate-change/>



## 4. Net Zero Review

The Chancellor of the Exchequer Sajid Javid has launched the Net-Zero Review, the first of its kind, which will assess how the UK can manage the transition to a low-carbon economy. The Review aims to determine how the UK can maximise economic growth opportunities associated with the transition to net-zero carbon. At its core will be an assessment of how to fairly balance contributions to ensure just transition of the economy – and how to reduce costs for low income households from the move towards a net-zero.

The Review will also consider how emissions can be cut without simply exporting them abroad, and will look to widely consult with industry experts as well as directly to key stakeholders that will be impacted by the transition to net-zero. An interim publication will be produced in spring 2020 with a final report in the autumn ahead of the UK hosting the COP26 UN Climate Change conference in Glasgow in November 2020.

The announcement of the Review marks the first formal government step towards the UK achieving net-zero emissions by 2050 after one of the final acts of the Theresa May administration was to formally legislate for such a target through an amendment to the Climate Change Act 2008. (1)

The Committee on Climate Change strongly welcomed the Treasury review into how the costs of the transition to a Net Zero economy by 2050 can be funded and distributed fairly. (2)

Theresa May committed the country to the net zero carbon emissions target by 2050 as one of her final attempts to cement a lasting legacy of her time in Downing Street. The policy was criticised by the then chancellor Philip Hammond, who warned it could cost £1tn to deliver and would lead to swingeing cuts in public spending. (3)

- 
1. Edie 2<sup>nd</sup> Nov 2019 <https://www.edie.net/news/11/Net-Zero-November--Government-launches-Net-Zero-Review/>
  2. Committee on Climate Change 2<sup>nd</sup> Nov 2019 <https://www.theccc.org.uk/2019/11/02/ccc-welcomes-treasury-net-zero-review/>
  3. iNews 2<sup>nd</sup> Nov 2019 <https://inews.co.uk/news/politics/sajid-javid-conservative-party-review-zero-carbon-emissions-pledge-825088>



## 5. Electric Vehicles

Many of the articles and reports about electric vehicles assume that car numbers in an electric future will remain at about 35million. But car use will still need to be curbed to address issues like traffic jams, urban sprawl and wasted space for parking. And, as well as the problem of obtaining enough cobalt, EV's won't offer a complete solution to air pollution problems because of particulate pollution from brakes and tyres. We are still going to have to transform our cities to make them more cycle and pedestrian-friendly. (1) Cycling champion Chris Boardman says EVs are one of the biggest threats to solving congestion, pollution and obesity. We need to give people viable and attractive options to get out of the car, not a different type of car. (2)

According to the government's Air Quality Expert Group particles from brake wear, tyre wear and road surface wear directly contribute to well over half of particle pollution from road transport, so electric cars won't offer a complete solution to air pollution problems. Even self-driving electric cars would produce pollution and congest the roads. The key is to reduce the use of cars by getting people on to less-polluting forms of transport. (3) Pollution from brakes will significantly decrease as more cars run on electric power, because regenerative braking is free of emissions and electric cars use this as the primary means to slow down or stop. (4) But brakes are only one of a number of factors that can contribute to changes in non-exhaust vehicle fleet emissions. (5)

National Grid inadvertently caused alarm in 2017 by suggesting that electric vehicles could, hypothetically, add as much as 30GW to national peak electricity demand by 2050. That would have been a 50% increase on today's peak, if nobody agreed to use "smart" chargers that charged at off-peak times. National Grid now anticipates that most consumers will avoid peak time charging using of smart chargers and vehicle-to-grid technology. A number of energy suppliers have launched EV specific tariffs that have a time of use element [pricing to encourage off-peak charging]. (6) So peak electricity demand could be increased by between 3-8 GW in 2030 (4-14%) and by 3-13GW in 2050 (6-22%) - a "net" maximum increase in demand as a result of electric vehicles of 12.7GW by 2050. (7)

An alternative scenario in a recent report by Redburn, a UK research and investment company, suggests the increase in demand as a result of the electrification of transport may be very limited and won't dent the established trends towards reduced electricity consumption because ever more energy-efficient lighting and motors will offset any increases in electricity consumption due to EVs. (8)

The introduction of EVs is likely to encourage the construction of a new generation of solar powered charging stations across Britain. Plans have been drawn up for a network of more than 100 forecourts tailored to charge cars, vans and buses quickly. Gridserve, the green energy company behind the plan, says that it has 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. (9)



Dundee, which has the largest number of electric minicabs anywhere in the UK (134 at the last count), has installed four council-owned solar-powered charging hubs capable of taking 78 cars at a time (with sites for another 60 being built) and the highest number of rapid chargers of any Scottish city. (10)

Elsewhere 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 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)

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. The Council has purchased 40 new EVs to trial the concept. The project combines three main elements: solar panels 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. 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. (12) If drivers keep their vehicle plugged in for most of the day V2G technology could reduce electricity bills by more than £500 per year. (13)

Meanwhile, Dutch electric vehicle (EV) company Lightyear unveiled a prototype of the world's first long-range solar-powered passenger car in June, claiming that the vehicle will have a range of up to 800km (nearly 500 miles). The car, called the Lightyear One, is fitted with a solar roof and a battery system which enables 600-800km of range, depending on the speed at which the vehicle travels and the terrain which it travels along. Lightyear claims that the car will be the world's first solar model with long-range capabilities. Lightyear is one of several automakers to have begun exploring cars with solar roofs in a bid to help motorists overcome "range anxiety" and concerns about charging costs. In the UK, the drive for a commercially available solar car is being led by a partnership between Aston Martin and solar giant Hanergy. (14) A German start-up is in the final stages of developing a charging system for an all-electric vehicle with solar panels to top up the battery as you drive. Sono motors say the Sion car, can be charged from conventional power outlets, solar power, or other Sions. The vehicle has 330 solar cells integrated onto the hood, side doors, and roof. That means that you can charge it while you drive. (15)

---

1. See nuClearn News No.118 for more on this. <http://www.no2nuclearpower.org.uk/wp/wp-content/uploads/2019/07/NuClearNewsNo118.pdf>



2. Times 29th July 2019 <https://www.thetimes.co.uk/edition/news/electric-cars-are-a-threat-to-clean-air-claims-chris-boardman-hhqzhvxz0>
3. BBC 11th July 2019 <https://www.bbc.co.uk/news/business-48944561>
4. Times 15th July 2019 <https://www.thetimes.co.uk/article/times-letters-press-freedom-and-the-police-role-in-the-darroch-affair-dxcht8hmn>
5. Times 19th July 2019 <https://www.thetimes.co.uk/article/times-letters-tackling-the-harmful-effects-of-air-pollution-3jxx8z2fw>
6. Carbon Brief 12th July 2018 <https://www.carbonbrief.org/rise-uk-electric-vehicles-national-grid-doubles-2040-forecast>
7. The Times 12th July 2018 <https://www.thetimes.co.uk/edition/business/grid-ups-its-estimate-for-electric-cars-9kqp58wgb>
8. Energy Post 6th November 2018 <https://energypost.eu/the-impact-of-electric-vehicles-onelectricitydemand/>
9. Times 1st April 2019 <https://www.thetimes.co.uk/article/109cd7fc-53ef-11e9-b872-7488e2315159>
10. Guardian 16th Aug 2019 <https://www.theguardian.com/uk-news/2019/aug/16/dundee-green-revolution-charging-hubs-electric-cabs-scotland>
11. Scotsman 27th March 2019 <https://www.scotsman.com/news/environment/solar-car-parks-across-scotland-to-charge-electric-vehicles-1-4896311>
12. (12) Edie 27th February 2019 <https://www.edie.net/news/8/Nottingham-gears-up-for-EV-rollout-with-EU-backed-vehicle-to-grid-trial/>
13. (13) Utility Week 14th May 2019 <https://utilityweek.co.uk/v2g-charging-could-save-drivers-more-than-500-per-year>
14. (14) Edie 15th May 2019 [https://www.edie.net/news/8/Solar-car-with-range-of-up-to-800km--to-launch-next-month---](https://www.edie.net/news/8/Solar-car-with-range-of-up-to-800km--to-launch-next-month---/) / CNET 28th June 2019 <https://www.youtube.com/watch?v=WEjQkkrY5Y>
15. (15) Euro News 13th August 2019 <https://www.euronews.com/2018/08/13/solar-panel-car-to-go-on-sale-in-2019>



## 6. Thirty Recommendations by 2030 – expert briefing for the Labour Party: A critique

### Introduction

The Labour Party has published what it calls an ‘expert briefing’ with 30 recommendations to be implemented by 2030 to achieve the fastest track to decarbonising UK energy. (1) The report aims to deliver a 77% cut in carbon emissions from energy by 2030 compared to 2010. This is an odd target which makes it difficult to compare with UK Government targets. Assuming it means all greenhouse gases emitted from every sector apart from agriculture industrial processes and waste management and doesn’t take into account carbon offsets due to forestry and land use management, it appears to represent a cut in carbon emissions compared to 1990 of around 83% (although the report says on page 26 the phrase ‘energy’ doesn’t include transport – but presumably the Labour Party will come up with proposals for that sector) (2)

Unfortunately, the recommendations include boosting renewable and low carbon electricity generation and are prefaced by the following statement:

*“This report assumes nuclear output will be maintained at current levels based on Labour’s policy that nuclear will continue to form part of the energy mix. This assumes the existing plants that are planned for decommissioning before 2030 are replaced with equivalent capacity, which this report finds could be possible in the time frame.”*

At this year’s conference a resolution was passed which called on the party to work towards “a path to net zero carbon emissions by 2030”. Labour then asked a group of independent energy-industry experts to identify a pathway to decarbonize the UK energy system by 2030. This is the resulting report. It is very detailed and quite radical. It identifies four overarching goals to transform the UK’s energy supply and use: reducing energy waste in buildings and industry; decarbonizing heat; boosting renewable and low carbon electricity generation; and balancing the UK’s supply & demand.

Thirty recommendations were made to meet those goals. They include installing eight million heat pumps as well as upgrading every home in the UK with energy-saving measures such as insulation and double glazing but focusing first on damp homes and areas with fuel poverty. The report also calls for the installation of 7000 off-shore and 2000 on-shore wind turbines as well as solar panels that would cover an area of 22 000 football pitches, so tripling the UK’s current solar capacity.

Specific recommendations for early action include a vast expansion of offshore wind to 52 GW while onshore wind would increase to 30 GW and solar energy to 35 GW – all contributing to the 137 GW boost in renewable capacity. The report also calls for an urgent UK-wide programme to upgrade existing buildings to “significantly reduce energy wastage and a shift to low-carbon heat”. All new buildings would have to be net zero-carbon.



The plan aims to reduce the need for energy across the UK by a minimum of 20% for heat and a minimum of 11% for electricity, relative to current levels. On the supply side, offshore wind would be supplying 172 TWh by 2030 while onshore wind would contribute 69 TWh and photovoltaic solar being 37 TWh. But there is also 63 TWh from nuclear — with 9 GW assumed to be in place by 2030 — as well as 32 TWh from gas with 40GW of power plants in use.

## Nuclear

The report assumes that in its 90% so-called low-carbon mix (a Labour euphemism for renewables and nuclear) for 2030 nuclear capacity stays at the current level. But it also says it is “*entirely possible to meet the 90% target without any new nuclear capacity*”, though that would be “*more challenging*” due to the loss of low-carbon base-load and increased use of variable power. So, the report notes, more grid balancing would be needed via storage, interconnection, demand management or fossil fuel back-up. Though it adds, “*the system will also benefit from cheaper generation technology such as wind & solar*”. Professor Dave Elliott calls it “*a good report that faces up to many of the issues, nuclear apart [but] avoid[s] detailed programme costing.*” (3)

The UK Government’s justification for building new nuclear stations is based, *inter alia*, on the grounds that electricity demand is likely to double by 2050, (4) so it’s worth having a look at what the Labour expert report says about this.

It says UK electricity demand reached a peak in 2006 of 357TWh. Since then it has dropped steadily to 297TWh. If the current trajectory of the last decade – in which demand has dropped were to continue, UK electricity would drop to 253TWh by 2030. However due to the potential impact of the rebound effect this work assumes that rebound will cancel this out ‘natural decrease’. This ensures that we do not double count the impact of electricity energy-efficiency measures.

Goal 1 is to reduce heat demand by 20% and electricity by 11%. This 11% reduction in electricity demand though refers to what the report calls ‘direct electricity demand’ which is electricity used ‘at the socket’ to power electrical appliances, lighting, and the like. It also includes plug-in electric heating and storage heaters. It does not include building-integrated electrical heating, such as from heat pumps. So, under these proposals, direct electricity demand is projected to fall from 297TWh/yr to 265TWh/yr by 2030. Chapter 3 goes on to say “*Decarbonising heating will create the need for more electricity generation (117TWh), which must all be from additional renewable or low-carbon sources.*” So that is a net increase in electricity demand of 85TWh/yr.

### Section 4.13 Nuclear Power. (page 109)

Not a big deal perhaps, but the spelling errors regarding nuclear power do not inspire great confidence in the expertise being offered to the Labour Party.

Hinkley Point C is not spelt with a “c”. (Before we get to Section 4.13 it’s spelt correctly on page 87; incorrectly on page 101 and 106) In paragraph 4.13.3 Hinkley is spelt two different ways,



and Moorside is spelt two different ways, both of which are incorrect (Moreside and Mooreside). Bradwell has mysteriously moved from Essex to Kent.

## Nuclear contribution

The report says (para 4.13.1) nuclear power is now one of the main electricity generation technologies deployed globally. Actually, the nuclear share of the world's gross power generation is declining from a historic peak of 17.46% in 1996 to 10.15% in 2018. So, it is debatable whether you would call it a "main" source of electricity at only just over 10%. Nuclear power's share of global commercial primary energy consumption has remained stable since 2014 at around 4.4%. (5)

The report quite rightly points out that nuclear is not a zero-carbon power source. A meta-study, conducted by Benjamin Sovacool, looked at over 100 lifecycle studies and found that the mean value of emissions from nuclear power was around 66gCO<sub>2e</sub>/kWh. This compares with around 9gCO<sub>2e</sub>/kWh for offshore wind, 32gCO<sub>2e</sub>/kWh for solar PV and 443gCO<sub>2e</sub>/kWh for gas. (6) The other problem, as far as carbon emissions are concerned, is the length of time it takes for nuclear power stations to be planned and built. Planning for Hinkley Point C began around 2008. It has an estimated completion year of 2025 to 2027, giving it a planning-to-operation (PTO) time of 17 to 19 years. Carbon emissions from the background grid while consumers wait 17 to 19 years for nuclear to come online, relative to 2 to 5 years for wind or solar, or less for energy efficiency measures, should also be taken into account. In addition, all nuclear plants emit 4.4 g-CO<sub>2e</sub>/kWh from the water vapour and heat they release. This contrasts with solar panels and wind turbines, which reduce heat or water vapour fluxes to the air by about 2.2 g-CO<sub>2e</sub>/kWh for a net difference from this factor alone of 6.6 g-CO<sub>2e</sub>/kWh. (7)

Sizewell C, the only nuclear station which appears to be going forward apart from Hinkley Point C, is not expected to come on-stream until 2031 by EDF Energy. If we were to decide now to do something else instead we could save the equivalent of up to eleven years' worth of emissions from the background grid less the lifecycle emissions of the extra renewables or efficiency measures implemented. None of the other proposed reactor sites have firm proposals, so would be unlikely to come on-line before 2031.

Paragraph 4.13.2 says:

*"The capacity factor of a typical nuclear power station is far greater than all other renewable and low-carbon sources, because a station provides output 24/7 when online – a core reason behind arguments that nuclear power should be a key part of any low-carbon energy mix."*

This rather overeggs the performance of the AGR reactors. In 2016 the UK's nuclear capacity factor was around 77%, (8) but since then it is likely to have deteriorated. Hunterston B reactor 4 was closed between 2nd October 2018 and 25th August 2019. Reactor 3 has been closed since March 2018 and is not expected to re-open until at least January 2020. Both reactors at Dungeness B have been closed since October 2018 due to corrosion in pipework (9) The latest forecast dates for a return to service are November 25th for Reactor 21, December 6th for



Reactor 22. (10) The most reliable UK plant (Sizewell B) has a lifetime load factor of 84%, with a range of 46-100%. The least reliable (Dungeness B) has a lifetime load factor of only 41% with a range 4-74%. (11)

Paragraph 4.13.3 suggests that we need 8.9GW of new nuclear capacity to replace the AGR reactors which are due to close between now and 2030. It says that Hinkley Point C is due to come on stream in 2025 without mentioning the possibility of a 15 month delay recently announced by EDF Energy. (12) Hartlepool, Hinkley and Hunterston are all due to close before 2025. Their output will need to be replaced before Hinkley Point C comes online.

The UK the Energy and Climate Intelligence Unit argues that existing nuclear reactors could be phased-out without pushing up emissions. If the UK's nuclear regulator, for instance, finds that cracks, like the ones found in the core of Hunterston B, are worse than expected, a mixture of renewable generation technologies – onshore wind, offshore wind and solar PV – would be the lowest cost option, with cumulative savings to 2035 up to £18 billion compared with natural gas-fired power stations. (13)

An accelerated programme to replace all the lights in the UK with LEDs could cut peak electricity demand by about 8GW – almost enough to replace all existing nuclear capacity. LEDs produce less waste heat and so can sometimes cut the need for air conditioning in places such as hotels and large office buildings. Even a much more restricted national campaign that just focused on domestic houses would have a dramatic impact. If we switched the lights in the parts of the house that are in use in early evening - essentially the kitchen and living areas - we would reduce home demand by more than 50%. We could cut the typical demand for electricity to run lights from today's evening average of 180W to 80W by replacing about 21 bulbs in the typical home. The impact would reduce peak electricity demand by 2.7GW – almost the capacity of Hinkley Point C. The payback period of such a scheme is about two years at 2015 LED prices. For an expenditure of around £60, the householder would typically save £30 a year. (14)

Para 4.13.3 says the UK plans to deliver 12GW of new nuclear capacity by 2030. As shown above, it won't get anywhere near this figure. Assuming Hinkley Point C does not suffer the same kind of delays seen in projects using the same reactor type, such as Flamanville in Normandy (15) and Olkiluoto in Finland (16) (both are ten years late), we might get 3.2GW by 2030.

The report's claim that we will have 8.9GW of nuclear capacity in 2030 *"...resulting in around 63TWh of output in 2030, contributing 15% of the renewable and low-carbon electricity needed"* is very unlikely to come to fruition. What looks most likely at the moment is that by the end of 2030 when Torness and Heysham B are due to close, we will have 3.2GW from Hinkley Point C and 1.2GW from Sizewell B making a total of 4.4GW.

The Regulated Asset Base (RAB) model proposed by the current Government for financing new nuclear stations after Hinkley Point C has come in for some severe criticism. (17)



EDF's claim that Sizewell C will be 20% cheaper than the current estimated cost of Hinkley Point C is dubious to say the least. It's not clear where the document gets the figure of £65/MWh for Sizewell C (page 111). The strike price for Hinkley Point C has now reached around £106/MWh in today's prices. If Sizewell C could manage a 20% reduction it would still be £85/MWh. When announcing the abandonment of the Wylfa project, the then energy minister (Greg Clark) talked about requiring a strike price of no more than £75/MWh - which he said would represent a 20% reduction compared to Hinkley Point C (this figure must be in 2012 prices). This would be based on the UK government taking a one third equity share, with government rather than banks providing all the required loans. This should have made the cost of capital very low indeed, but despite this, developers were unable to commit to achieving £75/MWh. So it seems that the lowest achievable price is more than £75/MWh.

The total construction cost of Sizewell C will be about £32 billion (non-discounted), but all experience with nuclear projects worldwide in recent years suggests it is almost inevitable that costs will substantially exceed estimates, and a total cost of at least £40 billion would be likely.

According to Thomas et al. *"the only way the strike price can be significantly reduced is by reducing the risk to the developers and financiers, which will reduce the cost of capital at the expense of consumers and taxpayers."* (18) The funding model proposed would let energy companies charge consumers a set amount, to be spent on future infrastructure provision. The consultation document claims the system will *"ensure that those who make payments for a new nuclear project should directly benefit from doing so."* But there is no suggestion that consumers on 100% renewable tariffs or living in Scotland can escape the nuclear surcharge and there is no attempt to define the term "directly benefit" in the above sentence.

EDF Energy estimates that Sizewell C will add £6 per year to every consumer's bill. (19) In contrast the capacity auction of 2019 yielded offshore wind prices of less than £40/MWh (2012 money) with none of the risk-sharing required by the RAB model and with a power purchase agreement for only 15 years. These sorts of prices would actually lower consumers bills.

The penultimate paragraph of Section 4.13.3 is garbled and, even ignoring spelling and geographical errors, doesn't make sense:

*"The Sizewell C site could house very similar plant to Hinkley Point C, at 3.2GW, meaning total of 6.4GW, meaning only 3GW needs to be found. Again there are multiple sites where a third 3.2GW plant could be housed. Sizewell on the east coast could be another option, or Bradwell in Kent. These are all in the south east, so from the point of view of supporting local industry, other sites in the north could be considered, such as Wylfa."*

Is this actually proposing a fourth plant at Sizewell?

The paragraph finishes with: *"This analysis serves to give confidence that with the right government support, nuclear capacity in 2030 could be returned to today's output levels."*

Again, Sizewell C is not expected to come on line until 2031. It is very unlikely that anything other than Hinkley Point C can be brought on-line before 2030.



Paragraph 4.13.4, unlike previous paragraphs, correctly identifies that by 2030 the UK would only have 4.4GW of operational nuclear capacity (1.2GW from the existing Sizewell B and 3.2GW from the new Hinkley C). It continues:

*“This would mean a further 32TWh of power would need to be found from other renewable and low-carbon sources to plug the gap and meet 90% renewable and low-carbon electricity. These levels are well within the available resources around the UK, and it is still entirely possible to meet the 90% target without any new nuclear capacity. It will however be more challenging for a number of reasons, including the loss of large volumes of low-carbon baseload power that nuclear provides and the increasing the proportion of generation capacity that is intermittent. This will necessitate greater capacity for grid balancing, either through power storage, interconnection, demand-side management, or fossil fuel back up. It may for instance necessitate greater volumes of fossil fuel to be put back on stand-by, resulting in higher system balancing costs. However, the system will also benefit from cheaper generation technology such as wind and solar.”* [emphasis added]

The paragraph has echoes of the statement made by former Business Secretary Greg Clark when he disclosed, to industry at a private meeting, estimates of the amount of firm power he thinks will be needed in 2050, as his department published plans for the RAB funding model. He said Britain needs to build a fleet of nuclear or carbon-capture power plants equivalent to a dozen Hinkley Point Cs - up to 40GW of non-intermittent low carbon power stations to hit climate change targets. (20)

As we saw above (in Do we Really Need 40GW of Firm Power?) a growing number of studies suggest that with flexibility and ever cheaper renewables it is perfectly possible to run our energy system on 100% renewables.

According to UBS Bank *“Large-scale power generation ... will be the dinosaur of the future energy system: Too big, too inflexible, not even relevant for backup power in the long run.”* Centralised power stations could be obsolete within 10 to 20 years. (21) And HSBC Bank predicts that conventional generators will be the biggest losers from an upcoming energy storage boom. (22) What an energy system with an increasing proportion of renewable capacity needs is not large baseload power stations, but flexible back-up which can be turned on and off quickly to provide electricity at peak times when renewables are not producing much. (23) Large baseload power stations, such as nuclear and large coal-fired power stations are not flexible because they are hard to turn on and off – they need to operate continuously 24/7.

Jerome Pecresse, of GE Renewables, said at the Eurelectric Summit of 2018 that: *“We are inventing things that we did not even imagine three years ago ...renewable baseload is coming fast.”* (24) According to the Recharge magazine report of the summit utilities are dispelling all doubts about renewables' ability to power the planet. (25) National Grid Electricity System Operator (ESO) has announced it will be able to fully operate Great Britain's electricity system with zero carbon by 2025. (26)



## Conclusion

Tackling climate change is urgent so we need to spend our limited resources carefully to maximise the carbon saving for every pound spent. New nuclear power costs about 2.5 times more than offshore wind power per kWh and takes 5 to 17 years longer between planning and operation to build. In effect this means that building nuclear power worsens the climate problem. In addition, it creates risks such as weapons proliferation, meltdown, and waste risks which should be avoided.

Nuclear advocates claim nuclear is still needed because renewables are intermittent and need natural gas for backup. However, nuclear itself never matches power demand so it also needs backup. Today, batteries are beating natural gas for wind and solar backup needs throughout the world. A dozen independent scientific groups have further found that it is possible to match intermittent power demand with clean, renewable energy supply and storage, without nuclear, at low cost.

The Labour Party Expert report includes some good proposals on renewables and energy efficiency. Promoting new nuclear power stations is not going to achieve any further new nuclear construction by 2030, but will detract from other more effective proposals in this document.

- 
1. Thirty by 2030, Labour Party, October 2019 <https://labour.org.uk/wp-content/uploads/2019/10/ThirtyBy2030report.pdf>
  2. See Table 1 here:  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/790626/2018-provisional-emissions-statistics-report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790626/2018-provisional-emissions-statistics-report.pdf)
  3. Physics World 7th Nov 2019 <https://physicsworld.com/a/a-2030-uk-energy-plan/>
  4. National Policy Statement for Nuclear Power Generation (EN-6) DECC July 2011  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/47859/2009-nps-for-nuclear-volume1.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47859/2009-nps-for-nuclear-volume1.pdf)
  5. World Nuclear Industry Status Report 2019 <https://www.worldnuclearreport.org/-World-Nuclear-Industry-Status-Report-2019-.html>
  6. Sovacool, B. *Valuing the greenhouse gas emissions from nuclear power: a critical survey*, Energy Policy 36 (2008) 2950 – 2963 <https://www.sciencedirect.com/science/article/pii/S0301421508001997>
  7. Jacobson, M.Z. Seven reasons why nuclear energy is not the answer to climate change, Leonardo Dicaprio Foundation (accessed) 27<sup>th</sup> October 2019 <https://www.leonardodicaprio.org/the-7-reasons-why-nuclear-energy-is-not-the-answer-to-solve-climate-change/>
  8. Nuclear Capacity in the UK, (accessed) 26<sup>th</sup> October 2019  
[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/604271/Nuclear\\_Capacity\\_in\\_the\\_UK.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/604271/Nuclear_Capacity_in_the_UK.pdf)
  9. Reuters October 30<sup>th</sup> 2018 <https://af.reuters.com/article/commoditiesNews/idAFL8N1XA3T8>
  10. EDF Energy 2<sup>nd</sup> Oct 2019 <https://www.edfenergy.com/media-centre/news-releases/dungeness-b-power-station-monthly-newsletter-october-2019>



11. Professor Steve Thomas, Peter Bradford, Tom Burke CBE, Dr Paul Dorfman. *The Proposed RAB Financing Method*, Nuclear Consultation Group October 2019 page 8  
[https://www.nuclearconsult.com/wp/wp-content/uploads/2019/10/NCG\\_RAB\\_submission.pdf](https://www.nuclearconsult.com/wp/wp-content/uploads/2019/10/NCG_RAB_submission.pdf)
12. Gosden, E. *Hinkley Point C faces delay as costs overrun, warns EDF*, Times 26<sup>th</sup> September 2019  
<https://www.thetimes.co.uk/article/4f0f6d1e-dfaa-11e9-8221-1b98fc56091e>
13. Cracks in the System, ECIU June 2019 [https://ca1-eci.edcdn.com/downloads/Cracks\\_in\\_the\\_System\\_FINAL\\_5\\_6\\_19.pdf?mtime=20190606145543](https://ca1-eci.edcdn.com/downloads/Cracks_in_the_System_FINAL_5_6_19.pdf?mtime=20190606145543)
14. Goodall, C The urgent case for a mass switch to LED lighting, Ecologist 8th June 2016  
[http://www.theecologist.org/blogs\\_and\\_comments/commentators/2987760/the\\_urgent\\_case\\_for\\_a\\_n\\_mass\\_switch\\_to\\_led\\_lighting.html](http://www.theecologist.org/blogs_and_comments/commentators/2987760/the_urgent_case_for_a_n_mass_switch_to_led_lighting.html)
15. Le Monde 10th April 2019 [https://www.lemonde.fr/economie/article/2019/04/10/nucleaire-l-epr-deflamenville-risque-de-connaître-de-nouveaux-retards\\_5448479\\_3234.html](https://www.lemonde.fr/economie/article/2019/04/10/nucleaire-l-epr-deflamenville-risque-de-connaître-de-nouveaux-retards_5448479_3234.html)
16. World Nuclear News 23rd May 2019 <http://www.world-nuclear-news.org/Articles/TVO-starts-work-to-resolve-Olkiluoto-3-vibration-i>
17. Professor Steve Thomas, Peter Bradford, Tom Burke CBE, Dr Paul Dorfman. *The Proposed RAB Financing Method*, Nuclear Consultation Group October 2019  
[https://www.nuclearconsult.com/wp/wp-content/uploads/2019/10/NCG\\_RAB\\_submission.pdf](https://www.nuclearconsult.com/wp/wp-content/uploads/2019/10/NCG_RAB_submission.pdf) and  
*The financing of new nuclear energy – responding to the UK Government consultation on a Regulated Asset Base financial model*, Nuclear Free Local Authorities, September 2019  
[https://www.nuclearpolicy.info/wp/wp-content/uploads/2019/09/NFLA\\_New\\_Nuclear\\_Monitor\\_No58\\_RAB\\_Consultation\\_response.pdf](https://www.nuclearpolicy.info/wp/wp-content/uploads/2019/09/NFLA_New_Nuclear_Monitor_No58_RAB_Consultation_response.pdf)
18. Written evidence submitted by Professor Steve Thomas, Tom Burke CBE & Dr Paul Dorfman (FEI004) to the House of Commons, Business Energy and Industrial strategy Committee, *Is there a ‘giant hole’ in UK energy policy*” March 2019  
<http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/business-energy-and-industrial-strategy-committee/financing-energy-infrastructure/written/98710.pdf>
19. BBC 11<sup>th</sup> June 2019 <https://www.bbc.co.uk/news/business-48593581>
20. Times 24th July 2019 <https://www.thetimes.co.uk/article/142efc8a-ad84-11e9-b657-11944f524f2a>
21. Will solar, batteries and electric cars re-shape the electricity system? UBS Global Research 20<sup>th</sup> August 2014 <http://knowledge.neri.org.nz/assets/uploads/files/270ac-d1V0t04LmKMZuB3.pdf>
22. Renew Economy 1st October 2014 <http://reneweconomy.com.au/2014/energy-storage-generators-biggestlosers-50615>
23. Clean Technica 4th Feb 2015 <http://cleantechnica.com/2015/02/04/big-expensive-power-plants-undermineclean-energy-future/>
24. Jeremy Leggett 5<sup>th</sup> July 2018 <https://jeremyleggett.net/2018/07/05/how-digitalization-is-ushering-in-a-new-solar-era-ge-on-digital-twins-and-smart-dispatchability/>
25. Recharge News 6<sup>th</sup> June 2018 <https://www.rechargenews.com/transition/1505979/utilities-dispel-all-doubts-about-renewables-ability-to-power-planet>
26. National Grid ESO 1<sup>st</sup> April 2019 <https://www.nationalgrideso.com/news/zero-carbon-operation-great-britains-electricity-system-2025>



## 7. Geological Disposal

The National Policy Statement for Geological Disposal Infrastructure, was designated on 17<sup>th</sup> October 2019. (1)

The NFLA briefing which dealt with the consultation on the draft National Policy Statement was published in April 2018 here: [http://www.nuclearpolicy.info/wp/wp-content/uploads/2018/04/Rad\\_Waste\\_Brfg\\_71\\_UK\\_Welsh\\_radwaste\\_policy.pdf](http://www.nuclearpolicy.info/wp/wp-content/uploads/2018/04/Rad_Waste_Brfg_71_UK_Welsh_radwaste_policy.pdf)

The NFLA view was that the Government's claim that:

*"There is a need for a permanent disposal solution for higher activity radioactive waste from a wide range of activities, including: waste from 60 years of nuclear generation and waste from new nuclear power stations; as well as waste from medical treatments, research, and defence activities. The government policy for geological disposal of this waste is based on an independent review by the Committee on Radioactive Waste Management (CoRWM)."* (2)

was highly contentious. CoRWM also made important recommendations which the Government completely ignored, for instance its

*"...recommendations are directed to existing and committed waste arisings ... the political and ethical issues raised by the creation of more wastes are quite different from those relating to committed – and therefore unavoidable – wastes".* (3)

And in September 2007 CoRWM said: *"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."* (4)

The National Policy Statement for Geological Disposal Infrastructure sets out the need for disposal infrastructure, as the Government sees it, to safely and securely manage the UK's higher activity radioactive wastes. The National Policy Statement provides an appropriate and effective framework for the Planning Inspectorate and the Secretary of State for the Department for Business, Energy and Industrial Strategy to examine and make decisions on development consent applications for geological disposal infrastructure in England. In order to support the requirements for the designation of the National Policy Statement for Geological Disposal Infrastructure,

The Minister noted that the NPS sits alongside the Working with Communities policy document that was published in December 2018 which sets out the framework for managing radioactive waste through geological disposal and the process for how the government will work with communities to find a location for this facility. The Minister said that process is now under way.

In a letter to the Guardian Professor Andy Blowers said:



*“The search for a disposal site diverts attention from the real solution for the foreseeable future, which is to ensure the safe and secure management of the unavoidable legacy wastes that have to be managed. It is perverse to compound the problem by a new-build programme that will result in vastly increased radioactivity from spent fuel and other highly radioactive wastes which will have to be stored indefinitely at vulnerable sites scattered around our coasts. A new-build programme would create an unmanageable and intolerable burden on communities into the far future. To suggest that a repository is the solution is in the realm of fantasy.” (6)*

- In a blow to Government plans, the word “support” has been removed from Copeland council’s position on geological disposal. The Government launched its latest search for a host community almost a year ago, prompting the council to come up with a statement that was broadly supportive of the project but non-committal in terms of the authority’s involvement. However, earlier this year councillor Sam Pollen of the Strategic and Nuclear Energy Board raised “moral” concerns over the very idea of a multi-million-pound geological disposal facility (GDF). The first statement said that the Council “supports” the Government’s approach for the disposal of radioactive waste, but the revised version adopted in November stops short of endorsing the GDF plans. The revised version now says that the Council “*acknowledges*” that the creation of a Geological Disposal Facility is Government policy, adding a new clause that the “*safety and security of the facility must take precedence over other considerations including timescales for delivery.*” (7)
- Ann McCall, Siting Director for Radioactive Waste Management Ltd, (RWM), the organisation responsible for delivering the UK’s geological disposal facility, will leave the company at the end of 2019. Following news of RWM MD Bruce McKirdy’s retirement, it is thought that her departure forms part of the wider review of organisational leadership being conducted by RWM’s parent organisation, the Nuclear Decommissioning Authority (NDA). No further information is yet available. (8)
- ONR and the Environment Agency, have published a joint annual report on their scrutiny of Radioactive Waste Management’s (RWM) work to develop geological disposal. The two regulators say they are working together to make sure that any future geological disposal facility (GDF) will meet the high standards for environmental protection, safety and security that the public expects, and have established agreements with RWM, the organisation responsible for developing a GDF, to provide regulatory advice and to scrutinise its work. The regulators have no regulatory role in selecting potential sites for a GDF. However, they will offer support on matters relating to their respective areas of regulation to communities that are considering hosting a GDF. (9)
- The report says RWM has significantly improved its generic Disposal System Safety Case since the last Annual Report. However, it is important to note that the 2016 gDSSC is not a fully scoped safety case. Instead it presents information on how RWM intends to make a safety case once a suitable site has been found. Areas identified where RWM needs to improve to provide further confidence in geological disposal include developing its



understanding of risk from the gas pathway; and it needs to substantiate the assumptions about copper container failure in the illustrative concept for disposal of high heat generating waste (HHGW) in higher strength rock. ONR presented 38 new recommendations to help RWM better understand its requirements when developing its DSSC for a GDF and the Environment Agency provided further detailed advice and comments. RWM still has a significant amount of work to do to develop a comprehensive, site-specific safety case and many aspects can only be fully evaluated once a site has been selected and specific designs produced.

- Augean’s bid for a permit to dispose of low-level radioactive waste at its landfill site at Port Clarence on Teesside have attracted objections from Thornaby Town Council and Tees Valley Mayor Ben Houchen. Mayor Houchen fears this latest move would result in “mission creep” on Teesside which could “open the floodgates” to more nuclear waste storage. (10)
- Gillingham Asda shoppers will be surprised to learn they have been parking next to an MoD nuclear waste dump with more than 3,000 cubic metres of waste dumped between 1968 and 1986. The land was once owned by Chatham Dockyard where nuclear Submarines were maintained. Contaminated tools and personal protective gear was dumped in paper sacks and buried five feet below the surface of the area. The most prominent radioactive isotope on the site is Cobalt-60, a high intensity gamma ray emitter. (11)

- 
1. Parliament 17th Oct 2019 <https://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Commons/2019-10-17/HCWS18/>
  2. CONSULTATION: National Policy Statement For Geological Disposal Infrastructure Implementing Geological Disposal, BEIS 25th Jan 2018  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/676402/Final\\_NPS\\_Consultation\\_Document.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/676402/Final_NPS_Consultation_Document.pdf)
  3. Managing our Radioactive Waste Safely, CoRWM, July 2006. Para 26  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/294118/700\\_-\\_CoRWM\\_July\\_2006\\_Recommendations\\_to\\_Government\\_pdf.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/294118/700_-_CoRWM_July_2006_Recommendations_to_Government_pdf.pdf)
  4. Re-iteration of CoRWM’s Position on Nuclear New Build, Gordon Mackerron September 2007. Page 3  
[http://webarchive.nationalarchives.gov.uk/20130717140311/http://corwm.decc.gov.uk/assets/corwm/pre-nov%202007%20doc%20archive/doc%20archive/tier%20%20\(7\)%20-%20implementation/tier%203%20-%20implementation%20advice/2162%20%20-%20corwm%20position%20on%20new%20build%20reiterated.pdf](http://webarchive.nationalarchives.gov.uk/20130717140311/http://corwm.decc.gov.uk/assets/corwm/pre-nov%202007%20doc%20archive/doc%20archive/tier%20%20(7)%20-%20implementation/tier%203%20-%20implementation%20advice/2162%20%20-%20corwm%20position%20on%20new%20build%20reiterated.pdf)
  5. World Nuclear News 17<sup>th</sup> Oct 2019 <http://www.world-nuclear-news.org/Articles/UK-designates-radwaste-disposal-policy>
  6. Guardian 24th January 2018 <https://www.theguardian.com/environment/2018/jan/24/exposing-uk-government-foolly-of-investment-in-new-nuclear>
  7. Carlisle News and Star 7<sup>th</sup> Nov 2019 <https://www.newsandstar.co.uk/news/18022384.council-removes-support-underground-nuclear-waste-storage-plan/>



8. GDF Watch 15<sup>th</sup> Oct 2019 <https://mailchi.mp/afa614c998f0/breaking-news-amccresigns?e=43483d1115>
9. ONR 30<sup>th</sup> Oct 2019 <http://news.onr.org.uk/2019/10/joint-ea-and-onr-regulatory-scrutiny-and-engagement-report-published/>
10. Teesside Gazette 23<sup>rd</sup> Oct 2019 <https://www.gazettelive.co.uk/news/teesside-news/more-objections-nuclear-waste-plans-17132905>
11. Kent Live 30<sup>th</sup> Oct 2019 <https://www.kentlive.news/news/kent-news/gillingham-asda-shoppers-no-idea-3484975>



## 8. World Nuclear Waste Report

The final disposal of high-level radioactive waste presents governments worldwide with major challenges that have not yet been addressed, and entails incalculable technical, logistical, and financial risks. This is the conclusion of the first "World Nuclear Waste Report - Focus Europe" launched in Berlin in November. (1)

According to the World Nuclear Waste Report, over 60,000 tons of spent nuclear fuel alone are stored in interim storage facilities across Europe (excluding Russia and Slovakia). Spent fuel rods are highly radioactive waste. To date, no country in the world has a repository for high-level waste from nuclear power in operation. Within the EU, France accounts for 25 percent of the current spent nuclear fuel, followed by Germany (15 percent) and the United Kingdom (14 percent).

In addition, more than 2.5 million m<sup>3</sup> of low- and intermediate-level waste has been generated in Europe (excluding Slovakia and Russia). Over its lifetime, the European nuclear reactor fleet will produce an estimated 6.6 million m<sup>3</sup> of nuclear waste. Four countries are responsible for most of this waste: France (30 percent), the UK (20 percent), the Ukraine (18 percent) and Germany (8 percent).

According to the World Nuclear Waste Report, many governments underestimate the costs of interim and final storage. No country has a consistent financing model to date in places. This poses further financial risk for taxpayers.

Marcos Buser, a geologist and co-author of the report, said: *"Increasing amounts of high-level waste have to be interim stored for ever longer periods of time, as no country in the world has yet commissioned a deep geological repository for such waste. The problem is that interim storage facilities have not been designed for such long-term use."* The Swiss nuclear expert warned that the storage facilities are already reaching the limits of their capacities. For example, storage capacity for spent fuel in Finland has already reached 93 percent saturation. Sweden's decentralized storage facility CLAB is at 80 percent saturation. "The shutdown and decommissioning of many nuclear power plants will again drastically increase the quantities of nuclear waste," warns Buser.

In addition to the safety aspects, the report identifies the enormous costs of interim storage and final disposal as another risk. *"National governments and operators often significantly underestimate the costs of decommissioning, storage, and disposal of nuclear waste,"* said Ben Wealer, co-author of the study and industrial engineer at the Technical University of Berlin. In many countries there is a large gap between the expected costs and the financial resources earmarked for them. The problem would be exacerbated by the fact that final disposal also involves incalculable risks, which could lead to enormous cost increases, as the German government experiences with the Asse repository illustrate.



Nearly every government claims to apply the polluter-pays-principle, which makes operators liable for the costs of managing, storing, and disposing of nuclear waste. In reality, however, governments fail to apply the polluter-pays-principle consistently. *"No country in Europe has taken sufficient precautions to finance the costs of the final disposal of nuclear waste. There is a threat that the real, massive costs will ultimately be borne by the taxpayers,"* Wealer warned.

Ellen Ueberschär, President of the Heinrich-Böll-Stiftung, said: "The numerous unsolved problems in dealing with nuclear waste show that nuclear power has no future. At the same time, the report makes clear that phasing out nuclear power is not enough. Insufficient financial provisions for disposing of nuclear waste must not undermine the care and safety of decisions for interim storage and final disposal. The search for a suitable final repository needs greater public attention. The report is intended to facilitate a qualified international debate."

- 
1. World Nuclear Waste Report 2019 <https://worldnuclearwastereport.org/>



## 9. Hinkley notes

- Owners of holiday homes and short-term rental properties in the south-west of England are being urged to check that their houses and flats are not being used as brothels. Avon and Somerset police said they were investigating 50 suspected brothels in residential settings such as holiday flats. The force also said almost half of the intelligence reports about human trafficking and modern slavery it received in August centred on the exploitation of women and girls in off-street prostitution. Officers say brothels are being set up not only in Bristol and other urban centres but in the countryside. There have been reports of brothels being established close to the vast building site on the Somerset coast where the Hinkley Point C nuclear power station is taking shape. (1)
- The UK's energy regulator has proposed cutting funding by £80m for the project that links the new Hinkley Point C nuclear reactor to the electricity grid after rejecting some of the National Grid's requests for cash. Ofgem said it plans to grant National Grid Electricity Transmission £637m, compared with an initial request for £717m, and that the new funding framework would save customers money. (2) National Grid has vowed to challenge the ruling and said it would continue to work with Ofgem to ensure a fair result but will seek to change its mind. Ofgem said it will make a final decision on the funding model after a six-week consultation. (3)
- The Office for Nuclear Regulation says it has no information about the risk of earth tremors from fracking near the Hinkley Point power station. Frack Free Exmoor, Quantocks and Sedgemoor (FFEQS) says ONR has had no correspondence on the subject with either the oil and gas industry regulator, the power station operator, local exploration companies or Somerset County Council. FFEQS has described the failure to assess the risk of fracking on the nuclear station as "a gaping hole" in the safety case. (4) Of course, this may not be an issue if the Tories stick to their pledge to end fracking, but doubts have been raised about this. (5)

- 
1. Guardian 17<sup>th</sup> Oct 2019 <https://www.theguardian.com/society/2019/oct/17/police-warn-somerset-holiday-home-owners-over-pop-up-brothels>
  2. Energy Voice 16<sup>th</sup> Oct 2019 <https://www.energyvoice.com/otherenergy/nuclear/209921/ofgem-tells-national-grid-to-cut-hinkley-funding-by-80m/>
  3. Telegraph 15<sup>th</sup> Oct 2019 <https://www.telegraph.co.uk/business/2019/10/15/national-grid-hits-back-ofgem-plans-cut-hinkley-funding-80m/>
  4. Drill or Drop 12<sup>th</sup> Oct 2019 <https://drillordrop.com/2019/10/12/campaigners-accuse-regulator-of-failing-to-assess-fracking-risk-to-nuclear-station/>
  5. iNews 11<sup>th</sup> Nov 2019 <https://inews.co.uk/news/politics/boris-johnson-fracking-ban-u-turn-shale-gas-general-election-921414>

## 10. Office for Nuclear Regulation

Chief Nuclear Inspector (CNI) Mark Foy has published his view on the performance of Great Britain’s nuclear industry during 2018/19. (1) He says he is satisfied that the nuclear industry has overall continued to meet the high standards of safety and security required to protect workers and the public.

In areas where shortfalls have been identified, the Chief Inspector says ONR has focused its attention on securing commitments and plans from the industry to improve performance in a timely manner. In the first report of its kind, the review provides a view of safety, security and safeguards performance across the nuclear industry over the last year. It details good progress in several areas including continued hazard and risk reduction at Sellafield; the transition of Bradwell power station into a period of Care and Maintenance – marking a UK first; the piloting of new site security plans in line with ONR’s Security Assessment Principles, launched in 2017; and the issue of consent for the first ‘nuclear concrete’ pour at Hinkley Point C.

### Liquid High Level Waste Stocks at Sellafield

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

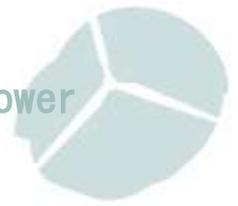


The report also recognises a number of challenges which require continued focus over the coming year. These include: Increased attention at defence weapons and propulsion sites, notably Devonport naval base and the Atomic Weapons Establishment, where programmes to upgrade ageing facilities have experienced delays; Continued scrutiny of Hunterston B power station which features the most advanced symptoms of graphite reactor core degradation in the Advanced Gas-Cooled Reactor fleet; Enhanced regulatory oversight at Dungeness B where both reactors have been shut down during the last year due to a range of complex age-related issues



which are being addressed by licensee EDF Energy; Ageing plutonium storage facilities at Sellafield which require sustained investment and focus by Sellafield Ltd, the Nuclear Decommissioning Authority and government.

- 
1. ONR 11th Oct 2019 <http://news.onr.org.uk/2019/10/chief-nuclear-inspectors-annual-report-on-great-britains-nuclear-industry/> and <http://www.onr.org.uk/documents/2019/cni-annual-report-1819.pdf>



## 11. Energy Storage

Edinburgh company – Gravitricity - is planning to generate electricity from gravity and is getting noticed by investors, as an effective alternative to large batteries, so that renewable energy supply can be stored until there is demand. (1) Electricity would be stored and then regenerated by hoisting and dropping 12,000-tonne weights – half the weight of the Statue of Liberty – down disused mine shafts. Gravitricity, hopes to use Britain’s old mines to make better use of clean electricity at half the cost of lithium-ion batteries. Gravitricity said its system effectively stores energy by using electric winches to hoist the weights to the top of the shaft when there is plenty of renewable energy available, then dropping the weights hundreds of metres down vertical shafts to generate electricity when needed. Gravitricity wants to start with a tower in Edinburgh, to prove the concept. But it then wants to use mines which are closing, or recently closed, to make use of their deep shafts. (2)

Surplus renewable electricity could also be used to compress and cool air in a tank, so it becomes a freezing liquid. Then when demand peaks, you warm the liquid back into a gas, and as that expands it drives a turbine to create more electricity. Highview, has announced that a grid-scale 50MW plant will be built in the north of England on the site of a former conventional power plant. The technology has been supported by the UK government. One attractive feature is that it uses existing simple technology developed for storing and compressing liquefied natural gas (LNG). A key innovation is to store the excess heat given out when the air is compressed and use it to re-heat the liquified air when it is needed. (3)

- 
1. BBC 22nd Oct 2019 <https://www.bbc.co.uk/news/uk-scotland-scotland-business-50146801>
  2. Guardian 21st Oct 2019 <https://www.theguardian.com/environment/2019/oct/21/how-uks-disused-mine-shafts-plan-to-store-renewable-energy>
  3. Solar Power Portal 22<sup>nd</sup> Oct 2019 [https://www.solarpowerportal.co.uk/news/highview\\_power\\_unveils\\_plans\\_for\\_250mwh\\_cryobattery\\_in\\_the\\_uk](https://www.solarpowerportal.co.uk/news/highview_power_unveils_plans_for_250mwh_cryobattery_in_the_uk)



## 12. Local Energy Notes

- Councils across the UK have committed more than £2 million to tackling climate change in response to declarations of a “Climate Emergency”, according to the DeSmog website. While many councils have declared a climate emergency over the past year, the precise implications of the commitments have so far been vague. Most councils are still working out the costs associated with plans to reduce local emissions, with some already signalling their intent to commit a portion of the next budget to the cause. DeSmog sent a questionnaire to 94 councils listed to have declared a climate emergency, asking what actions they have taken since the declaration, and whether they had allocated additional funding to implement these proposals. 39 councils responded to the questionnaire. 11 of the 94 councils DeSmog contacted said they had already committed funding to tackling the climate emergency. Others were still in the process of costing their intended climate actions, or had plans to include it in next year’s budget. (1)
- Hundreds of homes and businesses in Cornwall have started selling electricity to their local energy network and the national energy system in a pioneering move. The trial is the first time that traditional energy users – such as homes, hotels and businesses – have acted as suppliers in a microcosm of a full energy system. The trial harnessed together 100 Cornish homes, fitted with batteries and solar panels, to act as a mini virtual power plant for the local energy network, Western Power Distribution, and the UK’s energy system operator, National Grid. During sunny spells when homes generate more than enough electricity from solar panels they can store the power to use later, or supply the energy system with clean extra power. The homes took part in the trial alongside 150 local businesses, which were prepared to adjust how much energy they used depending on the balance of energy supply and demand on the grid. If wind and solar power output dropped the companies could choose to use less electricity in exchange for a payment from National Grid, or if the local grid had more electricity than it needed the companies could ramp up their energy demand. National Grid already offers to pay firms that own utility-scale batteries to provide a similar service, but the trial is the first time that companies can take part in the same “local energy market” as the network operator. The market was designed by energy giant Centrica and modelled on the same system used to balance energy markets across Europe. The energy companies believe the trial could help create a nationwide chain of flexible smart grids built around clean energy. (2)
- Swindon produces enough electricity to power 97 per cent of the borough’s houses from renewable sources. (3)
- Aberdeenshire Council is planning to install solar PV and battery storage for 500 local authority homes. The properties in Inverurie and MacDuff will receive solar and storage systems with the intention of alleviating grid constraints in the area. Around 3.25kW of solar will be paired with a 5.5kWh battery in each property, and the systems will be used to provide grid services to the local network. The pilot scheme has been launched



after the council attempted to roll-out energy efficient schemes on existing properties, including solar PV, but was hamstrung by local grid constraints which prevented connecting systems to the grid. (4)

- Stirling Council has installed over 37,000 solar panels on more than 3,900 council housing properties, generating an estimated 9,700,000kWh of free renewable electricity every year. The council's energy efficiency programme also means that in 49% of the council housing stock already meets the new challenging minimum energy efficiency standards for social landlords in Scotland 13 years ahead of schedule. And more than 330 battery storage systems are set to be installed in council houses by March 2020. No wonder the Council won the Best Residential Solar and Storage Project award at the annual UK Solar and Storage Awards 2019 in Birmingham. (5)
- Cheshire West & Chester Council has announced plans to install solar panels with battery storage technology across two large estates. It has appointed Aberla Renewables, part of the Aberla Group, for the installations which include heating solutions that cover 180 council-owned homes. The team has started surveying properties and the project, which consists of solar panels with a total capacity of 250kW, is expected to be completed next year. The £500,000 project is part of the Low Carbon Housing Support Programme and has been jointly funded by the European Regional Development Fund (ERDF). (6)

- 
1. DeSmog 28<sup>th</sup> Oct 2019 <https://www.desmog.co.uk/2019/10/28/councils-commit-2m-tackle-climate-emergency>
  2. Guardian 11<sup>th</sup> Nov 2019 <https://www.theguardian.com/environment/2019/nov/11/cornish-homes-take-part-in-trial-to-supply-clean-power-to-grid>
  3. This is Wiltshire 9<sup>th</sup> Nov 2019 <https://www.thisiswiltshire.co.uk/news/18025809.solar-power-enough-nearly-every-swindon-home/>
  4. Solar Power Portal 31<sup>st</sup> Oct 2019 [https://www.solarpowerportal.co.uk/news/emtec\\_energy\\_clinches\\_4m\\_aberdeenshire\\_solar\\_plus\\_storage\\_retrofit\\_tender](https://www.solarpowerportal.co.uk/news/emtec_energy_clinches_4m_aberdeenshire_solar_plus_storage_retrofit_tender)
  5. Stirling News 29<sup>th</sup> Oct 2019 <https://www.stirlingnews.co.uk/news/18000427.stirling-leading-light-solar-power-award/>
  6. Energy Live News 12<sup>th</sup> Nov 2019 <https://www.energylivenews.com/2019/11/12/cheshire-west-chester-council-to-install-solar-plus-storage/>