Grid Code Development Forum

10:00 Wednesday 31st March 2020

Meeting number: 595 178 272
Password: APvyXz2iJ37

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Agenda

1. Introductions
2. Presentation: SQSS Review Update:
   Action from Ofgem/E3C Reports on 9th August 2019 Power Outage
   (***Matt Magill***, National Grid ESO)
3. Presentation: Adding 220kV Equipment to the Codes (Grid Code and SQSS)
   (***Louise Trodden***, National Grid ESO)
4. Code Administrator Update
   (***Rob Pears***, National Grid ESO)
5. Any other business
6. Close

SQSS Review Update: *Action from Ofgem/E3C Reports on 9th August 2019 Power Outage*

Matthew Magill
Commercial Strategy Manager

National Grid ESO

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Aims

Engagement:

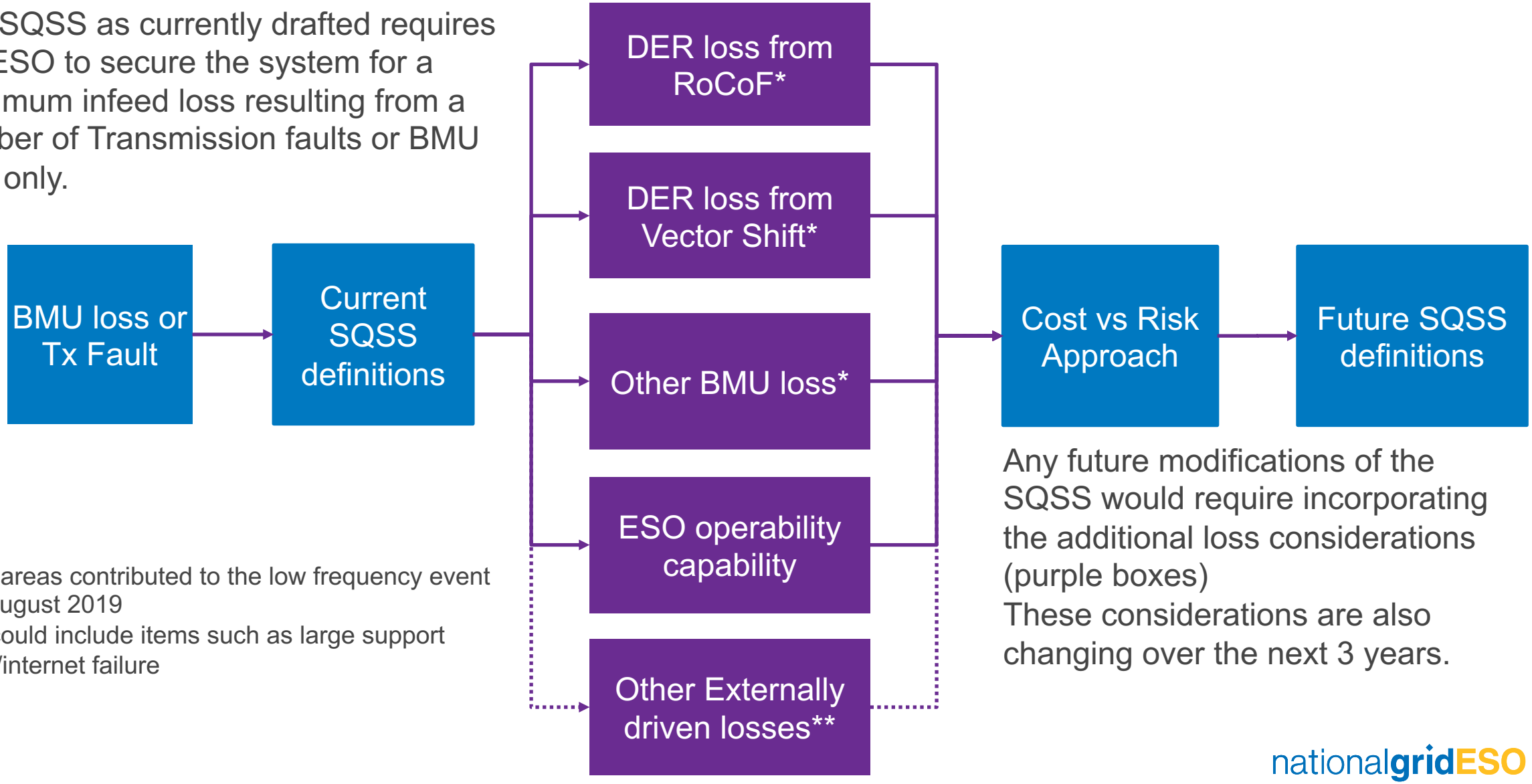
- The SQSS criteria for frequency performance were implemented to provide a defined level of security with an expected level of cost. Changing the SQSS to reflect additional risks will impact that balance. In raising any modification that balance must be considered with a wider audience to ensure the right outcomes for industry and the consumer.

Challenges:

- The modification must be explicit in its treatment of Distributed Energy Resources (DER) and simultaneous losses
- The current SQSS framework sets out a specific performance standard and optimisation is carried out by the ESO in a broader context: any modification must improve transparency.
- The conventional way of changing the SQSS relies on a single Cost Benefit Analysis to justify an enduring modification. Known changes that we need to take account of are;
    a) Decreasing system inertia countered by ESO stability pathfinder delivery
    b) Faster acting response products changing the operating envelope
    a) Reduction in the DER loss sizes as the Accelerated Loss of Mains Change Programme delivers.
- In a changing environment it would be preferable to be able to adjust the parameters or process needed to achieve the desired balance of cost and risk.

Factors Affecting Infeed Loss

The SQSS as currently drafted requires the ESO to secure the system for a maximum infeed loss resulting from a number of Transmission faults or BMU trips only.



Any future modifications of the SQSS would require incorporating the additional loss considerations (purple boxes)
These considerations are also changing over the next 3 years.

* These areas contributed to the low frequency event on 9th August 2019
** This could include items such as large support network/internet failure

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Potential Approach - Options

Option	Approach	Proposed Implementation	Framework	ESO Role
1. Deterministic	Expand the current SQSS definitions to include LoM risks in *infeed loss* consideration.	As per todays implementation	As per todays framework, would require a number of changes as the operating environment varies.	Feed into the proposed wording of the changes
2. Mixed	SQSS refers to a methodology where an agreed set of risks are considered and a recommendation of which to secure/not secure is proposed	SQSS will in an addendum list all of the risks which the ESO is required to secure	Similar approach to the Electricity Capacity Report and C16 process for governance	Create a transparent and consulted methodology. Create a transparent and consulted recommendation Cost and Volume optimise the recommendation, transparently, in real-time
3. Probabilistic	SQSS refers to a methodology where an agreed set of risks are considered together with probabilities to create a cost curve with a recommendation	The ESO will secure a loss size of x during period y. Where x and y are decided through the methodology	Similar approach to the Electricity Capacity Report and C16 process for governance	Create a transparent and consulted methodology. Create a transparent and consulted recommendation Cost optimise the recommendation, transparently, in real-time

Methodology

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Methodology Overview

- **There are three mains steps to the modelling approach:**

Imbalance vs. Likelihood	Assess how often the system is likely to experience imbalances of different sizes
Cost vs. Imbalance	Calculate the cost of preventing different size imbalances causing "unacceptable frequency conditions"
Reliability vs. Cost	Combine the first two steps together to assess the balance of the two key objectives

*Imbalance is the difference between generation and demand at any given time.

Results of the Analysis

Analysis included all ‘loss pairs’ (multiple infeed losses) and covering all LoM losses.

Cost effective solution is highly dependent upon

- Delivery of over 300 MW of fast acting response (Dynamic Containment)
- Achieving planned desensitisation of over 50% of Loss of Mains protection relays

Neither of these targets are now confirmed to deliver in the required timescales of this summer.

Evolution of the methodology now requires a stepping-stone to succeed:

- Part A – Provide stakeholders with a cost forecast to cover more than one simultaneous loss for consultation.
- Part B – Raise SQSS modification for the SQSS to reference methodology for management of Loss of Mains losses – including highlighting that not all losses are always cost effective to manage.

This stepping-stone will still allow inclusion of multiple losses in a future iteration.

Both parts would be subject to consultation and approval with similarities to C16 and the Electricity Capacity Reporting processes .

The methodology would include 'triggers' for a review to ensure that the ESO continues to deliver cost benefit to the consumer.

Part A: Cost benefit of covering more than one loss

Analysis in progress to share the required response volumes for covering all loss ‘pairs’

Part B: Methodology for inclusion of Loss of Mains

Methodology:

- Will be a framework to allow a periodic review of causes (faults) which are value for money and should be mitigated.
- Value decision is based on a cost to manage and risk of event happening.
- All information and methods published and consulted. Requires ESO to also publish operational considerations.

Operations:

- Clear publication to the market of the causes being actively managed
- Clear publication to the market of the factors being considered:
  - Infeed Loss size
  - RoCoF protection loss forecast size
  - Vector Shift protection loss forecast size

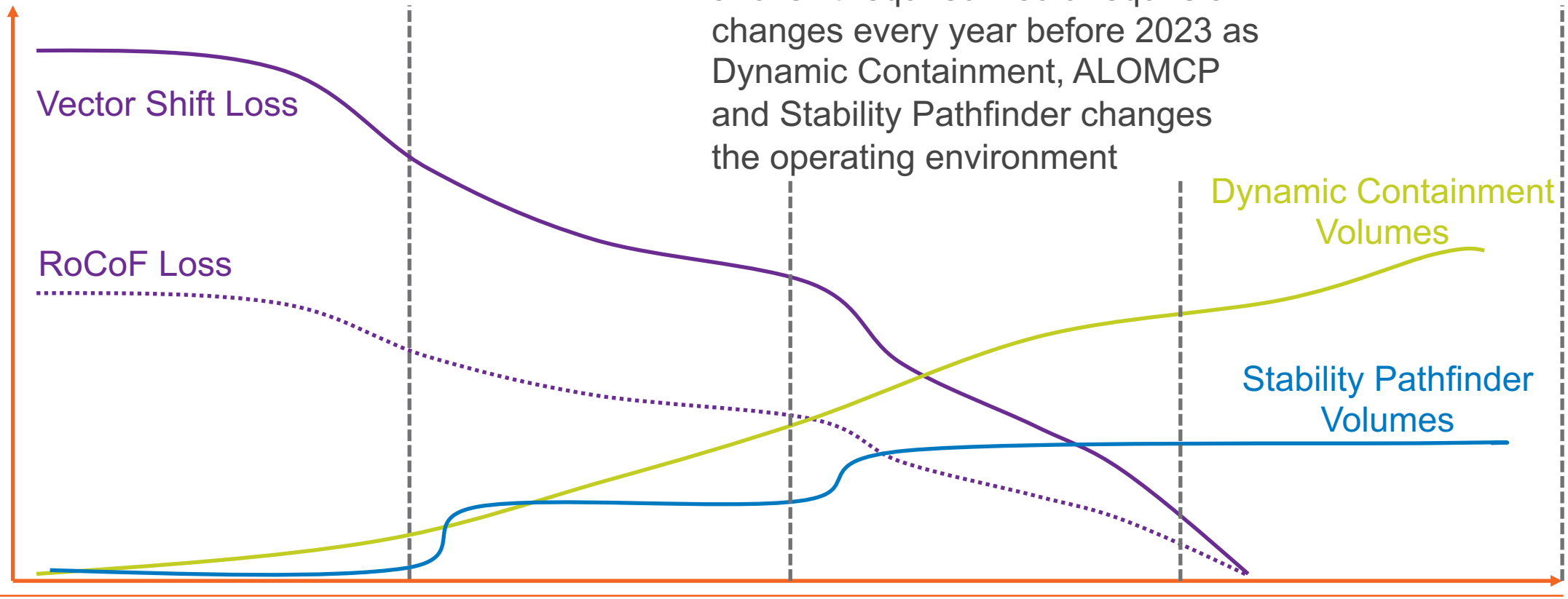
Next Steps

- The ESO will consult with stakeholders a confirmation of Part A of the methodology and how Part B fits within the overall cost forecast
- Raise a modification to the SQSS in April to reference use of the Methodology
- Develop and publish for consultation the Methodology for part B
- Develop method for publication of required data items for part B
- Continue to engage on the methodology
- Timescale to have an agreed and implemented methodology by Autumn 2020.

Appendix

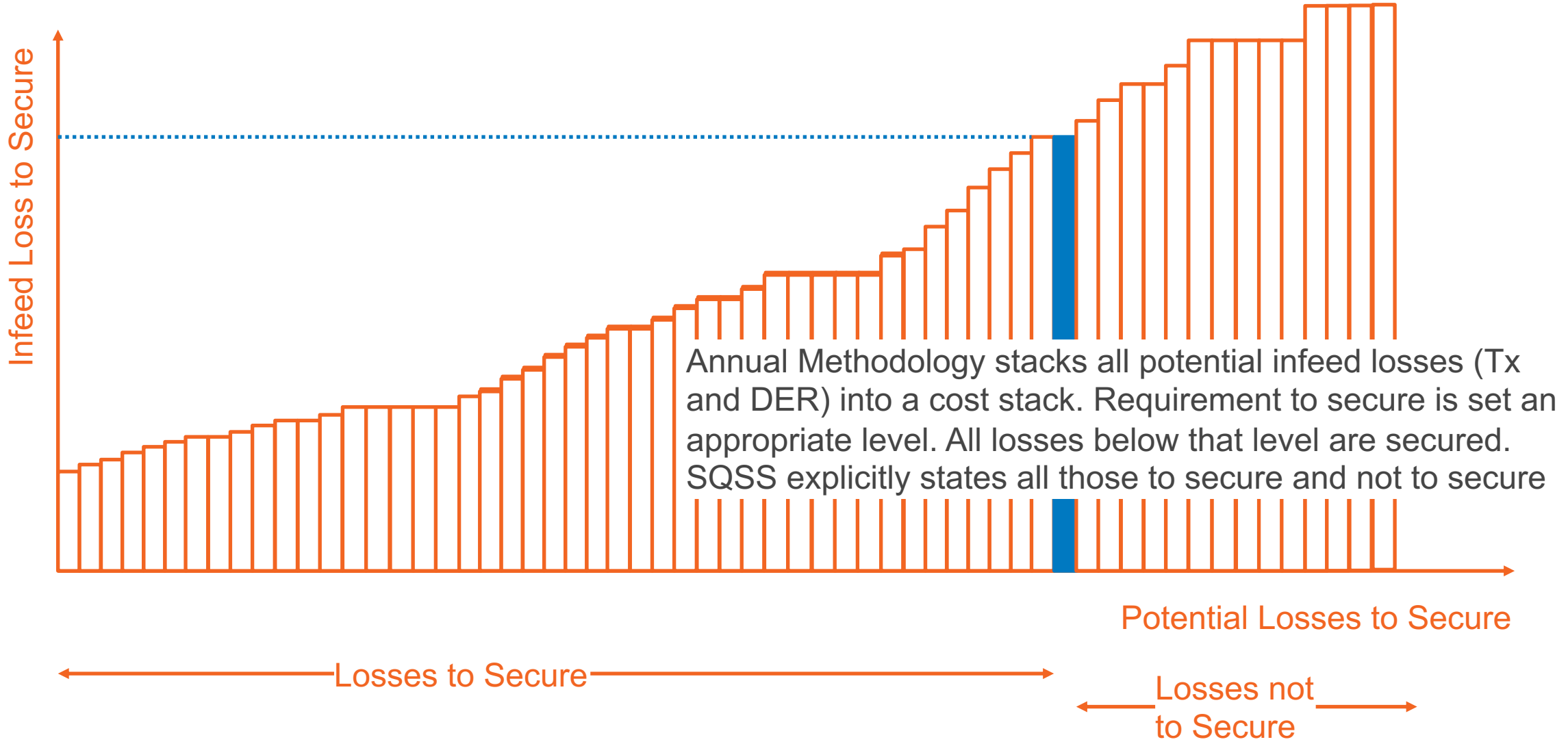
Option 1 - Deterministic

Specifying in the SQSS what is and isn't required would require a changes every year before 2023 as Dynamic Containment, ALOMCP and Stability Pathfinder changes the operating environment



	2020	2021	2022	2023
RoCoF	Pre-Fault	Pre-Fault	Dynamic Containment and Stability	NA
Vector Shift A	Pre-Fault	NA	NA	NA
Vector Shift B	Pre-Fault – Severe	Pre-Fault – Severe	Pre-Fault or Dynamic Containment and Stability	NA
> 1 Loss	Not Possible due to RoCoF loss	Not Possible due to RoCoF loss	Not Possible due to RoCoF loss	Dynamic Containment and Stability

Option 2 – Mixed Option



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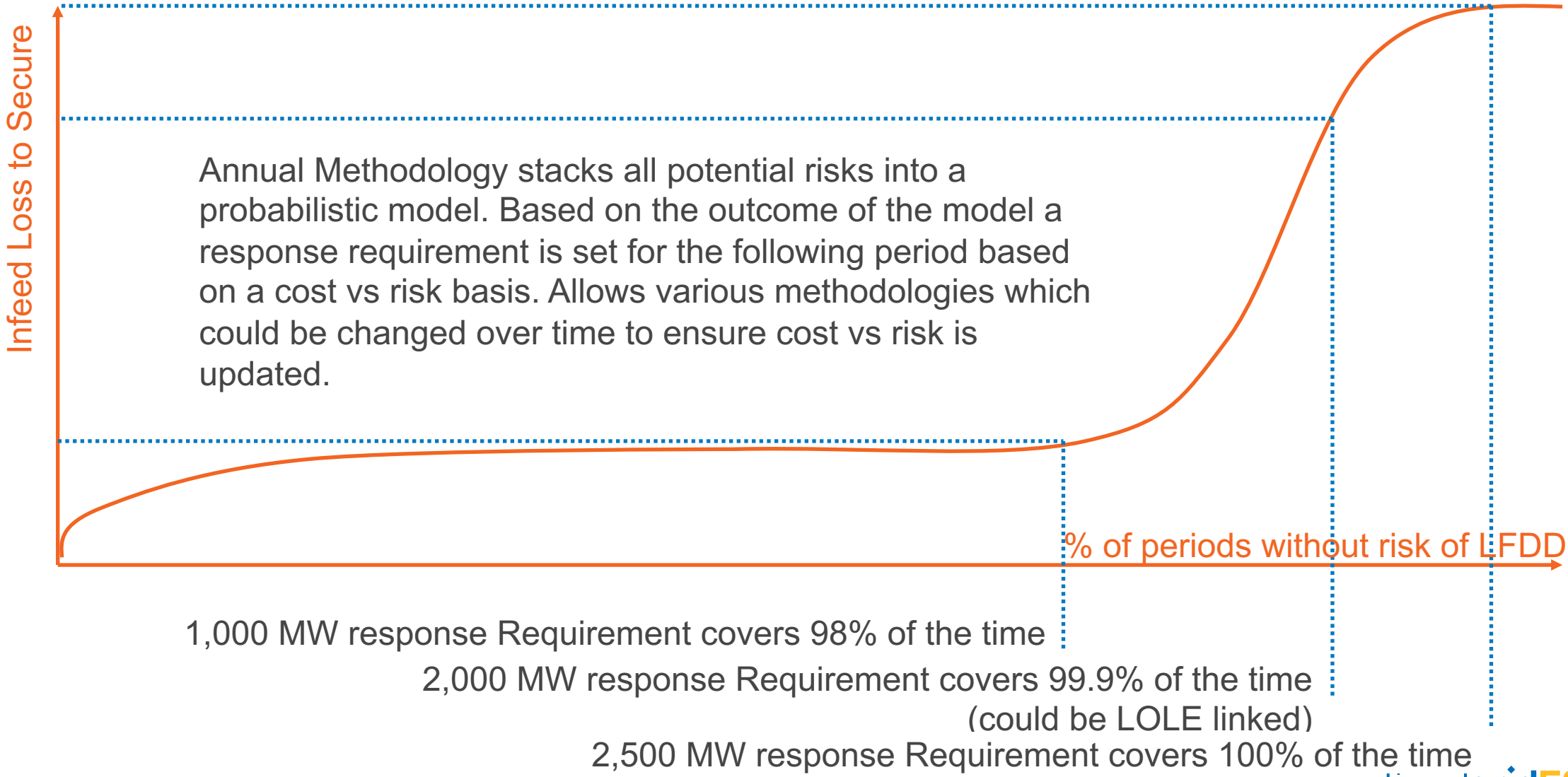
Option 3 - Probabilistic



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Adding 220kV Equipment to the Codes

Louise Trodden
National Grid ESO

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Introduction

History

GSR0021 was raised in 2015 to look at reviewing incorporating 220kV transmission assets into the SQSS.

This was subsequently rejected by Ofgem as it did not offer a solution to further nominal voltages potentially requiring review and addition to both the SQSS and the network.

Future proof- additional equip
Not urgent no customers- limited potential

Decision Letter from Ofgem
GSR0021 Industry Consultation Paper

Proposal

Raise a new modification in response to Ofgem's decision letter dated July 2016.

The objective of this modification will be to capture any future equipment with varying nominal voltages – therefore avoiding frequent amendments to the SQSS and also the Grid Code. The aim will be to do this using defined terms where possible and creating a table of voltages similar to that in the EU codes in both the SQSS and the Grid Code.

Where are these cables?

Current Locations

The Kintyre-Hunterston subsea AC link has two subsea cables between Crossaig on the Kintyre peninsula and Hunterston.

These are connected to the Onshore Transmission System via two 400/220kV supergrid transformers at Hunterston and via two 220/132 kV transformers at Crossaig.

Future

220kV is common EU transmission voltage. It is possible that further equipment of other common voltages (Eg: 380kV, 110kV) could be connected to the GB system in the future.

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Why should we review?

Clarity of Requirements

- Unclear what specification or performance is required from equipment at voltages not currently specified within the codes.

Consistency

- SQSS and Grid Code need to be aligned.

Specification

- In including specifications for equipment at voltage not currently covered by the codes.

What Areas of Code are to be Reviewed?

Section of the Grid Code	Grid Code Reference Points
Single Point of Connection	PC.A.8.1 and PC.A.8.3
Grid Voltage Variations	CC.6.1.4
Fault Clearance	CC.6.2.2.2.2 and CC.6.2.3.1.1
General Generating Unit	CC.6.3.2 and CC.6.3.4
Steady State Voltage	CC.A.7.2.2.1.2.4
Reactive Capability Table	CC.6.3.2
Grid Voltage Variations	ECC.6.1.4.1
Fault Clearance	ECC.6.2.2.2.2
Protection Arrangement	ECC.6.2.3.1.1

Version : Issue 5. Revision 40

Section of SQSS	SQSS Reference Points
Voltage Limits in Planning and Operating the Onshore Transmission System	Tables 6.1, 6.2, 6.3 and 6.4
Defined Term	Supergrid

Version : NETS SQSS v2.4 April 2019

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Current Grid Code

National Electricity Transmission System Nominal Voltage	Normal Operating Range
400kV	± 5%
275kV	± 10%
132kV	± 10%

Proposed Grid Code

National Electricity Transmission System Nominal Voltage	Normal Operating Range	Pu
>300kV- 400kV	± 5%	0.95pu-1.05pu***
>200kV-300kV	± 10%	0.90pu-1.10pu**
<200kV	± 10%	0.90pu-1.10pu*

Current SQSS Example

Table 6.1 Pre-Fault Steady State Voltage Limits and Requirements in Planning Timescales

(a) Voltage Limits on Transmission Networks		
Nominal Voltage	Minimum (***Note 1***)	Maximum
400kV	390kV (97.5%)	410kV (102.5%) ***Note 2***
275kV	261kV (95%)	289kV (105%)
132kV	125kV (95%)	139kV (105%)
(b) Voltages to be Achievable at Interfaces to Distribution Networks		
Nominal Voltage		
Any	105% at forecast *Group Demand*; 100% at *forecast Minimum Demand*, or as otherwise agreed with the relevant Network Operator	

Notes

1. It is permissible to relax these to the limits specified in Table 6.2 if:
   (i) following a *secured event*, the voltage limits specified in Table 6.2 can be achieved, and
   (ii) there is judged to be sufficient certainty of meeting Security and Quality of Supply Standards in operational timescales.
2. It is permissible to relax this to 420kV (105%) if there is judged to be sufficient certainty that the limit of 420kV (105%) can be met in operational timescales.

Proposed SQSS Example

Table 6.1 Pre-Fault Steady State Voltage Limits and Requirements in planning timescales

(a) Voltage Limits on Transmission Networks		
Nominal Voltage	Pu	Normal Operating Range
>300- 400kV	0.975 pu-1.025 pu***	± 2.5% **(Note 1 and 2)**
>200kV-300kV	0.95pu-1.05pu**	± 5%
<200kV	0.95pu-1.05pu*	± 5%
(b) Voltages to be Achievable at Interfaces to Distribution Networks.		
Nominal Voltage		
Any	1.05 pu at forecast Group Demand 1.00 pu at forecast Minimum Demand or as otherwise agreed with the relevant Network Operator.	

Notes

1. It is permissible to relax these to the limits specified in Table 6.2 if:
(i) following a secured event, the voltage limits specified in Table 6.2 can be achieved, and
(ii) (ii) there is judged to be sufficient certainty of meeting Security and Quality of Supply Standards in operational timescales.
2. It is permissible to relax this to 420kV (105%) if there is judged to be sufficient certainty that the limit of 420kV (105%) can be met in operational timescales.

Questions from previous meetings

Grid Code

Are we compliant?

We believe that we are still compliant- this did not seem to be a concern to Ofgem in the previous rejected modification as no customers are currently connected.

At the values set right in the tables?

The tables have had the values amended to show Greater or Less than. Rather than 200-300kV and 300-400kV.

SQSS

Will IEC standards be aligned?

There appears to be no conflict upon review.

The pu value on the table does not match

The table had a error on the presentation- it was the Grid Code, however within the legal text, it was correct.

Will the current cables work to those ranges?

Roddy Wilson at SEE has confirmed that the Kintyre – Hunterston cables are capable of operating over the voltage ranges set out in the proposal for the SQSS.

Is the 200kV cut off ok with the operational limits?

These values were derived from the previous papers that were submitted. (SQSS modification paper dated the 1st April 2015)

Summary

This modification is fairly straight forward in that there are not complex changes to be made, and uses the same principles and technical detail of that in the previously rejected modification from Ofgem. Its also worth noting that in the initial papers submitted it was the preferred approach to have a range of voltages in the table.

Having said this, it has been reworked to create flexibility of further nominal voltages being introduced in GB, therefore reducing the need to update the codes with further nominal voltages to support alignment for both the Grid Code and SQSS.

Next Steps

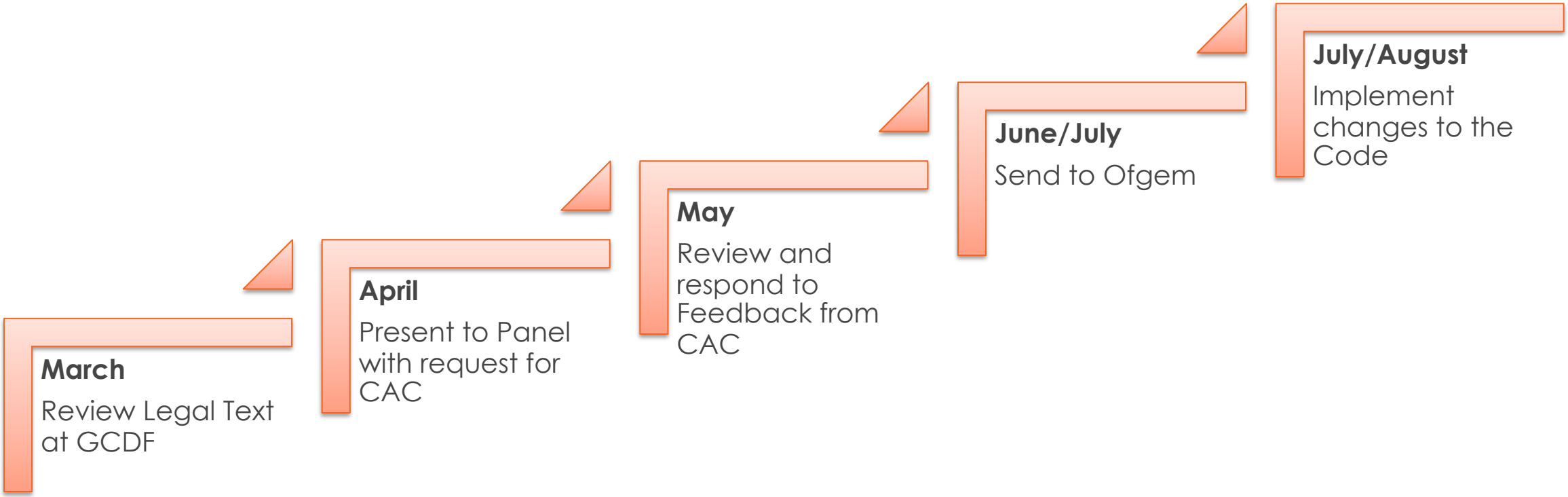
Review example legal texts (see attached documents)
Annex to Code Mods- Legal Text
Grid Code Proposal Form
SQSSProposal Form

Decision Letter from Ofgem be sure that the this now answers the letter from Ofgem and that all parties are happy with the suggestions

The next slide shows the reasons for rejection by Ofgem and the response that this modification proposal makes to them.

Authority's Assessment of the Proposed Modification	How the Proposed Modification Responds.
We agree with the workgroup's change to the definition of the term "supergrid" in Chapter 11. We also agree that the voltage levels proposed by this modification proposal are aligned with IEC 60038. However, we are not convinced of the workgroup's proposed approach to including these in the SQSS.	There is no dispute to the term ''supergrid'' being updated. To keep this in the proposal. Another review of the IEC shows no conflict.
First, the workgroup have not provided sufficient justification for their proposal to adopt approach 1 (as described in section 3 above) for Chapter 6 while approach 2 is already used in Chapter 10 of the SQSS. We further note that the voltage limits as set out in paragraph 27, part VII "Supplies to Installations and to other Networks" of the Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002 are based on approach 2. We think that the modification as proposed will produce unjustified and potentially confusing inconsistency between Chapters 6 and 10 of the SQSS and between the SQSS and ESQCR.	There is a range of voltages already used in Chapter 10 of the SQSS. This proposal aims to provide consistency in the code by also including a range of voltages and seeks to be aligned in its approach with EU codes.
We are also concerned that in the near future more changes to the SQSS may be required to reflect equipment being installed on the network at voltages different to the discrete voltages identified in the SQSS.	By removing specific nominal voltages and creating a table with a range, allows for other voltages to be used in the codes.
In terms of the timing of making the proposed changes to the SQSS, we note that the current installation of 220 kV transmission assets does not include any customer interfaces and therefore the proposed voltage limits do not apply to this installation. We do note though the possibility of 220 kV transmission network assets (as indeed those at other voltage levels) containing customer interfaces being installed in the future.	This change allows flexibility for any future assets to be clear on the requirements and specifications for each nominal voltages.
Given the above concerns, we believe that the workgroup and the SQSS Panel should consider the consistency between Chapters 6 and 10 voltage limits and review the options available to them to find an enduring solution that withstands the current technological limitations, whilst avoiding frequent and unnecessary changes to the SQSS.	This proposal seeks to create tables with voltage ranges so that there are consistencies in voltage limits and allows for further nominal voltages to be introduced without the need to frequently update the codes.

Time Line of Proposed Next Steps



Code Administrator General Updates

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Dates for your diary

	April	May	June	July
GCDF	31/03/2020	06/05/2020	03/06/2020	08/07/2020
New Modification Proposal Submission Date	07/04/2020	13/05/2020	10/06/2020	15/07/2020
Papers Day	14/04/2020	20/05/2020	17/06/2020	22/07/2020
Grid Code Review Panel	22/04/2020	28/05/2020	25/06/2020	30/07/2020

Any Other Business (AOB)

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