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1. Overtly and comprehensively ignoring demand side management

In nuClear News No.135 we asked if UK electricity demand is really going to double. While many other countries are spending billions on energy efficiency measures and proactively aiming to reduce energy and electricity consumption, the UK seems to be giving up on the old 'fabric first' idea and putting all its eggs into the nuclear and electricity supply basket. On transport there seems to be far too much focus on electric vehicles rather than public transport and active travel. With a nuclear tax on consumers' bills in prospect and a large percentage of the population dependent on non-car travel options, the Government's climate policies threaten to exacerbate inequalities rather than promote 'climate justice'.

Unlike the UK, Denmark has a policy to reduce total energy demand by 50% by 2050. (1) And, Germany is not projecting a doubling of electricity demand either, in fact gross electricity generation is projected fall by 2050. Energy efficiency is the main mechanism, but also less waste in the system, more flexibility in storage and grids, integration of the heat sector. These all come together to work towards less (or certainly no more) electricity use whilst switching to renewables. In 2010, the Federal Environment Agency wrote that in the households, industrial as well as trade, commerce and services sectors "*a reduction of final energy consumption by 58%, from 1639.4 TWh in 2005 to 774.2 TWh in 2050*" is expected. Electricity consumption by these sectors decreases by 19%, from 492.9 TWh in 2005 to 396.7 TWh in 2050. Electricity demand experiences a lower reduction rate than final energy consumption due to the switch from fossil fuels to electricity. Total electricity consumption is expected to fall from 564 TWh in 2005 to 506 TWh. (2)

The formal Pact, agreed at COP26, explicitly calls upon all governments to accelerate the adoption of policies "*rapidly scaling up ... energy efficiency measures*". This complements the International Energy Agency's conclusions that around half the investments needed to deliver net zero by 2050 will need to be achieved via improved energy efficiency. Andrew Warren, Chair of the British Energy Efficiency Federation, points out, though, that the UK Government's recent Heat and Buildings Strategy appears to have dropped the mantra of "*fabric first*". The focus is on fuels rather than building fabric. The Strategy supports the installation of heat pumps, but Warren describes even this support as "half-hearted". A grant of £5,000 will be available per household from April 2022, but this is the same as was available from October 2020 to March 2021 under the Green Homes Grant. The difference is that a total of £1.8 billion was to have been available under the Green Homes Grant scheme over 18 months rather than the £450m available now over three years.

Despite having a far more energy efficient building stock than the UK, many countries in Europe are injecting billions into efficiency schemes. Yet there is no substantive fabric-related announcement in the Heat and Building Strategy. Instead, it mainly re-iterates pre-existing policies. There are some welcome funding increases for local authority programmes. Warren concludes "*I cannot recall any other comparable Government elsewhere in the world so overtly and comprehensively ignoring the demand side of the energy marketplace*". (3)

The National Audit Office (NAO) published a damning report on the Green Homes Grant debacle. It has seldom issued a more excoriating report. The scheme was originally supposed to make 600,000 homes more energy efficient. It may just have reached 47,500. It was meant to create somewhere between 100,000 and 140,000 jobs, but may have only sustained 5,600 people in employment. It was supposed to last 18 months. It was ignominiously abandoned over a weekend, after just 6 months.

The NAO reckon "*the rushed delivery and implementation of the scheme has significantly reduced the benefits that might have been achieved, caused frustration for homeowners and installers, and had limited impact on job creation for the longer term*."

The NAO pointed out that its report was being issued "*against a backdrop of previous problematic attempts by Government to implement domestic energy efficiency schemes*." This is the fourth such NAO Report published on this policy area in just over a decade. Each has dealt with programmes ostensibly intended to revolutionise aspects of parts, sometimes all, of the residential building stock's energy performance.

The NAO Report ends with a set of instructions. "*The Department should set out by the end of 2021 how its various home energy efficiency schemes fit with its overall plans for decarbonisation, setting out timescales in a more detailed and longer-term plan. This will help to promote interest in future schemes from consumers and installers.*" (4)

The House of Commons Public Accounts Committee (PAC) says it is "*not convinced that BEIS has fully acknowledged the scale of its failures with this scheme*". The scheme's failure "*continues government's troubled record of energy efficiency initiatives and risks damaging the Department's future efforts to harness both consumer and industry action to deliver Government's net zero commitments*". (5)

Of course, some of the rise in projected UK electricity demand will be due to the increasing number of electric vehicles.

But even if all new cars were electric now, it would still take 15-20 years to replace the world's fossil fuel car fleet. Tackling the climate and air pollution crises requires curbing all motorised transport, particularly private cars, as quickly as possible. Focusing solely on electric vehicles is slowing down the race to zero emissions. (6) It is also unfair. The poorest sectors of the population don't have access to a car. In Glasgow, for example, 50% of households don't have access to a car.

While the role of active travel, public and shared transport was recognised in the COP26 declaration, the main focus of the conference on transport was electric cars, but they're not the solution. Cycling is ten times more important than electric cars for reaching net-zero cities. EVs can help us reduce emissions but they won't help us reach Net Zero fast enough. And EVs still emit dangerous particulates and don't solve current issues of congestion & road safety. Modelling by the Transport Department in 2018 showed that 100% electric car ownership could actually cause a 51% increase in traffic by 2050. (7)

Patrick Harvey the Scottish Minister for Zero Carbon Buildings, Active Travel and Tenants' Rights, told a workshop on Sustainable Transport at COP26 that "*electric or otherwise, we need to see fewer car trips if we are going to meet our climate targets*." Bernadette Kelly, the Permanent Secretary at the Department of Transport pointed out that there is much to unite the Westminster and Scottish Government on this issue. She said "*in our transport decarbonisation plan we have set an ambition that half of all journeys in our towns and cities, by 2030, should be on foot or on a bike*." (8) Assuming both governments are successful on reducing the number of car trips and promoting active travel then there will presumably be an impact on electricity demand in future.

New research from the Green Alliance thinktank says UK efforts to cut transport emissions by switching to electric vehicles (EVs) won't be enough to hit mid-term climate targets there needs to be more incentives to use public transport and a more holistic approach that encompasses different modes of transport, like cycling, and walking. The research also found that shifting 1.7% of car journeys to walking or cycling could provide up to £2.5bn in health benefits annually, while reducing congestion would deliver an economic boost as the cost of congestion was estimated to be almost £8bn in 2018. The findings echo analysis from the IPPR, which found that the Government's efforts to decarbonise transport are focusing too much on electric vehicles (EVs) and could fail to provide affordable and clean transport alternatives that cut overall car use. (9)

Gridserve, the company behind the UK's first "electric forecourt" in Essex has begun construction on two more in Norwich and at Gatwick Airport. It is developing smaller 'electric hubs' at more than 20 locations using a combination of chargers acquired from Ecotricity and new infrastructure. Each hub will feature between six and 12 chargers, with the same 350 kW fast charging capacity as those at the forecourts. All hubs and forecourts will be powered with 100% renewable electricity, self-generated by Gridserve at its portfolio of solar farms and onsite solar arrays. (10)

The UK Government needs to re-focus its climate policies. The energy transition needs to work for everyone. Aiming to reduce or, at least limit any rises in energy consumption, rather than planning for a doubling of demand, would help those in fuel poverty the most as well as those who don't own a car. And, luckily, efficiency in both energy and transport can reduce carbon emissions much more quickly than the Government's current climate policies focussed on nuclear and electric vehicles.

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2. Carbon Capture, Utilisation and Storage (CCUS)

Critics argue that the main purpose of Carbon Capture and Storage (CCS) is to delay the transition to a clean economy so that oil and gas corporations can maximise their existing asset base. They may say they're selling you 'clean hydrogen' or 'carbon-free electricity from coal', but what they are really selling you is a giant big delaying tactic. The fossil fuel industry is hoping to maintain its existing business model, by strongly supporting blue hydrogen. Yet unavoidable residual emissions mean that even though blue hydrogen might achieve significant carbon reductions compared to existing fossil fuel use, it will still contribute to Greenhouse Gas Emissions.

No-one is pretending that capturing carbon at scale will happen in the next decade. Even if it turns out to be successful after that it will be too late. Every penny, every minute spent on CCS is a penny and a minute not beings pent on solutions which stand a chance of actually working. (1)

CCS remains unproven at the industrial scale needed. Nor does not capture 100% of carbon dioxide and is largely used currently to aid exploration of fossil fuels. Even so, Chris Stark, CEO of the Climate Change Committee (CCC) says "*In our assessment for the UK, we couldn't construct a scenario for achieving net zero by 2050 without CCS*." (2)

According to the Center for Climate and Energy Solutions, there are currently 26 large-scale carbon capture projects in use globally, with 34 more in different stages of development. (3) The Global Status of CCS report published in October by the Global CCS Institute says there are now 27 operational carbon capture facilities around the world, with a further 102 under development and four in the construction phase. (4)

But, according to a recent study in the Energy Policy Journal most CCUS projects initiated in the past three decades have failed. (5)

Cost and the length of time projects take to develop are a problem as well as fears that carbon capture will be used as a way for countries with heavy fossil fuel production to continue to extract and sell them. (6)

One of the world's top CCS projects is lagging far behind on its targets. Project owner Chevron admitted breaching the terms set by regulators for the approval of its $54 billion Gorgon liquefied natural gas processing hub in Australia after the CCS plant attached to the project failed to meet the guidelines set for carbon storage. The CCS plant, Australia's largest, was supposed to lock away 80% of Gorgon's gas field emissions over its first five years, a period that ended in July 2021. But at that point, the CCS facility, which only began operating two years ago, had captured just 5 million metric tons of CO2. By one analyst's calculations, it should have captured approximately another 4.6 million metric tons to meet its commitments, meaning it had a shortfall of around 48 percent.

Even before the Gorgon shortfall, the technology already had a poor track record. A December study found that more than 80 percent of the 39 CCS projects attempted in the U.S. have ended in failure. The last such U.S. project, attached to a coal-fired power plant, NRG Energy's Petra Nova plant in Texas, was shuttered permanently earlier this year.

Failures have been frequent elsewhere as well. In the U.K., for example, the National Audit Office said in 2017 that CCS was "currently inconceivable" without government support, after investigating the collapse of a 100-million-pound ($136 million) project. (7)

Blue hydrogen is being promoted strongly by fossil fuel companies as a means of decarbonization. It would involve capturing and storing CO_2 emissions from methane gas used to create the hydrogen. Without carbon capture and storage (CCS), the emissions from blue hydrogen would also be higher than those of fossil gas because of the additional energy required to drive the process of hydrogen production and the carbon capture process.

Jan Rosenow and Richard Lowes say after years of pilot projects and substantial public investment in coal power plants with CCS, only a single commercially operating facility remains—one 115 megawatt unit of the Boundary Dam Power Station in Saskatchewan. Its primary purpose is to provide a low-cost source of carbon dioxide to the Weyburn Oil Field for enhanced oil recovery. There is a significant risk that blue hydrogen will not deliver on its promises and could lock society into ongoing greenhouse gas emissions. (8)

Earlier this year Global Witness and Friends of the Earth Scotland have commissioned world-renowned climate scientists at the Tyndall Centre in Manchester to assess the role of fossil fuel-based Carbon Capture and Storage (CCS) in the energy system, and its ability to help to achieve the Paris Agreement goal of limiting global average temperature increases to 1.5°C. Their report found that:

The scale of deployment of CCS to date is significantly less than proponents have predicted, with only 26 CCS plants currently in operation globally.

Global operational CCS capacity is currently 39MtCO2 per year, this is about 0.1% of annual global emissions from fossil fuels and less than Scotland's territorial emissions in 2018.There is no operational CCS capacity in the UK or the EU at all.

81% of carbon captured to date has been used to extract more oil via the process of Enhanced Oil Recovery (EOR). This means CCS is being predominantly used for carbon-emitting oil extraction that wouldn't have otherwise been possible.

Current CCS projects usually target 90% capture at peak capacity. The Petra Nova facility missed capture targets by around 17% between starting in 2017 and its mothballing in May 2020.

On the basis of this research, Friends of the Earth Scotland and Global Witness believe the promotion of CCS in energy is a distraction from the rapid growth of renewable energy and energy efficiency required. We urge instead reliance on technologies that can deliver the emissions reductions required by 2030 if we are to deliver on the Paris Agreement goals. (9)

A new article in the One Earth journal says the cost of renewable technologies has plummeted so fast that it is unclear whether other solutions such as carbon capture and storage (CCS) are necessary. Cost reductions in renewables reduce the value of CCS by 15%–96%, depending on the energy system sector under consideration. CCS is therefore less valuable to policymakers due to cost reductions in renewables. Nevertheless, CCS retains value for decarbonizing industry and removing CO2 from the atmosphere, and targeted CCS deployment should be prioritized. (10)

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3. Hunterston and Continuous Decommissioning

The Nuclear Decommissioning Authority's 2021-24 Business Plan (1) says it has reviewed the Magnox reactor decommissioning strategy and endorsed a site-specific approach to Magnox reactor decommissioning which will involve a mix of decommissioning strategies. For some sites this will result in their decommissioning being brought forward whilst for others a deferral strategy will be the chosen approach. New Site-Specific Strategies will be developed for each Magnox station across Britain. These will support optimal sequencing of reactor dismantling - a rolling programme of decommissioning which will maximise the opportunity for sharing any lessons learned, developing and implementing new technologies and strengthening wider capability.

These new site-specific decommissioning strategies are currently being defined. A timetable will be set that best suits each site and a business case developed to set out the benefits and cost and schedule impacts of any changes.

Reactor dismantling at the Hunterston A Magnox station, which ceased generation in 1990, is now expected to start in 2035. The previous strategy was to place the reactors into care and maintenance for up to 85 years to allow for radioactivity to decay. The current work programme which involves packaging various waste, sludges etc and placing the packages into an Intermediate Level Waste store will now take until 2030, 40 years after it ceased operation. The plant opened in 1964, so by 2030 Hunterston A will have spent longer being cleaned up than it actually spent generating electricity. Originally the current work programme was expected to be completed by 2022, but problems associated with retrieving waste in 5 bunkers has caused delays. The period between 2030 and 2035 will be spent demolishing various buildings.

Under the old strategy the NDA was going to install a "weather envelope" around the old Magnox reactors. Work on this has now been suspended.

Hunterston B

Meanwhile, Hunterston B - Reactor 3 switched off for final time on 26th November. The reactor was first switched on on 6th February 1976. When EDF acquired the power station it was expected to end generation in 2016. (2)

Hunterston B Reactor 4 - is scheduled to shut down in January, which will see the end of power generation for the site in North Ayrshire, Scotland. (3)

Reactor 3 and Reactor 4 were taken offline on 9 March and 3 October 2018, respectively, after cracks in their graphite cores were discovered during routine inspections. In August 2020, the UK's Office for Nuclear Regulation (ONR) gave approval to EDF to restart Reactor 4 in August 2020 and Reactor 3 the following month. The reactors were taken offline earlier this year for further inspections of their graphite cores. In April, the ONR gave permission for the units to be

switched back on. However, it said continued operation would be for up to a total of 16.7 terawatt days for Reactor 3 and 16.52 terawatt days for Reactor 4 - about six months of operation for each reactor. Reactor 3 returned to service on 23 April and Reactor 4 on 5 June.

In June, the UK government and EDF agreed on improved arrangements to decommission the UK's seven AGR nuclear plants that are scheduled to close this decade. This followed an announcement by EDF that it had decided not to restart the first of the AGRs, Dungeness B, and to begin defuelling with immediate effect. (4) Each of the AGR sites will move across to the NDA on a rolling basis once defueling and fuel free verification are complete, for the decommissioning work to be overseen and managed by the NDA's Magnox division. However, EDF's defueling work will be supported by the NDA divisions Sellafield Ltd and Nuclear Transport Solutions (NTS) alongside other parts of the NDA group. Spent fuel from Hunterston B will be sent by train to Sellafield. (5)

EDF has now submitted a defueling safety case to ONR. First there will be what's called "defueling outage" which will last about 60 days – making sure everything is safe to commence defueling. Defueling is then expected to start in March 2022 and will take around 3 years.

After defueling the NDA will take control of the AGR reactors. Under the old regime it would have taken until about 2030 to prepare the reactors for a period of care and maintenance. Now Hunterston B will develop a site-specific decommissioning strategy which should involve reactor dismantling sooner rather than later, thus providing the prospect of more continuous employment on the site.

The NDA, EDF and Magnox have been working together to investigate the feasibility of Hunterston B sharing the use of the Hunterston A Intermediate Level Waste (ILW) store and processing facility. Seems obvious that they should, but EDF has recently been working on plans for a standalone store. EDF and NDA have now agreed to share the Hunterston A store and EDF has suspended work on a Hunterston B store. ONR & SEPA still need to be consulted and a planning application made to North Ayrshire Council (NAC). (6)

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4. New Nuclear Energy Developments

In Safe Energy Journal No.92 and nuClear News No.135 we reported on a debate in the House of Commons on the Second Reading of the Nuclear Energy Finance Bill, which took place on 3rd November. (1) Since then, there have been several meetings of the Nuclear Energy Finance Bill Committee, including one session which took evidence from Doug Parr of Greenpeace, Mycle Schneider of the World Nuclear Industry Status Report and Professor Steve Thomas. (2)

The SNP's Energy Spokesperson at Westminster, Alan Brown, asked Mycle Schneider about the argument that the UK needs baseload power and can't meet its net zero targets without nuclear power. Mycle pointed out that we are in a climate emergency, so we need reductions in carbon emissions as quickly as possible. For every pound we spend we need to see large and fast results. It's clear that there are other options beside nuclear which are more climate effective. The cost of renewables is cheaper and nuclear is five times slower. Possible investments in nuclear which might deliver after 2030 are much too slow.

Regarding the need for baseload electricity, the National Grid's scenarios say nothing about the need for reliable baseload. Only one out of their three scenarios needs Sizewell C. Nuclear is not flexible. If the wind isn't blowing nuclear doesn't help. What is required is batteries and demand-side responses to compensate for intermittency.

Analysis of the French nuclear fleet shows that nuclear power is not a reliable source providing power 24/7. For 2019 – the year before Covid – when EDF starts an outage for maintenance and refuelling it has lost control entirely over the date and time it is able to restart its reactors. There were over 40 cases of revised times and dates. EDF was not even able to make reliable predictions 24 hours before the reactors were due to restart.

Labour's Alan Whitehead asked Mycle Schneider about the experience of the United States using the Regulated Asset Base (RAB) funding model for two plants in South Carolina which were abandoned recently. Should there be measures in any Bill which make sure any nuclear plant is finished to avoid consumers being dumped with the cost of a plant that wasn't finished. Construction of VC Summer started in 2013 and it was supposed to come on-line in 2017. By 2017 the cost estimate had increased by 75%. In July 2017 construction was abandoned. This was one of the consequences of the fact that Westinghouse filed for bankruptcy. The affair has cost consumers billions. Steve Thomas said what marked out the VC Summer project and a similar project in Georgia from other US projects was that they allowed the recovery of costs from consumers before completion of the reactors. The Summer experience shows very clearly the folly of using the RAB model. We would have to be careful with any legislation which prevents nuclear plants under construction being abandoned. Dungeness B took 24 years from the start of construction to commercial operation, and over its 32 years of operation its availability was well below 50%. It should have been abandoned before it was completed.

Matthew Pennycook said there is a lack of clarity around the Chinese company, CGN's investment in Sizewell C and how that interacts with the intentions of this Bill. He asked what is in the 2016 Strategic Investment Agreement and what provisions there are in that agreement that would allow the Government to remove CGN. And related to that there was £1.7 billion in

the budget to enable a final investment decision for a large scale nuclear project. Is that money to buyout the CGN stake?

Steve Thomas said in the 2016 Agreement CGN agreed to take up to 20% of the Sizewell C project up to the Final Investment Decision (FID). They have an option to take 20% of the construction and operation of the plant if it goes ahead. EDF and CGN have spent about half a billion pounds so far, It may take another £0.5 billion at the most to get to FID. So £1.7bn seems too much. In terms of how you get CGN out of Sizewell C it probably depends on what happens to Bradwell B. The Chinese really want to get the endorsement of UK nuclear regulators for it HPR1000 reactor. If they are not going to be allowed to build Bradwell B, they are unlikely to be interested in putting money into Sizewell C.

Steve Thomas told MPs there is a lot of missing detail in the RAB proposals. One of the biggest elements is how much the surcharge will be during the construction. The Government has said it will be a maximum of about £10 per year per consumer. That would yield £6bn. In the context of a project that will cost £24-40bn, plus financing costs, £^bn is not much of a game changer.

PMQs

On 24th November, during Prime Minister's Questions Matthew Pennycook asked:

"*The Government's integrated review has concluded that the Chinese state poses a systemic challenge to our national security, and the Prime Minister has made it clear that when it comes to China, we must remain vigilant about our critical national infrastructure. Can he therefore confirm unequivocally today that plans for China General Nuclear to own and operate its own plant at Bradwell in Essex have been abandoned, and explain to the House precisely how and when his Government intend to remove CGN's interest from the Sizewell C nuclear project?*"

Boris Johnson replied that "…*we do not want to see undue influence by potentially adversarial countries in our critical national infrastructure. That is why we have taken the decisions that we have. On Bradwell, there will be more information forthcoming - What I do not want to do is pitchfork away wantonly all Chinese investment in this country, or minimise the importance to this country of having a trading relationship with China*." (3)

The Times pointed to the National Security and Investment Bill, going through parliament at present, which will allow the government to "screen" and potentially block sensitive foreign investments, and concluded that China will be cut out of future involvement in developing new nuclear power stations, but this is still not entirely clear. (4)

Mr Pennycook later responded to the PMs answer via Twitter: "*We need certainty on the future of China's involvement in UK nuclear power and clarity about how and when the Government intends to remove China's state-controlled nuclear energy company from involvement in any future UK project*."

Subsequently the team behind Bradwell B said China's nuclear group remains committed to the project. (5)

A government source told *The Times* that they hoped the Chinese investment in Sizewell would be replaced by more "*palatable investors from like-minded countries*". (6) However, Boris Johnson has avoided giving any detail on how China will be removed from the Sizewell C deal. EDF and China General Nuclear (CGN) are joint developers of Sizewell C taking 80% and 20% shares respectively, though the *Financial Times* has previously reported that Whitehall is looking to push out CGN. (7)

CGN also has a 33.5 per cent stake in the £23bn Hinkley Point C nuclear power station under construction in Somerset, where it is also partnered with EDF. The project is due to be completed in 2026. (8)

The Government's diplomats and business advisers have a difficult task in front of them: negotiating a deal that will boot China out of its present strong position in Britain's nuclear programme. The Chinese design, for a plant called the HPR-1000, was submitted to British regulators for approval in 2017 and insiders say that it could receive the green light early next year. That approval would be a huge fillip for Beijing, representing the first time that a western nuclear regulator has given a clean bill of health to a Chinese design. Industry experts say it could open the door to a flood of export orders as more countries turn to nuclear power as a way to cut carbon dioxide emissions.

At the Nuclear Industry Association's annual conference, Zhu Minhong, CGN's UK chief executive said so far "*there have been no technical show stoppers*" regarding the HPR-1000 and the Generic Design Assessment (GDA) process. He also outlined the Bradwell plans, saying that initial work was going well and that a seismic survey had proved the site's suitability. Zhu may have been alluding to the diplomatic kerfuffle when he urged the industry to "keep calm and carry on".

CGN is the only company in the world to have built and operated the type of reactor under construction at Hinkley Point C, although one of the Taishan reactors has problems (see below). EDF hopes CGN experience will help them build Hinkley Point C on time and budget. *The Times* speculates that CGN could stay in at Hinkley Point but be persuaded to give up its stake in Sizewell C, a move that would allow British politicians to beat their chests on how they were being tough with China. CGN would get what it really desires, the British seal of approval on its home-grown reactor design. And the Bradwell plant? That could just sit and wait, ready either to be passed to another developer or to go ahead once Britain's interests have shifted again. (9)

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9. Times 3rd Dec 2021 https://www.thetimes.co.uk/article/the-china-conundrum-how-to-act-tough-but-still-get-its-nuclear-plants-68sh2sk8c

5. Taishan Problems

An investigation is still under way into the cause of problems at the Chinese EPR plant in Taishan. It was shut down in August after reports of damage to fuel rods. The plant is operated by CGN and owned in partnership with EDF, the two companies involved in building Hinkley Point C (HPC).

The Times (1) has reported that key safety components at HPC may need to be redesigned and the project delayed after defects were detected at a similar reactor in China. The newspaper says the scheduled start date for electricity generation, of June 2026, may have to be postponed.

The Commission for Independent Research and Information on Radioactivity (CRIIRAD), a French association created in the aftermath of the Chernobyl disaster, said that a whistleblower had reported to them that a design flaw in the reactor pressure vessel could be the cause of the problem at Taishan which means that design changes may be needed.

In a letter to the French nuclear regulator (2), ASN, CRIIRAD says:

"*In June 2021, the national and international press widely covered the case of the problems of ruptured nuclear fuel cladding at the Taishan 1 EPR reactor in China*."

It goes on to say there are several possible causes of the rupture some of which may involve design flaws in the reactor. A whistleblower has now told CRIIRAD that the ruptures are caused by a design flaw in the reactors pressure vessel. This will also cause problems in other EPR reactors like Hinkley Point C.

The letter continues:

"*If they are true, these revelations raise serious questions in terms of nuclear safety and radiation protection, both for plant workers and for residents. The existence of a generic design defect on the EPR reactor vessel could jeopardize the start-up of* [other EPR reactors]."

Stop Hinkley spokesperson, Roy Pumfrey says:

"*What's been cobbled together to get Taishan started clearly isn't working. It's just another example of the folly of complex designs for big new nuclear reactors. Trying to identify and correct the design flaw can only lead to further delays and cost overruns for the absurdly expensive HPC project*."

"*Stop Hinkley will be pressing the UK's Office of Nuclear Regulation for a full disclosure of its investigations into this matter. And if there are expensive delays and modifications to HPC required, given the already huge cost to consumers, we will be asking government officials to investigate whether, in fact, it would be cheaper to cancel the whole thing*."

Eva Stegen, German blogger and energy consultant says the whistleblower gave the radiation research institute 'CRIIRAD' important detailed technical information from Taishan. With every additional day on which neither the operator nor the French nuclear regulatory authority – ASN - deny, the hypothesis that the design error affects all EPRs, Taishan's problems become more

important. She reminds us that in June 2021, a 'CNN' report from Taishan, China caused a stir. There was talk of an "immediate radiological threat" in a letter from the French consortium partner "Framatome" to the US Department of Energy. The Chinese security authorities were accused of having raised the radiation limit values for the outside area around the nuclear power plant in order to circumvent the shutdown of the defective reactor block.

In this context, a little-noticed communication of the Institute for Radiation Protection and Nuclear Safety – IRSN - of March 31 assumes new significance: the Institute expressed concern about "abnormally high vibrations" already observed in the primary circuit of several EPR reactors. It said the overall architecture of the primary circuit piping leads to the severe vibrations in the reactor pressure vessel due to an unfavourable distribution of the cooling water. These vibrations could lead to a pipe rupture in the primary circuit and cause significant radioactive releases. This raises the question whether the entire piping architecture should not be revised.

As early as 2018, the Finnish power utility 'TVO' and the Finnish safety authority 'STUK' reported that during tests at Olkiluoto, vibrations had occurred in the primary circuit at the reactor pressure vessel.

So along with carbon-brittle misfits, botched welds and inferior concrete comes the vibration problem. The once-vaunted core catcher, which was supposed to be used to contain a melted reactor core, is apparently also giving engineers a headache. If a major fragment of the vessel were to block the chute to the catcher, the corium would not flow into the catcher. (3)

1. Times 1st Dec 2021 https://www.thetimes.co.uk/article/ef84adce-5215-11ec-8d72-b8ab431649b1
2. See CRIIRAD letter to ASN 27th Nov 2021 http://www.criirad.org/actualites/dossier2021/211125_Courrier_CRIIRAD_ASN_sureté_EPR_VF.pdf
3. Ausgestrahlt 9th Dec 2021 https://www.ausgestrahlt.de/blog/2021/12/09/insider-infos-aus-china-k%C3%B6nnen-franz%C3%B6sisches-atomflaggschiff-epr-versenken/

6. Fusion Waste

The Committee on Radioactive Waste Management (CoRWM) has published a preliminary position on the implications for decommissioning, radioactive waste management, and radioactive waste disposal associated with fusion energy. (1)

CoRWM member Claire Corkhill says: "*Although nuclear fusion does not produce long lived fission products and actinides, neutron capture by the fusion reactor structural materials and components forms short, moderate and some long-lived activation products. In addition to tritium emissions and contaminated materials, it is clear that there will be a need to manage radioactive materials and wastes produced by neutron activation, within regulatory controls, over the whole life cycle of a fusion reactor*." (2)

The paper itself says: "*The activation of components in a fusion reactor is low enough for the materials to be recycled or reused within 100 years*."

It continues:

"*Minimising the generation of long lived activation products, and tritium inventory at source, is therefore of fundamental importance in achieving the primary objective in the waste hierarchy of waste prevention. However, it is to be recognised that future generations will be committed to managing wastes arising from decommissioning and waste management plans that are predicated on extended decay storage, such as those discussed herein*."

However, the paper goes on to says that "*The primary components of the fusion reactor system are likely to require disposal, including the activated front wall, blanket, divertor and vacuum vessel materials … From a radiological perspective, it is reasonable to consider that, conceptually, wastes from a nuclear fusion power programme should be compatible with geological disposal, however, they may prove challenging for disposal in a near surface facility, given the long half-life and potential mobility of 14C and 94Nb*."

"*…some key activation products of concern, such as 14C and 94Nb, which are long lived, should be limited in near surface disposal facilities, given the reliance on engineered barriers to assure containment.14C poses a particular challenge given its potential mobility in the near subsurface*."

"***Nuclear fusion technology is advocated as not being compromised by the burden of generating long lived nuclear wastes. It is evident that this claim is challenged by the expected generation of some significant volumes of LLW and likely ILW arisings****. It may be noted that the recent call for expressions of interest to accommodate siting the STEP facility makes no mention of management of the arising radioactive waste. Future dialogue with local communities needs to ensure it is as open and transparent as possible on such matters*."

The Government is consulting on proposals for a regulatory framework for fusion. The consultation closes on 24th December. See:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1032848/towards-fusion-energy-uk-government-proposals-regulatory-framework-fusion-energy.pdf

1. CoRWM 6th Dec 2021https://www.gov.uk/government/publications/radioactive-wastes-from-fusion-energy-preliminary-position-paper
2. CoWRM 8th Dec 2021 https://www.gov.uk/government/news/nuclear-fusion-and-radioactive-waste-regulation-corwm-members-visit-the-culham-centre-for-fusion-energy

7. Advanced Reactors

Energy minister Greg Hands told the Nuclear2021 conference organised by the Nuclear Industry Association that the UK will build a high-temperature gas reactor (HTGR) as the centrepiece of its Advanced Modular Reactor Research, Development & Demonstration Programme.

The goal of the research programme is to "prove the potential" of advanced reactors and have a demonstration unit in operation "by the early 2030s, at the latest". The key focus would be to produce high temperature heat which could be used for hydrogen production, to supply industrial processes and potentially district heating as well as electricity generation.

Several other reactor concepts could have been selected. The emerging category of 'advanced' reactors includes the lead-cooled fast reactor, molten salt reactor, supercritical water-cooled reactor, sodium-cooled fast reactor and very-high-temperature gas reactor in addition to high-temperature gas reactors.

Paul Howarth, CEO of the National Nuclear Laboratory (NNL), called it "*a further signal of the resurgence of nuclear*." He added, "*With the opportunity HTGRs bring to deliver high temperature heat, hydrogen and synthetic fuels, the potential of this technology to help decarbonise our industries and energy grid is significant*." He noted that NNL is "*actively working on the fuel, graphite and high temperature materials required for HTGRs*."

The Advanced Modular Reactor Research, Development & Demonstration Programme counts on £170 million of government funding from a £385 million package intended to accelerate development of highly flexible nuclear technologies. (1)

In July the Government sought views on its preference to explore the potential of High Temperature Gas Reactors (HTGRs) for the Advanced Modular Reactor Research Development & Demonstration (AMR RD&D) Programme. It says the call found no significant, additional evidence to materially change the outcome of the Government's underpinning analysis. As a result, the Programme will focus on High Temperature Gas Reactors with the ambition for this to lead to a HTGR demonstration by the early 2030s at the latest. In parallel, government continues to support the development of all AMRs as part of wider policy on advanced nuclear activities. This includes: opening the Generic Design Assessment (GDA) process to advanced nuclear technologies and developing a siting approach for further nuclear developments. (2)

1. World Nuclear News 3rd Dec 2021 https://www.world-nuclear-news.org/Articles/UK-selects-HTGR-for-advanced-reactor-demonstration
2. BEIS 2nd Dec 2021 https://www.gov.uk/government/consultations/potential-of-high-temperature-gas-reactors-to-support-the-amr-rd-demonstration-programme-call-for-evidence#history