



15th March 2018

Consultation on a National Policy Statement for new nuclear above 1GW post 2025: siting criteria and process.

Background

National Policy Statements (NPS) are intended to establish the case for Nationally Significant Infrastructure Projects, as defined in the Planning Act 2008. The current nuclear NPS (EN6), published in 2011, lists 8 sites as potentially suitable for the deployment of new nuclear power stations by the end of 2025. These sites included Hinkley Point C in Somerset.

This new consultation considers the planning framework for new nuclear power for deployment after 2025. But, rather than considering in detail developments in the energy landscape since 2011, the proposed new NPS simply carries forward the designated sites from the current NPS, and even suggests that new sites may be designated in the 2020s.

The Government says the current nuclear NPS sets out the need for nuclear power, whilst also providing planning guidance for developers and for the Planning Inspectorate and Secretary of State in their consideration of applications. Yet when the Government first endorsed Hinkley Point C, (HPC) it was projecting an increase in electricity consumption of 15% by now, whereas in practice we are consuming 15% less than a decade ago. (In 2005 it was 29,981 ktoe . By 2015 it had fallen to 26,031 ktoe – a 15.2% decrease.) In other words it made a 30% error. This is despite a 13% increase in GDP over the last decade. HPC is only due to deliver 7% of consumption. So, in fact, there is no “need” for new nuclear power stations before or after 2025.¹

In February, the Business Secretary, Greg Clark, told a House of Lords committee the UK would have enough energy if Hinkley Point C was further delayed. EDF Energy has admitted that it could be delayed until 2027. The Minister also admitted the Government has no target for nuclear energy use in the future.² Former energy secretary, Sir Edward Davey, who signed off on Hinkley Point C has cast doubt on whether the project will ever get built at all, let alone by 2027.³ So there is plenty of time to implement some of the alternative measures we suggest below.

As we stressed in our response to the Helm ‘cost of energy’ review the best way for the Government to keep electricity costs to consumers as low as possible over the coming decades, while reducing carbon emissions, and providing secure electricity supplies, is to cancel Hinkley Point C, scrap the new nuclear programme, launch a much more comprehensive energy efficiency programme and expand renewable energy ambitions. Cancelling Hinkley Point C now might incur a cancellation cost of around £2bn, but consumers could save around £50bn over its lifetime.⁴

The cost of renewables is declining rapidly, and it is becoming increasingly clear that there are lots of ways of dealing with intermittency issues. Several financial institutions have predicted that large centralised power stations are likely to be obsolete within 10 to 20 years, because they are too big and inflexible, and are “not relevant” for future electricity.⁵ A recent UBS report which followed similar analysis by other large financial institutions and energy experts including Goldman Sachs, Barclay’s, Bloomberg and Citigroup, expects new solar and renewable technologies to drive rapid change in large scale utility companies.⁶ In short Hinkley Point C and the rest of the proposed new nuclear programme will already be obsolete before 2027.

So Hinkley Point C and the rest of the UK’s ill-conceived new nuclear programme will be too late, too expensive and too problematic. Wind and solar are cheaper more flexible and much quicker to build. It is time to cancel Hinkley Point C now before consumers are saddled with a needless bill for £50bn not to mention the nuclear waste which we still don’t know what to do with.

Overarching National Policy Statement on Energy (EN1)

This new NPS is supposed to sit outside of the 2011 Energy NPS suite, as a standalone NPS which will set the framework for development consent decisions on applications for new nuclear power stations post 2025. Yet the Overarching NPS on Energy EN-1, together with the original EN-6 were the documents which set out the need for nuclear power.

Other than expressing the view that “*the assessment of the need for new electricity generation carried out to support EN-1 remains valuable and continues to be relevant*” (para 1.7), the Government offers no evidence that the analysis in EN-1, after 7 years of rapid change in the energy sector remains relevant today.

The consultation document states that EN-1 “*carried out a detailed assessment of the future need for electricity generation and in light of that assessment made clear that new nuclear power has an important role to play in the UK’s future energy mix.*” (para 1.5)

Yet, that analysis was presented to Parliament in June 2011. It was based on an analysis of the evidence outlining different ‘pathways’ to 2050 published by the Department for Energy and Climate Change (DECC) in 2010.⁷ Based on that analysis EN-1 explains that “*electricity generation may need to more than double*” and so “*the government therefore anticipates a substantial amount of new generation will be required.*” Hence the need for new nuclear power stations.

However, by using more recent information from the DECC Calculator website, produced in 2014 – NOT the out of date DECC information on which EN-1 was based, which was published in 2010 – Together Against Sizewell C Campaign (TASC) has devised non-nuclear pathways which more successfully achieve every single government energy policy objective than any of the government’s pathways. Moreover, TASC shows how new nuclear power stations will hamper the achievement of government energy policy objectives.⁸ The difference between the TASC pathways and the government pathways used to justify new nuclear stations include for instance:

- All of the TASC pathways set home insulation at level 4 – meaning that 24 million homes will be properly insulated by 2050. Three government pathways, including the Government’s most cost effective option leave 6 million homes uninsulated and leaking heat and so with higher fuel bills.
- All the TASC pathways make greater use of solar power in buildings than all of the government pathways – again reducing fuel bills.

The point regarding the doubling of demand for electricity by 2050 was repeatedly emphasised by the Government in 2010 and 2011. However none of the recent pathways published by the Government demonstrate anything approaching a doubling of consumption. The relevance of this change in

circumstances is very clear: as the projected increase falls, so less new infrastructure (nuclear and otherwise) is needed. The increase in demand projected by the Government’s 2014 pathways ranged from 29.6% to 52.9%.

Ravi Gurumurthy, DECC’s Director of Strategy at the time, wrote in a blog⁹ on DECC’s website on 5th March 2012 that: “*All of our main scenarios for 2050 tell us that we need to plan to meet an increase in demand of between a third and two thirds, as transport and heating shift onto the electricity grid.*” Not a doubling of demand at all. Gurumurthy goes on to say: “*...no one can yet say for sure what the relative costs will be decades hence...*” If this is true, surely the Government should not have claimed in EN-1 that “*new nuclear is likely to become the least expensive form of low carbon electricity generation.*”

Updated Emissions Projections

The Government’s Updated Energy and Emissions Projections 2016 stated that by 2035 overall demand for electricity is expected to have increased.¹⁰ Annex F of this documents shows that electricity demand is expected to increase in low and high growth scenarios as follows:

	Ktoe 2016	TWh 2016	Ktoe 2035	TWh 2035	%increase
Low Growth	27002	314	31842	370	18%
High Growth	27030	314	33164	386	23%

These numbers are nowhere near consistent with a 100% increase in demand by 2050. The 56TWh – 72TWh projected increase in electricity consumption, for instance, is well within the 100 TWh of electricity savings detailed in a report for the Government by McKinsey for which there are currently no plans to capture.¹¹

Paragraph 1.7 of the consultation document states that: “*...all but one of the existing fleet of nuclear reactors are due to cease generating before 2030, so the need for new nuclear power remains significant.*”

This is a non-sequitur. There is no rule which says that old nuclear power stations must be replaced by new ones. Nuclear generation was 72TWh in 2016 or about 21% of electricity produced in the UK. Total installed nuclear capacity is around 8.9GW. As detailed below an accelerated programme of LED lighting installation could reduce peak electricity demand by almost this amount (8GW). The Government has offered no evidence to show that, for instance, building new nuclear power stations is a better plan than an accelerated programme of LED lighting installation or indeed any other alternative.

Energy Efficiency

The potential for energy saving was not fully assessed by Government until after EN-1 had been approved. The Ministerial Foreword to its Energy Efficiency strategy, published in November 2012 stated that energy efficiency could save the equivalent to the energy generated by 22 power stations.¹² The 2013 update to the Strategy pointed out that over the previous 12 months the UK’s final energy consumption had fallen by nearly 1%, and that energy consumption had fallen for seven of the previous eight years.¹³ The projections in the 2013 update suggested that the existing policy package would reduce UK final energy consumption by 154 terrawatt hours¹ (TWh) by 2020 (against business as usual projections).¹⁴

The current Energy Minister, Claire Perry, told the 2017 Conservative Party Conference that “*consumers’ energy bills have actually gone down, mostly because we are more energy efficient and use more efficient appliances.*”¹⁵

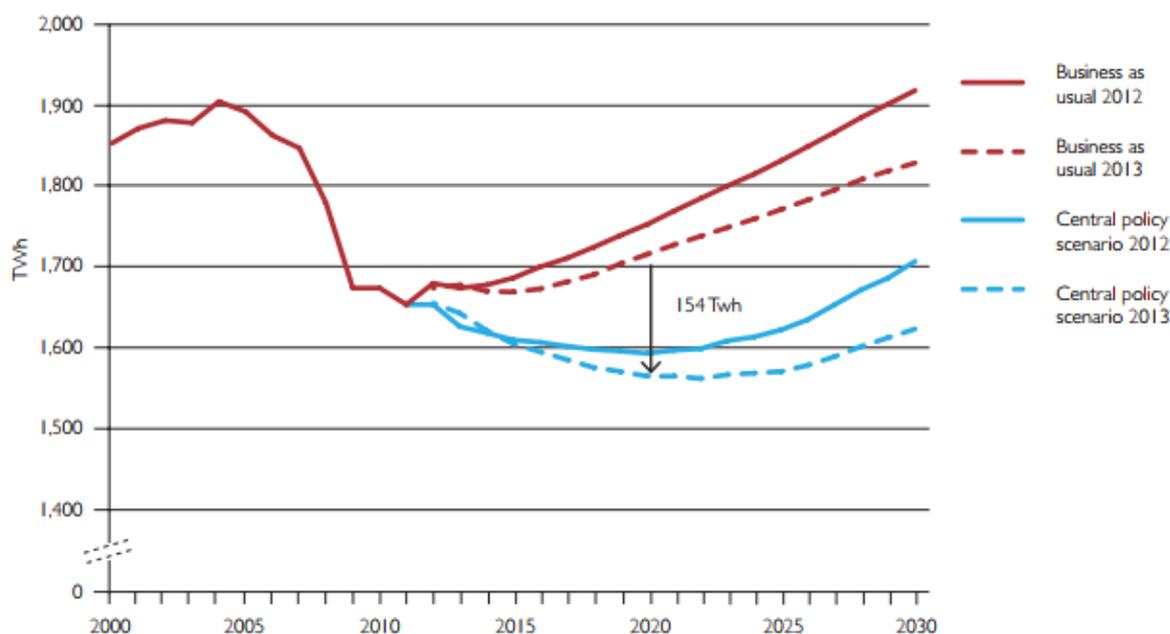
¹ 1 terawatt = 1 000 000 000 kilowatts or 1 billion units of electricity.

As detailed in the joint response to the Government’s Clean Growth Strategy from the Stop Hinkley Campaign and the Nuclear Free Local Authorities,¹⁶ there has been a consumption revolution over the past decade prompted by vastly improved electricity efficiency in industry, in consumer white and brown goods, and in areas like lighting, where household consumption has dropped from 20.7 TWh in 2007, to 19.3TWh by 2010 and by 2016 this was down to 14.2TWh. This trend is set to continue. By 2025 LEDs will probably have replaced most CFLs and incandescent light bulbs, and LEDs themselves are becoming more efficient.

An accelerated programme to replace all the lights in the UK with LEDs could cut peak electricity demand by about 8GW, a saving of another 15% of all power consumption. LEDs produce less waste heat and so can sometimes cut the need for air conditioning in places such as hotels and large office buildings. Even a much more restricted national campaign that just focused on domestic houses would have a dramatic impact. If we switched the lights in the parts of the house that are in use in early evening - essentially the kitchen and living areas - we would reduce home demand by more than 50%. We could cut the typical demand for electricity to run lights from today's evening average of 180W to 80W by replacing about 21 bulbs in the typical home. The impact would reduce peak electricity demand by 2.7GW – almost the capacity of Hinkley Point C. The payback period of such a scheme is about two years at last year’s LED prices. For an expenditure of around £60, the householder would typically save £30 a year¹⁷

Cost-effective investments in domestic energy efficiency alone between now and 2035 could save around 140 TWh of energy – roughly equivalent to the output of six power stations the size of Hinkley Point C, according to a report by the UK Energy Research Council. Such a programme could save an average of £270 per household per year at current energy prices. The investments would deliver net benefits worth £7.5bn to the UK, and could reach £47bn, if benefits such as health improvements and additional economic activity are counted.¹⁸

In short, EN-1 and EN-6 (the existing and the proposed new one) are based on a false premise – there is no “need” for new nuclear power stations. Energy efficiency has already reduced electricity consumption by 30% compared with what it was expected to be in 2017 at the time that Hinkley Point C was first mooted, and the reductions can continue.



Electricity Costs

EN-1 (para 3.5.8) states that the Government believes that nuclear power is economically competitive with other forms of generating technology.

In contrast a National Audit Office (NAO) report published in June 2017 warned the “*deal for Hinkley Point C has locked consumers into a risky and expensive project with uncertain strategic and economic benefits.*” It continued “*when the Department finalised the deal in 2016 its value-for-money tests showed the economic case for Hinkley Point C was marginal and subject to significant uncertainty. [Since then] the government’s case for the project has weakened ... Delays have pushed back the nuclear power plant’s construction, and the expected cost of top-up payments under the Hinkley Point C’s contract for difference has increased from £6 billion to £30 billion.*”¹⁹

The Committee on Climate Change (CCC) points out that the cost of renewables has fallen far more quickly than it assumed earlier. In its 2011 Renewable Energy Review offshore wind costs were expected to fall to £52-124/MWh by 2040, but recently offshore wind projects have signed contracts at £57.50/MWh for delivery from 2022 (compared with £92.50/MWh for Hinkley Point C). At the same time, projected costs for new nuclear power have increased, while the deployment of carbon capture and storage (CCS) has not yet begun in the UK. Battery costs have also fallen more quickly than the Committee assumed. As Mike Thompson, Head of Carbon Budgets at the CCC says “*It is increasingly apparent that renewables do or will offer the lowest cost of electricity over their lifetime of all generating options.*”²⁰

Nuclear can’t compete with offshore wind

According to Hans Bunting, chief operating officer of renewables at Innogy SE, part of the company that owns npower, offshore windfarms will become even cheaper than today and companies that want to build new reactors in the UK will not be able to compete with windfarms on cost, even when their intermittency was taken into account. Innogy recently secured a subsidy of £74.75/MWh of power to build a windfarm off the Lincolnshire coast, which is £17.75 cheaper than Hinkley and should be completed about three years earlier. He said by the time Hinkley Point C starts commercial operation offshore wind costs will be even lower.²¹ Dong Energy and Engie secured a subsidy of just £57.50 per megawatt-hour for projects due to start in 2022/23.²²

Bloomberg New Energy Finance (BNEF) predicts that offshore wind, until recently the most expensive mainstream renewable technology, will see costs will drop a stunning 71% by 2040.²³ This can be assumed to mean a fall from around £150/MWh to around £44/MWh.

New onshore wind – the cheapest way to produce electricity by 2015

The cost of electricity from new onshore windfarms could be about the same cost as from new gas power stations – around half the cost of Hinkley Point C, according to leading engineering consultant, Arup. The technology has become so cheap that developers could deliver turbines for a guaranteed price of power so low that it would be effectively subsidy-free in terms of the impact on household energy bills.²⁴

The average price at which contracts have recently been awarded in German auctions was €38/MWh. Once distribution and transmission costs are factored in, the figure is likely to be closer to €40/MWh – about £35/MWh.²⁵ According to Bloomberg New Energy Finance (BNEF) new onshore windfarms were the cheapest way for a power company to produce electricity in Britain by 2015 with costs dropping to £55/MWh.²⁶ The trade body, Scottish Renewables, has shown that costs could be cut by a further 20% if government, industry and regulators work together to make sure we can use the latest generation of turbines on suitable sites, reduce grid charges, and deploy energy storage technologies.²⁷ The Bloomberg New Energy Finance (BNEF) outlook says the price of onshore wind has dropped

30% in the past eight years, and is expected to fall another 47% by 2040. That means a fall from around £50/MWh in 2017 to nearer £20/MWh in 2040.²⁸

An analysis by ECIU shows that the current block on onshore wind could cost £1bn over 4-5 years relative to deploying other technologies.²⁹

Solar – the cheapest way to generate energy (not just electricity) everywhere by 2030-40

The solar energy industry has been notoriously difficult to predict correctly. The IEA have constantly underestimated solar's potential and growth. That said there are many trends in solar that we can foresee continuing or accelerating over the next couple of decades. Costs will continue to decline as solar power installations multiply and solar technology becomes more efficient. Price could decline by an additional 59% by 2025 compared against 2016 prices, according to the International Renewable Energy Agency. Further declines will be difficult to achieve, but by 2040, the price could be two-thirds of its current cost.³⁰ By 2030 or 2040 solar will be the cheapest way to generate electricity, indeed any form of energy everywhere. At the rate of growth that we are seeing at the moment of 35-45% per year solar will grow from providing 2% of global electricity to at least 50% by 2030.³¹

In October 2017 it was reported that Saudi Arabia had received offers to supply solar electricity for the cheapest prices ever recorded, at 1.79 cents per kWh beating the previous record for a solar project in Abu Dhabi at 2.42 cents.³² Since then Chile has received two bids for electricity from large-scale solar projects, in 20 year contracts, at prices under 2.5¢/kWh in a recent national auction. The lowest bid was 2.148¢/kWh. This represents continued price declines in the solar industry and financial trust in the product from global financial houses.³³ Obviously Saudi Arabia has a much better solar resource than the UK, and demand better matches supply because of the high air conditioning demand during the day. However the International Renewable Energy Agency (IRENA) has highlighted the fact that solar photovoltaic (PV) electricity costs have fallen by 73 per cent since 2010 and are expected to halve again by 2020.³⁴ The first solar farm in the UK to have been built without government subsidy started generating in 2017 in Bedfordshire. It is located next to a six megawatt hour (MWh) battery storage facility.³⁵

Clearly nuclear power is no longer economically competitive with other forms of generating technology if it ever was, and EN-1 needs to be completely rewritten.³⁶

Dealing with intermittency

Para 1.6 of the consultation document states that:

“Government has noted previously that there are technical and commercial barriers to deploying other technologies to produce the same annual generation as that of nuclear power ... Government considers that decarbonisation of the power sector could be achieved at lowest cost if nuclear remains a key part of the UK's energy system.”

Energy minister Richard Harrington attacked nuclear power detractors as “naïve and simplistic” in his recent keynote speech at the Nuclear 2017 conference. He said that nuclear power would continue to play an “important role” in the mix of the UK's energy sources. He admitted that: “[t]here will be more pressure on nuclear from battery storage but we know that nuclear will be competitive”.³⁷ In other words because renewables are intermittent, nuclear energy will still be needed, despite the falling cost of energy storage. Tom Greatrex, chief executive of the Nuclear Industry Association, that: “It doesn't matter how low the price of offshore wind is” we still need a “diverse, well-balanced” mix of low-carbon energy.³⁸

In contrast, Dave Elliott Emeritus Professor, Faculty of Science, Technology, Engineering & Mathematics at the Open University, and author of a book called “*Balancing Green Power: How to*

deal with variable energy sources” says “we have the technology to match green power supply and demand at affordable cost without fossil fuels - by deploying the 'smart grid', using 'green gas' made from surplus power, and raising energy efficiency.”³⁹

If the UK really wants 'baseload' electricity, nuclear power stations are not the only way to provide it. Wind power with 'wind to gas' plant and CCGT gas power stations, for example, 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.⁴⁰ The group performed a simulation of electricity production during August 2025, which showed that surplus wind power above the 3.2GW equivalent to Hinkley Point C is used in windgas facilities first to produce hydrogen (H₂), then convert it to methane (CH₄). This is then fed into the conventional gas distribution system or stored in existing gas storage facilities and later reconverted into electricity in combined-cycle gas turbine (CCGT) power plants when the need arises. The cost of a wind power and windgas alternative to Hinkley Point C amounts to €101.4 billion; this figure is €7.2 billion lower than the subsidy cost of €108.6 billion that would accrue during the 35 years following the start of operations at Hinkley Point C in 2025. The cost calculation for the wind power and windgas alternative includes the construction and operation of all wind turbines as well as all electrolyzers and CCGT (combined cycle) power plants.

The technology for producing renewable hydrogen is known as power-to-gas (P2G), and it is quickly improving. P2G is primed for significant growth in coming years as demand for clean hydrogen grows, electrolyser capital costs fall, and cheap renewable energy bathes the grid. Many commentators believe it will be the key to grid stabilisation in systems with an increasing contribution from intermittent renewables. Research and development into using hydrogen an energy source and storage medium which allows electricity to be stored for weeks and months beyond what lithium-ion batteries can manage is being backed by some big energy companies including Shell and Uniper (formerly part of Eon) as well as carmakers BMW and Audi.⁴¹

P2G has already surpassed its 2020 cost reduction target set by the European Union. Sheffield-based ITM Power has been quietly building a global market in hydrogen technology, making electrolyzers that convert electricity to hydrogen. The Company says its P2G product is now half the price it was just a few years ago. The firm's work in Germany – where it has two ground-breaking projects – shows that not only is the process possible, it's pretty much commercially viable. P2G can turn surplus renewable electricity, which would otherwise go to waste into hydrogen, which can be used anytime in a number of ways.⁴²

In January 2018 the influential think tank, Carbon Tracker, published a research note showing how wind and solar projects in Colorado are now set to undercut the cost of existing coal-fired power stations even when storage costs are included.⁴³

Heating

EN-1 (para 3.3.14) says that “...even with major improvements in overall energy efficiency, we expect that demand for electricity is likely to increase, as significant sectors of energy demand (such as industry, heating and transport) switch from being powered by fossil fuels to using electricity. As a result of this electrification of demand, total electricity consumption (measured in terawatt hours over a year) could double by 2050.”

So, predictions of increases in electricity demand depend, at least partly, on predictions that much of our heating demand will switch from gas to electricity.

The Government's Clean Growth strategy says home heating will need to be fully decarbonised by 2050. But decisions on how this will be done will not be taken until the early 2020s. The Government has commissioned research into different heat demand scenarios, the use of hydrogen, what changes might be needed to the electricity grid in response to large scale uptake of heat pumps, the role that bioenergy might play in decarbonising heat and international activity.

The National Grid's recent Future of Gas report concluded that:

*"It looks likely that, instead of a single solution to decarbonising heat, a combination of solutions will develop including decarbonised gases such as hydrogen and biogases, alongside electric heat pumps, Combined Heat and Power facilities (CHP); and district heat networks. Improvements in energy efficiency will also play an important role. Investigations into all of these options are ongoing, with considerations including the cost, the age, type and ownership of properties, and the geographical location. Hydrogen for heat is gaining momentum and we believe that hydrogen will play a role in the future. It is seen as an attractive option for meeting the decarbonisation targets due to the potential lower cost and level of disruption compared to other routes."*⁴⁴

Switching completely from gas to electric heating would put a huge strain on the power transmission and distribution system, because there would be huge variation in the daily and seasonal demand. The UK's current distribution network would require a significant upgrade.⁴⁵ The Government plans to publish initial findings from a number of studies later this year, and a full report by summer 2018. So it is still not clear what the extent of the switch to electric heating will be. There are already plans to blend hydrogen into the UK gas grid,⁴⁶ and a recent report from KPMG found that converting the UK to hydrogen gas could be £150bn to £200bn cheaper than rewiring British homes to use electric heating powered by lower-carbon sources.⁴⁷ The Government may still decide to put more resources into developing the use of hydrogen in our existing gas grid along with district heat networks, and larger heat pumps used to provide heat for networks where renewable electricity is plentiful with associated heat storage. This would mean that the scale of the switch to electrifying heat could be much less than envisaged by EN-1.

Conclusions

The electricity system has changed radically in the years since the project to build new third generation nuclear in Britain was initiated. As Michael Grubb, Professor of International Energy and Climate Change Policy at University College London, told the House of Lords Selected Committee on Economic in 2016, although he had supported new nuclear during his time on the Committee on Climate Change, he felt *"times and conditions had substantially changed ... renewables are now clearly cheaper. Committing to a 35-year contract at that level was economically inappropriate"* He continued: *"renewable energy costs ... appear almost to have halved in the past few years ... We now have more than 10 gigawatts of solar, when the cost projections were that we would get 1.5 gigawatts by about this time ... It is now clear that in the electricity sector we will be delivering more renewables than the Government planned for or expected by 2020."*⁴⁸

Clearly EN-1, upon which EN-6 depends, needs to be completely re-written. There is no "need" for new nuclear power stations. This current consultation should be scrapped and the Government should go back to the drawing board and re-write EN-1.

¹ Letter from Andrew Warren, Chair of the British Energy Efficiency Federation, Guardian 5th July 2017 <https://www.theguardian.com/uk-news/2017/jul/05/nuclear-is-to-wind-as-betamaxis-to-netflix-why-hinkley-point-c-is-a-turkey> For more information on the need for nuclear power on energy efficiency watch Andrew Warren speaking at the CND Conference "No Need for Nuclear" in June 2017

<https://www.youtube.com/watch?v=mJcEthAd8uw>

² Telegraph 20th Feb 2018 <https://www.telegraph.co.uk/business/2018/02/20/uk-could-cope-hinkley-point-delayed-business-secretary-claims/>

³ Sir Ed Davey: 'There are doubts about whether Hinkley will ever get built' Unearthed 15th December 2017. <https://unearthed.greenpeace.org/2017/12/15/ed-davey-doubts-over-hinkley-point-nuclear/>

⁴ See Time to Cancel Hinkley Point C by Emeritus Professor Steve Thomas,

<http://www.no2nuclearpower.org.uk/wp/wp-content/uploads/2017/09/Time-to-Cancel-HinkleyFinal.pdf>

⁵ See Stop Hinkley Press Release 28th August 2014 <http://www.stophinkley.org/PressReleases/pr140828.pdf>

⁶ Green World 27th August 2014 <https://safeenergy.org/2014/08/27/ubs-its-time-to-join-the-solar-revolution/>

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- ⁷ 2050 Pathways Analysis, HM Government 2010 – EN-1 footnote 25 page 20
- ⁸ Nuclear Power: New Evidence: A call for a statutory review of the Overarching National Policy Statement for Energy (EN-1) made pursuant to Section 6 of the Planning Act 2008
<http://www.tasizewellc.org.uk/images/publications/reports/Nuclear-Additional-Evidence-July-2016.pdf>
- ⁹ Gurumurthy, R. Future consumers would not thank us for looking for an energy policy in the bargain basement, DECC 5th March 2012
http://webarchive.nationalarchives.gov.uk/20140403100311tf_/http://blog.decc.gov.uk/2012/03/05/future-consumers-would-not-thank-us-for-looking-for-an-energy-policy-in-the-bargain-basement/
- ¹⁰ Updated Energy and Emissions Projections 2016, BEIS March 2017,
<https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2016>
- ¹¹ McKinsey, 2012 Capturing the full electricity efficiency potential of the U.K Draft report.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48456/5776-capturing-the-full-electricity-efficiency-potentia.pdf
- ¹² The Energy Efficiency Strategy: The Energy Efficiency Opportunity in the UK, DECC, November 2012.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65602/6927-energy-efficiency-strategy--the-energy-efficiency.pdf
- ¹³ The Energy Efficiency Strategy, 2013 Update, DECC December 2013
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/266187/2901415_EnergyEfficiencyStrategy_acc.pdf
- ¹⁴ Ibid page 15&16
- ¹⁵ Ambrose, J. Green Measures Cut Power Bills despite for PM Cameron’s Misgivings, Telegraph 2nd October 2017 <http://www.telegraph.co.uk/business/2017/10/02/green-measures-cut-power-bills-despite-former-pmcamerons-misgivings/>
- ¹⁶ Comment on the UK Clean Growth Strategy NFLA Briefing No.169 14th December 2017
http://www.nuclearpolicy.info/wp/wp-content/uploads/2017/12/A282_NB169_UK_Clean_Growth_Plan.pdf
- ¹⁷ Goodall, C *The urgent case for a mass switch to LED lighting*, Ecologist 8th June 2016
http://www.theecologist.org/blogs_and_comments/commentators/2987760/the_urgent_case_for_an_mass_switch_to_led_lighting.html
- ¹⁸ Timperley, J. *Energy Efficiency Policies could save UK Homes £270 report finds*. Carbon Brief 6th September 2017, <https://www.carbonbrief.org/energy-efficiency-policies-save-uk-homes-270-report-finds>
- ¹⁹ National Audit Office Press Release 23rd June 2017 <https://www.nao.org.uk/press-release/hinkley-point-c/>
- ²⁰ Thompson, M Five reflections on Dieter Helm’s Cost of Energy Review, Committee on Climate Change 31st Oct 2017 <https://www.theccc.org.uk/2017/10/31/five-reflections-dieter-helms-cost-energy-review/>
- ²¹ Vaughan, A *New Nuclear Cannot Rival Windfarms Price, Energy Boss Says*, Guardian 22nd November 2017
<https://www.theguardian.com/environment/2017/nov/22/new-nuclear-power-cannot-rival-windfarms-price-energy-boss-innogy>
- ²² Ambrose, J. Offshore wind to power £17.5bn investment boom as costs halve, Telegraph 11th September 2017
<http://www.telegraph.co.uk/business/2017/09/11/offshore-wind-power-175bn-investment-boom-costs-halve/>
- ²³ Shankleman, J & Warren, H. *Solar Power will kill Coal Faster than you think*. Bloomberg 15th June 2017
<https://www.bloomberg.com/news/articles/2017-06-15/solar-power-will-kill-coal-sooner-than-you-think>
- ²⁴ Vaughan, A *Drop in wind energy costs adds pressure for Government rethink*, Guardian 23rd July 2017
<https://www.theguardian.com/environment/2017/jul/23/drop-in-wind-energy-costs-adds-pressure-for-government-rethink>
- ²⁵ Howard, E. *Wind power prices have plummeted again in Germany*, Renew Economy 30th Nov 2017
<http://reneweconomy.com.au/wind-power-prices-plummeted-germany-52338/>
- ²⁶ Macalister, T. *Onshore windfarms cheapest form of UK electricity report shows*, Guardian 7th Oct 2015
<https://www.theguardian.com/environment/2015/oct/07/onshore-wind-farms-cheapest-form-of-uk-electricity-report-shows>
- ²⁷ *Scottish Renewables sets out plans to cut new onshore wind costs by more than 20%* Renewable Energy Focus 12th September 2016 <http://www.renewableenergyfocus.com/view/44681/scottish-renewables-sets-out-plans-to-cut-new-onshore-wind-costs-by-more-than-20/>
- ²⁸ Shankleman, J & Warren, H. *Solar Power will kill Coal Faster than you think*. Bloomberg 15th June 2017
<https://www.bloomberg.com/news/articles/2017-06-15/solar-power-will-kill-coal-sooner-than-you-think>
- ²⁹ *Blown Away*, ECIU 25th October 2017 <http://eciu.net/reports/2017/blown-away>
- ³⁰ Pennell, K How solar energy will transform in 20 years, Smart Cities Dive 6th December 2017
<https://www.smartcitiesdive.com/news/how-solar-energy-will-transform-in-20-years/512386/>
- ³¹ Goodall, C *The Switch, how solar, storage and new tech means cheap power for all*. Profile Books 2016
<https://www.carboncommentary.com/switch/>

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- ³² Dipaola, A. *Saudi Arabia gets cheapest bid for solar in auction*, Bloomberg 3rd October 2017 <https://www.bloomberg.com/news/articles/2017-10-03/saudi-arabia-gets-cheapest-ever-bids-for-solar-power-in-auction>
- ³³ Weaver, J.F. *Chilean solar cost down 26%, as important as Saudi Arabia at 1.79¢/kWh*, Electrek 8th November 2017, <https://electrek.co/2017/11/08/chilean-solar-down-26-as-important-as-saudi-arabia-at-1-79%C2%A2-kwh/>
- ³⁴ Onshore Wind Power Now as Affordable as Any Other Source, Solar to Halve by 2020, Renewable Energy Focus 15th Jan 2018 <http://www.renewableenergyfocus.com/view/47447/onshore-wind-power-now-as-affordable-as-any-other-source-solar-to-halve-by-2020/>
- ³⁵ Thomas, N. *Solar power breakthrough as subsidy-free farm opens*, FT 26th September 2017 <https://www.ft.com/content/8ea432e4-a1e9-11e7-9e4f-7f5e6a7c98a2>
- ³⁶ For more information on energy costs see the joint submission by the NFLA and the Stop Hinkley Campaign to the call for evidence on Professor Dieter Helm's independent 'Cost of Energy Review' for the UK Government here http://www.nuclearpolicy.info/wp/wp-content/uploads/2018/01/A283_NB170_Helm_cost_of_energy_review.pdf
- ³⁷ Minister blasts nuclear power detractors, Utility Week 7th December 2017 <http://www.utilityweek.co.uk/news/minister-blasts-nuclear-power-detractors/1319302>
- ³⁸ Harrabin, R. *Offshore wind power cheaper than new nuclear*, BBC 11th September 2017 <http://www.bbc.co.uk/news/business-41220948>
- ³⁹ Elliott, D. *Renewable energy can keep the lights on – here's how*, The Ecologist 6th May 2016 <https://theecologist.org/2016/may/06/renewable-energy-can-keep-lights-heres-how>
- ⁴⁰ Marie-Louise Heddrich, Thorsten Lenck and Carlos Perez Linkenheil, *Wind power as an alternative to nuclear power from Hinkley Point C: a cost comparison, A short analysis commissioned by Greenpeace Energy in Germany, Berlin, 6 January 2016* https://www.greenpeace-energy.de/fileadmin/docs/pressematerial/Hinkley_Point/20160121_Study_Windgas_HPC_English.pdf See also Energy Brainpool, *Wind power with 'windgas' is cheaper and greener than Hinkley Point C nuclear plant* Ecologist 17th February 2016, <https://theecologist.org/2016/feb/17/wind-power-windgas-cheaper-and-greener-hinkley-point-c-nuclear-plant>
- ⁴¹ Medium 11th Sept 2017 <https://medium.com/@ch2ange/making-h2-while-the-sun-shines-2cbd04b496c7>
- ⁴² Davies Boren, Z. *Power to gas: The other storage solution*, Unearthed 2nd Sept 2016 <https://unearthed.greenpeace.org/2016/09/02/power-gas-storage-solution/>
- ⁴³ Murray, J. *Report: US records 'lowest renewables plus storage bids' to date*, Business Green 8th Jan 2018 <https://www.businessgreen.com/bg/news/3023954/report-us-records-lowest-renewables-plus-storage-bids-to-date>
- ⁴⁴ *The Future of Gas*, National Grid, March 2018. http://futureofgas.uk/wp-content/uploads/2018/03/The-Future-of-Gas_Conclusion_web.pdf
- ⁴⁵ *Parliamentary Labour Party Energy and Climate Change Committee, The Green Gas Book Summer 2016.* https://alansenergyblog.files.wordpress.com/2016/07/final-the-green-gasbook_96pp_v5.pdf
- ⁴⁶ Ambrose, J. *Energy networks prepare to blend hydrogen into the gas grid for the first time*, Telegraph 6th January 2018 <http://www.telegraph.co.uk/business/2018/01/06/hydrogen/>
- ⁴⁷ Ambrose, J. *£50bn plan for hydrogen gas sparks back to life*, Telegraph 2nd September 2017 <http://www.telegraph.co.uk/business/2017/09/02/50bn-plan-hydrogen-gas-sparks-back-life/>
- ⁴⁸ *House of Lords Select Committee on Economic Affairs, The Economics of UK Energy Policy* 18th October 2016 <http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/economicaffairs-committee/the-economics-of-uk-energy-policy/oral/42115.pdf>