National Grid ESO- Operability & Future Inertia Trends

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Underlying trends

1st April 2019 - *Energy security*

National Grid Electricity System Operator (ESO) has announced it will be able to fully operate Great Britain's electricity system with zero carbon by 2025.

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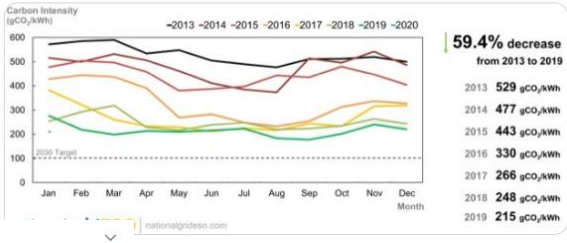
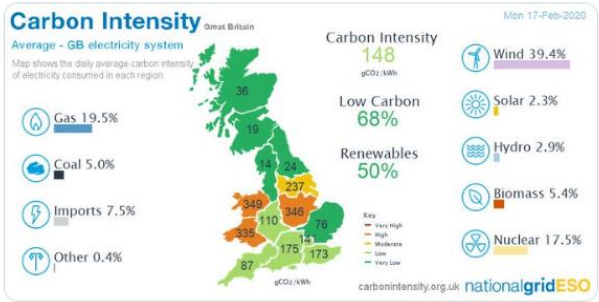
@ng_eso

!Record alert!👊 January was the greenest 🍃 ever in terms of GB's #electricity ⚡ system! Mild temperatures 🌡️ led to the lowest ever average carbon intensity - (the amount of carbon produced for every kilowatt). (Jan 2020 figure of 209gCO2/kwh is the blue dot below 🔵!) 1/2



ESO Control Room
@NGControlRoom

On Monday #wind generated 39.3% of GB electricity followed by gas 19.5%, nuclear 17.5%, imports 7.5%, biomass 5.4%, coal 5.0%, hydro 2.9%, solar 2.6%, other 0.4% *excl. non-renewable distributed generation



4:37 PM · Feb 18, 2020 · GB Elexon Electricity Data

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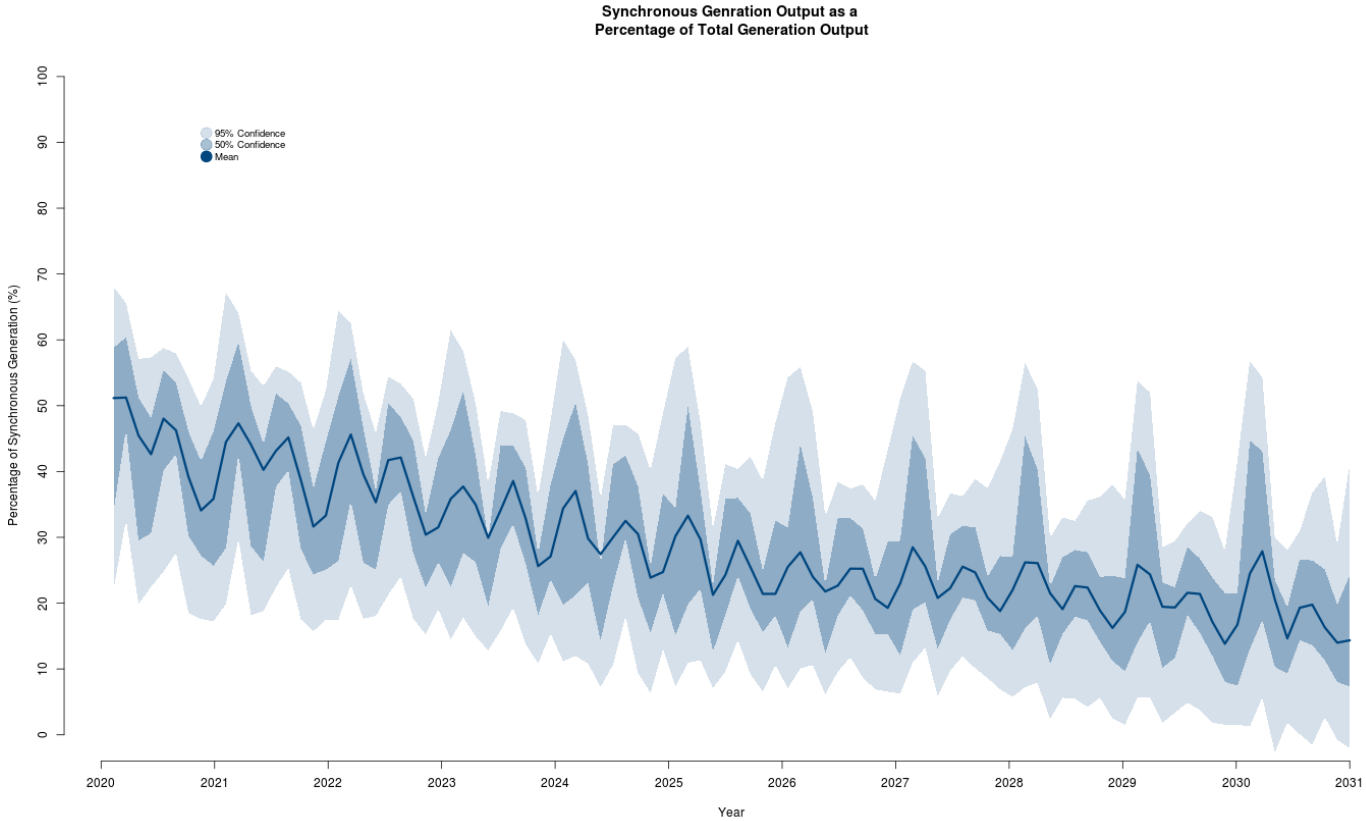
Underlying trends



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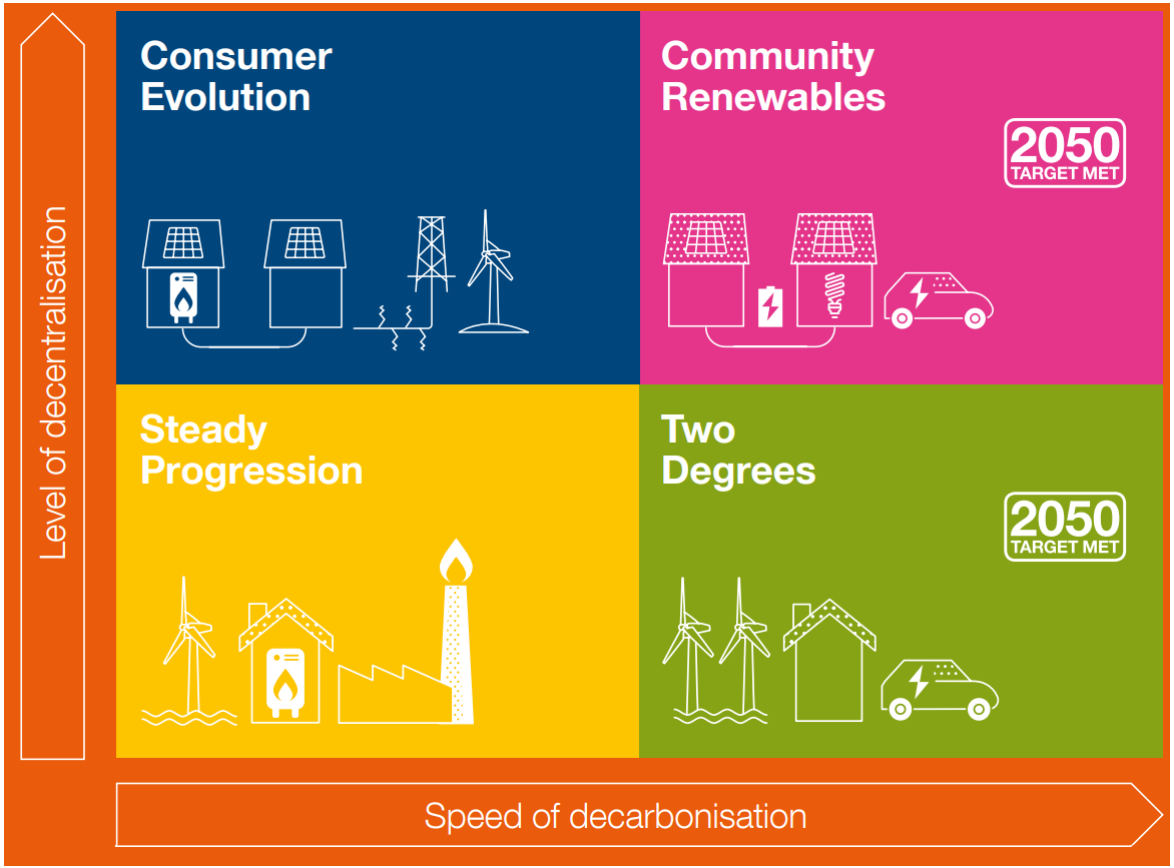
GB operability needs

Key drivers

- Higher non-synchronous generation output and capacities
- More HVDC interconnection
- Increases in embedded generation, lower net transmission system demand
- More active demand side behaviours
- Conventional synchronous generation closures and lower availability
- Reducing levels of industrial and other motor demand

Future Energy Scenarios



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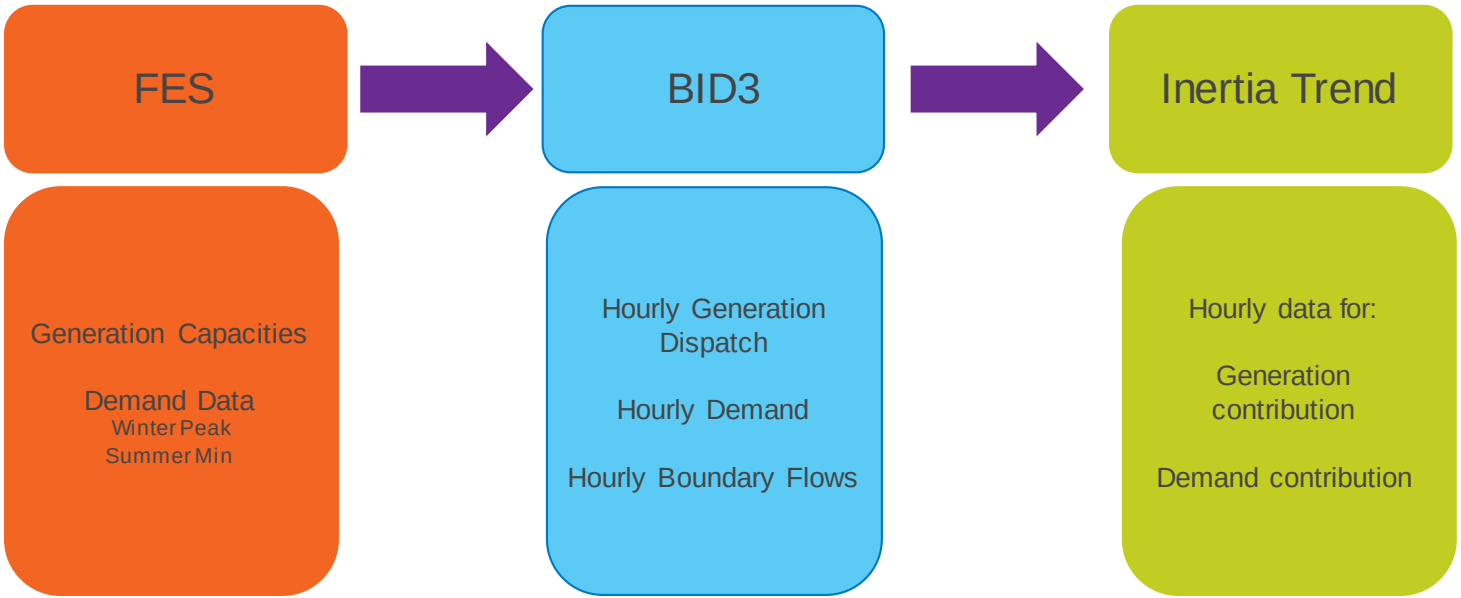
Calculating inertia



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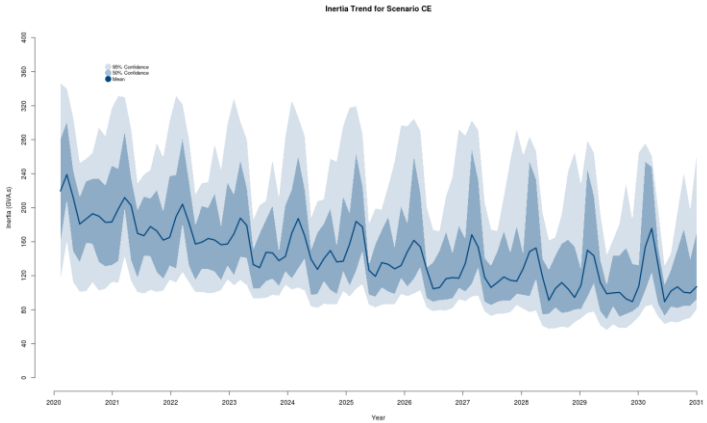
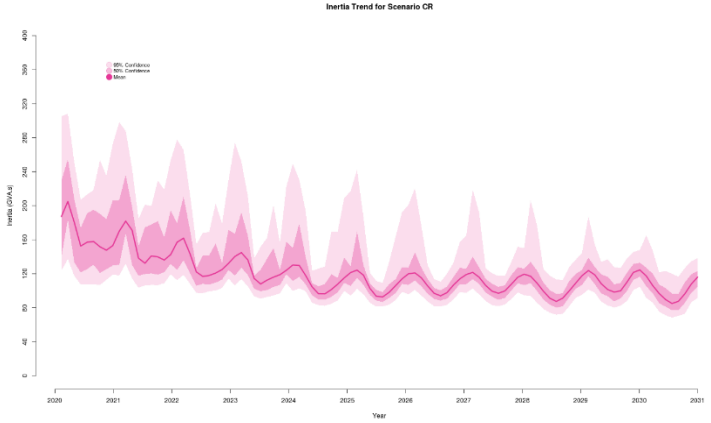
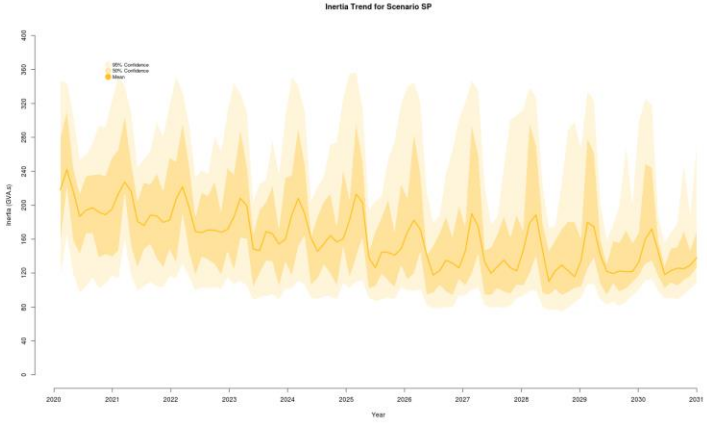
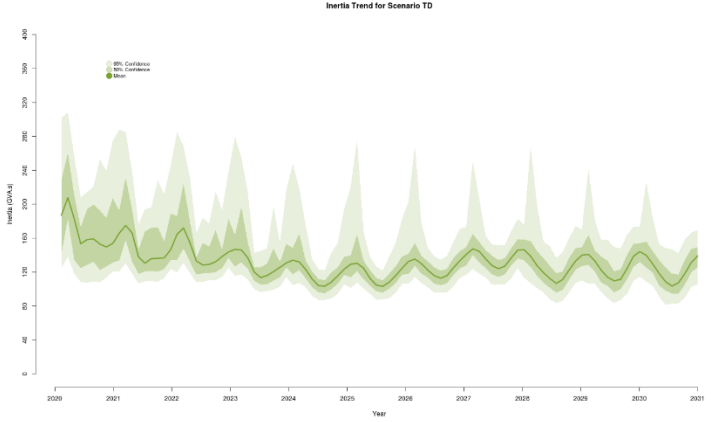
Inertia Trend









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Managing inertia

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RoCoF and largest loss

Today our biggest inertia constraint is Loss of Mains (LoM).

Some LoM relays currently have a Rate of Change of Frequency (RoCoF) trigger of 0.125 Hz/s

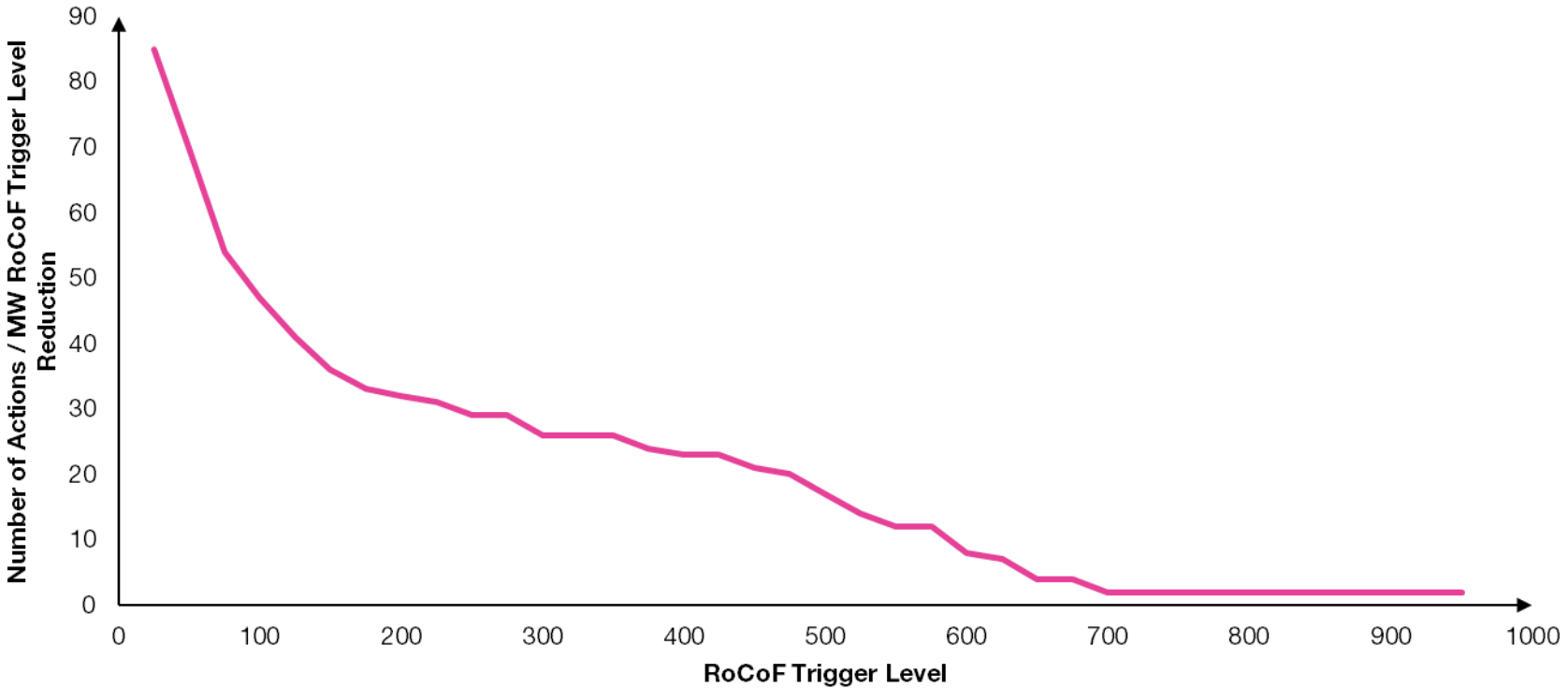
We have 2 ways to managing this:

- Reduce largest loss
- Increase inertia

We will always manage this risk in the most economic manner

Work also is ongoing to change setting on RoCoF relays

Controlling the largest loss



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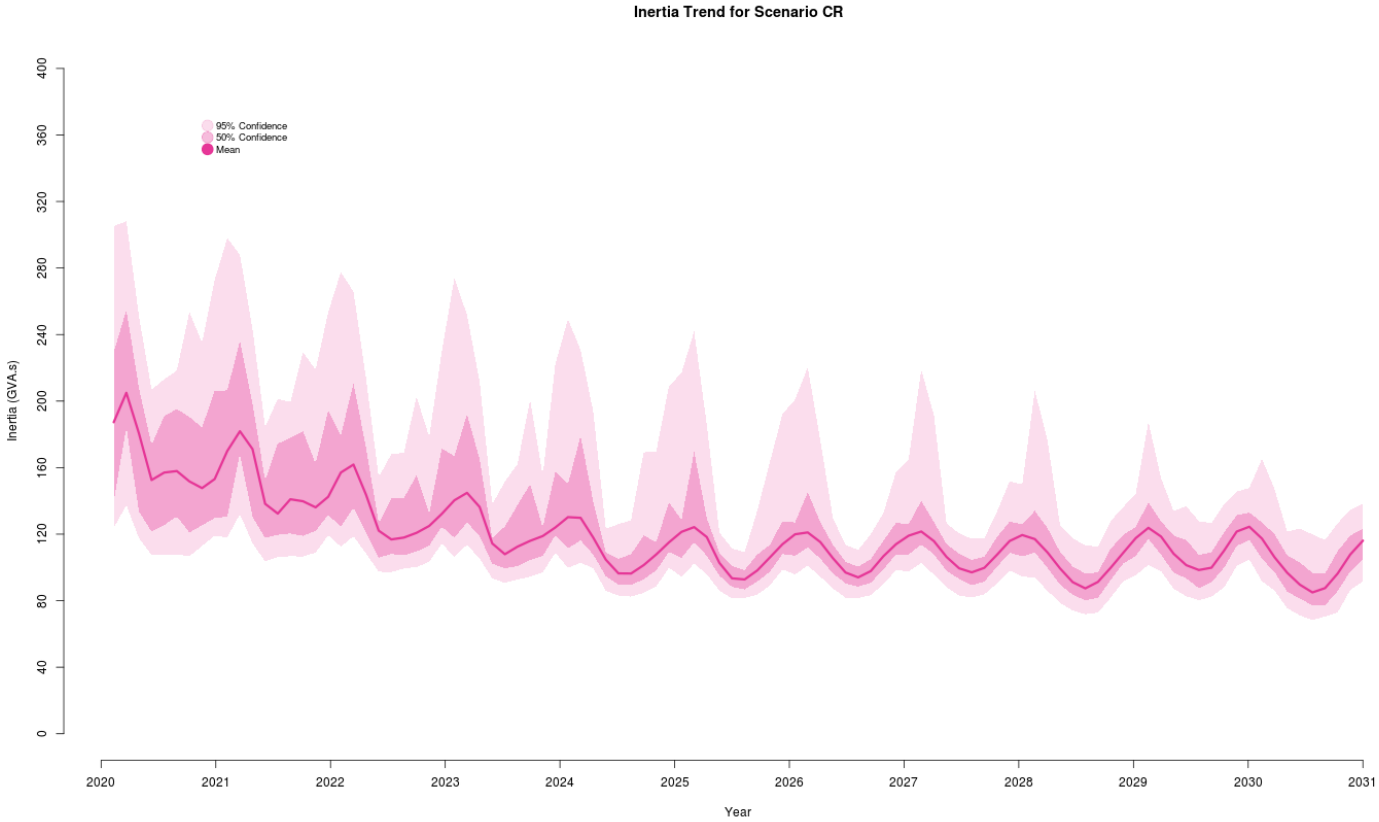
New limit



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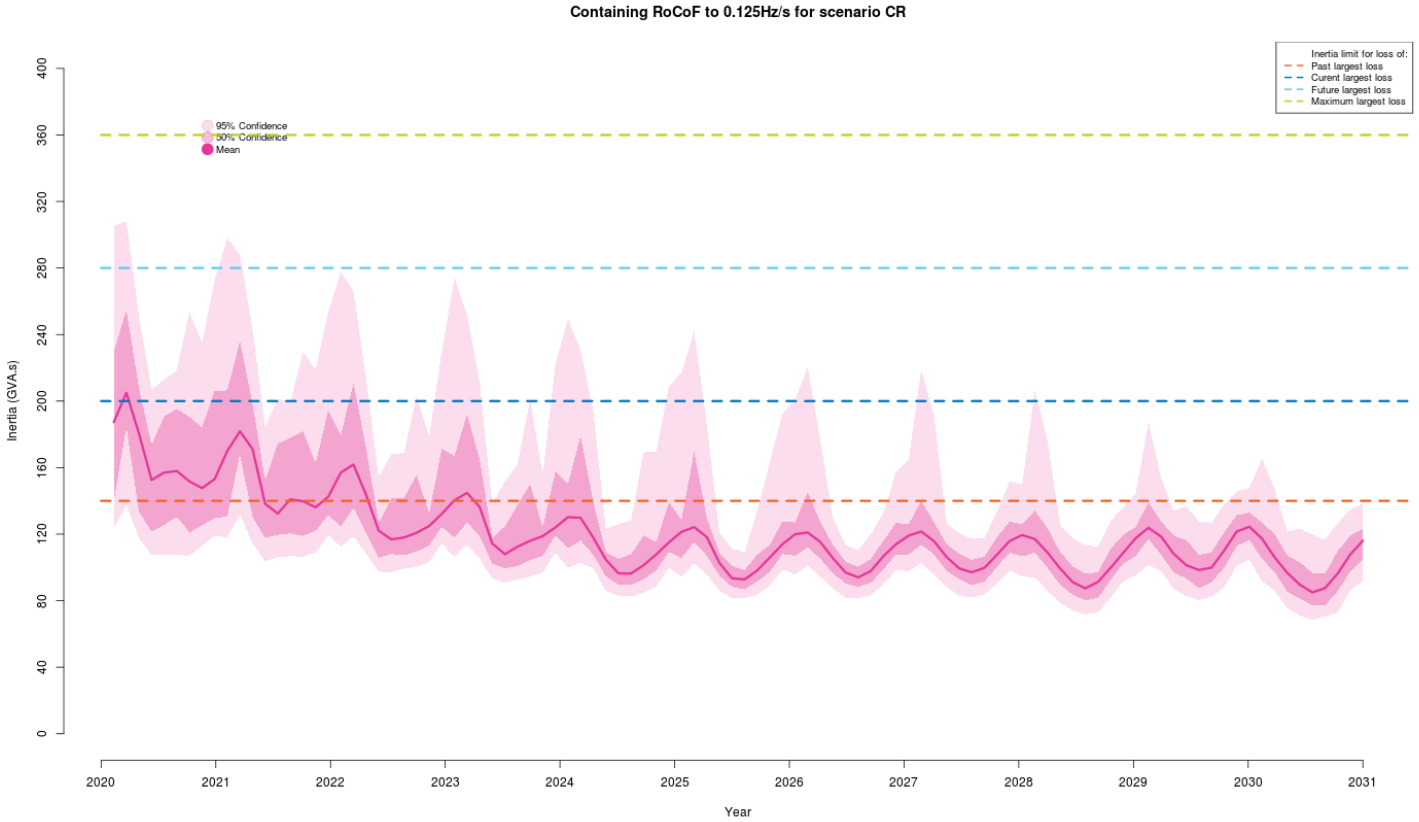

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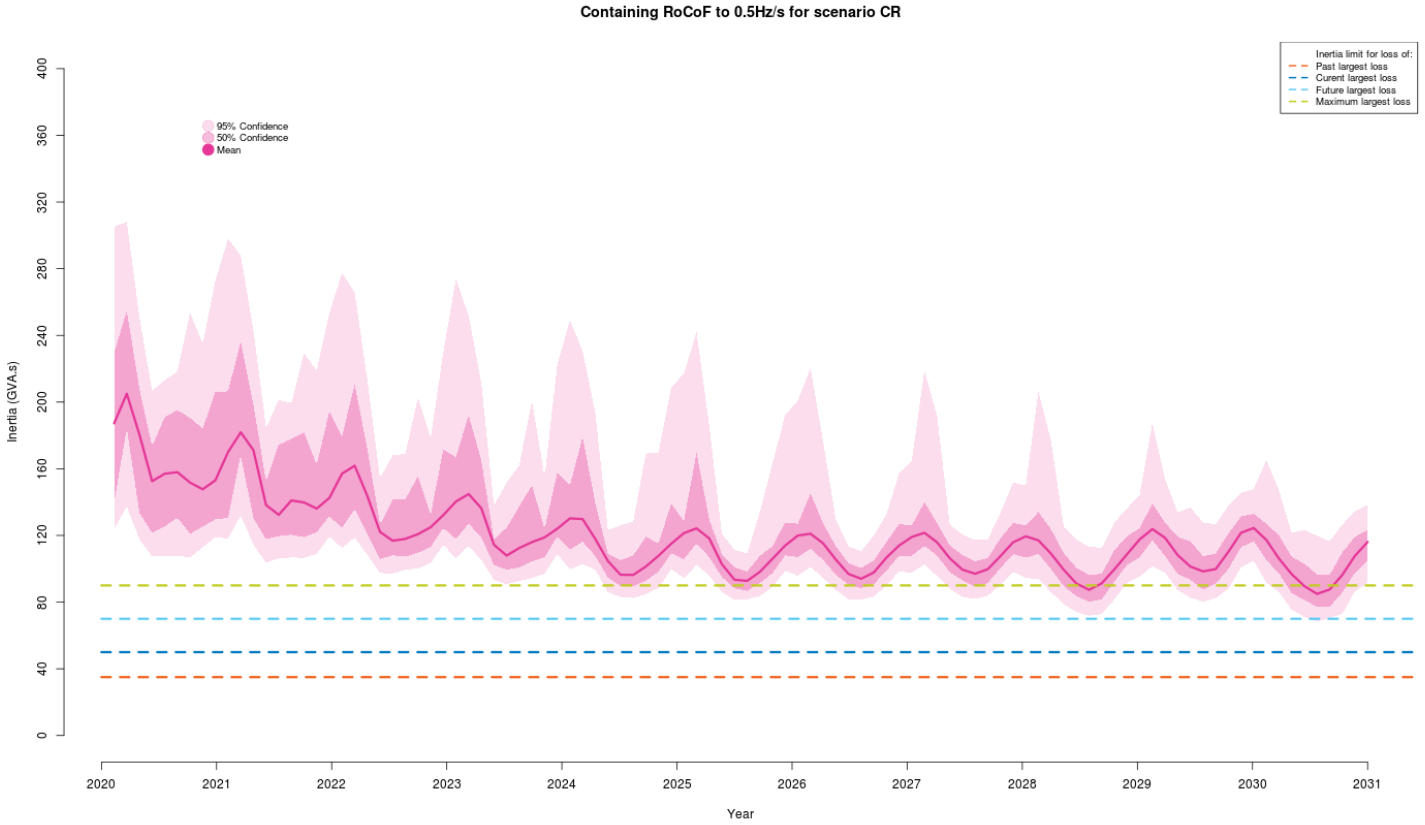

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Beyond inertia

Other operability challenges caused by the decline in Synchronous generation:

- Short Circuit Level
- Retained voltage
- Convertor stability
- Regional RoCoF
- Dynamic voltage

Stability pathfinder

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Stability Pathfinder – Phase one

Stability phase one tender GB wide – tender award End Jan 2020

- To address our national level stability needs
- Solution delivery between April 2020 and April 2021
- Contract award up to March 2026
- Limited to synchronous technology and 0 MW
- Awarded ~12GVA.s of inertia

Stability Pathfinder – Phase two

Stability phase two Scotland

- In Scotland, our stability need is SCL driven based on our detailed analysis
- Currently developing tender details for Scotland tender
- We will include a desk-top based technical feasibility study to understand how different technologies meet our specification

Stability phase two other areas

- Technical studies to work out detailed stability requirements for other regions

Useful links

- **Electricity Ten Year Statement**

https://www.nationalgrideso.com/publications/electricity-ten-year-statement-etys

- **Future Energy Scenarios**

http://fes.nationalgrid.com/

- **System Operability Framework**

https://www.nationalgrideso.com/publications/system-operability-framework-sof

- **Grid Code Working Group GC0100 (RfG implementation including Fault Ride Through and Fast Fault Current Injection)**

https://www.nationalgrideso.com/codes/grid-code/modifications/gc0100-eu-connection-codes-gb-implementation-mod-1

- **VSM Expert Group**

https://www.nationalgrid.com/uk/electricity/codes/grid-code/meetings/vsm-expert-workshop

- **Stability Pathfinder**

https://www.nationalgrideso.com/publications/network-options-assessment-noa/network-development-roadmap

- **VSM / GB Grid Gorming Grid Code Working Group (GC0137)**

https://www.nationalgrideso.com/codes/grid-code/modifications/gc0100-eu-connection-codes-gb-implementation-mod-1

Questions

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