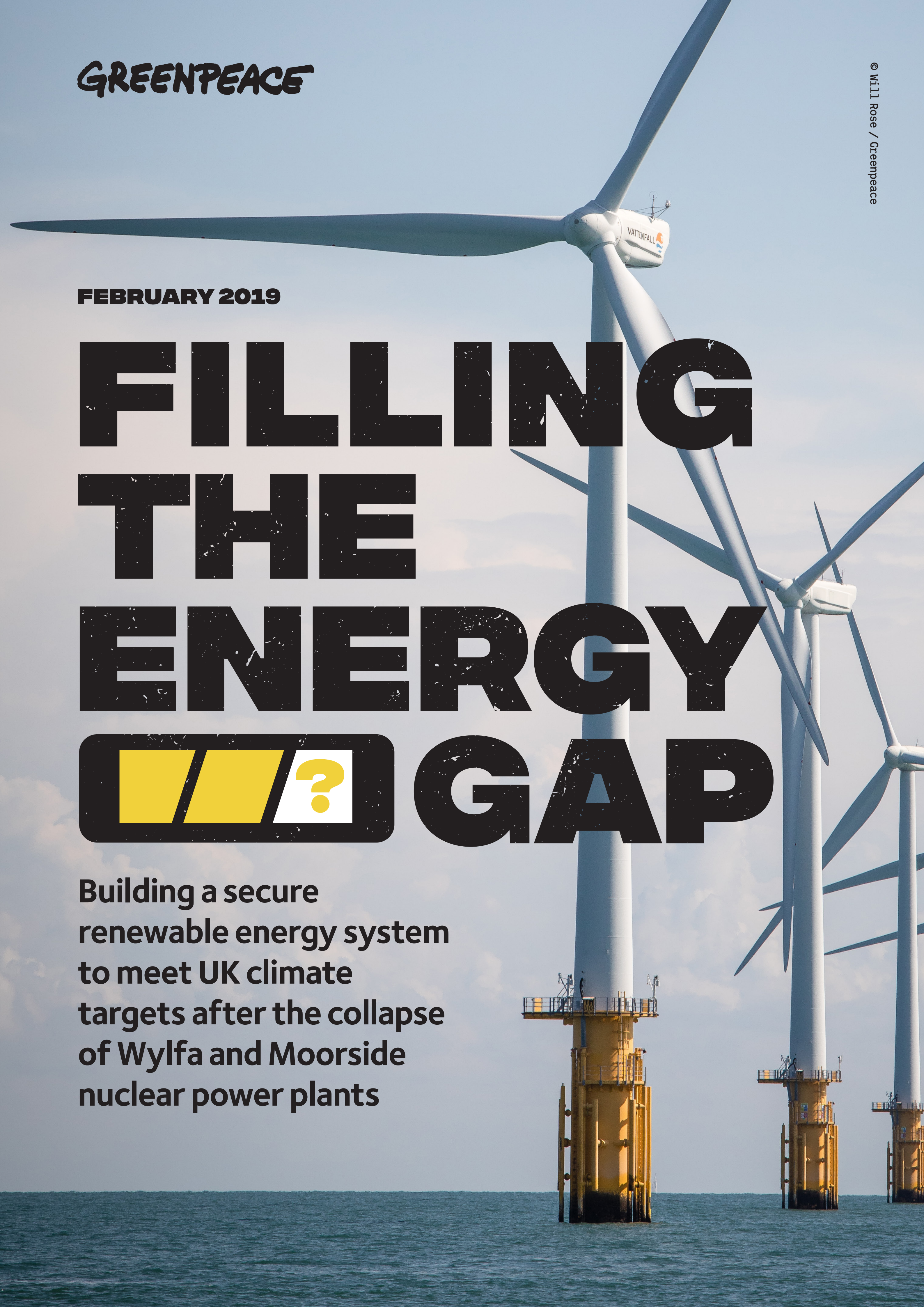

GREENPEACE

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FILLING THE ENERGY ? GAP

Building a secure renewable energy system to meet UK climate targets after the collapse of Wylfa and Moorside nuclear power plants

SUMMARY

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The Government's energy policy needs a radical change in direction. Following the demise of the Wylfa and Moorside nuclear power projects, carbon reduction deadlines are looming under the Climate Change Act. Public demand is also growing for bolder UK climate leadership to deliver on the Paris Agreement and 'net zero' emissions.

Business Secretary Greg Clark acknowledged in the House of Commons on 17th January 2019 that the cost of renewable technologies has dramatically fallen while nuclear costs have risen. As such, nuclear is being outcompeted and it is clear there is no other plausible pathway to deliver a heavily decarbonised power sector by 2030 than through renewables doing the heavy lifting.

"In many ways, the challenge of financing new nuclear is one of falling costs and greater abundance of alternative technologies, which means that nuclear is being out-competed. Far from there being a difficulty with future supply, those are the reasons why the competitiveness of nuclear is more difficult."

Secretary of State for Business, Energy and Industrial Strategy Greg Clark, House of Commons, 17th January 2019[1]

Added to this, electrification of heat and transport needs to happen at a much faster pace – including a phaseout of new petrol and diesel cars and vans by 2030. This is necessary to deliver on legally mandated carbon commitments and ensure the Government steps up to the moral urgency of climate change. This adds to the demand for high volumes of renewable power, coupled with an evolution of the power grid through increased interconnection, demand response, smart grid and storage to ensure security and flexibility.

It is therefore clear that large volumes of renewables need to be built in the 2020s to meet legally binding carbon targets and maintain the UK's global climate leadership. This means unlocking onshore wind and solar, whilst boosting offshore wind to a much greater degree than currently planned in the Offshore Wind Sector Deal. These technologies will need to deliver the majority of low carbon power by 2030. Current ambition in all of these sectors is severely lacking; **wind and solar generation needs to be tripled over the next decade from 2020 levels.**

Some commentators argue for increased reliance on gas power to fill the gap to 2030 instead. However, this approach is both incompatible with the UK's climate goals and would deliver poor value for money compared to increased supply from renewables and flexible grid technologies. **Technologies like storage and interconnection that accommodate this level of variable renewables are coming through strongly,** ensuring that renewable power can contribute to UK energy security. However, additional short term policy support is also needed **to guarantee expansion on the scale required**.

POLICY RECOMMENDATIONS

(See section Low Carbon Power Requirements to 2030 for detailed calculations)

Offshore renewables funding – The Government has confirmed the availability of £557m for Contracts for Difference (CfD) to support further renewables expansion. More than the current £60m should be made available in the spring 2019 auction for offshore wind (for delivery in financial years 2023/4 and 2024/5). This additional money is to guarantee contracts equating to at least 2.5-3GW of offshore wind power per year, compared to Government expectations of only 2GW per year. This will ensure the pipeline is established for the rapid expansion required over the second half of the next decade. If the additional money released for the spring auction pot is ultimately not required because of price drops, it would not be a problem. Sources from within industry suggest that the growth of a UK supply chain would not be adversely impacted by rapid expansion from the next 2019 auction onwards, although maximising UK content whilst sustaining cost reduction would require public support and investment into parts of the supply chain, for example the offshore fabrication yards. In the following CfD auction, ideally earlier than Spring 2021 as currently expected, installation rates must be expanded further to reach around 4.5GW per year by 2030.

"It is time to aim higher and seize the opportunity that offshore wind brings."

SSE Chief Executive, Alistair Phillips-Davies, 24th January 2019[2]

Offshore wind target – A target of around **45GW by 2030** is needed. The current Government target of 30GW by 2030 is wholly inadequate given the failure of the new nuclear power programme. Clear priority should be given to offshore wind as a use of seabed, ahead of oil and gas, aggregates or fishing, and the Crown Estate and Crown Estate Scotland should seek to designate substantially more seabed than currently proposed in its next licence round. The Ministry of Defence should be mandated to procure offshore wind-compatible radar technology in their new purchases. A strategic approach to grid infrastructure at this level of deployment would save costs and should reduce planning delays. Extensive innovation funding should also be made available for floating offshore wind, potentially from the £557m pot. This would assist with reducing environmental impacts, made possible through floating turbines located further away from the shore and seabird feeding grounds. The Westminster and Scottish Governments should also take a more proactive approach in assessing any environmental impacts of offshore wind, and ensuring siting takes place appropriately to minimise risks to nature, including birds and marine life.

Solar – A target of **at least 40GW by 2030** is required. Money should be made available, as necessary, from the £557m to enable larger scale solar projects to bid for auctions this year. Clearly many places will be inappropriate for large scale solar development given protection of the landscape is also a priority. Rooftop solar should therefore be significantly expanded. This would benefit UK smart grid capability as well as decarbonisation. Expansion should be achieved through sufficient incentives to generate private investment, including mandating a floor price for the new export guarantee, equivalent to or greater than the average annual spill price paid to large generators. The original export guarantee and Feed In Tariff scheme should also run until the new scheme begins. VAT and business rate charges should be reduced for solar, and the Government should implement the provisions the UK has agreed to in the EU 2030 package on protecting the rights of citizens to become producers of power.

Onshore wind – A target of **at least 30GW by 2030** is required. This can be delivered through giving the immediate go-ahead to the 4GW of onshore wind that is ready to build, and confirming repowering of all existing sites. Beyond that, the Government must allow onshore wind to bid in CfD auctions where planning permissions are obtained, and alter planning law to enable small scale onshore wind projects to continue in England where there is community acceptance.

UK Energy White Paper – This is an opportunity to robustly take stock, drawing upon advice from experts beyond Whitehall, of the latest low-carbon, smart and storage developments, their accompanying cost reduction curves, and broader global market trends. The speed of technological change and the growing urgency for emission reductions across the entire economy mean that it is imperative the paper has a broad enough scope. This means extending across the heat, transport and heavy industry sectors, as well as power – and taking an overview of how the system works together as a whole, particularly in terms of flexibility and security. The goals of delivering 'net zero' emissions before 2050 and maintaining cost-effective energy security must be front and centre.

LOW CARBON POWER REQUIREMENTS TO 2030

MEETING CARBON TARGETS

The UK's new nuclear power programme is in trouble, with companies pulling out of the developments at both Moorside and Wylfa. Renewables, combined with advances in smart grid technology, interconnection and demand-side response, can cost-effectively deliver on this new decarbonisation challenge. Below is an outline of what needs to happen.

A good guide to the level of renewables required is last summer's Climate Change Committee (CCC) scenarios for power in 2030[3], which seeks to portray how the UK could be compliant with the Climate Change Act's 5th carbon budget in 2030. The following table outlines the CCC's scenarios:

TABLE 1: CCC 2030 POWER SECTOR SCENARIOS REACHING 50GCO2/KWH

Technology	High Low Carbon (GW (TWh))	High Renewables (GW (TWh))
Nuclear	7 (59)	4 (35)
Onshore Wind	26 (62)	29 (70)
Offshore Wind	31 (114)	34 (123)
CCS	2 (16)	2 (16)
Solar	35 (29)	43 (37)
Tidal	1 (2)	1 (2)
Biomass	7 (29)	7 (29)
Hydro	2 (5)	2 (5)

These are the only scenarios the CCC have done that are expected to deliver an average emissions intensity of 50gCO2/kWh. This level of emissions reduction is required to be compatible with any 'net zero' ambition, to ensure delivery on the Paris Agreement (limiting global warming to 1.5 degrees), and to account for the present under-performance in decarbonising sectors such as heavy industry and building efficiency. In 2017, the UK's average emissions intensity was 263gCO2/kWh - so it is increasingly clear that significant additional decarbonisation is required across all sectors over the next decade to avoid contributing to runaway climate change on a global scale. Much greater ambition on power sector decarbonisation is necessary in the 2020s to support greater carbon reduction in the transport sector in particular, which is significantly lagging behind at present.

HOW MUCH LOW CARBON POWER DO WE NEED?

Increasing from present levels of around 300TWh[4], the CCC expects the power demand in 2030 to be 365TWh. However, if we factor in a 2030 phaseout of new cars and vans fueled with fossil fuels, and a steady rise in their sales to 2030, demand for charging vehicles would be approximately 34TWh by that date (see Appendix). This is compared to the CCC estimate of 20TWh[5] under their scenario, which has slower electric vehicles growth.

The Government should therefore be planning for total power demand in 2030 at approximately 379TWh. Only about 47TWh of this could be met by gas in order not to exceed the 50gCO2/kWh objective. So 332TWh would need to be met by low carbon generation by 2030.

WHERE WILL THE LOW-CARBON GENERATION COME FROM?

Nuclear will deliver only a small proportion of the necessary low-carbon generation. Given the collapse of Wylfa and Moorside nuclear power projects, nuclear generation in 2030 is going to be at the 4GW level. This is the same as in the CCC High Renewables scenario, assuming Hinkley Point C has started up by then. Therefore, the closest to what is required is the 'high renewables' scenario on the far right of Table 1.

We can assume that nuclear delivers its anticipated 35TWh and

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hydro power 5TWh - as per the CCC's high renewables scenario.

The CCC suggest 2TWh can come from tidal. Greenpeace believes there can and should be a lot more - but there are few prospects currently for delivery at this scale, so it is not reasonable to assume any generation from this technology in 2030.

The same absence of plausible routes to delivery apply to the 16TWh anticipated of CCS - so this generation must also be discounted.

Further, it is clear that climate and nature-friendly bioenergy is very limited in its potential: it should be confined to genuine wastes only, as opposed to forest or crop feedstocks. In any case, the most appropriate application of genuinely sustainable bioenergy would be in hard-to-decarbonise sectors like aviation or HGVs, rather than power. Notwithstanding this, some legacy projects could be delivering 5TWh by 2030.

This leaves 287TWh to come from wind and solar in 2030.

HOW MUCH WIND AND SOLAR POWER HAS BEEN BUILT ALREADY?

TABLE 2 SHOWS THE EXPECTED WIND AND SOLAR GENERATION IN 2020[6].

Technology	Capacity/GW	Generation/TWh
Offshore Wind	11	38
Onshore Wind	14	33
Solar	13	11

This adds up to 82TWh from wind and solar combined in 2020. If we assume for simplicity that not much early-build renewable capacity is retired by 2030, **we need to build a further 205TWh in the 2020s - trebling what we have now.**

SO HOW MUCH WIND AND SOLAR DO WE NEED TO BUILD IN THE 2020S?

Starting with onshore wind and solar, there is effectively a moratorium on deployment at scale for both of these technologies.

Roughly in line with the CCC 2030 High Renewables Scenario, the UK could deliver the following additional capacity, beyond what is currently built:

- 16GW onshore wind (30GW in total) delivering a further 39TWh
- 27GW solar (40GW in total) delivering a further 23TWh

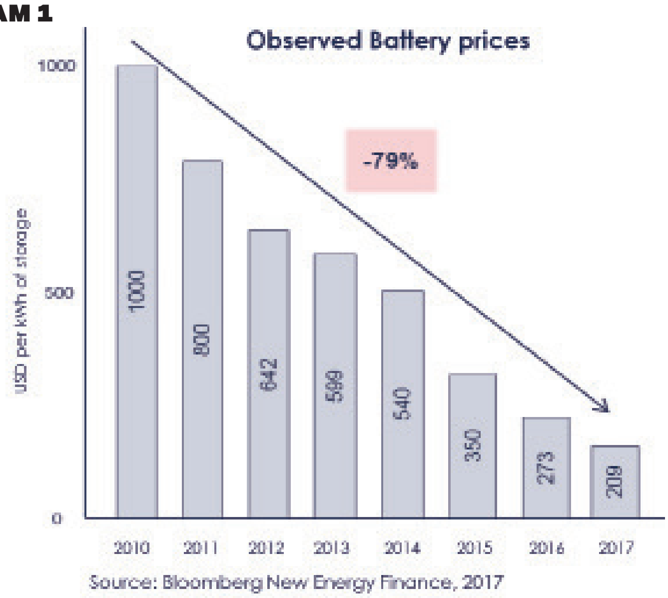
This delivers 62TWh, leaving a further 143TWh to come from offshore wind - equating to an additional 28-34GW on top of the 11GW already built by 2020[7]. So whatever the choice of technologies, we need a minimum of 39-45GW offshore wind in total by 2030 - not the 30GW currently in the Offshore Wind Industrial Strategy sector deal. Omitting deployment of any of these technologies makes the job harder. Not exploiting onshore wind, for example, means that 47-54GW offshore wind would be required in total by 2030.

These calculations assume that we will be able to use all the power generated, or at least supply spare power to other countries in times of excess in exchange for power supplied from Europe when the UK is short.

Given the uncertainties on future load factors, we believe a prudent target for offshore wind would be 45GW. Overdelivery would in any case allow for some wriggle room e.g. the need to accommodate further electrification in heat and industry (not accounted for here).

ENSURING RELIABLE RENEWABLE POWER

DIAGRAM 1



Following the failure of the new nuclear power programme, some commentators argue for the construction of more gas-fired power plants, on the assumption that it is a more secure solution to fill the gap. This assertion is fundamentally wrong - technologically, financially, and in terms of the UK's climate goals.

It is certainly true that some flexible gas generation is needed in the short to medium term, to provide backup for days when the wind doesn't blow and the sun doesn't shine. This is because the UK's current electricity grid is still evolving from an old 20th century model that was less flexible and relied purely on ramping large power generation up and down to meet demand. The new, flexible solutions of interconnectors, storage (for example in batteries), and demand side response are still expanding.

The Government has clearly indicated its support for a smart, flexible system that will be capable of dealing with renewable power's natural intermittency[8] - and these technologies are already established and growing significantly. This means that 'baseload' (i.e. continuous) power from inflexible power stations - such as those for nuclear - is no longer needed. Stephen Holliday, former CEO of National Grid, calls the idea of large power stations for baseload power "outdated".[9]

Key flexible technologies are:

- **Interconnection** – sharing power with the European mainland when we have excess, and receiving some in exchange when we're short
- **Storage** – as the name suggests, storing power for use at another time. Batteries are becoming a popular form of storage, although there are others
- **Demand response or DSR** – shifting usage from locations where there is a shortage of power to times where there is an abundance, and iron out peaks

By 2030, Imperial and Poyry estimate deployment may, in a scenario of high levels of renewables output, need to be as high as 15GW for interconnection, 38GW of storage and 18GW of DSR[10]. Imperial suggest that levels of DSR and storage may in practice need to be only a quarter of these levels, since high levels of deployment in one technology would mean less of others is required.

A 15GW interconnection level looks more or less on track, as Crown Estate anticipate around 16GW by 2025[11] so could clearly be even greater by 2030 with a concerted push.

Storage will require a significant lift compared to business as usual, although it is expanding rapidly

with 7GW of battery storage alone already in the pipeline[12]. This is 3,500 times more than was deployed just six years ago - to give an indication of the pace of technological growth and expansion.

DSR level deployment to this high level of 18GW looks challenging, although the Association for Decentralised Energy identified the potential for nearly 10GW from the business sector alone[13]. More will come from greater use of electric vehicles, through vehicle to grid technology, and also from smart technology in the domestic sector.

So in terms of the advancement and reliability of these technologies, there are strong grounds to think that even the highest required level of deployment of these flexibility technologies is achievable. However there is still a need for sustained support from government to ensure project pipelines remain strong into the second half of the 2020s. This need not require direct government funding, but must ensure fair market access and remove barriers to deployment. Such policy attention would be justified from an economic perspective as flexible technologies offer significant opportunities for the UK. It could form a platform for export opportunities given the UK's specialism[14] and could save UK consumers £8 billion per year[15]. Rapidly decreasing costs mean deployment is much cheaper than would have seemed possible only a few years ago. For example, lithium-ion battery costs have fallen by 79% since 2010[16] (see Diagram 1).

It is therefore right to conclude, as Richard Black, Director of the Energy & Climate Intelligence Unit, recently outlined, that renewables and flexible technologies offer a better financial proposition than new gas. The market is already starting to respond to this:

> ***"In reality, investors who could put money into gas are choosing to put it into renewables, storage, demand shifting, small-scale peaking generation and interconnection. That is where they see the market. One can presume, as it's their money, they're qualified to judge."***[17]

In conclusion, it is clear that the best investment of Government resource and policy attention over the next decade is in consolidating the expansion of UK renewables and the accompanying smart, flexible grid - not the building of new gas power stations. Any small scale gas that is deployed in the short term should be used efficiently, for example, through combined heat and power schemes. Its environmental credibility should be improved further through options like sustainably sourced biogas. And more green, flexible fuels should be pursued beyond gas, like hydrogen. These can combine to progressively replace fossil gas.

APPENDIX – POWER DEMAND IN 2030 FROM ELECTRIC VEHICLES

Assuming there is a linear growth (unlikely but a reasonable proxy) in electric cars and vans from now until 2030, the proportion of those vehicles on the road in 2030 would be around 39%. There are 31 million cars[18] and 3.8 million vans[19], which consume around 0.18kWh[20] and 0.2kWh per km[21] respectively, travelling 12,558km[22] and 20,600km per year[23].

Combining these numbers suggests a total of 34TWh per year is required to charge cars and vans. Clearly more sophisticated analysis, technology improvement and other developments could affect these numbers, but they are an approximate guide to how much power will be required from a more rapid conversion to electric transport.

ENDNOTES

1 https://hansard.parliament.uk/Commons/2019-01-17/debates/9C841326-B63A-4790-867F-905DEDDDD8AC/NuclearUpdate?highlight=%22nuclear%20is%20being%20out%20competed%22#contribution-5717A5A0-89FD-44EF-ADEC-D00D58DE0AE2

2 https://www.politicshome.com/news/uk/energy/renewable-energy/opinion/sse/101331/forget-nuclear-woes-offshore-wind-can-power-us

3 https://www.theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf

4 Power demand in 2017 was 300.5TWh

5 CCC 2018 Progress Report, page 59 https://www.theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf

6 CCC 2018 Progress Report, page 62 https://www.theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf

7 The lower number in this calculation assumes the recently published government load factor of 0.58 for offshore wind. The higher number uses the load factor from the most recent completed auction round in 2017 of 0.48 https://uk.reuters.com/article/uk-hitachi-nuclear-britain/hammond-says-hoping-hitachi-might-rethink-power-plant-plan-idUKKCN1PN1GX https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/601120/Allocation_Framework_for_the_second_Allocation_Round.pdf

8 https://www.gov.uk/government/publications/smart-power-a-national-infrastructure-commission-report

9 https://energypost.eu/interview-steve-holliday-ceo-national-grid-idea-large-power-stations-baseload-power-outdated/

10 CCC Progress Report 2018, page 64 https://www.theccc.org.uk/wp-content/uploads/2018/06/CCC-2018-Progress-Report-to-Parliament.pdf

11 https://www.thecrownestate.co.uk/en-gb/media-and-insights/stories/2018-electricity-interconnectors/

12 https://renews.biz/49868/uk-batteries-charge-towards-7gw/

13 https://www.theade.co.uk/resources/what-is-demand-side-response

14 https://www.green-alliance.org.uk/resources/UK_trade_in_a_decarbonising_world.pdf

15 https://www.gov.uk/government/news/a-smart-power-revolution-could-save-consumers-8-billion-a-year-adonis

16 https://www.bloomberg.com/news/articles/2018-03-28/fossil-fuels-squeezed-by-plunge-in-cost-of-renewables-bnef-says

17 https://twitter.com/_richardblack/status/1092391800642457601

18 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/608374/vehicle-licensing-statistics-2016.pdf

19 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/608374/vehicle-licensing-statistics-2016.pdf

20 https://pushevs.com/2016/11/23/electric-cars-range-efficiency-comparison/

21 https://ev-database.uk/car/1101/Renault-Kangoo-Crew-Van-ZE33

22 https://www.gov.uk/government/statistical-data-sets/nts09-vehicle-mileage-and-occupancy

23 https://www.telegraph.co.uk/connect/small-business/operations-and-logistics/renault/how-many-miles-do-vans-clock-up/

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