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# 1. Hinkley cost to consumers rockets to £50bn

Following last month's revelation that the cost of Hinkley Point C could rise to over £20bn (1) it has emerged that the cost to consumers could mushroom to £50bn. The new official estimate is more than eight times higher than the £6bn that the National Audit Office estimated the plant would cost consumers when ministers first struck a subsidy deal to support it in 2013.

The reason for the increase is the decline in electricity prices, which in turn have hugely inflated the subsidies Hinkley is expected to require. Under the terms of the deal Hinkley Point C will receive a guaranteed price of £92.50 for every megawatt- hour of power that the plant generates for 35 years. If wholesale prices are below that level, the difference will be subsidised by consumers through levies on their energy bills. Wholesale prices and projections of future prices have both fallen significantly since 2013. This has increased the estimates of the subsidy payments that will be required for Hinkley Point, making the project appear increasingly poor value. Government figures show that, as of September last year, the lifetime costs of Hinkley Point C were estimated at £49.9 billion. That compares with an estimate of £36.9 billion in 2015 and £14.5 billion in 2014. (2)

According to Matt Ridley, writing in *The Times*, "Almost nobody wants Hinkley to go ahead". He says it's time to scrap it. The French unions want Hinkley cancelled. It is not clear China wants to go ahead, and subtle negotiation could tease this out. They increasingly realise that the Hinkley design is a dead end, as costs escalate and delays grow. And they know that the future for nuclear power must lie in smaller, modular units, mass-manufactured like cars rather than assembled from scratch like He says cancellation would cost some £20 billion. But if the initiative comes from Beijing it is just possible that some new arrangement could be salvaged from the certain wreckage of the EDF scheme, without seriously damaging both livelihoods and our relations with China. (3)

Alberto Gandolfi, Head of European Utilities Research at Goldman Sachs Research says costs of wind and solar have dropped 60% since 2009 and another nearly 40% reduction is expected over the next ten years. What started as a decarbonisation process, thanks to better technology, is about to become a process driven by costs. You could see governments and countries adding more and more wind and solar without any impact on final consumers. Larger turbines are reducing wind costs by producing power at much lower wind speeds. Effectively what used to require 20 knots, now only requires 10 knots. Goldman Sachs forecast that by 2020 renewables will cost less than the current average power price. This will trigger acceleration in investment. Goldman Sachs forecast an investment of about \$3 trillion over the next 20 years. What this means is that the transition to a low carbon economy is accelerating. (4) So while the rest of the world is benefitting from falling power costs the UK will be stuck paying an index linked price for expensive nuclear electricity.

In the UK onshore windfarms could be built for the same cost as new gas power stations and nearly 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. Arup's report found that windfarms could be delivered for a maximum of £50-55 per MWh across 15 years. Scottish Power, which commissioned the analysis, hopes to persuade the government to reconsider its stance on onshore windfarms. If it did, Scottish Power believes most new projects would be built in Scotland.

Leo Murray, of climate change charity 10:10, said: *"It looks increasingly absurd that the Conservatives have effectively banned Britain's cheapest source of new power."* (5)

Dieter Helm, an economist at the University of Oxford, has been asked by the Department for Business, Industrial and Energy Strategy (BEIS) to carry out a review of energy costs. He has been a vocal critic of the costs of both renewable power and nuclear in the past. The Conservative manifesto promised the resulting report would be the first step towards *"competitive and affordable energy costs"*. Helm believes funding should be directed at next generation renewable technologies, such as more efficient solar panels. He also backs emerging technologies such as smart grids and battery storage. The new energy minister, Richard Harrington, has already said the government is still committed to a new generation of nuclear power stations, but Helm's review could provide justification for abandoning those ambitions on cost grounds. (6)

### **£22bn Hinkley Compensation?**

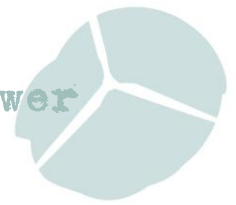
Meanwhile the Government has confirmed that there are provisions for compensation in Hinkley contracts – but hasn't given any further indication of what they are and under what circumstances they might be activated.

The National Audit Office's recent report on Hinkley Point C (HPC) said

*"Withdrawal from Euratom might be interpreted as a change in the law that could result in an adjustment to the terms of the HPC (Hinkley Point C) CfD, or an event that could trigger the compensation clause in the (Secretary of State Investor Agreement) SoSIA. At the time of the decision to withdraw from Euratom, the Department had not performed any assessments of the effects of withdrawal or the risks arising from this decision."*

The other certainty we have is that there are in place binding agreements about liabilities arising from the construction and operation of Hinkley Point C. These cover a whole range of liabilities and circumstances, and are essentially designed to give some certainty to the construction and operation process; but also to the circumstances under which Hinkley C might not go ahead, or be stopped once it is operational. In certain, highly unlikely, scenarios e.g. HMG permanently prevents the construction or operation of the facility or a reactor or where there is a political shut down of HPC by a UK, EU or international Competent Authority, payments could be up to around £22bn excluding non-decommissioning operational costs that may be incurred after any shutdown. However, the liability to make payments under the SOSIA is almost entirely within the control of HMG.'

The SOSIA does provide for compensation in the event, say, that the government decides, essentially politically, that Hinkley C is not a project they want to proceed with and wants to bail out: that is what is known in the agreement as a 'Qualifying Effective Shutdown Event'. But there



is more in the agreement than this: what is defined in the agreement as a Qualifying Shutdown event includes changes to the law or implementing changes to policy or guidance. These events could well trigger the ability of the injured party to walk away with a large amount of compensation, perhaps, as the Secretary of State says, of up to £22 billion. (7) But surely payment would only be that large if the government chose to close the plant the day after it entered service.

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  2. Times 19<sup>th</sup> July 2017 <https://www.thetimes.co.uk/edition/business/hinkley-point-cost-could-soar-to-50bn-6brnph9q7>
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  5. Guardian 23<sup>rd</sup> July 2017 <https://www.theguardian.com/environment/2017/jul/23/drop-in-wind-energy-costs-adds-pressure-for-government-rethink>
  6. Guardian 12<sup>th</sup> July 2017 <https://www.theguardian.com/environment/2017/jul/12/renewable-power-energy-costs-review-dieter-helm>
  7. Alan Whitehead's Blog 21<sup>st</sup> July 2017 <https://alansenergyblog.wordpress.com/2017/07/21/the-mysterious-case-of-the-22-billion-in-the-night/>



## 2. The Koreans are Coming

Korea Hydro & Nuclear Power (KHNP) - A Korean state-owned company - is drawing up plans to buy a slice of the new £10bn nuclear plant proposed for Wylfa on Anglesey in north Wales.

The development is the latest twist in the tortuous efforts to fund the UK's new nuclear programme. Hitachi, the current owners of Horizon nuclear, has been trying to attract funds for the 5.4MW twin ABWR reactors it wants to build on the island. It is unwilling to shoulder the project's £10bn-plus price tag on its own, however, and has been scouring the world for investors.

KHNP, a subsidiary of Korea Electric Power Corporation, would likely invest in Horizon as a minority shareholder alongside the governments of Japan and Britain. It is understood to be hiring advisers in the UK. Britain could end up with a 20% stake in Horizon, which the government would probably sell once the project is complete. Japan could put money into Horizon through state investment arms JBIC and NEXI. (1)

The Korea Electric Power Corporation (KEPCO) is also trying to buy the planned NuGen plant in Moorside, Cumbria, which is being sold by its embattled Japanese owner Toshiba. Hitachi has been told to undercut this "strike price" significantly, but is believed to be struggling to get it down to the £70-£80 range. It is calling for Tokyo and London to inject funds and share the construction risk. KEPCO says it is 'competing' to supply reactors for the Moorside project. It wants to use its own APR-1400 reactor design, rather than Toshiba's AP1000. This would cause a delay of at least 2 years as the APR-1400 undergoes a Generic Design Assessment. (2)

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1. Sunday Times 23rd July 2017 <https://www.thetimes.co.uk/edition/business/koreans-target-10bn-welsh-nuclear-plant-s5lswf9vh>
  2. Whitehaven News 12th July 2017 <http://www.whitehavennews.co.uk/news/Korean-firm-in-competition-over-Cumbrias-new-nuclear-reactors-789e0cdd-490c-4f46-abb9-0625f8e5bf90-ds>



### 3. Press generates electric vehicle nuclear demand scare

The National Grid has highlighted the risk of big increases in peak electricity demand unless electric vehicle (EV) charging is carefully managed. Much of the press chose to emphasise its most extreme scenario which could see peak demand increase by 18GW - the “*equivalent to capacity of 6 nuclear plants by 2050*” (1)

The National Grid’s latest annual report (2) says EVs could grow at twice the rate over the next 10 years compared to what was expected just a year ago, potentially posing major challenges for the UK’s electricity grid. Last year National Grid said there could be up to 2.8m EVs on the road by 2025, now it expects 4.8m and 9m by 2030. The report says:

*“If not managed carefully the additional demand will create challenges across all sections of the energy system, particularly at peak times.”*

Since the National Grid report was published the Government has announced plans to ban the sale of all new petrol and diesel cars and vans from 2040 because of fears that rising levels of nitrogen oxide pose a major risk to public health, so the figures may need to be revised upwards yet again next year. (3)

The press has had a tendency to generate nuclear demand scare stories on the back of predictions about the growth of demand for EVs. In February, the *Times* claimed that the UK would need 20 new nuclear plants to cope with demand from EVs. The article’s claim, repeated by the Mail Online, was later removed with a correction acknowledging a “*significant miscalculation*”.

On the back of this latest National Grid report some of the press has emphasised the extreme scenario which could see peak demand increase by 18GW. *The Financial Times* called it the “*equivalent to capacity of 6 nuclear plants by 2050*” (4) It said the National Grid report does highlight the risk of big increases in peak demand if EV charging is unmanaged. However it also notes that technologies such as smart charging could minimise the problem, describing 18GW as “*the most extreme scenario*” and emphasising that these are scenarios not predictions. Some of the other newspapers were not so careful. The *Daily Mail*, for instance, talked about “*five new Hinkley Points*” without including any of the caveats. (5) *The Express* claimed we would need ten new nuclear plants and 10,000 turbines for cars to go electric by 2040 with peak demand for ‘energy’ increasing by 50%. (6)

National Grid says that with 23-25m EVs in 2050, peak demand could be as high as 18GW, or as low as 6GW, depending how well managed the roll out is. *The Guardian* points out that shifting the charging of cars to times when demand is lower would reduce the extra peak demand to 3.5GW in 2030, a similar capacity to the new reactors being built at Hinkley Point. (7) Since we are already consuming 15% less electricity than we were a decade ago this need not be a huge concern. (8)

National Grid’s report presents a wide range of possible futures, partly in order to flag those challenges, so that they can be planned for and avoided. It does not make forecasts of what is



most likely to happen. In one scenario, where 100% of cars go electric but smart charging and shared autonomous vehicles help manage the impact on the grid, peak demand could be limited to around 6 gigawatts (GW) in 2050. This is equivalent to 10% of the current 60GW peak demand on a cold winter's day.

Reader in energy politics at Aberdeen University, Dave Toke, points out that on past trends peak demand is actually likely to FALL, not increase. He says almost everybody seems to have missed the fact that electricity demand has fallen since 2005 by around 12%. If you carry this forward to the future then this rate of decline would be more than the increase associated with the expansion in the number of EVs assumed by the National Grid. Given the fact that they identified opportunities for load shifting, in particular through 'time of use' charging that would reduce peak demand by up to 4.5 GW, that adds up altogether to a substantial FALL in the amount of peak generating capacity required in 2030. In fact if the extra electricity needed to power the projected expansion in EVs will be easily covered by the expansion in renewable energy if we assume recent trends continue. (9)

Carbon Brief says a wholesale move to EVs, in order to meet a ban on petrol and diesel cars, would add just 10% to UK electricity demand, according to a new analysis from consultants Cambridge Econometrics. As far as peak demand is concerned there are several unrealistic assumptions behind the media narrative and the claim we would need ten new nuclear power stations. Chief among them is the intuitively appealing idea that EV owners will all return home from work around the same time and immediately start charging their cars. In fact research suggests that the peak time for charging EVs is two hours later than the current evening peak demand. (10)

Chris Goodall also did some number crunching. He says that between now and 2030, the UK will add about 25 GW of offshore wind. Typically, these turbines will produce at about 50% capacity factor. (This is higher than 40%+ experienced at the moment as turbines get taller, more efficient and sited in higher wind locations). These turbines will thus produce about 110 TWh a year of electricity. Offshore wind load factors tend to be highest in winter, when power demand is also high. The annual electricity demand from 100% electric cars would be 75 TWh - just under about 2/3 of the amount of power produced by the offshore wind installed from now until 2030. Charging will be largely done at night, encouraged by the measures the government will put in place on off-peak charging. If users are incentivised to charge their vehicles overnight, demand will be essentially flat between 22.00 and 06.00. (11)

## Energy Revolution

In the foreword to this year's annual scenarios report, Marcus Stewart, National Grid head of energy insights explains: *"Last year I said that we were in the midst of an energy revolution, and this year it is even more evident."* The four scenarios, built around the company's own modelling and extensive consultation with the energy community, come with significant caveats. Chief among these is that only one of the four, named "Two Degrees" complies with legally-binding UK carbon targets. The Committee on Climate Change (CCC) says the UK must ultimately aim to reach zero emissions, in order to comply with the Paris Agreement. This is likely to require deeper emissions reductions by 2050 and, consequently, even the Two Degrees scenario is probably inadequate.





WWF criticised the National Grid for failing to live up to the Paris Agreement on climate change and its lack of ambition. It said the UK needs a better and more ambitious plan for how we meet increased energy demand whilst cutting emissions. We should be looking at scenarios which aim to reduce global temperature increases to 1.5 degrees. (12)

*The Guardian* reports that National Grid acknowledges that cars' batteries could also provide services and return power for the grid at a time when managing the network is becoming increasingly complex as variable sources of wind and solar power grow. (13)

The electric vehicle and gas outlooks produced by National Grid are just a small part of the Future Energy Scenarios work, which ranges across the entire UK energy system from transport, to heating, power and industrial demand. Other highlights in this year's report include much greater confidence in rapid, early growth of battery storage in the UK. National Grid now sees battery capacity reaching at least 2.1GW by 2025, across all four of its scenarios. As recently as March this year, Cordi O'Hara, director of system operator National Grid, suggested that if battery costs continued to fall at 20% per year, then the UK could see 8GW of storage connected within five years. However, it has now significantly scaled back its outlooks for longer-term growth, noting limited progress on adapting policy and regulation to encourage a market for batteries. Last year, it said up to 15GW could be installed by 2040. Now, it has cut this back to no more than 5GW by 2040. (14)

Marcus Stewart explained the reduction is down to "improved" modelling used to determine the amount of storage capacity needed to smooth generation in each scenario. *"Last year was the first year we included battery storage in the scenario modelling and we had a reasonably simplistic approach. This year we've built on that and improved the modelling."* he said. (15)

In all of the scenarios, new nuclear power stations are assumed to be built and the capacity of interconnectors that provide backup power from Europe rises from 4GW now to between 10GW and 19GW in 2030. *"Urgent action"* is needed on new nuclear power stations to help the UK stay within climate change targets, according to New Nuclear Watch Europe (NNWE). The "Two Degrees" scenario is only one of four possible ways forward for the UK energy sector. The report says 14.5GW of new nuclear capacity is needed by 2035 to meet the target and this will require *"urgent action"* to keep the nuclear new build programme on track. Potential delays and budget increases have recently hit large projects, such as Hinkley Point C. The National Grid report said there are *"many challenges"* in building nuclear plants at the pace and scale needed for the 2035 target. *"Financing for these large projects and political support can be assumed in a high prosperity, green world,"* the authors said. *"However, issues such as supply chain problems and legal challenges can all derail intended project progress. While this trajectory is plausible, a number of factors need to align for this amount of new nuclear build to progress."* (16)

Three of the National Grid's four scenarios predict that solar power will have the biggest share of generation capacity by 2050. National Grid says UK solar capacity could soar to as much as 44GW by 2050 if consumers take command of their own power supply. In the most pessimistic scenario solar capacity only grows to 14.33GW by 2025, an increase of less than 2GW on current levels, and it decreases by 2050 as PV generators are not renewed past their current operational life. However the most ambitious scenario for renewables deployment expects





23.53GW of solar deployed by 2025 and 44.15GW – a near quadrupling of current levels – by 2050. (17)

- Meanwhile, Cambridgeshire County Council has received planning permission for what it claims will be the UK's largest solar carport. The installation, which will be developed at the site of St Ives' Park & Ride, is anticipated to be 948kW in size and combined with a battery storage system as part of a wider demonstrator project with collaboration from distribution network operator UK Power Networks (UKPN). Although billed as a potentially significant boon for the UK's solar industry, carports have arguably yet to take off, with few installations of scale having been completed. Nottingham City Council installed a 76kW system at Harvey Hadden Leisure Centre in 2015, while SunGift claimed a UK first when it installed solar on a multi-story carport in Exeter the same month. The St Ives project may not be the UK's largest for long however, with Bentley Motors having last year won planning permission for a 3MW solar carport at its manufacturing facility in Cheshire. (18)

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1. FT 12<sup>th</sup> July 2017 <https://www.ft.com/content/11528c98-66fa-11e7-8526-7b38dcaef614>
  2. Future Energy Scenarios, National Grid, July 2017 <http://fes.nationalgrid.com/media/1244/final-fes-2017-interactive.pdf>
  3. Guardian 25<sup>th</sup> July 2017 <https://www.theguardian.com/politics/2017/jul/25/britain-to-ban-sale-of-all-diesel-and-petrol-cars-and-vans-from-2040>
  4. FT 12<sup>th</sup> July 2017 <https://www.ft.com/content/11528c98-66fa-11e7-8526-7b38dcaef614>
  5. Daily Mail 13<sup>th</sup> July 2017 <http://www.dailymail.co.uk/sciencetech/article-4691314/Britain-needs-equivalent-FIVE-extra-Hinkley-Points.html>
  6. Express 27<sup>th</sup> July 2017 <http://www.express.co.uk/news/uk/833529/electric-cars-michael-gove-national-grid-power-hinkley-point-diesel-petrol-demand>
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  8. Guardian 5<sup>th</sup> July 2017 <https://www.theguardian.com/uk-news/2017/jul/05/nuclear-is-to-wind-as-betamax-is-to-netflix-why-hinkley-point-c-is-a-turkey> See also nuClear News No.97 Hinkley Point – Plan B is already happening. <http://www.no2nuclearpower.org.uk/nuclearnews/NuClearNewsNo97.pdf>
  9. Dave Toke's Blog 27<sup>th</sup> July 2017 <http://realfeed-intariffs.blogspot.com/>
  10. Carbon Brief 27<sup>th</sup> July 2017 <https://www.carbonbrief.org/analysis-switch-to-electric-vehicles-would-add-just-10-per-cent-to-uk-power-demand>
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## 4. Smart Energy Revolution

The Government and Ofgem have published their strategy for a modernised, smart and flexible power system. The 32-page document by the Department for Business, Energy and Industrial Strategy (BEIS) looks at how a smarter energy system will create opportunities to reduce energy costs, increase productivity and put UK businesses in a leading position to export smart energy technology and services to the rest of the world. The plan aims to facilitate a smarter grid through a series of technical and regulatory changes. (1)

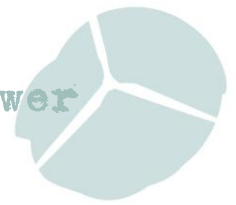
A study by Imperial College and the Carbon Trust, which was commissioned by BEIS, estimates that between £17bn and £40bn could be saved by 2050 if technologies such as battery storage and demand side response become more widespread. New rules will make it easier for people to generate their own power with solar panels, store it in batteries and sell it to the National Grid. The rules are due to come into effect over the next year. They will reduce costs for someone who allows their washing machine to be turned on by the internet to maximise use of cheap solar power on a sunny afternoon. And they will even support people who agree to have their freezers switched off for a few minutes to smooth demand at peak times. They'll also benefit a business that allows its air-conditioning to be turned down briefly to help balance a spell of peak energy demand on the National Grid. Thanks to improvements in digital technology, battery storage and renewables, these innovations in flexibility are already under way with millions of people across the UK generating and storing electricity. So instead of predicting peak demand then building power stations to meet it, energy managers will be able to trade in Negawatts - negative electricity. (2)

The Government will invest £246m in battery technology that it says will be a key pillar in helping to power its industrial strategy. In its first major move to support the nascent battery revolution, the Government will set up a "battery institute" to award hundreds of millions of pounds to companies on the brink of major research and development breakthroughs. Greg Clarke underlined the importance of "cutting -edge energy plans", which include battery power and electric, driverless vehicles.

The rapidly falling cost of battery power is expected to radically change the way Britain is able to make use of its renewable energy generation, by storing excess wind and solar for when wind speeds slip and sunshine wanes. Battery technology is already ushering in major upheaval for automotive industries and fuel retailers by accelerating the boom in electric vehicles. (3)

*"You almost need to draw a line under what has come before [with energy markets] and start again" says Nick Boyle, the founder of Europe's largest solar operator Lightsource. "There is no doubt that batteries completely and utterly metamorphose the market in that they make the uncontrollable controllable. It makes the arguments against renewable energy fall away,"*

The new energy reality is not simply about consumers taking power from generators, but means the roles of producer and consumer will flip and, in some cases, merge. Lightsource is already pairing solar panels with battery packs to allow customers to effectively become their own energy market. Solar panels create energy which can be used at cheaper rates than electricity from the main grid, or stored in the battery to use later. If the battery and electric vehicle are both charged a Lightsource customer could sell their power back to the grid. By creating a network of households and businesses which can generate power and reduce demand, Lightsource could create a string of virtual low-carbon power plants.



"We've always said that we would like to equip a million homes with solar panels and batteries. If you use a 4kW panel that would be 4GW of capacity," says Boyle. This is the equivalent scale of Hinkley Point C plus a gas-fired power plant, but only when the sun shines. "But if you add a 6kW battery you've created an extra 6GW of storable electricity which could be used to balance the grid."

"It's not about hardware anymore. It's about software. And this can move at such an incredible pace and will only get quicker," says Boyle. "It seems like we're offering something impossible. But this is only because many are still using a yardstick of how they bought energy in the past. You almost need to draw a line under what has come before and start again." (4)

"This government's record on energy has been incompetent to the point of derision or despair, depending on how much you care about it" says Stuart Elmes, CEO of Viridian Solar. But finally the Government is showing signs that it gets it.

Greg Clarke, Secretary of State for Business, Energy and Industrial Strategy (BEIS) is talking about nothing less than the coming revolution in energy, one that has become evident to many working in the renewables sector, but has until now been just a little too far over the horizon for the politicians to 'get'. A combination of key technologies - solar, wind, and energy storage coupled with a real-time energy market driven by information technology are maturing and the impact will be extraordinary.

Solar panels and wind turbines have a complementary output profile and a combination of both will even out seasonal energy production in northern climates such as the UK. Energy will be stored in and released from large batteries - including those in electric vehicles - to meet shorter term peaks in demand and troughs in supply. Real-time electricity pricing will allow internet enabled appliances to turn on or regulate down following pricing signals to smooth out demand to better match supply.

What we're looking at is a fundamental shift from an energy system based on resources to one founded on technology. The inflexion point is coming and it's now no longer a question of whether the oil age will end, but how soon it will come. So, two cheers for Greg Clarke, it looks like he's got the vision, competent implementation to support a smart grid will now be the key to the UK taking advantage of the coming energy revolution. (5)

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