nuClear news

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1. Nuclear Finance

Consumers could pay for new nuclear power plants years before they are built. The government is considering using a controversial financing system to build new nuclear power stations which would see customers charged for construction costs long before a project has actually been built. The fact that Mark Corben – former chief financial officer at the Special Purpose Vehicle (SPV) for the Thames Tideway Tunnel – has moved to the UK Department for Business, Energy and Industrial Strategy (BEIS) to advise on development of a new finance model for funding new nuclear projects, confirms that the Government is seriously considering this method of finance. (1)

The approach, called the Regulated Asset Base (RAB) model, has been described as an "open cheque book" for developers, as consumers could be locked into paying the costs of a project going wrong – like construction taking longer than planned, or prices spiralling – indefinitely until it's complete.

Shadow energy minister Alan Whitehead MP said: "*The problem with this model as applied to new nuclear power stations is that it transfers all the risk of construction from the developer to the customers, with the rather wobbly promise of benefits to come in the future*." Like other public-private finance models, the RAB model has a sticky history. The government has already supported the use of RAB for the Thames Tideway Tunnel, a £4.2bn project to revamp 15 miles of sewer lines in North London, which Thames Water says a RAB model has helped lower costs. As well as taking a RAB approach to financing the Thames Tideway, the government offered a "*contingent financial support*" package which guarantees public money when certain parts of the project go wrong. It's this transfer of liability first to the consumer, and then also the taxpayer, which helps lower risk and attract investors. A similar package may be offered to nuclear developers.

In 2017, the cross-party British Infrastructure Group of MPs, chaired by Conservative ex-minister Grant Shapps, raised concerns that bill payers had been asked to write a "*blank cheque*" for the project. The National Audit Office (NAO) has also been critical of the Thames Tideway contract, as it still isn't clear how much consumers will have to pay. The idea of a RAB approach has already proven popular with the nuclear industry. EDF boss Humphrey Cadoux-Hudson recently told the Financial Times that he is in talks with dozens of private investors over financing Sizewell C, the French giant's post-Hinkley nuclear project in Suffolk – and that the RAB model could be pivotal.

Much of the work around taking a RAB approach to financing nuclear power has been carried out by Dieter Helm, professor of Energy Policy at the University of Oxford and a figure respected by government. Writing in a blog about the model's application to nuclear last month, Helm highlighted a number of open issues – such as which regulator would set the RAB for nuclear projects, as well as the "*very severe lobbying pressures*" any regulator would come under when making its RAB evaluations. Helm concludes that the RAB may be an efficient approach to financing nuclear power, but still doesn't address fundamental issues about its cost competitiveness with other technology like wind and solar, or what do with all its radioactive

waste. "*It is for society to decide whether it wants new nuclear or not*," he said. "*The market cannot decide*." (2)

Finally the Government has, after I feared so long it would, chosen the doomsday option to fund new nuclear power stations – one that will be disastrous for the consumers and taxpayers, says Dave Toke, reader in Energy Policy at Aberdeen University. After years of swearing that they would not offer subsidies to nuclear power, and saying that in the future the terrible drain of (historical) over-spending on nuclear power would stop, the Government has gone back to square zero. Essentially, under the Government's proposals nuclear developers will have no real limit on what they can spend to build the power stations. It is a recipe for national disaster. No private developer is willing to take the construction risks of funding nuclear power in the UK, whatever 'strike price' is offered for the electricity that might be generated in future.

For Hinkley Point C the French state will pay for the inevitable cost overruns that come along with building the plant, combined quite probably, with an out-of-contract bailout by the British Government when the going gets tough. But now the Government is casting around for another nuclear power plant to be built, – Wylfa or Sizewell C – but neither developer (Hitachi or EDF) wants to take the risk of paying the almost inevitable losses on the project. So enter the Government's new proposals which will no doubt be promoted as a simple accountancy trick to lower costs. But it hides the fact that taxpayers will take the losses. Under the RAB arrangements electricity consumers will start paying extra on their bills from when construction starts, which could be anything from 7-10+ years ahead of any energy being generated. (3)

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1. Infrastructure Journal 29th Aug 2018 https://ijglobal.com/articles/134967/tideways-corben-becomes-uk-nuclear-financing-adviser
2. Unearthed 6th August 2018 https://unearthed.greenpeace.org/2018/08/06/new-nuclear-plants-funding-regulated-asset-base/
3. Dave Toke's Blog 7th Aug 2018 http://realfeed-intariffs.blogspot.com/2018/08/new-nuclear-plan-means-that-consumers.html

2. Bechtel & Wylfa

Reports in the Japanese press that Bechtel is to withdraw from its key role in building Wylfa Newydd due to concerns over the project's profitability, and the drastic rise in construction costs, (1) were swiftly denied. (2)

Nevertheless all mention of the joint venture Hitachi set up earlier in the year with Bechtel and JGC Corporation called Menter Newydd, (New Venture in Welsh) –to help deliver the Wylfa Newydd project – seems to have disappeared. The detailed allocation of work between Horizon and Menter Newydd remained to be worked out, but the new joint venture was expected to lead a significant proportion of on-site construction activities. At that time it seemed that Horizon would be the owners of the nuclear plant and Menter Newydd would be the builders.

The Wales Online website from 22nd May 2016 which announced the establishment of Menter Newydd said "*Menter Newydd is a joint venture of Hitachi Nuclear Energy Europe, US giant Bechtel Management Company and Japanese firm JGC Corporation (UK) and will be responsible for the construction of Wylfa Newydd, overseen by Horizon Nuclear Power*." (3)

Bechtel now describes itself as a "project management contractor (PMC) to help deliver a new, two-reactor nuclear plant in Wales for Horizon Nuclear Power": (4) Clearly a downgrading of its role.

And what of the JCG Corporation? Virtually no mention of Wylfa on their website. But a notice of changes of Directors dated 8th February 2018 has Tsuyoshi Iwasaki who was Associate Executive Director Project Director for Wylfa Newydd retiring and becoming simply an "advisor" to nothing specific. (5)

According to Asahi Shimbun on 17th August Bechtel has decided to withdraw from its key role in construction and only offer a consulting service. The article goes on to say that Horizon Nuclear Power, now a subsidiary of Hitachi, will be in charge of the construction while receiving advice from Bechtel and Japanese electric power companies. One Hitachi executive played down the significance of Bechtel's withdrawal from its role in construction. "*It only means that roles of companies will change. The impact to the project is not big*," the executive said

But the newspaper says "…*if Horizon replaces Bechtel, it faces the risk that the construction costs will become higher than anticipated. Hitachi is aiming to lower its stake in Horizon from the current 100 percent to less than 50 percent as a condition for the start of construction of the nuclear plant, and so it is asking other companies to invest in Horizon. But if other companies are concerned over Horizon's risk, they will hesitate to invest in it. As a result, Hitachi will face bigger difficulties in raising funds for construction and proceeding with the project.*"

The Daily Post, on the other hand says: "Reports that a US construction giant has withdrawn from building Wylfa Newydd are "*categorically untrue*" But Asahi Shimbun didn't say they had withdrawn completely – only that they had downgraded their role from lead constructor to more of a consultancy role.

Horizon made a big deal out of its announcement that it had appointed Bechtel as Project Management Contractor (PMC) claiming that it would mean cheaper nuclear electricity. It also

said it had signed further contracts with Hitachi Nuclear Energy Europe and JGC New Energy UK Limited (JGC) to continue to provide support during the project's development stage. Bechtel, who will have nearly 200 employees embedded within Horizon, will oversee the project management of the power station, together with Horizon.

Duncan Hawthorne, CEO of Horizon Nuclear Power, said: "*These world-leading companies bring a wealth of nuclear, engineering and construction expertise to complement our growing organisation and will help us replicate the cost and schedule successes of the previous four ABWR reactors. The UK still needs reliable nuclear power to help transform our energy mix, and we are gearing up to deliver that. "Our first power station will be cheaper than what has gone before and after that, with smart financing, supply chain learnings and no need for first time overheads, future project costs will fall further still*." (7)

People Against Wylfa B (PAWB) commented that Bechtel has obviously come to the conclusion that it would not make financial sense for them to take part in such a huge and extortionately expensive project. There is an apparent difference of opinion between Hitachi and Bechtel about the cost of construction with Bechtel's estimates being higher. If a company as large as Bechtel is getting cold feet, it will be difficult for Hitachi to engage another company to take their place. One idea mentioned was that Horizon could replace Bechtel to manage the construction. The risk linked to that would be huge since Horizon is only a local subsidiary company to Hitachi without any experience of building anything let alone two monster nuclear reactors. Hitachi also has no experience of building nuclear reactors. Their track record is offering their boiling water reactors for other companies to build. If, as reported Bechtel will stay as a consultant to the project that is very different to being an active building partner.

The Westminster Government and the Welsh Labour Government should wake up to what is very obvious to other countries worldwide that nuclear power is a technology that belongs to the middle of the twentieth century. It is dirty, dangerous and a threat to environmental and human health. There is an international trend now that sees the price of renewable energy technologies coming down. Using these various technologies and a comprehensive energy conservation programme in our homes, public buildings and workplaces is the sensible and progressive way ahead. This would create work immediately – unlike Wylfa B – without the enormous risks, both financial and healthwise. (8)

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1. Asahi Shimbun 17th Aug 2018 http://www.asahi.com/ajw/articles/AJ201808170035.html
2. Daily Post 18th August 2018 https://www.dailypost.co.uk/business/business-news/wylfa-newydd-developer-denies-reports-15045040
3. Wales Online 22nd May 2016 https://www.walesonline.co.uk/business/business-news/14bn-north-wales-nuclear-power-11368974
4. https://www.bechtel.com/projects/horizon-wylfa-newydd/
5. http://www.jgc.com/en/ViewPdf/view/1824
6. Asahi Shimbun 17th August 2018 http://www.asahi.com/ajw/articles/AJ201808170035.html
7. Daily Post 22nd Aug 2018 https://www.dailypost.co.uk/business/business-news/wylfa-newydd-bosses-promise-cheaper-15057931 and Nikkei Asian Review 23rd Aug 2018

https://asia.nikkei.com/Business/Companies/Hitachi-names-Bechtel-as-manager-for-UK-nuclear-project

8. PAWB 20th Aug 2018 https://stop-wylfa.org/wp/

3. Wylfa: Horizon applies for a Development Consent Order

An application for Development Consent was received by the Infrastructure Planning Inspectorate on 1st June. Horizon was supposed to have submitted its application by the end of March, but this was delayed. On 28th June, the Inspectorate announced that it had accepted the application for examination, and on 6th July it invited interested parties to register. Registration closed on 13th August.

Relevant representations appear on the Inspectorate's website and include submissions from the Welsh Anti-Nuclear Alliance, Nuclear Free Local Authorities, Together Against Sizewell C, Dr David Lowry, and Dr Carl Clowes. (1)

The NFLA has published its full submission here: http://www.nuclearpolicy.info/news/nfla-views-wylfa-b-nuclear-planning-application-inspectorate-outlining-litany-concerns/

This says it is highly regrettable that the consideration of Horizon Nuclear Power's application for a Development Control Order for the Wylfa Newydd Nuclear Power Station is reliant on Government National Policy Statements which are totally out of date. Nuclear power stations are clearly not economically competitive, cannot be built when required by 2025 and energy efficiency measures and cheaper low carbon energy alternatives mean there is no longer a need for them.

In what will form its full written response to the Planning Inspectorate, NFLA argue:

- The proposal put forward by Horizon Nuclear Power for this particular site on the Island of Anglesey is totally inappropriate and should not be approved.
- Building such a large infrastructure project in a remote rural area like Anglesey is likely to increase local unemployment in the longer term, and have a disruptive impact on the local economy. Going ahead with Wylfa Newydd is likely to detract attention from the far greater job-creating potential of other industries, such as a domestic energy efficiency programme, and the offshore renewable industry, and may actually dissuade companies from setting up in Anglesey, as well as damaging existing industry, such as tourism and agriculture, which rely on the areas reputation for a clean environment to attract business.
- It is also likely to be particularly disruptive to the future of the Welsh Language on the island.
- Wylfa B would produce nuclear waste which would contain almost 70% of the radioactivity as the existing waste burden, and which will most likely need to be stored on the Anglesey site for at least the next 120 years.
- If there were an accident at Wylfa B which required the evacuation of an area similar to the area evacuated around Fukushima, experience suggests this would cause complete chaos because of the limited capacity of routes to the mainland.

- Given that alternatives to Wylfa B do exist which are cheaper and can be implemented more quickly, it is particular perverse to accept the rather devastating impact the proposals will have on designated conservation sites.

- The impact of sea level rise on the proposed site needs to be thoroughly examined in the light of the latest scientific projections on the impact of climate change.

As we go to press an extraordinary meeting of Anglesey County Council's planning committee is about to consider Horizon's application for permission to clear 299ha of land to prepare for construction of the proposed Wylfa Newydd nuclear power plant. This vast swathe of land the size of more than 500 football pitches would be cleared over the next 15 months. It will involve clearing field boundaries, demolishing buildings and relocating protected species. It is likely to take up to 18 months for Horizon to get the Development Consent Order (DCO) required to start building Wylfa B, so it wants to get on with clearing the site now.

Anglesey council's committee has been advised to approve the proposals, but there is opposition from local groups who feel no work should happen until and if the DCO is approved by the Planning Inspectorate. The developers have said they'll put the site back to how it is now should the DCO not be granted.

The North Anglesey Partnership, consisting of Amlwch, Llaneilian, Llanbadrig, Rhosybol, Mechell and Cylch y Garn community councils, has raised concerns over the timing and lack of information made available by Horizon, stating that with "so many unanswered questions," no site clearance should take place until full approval is in place. Llanbadrig community council's own submission, while backing the nuclear plant in principle, went on to say: "There is still much doubt about whether this project will proceed, particularly in the prevailing environment of uncertainty exacerbated by the era of Trump and Brexit. "Horizon seem to recognize this uncertainty in their reluctance to proceed with the bypasses ahead of DCO approval. Site clearance should only proceed in parallel with the construction of bypasses when there is certainty that both are necessary. (2)

The move comes at a time of potential political sea change in some attitudes towards nuclear power in Wales. Leanne Wood, the current leader of Plaid Cymru has said she will fully review its energy policies if she is re-elected in the leadership election due to take place in September. There has been support for the project because of the jobs it would bring, but Wood has reportedly said that she doesn't want the dependence on Westminster funding that the project would bring. (3)

The Nation Cymru website says the Plaid leadership contest is an opportunity to banish the nuclear elephant in the room once and for all. Nuclear power has to be and needs to be a central part of the debate during the leadership election. If not now, when? This issue cannot be allowed to undermine the party, its current or future leaders any longer; it has become Plaid's ball and chain. How can we welcome voters old and new to believe manifesto promises or have faith in any single AM, MP or Councillor when the party is simultaneously against and pro one of the biggest issues of our time? Nuclear power is a great distraction from Plaid Cymru's progressive politics and progressive energy policies, a black hole sucking time and resources Wales doesn't have, denying communities and the country a real chance of a sustainable and

secure future. How can any party simultaneously be pro-independence and seriously entertain or endorse any new nuclear build. (4)

Leanne Wood is being challenged by the island's AM Rhun ap Iorwerth and Carmarthen East and Dinefwr AM Adam Price. Adam Price has said the new power station is incompatible with Welsh independence. Their opponent, Ynys Mon AM Rhun ap Iorwerth, has backed Wylfa Newydd. (5)

1. See https://infrastructure.planninginspectorate.gov.uk/projects/wales/wylfa-newydd-nuclear-power-station/?ipcsection=relreps
2. Daily Post 30th Aug 2018 https://www.dailypost.co.uk/news/north-wales-news/wylfa-nuclear-planning-site-cemaes-15090448
3. New Civil Engineer 31st Aug 2018 https://www.newcivilengineer.com/tech-excellence/wylfa-nuclear-bid-set-to-pass-key-planning-milestone/10034713.article
4. Nation Cymru 13th August 2018 https://nation.cymru/opinion/wylfa-newydd-b-plaid-cymru/
5. BBC 28th Aug 2018 https://www.bbc.co.uk/news/uk-wales-politics-45329200

4. NuGen searches for a buyer for Moorside

Kepco, the Korean state-owned nuclear company, which was looking at rescuing the troubled Nugen project at Moorside has strong reservations about the proposed funding model - the Regulated Asset Base (RAB) model. The company is no longer the leading bidder, and according to the Korean press prefers the Contract for Difference (CfD) deal given to EDF for Hinkley C. (1)

Sources in Korea blame the shift in Government policy on support for new nuclear for delaying the deal between Kepco and Toshiba. The Korea Herald, a daily English language newspaper based in Seoul, quoted a Korean government official who claims that the deal for NuGen is being renegotiated because the UK government's decision to "change profit models for the project". (2)

Toshiba has opened the door to alternative buyers for NuGen, raising doubts over the future of Moorside. Talks with Kepco, however, are still continuing, despite Kepco being stripped of its preferred bidder status. (3)

Cumbrian MPs have been demanding Government help to make sure nuclear new build happens. Trudy Harrison, Tory MP for Copeland said: "*The Government must take a proactive stance. Nuclear new build is not commercially viable without Government support. It is now time for Government to get a grip on our energy policy. In Cumbria we have the skills and experience*." Mrs Harrison is setting up a Moorside strategic partnership, with representatives from Sellafield, Cumbria LEP and councils.

Sue Hayman, Labour MP for Workington, has written to the Government to ask them to act immediately over NuGen. She is co-chair of the All Party Parliamentary Group on Nuclear Energy. "*NuGen is now in the last chance saloon. The Government must act now or it will be too late, and West Cumbria will not get the 20,000 jobs, economic investment and infrastructure improvements that depend on Moorside*."

Barrow's MP, John Woodcock, now sitting as an Independent says: "*We cannot wait much longer for the government to step in and rescue the stalled £15billion Moorside project*". (4)

NuGen announced it was restructuring as part of a review because of the "prolonged time" it had taken to seal the deal with the Korean utility. Around 100 staff and contractor jobs, including that of chief executive Tom Samson, are at risk under the restructuring plans. (5)

Toshiba has set a deadline to secure a deal by the end of September, according to the *Financial Times*. The Company is believed to have spent hundreds of millions of pounds on developing the site so far. It was forced to pay close to $139m to buy a 40% stake held by France's Engie last year. The Korean government is understood to remain keen to progress with the investment because it would give it a foothold in one of the few western nations backing the construction of new reactors. But it has said the investment must pass a "*national audit*" test before it can proceed. Kepco wants to deploy two of its APR-1400 reactors at Moorside to generate a combined electricity of about 3GW – close to 7% of Britain's electricity needs. Kepco said it was "too early" to say whether it would be able to meet the criteria for the audit. (6)

Meanwhile, NuGen has provided information to support the Moorside site in Cumbria being carried forward into the UK government's new national policy statement as a site for a new nuclear power plant. NuGen CEO Tom Samson said, "NuGen remains committed to delivering a nuclear power station at Moorside in Cumbria." (7)

Toshiba will once again be on the lookout for any sign of a new investor heading for West Cumbrian shores. Already discouraged by the loss of investment partners Southern & Scottish Energy (SSE), Spain's Iberdrola and France's Engie (formerly GDF Suez), all of whom deserted the Moorside ship to pursue greener pastures, dejected team members had been pinning their hopes on South Korea sailing to the rescue. The writing was on the wall, says CORE. Since day one when the original NuGen consortium bought 190 hectares of green field adjacent to Sellafield from the Nuclear Decommissioning Authority (NDA) for £70M in 2009 – despite the land being known to be less than optimum for new-build because of its geology, poor local infrastructure and its remoteness from where its electricity was needed. It was similarly clear that NuGen's subsequently projected construction and operation timetable for Moorside – building and bringing into operation three Westinghouse AP1000 reactors in just 6 years – was laughably out of kilter with reality.

CORE says: "*Once leading the race to get the first new UK reactors up and running, Moorside now languishes way down the list of potential new-build developments in the UK. Time to recall the lookouts and pull the plug on what many investors will now see as 'soiled goods' with acute funding problems and a project that can never compete in terms of cost or environmental benefit with the flourishing renewables sector*". (8)

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1. Unearthed 6th August 2018 https://unearthed.greenpeace.org/2018/08/06/new-nuclear-plants-funding-regulated-asset-base/
2. Korea Times 4th Aug 2018 http://m.koreatimes.co.kr/pages/article.asp?newsIdx=253300 In Cumbria 4th Aug 2018 http://www.in-cumbria.com/Government-policy-shift-on-nuclear-new-build-blamed-for-NuGen-deal-delay-71a8a563-6ccd-4a74-8e76-887f9960f012-ds
3. Reuters 31st July 2018 https://uk.reuters.com/article/uk-britain-nuclear/south-koreas-kepco-loses-preferred-bidder-status-for-uk-nuclear-project-idUKKBN1KL1YK
4. NW Evening Mail 8th August 2018 http://www.nwemail.co.uk/news/barrow/16422050.barrow-mp-we-cannot-wait-much-longer-for-the-government-to-step-in-and-rescue-the-stalled-15billion-moorside-project/
5. Whitehaven News 1st Aug 2018 http://www.whitehavennews.co.uk/news/business/Moorside-plans-at-risk-after-Kepco-stripped-of-preferred-bidder-status-fa195c3b-b57b-4b9a-be63-ba279ae2565a-ds
6. FT 28th Aug 2018 https://www.ft.com/content/50389e18-a6df-11e8-926a-7342fe5e173f
7. World Nuclear News 17th Aug 2018 http://www.world-nuclear-news.org/Articles/NuGen-confirms-Moorside-as-potential-UK-plant-site
8. CORE 31st July 2018 http://corecumbria.co.uk/news/nugens-moorside-all-at-sea/

5. Bradwell B (or not)

Bradwell B nuclear project is entering a new phase according to China General Nuclear Power Corporation (CGN) and EDF. The developers have begun analysing the findings from early investigative work carried out on the site on the Dengie peninsula. China General Nuclear Power Corporation (CGN) and EDF are at the pre-planning stage of their plans to build a UKHPR1000 nuclear reactor plant, with the design for this currently undergoing a Generic Design Assessment (GDA) by the Office for Nuclear Regulation and the Environment Agency.

The East Anglian Daily Times reports that up to 30 people were on site during more than 40,000 hours of investigative work, with specialist firms such as Structural Soils Ltd working alongside local firms such as Scott Parsons Landscaping Services at Burnham-on-Crouch taking part. The landscaping firm's project team has used drilling rigs to complete 20 boreholes. These will be used to analyse the make-up of the land using geophysical testing which should be completed later this year.

Since the start of the year, more than 3000 metres of exploratory holes in the ground have been completed and soil samples taken from each. These will now be taken to various laboratories for testing and examination as part of EDF's engineering analysis. Now the firm is sending out a newsletter update to local residents explaining the progress of the project. (1)

The Blackwater Against New Nuclear Group (BANNG) responded to the newsletter saying it was a partial and misleading piece of smooth 'nuke speak' that gives all the upsides and none of the downsides of a new nuclear power station at Bradwell. Nowhere in the newsletter is there the slightest hint that Bradwell B might not go ahead. In fact, early stage or not, so sure is CGN/EDF of success that an indicative project timeline is provided, showing that construction 'begins' in 5 – 7 years from now.

The newsletter tells us that comments can be made on the Generic Design Assessment (GDA) process. But one might well ask if there is any point in commenting on this given the obvious confidence of CGN/EDF that the Hualong 1000 reactor, not yet in use anywhere in the world, will pass the regulators' tests. Yet all the digging of boreholes and marine surveys cannot disguise the fact that the site is in Flood Zone 3 and, therefore, totally unsuitable for potentially dangerous new nuclear reactors. Words such as 'flooding', storm surges', 'other coastal processes', 'all predicted to get worse with climate change'.

There is no mention in the newsletter of the immense upheaval, currently taking place around Hinkley Point C in Somerset, that will take place on the estuary if Bradwell B goes ahead, making it a major industrial site and changing it forever; of the jetty on the Blackwater that will likely be needed to bring in large pieces of equipment to the construction site; of the routine radioactive emissions that will take place; of the on-site, long-term highly radioactive waste stores. (2)

BANNG has sent comments to the GDA process. Although the process is meant to be generic, not site-specific, BANNG is calling for the continuing viability of coastal sites under the threat of climate change to be taken into consideration. BANNG considers that the continuing integrity of sites is an issue that must be identified and taken into account in the GDA. Sites that are liable to inundation within the next 200 years should be ruled out. Forecasts of coastal change reveal

that the parts of the Dengie peninsula on which Bradwell B is proposed will be permanently below sea level within the next century. Assuming Bradwell B starts generating in 2030 with an operational lifetime of 60 years followed by, perhaps, fifty years storage on site before a GDF is available it will be at least the middle of the next century before the site is fully decommissioned and cleaned up. Estimates of time-scale are, of course, uncertain but these are broadly in line with current government forecasts. And this is a highly optimistic picture. Decommissioning is likely to be a protracted exercise, a GDF may not be available for new build spent fuel and site deterioration may set in well before the site is cleared. It is highly probable there will be nuclear activity on floodable sites for up to two centuries. Indeed, this may be a conservative estimate.

The GDA is predicated on the eventual development of a disposal facility. Although the government has stated that 'it is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced from new nuclear power stations' this amounts to no more than a claim. (3)

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2. BANNG 22nd Aug 2018 https://www.banng.info/wp/wp-content/uploads/2018/08/PR_Fake_News_22-08-18.pdf
3. BANNG 1st Sept 2018 https://www.banng.info/consultation-responses/response-to-uk-hpr1000-gda-stage-two/

6. Panglossian SMRs

The government should subsidise the deployment of small modular nuclear reactors in order to speed the transition to a low carbon energy system, according to an independent review into the technology commissioned by Ministers. The Expert Finance Working Group on Small Reactors (EFWG) said in a report that government should offer subsidies for small nuclear reactors to help de-risk the technology and kickstart cost reductions. (1)

Small modular reactors (SMRs) generally have a capacity less than 600MW, with the costs ranging from £100 million to £2.3 billion, which the experts suggest could be delivered by 2030. The EFWG has recommended the government to help de-risk the small nuclear market to enable the private sector to develop and finance projects – it believes SMRs could be commercially viable propositions both in the UK and for an export market.

The report says the "*Government should establish an advanced manufacturing supply chain initiative, as it did with offshore wind, to bring forward existing and new manufacturing capability in the UK and to challenge the market on the requirement for nuclear specific items, particularly Balance of Plant (BOP), thereby reducing the costs of nuclear and the perceived risks associated with it*."

Nuclear Energy Minister Richard Harrington said: "*Today's independent expert report recognises the opportunity presented by small nuclear reactors and shows the potential for how investors, industry and government can work together to make small nuclear reactors a reality. Advanced nuclear technologies provide a major opportunity to drive clean growth and could create high-skilled, well-paid jobs around the country as part of our modern Industrial Strategy*." (2)

"*Panglossian puffery*", says David Lowry. The report ignores the security and nuclear waste problems of small modular reactors. The report says "the United Nations Sustainable Development Goals 2030 agenda sets out 17 goals and how they will be implemented to meet the United Nation's objectives around people, the planet, prosperity, peace and partnership.The report boldly asserts "*Small reactors could play an important role in achieving these goals*" without spelling out how. "*I cannot relate this SDG to SMRs, however hard I try*", says Lowry.

The Nuclear Free Local Authorities (NFLA) says this is yet another attempt to promote the benefits of SMRs despite large and quite possibly insurmountable hurdles to cross. The Government suggests the report was produced by an 'independent' group, yet at least half of the group have strong links to the nuclear industry, including the Nuclear Industry Association. The UK appear to be one of the few governments pursuing a strategy of promoting SMRs. Even France and Finland, the only other countries in Europe currently developing large nuclear projects, have no plans to develop such technology. Indeed France has just commissioned a whole raft of new smaller-scale solar energy projects.

The report notes that despite the UK Government's key and important shift to low carbon power "*the financial sector has been slow to follow the Government's lead; the finance sector still seems to limit green finance to renewable power. This is an unhelpful and often unrealistic narrowing of opportunity by the finance market.*"

NFLA would rather suggest that the finance sector is accurate in being sceptical of new nuclear developments given the rapidly decreasing costs of renewable energy. (4)

The expert finance working group said that for technologies capable of being commercially deployed by 2030, the government should focus on bringing so-called first-of-a-kind projects to market through a number of different mechanisms to lower their cost of capital. The recommendation could be seen as a potential blow to the ambitions of Rolls-Royce, the aero-engine group, which has promoted its own project as a "national endeavour" to develop nuclear skills that can be used to create an export-led industry. The company did not receive any funding for its technology as part of the government's recent £56m initiative even though it is closer to being commercialised. Rolls-Royce warned last month that it was preparing to shut down the project if the government did not make a long-term commitment to its technology. (5)

1. Business Green 9th Aug 2018 https://www.businessgreen.com/bg/news/3037305/government-review-backs-subsidies-for-mini-nuclear-reactors
2. Energy Live News 8th Aug 2018 https://www.energylivenews.com/2018/08/08/uk-experts-back-subsidies-for-mini-nuclear-power-plants/
3. David Lowry's Blog 7th Aug 2018 http://drdavidlowry.blogspot.com/2018/08/panglossian-puffery-for-mini-reactors.html
4. NFLA 8th Aug 2018 http://www.nuclearpolicy.info/news/small-modular-nuclear-reactors-financing-report-nfla-remain-sceptical-such-technology-as-cost-effective-as-renewables/
5. FT 7th Aug 2018 https://www.ft.com/content/8882090a-999a-11e8-ab77-f854c65a4465

7. Hinkley Point C and Sea-Level Rise

The Stop Hinkley Campaign wrote to the Office for Nuclear Regulation at the end of July to express increasing concern about the number of reports from climate researchers who believe sea levels could rise by as much as 6 metres as a result of substantial melting of the Greenland and Antarctic ice sheets caused by climate change.

Some researchers say sea levels could rise by six metres or more even if the 2 degree target of the Paris accord is met. Sustained warming of one to two degrees in the past has been accompanied by substantial reductions of the Greenland and Antarctic ice sheets and sea level rises of at least six metres – several metres higher than what current climate models predict could occur by 2100. (1)

In the light of these recent higher estimates of sea level rise the group wanted to know whether ONR has revisited and perhaps revised its view on the future safety of the Hinkley Point C site. Stop Hinkley was particularly interested to know whether ONR is confident that the site will be suitable for the interim storage of spent fuel until at least the year 2140.

ONR responded by saying that "*the primary protection against coastal flooding for HPC is the height of the site platform (14m above sea level). The site characterisation has demonstrated that the platform is not vulnerable to a design basis coastal flood, including reasonably foreseeable climate change. The HPC site licensee (NNB GenCo) will monitor this hazard via Periodic Safety Reviews (including the interim spent fuel store) and if the assumptions in the safety case regarding climate change are shown to no longer be valid; they will be reconsidered. If necessary, further pre-planned flood protection measures will be put in place through a managed approach*."

The 14m above sea-level makes it sound like quite a large margin. But the Hinkley Point C Stress Test report shows an extreme flooding level of 9.52m (with no waves). Taking into consideration "wave effects" of 2m this gives a margin of 2.48m. (2)

Latest study suggests that rapid melting in Antarctica could begin within the next century, before HPC is decommissioned and before spent fuel is removed. (3) The Antarctic ice sheet contains enough ice to raise sea level by approximately 57 metres (187 feet), about half the length of a soccer pitch. (4) While it is unlikely that enough ice would melt to raise sea-levels by 57 metres, Antarctica is so massive that just a small fraction of this ice melting would be enough to cause huge problems for people and infrastructure on the coast.

ONR says it *"maintains a constant review of scientific thinking on climate change, and is guided by relevant good practice. This includes UK and international guidance, UK Climate Projections 09 (UKCP09) and the Intergovernmental Panel on Climate Change (IPCC). To support efficient and effective regulation, ONR has established an independent expert panel on meteorological hazards to provide advice. ONR's expert panel is a collection of competent consultants with expertise in this technical area. This panel has provided advice on the HPC external flooding safety case and will continue to provide advice on the potential impacts of climate change."*

"ONR is content that a suitable managed adaptive approach can be adopted, in the event that sea level rise is more than predicted."

Perhaps the next question to ONR is how long will it take to move 60 years' worth of spent fuel if the thinking on flood risk and the likelihood of a tsunami were suddenly to become out-dated?

1. Guardian 6th July 2018 https://www.theguardian.com/environment/2018/jul/06/global-temperaturerises-could-be-double-those-predicted-by-climate-modelling
2. See Stop Hinkley Briefing Hinkley Point C and Sea-level rise http://www.stophinkley.org/Health/Hinkley%20Point%20C%20&%20Sea-Level%20Rise.pdf
3. Climate News Network 21st May 2016 https://climatenewsnetwork.net/antarctic-glacier-melt-raise-sealevel-3m/
4. Climate News Network 21st June 2018 https://climatenewsnetwork.net/antarctic-buffer-damage-spursice-break-up/

8. Why the UK nuclear renaissance plan is doomed to failure.

Jeremy Leggett, former Chair of SolarCentury, has used 30 pictures and charts to show why the UK nuclear renaissance plan is doomed to failure. It's a great way to get a point across. But sometimes it's useful to have it written down too.

- Nuclear power has become uneconomic and grown increasingly so with every announcement of cost increases and delays; and every announcement of reductions in the cost of renewables.

- "Britain should cancel its nuclear white elephant and spend the billions on making renewables work." Economist 6th Aug 2016 http://www.economist.com/news/leaders/21703367-britain-should-cancel-its-nuclear-white-elephant-and-spend-billions-making-renewables

- Nuclear power can't compete with solar power says former IEA boss Nobuaki Tanaka. Nuclear is "ridiculously expensive" and "utterly uncompetitive" says the long standing nuclear advocate. It costs $9bn to build one reactor. Asahi Shimbun 24th July 2018 http://www.asahi.com/ajw/articles/AJ201807240045.html

- Key players know the game is up. Industrial giants once supportive of nuclear need no further persuasion that they must change to reflect the new economic of energy.

- For the first time, global solar capacity grew faster in 2017 than all fossil fuels and nuclear combined. The record 98GW of new solar built in 2017 increased the world's cumulative capacity by a third to 399GW. Carbon Brief 5th April 2018 https://www.carbonbrief.org/global-solar-capacity-grew-faster-than-fossil-fuels-2017-report Global Trends in Renewable Energy Investment 2018, http://fs-unep-centre.org/publications/global-trends-renewable-energy-investment-report-2018

- One example of officialdom underestimating exponential technologies: UK's Ofgem on solar PV. Ofgem's scenarios were hopelessly wide of the mark. Exeter University, 6th May 2016 http://projects.exeter.ac.uk/igov/new-thinking-solar-surprise-revisited/

- "Utilities dispel all doubts about renewables being able to power planet". Jerome Pecressse, GE Renewables: "We are inventing things that we did not even imagine three years ago …renewable baseload is coming fast." Recharge News 6th June 2018 http://www.rechargenews.com/transition/1505979/utilities-dispel-all-doubts-about-renewables-ability-to-power-planet

- The UK's first ever National Infrastructure Assessment says at least half of all UK power should be renewable by 2030, and can be at no extra cost. It urges the Government to grab the golden opportunity to ditch nuclear and go with cheaper solar and wind. Solar Power Portal 10th July 2018

https://www.solarpowerportal.co.uk/news/grab_the_golden_opportunity_to_go_green_uk_urged_to_ditch_nuclear_in_favour

- Tepco, long a mainstay of the Japanese nuclear industry pivots towards renewables. "We must gain competitive advantage in renewable energy" says President Tomoaki Kobayakawa. Nikkei Asian Review 24th July 2018 https://asia.nikkei.com/Business/Companies/Tepco-seeks-overseas-partners-in-renewable-energy-pivot

- EDF is in deep financial trouble: The utility upon which the UK Government's plans for a nuclear renaissance depend faces an existential threat with no obvious escape route.

- On 4th December 2007, EDF began construction of an EPR at Flamanville, It was due to cost €3.3bn and start in 2012. Start-up is now scheduled to occur no earlier than Q2 2020 and EDF now estimates project costs at €10.9 billion. The plant is intended to be the forerunner of two reactors to be built at Hinkley Point C in Somerset. https://en.wikipedia.org/wiki/Flamanville_Nuclear_Power_Plant

- High levels of carbon were found in the steel used for the in the reactor pressure giving it "lower than expected mechanical toughness values" Telegraph 17th April 2015 https://www.telegraph.co.uk/news/worldnews/europe/france/11546271/New-UK-nuclear-plants-under-threat-as-serious-anomaly-with-model-found-in-France.html

- So what do you do if you're the Chief Financial Officer of a Company with a balance sheet like this: €18.5bn market cap; €37bn net debt; €22bn for Hinkley C; €55bn to keep French reactors safe; FT 7th March 2016 http://www.ft.com/cms/s/0/ef9d4de8-e3e9-11e5-ac45-5c039e797d1c.html

- You resign over the company's failure to cancel Hinkley Point C. French unions also vote against the plant.

- On the 15th September 2016, the UK Prime Minister finally gave Hinkley Point C the green light after 6 weeks of indecision and veiled threats from Beijing. HPC is now a joint venture of EDF and China General Nuclear who are investing £6bn in the currently £18bn project. Guardian 15th September 2016 http://www.theguardian.com/uk-news/2016/sep/15/hinkley-point-c-nuclear-power-station-gets-go-ahead

- On 10th April 2018 EDF warned of yet more delays at Flamanville – 150 quality deviations found in welding of pipes used to carry steam to turbines. Guardian 10th April 2018 http://www.theguardian.com/business/2018/apr/10/edf-warns-of-faults-at-nuclear-power-station-it-is-building-in-france

- The French nuclear regulator fears epidemic safety culture collapse at Flamanville – didaster looms for EDF. Weld failures mean the nuclear plant is delayed until 2020. Liberation 31st May 2018 http://www.liberation.fr/france/2018/05/31/l-epr-de-flamanville-risque-de-voir-son-demarrage-reporte-a-2020_1655448

- On 25th July 2018 there was yet more bad news for EDF. 33 welds need repairing. Nuclear fuel now to be loaded Q4 2019. EDF says costs up €0.4bn to €10.9bn FT 25th July 2018 https://www.ft.com/content/1b2473c8-8fdd-11e8-b639-7680cedcc421

- The Nuclear industry lives on a safety knife edge globally. And after Fukushima it cannot afford a single major accident.

- Tepco wants to risk a meltdown at Kashiwazaki to generate profits to pay for the meltdown at Fukushima. It is the biggest nuclear plant in the world with 7 reactors. It sits on two active earthquake fault. Guardian 28th December 2017 https://www.theguardian.com/world/2017/dec/28/fears-of-another-fukushima-as-tepco-plans-to-restart-worlds-biggest-nuclear-plant

- On 5th September 2016 it was reported that the BBC had found that Sellafield is riddled with safety flaws. A whistleblower said that his biggest fear for the site was for one of the nuclear waste silos to go up in flames – the consequences of which would be dire. He said: "If there is a fire there it could generate a plume of radiological waste that will go across western Europe." Guardian 5th Sept 216 http://www.theguardian.com/environment/2016/sep/05/sellafield-nuclear-plant-riddled-safety-flaws-according-bbc-panorama

- Sizewell B and 27 other nuclear plants at risk of catastrophic failure due to carbon anomalies. A report from Greenpeace France based on documents provided to the independent French Institut de Radioprotection et de Sûreté Nucléaire. Ecologist 29th September 2016 http://www.theecologist.org/News/news_analysis/2988175/sizewell_b_and_27_other_edf_nuclear_plants_at_risk_of_catastrophic_failure.html

- New cracks in the reactor core at Hunterston B raise questions about the reliability of the entire UK nuclear fleet. Another setback for EDF - £120m loss of revenue for the 6 months the reactor is closed for repairs. Guardian 6th May 2018 http://www.theguardian.com/environment/2018/may/06/cracks-nuclear-reactor-threaten-uk-energy-policy-hunsterston

- Opinion in the business world is turning against the nuclear industry. And as its desperation becomes ever clearer, the UK Government is in danger of overreaching. Nuclear Power in the UK is now effectively nationalised at great expense to taxpayers.

- In august 2016 a major reversal in opinion on nuclear power amongst business leaders was reported. There was a big majority for new nuclear in 2015. In 2016 only 9% strongly agree. 75% of IOD members support strong solar and wind policies. Guardian 19th August 2016 http://www.theguardian.com/business/2016/aug/19/business-chiefs-attack-uk-government-failure-to-secure-energy-supply

- In 2017 it was reported that the Kuwaiti Sovereign Wealth Fund would sell its shares in Areva. French media reported that KIA had complained that its investment in Areva in 2010 had been based on incorrect company accounts. Reuters 4th Aug 2017 https://www.reuters.com/article/areva-restructuring-kia-idUSL5N1KQ3A5

- In a remarkable U-turn the UK Government agrees to a £5bn public stake in welsh nuclear power station. The total cost of Wylfa to be shared with Hitachi and the Japanese Government is estimated at £16bn. The price of power is expected to be £75-77/MWh – more than solar and wind. Guardian 4th June 2018 http://www.theguardian.com/environment/2018/jun/04/uk-takes-5bn-stake-in-welsh-nuclear-power-station-in-policy-u-turn

- Meanwhile a UK Government poll finds that a record 85% of the public support renewable energy – 87% support solar; 66% would be happy to have a large renewable project locally; 74% are concerned about climate change; 35% support nuclear and 22% oppose it. Climate Action 26th April 2018 http://www.climateactionprogramme.org/news/85-of-the-uk-supports-renewable-energy-in-record-high-poll Energy and Climate Change Attitude Tracker, Jan 2018 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/678077/BEIS_Public_Attitudes_Tracker_-_Wave_24_Summary_Report.pdf

- Security risks are becoming intolerable. Despite Whitehall's belief that military nuclear needs civil support; the security risk posed in the modern era simply by the existence of a civil nuclear programme are growing fast.

- It seems that Whitehall's obsession with civil nuclear is in fact a military romance. So argue researchers at the Science Policy Research Unit. They find evidence of desperation to keep expertise for submarine reactors alive. Guardian 29th March 2018 http://www.theguardian.com/science/political-science/2018/mar/29/why-is-uk-government-so-infatuated-nuclear-power

- In January 2016 Russian Security Services were accused by Kiev of getting hackers to shut down the Ukrainian power grid. Malware used had previously infected power supplies in the US and Europe, without shutting down the grid. This is a beginning. Hacker News 5th Jan 2016 https://thehackernews.com/2016/01/Ukraine-power-system-hacked.html

- Cyberattacks have turned potential control of US power plants over to Russia according to the Department of Homeland Security. New York Times 15th March 2018 https://www.nytimes.com/2018/03/15/us/politics/russia-cyberattacks.html

- And then there is global warming. If governments do not shut down residual nuclear programmes it seems climate change impacts will at some point – in the case of the many reactors on coasts and rivers – do the job for them.

- Nuclear regulators around the world have used out-of-date scientific understanding of sea level rise. Ensia: "A number of scientific papers published in 2018 suggest that climate change will impact coastal nuclear plants earlier and harder than industry government or regulatory bodies have expected." Ensia 8th Aug 2018 https://ensia.com/features/coastal-nuclear/

- This summer's heatwave forced 3 Nordic reactors to be curbed and 1 to close. EDF may close 4 reactors. Seawater off Sweden and Finland was too warm for reactor cooling. Reuters 1st Aug 2018 https://www.reuters.com/article/us-nordics-nuclearpower-explainer/in-hot-water-how-summer-heat-has-hit-nordic-nuclear-plants-idUSKBN1KM4ZR Reuters 1st Aug 2018 https://www.reuters.com/article/us-france-nuclearpower-weather/frances-edf-may-halt-four-nuclear-reactors-due-to-heatwave-statement-idUSKBN1KM56C

- Renewables offset Fossil and Nuclear shortfalls in generation. Recharge News 16th Aug 2018 http://www.rechargenews.com/wind/1558064/renewables-compensate-for-fossil-nuclear-shortfalls-in-heat-wave

1. Jeremy Leggett 22nd Aug 2018 https://jeremyleggett.net/2018/08/22/why-the-uk-nuclear-renaissance-plan-is-doomed-to-failure-in-30-pictures-and-charts/

9. Flexibility: Shifting the Power Balance

Tom Greatrex of the Nuclear Industry Association (1) says we should ignore the National Infrastructure Commission's (NIC's) recommendation that we only order one more nuclear station on top of Hinkley Point C before 2025 (2), because cutting carbon without the help of nuclear is a "*risky business*". He says the Government understands the inherent value of a baseload low carbon source of generation.

The NIC says: "*It is now possible to conceive of a low-cost electricity system that is principally powered by renewable energy sources*." It says at least 50% and up to 65% of electricity in 2030 should come from renewables. (3)

Australia is having similar debates where the fossil fuel lobby argues that because "coal" is "baseload", it must therefore be "reliable", but wind and solar are intermittent, so they cannot be relied upon to keep the lights on. It's political rhetoric that belies the reality of the electricity system. Australia's grid has challenges, but they are not necessarily ones that can be solved just by having more "baseload". What is really needed – as the Australian Energy Market Operator, chief scientist Alan Finkel, and any number of other independent experts point out – is dispatchable and reliable generation, one that the grid operator can count on, at times of peak demand and heat stress. And the answer does not lie in traditional "baseload" generation – the more than 100 trips of big fossil fuel plants since December, often at times of soaring heat, underline that point.

The energy debate is usually dominated by simple political rhetoric – based around emissions or no emissions, cheap prices or expensive ones, baseload versus intermittency. That just skims over the surface. Behind the scenes, as the clean energy transition continues, debates are raging about good engineering practices and the design of markets. One of Australia's leading electrical engineers, Kate Summers says large diverse renewable resources are far more stable in output than singular sources. She uses a series of graphs to illustrate that at moments when stability can be won or lost it has been wind and solar that have held firm, and acted as what one might consider to be "baseload". And it has been coal and gas that has proved "intermittent" at the very minutes that stability is needed. (4)

It's the Flexibility Stupid

A new report from Chatham House says evidence is growing that highly flexible electricity systems could deliver lower whole-system costs, especially given the dramatic projected falls in solar and wind power costs by 2030. (5)

While the renewables rollout is a key part of global climate policy, the challenge is that the costs associated with managing the system start to escalate once renewables exceed a 30% share of generated electricity. Unless properly planned for, the growth in electric vehicle use and electric heating could further amplify these 'system integration costs'. They include the cost of holding fossil fuel power plants in reserve for periods of low renewable supply, grid upgrades and the dumping of power from renewables when system constraints are reached. Governments can ensure electricity is affordable by promoting 'flexibility'. Grid operators and power companies should pursue a diverse range of flexible, decentralized, modular technologies.

New technologies that enhance system flexibility, including smart electric vehicle (EV) charging, battery storage, digitalization with intelligent control and demand-side management, are unleashing a new phase of transformations in the power sector, for which existing companies are ill prepared. Companies providing these solutions may come to dominate the power sector in the coming decades. The accelerating deployment of this array of 'flexibility enablers' means the spectre of cost escalation – resulting from the expense of managing intermittent wind and solar power at huge volumes – may never materialize.

Smart, staggered EV charging could enable significant advances in system flexibility. By 2030, smart EV charging in the UK could be equivalent to 18% of the country's current generating capacity. Rapid cost reductions in battery manufacturing, driven by increased deployment of EVs, are enabling affordable static, grid-level storage, in turn enhancing power system flexibility.

Digitalization of the electricity sector will lead to significant advances in system efficiency and flexibility. Residential demand will become flexible and networks functionally 'smarter'. Machine-learning algorithms could be a game-changer, helping to manage the increasing complexity of electricity systems and identify new system-level efficiencies.

Enhanced system flexibility and a growing role for these technologies will provide new entry points for highly disruptive market actors, many of them not traditionally associated with the power sector. These actors include powerful technology companies and automotive manufacturers such as Google, Tesla and BMW. More widespread electrification of transport, and eventually of heating, will change the political and regulatory landscape of the electricity sector.

The transformations which have happened so far, with the rapid introduction of renewable technologies and falling demand due to greater energy efficiency, have undermined the business models of traditional power utilities. Now they face the prospect that renewables will achieve ever higher penetrations within the electricity market, aided by greater system flexibility. This will continue to erode the role of large power stations in 'system balancing' – balancing supply and demand – and will put further pressure on existing business models.

Evidence is growing that highly flexible electricity systems could deliver lower whole-system costs, especially given the dramatic projected falls in solar and wind power costs by 2030. But new regulatory approaches are needed to encourage market actors to deliver flexibility. Regulatory frameworks need to prioritize and incentivize investment in these areas, and encourage alternative business models. And in this future, our reliance on large fossil fuel power plants would fade, along with the utility business models that have long been based on a centralized power system.

New business models are emerging to aggregate and manage behind-the-meter investments. One example: storage-as-a-service. The innovative US utility, Green Mountain Power (GMP), in Vermont offers customers a Tesla Powerwall 2.0 battery for $15 a month so long as the customer allows GMP to manage when and how the battery is charged and discharged. Alternatively, customers can buy one for $1,500 – which is roughly a fifth of the actual cost of the battery. In either case, substantial subsidies, approved by the Vermont's Public Utilities Commission, are offered. The regulator has been convinced that the scheme will more than pay

for itself in the sense that all customers, not just those participating, will benefit from the program. The distributed storage paid off handsomely during a heat wave in early July 2018. The company was able to discharge stored energy out of about 500 Tesla Powerwall batteries installed in the homes of some 400 customers and feed it into the grid when it was sorely needed. It saved roughly half a million dollars by avoiding the need to buy expensive power from suppliers at the time of peak demand. GMP, which serves roughly a quarter-million customers in VT uses the batteries in customers' premises as a virtual power plant (VPP). Customers like the batteries because they typically replace an emergency generator when power fails – which is not uncommon during storms in rural areas. (6)

UK Power Networks

The UK's largest electricity distributor has proposed adopting a "flexibility first" approach to the delivery of extra grid capacity, in a move that could bring renewable energy onto the network at a lower cost. UK Power Networks has revealed plans to "supercharge" local markets for flexibility services, which rely on customers changing their energy consumption or generation to balance network demand, possibly by creating them itself.

The company claims that if flexibility services were made available to the 8.2 million buildings it serves, new markets for distributed renewable generation would open across London, the South East and the East of England. It speculates that such increased competition would result in a higher proportion of renewable power being bought onto the network, but at a lower cost. The Flexibility Roadmap proposes a radical rethink to the way we do business, moving away from automatically building new assets and instead giving the distributed energy resources market the opportunity to offer their services. If the market can provide the capacity we need at a more cost-effective rate than building new infrastructure, that's exactly what we should do.

Specifically, UK Power Networks believes that the actions outlined in the roadmap will lower costs for consumers by delaying or avoiding expensive grid reinforcements, increase the resilience of the network and provide new sources of revenue for flexibility providers. To ascertain how it should best meet demand for flexibility, the company has launched a consultation on its Flexibility Roadmap. The consultation will run from August to 8 October. If accepted the proposals will come into effect from 2019.

Earlier this summer, UK Power Networks unveiled its plan to create the nation's first "virtual" solar power station by the end of the year, using PV panels on the rooftops of its London customers' homes. (7)

Demand-Side Response

By 2040 Bloomberg New Energy Finance predicts that more than half of global energy capacity will come from renewables and flexible sources, such as battery storage and demand side response. At 7% of global capacity, flexible sources such as batteries and demand side response – where homes and businesses automatically cut energy usage a peak times – will account for the same level of global energy capacity as oil-fired power plants today. And more than half of this energy storage capacity will come from small-scale batteries installed by households and businesses alongside rooftop solar panels. This trend away from larger power plants and

towards smaller, decentralised energy systems is happening already in both developed and developing nations.

Energy, like every other sector, is going digital. From smart home products such as Hive that allow home owners to control their energy use from their smartphone, through to companies like REstore employing artificial intelligence to calculate just how much energy capacity a factory can offer as a virtual power plant. Centrica's CEO Iain Conn says he expects demand side response to become one of the fastest growing elements of the energy market over the next few years. Europe's largest demand side response aggregator, REstore, was acquired by Centrica in 2017.

In the same way as demand side response aggregators are emerging as a new type of energy company for the decentralised era, a new breed of companies is providing a route to market services for small generators. Centrica acquired one of Europe's leading route to market companies, the Denmark-based Neas Energy, in 2016. Neas is able to take all of the Big Data coming from smart meters and Internet of Things (IoT) connected devices to build an accurate real-time picture of energy demand, as well as demand trends. Neas also uses software that combines this data with smart algorithms that judge weather patterns, so that it knows how much any given wind turbine or solar panel is likely to generate, and when. This helps balance the grid by matching supply and demand more accurately. And for the smaller energy producer, it helps them sell their energy at the most accurate market price. The growth in services supplied by companies like Neas is being driven by the rapid improvement and increasing availability of smart digital technology to both energy companies and their customers.

Greater insight through digital technology is just the start of the shift of power away from energy companies and towards the customer. Centrica is currently piloting a project in the south west of England that will allow local residents and businesses to buy and sell energy between themselves without the intervention of their energy supplier. The £19 million Local Energy Market in Cornwall is enabling 200 homes and businesses to do this using a digital record known as Blockchain. It is used to create a secure electronic ledger of transactions between participants. Iain Conn says he believes such local networks will become the norm in a new decentralised energy market.

Home owners using Blockchain to become their own micro-energy companies may seem like something for the distant future, but Microsoft's Michael Wignall says that digital technology is accelerating at such a pace that these kinds of radical changes will be delivered over a short period of time. The Fourth Industrial Revolution we are currently experiencing will make energy systems of the future completely unrecognisable from what they are today. (8)

"Energy storage is all the rage", says Dave Elliott, Emeritus Professor of Technology Policy at the Open University. But while the field is full of innovation at present, pumped hydro storage continues to dominate. And while storage offers one way to respond to the variability of some renewables, there are other options, including smart grid demand management (to time-shift demand peaks) and super-grid imports and exports (to balance local supply and demand variations across wide areas). (9) "There is nothing that storage can do that something else can't do," according to Professor Mark O'Malley of Canada's McGill University and University College Dublin. (10)

Batteries, capacitors, and flywheels, along with smart-grid demand adjustments, may all be fine for brief periods, dealing with short-term variations in renewable inputs, but are not much use for longer-term lulls in renewable availability. Pumped hydro projects may be able to deliver power for perhaps a day or so, depending on their scale, but for longer term storage that's when big hydrogen gas or compressed air underground storage facilities may come into their own- linked to back-up generators. The stores can be charged using green energy already produced, when there was surplus, locally or on a wider basis, with super-grid links for transfers.

1. Business Green 19th July 2018 https://www.businessgreen.com/bg/opinion/3036159/its-time-totalk-about-solving-the-decarbonisation-challenge
2. Guardian 10th July 218 https://www.theguardian.com/business/nils-pratley-on-finance/2018/jul/10/government-needs-u-turn-over-mania-for-nuclear-plants
3. Carbon Brief 10th July 2018 https://www.carbonbrief.org/in-depth-uk-can-go-low-carbon-at-no-extra-cost-say-infrastructure-advisors
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10. Energy Efficiency: Falling Demand Should Spark Policy Review

Andrew Warren has been arguing that falling energy use should spark a reappraisal of government energy policy for a while now. The UK's energy statistics for 2017 confirm the continuing trend of falling energy consumption. Primary energy consumption in the UK has now fallen by 19% since the start of the century. Actual figures are 236,856 ktoe then, 192,126 ktoe now. This has happened even though our overall wealth as a nation has grown over that period by well over one-half. In other words we have succeeded in decoupling growth in living standards from growth in energy consumption. (1)

Electricity demand keeps dropping

Overall electricity consumption fell by over 15% between 2005 and 2015. It went down, again, by one per cent between 2016 and 2017. This means that we are now using less electricity than we were, say, in the mid-90s.

According to government forecasts at the time of the last Energy White Paper in 2006, the Paper which reinvented the need for 10 new nuclear fission power stations, we should by now be consuming approaching 30% more electricity than we actually are.

Keeping home fires burning less

Because it is the dominant heating fuel, there is well over three times as much gas used in the average home as there is electricity. Gas consumption has fallen by approaching one-third since 2005, largely owing to requirements to replace malfunctioning boilers with more efficient condensing ones. But there are still 40% of elderly inefficient boilers, staggering on. Replacing them will cut gas sales even more.

Programmes prevalent during the first decade of the century to put insulation in homes have largely vanished - the Committee on Climate Change recorded a 95% drop in insulation installations. But as we stand, already 83% of homes have some double glazing; 69% of homes with cavity walls have had those insulated; and 68% of homes have had 125mm or more of insulation placed in their lofts - at least some of which is still in place.

In contrast, less than 9% of those homes with solid walls have ever had those insulated: there remain a further eight million still without any insulation. Systematically helping those occupiers will again drive down gas consumption further.

Almost three-quarters of electricity usage in homes comes from appliances and lighting. There have been enormous improvements - practically all driven by the European Union - in the minimum energy standards required for most white and brown consumer goods. Again, this is a key reason why, despite the increase in electronic gadgets, overall electricity consumption in homes keeps falling.

Halogen Lightbulbs

From the end of August halogen lightbulbs are to be removed from the market across Europe, with households expected to switch to LED lights – which cost more but last far longer and use much less electricity than energy-hungry halogens. According to Philips, the lighting manufacturer, the average UK household has 10 halogen bulbs and uses them for 2.7 hours a day. (So 272 million bulbs)

This could mean 272 million bulbs each save 43watts x 2.7hours x 365days which is around another 11.5TWh per year saved – about half a Hinkley Point C.

The Energy Saving Trust estimates that the typical halogen uses £11 of electricity a year while a replacement LED would use only £2 worth. What's more, halogen bulbs typically fail after about two years, while LEDs should last for around 15 to 20 years on the same usage.

Lighting manufacturers have made it clear that they are not likely to produce special bulbs for the UK market after Brexit. (2)

Overall the pattern is consistent. Year on year better energy management of all types, combined with stronger regulations, are together ensuring that the trend for lower and lower overall energy consumption figures keeps on improving.

Andrew Warren says there is though no cause for complacency. The complete absence of any purposeful energy saving strategy from government since 2015 means there are few new initiatives in the pipeline to ensure that the trend continues. Over recent weeks the Prime Minister herself has been making specific interventions to galvanise the building sector into far stronger commitments towards better energy efficiency, particularly in existing buildings. A plethora of consultations, both formal and informal, are starting to emerge.

Perhaps there is a realisation that, without really trying, the UK has succeeded in producing a strong empirical record on reducing energy wastage. It makes one conscious about how much more could be achieved with just a little more effort and focus. As the International Energy Agency endlessly repeats, energy efficiency needs to be everyone's number one policy priority.

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1. Business Green 31st July 2018 https://www.businessgreen.com/bg/opinion/3036752/so-much-for-predict-and-provide-uk-energy-use-keeps-on-falling
2. Guardian 11th Aug 2018 https://www.theguardian.com/money/2018/aug/11/switch-led-light-bulbs-halogen-ban