The Drax Power (Generating Stations) Order

Land at, and in the vicinity of, Drax Power Station, near Selby, North Yorkshire

Applicant's Response to Deadline 5 Submission by Julian May

(Submitted for Deadline 6)

The Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(q)

Drax Power Limited

Drax Repower Project

Applicant: DRAX POWER LIMITED
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1 APPLICANT'S RESPONSE TO JULIAN MAY

1.1.1. Mr May's submission at deadline 5 (Examination Library Reference REP5-024) raises a number of questions which are answered below. Where the point Mr May has made has started with a numerical reference, this reference has been used to identify the relevant answer.

1.1.2. 3.30 – It is agreed that a synchronous condenser does provide reactive power, short circuit infeed and inertia, however, the largest clutch available is around 300 MW. This type of arrangement would therefore not be suitable for the Proposed Scheme and the proposed units associated.

- *Julian May's question – If reactive power compensation and voltage control is what the applicant is talking about in the above-mentioned comment, it would be helpful if a figure could be provided.*

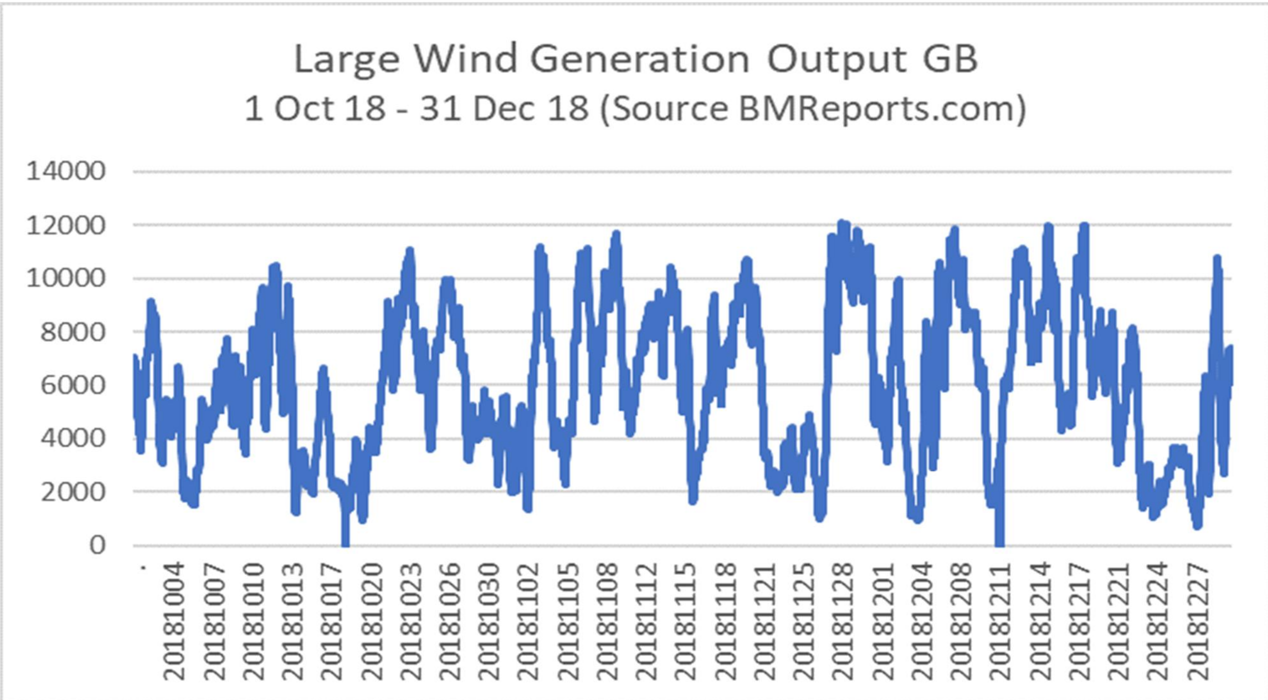
1.1.3. The level of reactive power procured by National Grid in the northern region over a 12-month period is in the region of ~12,500 GVAR/Hr. To give you some idea of the existing Drax Power Station's contribution to this figure, it was in the region of ~1,750 GVAR/Hr. A large 660 MW thermal plant will provide an instantaneous 217 MVAR at any one time. National Grid procured 14,500 GVAR/Hr from the remaining regions of Great Britain i.e. the total reactive power procurement minus the northern region reactive power procurement over the same period. This demonstrates the significance of the region (compared with other regions) when considering management of power flows and the strategic location of both the Existing Drax Power Station and the Proposed Scheme. National Grid's Electricity Ten Year Statement 2018[1] identifies a future boundary capability of 16 GW based on the significant increases in renewable energy forecasts. Large, flexible thermal plant is required to manage the intermittency associated with both future forecasts in wind and solar capacity and manage these power flows through the region; this is required both when power is flowing North to South (high wind generation) and South to North (low wind generation). This is explained further in the "Applicant's Note on Substantial Weight to be Given to Need and Application of Tests Under S104" (Examination Library Reference REP5-021, see paragraph 3.40).

- *Current projections of power flow across the boundary*

1.1.4. The capability needs of boundary 7a in the future, is to ensure the boundary can meet the needs of the power flows in that area. Currently the power flows equate to some 8.7 GW with the introduction of the Western HVDC link. The area is backed with increasing renewable generation flowing from Scotland. When wind is available power will need to flow towards the high demand areas of the midlands and the South East. When the wind is unavailable, power will need to flow north to supply Scotland and Northern England.

[1] https://www.nationalgrideso.com/sites/eso/files/documents/ETYS_2018_Document_v1.pdf

1.1.5. Wind generation across Great Britain can drop to very low levels for extended periods of days or even weeks (see chart below); these gaps must be filled by a secure source of generation or storage. The volume of storage that would be required to fill these gaps would be very large, and currently not available (both in terms of technically feasible and economically feasible), and to be effective would have to be filled by excess low carbon generation immediately prior to the wind lull, which is unrealistic. As this storage is unavailable, the only current option for reliable controllable generation of the capability needs required, is thermal plant and high efficiency units are the best solution. When power has to flow north (no wind), system security requirements will be best met by having a geographic spread of generators.



1.1.6. 3.31 – All gas fired power stations do have a reduction in efficiency at lower loads, but it is also the case that storage has an efficiency loss - pump storage may typically be 70%-75% and battery storage around 90%. These storage devices will have to be replenished after exporting power, therefore renewable capacity in excess of peak demand will have to be built in addition to the storage facility itself. In the example above, it can be seen that a wind lull occurred around the 22-23 December 2018. Assuming the storage had to just supply a modest 5 GW over a single day peak period of 12 hours (peak demand was 35-40 GW) the storage required would be 60 GWh per day. This is six times bigger than the largest pump storage facility in the UK, Dinorwig. To cover a four day low wind period, we would be looking at 0.25 TWh which would have had to be stored in the days immediately preceding the low wind event. It may be that over time storage technology moves on and the cost of storage reduces to a point where this is feasible but currently, storage does not provide this level of capacity to cope with low generation from installed wind capacity.

1.1.7. Generally speaking it would be expected that the repowered Units X and Y would move out of open cycle mode within 10 minutes in to combined cycle mode.

1.1.8. 3.39 - Unless renewable generation is firm and the storage issues referred to above can be overcome, there will remain a need to hold a large quantity of controllable generation to meet demand when solar is low and wind is low. It is important to recall that demand is forecast to increase significantly as a result of decarbonisation of other sectors, through, for example, the electrification of the transport network and the evolution of Electric Vehicles. With nuclear power potentially not providing the level of generation originally forecast (which itself emphasises the danger in over relying on predictions and forecasts), this controllable generation will need to be met by thermal plants.

1.1.9. 3.44 – Inertia has been cited by National Grid in several publications[2] as a concern as the wind, solar and Interconnector capacity grows, see link below: https://www.nationalgrideso.com/news/project-sim-unlocks-inertia-issues

- Britain's energy system is undergoing a transformation, with more renewable sources of energy such as solar connecting to the network. Historically, our power was supplied by large power stations that provided higher levels of inertia because they use large rotating masses in the form of turbines.
- Inertia is important to the grid because it acts as a damper buffer to fluctuations in frequency, helping to reduce the rate of change smooth their effect.
- In contrast renewable sources, such as wind farms and solar panels provide no inertia. Wind generators are not connected directly to the transmission system and solar panels have no moving part. Interconnectors such as those to the continent are also devoid of Inertia as they transmit power as Direct Current via an inverter. The growth of Interconnectors will further diminish inertia do not detect changes in frequency and so do not provide inertia. Solar panels don't have any moving parts so when the sun stops shining, they stop generating power straight away. This acts to reduce inertia on the system.
- As the amount of intermittent energy such as wind and solar on the network increases, the importance of managing inertia grows too. A sudden drop in frequency causes stability problems. For example, embedded generation, connected directly to the distribution network, can disconnect from the system as a precautionary measure, Off Grid Protection, this could lead to cascade tripping

1.1.10. Synthetic Inertia differs from Inertia in that Inertia is basically instantaneous because it is connected to the system directly via an electrical/mechanical bond. Synthetic Inertia must detect the frequency deviation, send a signal to the responding equipment which will then deliver power; inevitably there is a time delay, however small. Even if National Grid does

[2] https://www.nationalgrideso.com/sites/eso/files/documents/8589937803-SOF%202016%20-%20Full%20Interactive%20Document.pdf p60-100 and https://www.nationalgrideso.com/sites/eso/files/documents/8589940795-System%20Needs%20and%20Product%20Strategy%20-%20Final.pdf p8-11

relax the acceptable rate of change of frequency it does not negate the need for it; there will always be a de-minimis inertia requirement. Relaxation of the acceptable rate is also likely to lead to greater Frequency response holding along with the associated cost. The fact that NGC are considering relaxing the requirement is an indication that there is a growing issue which will need to be addressed.

1.1.11. Flywheels and synchronous compensators can help but they are limited in the services they offer, they cannot provide energy other than Inertia, consequently they cannot replace the back-up generation required when intermittent renewables are not generating.