Battery Storage De-Rating Factors for the GB Capacity Market Auctions

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Overview

- National Grid UK – who are we?
- Battery storage trends in Great Britain (GB)
- Duration limited batteries – how to reward in the Capacity Market (CM)?
- The battery storage “Coordination Problem”
- Which risk metrics are most appropriate to model duration limited storage?
- International/US experience in this area?
- Acknowledgements / Questions / Discussion
National Grid Electricity Transmission (NGET) – Who are we?

Multiple GB Transmission Owners

- Scot Power
- Scot Hydro
- National Grid TO

One System Operator

System Design
Project Management
Engineering and Maintenance

System Planning
System Operation
Market Facilitation
Energy Trading

Electricity Market Reform (EMR) Delivery Body

LOLE of 3 hours/year
Battery Storage Trends in GB

- Battery storage won ~ 500MW capacity contracts in the 2020/21 CM auction

- Penetration levels are expected to grow, based on battery stacking of multiple revenue streams e.g. Enhanced Frequency Response (EFR)

- Batteries have received a de-rating factor equivalent to pumped hydro to date (96%) - this is almost surely inappropriate for batteries that have relatively short duration at maximum power output

- Most EFR batteries are 30-minutes duration ability

- The risk is that battery storage projects are over-compensated via the CM, and that GB system reliability is less than the CM target de-rated capacity would suggest
Initial analysis suggests that for the GB system, then CM stress events may last in some cases a couple of hours or more – short duration batteries will not mitigate all shortfalls therefore.

The GB policy trend at the moment is to not create a barrier to short duration batteries in the CM by e.g. enforcing minimum 4 hour duration ability as we need more flexibility on the system.

Instead we wish to ensure short duration batteries are rewarded in proportion to their security of supply contribution.

In summer 2017, we are developing a more quantitative assessment of the battery storage reliability contribution with an estimation of an “Equivalent Firm Capacity” (EFC) - we plan to use this in % terms as the CM de-rating factor.
Battery Storage Equivalent Firm Capacity

- Equivalent Firm Capacity is a useful construct to normalise the security of supply contribution of unconventional adequacy resources
  - Marginal EFC is essentially, “for an additional penetration of that resource, what is the amount of perfectly reliable firm capacity can it displace while maintaining exact risk level”?

- It exists already as a concept in the GB market via the contribution of wind to security of supply – i.e. wind power EFC reduces the amount of CM procurement

- Noted trends are that an unconventional resource EFC
  - Can be sensitive to that resource’s penetration level
  - Can vary from one year to the next as system adequacy margin varies
  - May have subtle interactions with other resources already on the system

- In the calculation of a battery storage EFC, important questions relate to:
  - How to model the resource in the assessment, particularly storage limits?
  - Which risk metric is most appropriate to base the EFC upon?
The Battery Storage “Coordination Problem”

Consider a simple stylised example of a CM stress event on a given day

- There are multiple possible ways one could utilise a duration limited resource in this example above – number of loss of load (LOL) periods is affected, though overall unserved energy level (ENS) remains similar
- A challenge is that our GB VoLL parameter is independent of duration/depth
- The bottom left option at present reflects the GB CM operational process
### Which risk metric to use for EFC assessment?

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<tr>
<th>LOLE (hours/year with outages)</th>
<th>EENS (MWh per year unserved)</th>
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<tr>
<td>- LOLE is the national reliability standard</td>
<td>- More closely associated with economic costs via VoLL</td>
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<td>- Wind power EFC is already calculated with LOLE</td>
<td>- Less sensitive to operational strategy of controllable duration-limited resources</td>
</tr>
<tr>
<td>- But LOLE is sensitive to operational strategy for controllable duration-limited resources</td>
<td>- But this is not the metric used for national reliability standard</td>
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<td>- LOLE can be misleading on economic costs of outages</td>
<td>- Could create an inconsistency of resource treatment in CM</td>
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- For conventional / uncontrolled resources, the EFC derived would be similar based on either metric as both LOLE and EENS increase/decrease ~ proportionally for such resources
- A controllable short duration resource may create a divergence between these metrics
- Which metric is best depends on the ~ subjective view of the pros and cons listed above
- We plan to engage with our main stakeholders in GB to decide the methodology used
Next Steps

- We plan to finalise our battery storage EFC based de-rating factor in time for the next CM auctions in January

- **Acknowledgement** – Chris Dent, Stan Zachary academics from GB who have been very helpful to chart out the GB methodological assessment details

- Interested to hear about US/International experiences on
  - Battery storage penetration
  - Capacity market de-rating factors applied
  - Methodologies/assumptions for resource assessment
  - Any other relevant observations on our methodology choices