nuClear news

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1. Hinkley's Troubles Continue

The resignation of the man in charge of building Hinkley Point C capped a month of very bad news for the proposed £18bn nuclear power plant. Chris Bakken announced that he would be returning home to the US to take up the post of chief nuclear officer for Entergy beginning on April 6 to "*spend more time with his family*."

Anti-nuclear campaigners declared the resignation was yet another sign the project is in trouble. John Sauven, executive director at Greenpeace, said: "*Coming just days after the EDF board failed to agree a final go-ahead for Hinkley, this move is yet another symptom of the disquiet this project is causing within the company itself. The whole enterprise makes so little economic sense that EDF's own staff and many board members are concerned it will seriously damage the company*." (1)

According to the French newspaper, *Le Figaro*, EDF was expected to make a final investment decision on the proposed reactors at its Board meeting on 27th January 2016, (2) although the Stop Hinkley Campaign pointed out it was the ninth time that EDF has said a final investment decision is imminent and then nothing happened. (3) The campaign group argued that EDF is in such a precarious state that it is really not sensible to commit to building two new European Pressurised water Reactors (EPRs) when there are still no EPRs operating anywhere in the world and there is considerable unease amongst employee shareholders about the financing of Hinkley Point C - some fear it could sink the company altogether. (4) *The Financial Times* revealed at the end of December that the EPRs being built at Taishan have been delayed by at least another year. (5) Dr Dave Toke said the debate is now not about whether Hinkley Point C will go-ahead, but whether EDF itself can survive. (6)

EDF is in dire financial straits and is reported to be seeking more help from the French Government. It has seen its debts reach €37 billion (£28 billion) and its share price has fallen from €29 in April 2014 to €11.87 now. It is being forced to take over Areva, the company that developed the EPR technology. Peter Atherton, an analyst at Jefferies, the US investment bank, said: "*Financing such a massive project* [as Hinkley] *will place a significant strain on EDF's finances*." (7)

The Company had already announced that it is considering selling assets worth more than €6bn (£4.5bn) including a stake in its eight British nuclear plants, of which Hinkley Point B is one, to fund Hinkley Point C. But it could only sell a 29% share if it wants to retain a controlling 51% stake, so this would only raise around €2.6bn. (8)

The company also needs €55bn to upgrade its ageing nuclear plants in France. EDF has also agreed to buy between 51 and 75% of the struggling French reactor builder Areva NP which is valued at €2.7bn. So it will have to find at least €1.4bn for that.

EDF is also said to be considering disposing of its 49.99% stake in five American reactors. But this sale would be complicated. At least two of the reactors are at risk of closure due to economic pressures, and EDF's partner, Exelon, is unlikely to be willing to take on more liability.

Another possibility is that EDF will sell 50% of its holding in the French power transmission business RTE. It cannot sell more than half because 50% is allocated to its decommissioning fund, which is segregated. There is of course a risk in selling half because if it turns out to be worth less than EDF has claimed it is worth for the decommissioning fund, EDF would have to top up the decommissioning fund by the shortfall. EDF has already launched the sale of its Polish coal-fired heating and power plants but that will raise less than €0.5bn. (9)

Another problem for EDF which caused its share price to drop to an all-time low is that estimates on the cost of a proposed French nuclear waste dump have increased. The French waste agency Andra estimates that the cost of its deep geological disposal project could be as high as €30bn rather than the €20bn estimated by EDF. (10)

On top of all this the French nuclear regulator ASN now says it won't decide until the end of this year what to do about weak spots in steel of the pressure vessel at Flanaville. In October, ASN said it would rule "soon" on EDF and nuclear group Areva's plans for dealing with the weak spots. Pushing back the decision could lead to further delays at the reactor, which is already years behind schedule. If ASN were to decide that Areva needs to replace the reactor vessel or lid because of the weak spots, the Flamanville project could face significant further delays and cost overruns. (11)

According to *The Ecologist* the China General Nuclear Power Corp (GGN) – EDF's partner at Hinkley C - is understandably risk-averse over EPRs and is reportedly demanding an indemnity from EDF against losses at Hinkley C - so that while EDF would only own 66.5% of the project, it would be liable for 100% of any cost overruns. Meanwhile two legal challenges against the UK government's enormous state aid package for Hinkley C are looming at the European Court: one brought by Austria, now joined by Luxembourg; and one by Germany's Greenpeace Energy cooperative together with other green energy suppliers in Germany and Austria. (12)

FID Postponed

Then, just as EDF was about to make its final investment decision (FID), the item was taken off the agenda for the 27th January Board meeting, because of last-minute concerns expressed by some of the company's most important backers about how Hinkley would be financed. The CFE-CGC managers' union, which has a seat on EDF's board, posed a set of last-minute questions to the company about the financial risks. It voiced concern that "significant" financial issues related to Hinkley could "*put EDF in danger*" in the long term. A CFE-CGC document highlighted the construction problems at both Flamanville and Olkiluoto in Finland, which is 10 years behind schedule and €5bn over budget. (13)

Les Echos said the French firm was struggling to find the cash for its 66.5% stake in Hinkley and was now "putting pressure on the [French] state, which owns 84.5% of EDF, to come up with fresh funds". It said a final investment decision would now be made at the earliest at EDF's annual results on 16 February. (14)

CFE-CGC submitted a list of 15 questions it said have yet to be answered. (15) The list includes an expression of serious concern about the plant's viability and what it might cost the company. The document reveals that the Infrastructure UK arm of the government has attached a BB+ credit rating to the project - below investment grade - reflecting worries in Whitehall that it

might not be completed. The Union also asked what happens if the project is not built before 2025, as planned, and expressed concern that "significant" financial issues related to Hinkley could put the long term survival of the company in jeopardy. It asked: "*What is the rationale for starting construction on two EPRs, at the same site, in such a short period of time?*" Given that the other projects appeared to be taking 10-15 years to build, it asked how EDF can estimate a construction time of nine years? Much of the concern in France about the project focuses on how EDF plans to pay for the reactor while continuing to pay its dividend.

Sources close to the board suggest the concerns go beyond the unions meaning the firm may not have sufficient support to make a decision. The news comes amidst warnings from France's technical regulator that there could be further problems with EDF's Flamanville plant. Speaking to the French press, ASN chief Pierre-Frank Chevet warned the body was concerned by "anomalies" with the project which had not been spotted by EDF. The authority is conducting further tests on the crisis stricken plant which could cause further delays – with a decision expected later this year. (16)

According to *The Times* the EDF Board remains deeply split over whether to proceed with Hinkley, with nearly half its members expected to vote against. Mycle Schneider, a Paris-based nuclear energy expert, said that the situation was very serious, adding: "*The indications are that the unions, who have six board seats, would have voted against it and at least one more member. Maybe more.*" Although the executive team of EDF, including Jean-Bernard Lévy, the chairman, is strongly backing the project with government approval, they are facing stiff opposition from other powerful industry figures. Upheaval within the French nuclear industry is complicating efforts to finalise the Hinkley project. (17)

The six union members on EDF's 18-seat board would vote against the French utility's plans for two nuclear reactors in the UK, but other board members do not want to postpone the project, according to *Reuters*. The unions want EDF to put off the £18bn ($26 billion) project until it has strengthened its balance sheet and started up at least one of the four EPRs it has under construction elsewhere. A united front of EDF's unions opposing a major investment decision would be unprecedented, but the lack of support from other board members removes a major element of uncertainty for the plan. EDF's dominant CGT union, which has three board members, called on the firm to postpone the project, saying EDF should prioritise upgrading its ageing nuclear fleet in France, start up the long-delayed EPR it is building in Flamanville, and design a new-model EPR reactor. The more radical FO union, which has one board seat, also said on Monday it was "urgent to wait" and said that going ahead with Hinkley Point could put EDF's very survival at risk.

Since EDF board member Philippe Varin is also chairman of Areva, he cannot vote on the UK project, which means that nine votes could block it. Besides the six union members, EDF also has six independent board members - including its chief executive Jean-Bernard Levy, Varin and the chairmen of listed French firms Vallourec and Lafarge - while six other members are appointed by the state. Three of these people are government officials. Two sources familiar with the situation told *Reuters* that none of the other independent or state-appointed board members would side with the unions. (18)

Confusion about financing

The original idea for financing Hinkley was for the promoters to put in £7.5bn in equity and then to borrow £17bn supported by UK Government Credit Guarantees (for which a premium would be paid). This £24.5bn total was made up of £16bn cost plus £8.5bn interest. Now the cost seems to have gone up to £18bn (or adjusted for today's prices). But EDF Energy seems to be talking about largely funding this out of equity. EDF said on 21st October: "*The project is due to be equity funded by each partner, at least during a first stage*." (19) Of course, there is no indication given by EDF of how long the "first stage" would last. However *The Telegraph* reported that EDF had originally been expected to use project financing for Hinkley, backed up by up to £16bn in UK Government guarantees via Infrastructure UK. But Mr Lévy announced in October a "*radical change*" to what he said was a "*more efficient*" option of delivering its £12bn share of the project from EDF's own balance sheet. (20)

Under the deal agreed with the European Commission, the Flamanville EPR project must be up and running before the guarantees come into effect. And until that time, the shareholders must provide billions in 'contingent equity' to cover the bondholders' risk, protecting UK taxpayers. And if it is not operating by 2020 the guarantees will expire. (21) What this means, according to *The Ecologist*, is that there is now a near-zero chance of these guarantees ever actually being taken up. This could be why EDF is now talking about funding the whole project through equity.

The *Sunday Times* reported that when the European Union signed off on the Treasury's guarantee of Hinkley Point, it insisted it be conditional on Flamanville having "*completed the trial operation period*" and other operational milestones by December 2020. If Flamanville misses that deadline, EDF would be forced to immediately repay any loans that benefited from government support. (22) The date of earliest completion of the Flamanville reactor is 2018, and even that assumes that things go a lot better than they have so far.

Dr Dave Toke says there is no chance of Hinkley C being funded without the Government guarantees - EDF haven't got anywhere near the money needed and it would be financially crazy to pay for it without the guarantees - so EDF cannot take the chance of going ahead without a firm loan guarantee. (23)

It is no surprise that employees and shareholders of EDF are up in arms about the prospect of a 'final investment decision' being taken by the EDF Board. This leaves people wondering about the motives of EDF in announcing that they are 'restarting' work on Hinkley C. EDF seems to want to carry on despite the increasing likelihood that the Hinkley project will destroy EDF as a going business. So why do they carry on with this apparent financial suicide? The answer according to Toke is that the leaders of EDF have two choices: abandon Hinkley C and effectively end EDF's visions as being leaders of a world (or even French) nuclear resurgence or carry on spending money on Hinkley C and hope that the French Government will bail them out of any further difficulties. The first choice involves the certainty of loss of face and resignation, but the second choice involves a probability of disaster (and eventual resignation), but the faint hope that they still might win out. (24)

So EDF has told contractors at Hinkley Point to restart "unconstrained spending" in anticipation of the £18bn nuclear plant obtaining the final green light soon. By 'unconstrained' they mean 'we're going to go on as if a decision has been made'." (25)

Sizewell

A final investment decision on Hinkley is expected to trigger the launch of the next round of public consultation over plans for Sizewell C. (26)

But if EDF is struggling to find its 66.5% share of Hinkley C, how will it ever find the 80% it is expected to put into Sizewell C?

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1. FT 2nd Feb 2016 http://www.ft.com/cms/s/0/e6897194-c9b5-11e5-be0b-b7ece4e953a0.html
2. Le Figaro 14th Jan 2016 http://www.lefigaro.fr/conjoncture/2016/01/13/20002-20160113ARTFIG00333-le-nucleaire-francais-confirme-son-grand-projet-anglais.php
3. Stop Hinkley Press Release 14th Feb 2016 http://www.stophinkley.org/PressReleases/pr160114.pdf
4. Guardian 13th November 2015 http://www.theguardian.com/environment/2015/nov/13/hinkley-point-nuclear-plan-puts-survival-edf-at-risk-say-employee-shareholders
5. FT 29th December 2015 http://www.ft.com/cms/s/0/789e5070-974a-11e5-9228-87e603d47bdc.html
6. Dave Toke's Blog 6th Jan 2016 http://realfeed-intariffs.blogspot.co.uk/2016/01/more-daishan-epr-delays-as-edf-ponder.html
7. Times 27th Jan 2016 http://www.thetimes.co.uk/tto/business/industries/industrials/article4675395.ece?CMP=OTH-gnws-standard-2016_01_27
8. Reuters 6th Jan 2016 http://af.reuters.com/article/commoditiesNews/idAFL8N14Q1LP20160106?sp=true & Les Echos 6th Jan 2016 http://www.lesechos.fr/industrie-services/energie-environnement/021594340218-edf-envisage-de-ceder-plus-de-6-milliards-deuros-dactifs-en-2016-1189865.php
9. Reuters 13th Jan 2016 http://af.reuters.com/article/commoditiesNews/idAFL8N14X0QS20160113
10. Power Engineering International 13th Jan 2016 http://www.powerengineeringint.com/articles/2016/01/edf-disputes-french-nuclear-waste-agency-estimates-on-costs.html
11. Reuters 20th Jan 2016 http://www.reuters.com/article/edf-france-nuclear-idUSL8N1541PE
12. Ecologist 8th Jan 2016 http://www.theecologist.org/News/news_round_up/2986810/edf_may_sell_3bn_stake_in_uk_nuclear_to_fund_hinkley_c.html
13. FT 26th Jan 2016 http://www.ft.com/cms/s/0/2f249254-c451-11e5-b3b1-7b2481276e45.html
14. BBC 27th Jan 2016 http://www.bbc.co.uk/news/business-35415187
15. The Energy Union Questions on Hinkley (in French), CFE-CGC 19th Jan 2016 http://www.cfe-energies.com/dossiers_et_themes/economie_des_entreprises/info_salaries_edf_sa__projet_hinkley_point_c__15_questions_au_conseil_dadministration_dedf
16. Greenpeace 26th Jan 2016 http://energydesk.greenpeace.org/2016/01/26/hardly-anybody-in-france-wants-edf-to-build-hinkley/
17. Times 1st Feb 2016 http://www.thetimes.co.uk/tto/business/industries/naturalresources/article4679035.ece
18. Reuters 2nd Feb 2016 http://uk.reuters.com/article/uk-edf-britain-idUKKCN0VB273
19. EDF Press Release 21st October 2015 http://media.edfenergy.com/r/960/agreements_in_place_for_construction_of_hinkley_point_c

20. Telegraph 26th Jan 2016
http://www.telegraph.co.uk/finance/newsbysector/energy/12123674/Hinkley-Point-go-ahead-delayed-amid-EDF-funding-doubts.html
21. Ecologist 22nd Oct 2015
http://www.theecologist.org/News/news_analysis/2985984/will_hinkley_c_ever_be_built_if_so_china_will_exact_a_very_high_price.html
22. Sunday Times 31st Jan 2016
http://www.thesundaytimes.co.uk/sto/business/energy_and_environment/article1662807.ece
23. Dave Toke's Blog 1st Feb 2016 http://realfeed-intariffs.blogspot.co.uk/2016/02/treasury-ruling-spells-final-end-for.html
24. Dave Toke's Blog 29th Jan 2016 http://realfeed-intariffs.blogspot.co.uk/2016/01/how-rational-choice-theory-explains.html
25. Guardian 28th Jan 2016 http://www.theguardian.com/environment/2016/jan/28/edf-hinckley-point-nuclear-reactor-contractors
26. Ipswich Star 27th Jan 2016
http://www.ipswichstar.co.uk/news/still_no_date_for_sizewell_c_consultation_1_4396265

2. The Impact of a New Reactor Programme on the UK's Radioactive Waste Inventory

The proposed Hinkley Point C nuclear power station would produce radioactive wastes and spent fuel with a radioactivity inventory equal to roughly 80% of the radioactivity in all of the UK's existing radioactive wastes put together.

The nuclear industry and government have repeatedly said the volume of nuclear waste produced by new reactors will be small, approximately 10% of the volume of existing wastes; implying this additional amount will not make a significant difference to finding an underground dump for the wastes the UK's nuclear industry has already created. The use of volume as a measure of the impact of radioactive waste is, however, highly misleading. (1)

Volume is not the best measure to use to assess the likely impact of wastes and spent fuel from a new reactor programme, in terms of its management and disposal. New reactors will use so-called 'high burn-up fuel' which will be much more radioactive than the spent fuel produced by existing reactors. So rather than using volume as a yardstick, the amount of radioactivity in the waste – and the space required in a deep geological repository to deal with it - are more appropriate ways of measuring the impact of nuclear waste from new reactors.

New Reactor Programme to Quadruple Radioactive Waste Inventory

In 2006 the Government's advisory committee – the Committee on Radioactive Waste Management (CoRWM) estimated that a programme of ten new AP1000 reactors would add an amount of radioactivity, to that already held in all nuclear wastes, of 265% - a tripling the inventory of radioactivity. (2)

The latest figures from Radioactive Waste Management Ltd published in July 2015 suggest that waste from the proposed 16GW new reactor programme will be more than quadruple the inventory of radioactivity in the 2010 inventory. (3) The 3.2GW Hinkley Point C project alone would increase the inventory by about 80%; the vast majority of which would be in the intensely hot and radioactive spent fuel.

Another way of looking at the impact of radioactive waste produced by new reactors was presented by the Nuclear Decommissioning Authority (NDA) to the West Cumbria Managing Radioactive Waste Safely Partnership (WCMRSP) in August 2010. (4) The presentation showed that while a 10GW new reactor programme would increase the volume of the total waste by only around 10%, the area of space required by the wastes if emplaced in a deep geological repository in various different rock types could be almost as big, if not bigger, than the area of space required by existing wastes.

The NDA's document looked at the repository footprint of a baseline inventory (total waste expected to be created by the existing programme) and compared this with the repository footprint of an upper inventory which would include waste from four new AP1000 reactors and four new EPRs all operating for 60 years. This 10GW new reactor programme would virtually double the footprint of radioactive waste compared with the footprint of existing waste.

	Baseline Inventory	Upper Inventory
High strength rock	5.6km^2	9.8km^2
Lower strength rock	10.3km^2	19.5km^2
Evaportite	8.8km^2	18.4km^2

Table 1: Repository Footprints.

But this Upper Inventory only allows for a new reactor programme of 10GW. Currently there are proposals to build almost 16GW of new capacity (Hinkley C 3.2GW; Sizewell C 3.2GW; Wylfa 2.76GW; Oldbury 2.7GW; Moorside 3.6GW). Another presentation (5) to the WCMRSP in August 2010 estimated that the repository footprint for a 16GW new reactor programme could almost triple the repository footprint:-

	Baseline Inventory	Maximum Inventory
High strength rock	5.6km^2	12.3km^2
Lower strength rock	10.3km^2	25.0km^2
Evaportite	8.8km^2	24.1km^2

Table 2: Repository Footprint for Maximum Inventory which includes a 16GW New Build programme.

The NDA subsequently said: *"These values seem reasonable as indicative figures at the present time, given the uncertainty over the reactor types that will be used".* (6). These figures show the currently proposed new reactor programme would increase the repository footprint by between 120% and 174%.

The 16GW programme does not allow for the possibility of two 1.15GW Hualong One reactors at Bradwell which would add another 2.3GW of capacity.

Derived Inventory

Radioactive Waste Management Ltd (RWM) has developed a detailed inventory of radioactive waste for disposal in its proposed geological disposal facility (GDF) which it calls the 'Derived Inventory'. This inventory is subject to uncertainty due to a range of factors such as uncertainty about the life of the AGR reactors and what happens to the UK's plutonium inventory, and, of course proposals for new reactors. The Derived Inventory is therefore updated periodically to take into account new information. RWM published a new 2013 Derived Inventory in July 2015. This can be compared with the previous 2010 Derived Inventory to obtain further information about the impact of a new reactor programme. The table below is from an RWM report which does just that. (See http://www.nda.gov.uk/publication/differences-between-2013-and-2010-derived-inventory/)

The 2010 inventory showed a derived inventory (2010 DI) which did not include any spent fuel or other waste from new reactors and an upper inventory (2010 UI) - which did include spent

fuel and wastes from a 10GW new reactor programme. On the other hand the 2013 Derived Inventory has only one inventory which includes spent fuel and waste from a 16GW new reactor programme.

The total activity measured in Terabecquerels (TBq) of the 2010 Derived Inventory, (not including any wastes from new reactors) was 4,770,000 TBq. The total activity given in the 2013 Derived Inventory was 27,300,000 TBq. Not all of this huge increase in activity is down to new reactors. For instance there is a big jump in the activity of legacy spent fuel and 3,700,000 TBq from spent mixed plutonium-uranium oxide (MoX) fuel – a category which does not appear at all in the 2010 inventory. However, 19,793,000 TBq is activity from new reactor wastes and spent fuel. So the activity of radioactive waste from a new reactor programme would be roughly four times the activity in the total 2010 inventory. (7)

Table 5 **Total activities in TBq for each waste and material type at 2200. Data is shown for the 2010 Derived Inventory (2010 DI), 2010 Upper Inventory (2010 UI) and 2013 Derived Inventory (2013 DI)**

Waste category	2010 DI	2010 UI	2013 DI
HLW	1,170,000	2,190,000	1,090,000
Legacy ILW	388,000	580,000	372,000
LLW	6.31	70.7	2.48
Legacy SF	1,920,000	315,000	2,270,000
DNLEU	7,910	9,510	8,370
HEU	3.10	54.4	53.8
Pu	1,280,000	1,840,000	43,700
New build ILW	-	104,000	793,000
New build SF	-	14,100,000	19,000,000
New build DNLEU	-	3,800	-
MOX SF	-	-	3,700,000
Total	4,770,000	19,100,000	27,300,000

1. For example, Dr Peter Bleasdale who went on to become Managing Director of the National Nuclear Laboratory said: "Already there are significant volumes of historic wastes safely stored, and a programme of new reactors in the UK will only raise waste volumes by up to 10%." BBC 13th May 2008 http://news.bbc.co.uk/1/hi/sci/tech/7391044.stm
2. CoRWM (17th January 2006) Inventory Summary Information , Doc 1531 http://webarchive.nationalarchives.gov.uk/20130503173700/http:/corwm.decc.gov.uk/assets/corwm/pre-nov%202007%20doc%20archive/plenary%20papers/2006/25%20-%2026%20january%202006/1531%20-%20inventory%20summary%20information.pdf
3. Geological Disposal: An overview of the differences between the 2013 Derived Inventory and the 2010 Derived Inventory, RWM Ltd July 2015 http://www.nda.gov.uk/publication/differences-between-2013-and-2010-derived-inventory/

4. See pages 5 to 12 of Geological Disposal Inventory presentation to West Cumbria Managing Radioactive Waste Safely Partnership: Issue 2 November 2010 http://www.westcumbriamrws.org.uk/documents/88.2-Inventory_presentation_to_West_Cumbria_MRWS_Partnership_Issue_2.pdf
5. Higher Level Radioactive Waste: Likely inventory range; the process for altering it; how the community might influence it and understanding the implications of new nuclear build. Presented to West Cumbria Managing Radioactive Waste Safely Partnership, by Pete Roche, 5th August 2010 2nd Version with reactions to NDA responses http://www.nuclearwasteadvisory.co.uk/wp-content/uploads/2011/05/Inventory_presentation_to_WCMRWS_Aug2010.pdf
6. See pages 13 to 14 of Geological Disposal Inventory presentation to West Cumbria Managing Radioactive Waste Safely Partnership: Issue 2 November 2010 http://www.westcumbriamrws.org.uk/documents/88.2-Inventory_presentation_to_West_Cumbria_MRWS_Partnership_Issue_2.pdf
7. Geological Disposal: An overview of the differences between the 2013 Derived Inventory and the 2010 Derived Inventory, RWM Ltd July 2015 http://www.nda.gov.uk/publication/differences-between-2013-and-2010-derived-inventory/

3. Wylfa Warning

Hiroaki Nakanishi, chairman and chief executive of the Japanese company Hitachi has raised concerns about funding of the Wylfa Newydd project with the UK foreign secretary. He warned that the debacle surrounding the construction of Hinkley Point nuclear plant throws up "*very serious concerns*" about its own investment in the UK.

Horizon is in talks with the Government to ensure the Wylfa deal presents value for money for both sides, and negotiating with the Department of Energy and Climate Change (DECC) on the strike price for electricity produced. (1)

Horizon started the next stage of public consultation on its proposed Wylfa Newydd power station on Anglesey on January 25, with a series of events set to take place throughout spring. The first stage of consultation was conducted in 2014, but the plans have changed considerably since then, so the Company is updating its information. It wants feedback by 24th March 2016. Another, larger, consultation will follow later this year. (2) The consultation website is here: http://consultation.horizonnuclearpower.com/stage-2/home

1. Telegraph 30th Jan 2016 http://www.telegraph.co.uk/finance/newsbysector/energy/12128405/Hinkley-Point-nuclear-fiasco-spooks-Hitachi-boss.html
2. Utility Week 12th Jan 2016 http://utilityweek.co.uk/news/Horizon-sets-date-for-next-stage-of-consultation-on-Wylfa-Newydd/1204442

4. Moorside application for offshore investigations

In early December last year NuGen submitted its application to the Marine Management Organisation (MMO) for a licence to undertake offshore geotechnical investigations within West Cumbria's inshore waters. The application is in support of its plans to build three AP1000 reactors at Moorside. The focus of the investigation will be the location for the sub-seabed tunnels required for the reactors' cooling water intake and outlet systems. The £20m contract for the work, which also includes onshore site investigations, was awarded last year to Dutch company Fugro. The company, with a major involvement in oil and gas extraction (including fracking) and relatively little experience in the nuclear field describes itself as providing geotechnical, survey, subsea and geosciences services.

The offshore work is scheduled to start on 29th February 2016 and will involve the drilling of some 40 boreholes each between 34 metres to 92 metres in depth, with an expected average depth of 70 metres. Disturbance to sediments which contain plutonium, americium and a cocktail of other radioactive elements leads not only to their spread in local waters but also to their being driven ashore where particles can be re-suspended and blown inland.

NuGen however believes that the amount of radioactive sediment that will be disturbed by the borehole drilling and core extraction will be 'small' and no bigger than 'storm background levels' and therefore proposes to take no mitigation measures. Such a proposal is likely to be treated with a similar level of scepticism to that given to the pronouncement made many decades ago by the then Windscale site that its radioactive discharges to the Irish Sea would safely disperse into the wider oceans.

1. CORE 17th Jan 2016 http://www.corecumbria.co.uk/newsapp/pressreleases/pressmain.asp?StrNewsID=364

5. Towards 100% Renewables

As Shadow Secretary of State for Energy and Climate Change, Lisa Nandy, re-iterates the myth that nuclear power is an "*important as part of the energy mix* [if] *we're going to meet the commitments we made in Paris*" we investigate how the UK could move to a 100% renewable energy system. Although Nandy says she is not happy with the Hinkley deal she says "*we know we will need nuclear power as part of the mix*", but is she right? (1)

The argument seems to be that renewables are fine up to a point, but they can't provide baseload power and so we can never move to a system based on 100% renewables – this couldn't reliably power a modern industrial society. Since we need to phase out the use of fossil fuels to combat climate change we need nuclear power to provide some baseload.

The reality is that baseload power as a concept is obsolete. And a system powered 100% by renewables supported by a backbone of electricity storage, smart grid technology and management, energy efficiency, and 21st century technology is feasible now. In fact, not only is it feasible, but strong market and social forces mean that such a system is increasingly the only kind of system that makes any sense. As Rainier Baake, Germany's minister in charge of the Energiewende, points out, solar and wind have already won the technology race. (2)

100% is Possible

Mark Jacobson of Stanford University and Mark Delucchi of the University of California have spelled out how 139 countries can each generate all their energy needs from renewables by 2050. The 139 national blueprints they have produced include the UK. (3)

Former Labour MP, Alan Simpson says anyone even glancing towards tomorrow knows that its energy systems will be smarter, quicker, lighter, more adaptive and more interactive than anything we have today. That means that energy systems will not be designed around big centralised power stations. They may not revolve around power stations at all. The energy we don't use (and the energy we store) will become at least as important as the energy we consume. Energy security will be found, and financed, in a myriad of different ways. The Government's plans for 19GW of new nuclear power stations will saddle Britain with an energy investment programme at a cost that will sink the country rather than save it. (4)

When renewables become the dominant source of power, baseload power stations get in the way because they have to operate as close to full-time as possible and cannot power up or down quickly. These old-fashioned plants are not merely a problem, they become an obstruction. Instead, it is necessary to have power sources whose power can be adjusted up and down quickly.

In NuClear News No.73, April 2015 (5) we discussed Intermittency, baseload, energy security and 100% renewables. We argued that what a renewable system needs is not baseload but flexible back-up which can be turned on and off quickly to provide electricity at peak times when renewables are not producing much. There are at least five ways this can be done:-

1. By using the right mix of renewables intermittency can be reduced;

2. By increasing grid connections to other countries so that electricity can be imported at peak times when indigenous renewable production is low, and so that surpluses can be exported;

3. By storing surplus renewable electricity which can be called upon when wind and solar production is low;

4. Demand management – using various techniques to reduce demand at peak times;

5. By calling on combined heat and power stations working in conjunction with heat storage to generate electricity at peak times.

It is not just former left wing Labour MPs who are saying the old centralised electricity system is dying. According to UBS Bank, "*Large-scale power generation … will be the dinosaur of the future energy system: Too big, too inflexible, not even relevant for backup power in the long run*." (6) Large baseload power stations, such as nuclear and large coal-fired power stations are not flexible because they are hard to turn on and off. So building more baseload power stations would actually undermine moving towards a clean energy future. It would simply mean that during peak times when renewables are supplying lots of electricity, some of that power will go to waste. (7)

It used to be thought that replacing large centralized power stations with renewables would jeopardize the electricity grid's reliability. But now several major countries have demonstrated that there really are no limits to renewable integration. Last year a Bloomberg Business piece aptly headlined, "*Germany Proves Life With Less Fossil Fuel Getting Easier*" pointed out that Germany experiences just 15 minutes *a year* of outages, compared with 68 minutes in France and more than four hours in Poland. (8) Renewables currently deliver 28 percent of Germany's total grid power (and up to 40 percent in some regions). Lead energy specialist at the World Bank, Morgan Bazilian, told *Bloomberg* after 20 years studying this issue, "*Very high levels of variable renewable energy can be accommodated both technically and at low cost*." There are two primary ways the intermittency challenge posed by solar and wind power is being addressed today.

First, half or more of the "intermittency problem" is really a "predictability problem." If we could predict with high accuracy wind availability and solar availability 24 to 36 hours in advance at a regional level, then electricity operators have many strategies available to them. For instance, operators could plan to bring online a backup plant that otherwise needs several hours to warm up. An even cheaper way to fill the gap from clouds or a lull in winds is to use "demand response," which involves paying commercial, industrial, and even residential customers to reduce electricity demand given a certain amount of advance warning.

A second way to deal with the variability of wind and solar photovoltaics is to integrate electricity storage into the grid. That way, excess electricity when it is windy or sunny can be stored for when it isn't. The biggest source of electricity storage on the grid today is "pumped storage" at hydroelectric plants. In NuClear News No.78 (Baseload Renewables?) we reported on research by Professor Phil Taylor of Newcastle University and Dave Holmes of the Quarry Battery Company show that by building 10GW of Pumped Hydro Energy Storage instead of 10GW of offshore wind and back-up fossil fuels, we could save £3.6bn and reduce carbon dioxind emissions by 5 million tonnes,

What happens when the sun doesn't shine?

Asked what happens when the sun doesn't shine, Professor Keith Barnham, author of *The Burning Answer*, says "*the short answer is that the wind is usually blowing*". PV power and wind tend to be complementary. But the fact that these two renewable sources of power are intermittent it doesn't necessarily mean that a 100% renewable energy system would need lots of back-up batteries. A large-scale experiment, called Kombikraftwerk, started in Germany on 1st January 2006. This is a computer model which uses actual real time power output from a number of wind, PV and biogas electricity generators. The experiment worked – electrical power demand matched the electricity power supply throughout the year. The model showed that the actual output of wind and biogas generators was able to cope with the 7pm winter evening peaks. (9) The biogas electricity generators are crucial here – they are able to increase and decrease output in minutes to match increases in demand or a drop in the amount of electricity generated by wind. The contribution from PV is different with peaks every day within an hour or so of noon. This is around the time of peak daytime electricity demand in the UK and Germany anyway.

Another very significant result from the Kombikraftwerk experiment was that wind and PV supplied around 78% of the power. The main back-up was biogas generators, but these only had to supply around 17%. There was some pumped hydro storage capacity, but only 5% was required over 2006. (10)

Storage Advances

The Renewable Energy Association says 2016 is going to be the breakthrough year for energy storage and the growth of decentralised energy in the UK. Despite a total of 13 'sudden and severe' changes to the Government's green energy policies since the 2015 general election – which have created significant uncertainty in the UK renewables industry – a new independent report by KPMG for the REA says that '*we could enter an era of continued green growth and domestic decentralised energy production'*. The report *Development of decentralised energy and storage systems in the UK* – details that energy storage is a valuable and previously missing component in the movement towards a decentralised, consumer focused and low carbon energy system. (11) Substantial reductions in the cost of storage technologies have brought forward the anticipated timeframe for their deployment, the report points out. It finds that grid-scale projects, such as those recently announced by RES or completed by AES are already economic, but facing significant regulatory issues, including short contract lengths for balancing services and 'discriminatory' charges' for grid connection. These could be relatively easily solved by more effective Government regulation, the report says. The research also found that energy storage can already be economic for domestic homes with solar PV panels installed and Feed-in Tarriff subsidies. (12)

Renewables too expensive?

Another concern seems to be that renewables are too expensive. But solar PV electricity has already achieved grid parity in Italy and Germany. According to researchers at Oxford University, solar power costs are tumbling so fast the technology is likely to fast outstrip mainstream energy forecasts. (13)

The Burning Answer shows that renewable alternatives to Hinkley Point C are cheaper, have a lower carbon footprint and can be built much faster. (14)

1. Carbon Brief 3rd Feb 2016 http://www.carbonbrief.org/the-carbon-brief-interview-lisa-nandy
2. Green World 2nd Feb 2016 http://safeenergy.org/2016/02/02/the-verdict-is-in/
3. Scientific American 19th Nov 2015 http://www.scientificamerican.com/article/139-countries-could-get-all-of-their-power-from-renewable-sources1/ Plan for the UK https://100.org/wp-addons/maps/embed-large.html#826 Also see Science Alert 20th Nov 2015 http://www.sciencealert.com/here-s-how-139-countries-could-run-on-100-wind-solar-and-hydro-power-by-2050
4. After Ozymandias: -will Labour miss the energy revolution? Alan Simpson, March 2015 See http://www.michaelmeacher.info/weblog/2015/03/what-the-3-main-parties-arent-telling-you-a-radical-way-out-of-austerity/
5. http://www.no2nuclearpower.org.uk/nuclearnews/NuClearNewsNo73.pdf
6. Will solar, batteries and electric cars re-shape the electricity system? UBS Global Research 20th August 2014 http://knowledge.neri.org.nz/assets/uploads/files/270ac-d1V0tO4LmKMZuB3.pdf
7. Clean Technica 4th Feb 2015 http://cleantechnica.com/2015/02/04/big-expensive-power-plants-undermine-clean-energy-future/
8. Bloomberg 13th April 2015 http://www.bloomberg.com/news/articles/2015-04-12/germany-proves-life-with-less-fossil-fuel-getting-easier
9. Climate Progress 1st Feb 2016 http://thinkprogress.org/climate/2016/02/01/3743082/renewables-revolution/
10. As well as Barnham, K The Burning Answer: A User's Guide to the Solar Revolution, Weidenfeld & Nicolson, 2014, pages 153-6 also see Barnham, K et al Energy Policy 54 (2013) 385-390
11. Scottish Energy News 21st Jan 2016 http://www.scottishenergynews.com/renewables-report-identifies-new-hope-for-battered-uk-battery-storage-power-sector/
12. Edie 20th Jan 2016 http://www.edie.net/news/8/REA-Energy-storage-already-financially-viable-for-grid-and-homes/29627/
13. Guardian 26th Jan 2016 http://www.theguardian.com/environment/2016/jan/26/solar-panel-costs-predicted-to-fall-10-a-year
14. Ecologist 8th July 2015 http://www.theecologist.org/News/news_analysis/2939971/safe_low_carbon_inexpensive_the_renewable_alternatives_to_fracking.html

6. Nuclear Waste Notes

On Valentine's Day 2014 a drum of packaged waste from the Los Alamos National Laboratory (LANL) ruptured 2,150 feet (655 metres) underground in New Mexico's nuclear waste repository known as the Waste Isolation Pilot Plant (WIPP) which is carved from ancient salt beds. The incident was described as a heat-generating chemical reaction – the US Department of Energy (DOE) called it a deflagration rather than an explosion. Explosion or not, the chemical reaction compromised the integrity of a barrel and spread contaminants through more than 3,000 feet of tunnels, up the exhaust shaft, into the environment, and to air monitoring equipment approximately 3,000 feet north-west of the exhaust shaft. The accident resulted in 21 workers receiving low-level internal radiation exposure. (See NuClear News No.69)

It later transpired that LANL had improperly packaged hundreds of waste drums with a combustible mix of nitrate salts – a byproduct of nuclear weapons production – and organic cat litter, causing a hot reaction in one drum that cracked the lid. The rupture released americium and plutonium into the deep salt mine and, in small amounts, into the environment. (1)

The repository is still closed two years later, and a March 2016 date for re-opening has been pushed back to later this year.

"These accidents during the first 15 years of operation really illustrate the challenge of predicting the behavior of the repository over 10,000 years," said Rod Ewing, the Frank Stanton Professor in Nuclear Security at Stanford and a senior fellow at the Center for International Security and Cooperation. The Stanford experts also suggest more attention should be paid to how the buried materials may interact with each other, particularly with salty brine, over centuries. A single storage drum may contain a variety of materials, such as lab coats, gloves and laboratory instruments; thus, the chemistry is complex. Ewing said that the complacency that led to the accidents at WIPP can also occur in the safety analysis. Therefore, he advises, it is important to carefully review the safety analysis as new proposals for more plutonium disposal are considered. (2)

Now, 500 metres beneath the forests of northern Germany, in an old salt mine, another nightmare is playing out, according to Fred Pearce in the *New Scientist*. Enough plutonium-bearing radioactive waste is stored here to fill 20 Olympic swimming pools. When engineers backfilled the chambers containing 126,000 drums in the 1970s, they thought they had put it out of harm's way forever. But now, the walls of the Asse mine are collapsing and cracks forming, thanks to pressure from surrounding rocks. So the race is on to dig it all up before radioactive residues are flushed to the surface. It could take decades to resolve. In the meantime, excavations needed to extract the drums could cause new collapses and make the problem worse. (3)

Some 300,000 cubic metres of low and intermediate-level waste, including the waste dug from the Asse mine, is earmarked for final burial at the Konrad iron mine in Lower Saxony. But Germany still has no plan for dealing with high-level waste and spent fuel. Later this year, a Final Storage Commission of politicians and scientists will advise on criteria for choosing a site where deep burial or long-term storage should be under way by 2050. But its own chairman,

veteran parliamentarian Michael Muller, says that timetable is unlikely to be met. "*We all believe deep geology is the best option, but I'm not sure if there is enough* [public] *trust to get the job done*," he says. Many anti-nuclear groups are boycotting the Commission. The problems at the Asse salt mine have led to further distrust of engineers and their solutions.

The problems at Asse became public knowledge in 2008. Despite hurried backfilling of much of the mine, the degradation continues. Brine seeps in at a rate of around 12,000 litres a day, threatening to flush radioactive material to the surface. In 2011, the Federal Office for Radiation Protection (BfS) ruled that the waste had to be removed. But this is likely to take decades. Just checking the state of the 13 chambers holding the waste drums is painfully slow. Engineers drilling to reach them through 20 metres of rock don't know whether the drums have leaked, and of course they cannot risk a release of radioactivity. And unless care is taken to keep clear of the geological barrier, the excavations risk allowing more water in, and flooding of the mine can't be ruled out. Nothing will be moved until at least 2033. Meanwhile the bill keeps rising. It costs €140 million a year just to keep the mine safe for work to continue. The final bill will run into many billions. Is it worth it? Many experts fear that digging up the drums, with consequent risks of radioactive leaks, could create a much greater hazard than leaving them where they are.

Meanwhile at least 1 worker has been killed and another injured in tunnel collapse at France's planned nuclear waste repository at Bure, in northeastern France. Scheduled for an authorization decree in 2018 and industrial commissioning in 2025, the facility – if approved – is expected to bury France's highly-radioactive nuclear waste. The project, estimated to cost €25 billion ($27 billion), is awaiting the government's final investment decision, but testing works with deep shafts and some future installations have already begun at the site. (4)

1. Albuquerque Journal 19th October 2015 http://www.abqjournal.com/661954/news/safety-top-dog-in-new-wipp-culture.html
2. Stanford News 15th Jan 2016 http://news.stanford.edu/news/2016/january/waste-nuclear-material-011516.html and Nature 13th Jan 2016 http://www.nature.com/news/policy-reassess-new-mexico-s-nuclear-waste-repository-1.19135
3. New Scientist 29th Jan 2016 https://www.newscientist.com/article/2075615-radioactive-waste-dogs-germany-despite-abandoning-nuclear-power/
4. Cumbria Trust 27th Jan 2016 https://cumbriatrust.wordpress.com/2016/01/27/at-least-1-killed-in-tunnel-collapse-at-frances-planned-nuclear-waste-storage-site/

7. Progress on Small Modular Reactors as renewables head off the cliff

In response to a letter about energy policy in *The Times* on 26th January 2016, Energy and Climate Change Secretary Amber Rudd listed the top 10 things the government is doing to secure investment in clean secure energy. Besides committing to Hinkley Point C, Rudd also mentioned spending £250m for nuclear innovation and Small Modular Reactors. (1) Oddly enough there was no mention of the rest of the 19GW of new reactors proposed - (up from 16GW now that Bradwell B has been added to the theoretical list).

Now a study by the UK's National Nuclear Laboratory (NNL) has confirmed that NuScale Power's small modular reactor (SMR) has the capability of using mixed uranium-plutonium oxide (MOX) fuel in addition to conventional light water reactor fuel. (2)

UK Energy Secretary Amber Rudd told Parliament in November 2015 that SMRs have "excellent" potential and that the current government "is doing as much as it can" to support the technology. To that end it announced £250m funding over the next five years for nuclear research and development including a competition to identify the "*best value small modular reactor design for the UK*." The UK is doubling funding for the Department of Energy and Climate Change's (DECC's) energy innovation program to £500m over five years, including research into SMRs. (3)

Both NuScale (part of Fluor) and Westinghouse are hoping to build their first-of-a-kind SMRs in the UK by 2025. But the real challenge will be to get enough orders so they can build factories to turn out SMRs on a cost effective production line basis. There isn't enough of a market within the UK itself to generate these orders. Both firms see the UK as a launch pad to gain market share in Europe and the Middle East.

The UK wants to develop a major export market for SMRs. Everything depends on both NuScale and Westinghouse passing through the gauntlet of the UK's notoriously complicated and expensive generic design review process to certify the safety of their reactors. Both firms have made optimistic estimates of how long this will take. In order to break ground by 2025 a new land speed record for bureaucratic action will have to be achieved.

NuScale plans to submit its 50-megawatt reactor design for approval by U.S. nuclear authorities towards the end of 2016. That would leave it well-placed to seek the U.K. equivalent, called Generic Design Assessment, in 2017. (4)

Meanwhile, Britain's renewable energy industry is about to "fall off a cliff" just at the point it was coming into its own according to The Independent reveals. The dour forecast comes as the industry celebrated a record-breaking year in 2015, with billions of pounds poured into solar and wind energy and more homes powered by nature than ever before. But experts have warned this is all about to grind to a halt as the Government abandons its commitment to green energy and instead invests in fracking and nuclear power. Figures from Bloomberg forecast that over the next five years the country will lose at least 1 gigawatt of renewable energy generation

– enough to power 660,000 homes. After 2020, the new renewables infrastructure will collapse to almost nothing because of a lack of investment and the blossoming industry could wither, the figures suggest. (5)

1. DECC 26th Jan 2016 https://www.gov.uk/government/news/what-the-government-is-doing-to-secure-investment-in-clean-secure-and-affordable-energy
2. Power Engineering 20th Jan 2016 http://www.power-eng.com/articles/2016/01/uk-study-shows-nuscale-smr-can-use-mox-nuclear-fuel.html and World Nuclear News 21st Jan 2016 http://www.world-nuclear-news.org/WR-Study-confirms-NuScale-reactors-MOX-capability-2101164.html
3. Energy Post 21st Jan 2016 http://www.energypost.eu/uks-plan-become-global-centre-small-nuclear-reactors-can-succeed/
4. Bloomberg 18th Jan 2016 http://www.bloomberg.com/news/articles/2016-01-18/mini-nuclear-plants-seen-in-u-k-by-2025-fluor-s-nuscale-says
5. Independent 18th Jan 2016 http://www.independent.co.uk/news/uk/home-news/britains-renewable-energy-industry-is-about-to-fall-off-a-cliff-says-new-research-a6818186.html