From: [redacted]
To: Cleve Hill Solar Park
Subject: Deadline 4 Submission
Date: 29 August 2019 17:44:13
Attachments: [redacted]

Dear Hefin & Paige,

Please find attached a reply to the Applicant's response, submitted at Deadline 3, on GREAT's submission on Need.

Please let me know if you require any more detail.

Kind regards,

Marie

Reply to the Applicant's response
29th August 2019

This document constitutes a Reply to the comments submitted by the Applicant in response to the GREAT expert report on the Statement of Need and comments which were made during the hearing on the 17th July 2019. This document intends to summarise key points which should be considered in the context of need for the Cleve Hill project, and to clarify some of the points made by the Applicant throughout the process. Rather than add to the burden of additional resources and documents this Reply aims to bring clarity to some of the more complex but relevant points about the Application.

Debunking "100,000 homes each year"

While the claim that the Cleve Hill project can power nearly 100,000 homes each year, from 2023 or earlier, has been made more than several times in the Reply report submitted on behalf of the Applicant, in fact such claim is difficult, if not unrealistic to make. I note that this claim has also increased from over 90,000 homes mentioned in the Statement of Need (para 7.2, p.51).

Such calculation would have to take several things in consideration, such as the size of the panels and the material that they are made of, as determinants of efficiency, along with average sunshine, electricity consumption, temperature and wind. As discussed in the GREAT expert report, there are significant difference in the efficiency of solar PV depending on the materials. However, these material parameters are unknown at this point in the application.

Even if Cleve Hill produces the same amount of power across a year to power between 90,000 and 100,000 homes, its generation output will not be at the same time as household demand (i.e. when it matters). Since the UK is currently not struggling to meet its energy demand nor is projected to struggle in the mid and long term (as evidenced in the GREAT expert report on Need), when household demand can be met is as important as how (i.e. using low carbon resources).

In the words of the Aurora Energy Research report (2016), "not all MWhs are created equal". A MWh delivered at times of the year when demand is high and supply is low is inherently more valuable than a MWh delivered when demand is low and supply is high (Aurora Energy Research, 2016). Solar PV is characterised by season and daily variability which limits the occasions when peak supply overlaps with peak demand (National Grid, 2018). Although the Applicant's response dismisses the importance of load factor, as not the only or most important factor when considering the feasibility of large-scale solar PV. A claim of output of 100,000 homes is further undermined by the low load factor of solar PV. Despite representing one third of the total share of capacity (second highest share at 31.5 per cent) in 2017, its share of generation was just 12 per cent (BEIS, 2018).

Furthermore, how many households in the UK could be powered by a large scale solar PV farm such as Cleve Hill also depends on the demand profile of homes. The average household electricity use in the UK has fallen to 3760kWh in 2017. But big differences exist across regions and between different types of homes. For example, while the average annual electricity consumption for a mid-terrace home is 2779 kWh/year, for a detached house it is 4153 kWh/year. In 2017, the average household domestic electricity consumption in the UK was highest in the Southwest of England, at 4,279 kilowatt hours, in comparison with 3,347 kilowatt hours in the North East of England.

Need for a diverse range of technologies and scale of generators

The Applicant has responded to a significant number of points raised against the proposed Cleve Hill project in relations to need with reference to the National Grid FES statement that the UK needs a "diverse" range of technologies and scale of generators going forward. Although this is generally true, technologies and scales of generation are not equal in efficiency in terms of energy generation and in the way in which they can contribute to balancing the supply and demand of energy in the UK. The usefulness of the National Grid FES (2019) analysis here is in showing how different technologies and scales of generation could fit together (represented in different scenarios); and how these are changing in the longer term, identifying trends of importance across scenarios. These are: decentralised energy generation; growth in meeting own demand through solar panels (household and rooftops); slower growth for solar beyond 2040; and electricity storage projects needing multiple income streams to be commercially viable, among others. In all scenarios, the decentralisation of generation increases, and new microgeneration develops, including small solar panels.

The FES 2019 acknowledge that following very rapid growth, the installation of solar capacity in the UK has slowed in the past 3 years, and that more rapid growth of solar until the late 2020s is not anticipated. The greatest growth in solar capacity is reached in the Community Renewables Scenario due to high consumer interest in technologies like residential solar plus storage systems. The FES 2019 have reduced maximum levels of solar in this scenario compared to FES 2018 to reflect stakeholder feedback on the problems with solar PV in the UK. It projects slowing down of solar growth beyond 2040 across all scenarios, with prices for solar output falling to the extent that it no longer becomes commercially viable to build new solar plants.

Across all scenarios, the FES 2019 assume electricity storage projects will need multiple income streams to be commercially viable, with potential revenues from price arbitrage, balancing and ancillary services, and providing services to network operators. The analysis highlights the increasing number of new customer tariffs and business models in the electricity storage market for domestic solar PV. The two decentralised scenarios also reflect the growth in battery storage, mostly connected at the distribution level.

The FES analysis considers transmission connected generation (such as Cleve Hill) as being centralised, and distribution system generation or at lower voltages (including microgeneration) as being decentralised. The scenarios that meet the 2050 carbon target have a higher requirement for flexibility which is met through rapid growth in smaller-scale generation co-located with storage, highlighting once again the system-level shift toward smaller scale, more decentralised capacities. A key take-away message is that large number of distributed smaller scale systems (such as rooftop solar PV) offer greater flexibility than larger energy capacities, like the large-scale solar PV project at Cleve Hill. This trend resonates with BEIS's DUKES analysis (2018) and other research (Hinson, 2019), showing greater increase in distribution connected renewables capacities than transmission installed renewable capacities (BEIS, 2018, p.124).

The trend for increasing quantities of embedded solar and wind generation (connected into the distribution network) started in 2011 and is projected to continue past 2030 (BEIS, 2018, p.124). The FES 2019 analysis is clear that in a decentralised world, far more small-scale solar PV connects to the distribution networks, alongside an increase in smaller-scale, consumers access technology (such as rooftop solar PV with EV battering storage) to manage own electricity needs in a more localised manner.

The exact proportions of embedded electricity supplied vary through the year. Embedded solar PV is affected by the seasonal and daily variability of solar PV, leading to variability in the demand from the transmission network. The changing electricity mix, and the increase in embedded generation (and through it, its impact on demand for the transmission network) is impacting grid balancing requirements. It means that balancing the grid is much more complex, and requires National Grid to draw on a wider variety of technologies, including gas, storage, and exports, including better interoperability and balancing across them (for example, across electricity and gas) Adjusting to the interaction of embedded generation with the balancing of the transmission network is complex from National Grid's view point and links to longer term and deeper transition of the institution which is already underway (Hinson, 2019).

In para 7.2 the Applicant contrasts embedded and transmission connected generation, arguing that the former causes complex flows at the sub-system level, which are avoided in transmission connected generation. Typically, transmission connected generation includes smaller stations on industrial sites, combined heat and power plant, renewable energy plant such as wind farms, as well as some domestic solar PV generators.

As mentioned earlier, embedded generation has grown rapidly in recent years, a trend which covers, but also goes beyond solar PV. The FES 2019 analysis show that in the medium and long-term transmission connected capacities will likely take place with low-carbon sources other than solar PV, including pumped hydro with storage, putting a stop to the dominance of large transmission connected electricity. Instead there is a transition to more distributed supply patterns, varying in terms of scale and location, and more complex flows of energy. Since many of the distribution connected electricity supplies are renewable, the generation patterns become more weather dependent, with significant swings in both scale and location of supply dependent upon weather conditions.

Large scale solar PV farms do play a role in the UK energy system but they are not *least regret options* for the UK energy system as they do not fit the long terms trends of the FES 2019 analysis. In contrast, smaller scale solar PV is a least regret option for the UK energy system. The BEIS DUKES (2018) analysis acknowledges that the increase in generating solar capacity in 2017 was driven by Major power producers (MPPs), those generating 50 MW or more. In fact, total transmission entry capacity for solar PV MPPS has doubled between 2015 and 2017 (588MW), suggesting that there is already significant large scale (albeit smaller than the proposed Cleve Hill project) solar PV capacity connected to the transmission network. In comparison, this is just 1/3 of the connected smaller solar PV (BEIS, 2018).

Connection offer

To clarify, under BETTA, National Grid has a statutory duty to offer grid connections to generators where there is capacity in the system, through the development of a connection offer which details the conditions of connection: its design; the infrastructure of the transmission system; initial outage requirements; asset details; and cost and programme information. The process includes a Connection and Use of System Code Construction Agreement (CONSAG) detailing the scope of transmission works, costs, programme and Bilateral Connection

Agreement (BCA) setting out requirements for compliance with Grid Code, Connection Use of System (CUSC) and Balancing and Settlement Code (BSC).

National Grid is not, as part of the offer process, obliged to consider wider questions of the value or contribution of the proposed capacity to meet demand. Its primary focus of consideration is on technical issues and costs relating to connection (i.e. what works are required in order to facilitate the connection). National Grid has a duty to provide advice before connection application and following the offer, in order to answer any questions. As stated previously, a connection offer is not an endorsement of the proposed project or evidence that the National Grid actually feels that there is a "need" for the particular project. Its duty is to put forward the conditions within which a project could be connected to the grid, even if these render the project not-viable in practical terms because of a delay in connection due to the need for reinforcement. So far, the Applicant has not presented any substantial evidence of cooperation with the National Grid on the connection offer beyond performing its statutory duties.

Such endorsements will also not be found in the annual FES analysis, as these are both generic and focus on the system level and can change every year, based on stakeholder feedback, unexpected events and market conditions. The National Grid has a duty to find technical solutions to balancing problems rather than pass judgement on the types of projects that could add value or not to balancing the grid and meeting energy demand. Furthermore, since the National Grid's focus on transmission generation and balancing, (for example it considers embedded renewable generation as demand management rather than contributing to generation) it often lacks not only mandate but also the ability to "see" related issues at the distribution level. Forecasting difficulties about assessing the impact of solar PV exist for the National Grid not only at the distribution level but also within the transmission level (National Grid, 2018). The recent blackout in August 2019 illustrates the multiple socio-technical challenges faced by National Grid in managing grid stability.

The limited technical details about the battery storage component of Cleve Hill, lack evidence in the design of the plant that the battery system would be configured in such a way that it would be able to respond in sufficient time to meet frequency response requirements of the National Grid. In fact, the Applicant considers the battery storage system as non-essential to the project.

Integration/intermittency costs

Comment 6.1 from the Applicant's Reply references a view from the National Infrastructure Commission and Aurora Energy Research (para 6.14) "*that reduction in capital cost of generation are more than likely to offset completely, integration costs associated with renewable technologies*". The Aurora report (2016) analyses the integration (or intermittency) costs of solar PV. However, the report is explicit that it does not include the impact of renewables on transmission and distribution costs or benefits, excluding costs renewables can impose on transmission and distribution by exacerbating congestion and increasing the amount of capacity required to cope with low utilisation and volatile demand (Aurora Energy Research, 2016). This supports the initial argument that calculations about the feasibility of the Cleve Hill project exclude important costs "passed on" to other system actors, a widely recognised weakness of LCOE. This puts into question any subsequent claims made based on these calculations.

The Aurora report (2016) estimates solar's cost of intermittency in 2016 to be around £1.3/MWh, which increases with increased solar penetration. For example, the intermittency cost associated with the timeliness of delivery would increase from £-1.2/MWh to £3/MWh by 2030. The cost of backup capacity for solar would increase from £2.5/MWh to £4.5/ MWh by 2030. A doubling of solar capacity from the current 11GW by 2030 would bring the cost of intermittency from £1.3/ MWh to £3.4/MWh.

This "disconnection" between the National Grid and lower-levels effects of transmission connected generation are attempted to be rectified through the transitioning of Distribution Network Operators into are Distribution System Operators. This will see them take on a more managerial role including some of the balancing actions National Grid operates on the transmission network, being replicated on the distribution network (Hinson, 2019). This will likely help make more visible and re-connect the costs and benefits of large scale renewable capacities across the transmission and distribution networks. However, this process is far from complete and for many DNOs it has just started.

Downplaying socio, economic and technical risks and uncertainties

The Applicant plays up the "need" for a large scale solar project to bridge the delay in nuclear capacity (para 3.28). However, there is a stable renewable energy pipeline which is strengthened by the Government Offshore Wind Deal and continuous reduction of annual energy demand since 2010, largely as a result of improved energy efficiency (EFS, 2019). However, the narrative offered by the Applicant continues to downplay a number of key socio-technical risks and uncertainties, discussed at length in the previous expert submissions on behalf of GREAT. Other than integration/intermittency costs discussed above, these include high levels of regulatory and market uncertainties, for both large scale solar PV and co-located battery and storage.

Furthermore, the discussion of the FES 2019 analysis highlights the mismatch between large scale (300-400MW) solar PV and the long term, deeper trends of the energy system, which favour decentralised, smaller scale solar PV capacity, either embedded within the distribution grid or for self-consumption. These also illustrate how such options can provide greater diversity and flexibility in the UK energy system, as least regret options. All of these, put together challenge the Applicants' claim of Cleve Hill being the right technology, at the right place and at the right time, and cast doubt over promises of powering 100,000 homes.

References:

Aurora Energy Research, 2016, Intermittency and the cost of integrating solar in the GB power market.
BEIS, 2018, Digest of United Kingdom Energy Statistics 2018, July 2018.
BEIS, 2019, Digest of United Kingdom Energy Statistics 2019.
Hinson, S. 2019, Electricity Grids, Briefing Paper, Number 8472, 8 January 2019, House of Commons Library.
National Grid, 2018, Summer Outlook Report.