Public

GC0181 Enhance the Effectiveness of System Incidents Reporting

Workgroup 1, Tuesday 04 November

Online Meeting via Teams

NESO
National Energy System Operator

WELCOME

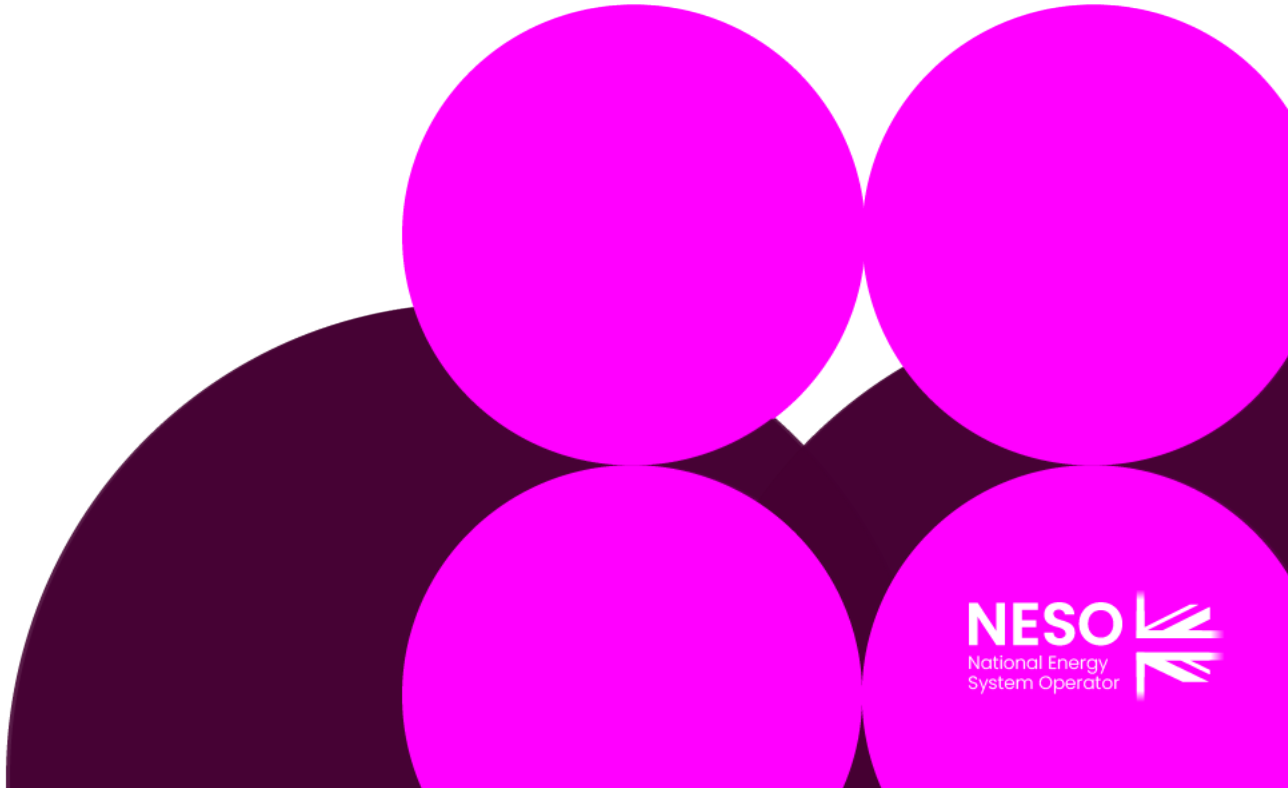
NESO
National Energy System Operator

Agenda

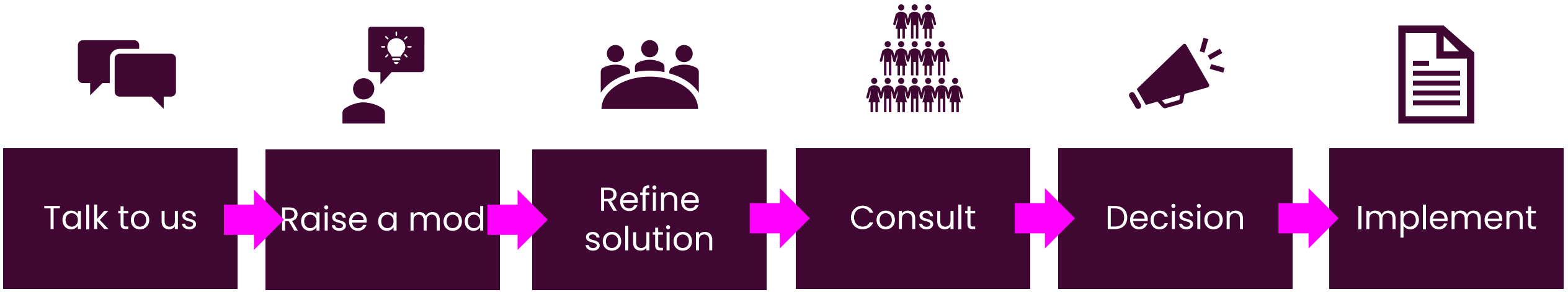
Topics to be discussed	Lead
Introductions	Chair
Code Modification Process Overview • Workgroup Responsibilities and Membership • Workgroup Alternatives and Workgroup Vote	Chair
Objectives and Timeline • Walk-through of the timeline for the modification	Chair
Review Terms of Reference	All
Proposer presentation	Proposer
Agree Terms of Reference	All
Cross Code Impacts	All
Any Other Business	Chair
Next Steps	Chair

Modification Process

Jess Rivalland– NESO Code Administrator



Code Modification Process Overview



Forums	Panels	Workgroups (Workgroup Consultations)	Ofgem/Panel

Refine Solution

Workgroups

- If the proposed solution requires further input from industry in order to develop the solution, a Workgroup will be set up.
- The Workgroup will:
  - further refine the solution, in their discussions and by holding a **Workgroup Consultation**
  - Consider other solutions, and may raise **Alternative Modifications** to be considered alongside the Original Modification
  - Have a **Workgroup Vote** so views of the Workgroup members can be expressed in the Workgroup Report which is presented to Panel

Consult

Code Administrator Consultation

- The Code Administrator runs a consultation on the **final solution(s)**, to gather final views from industry before a decision is made on the modification.

- After this, the modification report is voted on by Panel who also give their views on the solution.

Decision

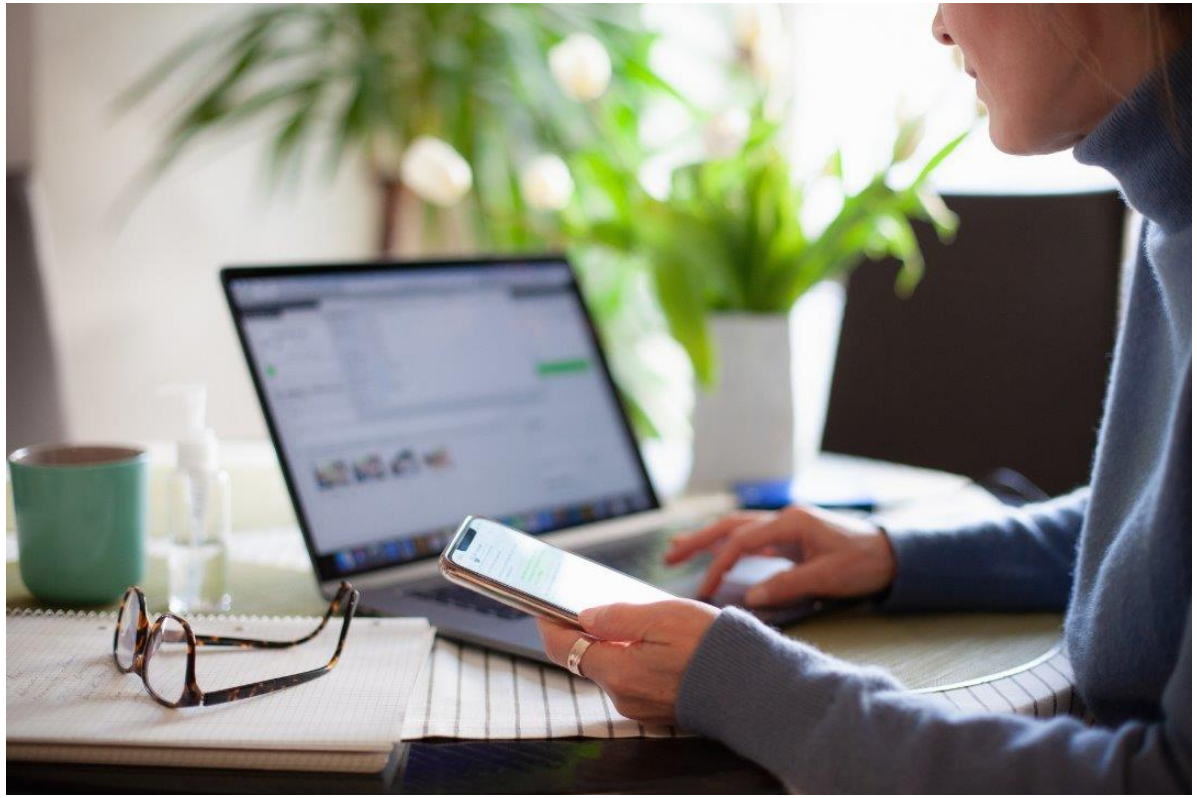
- Dependent on the Governance Route that was decided by Panel when the modification was raised

- **Standard Governance:** Ofgem makes the decision on whether or not the modification is implemented

- **Self-Governance:** Panel makes the decision on whether or not the modification is implemented
    - an appeals window is opened for 15 days following the Final Self Governance Modification Report being published

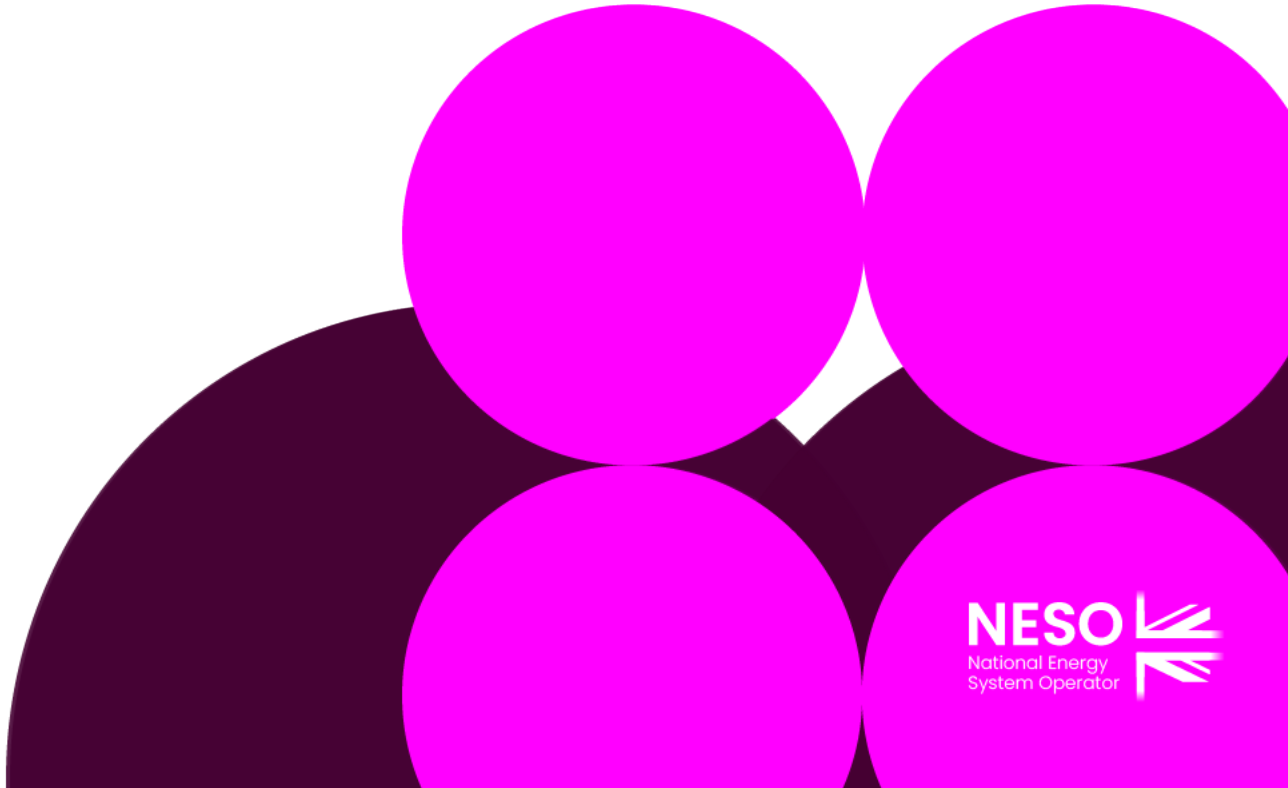
Implement

- The Code Administrator implements the final change which was decided by the Panel / Ofgem on the agreed date.



Workgroup Responsibilities and Membership

Jess Rivalland – NESO Code Administrator



Expectations of a Workgroup Member

- Contribute to the discussion
- Be respectful of each other's opinions
- Language and Conduct to be consistent with the values of equality and diversity
- Do not share commercially sensitive information
- Be prepared - Review Papers and Reports ahead of meetings
- Complete actions in a timely manner
- Keep to agreed scope
- Email communications to/cc'ing the .box email

Your Roles

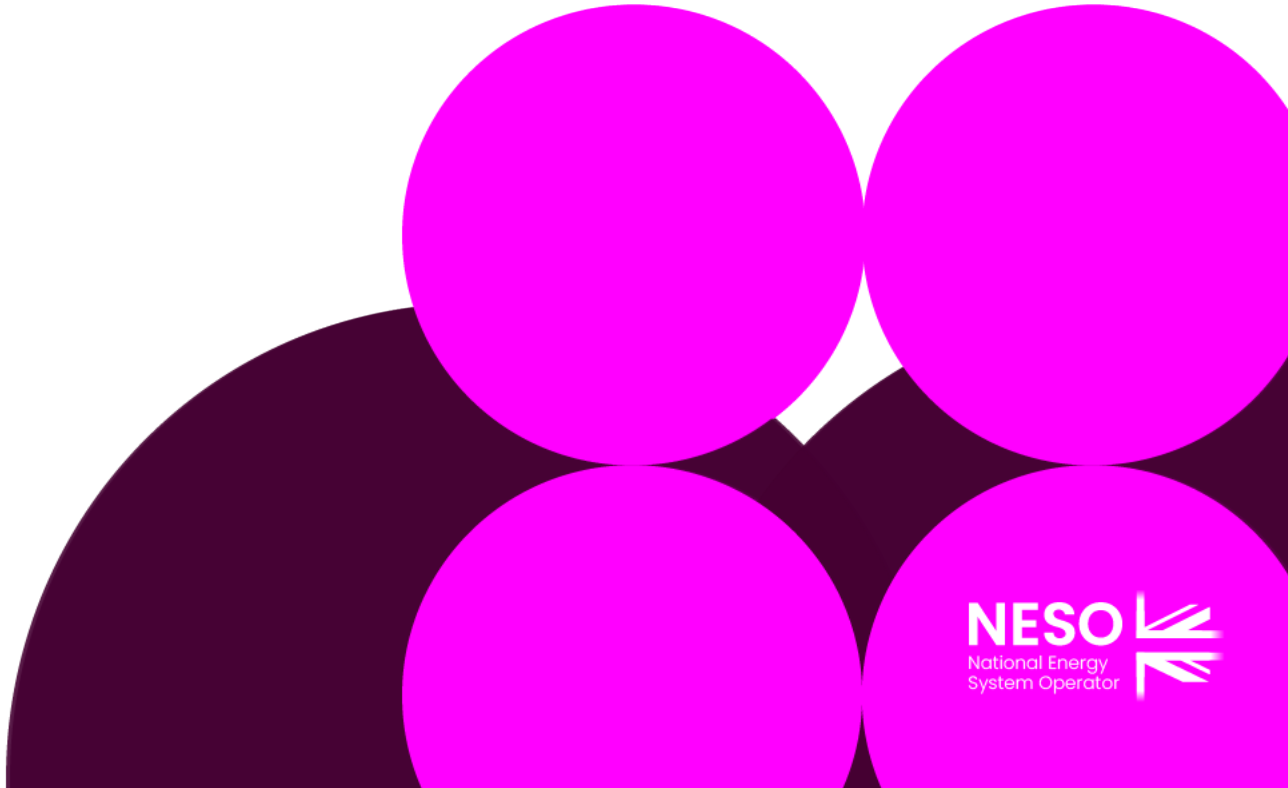
- Help refine/develop the solution(s)
- Bring forward alternatives as early as possible
- Vote on whether or not to proceed with requests for Alternatives
- Vote on whether the solution(s) better facilitate the Code Objectives

Workgroup Membership

Name	Role	Company
Andrew Larkins	Observer	Sygensys
Andrew Urquhart	Workgroup Member	SSE
Frank Kasibante	NESO Representative	NESO
Gareth Williams	Workgroup Member	SPT
Guy Nicholson	Proposer	Statkraft
Helge Urdal	Observer	Otley 2030
Jesus Sanchez Cortes	Workgroup Member	NESO
Mathew Chandy	Workgroup Member	EDF Energy
Tim Ellingham	Workgroup Member	RWE
TBC	Authority Representative	Ofgem

Workgroup Alternatives and Workgroup Vote

Jess Rivalland– NESO Code Administrator



What is the Alternative Request?

What is an Alternative Request? The formal starting point for a Workgroup Alternative Modification to be developed which can be raised up until the Workgroup Vote.

What do I need to include in my Alternative Request form? The requirements are the same for a Modification Proposal you need to articulate in writing:
- a description (in reasonable but not excessive detail) of the issue or defect which the proposal seeks to address compared to the current proposed solution(s);
- the reasons why the you believe that the proposed alternative request would better facilitate the Applicable Objectives compared with the current proposed solution(s) together with background information;
- where possible, an indication of those parts of the Code which would need amending in order to give effect to (and/or would otherwise be affected by) the proposed alterative request and an indication of the impacts of those amendments or effects; and
- where possible, an indication of the impact of the proposed alterative request on relevant computer systems and processes.

How do Alternative Requests become formal Workgroup Alternative Modifications? The Workgroup will carry out a Vote on Alternatives Requests. If the majority of the Workgroup members or the Workgroup Chair believe the Alternative Request will better facilitate the Applicable Objectives than the current proposed solution(s), the Workgroup will develop it as a Workgroup Alternative Modification.

Who develops the legal text for Workgroup Alternative Modifications? NESO will assist Proposers and Workgroups with the production of draft legal text once a clear solution has been developed to support discussion and understanding of the Workgroup Alternative Modifications.

Not for SQSS

Can I vote? And What is the Alternative Vote?

To participate in any votes, Workgroup members need to have attended at least 50% of meetings. The vote shall be decided by simple majority of those present at the meeting at which the vote takes place (whether in person or by teleconference)

Stage 1 – Alternative Vote

- Vote on whether Workgroup Alternative Requests should become Workgroup Alternative Grid Code Modifications.

- The Alternative vote is carried out to identify the level of Workgroup support there is for any potential alternative options that have been brought forward by either any member of the Workgroup OR an Industry Participant as part of the Workgroup Consultation.

- **Should the majority of the Workgroup OR the Chair believe that the potential alternative solution may better facilitate the Grid Code objectives than the Original then the potential alternative will be fully developed by the Workgroup with legal text to form a Workgroup Alternative Grid Code modification (WAGCM)** and submitted to the Panel and Authority alongside the Original solution for the Panel Recommendation vote and the Authority decision.

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Can I vote? And What is the Workgroup Vote?

To participate in any votes, Workgroup members need to have attended at least 50% of meetings. The vote shall be decided by simple majority of those present at the meeting at which the vote takes place (whether in person or by teleconference)

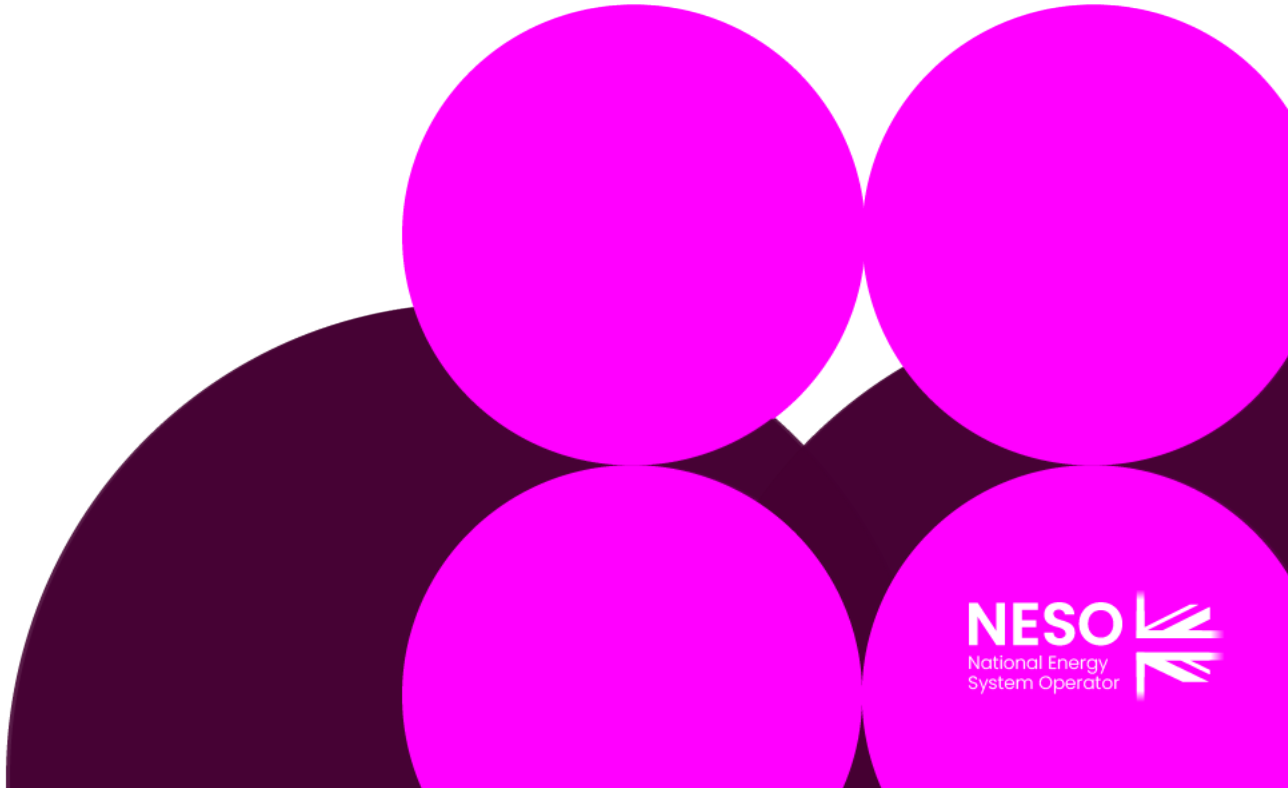
Stage 2 – Workgroup Vote

- 2a) Assess the original and Workgroup Alternative (if there are any) against the relevant Applicable Objectives compared to the baseline (the current code)
- 2b) Vote on which of the options is best.

Alternate Requests cannot be raised after the Stage 2 – Workgroup Vote

Objectives and Timeline

Jess Rivalland– NESO Code Administrator

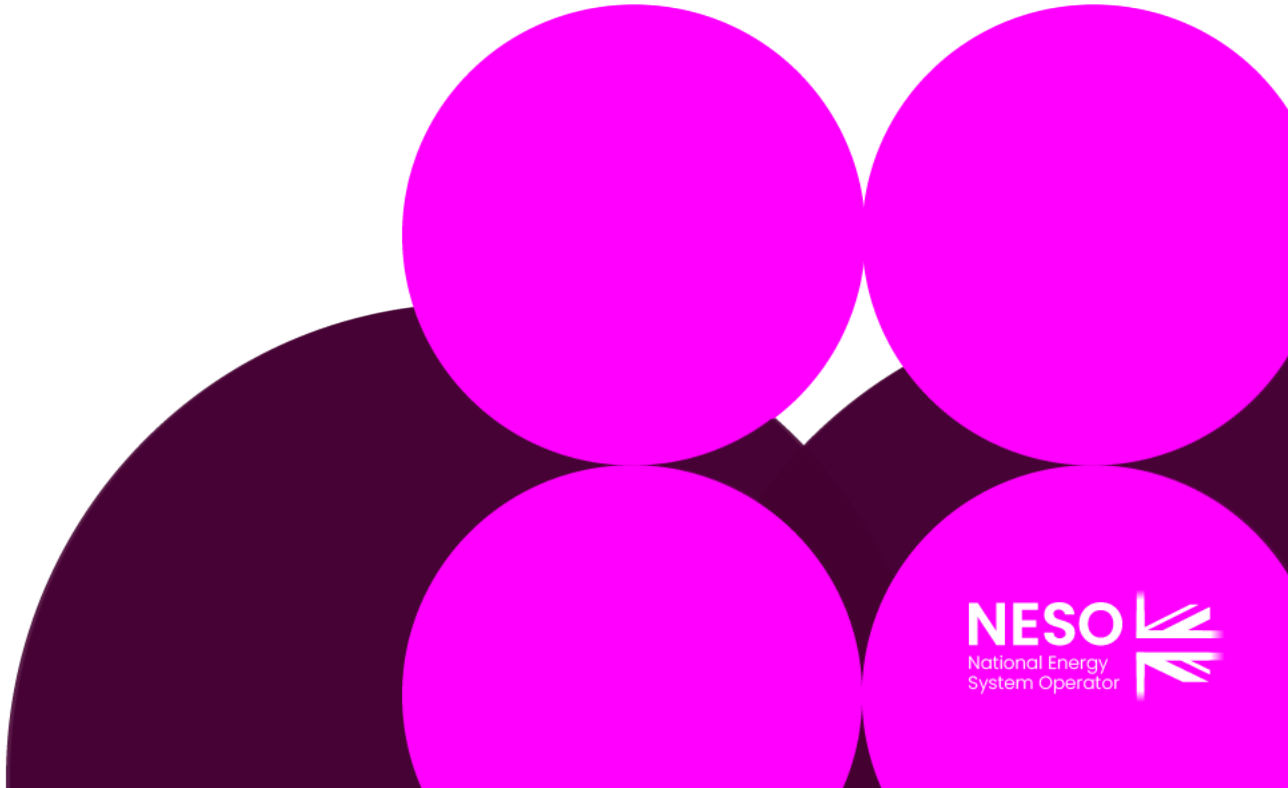


CM0181 Objectives and Timeline as at 30 October 2025

Timeline	Workgroups	Objectives
Workgroup 1	04 November 2025	Review Proposal and legal text
Workgroup 2	28 November 2025	
Workgroup 3	16 December 2025	
Workgroup 4	07 January 2026	Finalise Workgroup Consultation
Workgroup Consultation	14 January 2026 – 04 February 2026	
Workgroup 5	19 February 2026	Review Consultation feedback
Workgroup 6	12 March 2026	Finalise Report
Workgroup 7	23 March 2026	Agree ToR met /Workgroup Vote
Workgroup Report to Panel	15 April 2026	Panel sign off ToR
Post Workgroups		
Code Administrator Consultation	30 April 2026 – 01 June 2026	
Draft Final Modification to Panel	17 June 2026	
Final Modification to Ofgem	07 July 2026	
Implementation Date	10 Business Days after Authority Decision	

Review Terms of Reference

Jess Rivalland– NESO Code Administrator



Terms of Reference

Terms of Reference
a) Implementation and costs;
b) Review draft legal text should it have been provided. If legal text is not submitted within the Grid Code Modification Proposal the Workgroup should be instructed to assist in the developing of the legal text;
c) Consider whether any further Industry experts or stakeholders should be invited to participate within the Workgroup to ensure that all potentially affected stakeholders have the opportunity to be represented in the Workgroup. Demonstrate what has been done to cover this clearly in the report;
d) Consider implications to sections linked to the Regulated Sections of the Grid Code
e) Assess and form a view whether there are material effects or not from the modification and provide a view to the Panel on whether the Governance Route should change
f) Consider the recommendations of Ofgem's data best practice guidance and energy data taskforce.
g) Consider the current granularity of frequency data and duration post event for publishing and evaluate options for change. This should include a review of existing available data and consideration of costs and impacts on Grid Code parties.
h) Consider cross code impacts of the modification, particularly on the STC
i) Consider relevant Electrical Standards as necessary, including but not limited to TS.3.24.70 and TS.3.24.95.

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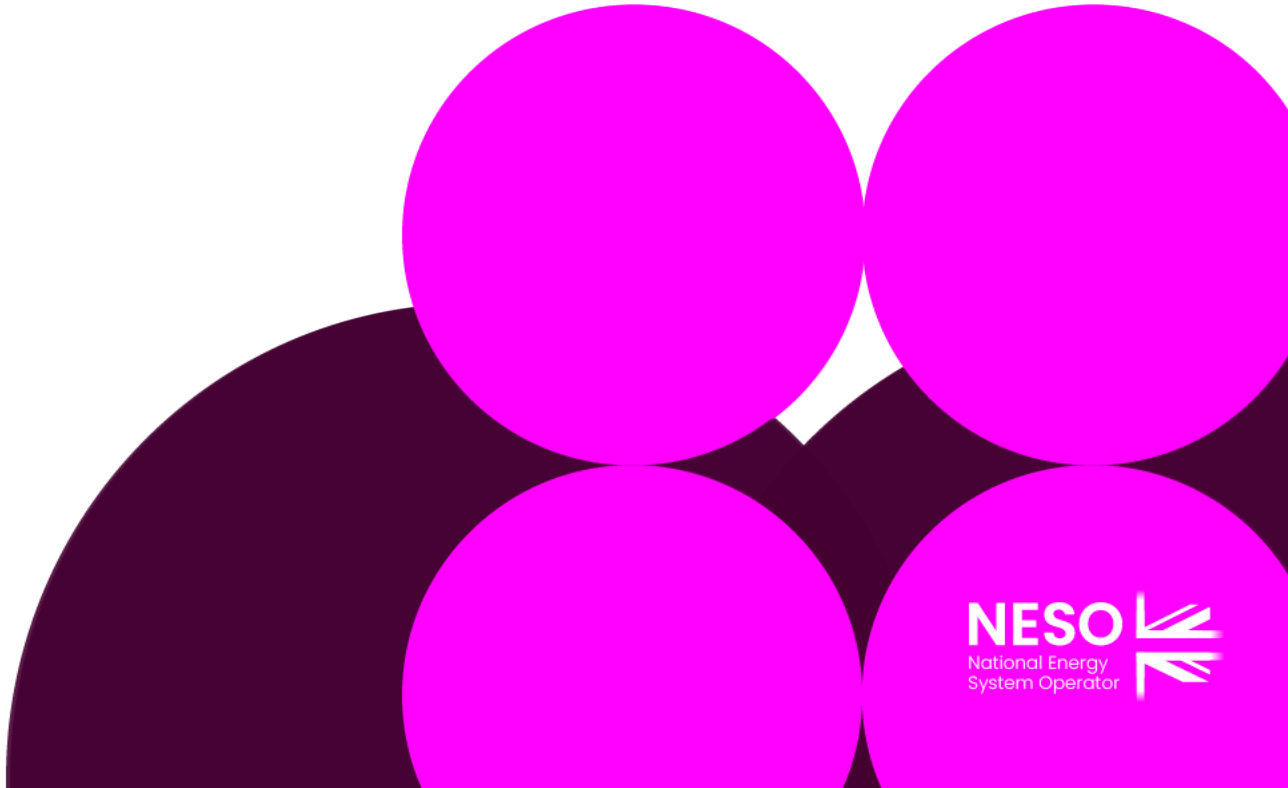
Proposer's Solution: Background; Proposed Solution; Scope; and Assessment vs Terms of Reference

Guy Nicholson – Statkraft



Statkraft

GC0181: Enhance the Effectiveness of System Incidents Reporting

GUY NICHOLSON

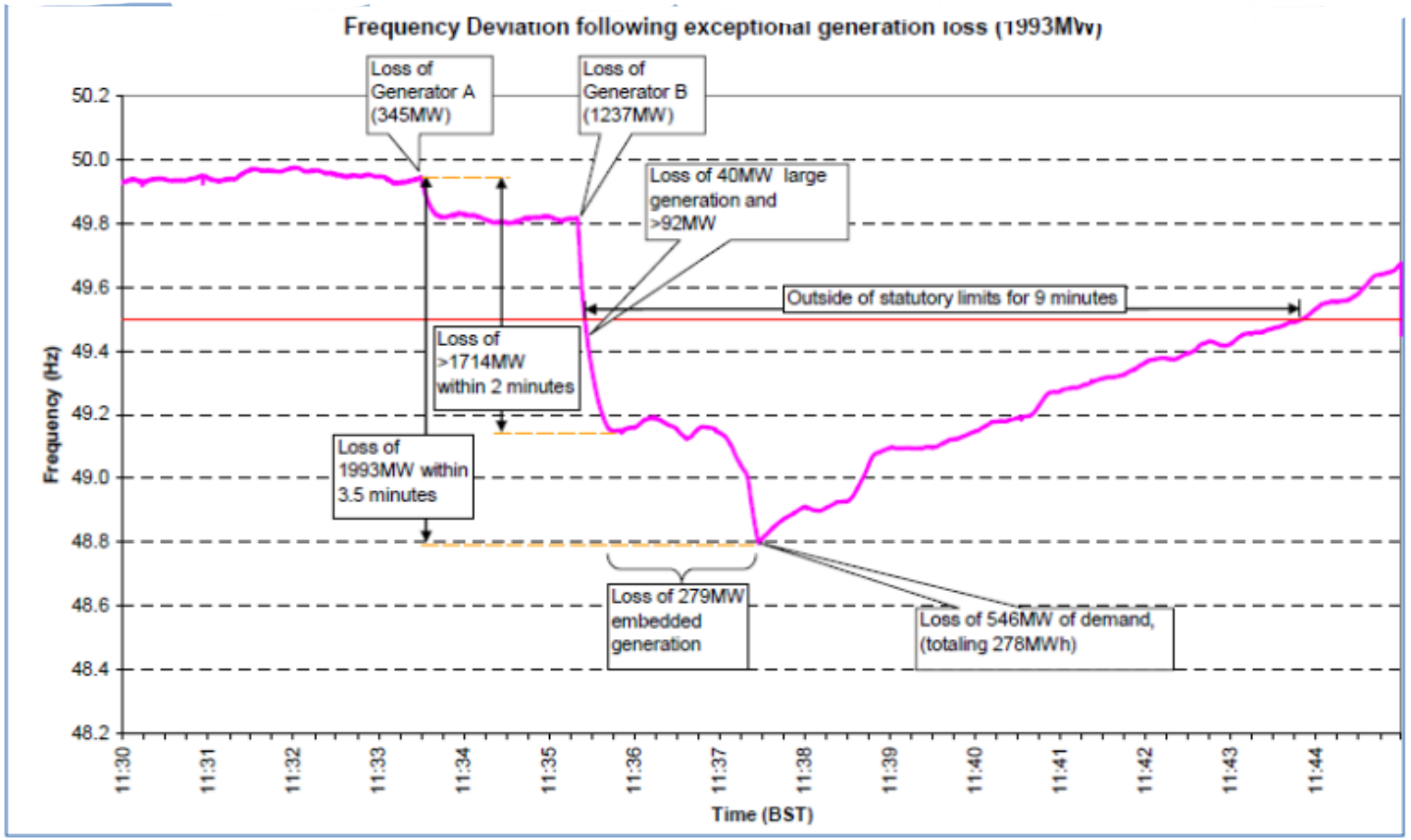
Aims of this Presentation

- Reviewed the data of GC105 & GC151 System Incidence Reports in 2 ways:
  - ❑Generic analysis
  - ❑Specific incident analysis
- These analysis show that the existing reporting process has room for improvement to increase its effectiveness.
- Some key areas that need improvement:
  - ❑ Reports are made available to the industry quite late, often three months after the events have occurred.
  - ❑ The data sampling rate is insufficient for thorough analysis.
  - ❑ Reports do not incorporate data from various locations across Great Britain.
- The Proposer raises GC0181 to be implemented by NESO in its capacity as the GB System Operator.

Background

Report of the National Grid Investigation into the Frequency Deviation and Automatic Demand Disconnection that occurred on the 27th May 2008

Issued: February 2009



Under the auspices of the GB Grid Code Review Panel, a reporting procedure was established in 1997 where the DNOs are required to provide National Grid with information on embedded generation that may have tripped in the event of a significant incident on the GB transmission system including generation trips causing large frequency deviations.

1. Grid Code established this reporting procedure, but it wasn't encoded in the grid code system.
2. Grid Code modification raised in Oct 2017.
3. GC105 & GC151 established in June 2020.

GCRP January 2016 pp16/19
NEW INCIDENTS

Old System Incidents Report before GC105 was established

Inc Date	Inc Time	DoW	ToD	Size Loss (MW)	Reported Generation Lost (MW)	RoCoF (Hz/s)	Starting F (Hz)	Estimated Residual H Equivalent (s)	Demand (MW)	Min/ Max Freq	Event
24 Dec 2013	01:12	Tue	Night	-925	-	-0.135	50.05	0.199	29137	49.73	IFA Bipole 1 following Dung-Sell 2 trip and co-incident with Dung-Ninf 2 trip
24 Dec 2013	03:32	Tue	Night	-925	-	-0.145	50.11	0.196	25248	49.79	IFA Bipole 1 co-incident with Dung-Sell 2 trip
25 Jan 2014	08:06	Sat	Day	-1000	-	-0.087	50	2.880	33716	49.68	IFA-Bipole 2
20 Mar 2014	23:06	Thu	Night	500						50.26	Dinorwig 1 & 6 tripped while in pumping mode
16 Apr 2014	20:35	Wed	Eve	-800						49.67	Shutdown of Northwest SHETL group; 1000MW lost generation (500mW wind, 250MW hydro, 100MW Glendoe, 150MW Foyers 1) and 200MW lost demand
27 Apr 2014	11:37	Sun	Day	-1000	-	-0.104	49.98	1.773	32946	49.57	IFA Bipole 2 followed by Dungeness 2 (545MW) at 11:38
01 May 2014	09:52	Thu	Day	-1280						49.56	All 4 Staythorpe units
08 May 2014	18:17	Thu	Eve	-1000			-			49.63	IFA Bipole 2
16 Oct 2014	09:06	Thu	Day	-1000	-	-0.081	49.93	1.434	39793	49.56	IFA Bipole 2
09 Jan 2015	15:56	Fri	Day	-830						49.7	Spalding North
13 Jan 2015	02:31	Tue	Night	-285						49.8	Dinorwig moving to Spin Pump later than expected, frequency trace suggests some other events may have followed this
05 Jun 2015	14:55	Fri	Day	-950	-	-0.077	49.98	3.268	31471	49.68	IFA Bipole 2
21 Jul 2015	15:28	Tue	Day	-748						49.96	IFA Bipole 2
06 Aug 2015	06:21	Thu	Night	-1000	-	-0.103	50.02	3.329	24528	49.69	IFA Bipole 2
11 Nov 2015	01:54	Wed	Night	-991	-	-0.119	50	2.921	22727	49.6	IFA Bipole

Power Available >

System Performance Reports >

Balancing services performance monitoring report >

Data finder and explorer >

Forecast volumes and costs >

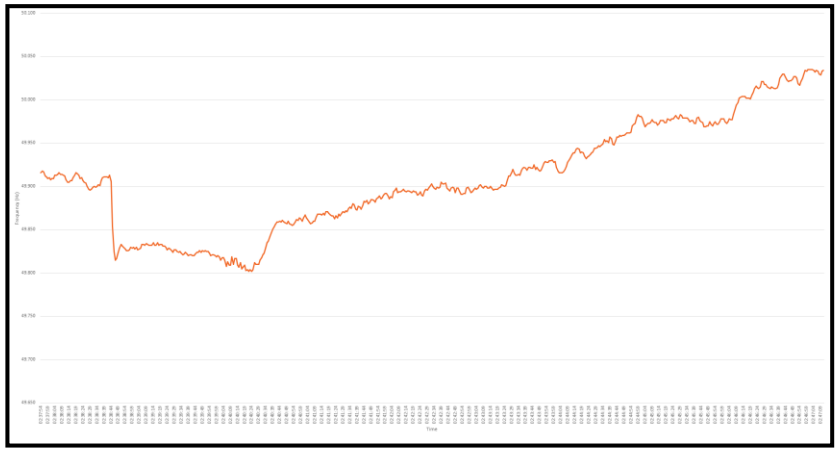
GB Electricity System Operator Daily Reports >

System Performance Reports

At NESO, we're committed to being transparent and sharing information with our partners in the energy industry.

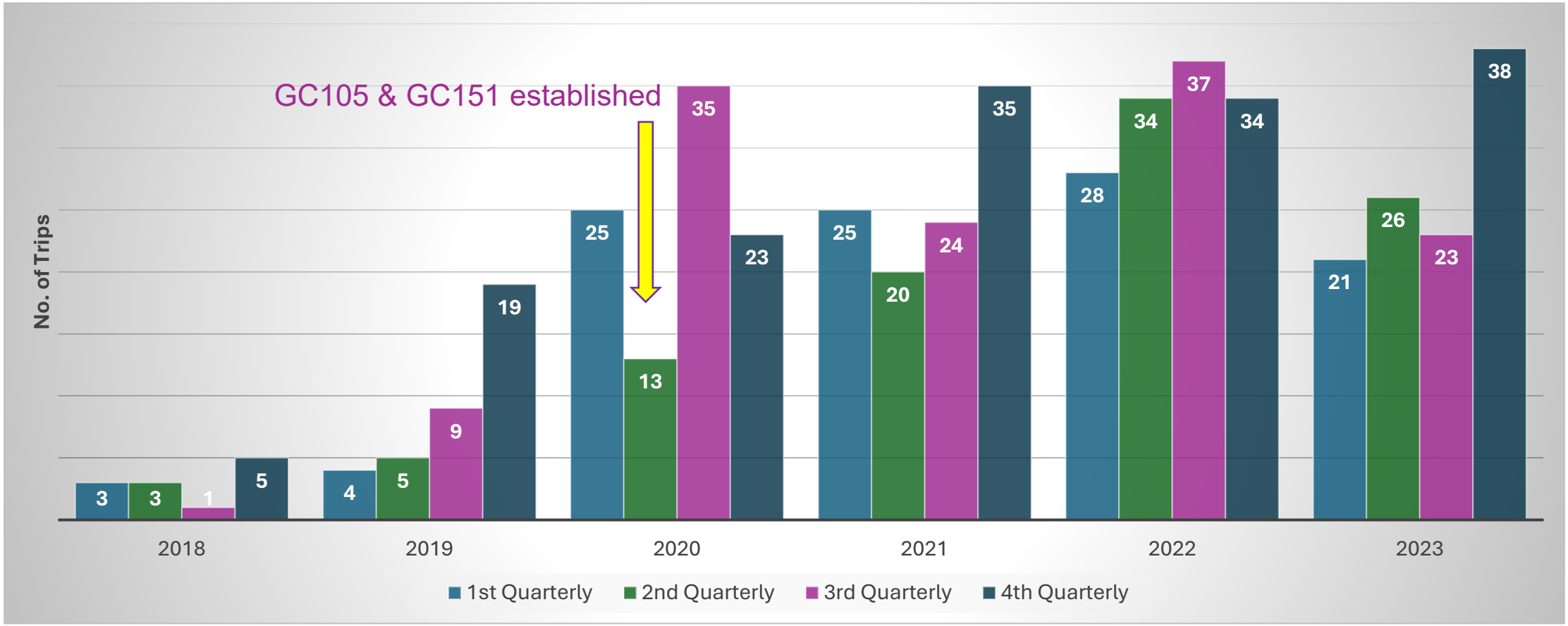
On this page, you will find reports that NESO publishes as required for:

- GB National electricity transmission system performance as required by Transmission Licence Standard Condition C17: Transmission System Security Standard and Quality of Service.
- Reports for industry and the Grid Code Panel to monitor the effectiveness of technical requirements in the Grid Code and Distribution Code – GC105 and GC151
- UK Statutory Instrument - Electricity Network Codes and Guidelines (Markets and Trading) (Amendment) (EU Exit) Regulations – Article 15 and 16.
- UK Statutory Instrument - The Electricity and Gas (Internal Markets and Network Codes) (Amendment) (EU Exit) Regulations – Clean Energy Package Article 13.

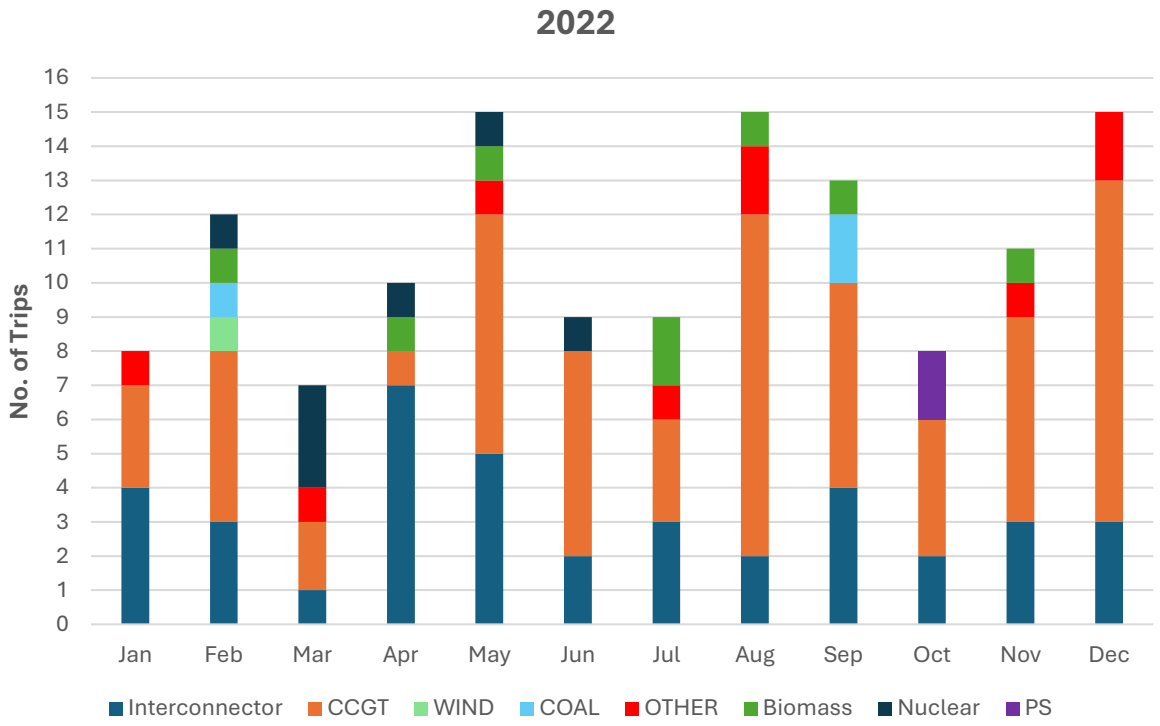


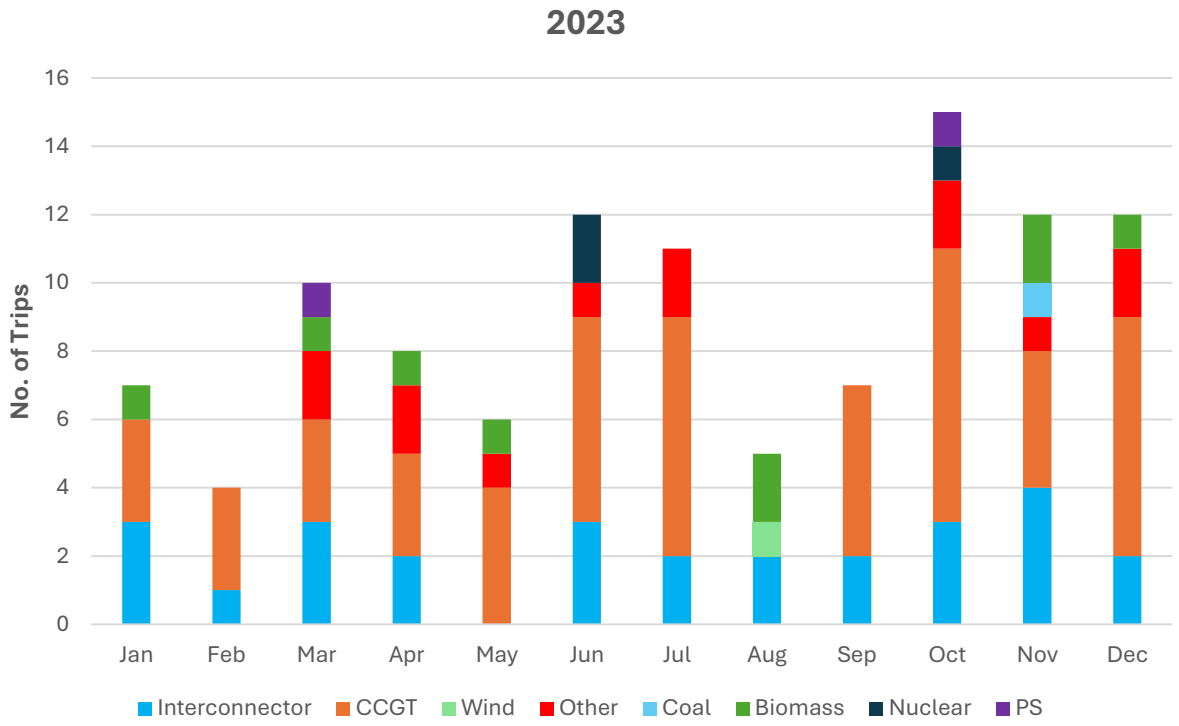
	A	B	D	E	F	G	H	I	J	K	L	M
1			Date and time of the incident	System frequency trace (1-second interval) for the incident	System frequency immediately before the incident	System frequency immediately after the incident	Maximum/Minimum rate of change of frequency (RoCoF) of the incident	System inertia at the time of the incident	Where known, MW trip/loss of all generation/ interconnection related to the incident		Where known, MW trip/loss of all Embedded Generation(EG) related to the incident	
2	Reference	Name	Date Time	System Frequency (Refer to sheet)	Pre-Event Frequency (Hz)	Post-Event Frequency (Hz)	RoCoF (Hz/s)	System Inertia (GVAs)	Generation/Interconnection (MW)		EG (MW)	
3	20240702-1	Trip of IFA2	02/07/2024 07:06:00	20240702-1	49.90	49.68	-0.164	159	IFA2	992.35		
4	20240705-1	Trip of STAY-2	05/07/2024 17:06:00	20240705-1	50.06	49.87	-0.076	184	STAY-2	396.08		
5	20240706-1	Loss of Supply at Glenniston 33kV substation	06/07/2024 17:47:00	20240706-1				128				
6	20240717-1	Trip of PEMB-11	17/07/2024 00:33:40	20240717-1	49.93	49.82	-0.029	151	PEMB-11	436.80		
7	20240722-1	Trip of DRAXX-4	22/07/2024 17:24:00	20240722-1	50.02	49.81	-0.088	197	DRAXX-4	641.48		
8	20240723-1	Trip of DAMC-1	23/07/2024 17:27:00	20240723-1	50.02	49.89	-0.045	206	DAMC-1	344.44		

No. of Trips Analysis in Quarterly Basis (Jan 2018- Dec 2023)



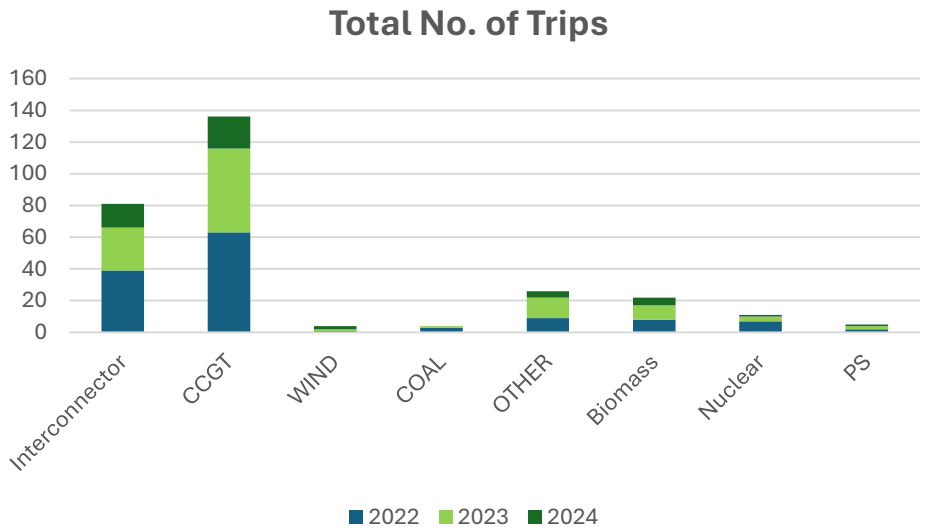
What's causing the trips?

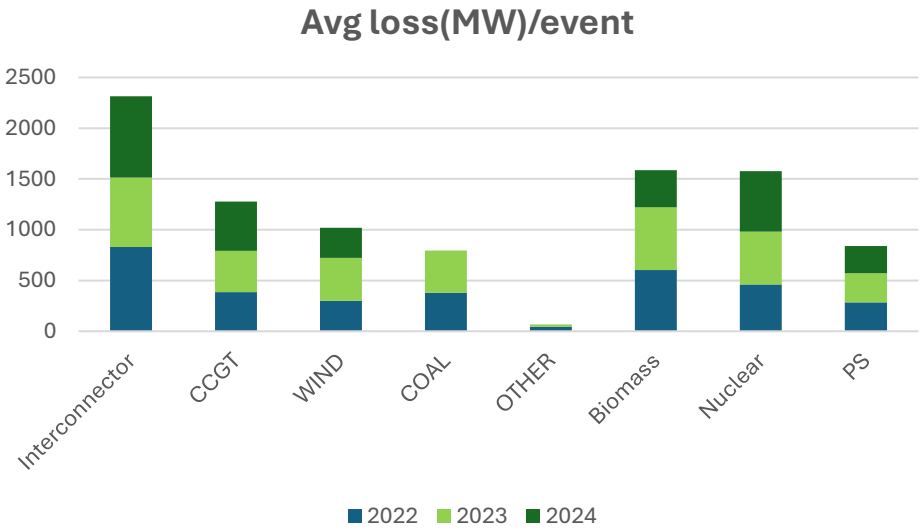




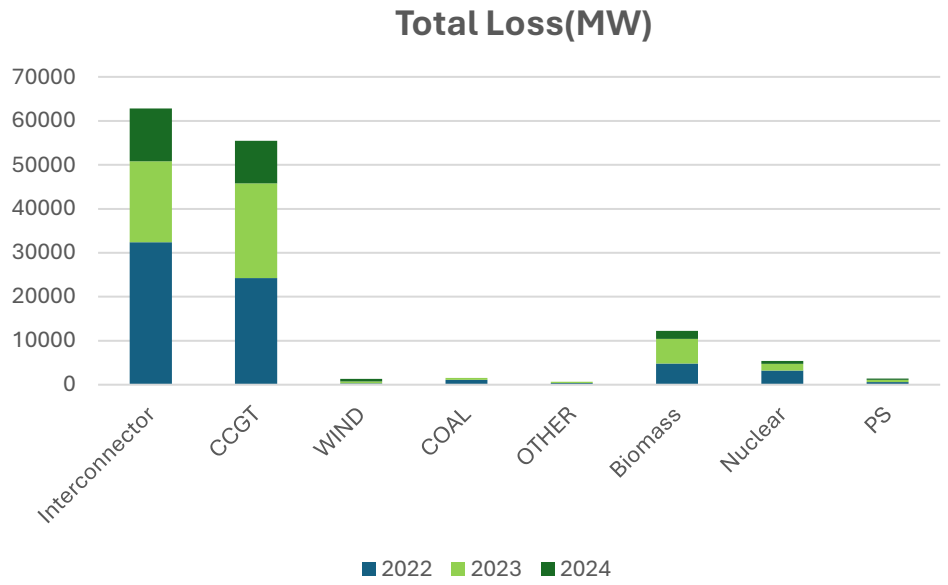
Other-Transmission/network losses like loss of supply at substations, low frequency deviation, demand loss, busbar & circuit trips.

Extent of Trips

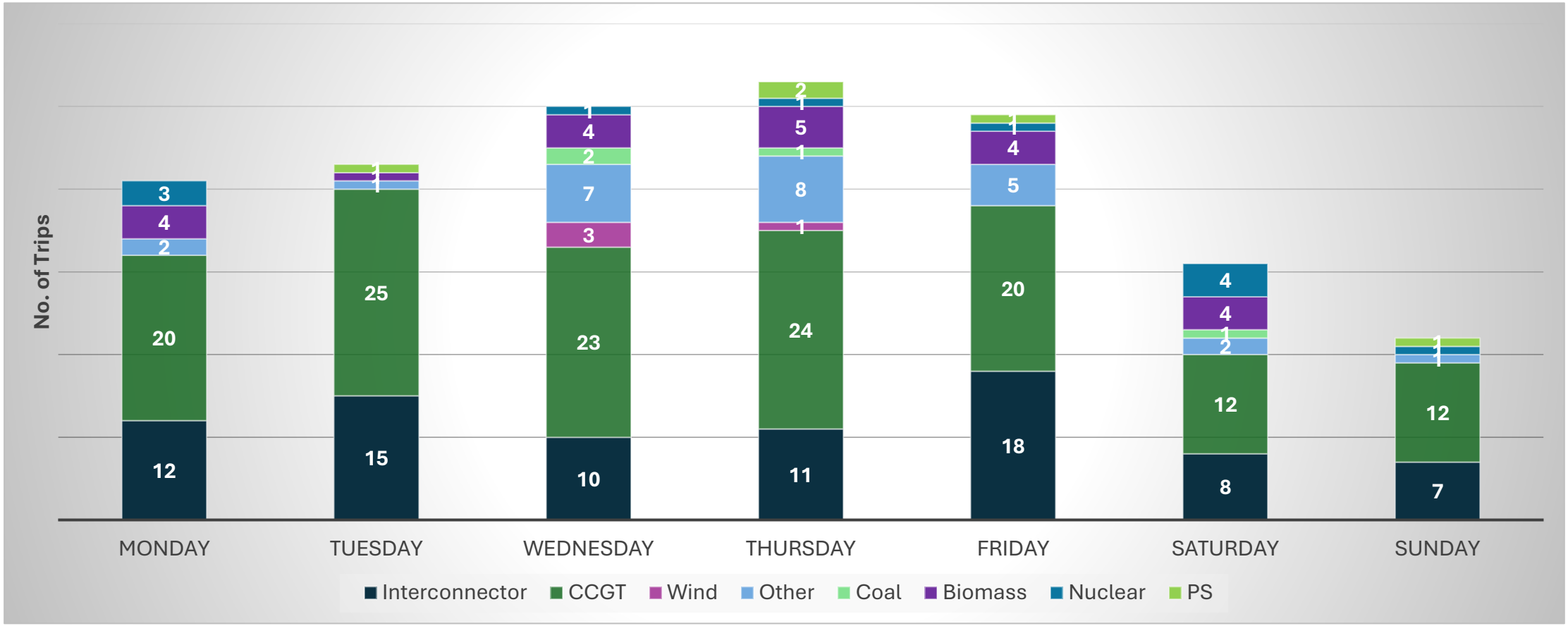




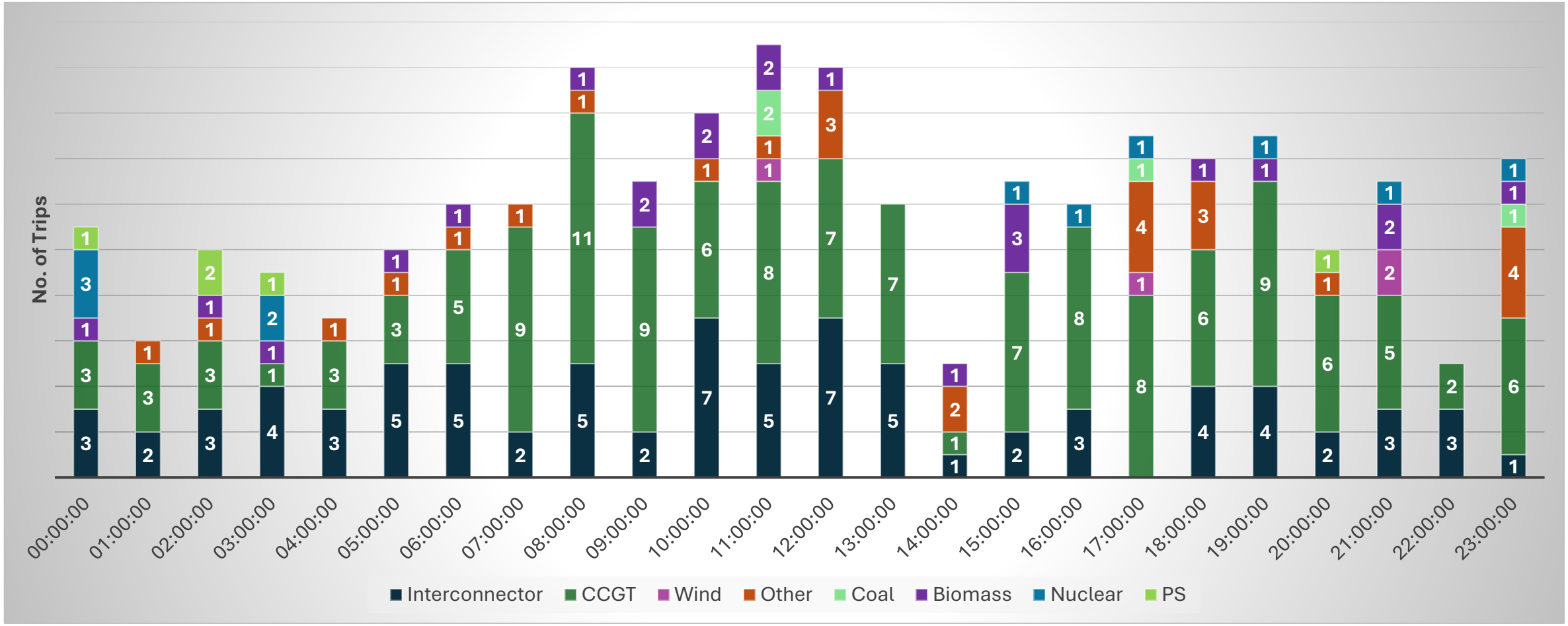
Other-Transmission/network losses like loss of supply at substations, low frequency deviation, demand loss, busbar & circuit trips.



No. of Trips Analysis against the Days of the Week (Jan 2022- May 2024)



No. of Trips Analysis against the Time of the Day (Jan 2022- May 2024)



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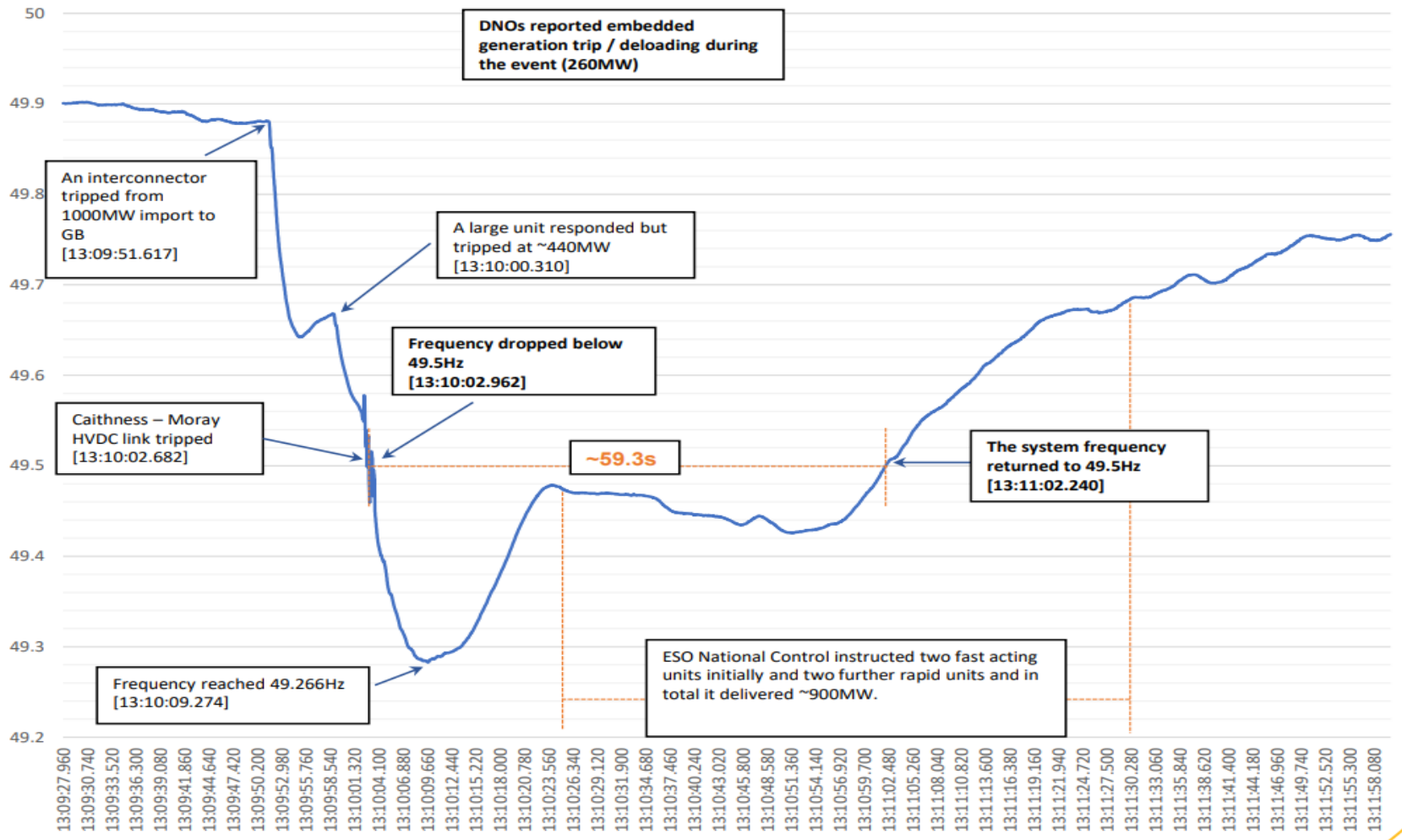
Analysing the 22nd Dec 2023 event at 13:09

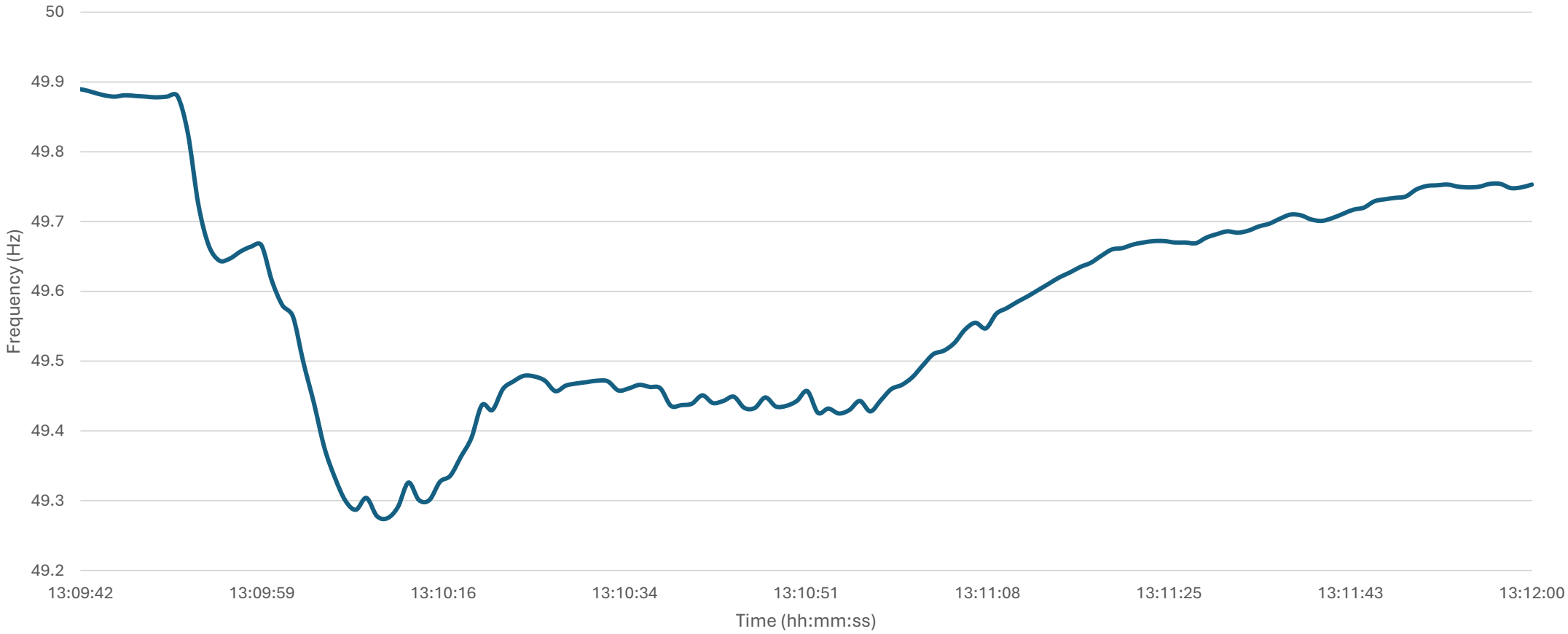
Sli.do code #OTF

Annotated Frequency Trace of the Events



* Note: the graph is based on currently available data

Frequency trace during the incident using data from NESO System Incident Report



RoCoF calculation in 2 ways

Method 1 (based on MW loss and Inertia)

$$\text{RoCoF}=\frac{P(loss\ of\ generation\ in\ MW)\times Fi(initial\ frequency\ in\ Hz)}{2Eo(Inertia\ in\ MWs)}$$

- RoCoF of the Interconnector trip $=\frac{1000\times49.826}{2\times161\times1000}=-0.155\text{Hz/s}$
- RoCoF of the CDCL unit trip $=\frac{440\times49.666}{2\times161\times1000}=-0.068\ \text{Hz/s}$
- RoCoF of the HVDC link trip $=\frac{260\times49.564}{2\times161\times1000}=-0.04\ \text{Hz/s}$

Method 2 (based on Frequency measurements)

$$\text{RoCoF}=\frac{F2-F1\ (in\ Hz)}{T2-T1\ (in\ s)}$$

- RoCoF of Interconnector trip $=\frac{49.724-49.826}{13:09:53-13:09:52}$ = -0.102 Hz/s
- RoCoF of the CDCL unit trip $=\frac{49.615-49.666}{13:10:00-13:09:59}$ = -0.051 Hz/s
- RoCoF of the HVDC link trip $=\frac{49.498-49.564}{13:10:03-13:10:02}$ = $-0.066\ \text{Hz/s}$

Comparison:

Name of Trip	Ratio Calculation	Comment
Interconnector	{(155-102)/102}*100= 52%	Method 1 is 52% higher than method 2
CDCL unit	{(68-51)/51}*100= 33%	Method 1 is 33% higher than method 2
HVDC link	{(40-66)/40}*100= -65%	Method 1 is 65% lower than method 2.

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Calculating the power loss for the HVDC Link incident

Applying the ratios 52% and 33% to 3rd incident (HVDC Link) means the ROCOF could be:

i. 0.066*1.52=0.100 Hz/s

ii. 0.066*1.33=0.088 Hz/s

Based on these ROCOFs what would the MW loss have been?

i. For 0.100 Hz/s

$$P\ (loss\ of\ generation\ in\ MW) = \frac{RoCoF \times 2Eo(Inertia\ in\ MWs)}{Fi(initial\ frequency\ in\ Hz)}$$

= (0.1*2*161*1000)/49.564 = 649 MW

i. For 0.088 Hz/s

$$P\ (loss\ of\ generation\ in\ MW) = \frac{RoCoF \times 2Eo(Inertia\ in\ MWs)}{Fi(initial\ frequency\ in\ Hz)}$$

= (0.088*2*161*1000)/49.564 = 571 MW

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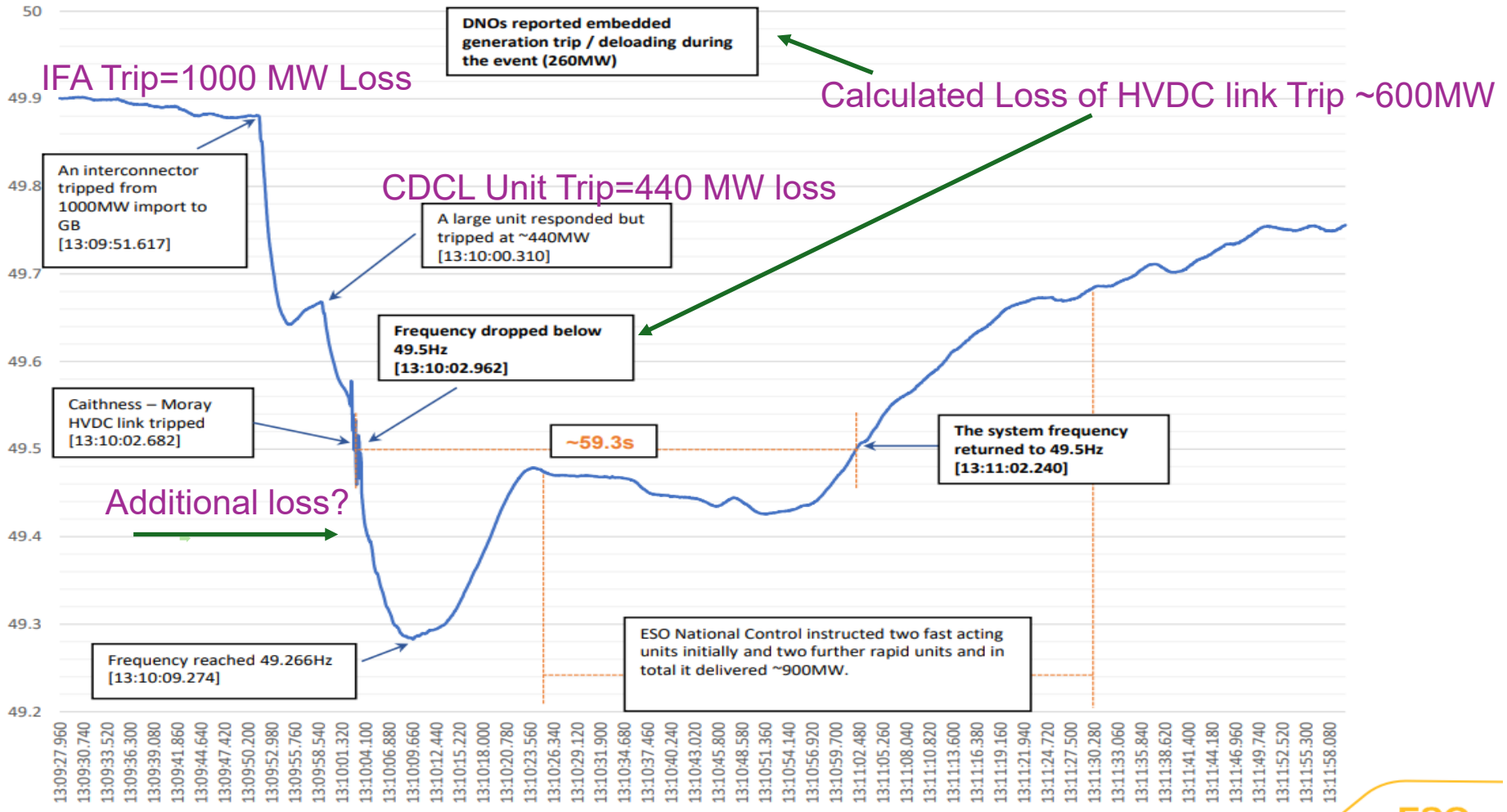
Analysing the 22nd Dec 2023 event at 13:09

Sli.do code #OTF

Annotated Frequency Trace of the Events



* Note: the graph is based on currently available data

GC0181: Enhance the Effectiveness of System Incidents Reporting

1. Reduce the reporting time from 3 months to 1 week.

Advantage- it would be easier to access data from various parties soon after each event rather than 3 months later.

2. Increase the sampling rate from the existing 1 second to 100 milliseconds to be able to analyse events more effectively.

3. Gather frequency measurements from at least five different regions across Great Britain to better see any regional variations.

Proposed Solutions Continued

- NESO should analyse the data and publish an annual report to track trends in system stability compared to previous years.
- This is essential for monitoring any adverse trends in system stability.
- The report should contain generic analysis that is done by aggregating the data of all the incidents that have occurred in that year.
- The analysis should be done in several categories including:
  - analysis done against the time of the day,
  - analysis done against the days of the week,
  - analysis done on a quarterly basis,
  - the type of Balancing Mechanism Units (BMU) responsible for causing each trips/incidents,
  - the extent of the trips such as the total number of trips caused by the BMUs,
  - the total MW loss associated with the trips; and
  - the average loss(MW) per event.

Addressing the Defects

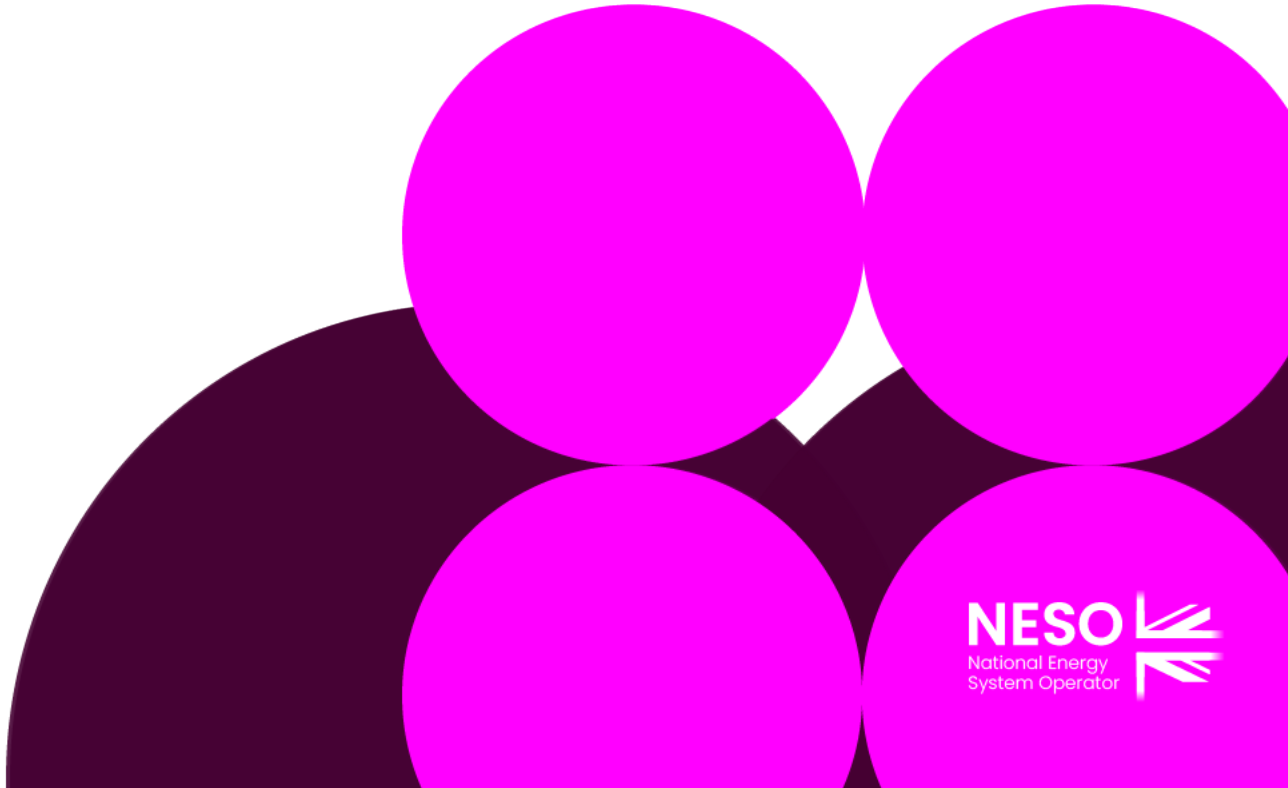
- The existing reporting process has 3 defects that need to be resolved to allow efficient and effective analysis of incidents/trips.
    1. Reports are made available to the industry quite late, often three months after the events have occurred.
    2. The data sampling rate is insufficient for thorough analysis.
    3. Reports do not incorporate data from various locations across Great Britain (GB).
- The defects deter the industry and relevant parties from carrying out effective analysis in a timely manner which further prevents understanding the cause of Grid disturbance events.
- Publishing the data long after the event makes it less useful, as industry are not receiving up-to-date information and the additional data that Users may have from their sites that would support the investigation of the incident, is less likely to be available.
- With the current sampling rate of 1 second, the frequency data is too averaged so it's masking the real Rate of Change of Frequency (RoCoF). Moreover, if accurate frequency data is not available, then the loss(MW) cannot be calculated properly.
- Lack of regional data from the place of incident is masking the actual frequency of that place as this frequency may vary from the frequency at the Synchronous Grid due to phase differences throughout the Grid.

The proposer would welcome comments, suggestions, feedback or any improvements.

Guy Nicholson
Grid Stability Analyst Intern, Statkraft UK
guy.nicholson@statkraft.com

Agree Terms of Reference

Jess Rivalland– NESO Code Administrator



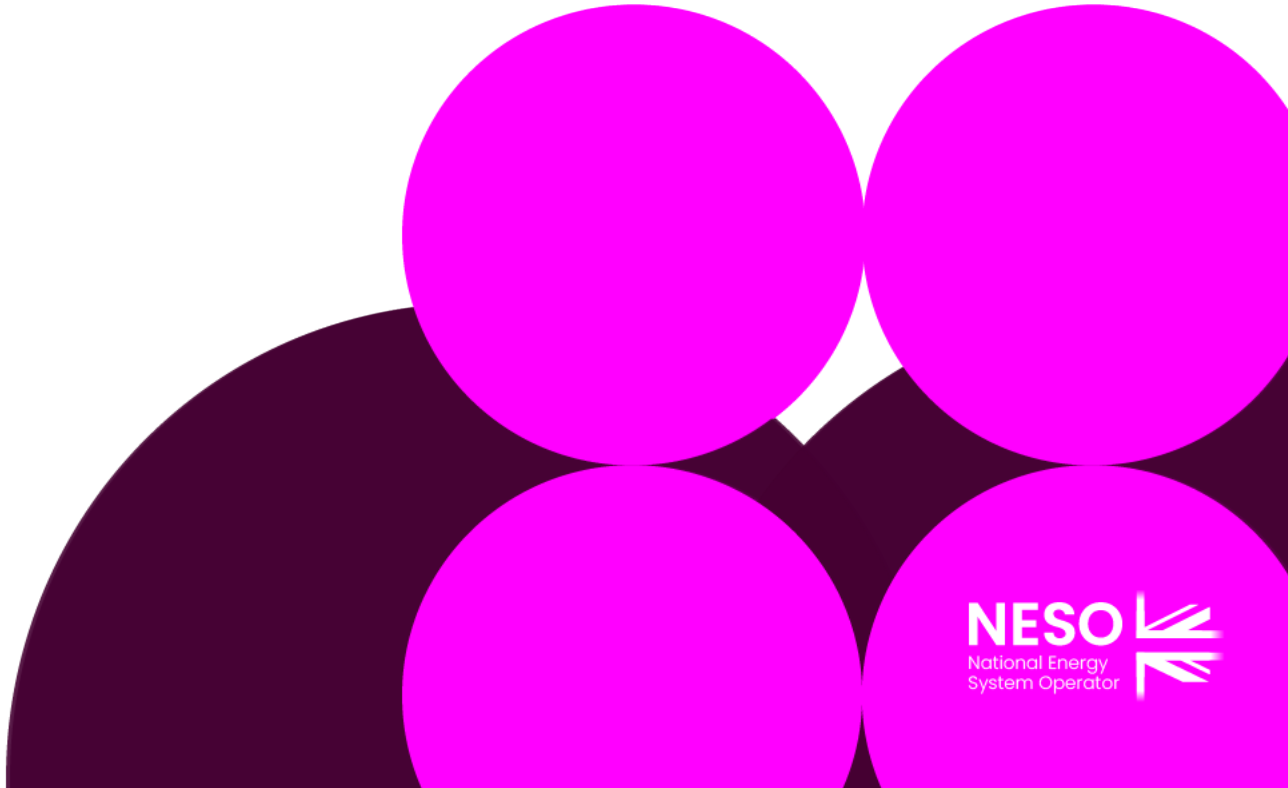
Terms of Reference

Terms of Reference
a) Implementation and costs;
b) Review draft legal text should it have been provided. If legal text is not submitted within the Grid Code Modification Proposal the Workgroup should be instructed to assist in the developing of the legal text;
c) Consider whether any further Industry experts or stakeholders should be invited to participate within the Workgroup to ensure that all potentially affected stakeholders have the opportunity to be represented in the Workgroup. Demonstrate what has been done to cover this clearly in the report;
d) Consider implications to sections linked to the Regulated Sections of the Grid Code
e) Assess and form a view whether there are material effects or not from the modification and provide a view to the Panel on whether the Governance Route should change
f) Consider the recommendations of Ofgem's data best practice guidance and energy data taskforce.
g) Consider the current granularity of frequency data and duration post event for publishing and evaluate options for change. This should include a review of existing available data and consideration of costs and impacts on Grid Code parties.
h) Consider cross code impacts of the modification, particularly on the STC
i) Consider relevant Electrical Standards as necessary, including but not limited to TS.3.24.70 and TS.3.24.95.

NESO National Energy System Operator

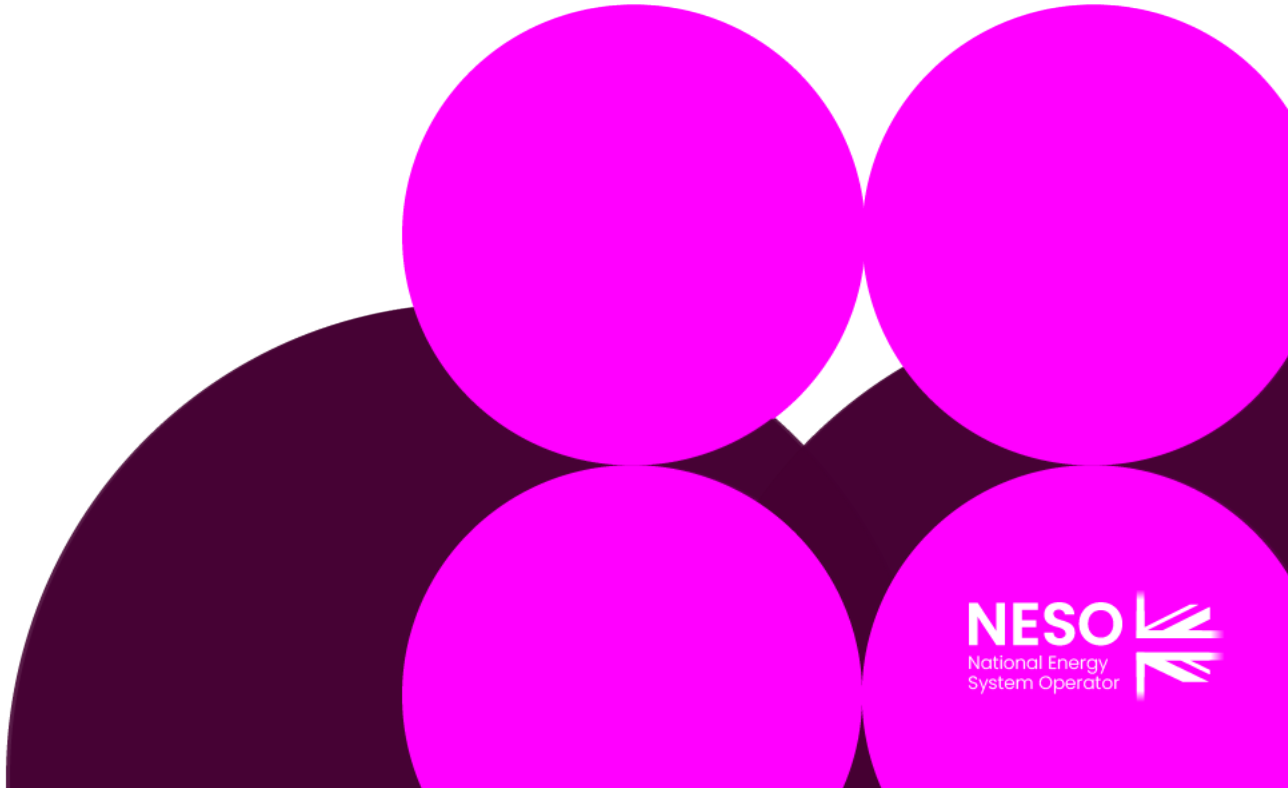
Cross Code Impacts

Jess Rivalland– NESO Code Administrator



Any Other Business

Jess Rivalland– NESO Code Administrator



Next Steps

Jess Rivalland– NESO Code Administrator