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1. The Baseload Debate

The contention in a new Stop Hinkley Campaign briefing (1) that the concept of baseload power is quickly becoming obsolete, has been backed up by Dr Mark Diesendorf, Associate Professor of Interdisciplinary Environmental Studies at UNSW Australia in an article in *The Ecologist*. (2)

Diesendorf 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.

Energy and Climate Change Secretary, Amber Rudd, claims we need Hinkley Point C because we need secure baseload power. Diesendorf says underlying this claim 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 3.2GW nuclear power station has to be matched by 3.2GW 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.

'Baseload power stations' are inflexible in operation, in the sense that they are unsuitable for following the variations in demand and supply on timescales of minutes and hours, so they have to be supplemented with flexible peak-load and slightly flexible intermediate-load power stations. The assumption that baseload power stations are necessary to provide a reliable supply of grid electricity has been disproven by both practical experience in electricity grids with high contributions from renewable energy, and by hourly computer simulations. In the USA, for instance, a major computer simulation by a large team of scientists and engineers found that 80-90% renewable electricity is technically feasible and reliable.

Fluctuations in variable wind and solar PV can be balanced by flexible renewable energy sources that are dispatchable, i.e. can supply power on demand. These are hydro with dams, Open Cycle Gas Turbines (OCGTs) and concentrated solar thermal power (CST) with thermal storage. It is not essential for every power station in the system to be dispatchable. And gas turbines can themselves be fuelled by 'green gas', for example from composting municipal and agricultural wastes, or produced from surpluses of renewable electricity, as discussed in the Wind-Gas alternative to Hinkley proposed by the Energy Brainpool. (3)

Diesendorf concludes that in all the flexible, renewables-based approaches set out, conventional baseload power stations are unnecessary. In the words of former Australian Greens' Senator Christine Milne: *"We are now in the midst of a fight between the past and the future"*.

When Energy Post re-published Mark Diesendorf's article it stirred up quite a controversy with many readers disagreeing, but others agreeing. (4) It is well worth reading through some of the comments and Diesendorf's replies. (5)

1. See http://www.no2nuclearpower.org.uk/wp/wp-content/uploads/2016/02/Do-we-really-need-nuclear-power.pdf
2. Ecologist 10th March 2016 http://www.theecologist.org/News/news_analysis/2987376/dispelling_the_nuclear_baseload_myth_nothing_renewables_cant_do_better.html
3. Ecologist 17th Feb 2016 http://www.theecologist.org/essays/2987195/wind_power_with_windgas_is_cheaper_and_greener_than_hinkley_point_c_nuclear_plant.html
4. See http://energypost.cmail20.com/t/ViewEmail/i/ECA42F910BDCD91B/8B5A5E7DF22B565444D0DD5392A9C75A#toc_item_0
5. See http://www.energypost.eu/dispelling-nuclear-baseload-myth-nothing-renewables-cant-better/#comment-273092

2. Green Gas

Since renewable electricity is variable in output, flexible 'dispatchable' gas-fired power generation will be suitable to back up, or 'load balance' renewable electricity generation. By using biomass stocks of various kinds, some of the gas burnt can even be renewable gas. It won't be possible for all gas to be solely derived from the microbiological decomposition of biomass. There are limits to the amount of biomass available to produce methane, but synthetic green gases could also be made by using surplus renewable electricity and carbon dioxide captured from the air. Hydrogen gas can be made by electrolysis of water and then converted to methane using captured carbon dioxide.

In July 2011 the Government published its National Policy Statement (NPS) on Energy which foresaw a need for 113 Gigawatts (GW) of electricity generating capacity by 2025 compared with 85GW at that time. The NPS said that the Government expects a doubling of electricity demand by 2050. In actual fact, the latest Government scenarios envisage increases in demand of only 29.6 to 52.9% by 2050. (1)

One of the reasons the NPS predicted such a large increase in electricity demand was the view that domestic heating should no longer be done using fossil gas and that heat pumps using electricity would need to be the main replacement source of domestic heating.

A new book "*Renewable Gas: The Transition to Low Carbon Energy Fuels*" by Jo Abbess (2) offers an alternative to this view which might make more sense given that the UK gas grid currently carries 3 to 4 times more energy than the electricity grid. 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. Converting to renewable gas means we can continue to make good use of the gas grid.

Another point which needs to be borne in mind is that the quality of the remaining Natural Gas fields is worsening. It is estimated that 40% of remaining conventional Natural Gas is sour – with high levels of hydrogen sulphide and acid and high levels of carbon dioxide.

Affordability, flexibility and efficiency reinforce a growing dependency on Natural Gas for electricity generation. But long-term reliance on Natural Gas and its potentially more polluting unconventional alternatives is not going to provide the end point in decarbonisation. The use of Natural Gas in power generation in industrialised countries may remain acceptable in carbon terms for several decades, but it makes sense to enable a transition to low carbon gas to begin now. An obligation on gas supply companies to provide green gas may go some way to creating a traded market.

1. Nuclear Power: New Evidence, Together Against Sizewell C, 2015
   http://www.tasizewellc.org.uk/images/publications/reports/Nuclear-New-Evidence-final.pdf
2. Renewable Gas: The Transition to Low Carbon Energy Fuels" by Jo Abbess, Palgrave, 2015
   http://www.palgrave.com/br/book/9781137441799

3. Nuclear Safety

In an article in Physics and Society Wheatley, Sovacool and Sornette question the accuracy of probabilistic safety analysis (PSA) – the nuclear industry's standard technique for the evaluation of the risk of nuclear accidents. PSA requires the definition of failure scenarios to which probabilities and damage values are assigned. The reliability of PSA depends on the inclusiveness of scenarios as well as correct modelling of possible cascade effects, in the presence of unavoidable uncertainties. It is thus perhaps not surprising that there have been a number of incidents and accidents in the history of civil nuclear energy that failed to be properly anticipated, and in particular for cascades to be under appreciated.

David Lochbaum of the Union of Concerned Scientists says the probability assessments are fraught with unrealistic assumptions, severely underestimating the probability of accidents. Even the chairman of the World Association of Nuclear Operators has stated that the nuclear industry is overconfident when evaluating risk and that the severity of accidents is often underreported. Several studies have found that PSA dramatically underestimates the risk of accidents. (1)

Princeton University physicist M.V. Ramana challenges "misleading" PSAs such as Areva's estimate for its EPR of one core-damage incident per reactor in 1.6 million years, and Westinghouse's claim that for its AP1000 reactors the core melt frequency is roughly one incident per reactor in two million years. Uncertainties in PSA methods and databases make it prudent to keep actual historical risk experience in mind when making judgments about safety.

An alternative way of assessing reactor risks is to analyze the historical record. Ramana says globally, there have been close to 15,000 reactor-years of experience, with well-known severe accidents at five commercial power reactors – three of them in Fukushima – so 1 in 3000 reactor years. But there are other accidents that should be included which brings the frequency of severe accidents up to as high as 1 in 1,400 reactor-years. If nuclear power expands from today's 440 commercial power reactors to, say, 1,000 reactors then the risk of accidents rises to once in every 1.4 years.

Another study, by Thomas Rose and Trevor Sweeting, recently published in the Bulletin of the Atomic Scientists estimates a failure rate of 1 per 3704 reactor–years. This rate indicates that more than one such accident could occur somewhere in the world within the next decade. (2)

This type of prediction often runs up against the argument that nuclear operators learn from the past. The authors, therefore, also analyzed the role that learning from past accidents can play over time. The analysis showed few or no learning effects occurring. The authors estimate that, the overall probability of a core melt accident in the next decade, in a world with 443 reactors, is almost 70%. (Because of statistical uncertainty, however, the probability could range from about 28% to roughly 95%.) The United States, with 104 reactors, has about a 50% probability of experiencing one core-melt accident within the next 25 years.

Wheatley, Sovacool and Sornette found that the frequency of accidents dropped substantially after Three Mile Island (TMI) and Chernobyl, and has remained relatively constant since. But there is no reason for complacency. The Union of Concerned Scientists (UCS) has released a

report on the failure of the U.S. nuclear power industry to adequately respond to safety flaws in the five years since Fukushima, as well as the failures of the Nuclear Regulatory Commission (NRC). After Fukushima, the NRC set up a task force to analyze what happened at Fukushima and assess how to make U.S. reactors safer. In July 2011, the task force offered a dozen recommendations to help safeguard U.S. nuclear plants in the event of a Fukushima-scale accident. Unfortunately, the NRC has since rejected or significantly weakened many of those recommendations and has yet to fully implement the reforms it did adopt. The UCS report also finds that the NRC abdicated its responsibility as the nation's nuclear watchdog by allowing the industry to routinely rely on voluntary guidelines, which are, by their very nature, unenforceable.

"*Once again, the NRC is ignoring a key lesson of the Fukushima accident: Emergency plans are not worth the paper they are printed on unless they are rigorously developed, maintained, periodically tested, and subject to NRC inspection and enforcement*," said Edwin Lyman from the UCS. "*When it comes to many critical safety measures, the NRC is allowing the industry to regulate itself*." The UCS recommends a revised regulatory framework; expedition of transfer of spent fuel to dry casks; increased emergency planning zone sizes (beyond the current 10-mile radius); increased NRC oversight of operator guidelines instead of voluntary guidelines that are not subject to NRC enforcement; and validation of FLEX strategies that aim to make emergency equipment readily available to reactors during extreme events.

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1. Spencer Wheatley, Benjamin Sovacool and Didier Sornette, April 2015, 'Of Disasters and Dragon Kings: A Statistical Analysis of Nuclear Power Incidents & Accidents', Physics and Society, http://arxiv.org/abs/1504.02380
2. Thomas Rose & Trevor Sweeting (2016) How safe is nuclear power? A statistical study suggests less than expected, Bulletin of the Atomic Scientists, http://dx.doi.org/10.1080/00963402.2016.1145910

4. BBC Wrong on Fukushima, Again

A common response since Fukushima of nuclear advocates has been to try to persuade us that evacuation zones are not necessary and that the best science and international consensus on safety policies are wrong. The BBC has, yet again, published a programme promoting this extraordinary claim, and backing it up with false and misleading information.

The BBC interviewed Professor Gerry Thomas who it describes as "*one of the world's leading experts on the effects of radiation on the human body*". She is interviewed in the town of Ohkuma inside the radiation exclusion zone. She believes strongly the world has been told the wrong story about this place. She is very much of the opinion that this exclusion zone is not necessary. Thomas says:

"*…in terms of radiation the amount is very small*." A personal dosimeter says the dose is about 2.8 microsieverts per hour. Thomas says: "*If you stood in the open air all day you'd be getting about an extra millisievert per year*.

She is significantly wrong 2.8 microsieverts per hour is equivalent to 24.5 mSv/y. Field scientists use a rule of thumb that 1 microsievert per hour is roughly equivalent to 9mSv per year. Yet this error forms the backbone of her arguments.

If you're working in a nuclear power plant you can get up to 20mSv per year. Thomas says the long-term impact of 1mSv per year on your health is absolutely nothing. The aim of her argument is to make the worst case appear absurdly mild, far less than normal exposures. But in fact the data upon which her argument is based establishes a dose which is in excess of the annual limit for nuclear workers. Is it reasonable that every man woman and child living in a city is exposed to as much as the upper limit allowable for a nuclear worker? Of course it's not reasonable. So she fails to establish that the international scientific and political consensus is absurd.

Goddard's Journal (1) looks at some research data on the effects of exposure to 20-25mSv per year. A graph of genetic damage in nuclear workers receiving below, around or above 20mSv shows significantly elevated levels of damage, which are considered to be bio-markers of cancer risk. Even down to 3mSv per year there is significant levels of damaged compared with controls.

Another graph demonstrates a statistically significant level of increase in childhood leukaemia down to approximately 4mSv. Another study found a statistically significant increase in all cancers among children at a dose rate ten times lower than the rate seen in the street of the abandoned city. There is no lack of research in the scientific literature with statistically significant evidence indicating the likelihood of cancer risk at doses comparable to and below the dose observed in the abandoned Japanese city. So the claim by Thomas that the excess dose from nuclear fallout imposes nothing is just flat out wrong.

It is disturbing that nuclear advocates response to Fukushima hasn't been what can we do to make nuclear power safer, but instead what can we do to get people to accept future disasters.

This is only the latest example where the BBC goes beyond the bounds of scientific reason to make light of nuclear disasters. A programme called Bang goes the Theory has Professor Thomas comparing the expected death toll from Chernobyl to other more common mortality risks. She says 106 people each year fall out of bed and die as a result of their injuries, but only 122 died from Chernobyl. According to her that figure includes both the short term effects of acute radiation sickness and most cancers. In response to complaints the BBC conceded that Thomas's claim that Chernobyl will kill 122 people is misleading. The European Environment Agency in a 2013 report predicted that Chernobyl will cause between 17,000 and 68,000 cancer deaths over 50 years.

Jim Al-khalili on 14th September 2011 also argued against imposing exclusion zones after nuclear disasters. It seems to be quite a theme at the BBC to down play nuclear disasters to an extent that exceeds the boundaries of science.

1. Goddards Journal 11th March 2016 https://www.youtube.com/watch?v=qrgdAA5oiIA&feature=youtu.be

5. Renewable Notes

Scrapping plans for new nuclear reactors at Hinkley Point in Somerset and building huge amounts of renewable power instead would save the UK tens of billions of pounds, according to an analysis that compares likely future costs. The Intergenerational Foundation think-tank which campaigns for fairness between generations, found that onshore windfarms would cost £31.2bn less than Hinkley, and solar photovoltaic power £39.9bn less over 35 years to build and run. The estimate is based on both the value of subsidies paid by the taxpayer for the electricity and the cost of building the infrastructure. (1)

Yet the Government seems determined to butcher the renewable industry. Attacks on renewable energy subsidies have spooked investors and could add as much as £120 extra to average household bills, a select committee report has found. The damning report concludes the Energy and Climate Change select committee's examination of investor confidence which started last September as a result of a string of cuts to renewable subsidies. Its findings also appear to directly contradict the Department of Energy and Climate Change's (DECC) much-vaunted aim of protecting bill payers from increased costs.

The committee identified six factors that it said combined to significantly damaged confidence in the UK market, including a lack of transparency in decision making processes, inconsistent and contradictory approaches to policy, a lack of "long-term vision" and the creation of a policy cliff-edge from 2020 onwards. It states a list of immediate priorities that must be addressed, most notably greater clarity over how existing policy mechanisms will be used. Of particular interest to the committee has been the Levy Control Framework (LCF) and its application as a budgetary measure. The report argues that the LCF has been seen as "*the root of many of the recent policy alterations*" and has assumed a "central role" in energy policy. (2)

Simon Rogerson CEO of Octopus Investments, which took part in the ECC committee's inquiry, said: "*Constant changes to policy has made the UK a less attractive place to invest in energy infrastructure. We need to get a more transparent and stable policy environment that gives investors long-term clarity*. Richard Black, director of the Energy and Climate Intelligence Unit (ECIU), said: "*This report pulls no punches in setting out the extent to which recent abrupt changes in energy policy have spooked investors, so putting an upwards pressure on bills*. *It's interesting that critical evidence given to the Committee came from some of the biggest investment houses as well as from people in the renewables industry – and interesting too that the Committee points its finger squarely at Treasury*." (3)

As well as calls for transparency around the LCF, the new report makes significant references to the damage policy decisions have caused to investors across the renewables sector. This has been supported by a number of individuals, such as Nick Molho, executive director of the Aldersgate Group. "*The ECC select committee is right to highlight the recent dip in investor confidence in the sector. What has been particularly damaging is the lack of an alternative plan accompanying recent policy changes, rather than the changes themselves*," he said. "*Confidence is essential to attracting investment at sufficient scale and at the lowest possible cost in the energy efficiency and low carbon sector and needs to be a priority for the government in 2016*."

Just as the Select Committee report was published the Government published a consultation on yet another cut to renewable subsidies – a proposal to remove subsidies from solar thermal panels. (4)

Solar Futures

Meanwhile, Lightsource Renewable Energy - the UK's largest solar energy generator, operating the largest portfolio of commercial scale solar photovoltaic (PV) assets - has been forced to write to Energy and Climate Change Secretary Amber Rudd to ask her and her Ministers to refrain from defending controversial subsidy cuts by "inaccurately" citing the company's plans to develop "subsidy-free" solar projects. DECC Ministers have recently highlighted Lightsource's plans to build new solar projects without subsidy this year as evidence the industry can continue to prosper in the wake of steep subsidy cuts. But in fact this only works for projects that are directly connected to the company that uses the generated electricity through a 'private wire connection. "*This is a crucial distinction, because the economics and rationale for these types of solar PV projects are very different from projects that feed directly into the national electricity grid and provide green electricity to the wider British public*." (5)

Solar farms which mostly sell electricity direct to the grid have to compete with the wholesale price of electricity, which is going down. On the other hand if the farms can sell direct to a customer via a private wire they are competing with the retail price of electricity which is still going up. Solar panels on commercial roofs more generally sell electricity to the occupant in the commercial building. So with the ending of subsidies the return on investment for solar farms and commercial roofs can be increased by increasing the amount of electricity which is sold directly to a customer.

For example a 100kW community-owned solar array built by the Wadebridge Renewable Energy Network (WREN) in Cornwall is now selling its electricity to the South West Water Nanstallon Sewage Treatment Works under a 20-year Power Purchase Agreement (PPA) at a price that is cheaper than it would otherwise pay for its delivered electricity. (6)

Public sector energy consultant Stephen Cirrell, speaking at the Solar Energy UK exhibition in Birmingham in October, said Councils have not been put off investing in solar by the recent subsidy cuts. They are simply adjusting the timeline for projects with many opting to wait it out for two years. Very few however, are walking away from a commitment to pursue solar energy. Storage, private wires and falling costs of PV panels will all help to make solar economic for local authorities. (7)

Many local authorities have been installing solar panels on social housing in their borough. For instance Warrington Borough Council has installed solar PV on over 3,000 social homes in an effort to tackle fuel poverty. Tenants receive some free electricity and the Council receives an income to pay for the panels from the feed-in tariff. Unfortunately a lot of these schemes are now ending due to the reductions in feed-in tariffs. (8) But the signs are that this will be just a short hiatus and soon schemes like the one in Warrington can be re-introduced across the rest of the UK. For instance a scheme run by Barnsley Council, which has also been suspended expects to resume soon. A spokesperson said:

"*The price of panels and ancillary equipment is expected to fall over time and we will monitor this closely to see whether we can meet grid-parity or provide other funding options … we are already looking at other low carbon technologies we could deploy to assist the projects aims of reducing fuel poverty, driving down the borough's carbon footprint and saving money*".

This could include a battery storage trial which will see homes in receipt of solar installations offered storage systems, boosting self-consumption. (9)

A typical domestic solar installation today would be around 4kWp which would need 16 x 250W panels and cost around £6,500. With a feed-in tariff of only 4.39p the economics would be challenging – it is going to take up to 15 years to get your money back. But by 2020 you can probably expect to get the same amount of electricity from 12 x 330W panels at a cost of only £4,250. At this level the cost is beginning to look like it is worth doing without any subsidy. With only a small rise in the cost of electricity, this could pay back the cost in around 10 years with no feed-in tariff. To achieve this, the challenge will be increasing the amount of electricity used by the solar panel owners. This could be done by using heat storage or batteries, changing consumer behaviour and more use of electric vehicles. (10)

Renewable Heat

The next subject the House of Commons Energy and Climate Change (ECC) Committee wants to investigate is the 2020 renewable heat and transport targets. While progress towards the share of renewable electricity is on track, concerns have been raised regarding progress in renewable heat and transport. The Committee on Climate Change has warned that the Government's ambitions may no longer be achievable and moreover, some research has suggested that renewable transport fuels may cause more carbon emissions than they save. (11)

Final consumption of electricity is 'just' 303.4TWh (according to figures for 2015) compared to the final heat consumption of 760TWh (according to figures for 2013). To fully decarbonise our heat supply, we need a mix of all renewable technologies: geothermal, biogas/biomethane, heat pumps, solar thermal, and biomass heating. Neither one can on their own deliver all required heating for industrial use, heating of schools and care homes, and different homes with different needs .A shortfall against either the heat or transport targets requires a significant increase in renewable power contribution. With renewable transport currently only achieving about 2.5%, the power sector will need to deliver 44-45 per cent renewable energy to make up the difference between 2.5% and the 109% target! (12)

Offshore Wind

The UK government has signaled that financial support for new offshore wind projects after 2020 will only be forthcoming if costs fall below £100/MWh. Vattenfall says it is confident it can meet the target and a major new report from the industry and government-backed Offshore Renewable Energy Catapult (ORE) and Offshore Wind Programme Board, also argues that the sector is on track to meet the target. Such a figure would be similar to the £92.50/MWh figure for Hinkley Point C which is index linked, and will by now have reached about £99/MWh.

The ORE report argues that for 12 of the 13 cost indicators it tracks the sector is either on target or ahead of target, with concerns about the ability to maximise economies of scale and bring

online new 10MW turbines the only potential cloud on the horizon. The industry is fast-tracking adoption of new innovation in turbine design and in project operations to bring down costs. However the report also highlighted uncertainty over when the next round of price support contracts for offshore wind projects will be auctioned. Further clarity on the timing and volume of future Contract for Difference auctions, and the longer-term capacity requirements out to 2030 and beyond, is essential for the industry to galvanise the activity that will deliver further innovation and cost reductions.

The government has said further auctions will take place during this parliament, but the first was postponed and there is still no timeline for the award of new contracts. (13) The March 2016 Budget allocated £730m by 2021 to offshore wind and other less-established renewables (i.e. not including onshore wind and solar PV). There will also be a 4GW cap which means that "*only a third of the estimated 12GW offshore wind pipeline to 2026 could be supported, if offshore wind were to win all the subsidy allocated*," according to Bloomberg New Energy Finance (BNEF). (14)

Energy Efficiency back in vogue?

Globally energy efficiency is becoming all the rage again. Efficiency has had a relatively low profile in recent years because it isn't sexy like solar panels, which have become cheaper every year. But efficiency can be very cheap costing as little as 3p to save a kilowatt hour. So if you want to wean a utility off fossil fuels and reduce carbon emissions, it's less costly for the company to pay customers to get efficient than it is to build new solar or wind capacity. But the reason why efficiency is coming back in vogue, particularly in areas with a lot of solar pv is that it reduces peak demand and the pressures on the power industry that might lead to what's been called a "death spiral" for power utilities. Those companies have to maintain the grid and power plants for peak demand and cloudy days, all while selling far less energy when the sun is shining. (15)

Glance back to the Government's 'Energy Challenge' White Paper of 2006 which promoted the importance of having more nuclear power and you will see that the Government projected that between 2005 and 2015 electricity generation would increase by around 12%. In reality - it has decreased by 13%! (A fall of more than is expected to be supplied by Hinkley) Consistently UK governments ignore and underplay the importance of reducing energy consumption, so we manage to save quite a lot without really trying. Imagine what we could save with a concerted effort. There is a long history of this sort of thing. In 1976 the UK Government projected that UK annual energy consumption would increase to between 500 and 550 million tonnes of coal equivalent (tce) by the year 2000. In fact it has never risen above 280 million tce. As Andrew Warren, the Honorary President (and founder) of the Association for the Conservation of Energy has commented:

'For fifty years, continuous improvements in the energy efficiency of technologies and buildings has led the most successful revolution in improving security in the entire energy market. So why on earth do our political leaders continue to wilfully pretend it just isn't happening?' (16)

A new study from the European Commission's Joint Research Centre has found that if European Union member states adopt a 40% energy efficiency target, the sum of energy savings and power from renewable sources such as wind and photovoltaics together would overtake the

sum of all imported coal, oil and gas by 2030. The drive to wean the community off carbon-based fuels could also lead to the creation of jobs and economic growth if the right investments were made in low-carbon technologies. (17)

One inspiring example of what can be done is taking shape in London where two streetlamps will soon be erected by Transport for London. These Monopoles can convert sunlight to streetlight via photovoltaic (PV) panels. The energy they generate can be stored in a battery and used during the night to power the lamps. As a result, the "zero-emission streetlight" eliminates electricity costs. But not only do they generate enough energy to light themselves, they create a surplus which can be sold to the National Grid, potentially making millions of pounds for Britain's local authorities, for which running streetlights costs an estimated £300m a year. Many councils are now dimming their streetlights or switching them off, raising fears of an increase in accidents and crime. (18)

Danish lighting company Scotia has unveiled the new range of solar-powered streetlights that promise to turn local authorities into 'energy powerhouses' According to Scotia, if all of the UK's seven million streetlights were switched to Monopoles, it would save more than £300m in electricity costs and generate more than 4TWh of clean power per year. Some 40 per cent of this would feed back into the grid. (19)

A more conventional energy efficient lighting scheme is being implemented by Stirling Council. With a £9.87m loan from the Green Investment Bank the Council is fitting LEDs in its street lighting and expects to save £31m over the next 30 years. By April 2017, nearly one-third of Scotland's streets will be LED-lit, as local councils move to invest £56m to fund LED lighting. There are signs that more and more local authorities are considering the benefits of the spend-to-save approach, with Stirling becoming the third UK council to opt for a Green Loan. (20)

Energy efficiency is increasingly being recognised as profitable without the kind of subsidies offered to new nuclear reactors and capable of delivering multiple other non-energy benefits such as better productivity, job creation, reduced fuel poverty and improved public health. A recent report from the United National Environment Programme (UNEP) shows that the potential for energy policy to increase energy efficiency in industry alone is massive. (21)

Another report from the University of Cambridge says that 73% of energy used in industry could be saved using currently available technical know-how and technology. (22) Up to 25% of energy used in industry could be saved without major capital expenditure or changes to business practices. As such, there is a large scope to save energy and avoid building new power stations altogether. (23)

Demand Management

Britain could save £8bn a year and slash its carbon footprint by using electricity better, according to the National Infrastructure Commission. A "smart power revolution" which improves the storage of power could transform the energy landscape. (24)

1. Toxic Time Capsule by Andrew Simms, Intergenerational Foundation, April 2016 http://www.newweather.org/wp-content/uploads/2016/04/Toxic-Time-Capsule.pdf and Guardian 5th April

2016 http://www.theguardian.com/environment/2016/apr/05/scrapping-hinkley-for-renewable-alternatives-will-save-tens-of-billions

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6. SMRs – Osborne's Nuclear Fantasy

The government has launched a competition to find a partner to help bring "mini nuclear reactors" into the UK energy market. More than 16 firms are set to enter the Department of Energy and Climate Change competition, which aims to identify a preferred technology for Small Modular Reactors (SMRs) to be rolled out in a series of new power plants over the next 15 years. Companies expected to take part include NuScale, Westinghouse and Bechtel, which have already put their names forward as potential partners. The government will chose the best SMR design at the end of the competition. Companies have been given until 6 May to put forward their designs and business cases, with a decision on which companies will make the next round of the competition expected in the autumn.

The government said it will also publish an SMR delivery roadmap later this year and will allocate at least £30m ($42m, €38m) for an "*SMR-enabling advanced manufacturing R&D programme*" to develop nuclear skills capacity. In November 2015 the government announced that the UK would double funding for DECC's energy innovation programme to £500m over five years, which will help pay for an ambitious nuclear research programme that will revive the country's nuclear expertise and help turn it into a leader in SMR technology. At the time Mr Osborne said the investment would strengthen future security of supply, reduce the costs of decarbonisation and boost industrial and research capabilities. In January 2016 Fluor Corporation's NuScale unit, which is seeking to be a pioneer in the SMR market, said the UK's ambitions to build SMRs could be realised as soon as 2025. Westinghouse Electric Company said earlier this month it is working with the UK's Nuclear Advanced Manufacturing Research Centre to explore the most effective way to manufacture Westinghouse SMR pressure vessels in the UK. (2) (3)

Rolls-Royce is positioning itself as a "white knight" that could rescue Britain's faltering nuclear power strategy and stop the lights going out. The company best known for its jet engines has met with Government to put forward plans for a fleet of small reactors built around Rolls's expertise gained producing power plants for the Royal Navy's submarines. Rolls has submitted detailed designs to the Government for SMRs capable of generating 220MW, that could be doubled up to 440 megawatts. Paul Stein, Rolls's director of research and technology, said: "*Traditional plants are bespoke projects and aren't getting cheaper. SMRs could be made in factories and assembled on site, speeding up work*." Stein said with financial backing from Government to seed development and political and regulatory support, the company could have the first SMR generating power in 10 years for £1.25bn. Costs would fall as more were produced. Britain is "ideally placed" to take a global lead in the SMR market which could be worth £400bn, according to Stein. "*We have no significant indigenous large reactor nuclear power industry to stand in the way but we have skills in place to develop the technology*." (4)

According to the Telegraph, SMRs have moved a step closer after it emerged the Government is assessing suitable sites to push ahead with a build. A team of experts working for Ministers is looking at possible locations for SMRs, which could be built by 2025. Other than sites already included in the Government's National Policy Statement, Trawsfynydd in North Wales is the only site mentioned. (5)

The Nuclear Free Local Authorities published a briefing on Small Modular Reactors last year:

http://nuclearpolicy.info/docs/nuclearmonitor/NFLA_New_Nuclear_Monitor_No37.pdf

This concluded that for SMRs to reduce costs and speed up construction first you would need a large-scale standardized manufacturing process to churn out dozens, if not hundreds, of identical plants. So someone would need to build a massive supply chain. Money for that would presumably have to come from customer orders - if there were any. The problem is it that no one actually appears to want to buy one. (6)

None of the designs, including the most credible, which are based on scaled-down versions of currently deployed PWR technology, is yet ready. It is therefore no surprise that no company has yet built a single SMR let alone made a commitment to building the large numbers that would be needed to make the economic case remotely credible. And the safety licensing process that will need to follow design completion would, according to the Chief UK Nuclear Inspector, take up to 6 years in the UK. (7)

The cost of SMRs is essentially unknowable at the moment, but there is evidence to suggest they will be even more expensive than existing reactors. Despite this the National Nuclear Laboratory (NNL) suggests a potential UK market of between 7GW and 21GW in 2035. For chair of the Committee on Radioactive Waste Management (CoRWM) Prof Gordon Mackerron says this latter number is frankly not credible under any conceivable circumstances. These hoped-for UK markets are also linked to the idea that the UK could become a major technological player in SMR technology, a view that seems tinged almost with fantasy, given that all significant SMR development to date has been outside the UK. (8)

M.V. Ramana says the nuclear industry continues to practice selective remembrance and to push ideas that haven't worked. Once again, we see history repeating itself in today's claims for small reactors—that the demand will be large, that they will be cheap and quick to construct. But nothing in the history of small nuclear reactors suggests that they would be more economical than full-size ones. In fact, the record is pretty clear: Without exception, small reactors cost too much for the little electricity they produced, the result of both their low output and their poor performance. In the end, as an analyst for General Electric pronounced in 1966, "*Nuclear power is a big-plant business: it is most competitive in the large plant sizes.*" And if large nuclear reactors are not competitive, it is unlikely that small reactors will do any better. Worse, attempts to make them cheaper might end up exacerbating nuclear power's other problems: production of long-lived radioactive waste, linkage with nuclear weapons, and the occasional catastrophic accident. (9)

What is most worrying about these future nuclear scenarios is that the UK Government is failing to develop alternative non-nuclear scenarios to replace them when they turn out to have been a delusion, which they surely will.

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7. Chernobyl

The other report on Chernobyl 2016: FoE Austria has just published an (English) Update of Ian Fairlie's "Other Report on Chernobyl", updated to include relevant studies and reports of the last ten years. His findings in particular on Iodine-131 releases and Thyroid Cancer indicate that the Vienna region was hit heavily by Iodine and that 8--40 % of the excess thyroid cancer cases since 1990 can be attributed to the Chernobyl accident -- more than 1000 kilometers away. Austria also received heavy caesium-137 fallout with 13 % of its surface contaminated above 40 kBq/m^2, making it the second most contaminated country after Belarus in relation to surface area contaminated.

1. Global 2000 - FoE Austria 7th March 2016
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