Issue Specific Hearing 3 on Environmental Matters

Session 2: Carbon Savings

Submission from 7000Acres

This submission includes:

- **Item 7: Generating Capacity/Electricity Exported**
- **Item 8: BESS**
- **Session Conclusions**

General Note:

The Applicant had the opportunity to address concerns raised in Written Submissions by 7000Acres and others, but chose not to dispute any of the points raised, in particular about the effectiveness of solar, the potential for rooftop deployment, the adverse impact inefficient land use will have on decarbonisation and the true carbon savings.

Item 7: Generating Capacity/Electricity Exported

Key Points Made During the OFH3 in response to the EXA's Questions and Applicant's responses:

Speaker: Peter O'Grady, a chartered electrical engineer, with 35 years of experience in power plant engineering, management and leadership, working across a range of different generation assets, in roles spanning including plant operation, engineering and major asset projects.

Grid Capacity & Grid Connection

- With individual panels rated 650W and generating at 48 Volts, fundamentally solar has no need for a high-voltage / high power grid connection.
- It is only the accumulation of panels over such an area that aggregates to 500MW, which then can make use of such a connection.
- However, because solar generates at low voltages (48 Volts), stepping the voltage up to 400,000 Volts for transmission and stepping it back down to domestic voltages (240 Volts) is the source of an unnecessary inefficiency.
- In terms of Nationally Significant Infrastructure, use of high power / high voltage connections at Cottam or West Burton substation connections for solar will sterilise these connections for future strategic uses that may require such connections, e.g. hydrogen electrolysers.
- Rooftop solar frequently needs little or nothing in the way of grid modifications – so it is quicker to deploy, has no need to occupy such strategic connections and bypasses the inefficiency of stepping up / stepping down voltages. Rooftop solar power is also consumed locally, thereby avoiding losses incurred by transmission over distances.
- For further details, see:
    - EN010131-000919 7000 Acres – Written Representation,
    - "The role of Solar in Energy Provision & Decarbonisation", Section 4

Volume of Power Produced

- The Applicant describes the power output per year in terms of 922kWh / kW installed, i.e.
    - The rating of the installation is 500MW, therefore 500,000kW
    - The power output per year 922kwh x 500,000kW = 461,000,000kwh or 0.461TWh
- More conventionally, in the industry, the power produced is described in terms of a "load factor". A load factor 10%, would result in
    - 500MW capacity x 24 x 365 (hours in a year) x 10% (load factor) = 438,000 MWh or 0.438 TWh
    - (the difference between the 0.461TWh and 0.438TWh is because the Applicant has implied a slightly higher load factor, at c. 10.525%)
- Put simply, the load factor of around 10% means that, on average, the 500MW Gate Burton scheme can provide around 50MW.
- Load factor is important, because it reflects the degree of intermittency – for instance, although off-shore wind is intermittent, it has a load factor of over 50%, so the return the technology makes for the investment and consequential impacts of that investment, is much greater than for solar.

- Currently the UK annual electricity demand is 317TWh per year. Producing c. 0.461 TWh over a year would contribute 0.145% to national demand.
- Looking forward to 2050, with demand expected to be in the region of double this, i.e. 700TWH, the scheme will produce < 0.66% of annual demand.
- The Applicant has used the method of "kWh / kW installed", which is not frequently used in the electricity supply industry – and is much less transparent to the public than a % figure like "load factor".
- For further details, see:
    - EN010131-000919 7000 Acres – Written Representation,
    - "The role of Solar in Energy Provision & Decarbonisation", Section 2

Timing of When Power is Produced

- The output of solar is mismatched with the UK demand curve. This is important because generation supply must match demand in each moment.
- There are already periods of "curtailment" in the UK, where there is more renewable generation than the grid needs (demand), and this is then switched off – for which the generator is compensated (paid).
- National Grid foresee levels of curtailment rising to the region of 40-60TWh per year by the mid 2030's. For context, the total lifetime output of the solar farm is expected to be c. 26TWh over 60 years, i.e. National Grid will curtail almost double the lifetime output of the proposed solar scheme every year.
- It is therefore inevitable the scheme will be curtailed – reducing the load factor from its assumed 10%, thereby reducing the output of the scheme and the contribution it can make to decarbonisation.
- Although the average output Solar provides is 10% of its rated capacity, the bulk of this is in the summer, with a 16% load factor in July, and least in winter, with a 3% load factor in December.
- Therefore, the scheme will contribute very little to national need in winter, and nothing in the moment when demand is at its peak (winter evenings).
- The scheme will provide most of its power in the summer, during the daytime, when demand and prices are low – therefore it will contribute to least when demand, and prices are at their highest.
- For further details, see:
    - EN010131-000919 7000 Acres – Written Representation,
    - "The role of Solar in Energy Provision & Decarbonisation", Section 2, in particular Section 2.1.3 (Curtailment)

CO2 Intensity

- Making a direct comparison of CO2 intensity between different sources of energy is of limited validity, because of the timing of when the power from that source may be produced.
    - Solar may have a very low CO2 intensity, but it cannot be scheduled to match demand.
    - The Applicant referred to a Combined Cycle Gas Turbine (CCGT) power station as having a higher CO2 intensity than solar, but in winter / overnight, there may not be

any / sufficient solar generation available, hence a CCGT can be dispatched to meet demand. The inference that solar can directly displace emissions from CCGT may not be true.

Government Policy

- It is clear that the common objective is decarbonisation
- Solar is not part of the UK Government's 10 point plan for a Green Industrial Revolution (2020).
- The ambition for 70GW of solar is very recent (18 months old) – first appearing in the British Energy Security Strategy (2022).
- While the policy landscape includes solar, **nowhere is large scale ground mounted solar explicit in Government policy**.
- Policy and Planning landscape has long called for efficient land use, sensitive planning, community engagement, citing examples of rooftop solar and small, community-scale solar projects.
- NPS EN-3 (Draft 2023) provides the example of a "typical solar farm" being 50MW, i.e. a fraction of the size of the proposed scheme.
- The economic landscape is such that it favours ground-mounted solar over rooftop solar, owing to:
    - There being complexity and misaligned objectives between who builds, owns and occupies buildings and would therefore incur costs or receive benefits of rooftop solar installation.
    - The Government Contract for Difference (CfD) scheme for renewable energy provides investor certainty and encourages development of solar at any scale planning will allow.
- However, if there is such an urgent need for decarbonisation and solar, why isn't solar a planning requirement of every rooftop?
    - Rooftop needs no extended NSIP process (consultant reports, consultation and examination process)
    - Just domestic rooftop solar on new houses could deploy hundreds of MW of solar each year, with no overhead of NSIP and would be deployed more quickly (without even considering any retro-fit to existing rooftops).
- For further details, see:
    - EN010131-000919 7000 Acres – Written Representation,
    - "The role of Solar in Energy Provision & Decarbonisation", Section 1.

Decarbonisation (General)

- The Applicant described the importance of technologies to facilitate decarbonisation, being nuclear, solar, wind, hydrogen and carbon-capture and storage (CCS), noting that hydrogen and CCS are in their infancy.
- To decarbonise, the energy system needs to provide flexible power to meet demand, and long-term / inter-seasonal energy storage to balance the variability of demand over the day and across the year.

- Regarding Decarbonisation, in overall CO2 terms, the Applicant appears to consider a relatively narrow perspective, i.e. that the raw materials, manufacturing and construction of the project will incur a carbon cost, and this will be offset by the low carbon energy produced.
- There seems to be no consideration for crops that are displaced, where they will be grown, and what this implies in terms of change in CO2 emissions. It makes little sense to import more crops for food, animal feed or bio fuels, in the name of CO2 reduction, quite aside from any security of food supply considerations.
- Ordinarily, this may be purely a feature of a competitive market, and not the concern of the developer, but here, the whole purpose for the scheme, the whole reason for the Government CfD framework to support investment, is to reduce CO2 emissions. Therefore, there is a responsibility to demonstrate that the subject is thoroughly considered.
- Looking across the whole decarbonisation challenge, the UK Climate Change Committee expects to see a reduction in arable land to sequester carbon to decarbonise, through planting of trees and establishing peatlands. Misusing land at scale, such as through the indiscriminate placement of solar farms which make a limited energy contribution, will add to pressure on land use and perversely may impede decarbonisation by stalling other decarbonisation measures. This dimension does not appear to have been addressed by the Applicant, either in terms of decarbonisation or land use.
- This is vital as the Government is already being accused of over-committing on land use.
- For further details, see:
    - EN010131-000919 7000 Acres – Written Representation,
    - “The role of Solar in Energy Provision & Decarbonisation”, Section 1.

Item 8: BESS

Operation of BESS

- The proposed BESS has a capacity of 500MWh, with a grid import rate of 140MW, and an export rate of 250MW.
- The load the solar farm will require to sustain auxiliary systems (security, lighting, heating, office equipment etc.) is in the order of kW, rather than MW, so the import capacity of the BESS is oversized for "associated development" and is therefore designed for grid system balancing.
- The proposed BESS can charge at 140MWh for c. 3 hours (from grid) to reach capacity. The rate of discharge is 250MW, so it would take 2 hours to discharge (to grid) fully. These ratings enable the BESS to operate in a specific segment of the electricity market, to "balance" the electricity system within each day, buying energy when it is cheap (when there is excess energy or periods of low demand) and selling it back to the grid at periods of higher demand (and higher prices).
- The solar farm operates in a separate segment of the electricity market, under the Government CfD scheme. The economics of BESS are separate, based upon the economics of operation in the balancing market.
- The primary purpose of BESS is to trade in the system balancing market, rather than as associated development.

BESS Safety

I am Mark Prior representing 7000Acres. We made written submissions at Deadline 2 concerning BESS safety. At ISH 3 the Applicant has had their specialist (Mr Gregory) present but chose not to address any specific concerns raised in our written submission. Instead the Applicant's specialist repeated information about BESS fires and that a fire suppression system would be fitted to each BESS enclosure. This is consistent with the Applicant's Outline Battery Safety Management Plan (Document Reference: EN010131/APP/7.1) that also fails to address thermal runaways.

7000Acres is concerned that a BESS thermal runaway is the major threat and not a fire. A fire suppression system will have no impact on a thermal runaway.

A BESS thermal runaway is a foreseeable event, as there have been in excess of 30 events recorded globally, including a 20MW BESS thermal runaway occurring in Liverpool. The Liverpool thermal runaway led to an explosion, release of a toxic cloud and toxic firewater. The fire hydrants failed to provide sufficient water to quell the thermal runaway, that took many hours. Under a FOI request 7000Acres has obtained the Liverpool Fire Brigade Incident Report and an internal memo: we are prepared to share these with the Applicant to assist in their comprehension of this serious issue. Evidence shows that enormous quantities of water are required to cool a thermal runaway and that the volume of water required is proportional to the amount of energy stored. Our written submission included a letter from the Yorkshire Fire Brigade stating that 5.5 million litres of water would be required to contain a thermal runaway in a 50MW BESS, i.e. a BESS 1/10th the size of the Gate Burton proposal. In the opinion of 7000Acres sufficient water must be available to contain a BESS thermal runaway and this must be secured in the DCO. As shown in written submissions, the water

available on-site is insufficient to quell even 1 BESS enclosure, let alone contain the spread over the whole site. There are no major water mains on this remote site, and so on-site water storage is key.

The BESS containers are situated 3m apart, which is contrary to the National Fire Chief Council Guidance of 6m apart. This must be corrected and secured in Work No 2.

There is no bunding around the BESS enclosures identified in Work No. 2. In the event of a thermal runaway this could result in large volumes of contaminated fire water, containing hydrofluoric acid, entering the local ecosystems. Suitable bunding must be included in Work No.2. Due to the potential for highly contaminated firewater being released into the local environment, the Environment Agency should be consulted on the BESS design.

Finally, the Applicant's Unplanned Atmospheric Emissions from Battery Energy Storage Systems [APP-172/3.3] does not address the emissions from even a single battery enclosure ("LFP 280Ah cell type in a 416S10P configuration to reach a total battery capacity of 3,727 kWh per unit") but only considers a 100kWh battery (Tesla car sized battery).

Concluding points made during Any Other Matters

- Reflecting on the scheme, any claimed **benefits are national in nature**, and these benefits are limited, in terms of load factor and the mismatch between supply and demand. At scale, large-scale ground mounted solar places additional pressure on land use.
- **There are no local benefits**; electricity generated isn't for the local area, the scheme doesn't provide jobs or other economic benefits (e.g. through cheaper local power).
- By contrast, the **impacts and harms are exclusively felt locally**. These are felt in a concentrated area, which will negatively impact a cluster of small communities.
- Many of the impacts and harms are subject to commitments by the developer that they will be mitigated in some way, e.g. to manage construction disturbance, flood risk, visual impact, biodiversity, traffic, however any failures in delivery of these commitments would leave the community fully exposed to one, many or all of these harms.