

Managing Fault Ride Through Compliance



D Balasingam (Bala) & Ian Nuttall
National Grid – Generator & Asset Compliance

Grid Code Requirement

- All generators should ride through faults at the nearest 275 kV or 400 kV transmission network
- Applies to both balanced & unbalanced faults
- Compliance is managed by looking at simulation studies
- Type tests are requested on wind turbine types that constitute more than 100 MW in any one site

Type A Faults

- Solid Faults lasting <140 ms

During Type A Faults

- Generator should remain connected without tripping
- Generate maximum reactive current within transient rating

Following Type A Fault Clearance

- Recovery to at least 90% of pre-fault power within 0.5 s
- Any oscillations must be damped

Type B Faults

- Faults lasting > 140 ms
- Residual Voltage $>$ Profile given in CC.6.3.15.1.(b)

During Type B Faults

- Generator should remain connected without tripping
- Provide Active Power at least in proportional to the voltage at the Grid Entry Point
- Generate maximum reactive current within transient rating

Following Type B Fault Clearance

- Recovery to at least 90% of pre-fault power within 1s
- Any oscillations must be damped

CC.6.3.15.1 (b) (i)

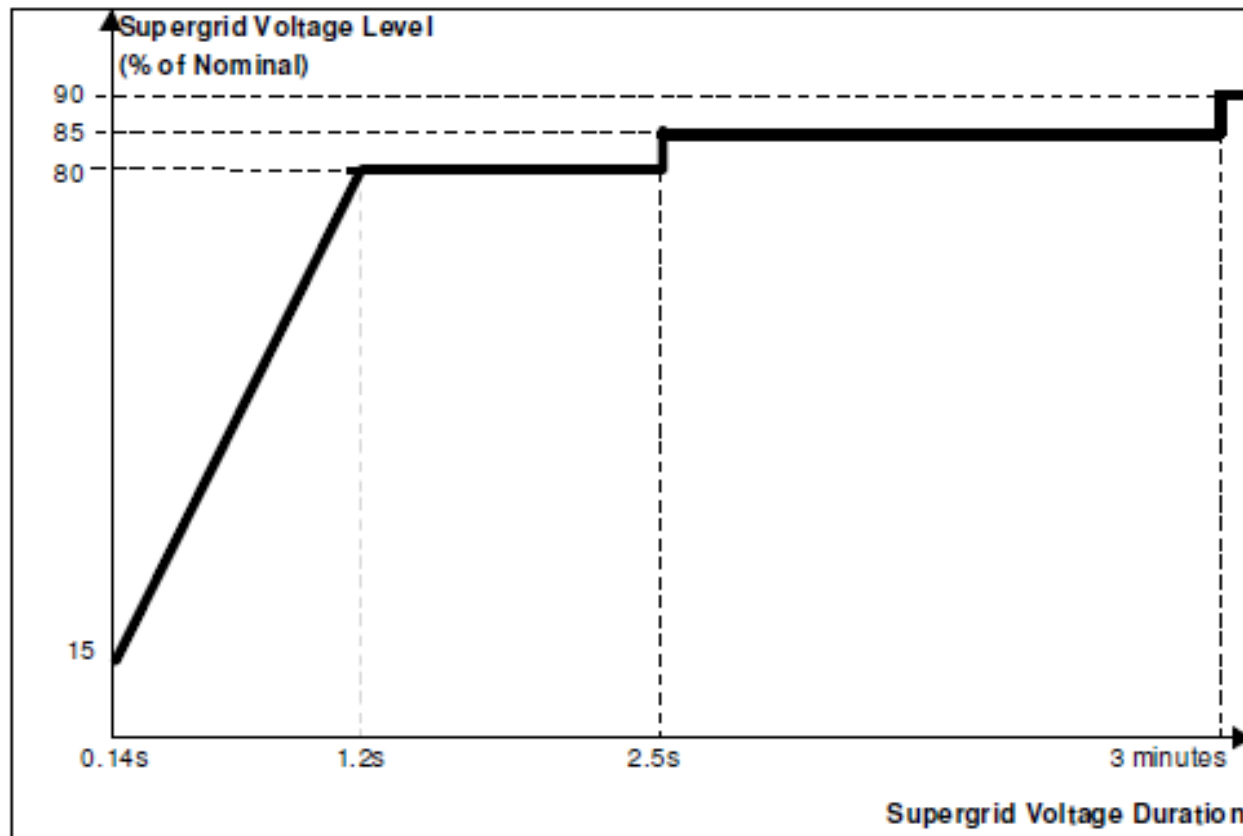


Figure 5

Type B Faults

- An example Type B fault: Lasting 300 ms with a residual voltage of 30%
- Therefore it should provide active power proportional to grid interface voltage during fault and power recovery within 1s following fault clearance
- Consider a fault lasting 100 ms with a residual voltage of 30% (Is it type A or type B?)
- It should provide active power proportional to grid interface voltage during fault
- Power recovery within 0.5 following fault clearance

Comparison between UK Grid Code and the ENTSO-E Proposals

ENTSO-E Draft Requirements

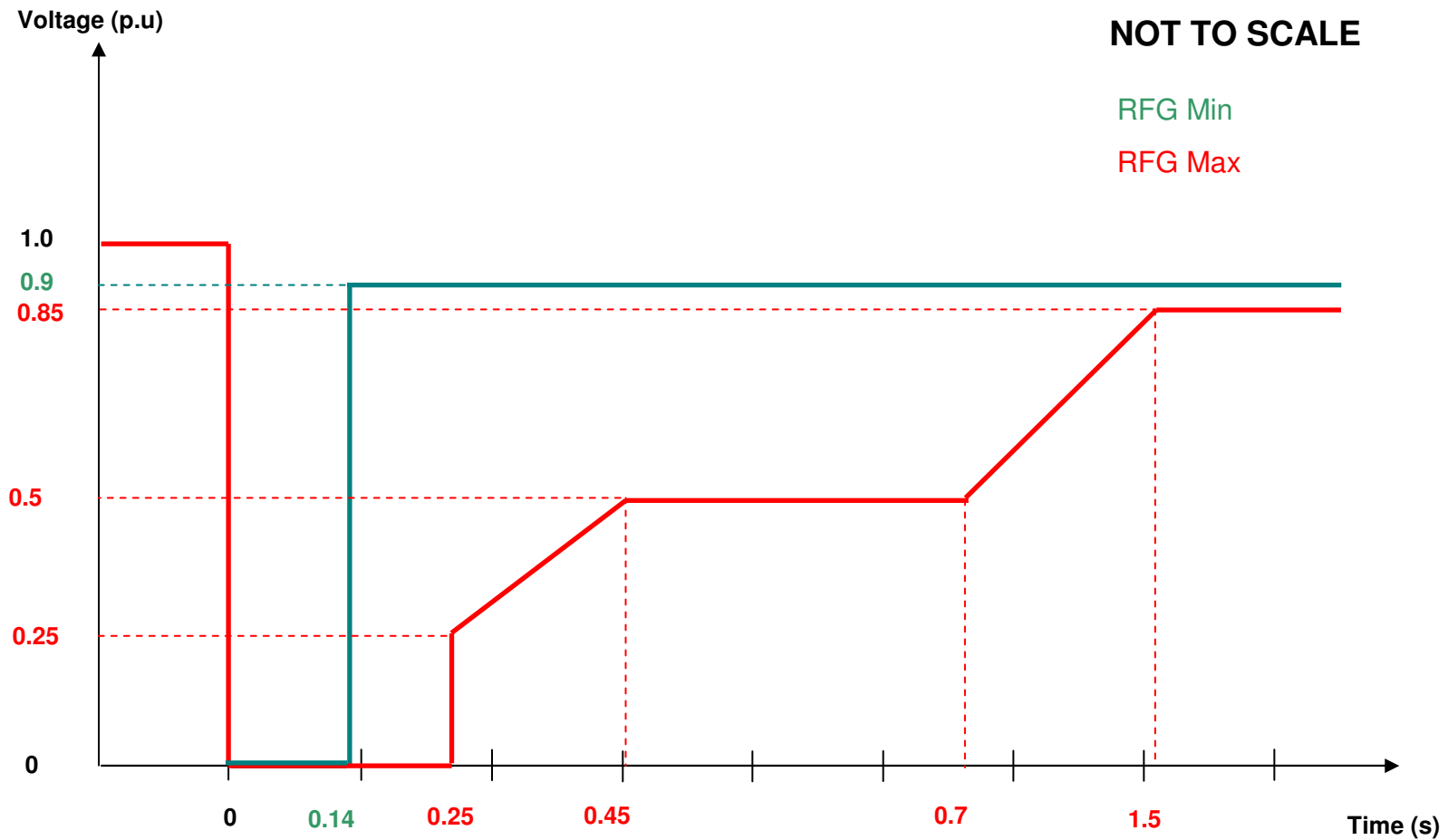
- ENTSO-E consultation published in January 2012.

- Includes different envelopes for FRT on different generator sizes and types.

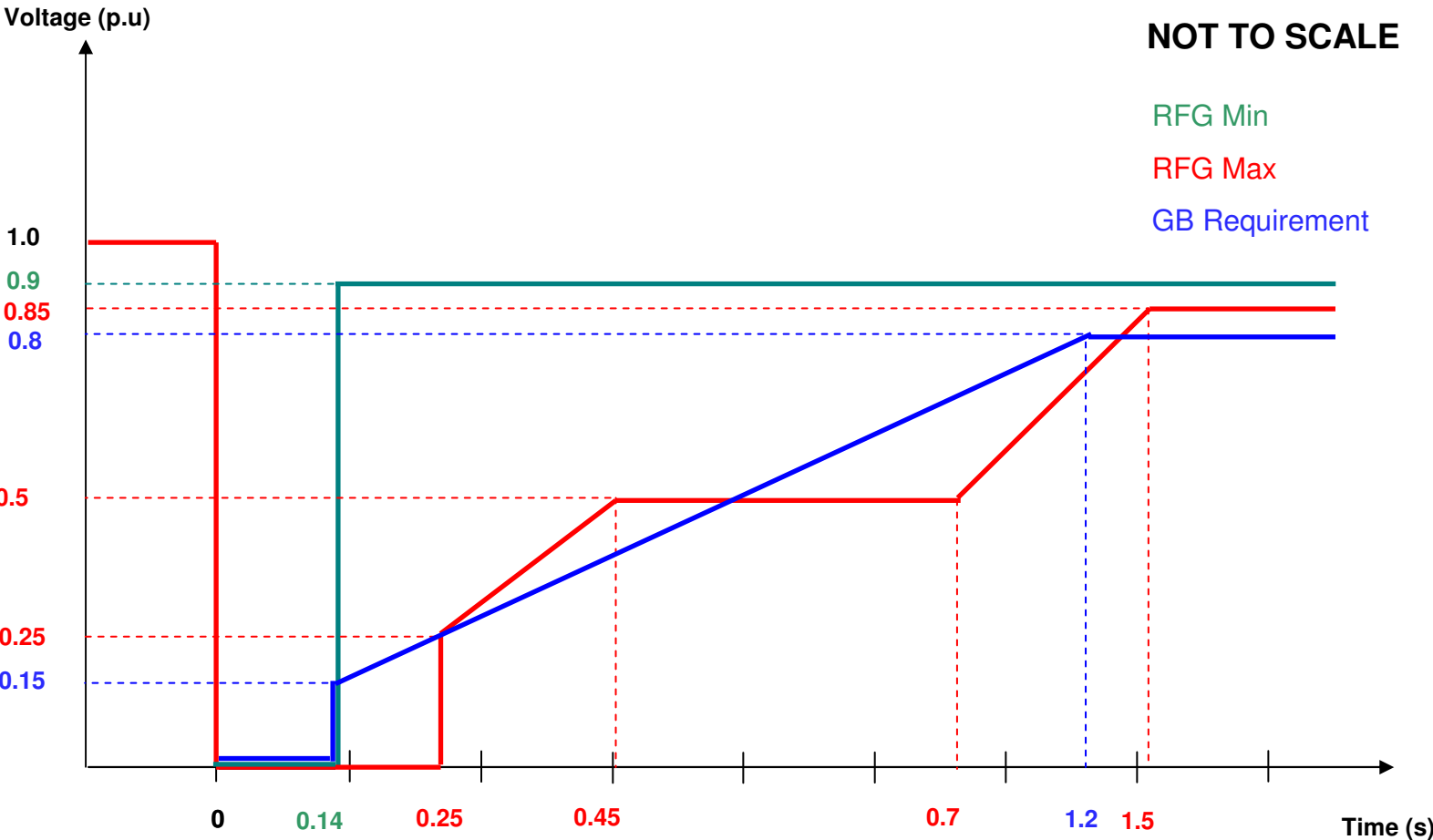
- Following plots indicate the comparison between current GB Grid Code and the ENTSO-E proposals for
 - Type B & C Synchronous
 - Type D Synchronous
 - Type B & C Power Park Modules
 - Type D Power Park Modules

ENTSO-E RfG - Voltage Duration Profiles

Type D Units Table 7.1



ENTSO-E RfG - Voltage Duration Profile – Range compared with GB Requirement



-
- The TSO shall define the Post Fault Active Power Recovery Characteristics
 - The TSO shall define the fault ride through capabilities in the case of asymmetrical faults.
 - In general the **Minimum** ENTSO-RfG Fault Ride Through requirements are less onerous than those in GB.
 - Interpretation of the ENTSO-E Fault Ride Through Requirements are further clarified in Question 24 of the FAQ document.
 - <https://www.entsoe.eu/resources/network-codes/requirements-for-generators/>
 - Early adoption of the ENTSO-E RfG may be a possible way forward subject to National Choice based on Minimum Transmission System Need and Generator capability.

-
- Any questions?