Fault Ride Through

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National Grid – TNS Technical Policy

Summary

- Resume of Actions

- Effect on Large Nuclear Generators

- Voltage against time curves

- RfG Voltage against time curve issues

- Review of RfG Requirements / Interpretation

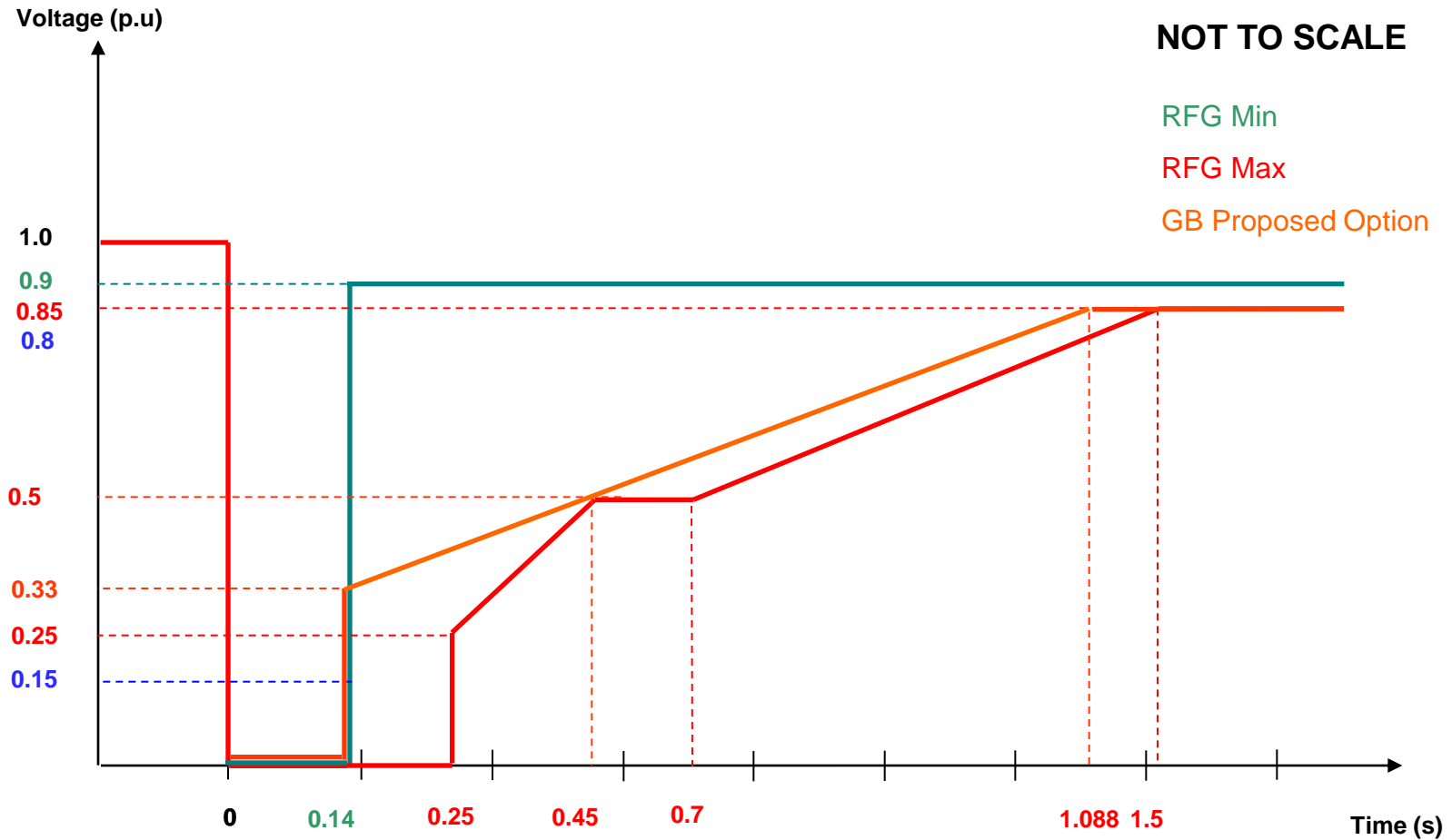- RfG Frequently Asked Questions Document

- Next Steps

Actions

- A summary of the workgroup findings and proposal, as a slide pack, for discussion – *Completed – See separate Slide Pack*

- Consider the impact on the new large nuclear fleet of Generators – *Included in slide pack / Discussion*

- Consider further the requirement of specifying the fault-level at either a local or global level – *Discussion – Current basis is towards site specific requirement similar to that for Excitation Performance.*

- Superimpose the orange voltage against time curve on top of the RfG requirement – *Completed – Included in slide pack.*

- Change the date in the terms of Reference to March 2015 instead of March 2014 – *In progress / Completed*

- Industry parties are asked to consider the stability of their station auxiliaries against the proposed curve. – *Discussion - covered as a specific agenda item.*

- Industry Parties where possible, to do some further analysis – particularly of large plant – against the proposed GB curve. - *Discussion*

- Expansion of the group to consider the requirements for Embedded Plant - *covered as a specific agenda item.*

Effect on Large Nuclear Generators

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- Detailed studies undertaken

- Noted issues

- Open Circuit Response – Non Grid Code Compliant

  - Believed to be an issue with model / parameters

  - Model evaluation being undertaken

- Application of faults on this model results in undamped oscillations.

- Need to work with individual manufacturers to ensure the models are correct (especially EDF, Horizon and NuGen)

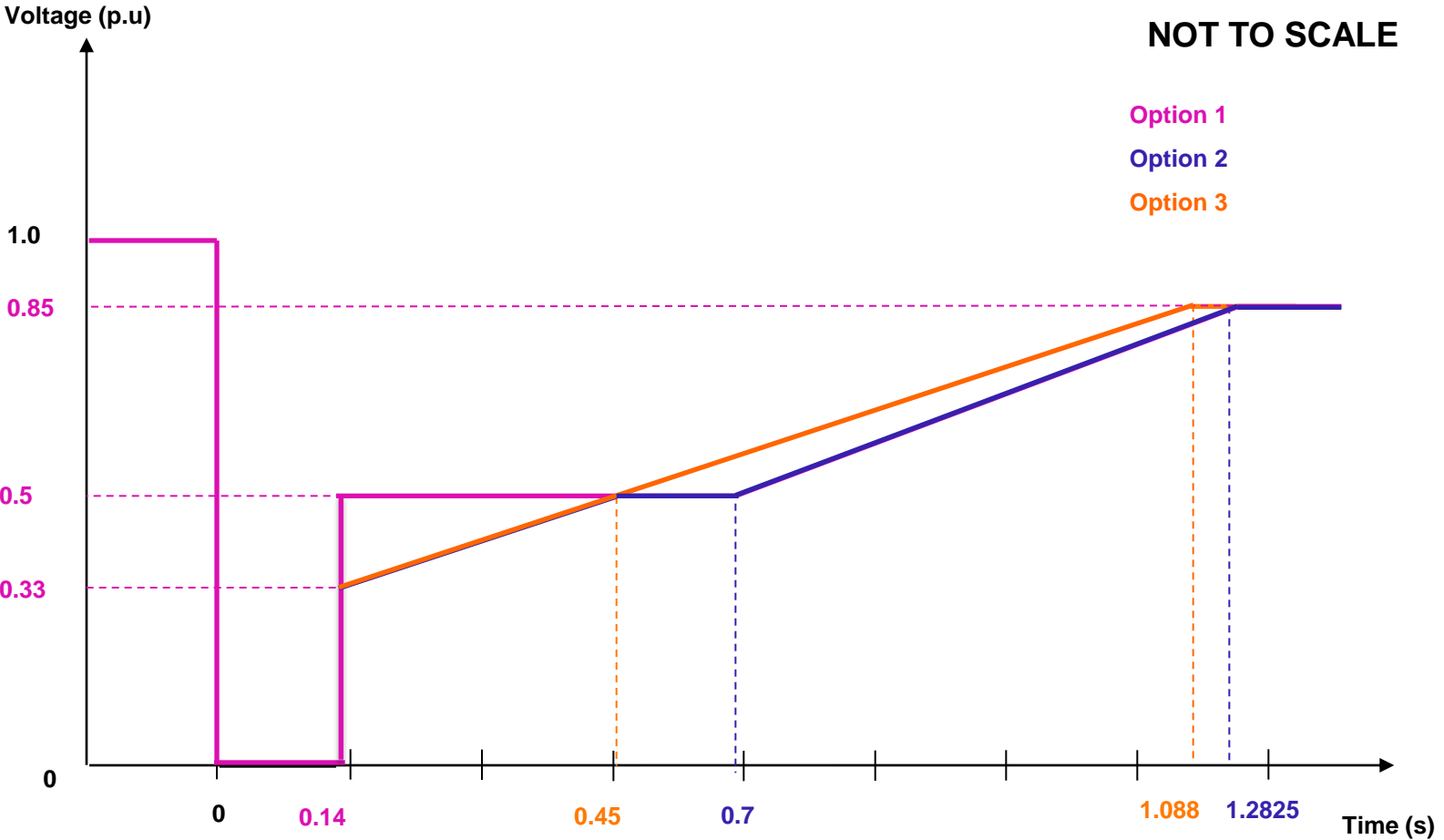# ENTSO-E RfG - Voltage Duration Profile – Possible GB Option (3)

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Voltage (p.u)

NOT TO SCALE

RFG Min

RFG Max

GB Proposed Option

1.0
0.9
0.85
0.8

0.5

0.33
0.25

0.15

0   0.14   0.25   0.45   0.7   1.088 1.5   Time (s)

Proposed Option

- Based on the extensive study work completed to date option 3 (Orange Curve) was the preferred option

- However it has subsequently been identified that Table 7.1 of the RfG for Type D Generators includes certain deadzones between RfG MIN and RfG MAX which would prevent the suggested curve from being used

- Limitations in the range of voltage parameters identified within Table 7.1 of the RfG document

- Clarification sought from ENTSO-E drafting team.

- Checks need to be made with the smaller units (Band B and C)

Options for Voltage Against Time Curves

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NOT TO SCALE

Voltage (p.u)

Option 1
Option 2
Option 3

1.0
0.85
0.5
0.33
0

0   0.14   0.45   0.7   1.088 1.2825

Time (s)

ENTSO-E RfG - Fault Ride Through Requirements – Voltage Against Time Profile – Figure 3

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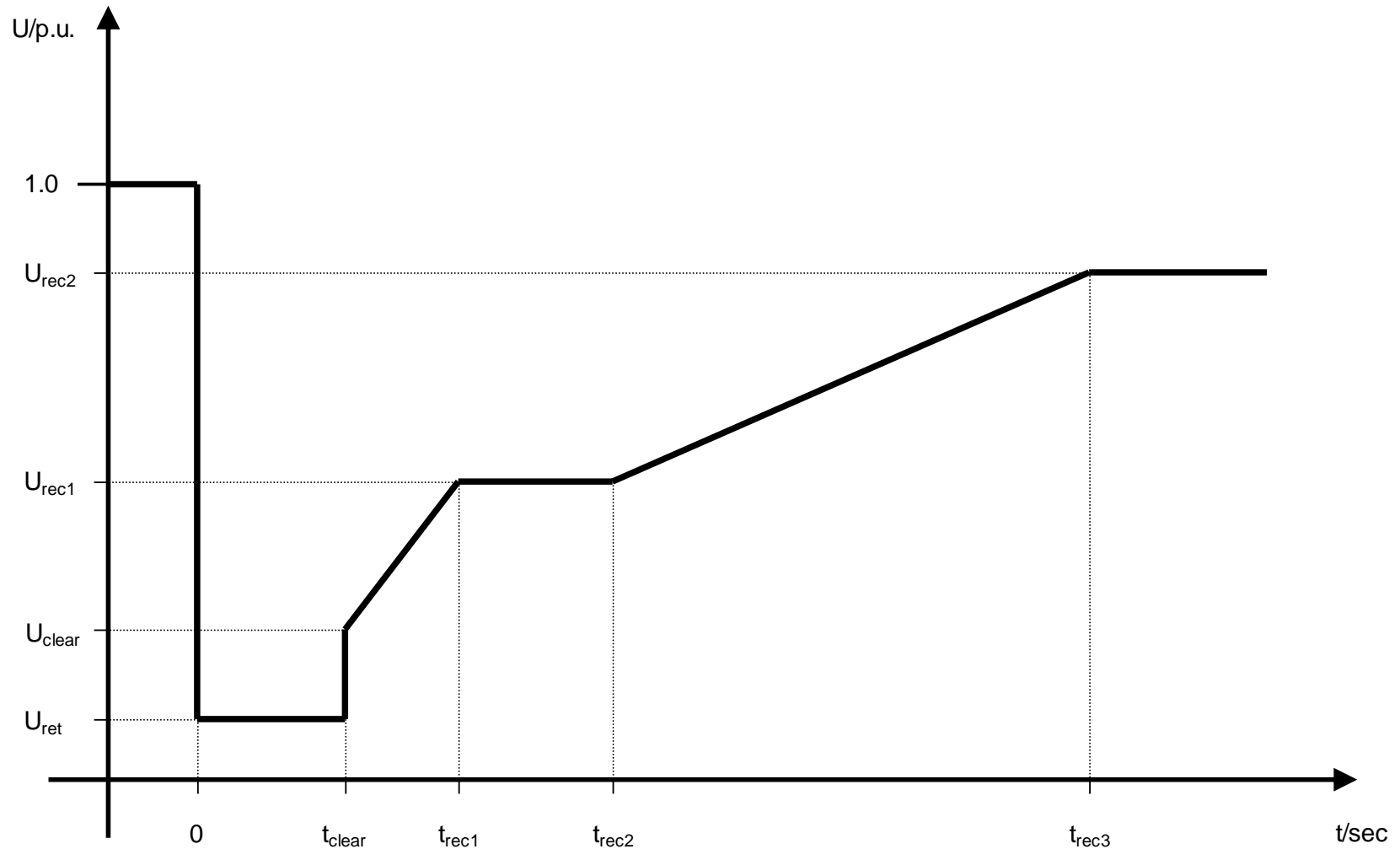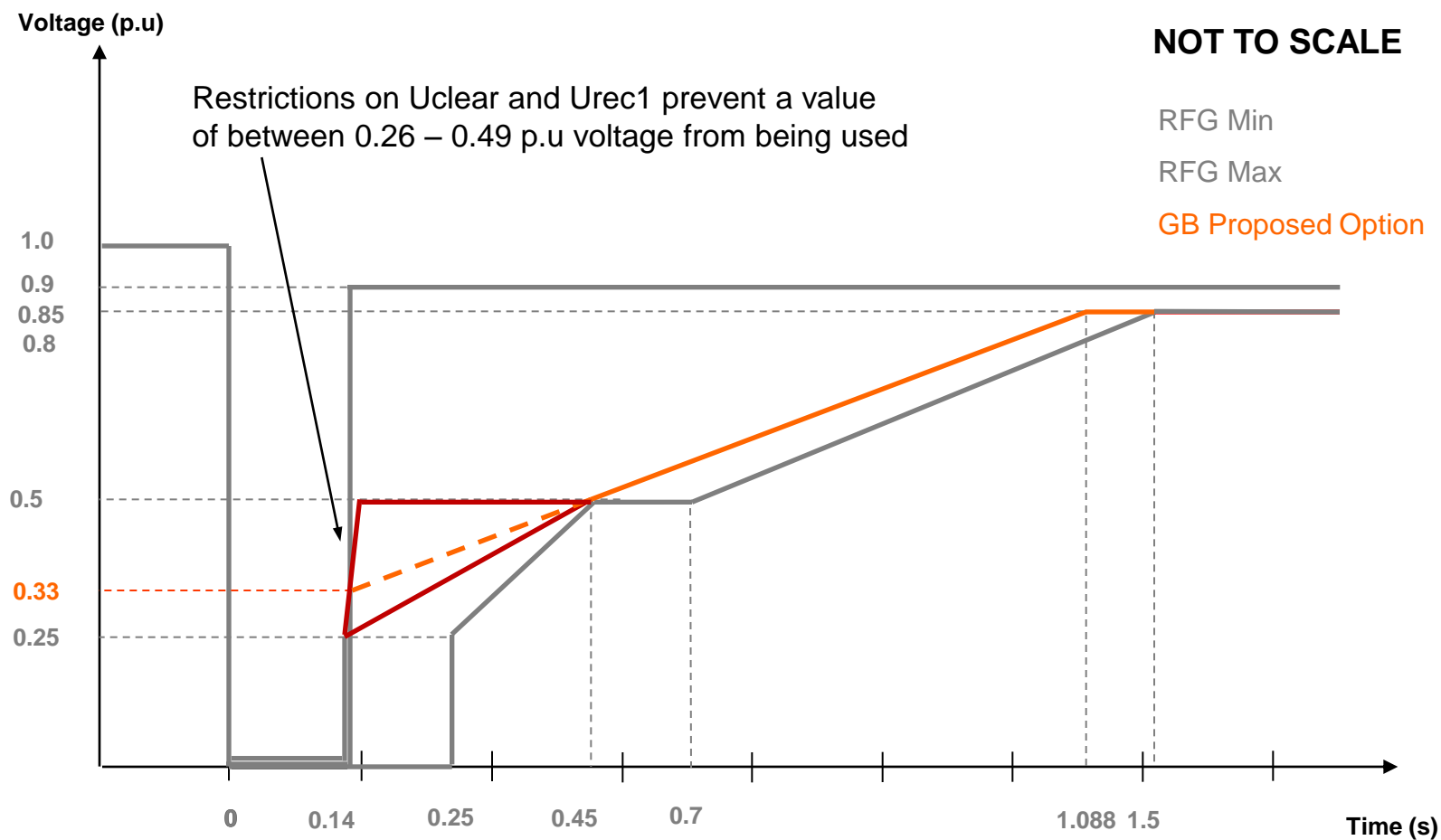
ENTSO-E RfG - Voltage Against Time Parameters – Table 7.1 – Type D Synchronous Power Generating Units

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Voltage parameters [pu]		Time parameters [seconds]	
Uret:	0	tclear:	0.14 – 0.25
Uclear:	0.25	trec1:	tclear
Urec1:	0.5 – 0.7	trec2:	trec1 – 0.7
Urec2:	0.85 – 0.9 and > Uclear	trec3:	trec2 – 1.5

Table 7.1 – Fault Ride Through Capability of Synchronous Power Generating Modules

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Voltage (p.u)

Restrictions on Uclear and Urec1 prevent a value of between 0.26 – 0.49 p.u voltage from being used

NOT TO SCALE

RFG Min

RFG Max

GB Proposed Option

1.0
0.9
0.85
0.8

0.5

0.33

0.25

0   0.14   0.25   0.45   0.7   1.088 1.5   **Time (s)**

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Review of RfG / Interpretation

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- Review of RfG requirements and Frequently Asked Questions document to be reviewed to ensure correct interpretation

- System studies have been run on the basis of identifying

  - Stable operating conditions

  - Post fault voltage recovery – especially for onerous faults cleared in backup operating times and the effect on generation remote from the fault

  - Generator operating conditions (ie full lead and max output)

  - Effect of Generation on fault level

- Recap of RfG Fault Ride Through requirements – working group discussion

Drax – Keadby – Thorpe Marsh, Drax – Thorpe Marsh - Double Circuit fault
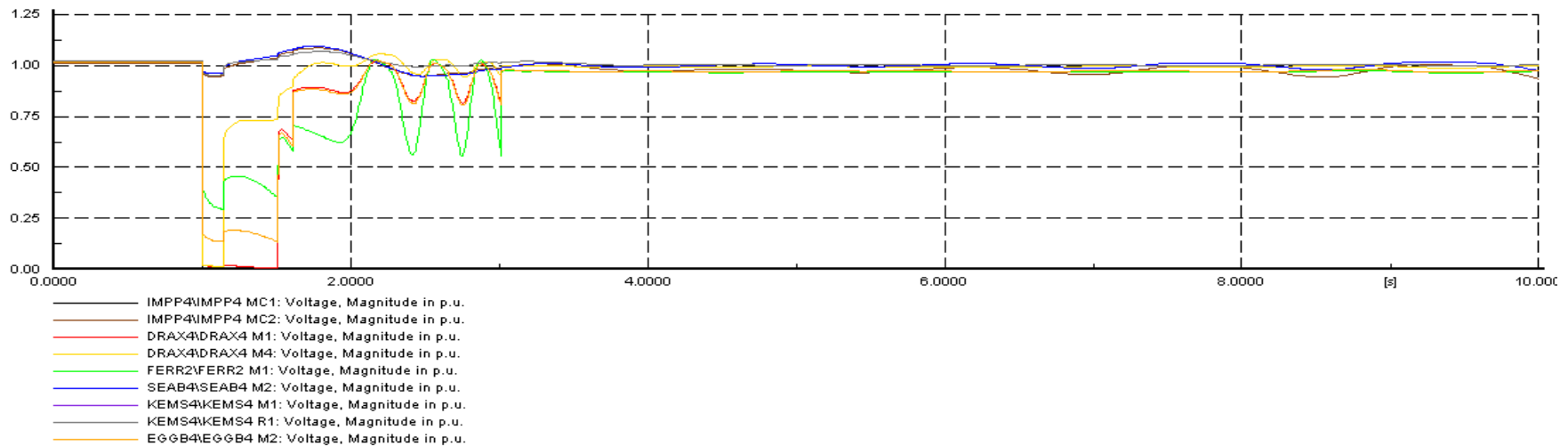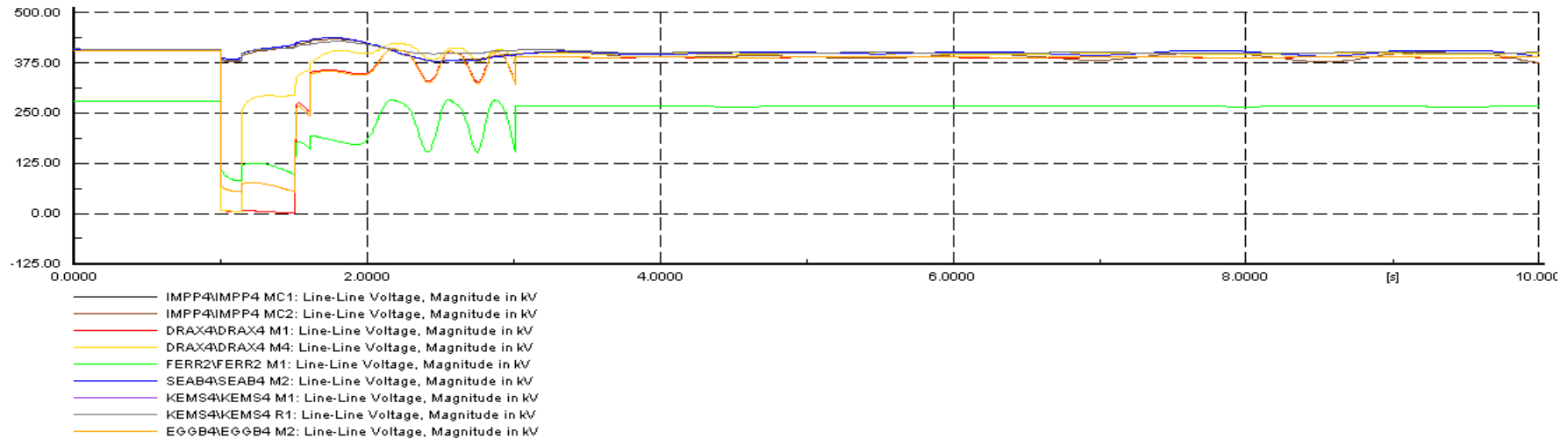
Next Steps

- Ensure NGET and working group assumptions are consistent with RfG Fault Ride Through Requirements

- Re-assess and finalise RfG Voltage against time curve

- Develop Grid Code Legal Text

- Finalise how compliance simulations would be demonstrated

- Consider changes on other documents – eg Guidance Notes for Synchronous Generators?

- Extend the remit and representation of the Working Group to consider the Fault Ride Through requirements for Embedded Synchronous Generators