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1. Hinkley – an enormous error of judgement

The British government and EDF signed the main contract for the new £18 billion Hinkley Point C nuclear power station on 29th September. (1) The Stop Hinkley Campaign branded this "*an enormous error of judgement*" on the part of both EDF Energy and the UK Government.

"*We will be paying the bill for this folly for decades to come. It's a bad deal for consumers; it's a bad deal for Somerset; it's a bad deal for the country and it's a bad deal for the planet*," said Stop Hinkley spokesperson Roy Pumfrey. "*Hinkley Point C will be out-of date long before it generates a single kilowatt, and yet after today we will still have to pay for it*."

"*Most of the Hinkley jobs will be abroad, and meanwhile Somerset will fall behind other parts of the country which have a more forward thinking attitude to renewable energy and the transition to a sustainable energy future".* (2)

"While other parts of the world are making fuel poverty a thing of the past and generating jobs from cheap solar and wind energy, (3) Somerset will be left with a legacy of nuclear waste which we will be expected to look after on the Hinkley site for the next 160 years." (4)

Fortunately, EDF Energy still has a large number of obstacles to overcome.

EDF Energy has said there will no concrete poured until at least mid-2019. This first concrete will depend on the start-up of the reactor at Flamanville which is a similar design, but not scheduled until the end of 2018 – six years late. There are still concerns over the safety of the reactor pressure vessel at Flamanville after the discovery of a high carbon concentration in the steel, leading to lower than expected mechanical toughness values. Tests will continue until the end of this year. (5) The French safety regulator ASN is making no promises about what remedial action might be required. In the worst case scenario the entire project may need to be abandoned. (6)

Secondly EDF doesn't have the money to pay for it. EDF is a company in a very precarious financial situation. It has €37 billion of debt. The collapse in energy prices has pushed earnings down 68% in 2015. The Company needs to spend €50 billion upgrading its network of 58 ageing reactors by 2025. It is scrambling to sell €4 billion of new shares and €10 billion of assets to strengthen its balance sheet. EDF is also expected to participate in the €5 billion bailout of Areva, the bankrupt developer of EPR technology, by taking a 75 per cent stake. (7) About the last thing that it needs is a new €15 billion millstone around its neck. (8) Influential credit ratings agency Standard & Poors (S&P) has downgraded EDF's rating following the Hinkley approval and Moody's credit rating agency has placed its A2 rating on review for a downgrade. (9)

Thirdly there is a legal challenge which needs to be resolved from Austria and Luxembourg, at the European court of justice against the European Commission decision to allow subsidies for Hinkley Point C. (10)

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2. No need for Wylfa

(This document, originally produced for the Nuclear Free Local authorities, is also available here http://www.nuclearpolicy.info/wp/wp-content/uploads/2016/10/NFLA_New_Nuclear_Monitor_No43.pdf)

The NFLA pointed out in its submission of April 2016 (1) that the Overarching National Policy Statement (NPS) on Energy (July 2011) (2), which said that demand for electricity could double by 2050 because of the "*need to electrify large parts of the industrial and domestic heat and transport sectors"*, is in urgent need of review.

Now, seven months later, that review is even more urgent.

Britain is consuming 17% less energy than it was in 1998, (3) and 15% less in 2014 than it was in 2000. (4) Official projections in 2006 were that today's electricity consumption levels would be more than 25% higher than they currently are. Despite our GDP having increased by 18% over the decade, demand for electricity has consistently fallen year on year, largely due to far more efficient usage. (5)

Germany, which is planning an entirely non-nuclear route, even with the same 2050 objective of an 80% reduction in greenhouse gases, expects electricity demand to be 25% below present levels by 2050 – compared with our doubling – by implementing energy efficiency programmes. (6) If, instead of planning for a doubling or tripling of electricity demand by 2050, the UK Government was planning for a reduction of 25%, as in Germany, then the capacity required by 2025 would fall by around 15%, removing the need for new reactors.

And there appears to be plenty of opportunity in the UK to continue reducing energy demand. The Government's own Energy Efficiency Strategy says 196TWh could be saved by in 2020, equivalent to 22 power stations (or 9 nuclear stations the size of Wylfa B) (7) There are 100 TWh of electricity savings available for which there are currently no plans to capture which are detailed in a report for the Government by McKinsey. (8) A crash programme just on lighting efficiency which replaced all the lights in the UK with LEDs could cut peak electricity demand by about 8GW, a saving of about 15% of all power consumption. (9) These are the kinds of cost effective efficiency improvements which drove consultancy Utilitywise to describe Hinkley Point C as an "*unnecessary expense*". In fact energy efficiency improvements could save £12 billion compared to the construction of Hinkley Point C. (10)

Electrifying Heat

The Government appears to favour replacing the use of gas for home heating with domestic-scale heat pumps which partly explains why it expects a doubling of demand by 2050. There have been some very dismissive remarks made about this plan. Iain Conn, Chief Executive of Centrica has called the idea "mad". (11) The Labour Party's former energy team published a pamphlet called the "*Green Gas Book*". The pamphlet points out that electricity distribution networks couldn't cope with the huge fluctuations in demand on a really cold winter's day without extensive upgrading. On top of that every household with gas central heating would have to rip out their boiler and radiators and install a completely new system probably using

ground or air-source heat pumps. This would be extremely expensive for each individual consumer and most people probably couldn't afford it without massive subsidies. And why would we want to ditch the UK's gas distribution grid, developed over many years and only recently upgraded with new pipes anyway? (12)

Jo Abbess in her book "*Renewable Gas: The Transition to Low Carbon Energy Fuels*" agrees that switching from gas to electric heating would put a huge strain on the power transmission and distribution system and entail constructing a large number of new power stations in a short space of time that would only be used for a few months of the year. It would make more sense, given that the UK gas grid currently carries 3 to 4 times more energy than the electricity grid, to convert to renewable gas making good use of the recently modernised gas grid. (13)

A report from a team at Imperial College says heat pumps are currently more expensive than equivalent gas boilers and only perform effectively and economically in well insulated buildings and may require radiators to be changed. And air-source heat pumps do not perform well in cold weather. By contrast the Imperial College team felt that gas heating was more flexible and was supportive of a shift to green gas, and district heating. (14)

The Policy Exchange Think Tank says it has identified significant weaknesses in the Government's approach, particularly the focus on electric heat pumps – it represents an extremely costly way to decarbonise heating. The Government's heat strategy suggests that heat pumps could provide more than 80% of domestic heating by 2050. This could cost in around £200 billion. In addition, an investment of around £100 billion would be required to expand and upgrade the power system to cater for the additional demand for electricity.

Policy Exchange says the Government's strategy has been contested by the energy industry, academics and commentators, who suggest that it would be very expensive and challenging to achieve in practice. Instead the Policy Exchange calls for Government to develop a new heat strategy, based on a more balanced set of priorities and technologies – incorporating substantial improvements in energy efficiency, more efficient gas appliances, greener forms of gas, and alternative heat technologies. It claims this approach could deliver the required reduction in emissions by 2050, but at substantially lower cost to the consumer. (15)

Policy Exchange says energy efficiency could reduce overall domestic heat demand by 20% by 2050. There is still significant potential to improve the efficiency of gas boilers and there is potential to decarbonise gas through the use of greener gases such as biomethane and biopropane, which can be produced from waste and organic matter.

Electricity Demand

Total UK electricity demand was about 360TWh in 2014. Despite the fact that the NPS says that this could reach around 720TWh - by 2050, the latest Government scenarios only envisage increases in demand of between 29.6% and 52.9% by 2050 – taking demand to between 467TWh and 550TWh. (16) Friends of the Earth's September 2012 Plan for Clean British Energy looked at a scenario in which electricity demand reaches around 470TWh. Renewables provided 19.1% of electricity demand in 2014 or around 65TWh In Friends of the Earth's scenario renewables grow to 348TWh by 2030. At the moment it looks as though the UK will

miss its European target which requires us to produce around 30% of our electricity supplies from renewable resources –about 108TWh in 2020 rising to 141TWh in 2030.

Although we don't know yet what level of subsidy Horizon might expect for Wylfa B, with onshore wind and solar projects now going ahead at much lower CfD strike prices than that promised for Hinkley Point C, it looks as though scenarios in which renewables expand much more rapidly than the 33TWh envisaged by the Government for the decade to 2030 will be much more attractive than continuing with nuclear expansion , even when the extra cost of grid balancing to deal with the variability of wind and solar is included. And crucially, offshore wind projects are now set to get a strike price of £85/MWh from 2026 compared with Hinkley's £92.50/MWh at 2012 prices. (17)

The sudden levelling off in the growth in renewables foreseen by the Government in the decade to 2030, compared with the previous decade means the benefits which could have accrued, as deployment grew, from a continuing growth in supply chains and reductions in costs will be thrown away.

Baseload

The Government argues that we need nuclear to provide non-intermittent, low carbon electricity. It says whether or not the sun is shining or the wind is blowing nuclear will provide a secure base load. (18)

However, the concept of baseload power is increasingly being seen as obsolete. Dr Mark Diesendorf, Associate Professor of Interdisciplinary Environmental Studies at UNSW Australia says not only can renewables supply baseload power, they can do something far more valuable - supply power flexibly according to demand which means nuclear power really is redundant. Diesendorf says underlying the claim that we need nuclear power to provide a secure baseload are three key assumptions. First, that baseload power is actually a good and necessary thing. In fact, what it really means is too much power when you don't want it and not enough when you do. What we need is flexible power (and flexible demand too) so that supply and demand can be matched instant by instant. The second assumption is that nuclear power is a reliable baseload supplier. In fact it's no such thing. All nuclear power stations are subject to tripping out for safety reasons or technical faults. That means that a 2.7GW nuclear power station like Wylfa B has to be matched by 2.7GW of expensive 'spinning reserve' that can be called in at a moment's notice. The third is that the only way to supply baseload power is from baseload power stations, such as nuclear, coal and gas, designed to run flat-out all the time whether their power is actually needed or not. That's wrong too. (19)

If the UK really wants baseload power building new nuclear power stations is not the only way. Wind power with 'wind to gas' plant and CCGT gas power stations could do the same - faster, cheaper, more flexibly, and at much lower technical and financial risk, according to a report by Energy Brainpool for Greenpeace Energy. Under their proposal, surplus wind power is used in wind-to-gas facilities first to produce hydrogen (H_2), then convert it to methane (CH_4) which is then fed into the conventional gas distribution system or stored in already existing gas storage facilities and later reconverted into electricity in combined-cycle gas turbine (CCGT) power plants when the need arises. Comparing this system with Hinkley Point C shows a saving of €7.2 billion over 35 years. (20)

Michael Liebreich, CEO of Bloomberg New Energy Finance says: "*…there are plenty of ways of managing intermittency in renewables without resorting to expensive backup power*." (21) In fact, the more we look at how technology and energy markets are likely to develop over the next decade or so, the more we can see that in reality the idea of 'baseload' power is fast becoming obsolete. Variable renewables combined with stronger grids, energy storage and responsive demand can do a better job for less money. The old grid, beholden to massive, centralised baseload power plants, is being replaced by a nimbler, high-tech 21st century system oriented toward variable renewable energy. A grid based on smaller, distributed variable power sources can be just as reliable, and even more resilient and secure, than a grid reliant on baseload power. (22)

What an energy system with an increasing proportion of renewable capacity needs is not large baseload power stations, but flexible back-up which can be turned on and off quickly to provide electricity at peak times when renewables are not producing much. (23) Large baseload power stations, such as nuclear and large coal-fired power stations are not flexible because they are hard to turn on and off – they need to operate continuously 24/7.

What the Government should be asking is not "*how are we going to provide baseload power in future*" but what are we going to do with the expensive electricity from nuclear and other centralised power stations when renewables are supplying lots of electricity at very low or zero marginal cost?

A system powered 100% by renewables supported by a backbone of electricity storage, smart grid technology, demand management, energy efficiency, and 21st century technology is feasible now. In fact, not only is it feasible, but strong market and social forces are moving our energy systems in the decentralised direction very rapidly. As Rainier Baake, Germany's minister in charge of the Energiewende, points out, solar and wind have already won the technology race. (24)

Large centralised power stations are fast becoming the dinosaurs of the energy system. If Horizon Energy continues to cling to the old large-scale, centralised utility business model which is fast becoming obsolete it will put at risk the very existence of its parent companies.

Advanced Boiling Water Reactors

Rhere are only four operable Advanced Boiling Water Reactors (ABWR) in the world – all in Japan. Two more were under construction (Ohma and Shimane 3) at the time of Fukushima. At the time of writing only 3 of Japan's 54 reactors were operating – all of them PWRs.

According to a 2013 paper on Boiling Water Reactors by the National Nuclear Laboratory the average load factor for the for ABWRs is only about 45% making it one of the least reliable reactor types in the world. This is explained as due to the short operating experience – so a bad year skews the load factor disproportionately. There were damaged turbines found at two of the reactors – a problem which it is claimed can be changed in future designs. The load factor was over 80% at two of the reactors before an earthquake in 2007. To summarise the NNL says that none of the problems suggest there are any inherent ABWR-specific problems now that the turbine issues have been resolved. It can be anticipated that ABWR availability in future will be comparable to other modern PWR and BWR designs. (25) Not exactly a ringing endorsement

from a limited operating experience. It might be thought sensible to wait until there is more operating experience before building more reactors of the same type. But it is unclear when any of the Japanese reactors might restart operation if they ever do. (26)

Another two ABWRs were being built in Taiwan at Lungmen. However, the Democratic Progressive Party elected in January 2016 has a policy of phasing out nuclear power by 2025, and writing off the reactors which had been under construction at Lungmen. (27)

There had been plans to build a single ABWR at Visaginas in Lithuania, but the project was declared dead in April 2016 by the former Minister who proposed the project. (28)

In recent elections in the Niigata prefecture where the KashiwazakKariwa reactors are located an anti-nuclear candidate was elected. Ryuichi Yoneyama, who was a political outsider, became the Governor largely on the basis of his vow to keep the nuclear power plant located there shut. A local exit poll in the prefecture for NHK Japan showed that 73% opposed restarting the plant, compared to 27% who supported it. As the site of two of the only four operable ABWRs in the world, this is a significant blow to the project. (29)

As a result there is little commercial sense in developing the ABWR given its lack of a home market in Japan. Whether Hitachi will be able to raise the finance for a reactor-type which cannot find a market in its home country needs to be carefully considered by Horizon Nuclear and the UK / Welsh Governments. A repeat of the delays already seen at Hinkley Point, due to difficulties of securing finance, is more than possible.

Radioactive Waste

Radioactive waste with a radioactive content equal to around 70% of the radioactivity of all the existing UK legacy waste could well remain on-the Wylfa site for 140 years after the closure of the plant – until around the year 2230. (30)

A recent study in the US detailed how a major fire in a spent fuel pond "*could dwarf the horrific consequences of the Fukushima accident*." The author Frank von Hippel, a nuclear security expert at Princeton University, who teamed with Princeton's Michael Schoeppner on the modelling exercise said "*We're talking about trillion-dollar consequences*." (31)

Nuclear Security

The National Audit office recently recognised that nuclear costs have increased in recent years particularly as a result of increasing terrorist threats. (32) The Office for Nuclear Regulation, has also recently expressed concern that "*There are areas where the dutyholder's security arrangements did not fully meet regulatory expectations*." (33)

Europol, the EU's Dutch-based counter- terrorism agency says in its annual report that "*Nuclear power plants and nuclear weapon facilities in the EU also remain potential targets for terrorists*." (34). Yet there is very little information available on security arrangements in the consultation document. It should be noted, however, that the preferred location for the interim long-term store for spent fuel, and intermediate level radioactive wastes – perhaps the most vulnerable part of the proposed site – is right on the edge of the site boundary.

Planning Issues

In September 1976 the Gwynedd County Planning Officer published a report entitled "*The Impact of a Power Station on Gwynedd*". This report looked at evidence from the four big construction projects in the County around that time. Trawsfynydd (1959-63) and Wylfa (1963 -69) – both nuclear power stations - Anglesey Aluminium Smelter (1969 – 71) and the Dinorwig Pumped Storage Scheme (1974-80). He observed that while these projects were going on unemployment only dropped a little.

"*…The completion of the large scale construction schemes in the County has often been followed by a rapid rise in unemployment … The situation is much worse in a period of economic depression since it is difficult to create new jobs for local workers and migrant workers tend to stay in the area, adding to the number of unemployed. The pattern of events is well illustrated by the recent employment history in Gwynedd … Thus, while it is difficult to prove conclusively, the evidence suggests that the long term effect of the major construction schemes in Gwynedd has been to help prevent the growth of employment in more stable industries as a result of the impact of large scale construction projects on low wage levels and labour supply*". (35)

In other words past experience suggests that building a new nuclear power station in a remote area like Anglesey could have a detrimental effect on employment in the long term. Local companies cannot compete with the high wages offered on construction projects, so even if these projects are required to hire as much local labour as possible, rather than importing skills from outside, the projects can still have a detrimental effect. High wages on construction projects can hasten the decline of local companies. Perhaps more serious, in an area where a construction project is creaming off skilled and unskilled workers by offering high wages, this will act as a deterrent to new firms moving into the area. (36)

The overall workforce for the project is anticipated to peak at 10,720 in the last quarter of 2022. The construction Worker Accommodation Strategy expects to see 4,700 construction workers living in new-build permanent housing, empty homes brought back into use, and purpose-built Temporary Workers' Accommodation.

The total population of Anglesey is only around 68,600. So the influx of construction workers could amount to around 15% of the existing population.

There needs to be an assessment carried out of ways to avoid a large increase in unemployment on the Island as numbers of construction workers required tails off.

Welsh Language

At the peak almost 8,000 of the workforce are likely to be from outside the travel to work area so are likely to be non-Welsh speakers. Horizon is reported to have said that the language measures contained in the proposed Gwynedd and Anglesey Local Development Plan (LDP) are "*too restrictive*", and that failing to make changes could jeopardise the Wylfa Newydd. The LDP says that councils could refuse developments which would cause "*significant harm to the character and language balance of a community*". Horizon has asked for the measure to be deleted from the final plan.

Bringing in 8,000 construction workers from outside the travel to work area is going to put the language under severe pressure. The Welsh Language Commissioner does not agree with Horizon's views that the policy is not consistent with the guidance in relation to the Welsh language in planning. (37) Horizon has been forced to admit that it has "*made a bit of a mess of communicating*" its policies regarding the Welsh Language. The Welsh Language Society said this appears to confirm the negative effect Wylfa B will have on the Welsh language:

"*It's also got to be asked: if they can't even communicate clearly and honestly with the public, why should we trust them to run a nuclear power station?*" (38)

Concerns were compounded when the Planning Inspectorate arranged a public meeting at Llangefni without proper translation facilities. (39)

In the Welsh Language Impact Assessment Interim report Summary under the heading "*Effects of the Projects on the Welsh Language*", there are five bullet points. Only one of these is negative:

"*In-migration of non Welsh-speaking construction workers into local communities will have an adverse effect on the Welsh language and culture by reducing the proportion of Welsh speakers in a community*."

However, no consideration appears to have been given to the impact on the language after the project has been completed. Evidence from earlier large scale projects in the area suggests that the long term effect of the major construction schemes helps to prevent the growth of employment in more stable industries. The combination of a sudden drop in income for the area and non-Welsh speaking construction workers who decide to remain in the area after the project has finished could have a devastating effect.

Conclusion

A power station that is not required, which is proposing to use one of the worst performing reactor types in the world will be putting a unique Welsh speaking community at risk not only by reducing the proportion of welsh speakers in the community, but also by locating within it nuclear waste with a radioactive content equivalent up to around 70% of the UK's existing legacy waste for the next 200 years. A major accident or terrorist incident which caused a spent fuel fire could have devastating consequences for large parts of Britain and Ireland.

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3. Brexit and Nuclear Waste Management

As we all know there is a huge amount of uncertainty surrounding Brexit. The primary legislation governing the nuclear sector in the European Union is the Euratom Treaty. All EU Member States are automatically obliged to be part of the EURATOM treaty, which promotes the development of nuclear power throughout the EU. But the Euratom Treaty is a standalone treaty, so there is some uncertainty over whether triggering Article 50 for the UK to leave the European Union will automatically trigger the UK's exit from the Euratom Treaty.

Although other European communities were merged in 1993 (by the Maastricht Treaty) and 2009 (by the Lisbon Treaty) Euratom is legally distinct from the European Union, and has remained largely unchanged since 1957 – mainly because of the sensitivity about nuclear power amongst the European public. The European Coal and Steel Community was allowed to expire in 2002. So there is an argument that it is time to look at reforming or even scrapping the Euratom anyway.

The European Economic and Social Committee (EESC) (a body designed to strengthen the democratic legitimacy and effectiveness of the European Union by enabling civil society organisations from the Member States to express their views at European level) - says it has consulted the European Commission and been told that Brexit will automatically lead to a UK exit from Euratom. In other words when the UK triggers article 50 this will also apply to Euratom membership as well. (1)

On the other hand the European nuclear lobby group – Foratom – thinks the UK may decide to negotiate to remain a member (or agree some form of associate membership). The EU has numerous associate agreements with other countries. For instance Switzerland is an associate member of Euratom and the Ukraine has joined the Euratom Research and Training Programme. So, it remains to be seen exactly what the UK's future relationship with Euratom will be. A blog on the Euractiv website goes even further saying that the idea that Euratom is included in the exit clause of the Lisbon Treaties is false. (2)

However, it does seem to be generally agreed that when the UK Government triggers Article 50 to exit the European Union, this will also trigger our exit from the Euratom Treaty. But. of course, as the Office for Nuclear Regulation in particular will stress, much of our regulation of nuclear safety and waste management comes from an International Framework as well as a European Framework.

Under the Euratom Treaty the European Commission is able to deal with Nuclear Safety; Radioactive Waste & Decommissioning; Radiation Protection; Nuclear Fusion Research; Regulating the proper use of nuclear materials – safeguards; Nuclear Security and Nuclear Fuel Supply.

The original purpose of the Euratom Treaty or the European Atomic Energy Community was to create a specialist market for nuclear power in Europe, develop nuclear energy and distribute it to member states. It provides a mechanism for providing loans to finance nuclear projects in the EU. In the preamble to the treaty, the signatories: *"…resolved to create the conditions necessary*

for the development of a powerful nuclear industry." So its purpose is unambiguous. It is a pro-nuclear treaty. And like the Non-Proliferation Treaty, the Euratom Treaty aims to prevent nuclear materials intended for civilian use being diverted for military purposes, but it has the contradictory aim of promoting the development of nuclear power amongst member states. Euratom also promotes standardised safety standards for workers and the public. So it promotes and regulates nuclear power – a dangerous contradiction.

It is an undemocratic institution and the European Parliament is almost entirely excluded from decision-making,

Hans-Josef Fell, president of the Energy Watch Group and a former member of the German parliament for the Greens is keen for the UK's exit from Euratom to be seen as an opportunity. He says it's a clear sign that it is possible for anti-nuclear countries like Austria, Ireland and Germany to unilaterally leave the Treaty – even a unique chance to dissolve Euratom. He says the core task of Euratom is to support the nuclear industry. After Chernobyl and Fukushima ending this support is long overdue. (3)

PINC – a nuclear illusory programme

One way the Commission continues to promote nuclear power is by regularly publishing an illustrative nuclear programme or (PINC), which it is required to do under the Treaty. This indicates, in particular, nuclear energy production targets and the investment required for their attainment. The latest draft Nuclear Illustrative Programme, PINC 2016, was unveiled in April 2016. It is the sixth presented under article 40 of the Euratom Treaty since 1958, and the first to be published since the Fukushima-Daiichi nuclear disaster in 2011.

Nuclear power has been declining and increasingly losing out against rapidly expanding renewables, but this trend is not even reflected in PINC 2016. The growing role of renewables in Europe and how it challenges the role of nuclear power in EU energy policy is not even discussed in PINC 2016.

No new reactors have come on line and no new construction has been started since PINC 2007, while there are 21 fewer reactors operating. Yet the Commission uses very ambitious and seemingly unrealistic targets which envisage maintaining most European nuclear capacity up to 2050, using a combination of new reactors and a huge programme of plant lifetime extensions. There are 129 nuclear power reactors in operation in the EU across 14 Member States. 10 of those states are planning to build new-build reactors Assuming 90% of the existing fleet is replaced between now and 2050 to maintain a nuclear capacity of between 95 and 105 GWe this would require an investment of EUR 350-450 billion. (4)

No real lessons are drawn, for instance, from the financial disasters of EPR projects in Olkiluoto or Flamanville or the obstacles to the investment decision regarding Hinkley Point C. According to a report for the European Green MEPs by WISE Paris the Commission appears to underestimate by more than half the possible costs for decommissioning and waste disposal, and it underestimates the costs and challenges of a programme of reactor life extensions. In conclusion WISE says: *"The investment needs presented by PINC 2016 are a groundless mix of underestimated costs applied to overestimated projections."* (5)

The EESC has also criticised PINC 2016. The Committee is required by the Euratom Treaty to give its opinion on such plans before they are finalised. It released its opinion in September. This said PINC 2016 fails to address key issues faced by EU nuclear energy, including the competitiveness of nuclear, its investment needs in the context of the EU's Energy Union goals and the speed at which new technologies may be rolled out. It calls for better national coordination between Member States, improved cooperation between stakeholders and greater transparency and public participation in nuclear issues should be given priority. (6) The Committee would also like to see further references being made to extensive work on off-site and cross-border preparation for emergencies and responses to potential terrorist threats, the implications of the Brexit vote and a road map illustrating nuclear fusion progress should also be covered by the Commission document. (7)

Radioactive Waste Disposal.

The European Council adopted a new Radioactive Waste and Spent Fuel Management Directive in 2011 intended to regulate the safe management of radioactive waste. According to the Energy Commissioner at the time Günther Oettinger: "*After years of inaction, the EU for the very first time commits itself to a final disposal of nuclear waste. With this directive, the EU becomes the most advanced region for the safe management of radioactive waste and spent fuel*." Council Directive 2011/70/Euratom of 19 July 2011 establishes "*a Community framework for the responsible and safe management of spent fuel and radioactive waste*". (8)

The Directive imposes strict obligations on member states – they are required to draw up national programmes for the construction of modern disposal facilities, including a timetable, costs assessment and description of activities to be used in waste management. The UK's first report on this was to be presented to the Commission in August 2015 and must be updated regularly. (9)

According to CoRWM for a country like Scotland that does not intend to pursue Geological Disposal it would still need to produce a plan for Geological Disposal. (10) So concerns were expressed in response to a European Commission consultation which closed in May 2010 that the Directive would force all member states to use Deep Geological Disposal as the main means of managing Higher Activity Wastes - preventing Scotland from implementing its near surface, near site radioactive waste policy. (11)

Access to Research

The Joint Research Centre is the European Commission's science and knowledge service; The JRC's *nuclear work*, funded by EURATOM Research and Training Programme – focuses on nuclear safety and security; In recent years the UK has benefited from grant funding from the Joint Nuclear Research Centre. Brexit could mean such funding is withdrawn and that new arrangements will possibly have to be agreed regarding, for instance, the Joint European Torus project based at Culham.

A JRC report was quite influential in the production of the Nuclear Waste Advisory Associates "Issues Register" on Deep Geological Disposal. This detailed over 100 issues which need to be resolved before considering deep geological disposal of radioactive waste. (12) On this occasion research by JRC played a valuable role by showing how much we don't know. Whatever the

policy for managing radioactive waste there are huge benefits to be gained from working and sharing research with partners in other European countries.

Basic Safety Standards Directive

Article 2 of the Euratom Treaty provides for the establishment of uniform safety standards to protect the health of workers and of the general public. Article 30 of the Euratom Treaty defines "basic standards" for the protection of the health of workers and the general public against the dangers arising from ionising radiations.

These Basic Safety Standards have recently been revised to take into account new recommendations from the International Commission on Radiological Protection (ICRP), new scientific evidence and operational experience. The Government is still working to implement the BSS Directive by the deadline of February 2018, and there may be consultations on how to do this

As a country outwith Euratom we would probably want to respond to recommendations from international bodies like ICRP in any case. Lawyers Burges & Salmon say:

"The Basic Safety Standards Directive provides the legal basis for justification and radiation protection within EU law. On withdrawal from the EU, the BSS Directive will cease to apply but it is likely that the current UK legislation will remain substantially the same in order to maintain UK compliance with IAEA Fundamental Safety Principles and best practice published by the International Commission on Radiological Protection." (13)

Similarly whilst the UK may no longer be obliged to submit information about planned discharges of radioactivity into the environment under Article 37 of the Euratom Treaty to enable the Commission to consider whether such a plan is liable to result in the radioactive contamination of the water, soil or airspace of another Member State, we are signatories to the Convention on Environmental Impact Assessment in a Transboundary Context. This means the UK will probably want to retain legislation requiring developers to undertake transboundary environmental impact assessment under its general environmental laws to secure compliance with its obligations under that Treaty

ENSREG

The European Nuclear Safety Regulators Group (ENSREG) was established in 2007 by the European Commission. All EU Member States with nuclear follow basic principles set by IAEA on nuclear safety & safe management of radioactive waste anyway, but ENSREG was set up to strive for continuous improvements in nuclear safety & waste management and to promote openness and transparency.

Post Fukushima Initiatives

After Fukushima the European Commission ordered a series of stress tests to be carried out by European nuclear plant operators and regulators. These revealed hundreds of problems, including four reactors that would have under an hour to restore safety functions if a power blackout occurred. Ten reactors were found not to have proper equipment to detect

earthquakes. The Commission estimated that the cost of addressing these failures would be up to €25 billion. (14)

This led the Commission to propose new EU-wide safety rules. Greenpeace said exercise dodged some major questions such as the threat from terrorism, plane crashes etc. Off-site emergency plans should have looked at the same multiple disaster scenarios that sparked the Fukushima crisis. And the stress tests ignored the impact of plant aging – such as the appearance of cracks in reactor pressure vessels. (15)

But the exercise did make some necessary improvements, including on the independence of regulators and on the provision of information to local authorities and stakeholders.

Safeguards.

Euratom is designed to provide a common market in nuclear materials, to guarantee a supply of nuclear fuels, and to ensure that nuclear materials are not diverted from their intended purpose. According to Article 1 of the EURATOM Treaty, the task of EURATOM Safeguards is to make certain that nuclear materials are not diverted to purposes other than those for which they are intended.

Basically, by agreement, Euratom carries out a lot of the safeguards work which outside of the European Union would be done by the IAEA. Typical Euratom safeguards inspection frequencies range from three weeks in every four at sites like Sellafield, to monthly inspections at enrichment plants, less frequent inspections at power stations and inspections only once every several years at selected locations with smaller inventories of material. More than 100 UK facilities or other duty holders are currently subject to Euratom safeguards, with some 220 inspections (about 1000 person days of Euratom effort) during 2014. All of this will probably have to be replaced by the IAEA. (16)

We can probably expect some changes here, but UK legislation on safeguards have to remain in force in some form to ensure the UK complies with various obligations under international law including the Treaty on the Non-Proliferation of Nuclear Weapons and the voluntary offer safeguards agreement and additional protocol in place between the UK, Euratom and the IAEA.

Article 35 Visit

Under Article 35 of the Euratom Treaty nuclear operators are required to provide facilities for continuous monitoring of radioactivity in air, water and soil to ensure compliance with BSS. Euratom Inspectors will carry out a verification visit to Torness on 24th October. So this will be an audit of both the operator and the regulator – the Scottish Environment Protection Agency (SEPA).

Conclusions

The proper answer to the question how will Brexit impact on nuclear waste management is – we don't know. But it is likely that Brexit also means a Euratom exit. Euratom promotes nuclear power and regulates it – a dangerous conflict of interest

Granting a special status in the basic European law to nuclear over all others distorts effective competition. So it is high time that the Euratom Treaty was reformed for the whole of Europe, not just the UK

BSS comes from international bodies – but perhaps the UK has needed the extra push from Euratom to implement?

The UK will need to continue to meet its obligations under the Non-Proliferation Treaty, Convention on Environmental Impact Assessment in a Transboundary Context and the basic principles set by IAEA on nuclear safety & safe management of radioactive waste.

On the other hand we clearly benefit from cross-fertilisation with organisations like ENSREG and may have needed the extra push from the European Commission to make even the limited safety improvements suggested by the Stress Tests to respond to Fukushima.

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4. New Nuclear – why?

In February 2002 the Government's Performance and Innovation Unit published an Energy Review after two years work by a group of experts. It concluded that there was no case for public support for the existing generation of nuclear technology. A year later the Government published a radical Energy White Paper entitled "*Our Energy Future – creating a low carbon economy*". (1) It set out to put the UK on a path towards a reduction in carbon dioxide emissions of 60% by 2050, mainly by promoting renewable energy and energy efficiency. While the White Paper did not rule out the possibility of new nuclear power stations at some point in the future, it said that current economics make it an unattractive option and there are important issues of nuclear waste to be resolved.

Clearly unhappy with the result of this review Tony Blair announced a second review less than three years later in November 2005. Then in July 2006 after a brief public consultation the Government published "*The Energy Challenge"* which concluded that new nuclear power stations could make a significant contribution to meeting our energy policy goals but the private sector would have to finance them. (2)

In February 2007 the government's decision to back new nuclear reactors was declared illegal in the High Court after Greenpeace argued that the energy review was not the 'fullest public consultation' the government had promised in the 2003 White Paper. (3) A new consultation document on the future of nuclear power was launched on 23rd May 2007 along with a new Energy White Paper. (4)

In January 2008, the Government finally gave the go-ahead to new nuclear power stations when it published "*Meeting the Energy Challenge: A White Paper on Nuclear Power*". (5) The White Paper concluded that it "*would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to facilitate this. … It will be for energy companies to fund, develop and build new nuclear power stations in the UK, including meeting the full costs of decommissioning and their full share of waste management costs*."

In May 2010 the new Conservative-Liberal Democrat Coalition Government agreed to promote the construction of new nuclear reactors provided they receive "*no public subsidy*". Although there was a great deal of scepticism throughout the period of the Coalition Government that what was being proposed did not amount to a subsidy, the Government stuck to its guns. In October 2015, the new Tory Government finally dropped the pretence. (6)

Clearly all three of the UK's main political parties are prepared to offer nuclear power a level of support which is unparalleled in other liberalised energy markets. Despite many challenging developments, these general nuclear attachments show no sign of easing. With many viable alternative strategies for efficient, secure, low-carbon energy services, it is difficult to explain these commitments solely in terms of officially-declared policy rationales. A variety of possible reasons are suggested for the persistent intensity of UK attachments to civil nuclear power.

Emily Cox, Phil Johnstone and Andy Stirling of the Sussex University Science Policy Research Unit (SPRU) have looked at possible reasons for this seemingly irrational support for nuclear power. They conclude that one hypothesis – about maintaining national capabilities to build and operate nuclear-propelled submarines – needs to be explored further. Their paper analyses linkages between UK military and civilian nuclear sectors in terms of high-level policy processes around supply chains, skills and expertise. Especially interesting is the critical juncture between 2003-2006, when stated policy moved radically from nuclear power as 'unattractive' to calls for a 'nuclear renaissance'. In this period, especially intense activity can be observed around UK nuclear submarine capabilities. They say it is difficult fully to comprehend the persistent intensity of official UK attachments to nuclear power, without also considering aims to maintain nuclear submarine capabilities. Yet this aspect is entirely undocumented anywhere in UK energy policy literatures. To acknowledge this, is not to entertain a conspiracy theory. It can be understood instead, in terms of more distributed and relational dynamics of power. Building on literatures in political science, they refer to this as a 'deep incumbency complex'. Such an evidently under-visible phenomenon would hold important implications not only for UK nuclear strategies, but also the wider state of British democracy. (7)

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5. The Legacy of Nuclear Power

In all the arguments about the future of nuclear power, one fundamental issue seems to be overlooked – the inevitable and long-lasting legacy of radioactive waste, contamination and risk that it leaves for generations to come. Already this legacy is massive and will take decades to clean up. Adding to this intractable and enduring problem by building more nuclear power stations should be economically and morally unthinkable.

In his new book, The Legacy of Nuclear Power, Andrew Blowers, academic and activist, brings to life what the legacy means for our future and why. It is published at a critical time when the future of nuclear energy is high on the political agenda across the world. Andy is currently chair of the Blackwater Against New Nuclear Group which is working to oppose plans to build a Chinese Hualong One Reactor at Bradwell in Essex. He is Emeritus Professor of Social Sciences at the Open University, and was a member of the first Committee on Radioactive Waste Management.

Managing the nuclear legacy is not just a technical problem; it is a social one, too. The places studied in this book, Hanford, Sellafield, La Hague as well as many others across the world, have long lived with the legacy and will continue to do so. In some places, Gorleben the most significant, the nuclear industry has met with resistance and has never become fully established, indicating how difficult it will be for nuclear energy to develop in new locations. The places covered in this book are all, in their different ways, nuclear oases, peripheral places with distinctive identities. Their stories represent the changing discourses of the nuclear industry through its early years down to the present day. Whatever the future fortunes of the nuclear industry, its legacy and the communities that manage it, will be with us for generations to come.

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6. The Slow Death of Fast Reactors

'Fast breeder' reactors are promoted by nuclear enthusiasts as the clean, green energy technology of the future. But all the evidence tells us they are a catastrophic failure: complex, expensive, unreliable and accident-prone. Is Japan's decision to abandon its Monju reactor the latest nail in the coffin of a dead technology? Or the final stake through its rotten heart?

Fast neutron reactors are *"poised to become mainstream"*according to the World Nuclear Association.

The Association lists eight *"current"* fast reactors. But three of them - India's Prototype Fast Breeder Reactor, and the Joyo and Monju reactors in Japan - are not operating. That leaves just five fast reactors, three of them experimental.

In a survey of fast reactors around the globe Jim Green Editor of Nuclear Monitor says Russia's fast reactor program is the only one that could be described as anything other than an abject failure.

Allison MacFarlane, former chair of the US Nuclear Regulatory Commission, recently made this sarcastic assessment of fast reactor technology: *"These turn out to be very expensive technologies to build. Many countries have tried over and over. What is truly impressive is that these many governments continue to fund a demonstrably failed technology."*

1. Ecologist 6th October 2016
   http://www.theecologist.org/News/news_analysis/2988203/japan_abandons_monju_fast_reactor_the_slow_death_of_a_nuclear_dream.html

7. Local Authorities and Energy: Building a Fairer Low Carbon Energy System

Local Authorities across the Globe are showing an increasing interest in energy. In June 2016 the Global Covenant of Mayors for Climate & Energy, which represents more than 7,100 cities, and more than 600 million people, agreed to work together in an unprecedented alliance to tackle climate change. Michael Bloomberg, Mayor of New York City, writing in the *Guardian*, said:

"*One of the best steps national governments can take to fight climate change is to empower their cities with the tools and autonomy they need to act.*" (1)

The Global Covenant Mission Statement says the cities participating in this initiative commit to targets that will eventually be more ambitious than those their respective national governments presented in Paris. (2)

Here in the UK the Association for Public Service Excellence (APSE) is co-ordinating local authority collaboration to maximise the opportunities for local authorities to work together on the green energy agenda. The motivation for local authorities getting involved in energy is wider than just the need to reduce greenhouse gas emissions. As large consumers of energy themselves high energy prices have been having a big impact on council budgets. By generating their own energy or reducing consumption or encouraging community projects to generate energy and reduce consumption, they can bolster the local economy and generate revenue at a time of severe budget constraints. Decentralised energy and energy efficiency projects allow them to bring money into the local economy by making the most of grants and financial support available. And Councils want to assist residents suffering from fuel poverty. If low income families spend less on energy, they will have more money to spend in the local community.

Many local authorities have been developing ambitious projects ranging from energy efficiency schemes and generating their own electricity to setting up heat networks and even setting up their own energy supply companies. These innovative local energy initiatives present a challenge to the existing UK energy framework dominated by the Big Six energy companies and large centralised power stations. They also present us with an opportunity to move to a more democratic, locally-controlled sustainable energy market.

No 2 Nuclear Power has collected a list of 30 local authorities and described what they are doing and planning on energy. Hopefully this will inspire all local authorities to learn from each other, prevent wheel re-inventing and speed up progress towards a low carbon local renewable energy revolution. We can learn for instance from Aberdeen's pioneering district heating scheme and Portsmouth City Council's plans to continue installing solar panels on public building despite cuts in feed-in tariffs, or Peterborough's scheme to install solar panels free of charge on homes in the City. Every Authority should know about Wolverhampton's highly efficient new schools which require hardly any energy to heat, about Shetland Island Council's plans to extract heat from the North Sea or Islington's plan to extract heat from the London Underground and how Nottingham City Council managed to set up its own energy company

which can sell electricity more cheaply than any other company in the East Midlands. Surely every councillor will want to hear about Oxford's project to provide low income households with solar electricity and batteries to store any surplus, Edinburgh's work with a local community energy co-operative to install solar panels on schools and leisure centres across the City, and Fife Council's project to fuel council refuse collection vehicles with wind generated hydrogen.

The report looks at a range of these innovative local energy initiatives to show how Britain's towns and cities are transforming efforts to create a cleaner, smarter and more affordable energy system, providing an alternative to the big utilities, and boosting their local economies in the process. (3) We look at a range of different energy initiatives being carried out by local authorities around the country. The list is not meant to be exhaustive, but hopefully it will inspire others to set up projects of their own. If local authorities can learn from each other, rather than starting from scratch, it will avoid common pitfalls and speed up progress towards a low carbon local renewable energy revolution.

The report is available here: http://www.no2nuclearpower.org.uk/wp/wp-content/uploads/2016/10/Local-Authorities-and-Energy.pdf

To keep up with news about the local energy revolution as it happens see here: http://www.microgenscotland.org.uk/news/ and

subscribe to our weekly news e-mail here: http://www.microgenscotland.org.uk/maillist/?p=subscribe

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