Managing System Stability and Fault Ride Through with Declining System Strength

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Contents

Background

The Grid Code places an enduring requirement on Users to ride through system disturbances. It also includes provisions for Users to request the data that required to allow them to assess compliance and, where necessary, modify their plant accordingly. However, with system strength data being requested by Users only at the design stage, there is a risk that the obligation for enduring compliance could be overlooked.

To address this risk, we intend to engage with other industry stakeholders to highlight the issue, identify what data is necessary for any assessment, and agree the best way to communicate this data going forward.

Roles and Responsibilities

Users

Interconnectors, Generating Units, and Power Park Modules are required to ride through electric faults provided that

- these faults are cleared within specific timescales, and that
- voltage recovers rapidly enough to a level that is sufficiently high to allow them to start injecting power into the NETS.

They are also required to be

- fitted with protection equipment to clear any fault that may affect the NETS within specified times.
- inject reactive current both during the fault and following fault clearance to support the voltage recovery.
- Fitted with a dynamic voltage control system that helps supporting the voltage recovery and, with synchronous machines, helps with first swing stability.
- In some cases, fitted with PSS/Power Oscillations Damping that usually improves system damping.

Roles and Responsibilities

TOs (Onshore and Offshore)

For all TOs, onshore and offshore, the NETS SQSS requires that they develop a transmission system that

- under certain background conditions, remains stable following any of the secured events defined in the standard and
- for all other background conditions, can be operated by the ESO such that it remains stable following a secured event.
- These obligations exist in Sections 2, 3, 4, 7, and 8. However, the focus in this paper is on Sections 2, 4, and 7 as these are more relevant to generation connections.

- TOs are also expected to ensure robust protection systems are in place to clear any fault on the NETS within acceptable timescales.

- For Offshore TOs, Section K of the STC include technical requirements that mirror that applicable to offshore Generators.

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- The NETS SQSS (Section 5) requires that ESO to operate the system at all time such that it remains stable following specific secured event

Roles and Responsibilities

Requirements are enduring however the background conditions change all the time.

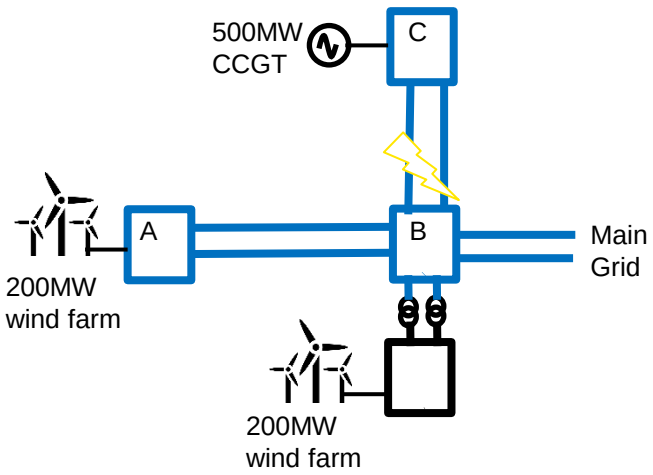
Issues need to be identified at the right time in order to allow for investment decisions, modifications to existing plant, and commercial contracts to be put in place.

The Grid Code allows for data to be requested by Users however,

- This right is not often exercised after commissioning
- We need to understand what data would be helpful for Generators/Manufacturers to work out if they need to do anything – **Focus currently is on Short Circuit Level/System Strength data**.
- There could be a value in publishing all the relevant data for all connection sites potentially in ETYS

Data Requirements - Short Circuit Level

Contribution from Inverters



Calculation	FL at Stattion B (MVA)
Method 1	2400
Method 2	2000
Method 3	1600
	1200
	800

Sync machine FL contribution (4-5 times of rating): 4x500=2000MVA

Wind farm converter FL contribution: 2x200MW (https://www.nationalgrideso.com/news/what-short-circuit-level)

1. Equivalent based on converter rating wk24 submission (ETYS)

   SCL=2000+2x200=2400MVA

2. No FL infeed from inverter (only consider voltage source behind a impedance)

   SCL=2000MVA

3. Grid following inverter consumers FL/system strength

SCL=2000-2x200*3=800MVA (SCR=3)

SCL*=2000-2x200*2=1200MVA (* SCR=2)

SCL**=2000-2x200*1=1600MVA (** SCR=1)

Data Requirements - Short Circuit Level

Other things to consider

- Dispatch of different plant on the system (generation/storage/interconnectors/…)
- Network outage condition
- Pre fault and post fault
- Demand contribution

Other studies might require a different way of calculating SCL

- Protection settings with additional appropriate safety margins.
- Electromagnetic transient study in relation to CC.6.1.7(a) and (b) and TOV (TGN 288).
- Any study in relation to unbalance
- Fault ride through, DPS
- SSTI, Control interaction
- Transient active and reactive power exchange studies

Input Sought

What data do you require to be able to make decisions about fault ride through

- Data discussed in the previous slide
- Other additional/alternative data

How do you like to be notified by this data?

- Upon request (current position)
- Annually

How far ahead do you need to know the change?

How would you like to engage with us on that.

Next Steps

A System Operability Framework publication is currently being scoped – we will be seeking input from relevant stakeholders to support that paper.

Discussions are undergoing with TOs to discuss the assumptions to be made when estimating future minimum short circuit levels.

We are assessing whether an annual publication for minimum short levels as a part of ETYS would provide sufficient visibility

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