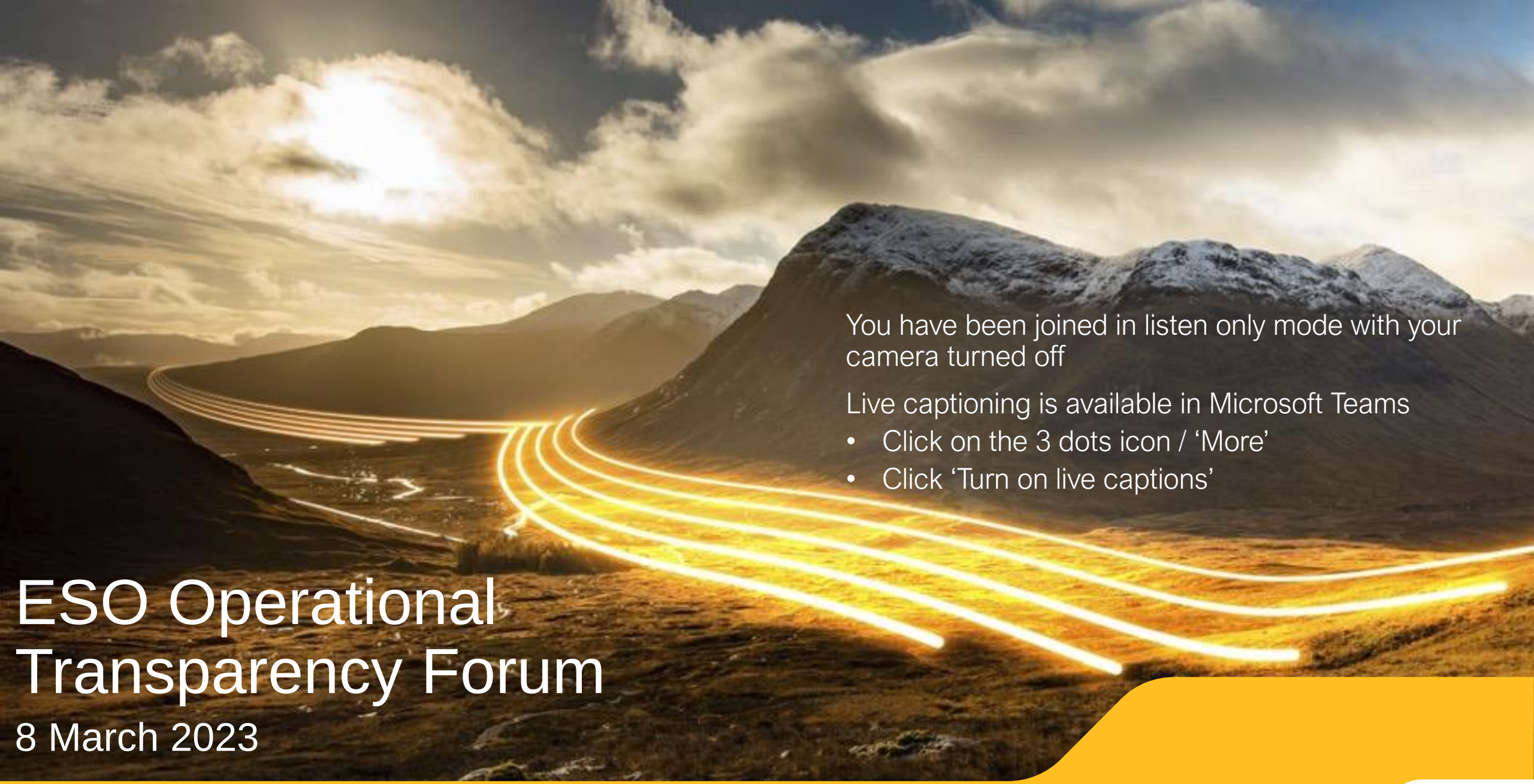


You have been joined in listen only mode with your camera turned off

Live captioning is available in Microsoft Teams

- Click on the 3 dots icon / ‘More’
- Click ‘Turn on live captions’

ESO Operational Transparency Forum

8 March 2023

ESO

Introduction | Sli.do code #OTF

Please visit www.sli.do and enter the code #OTF to ask questions & provide us with post event feedback.

We will answer as many questions as possible at the end of the session. We may have to take away some questions and provide feedback from our expert colleagues in these areas during a future forum. **Ask your questions early in the session to give more opportunity to pull together the right people for responses.**

To tailor our forum and topics further we have asked for names (or organisations, or industry sector) against Sli.do questions. If you do not feel able to ask a question in this way please use the email: box.NC.Customer@nationalgrideso.com

These slides, event recordings and further information about the webinars can be found at the following location:

Advanced question can be asked here: https://forms.office.com/r/k0AEfKnai3

Stay up to date on our new webpage: https://www.nationalgrideso.com/OTF

Future deep dive / focus topics

Today

SO-SO Trades, Emergency Assistance/Instruction on Interconnectors

Coming soon

Balancing Markets Winter Costs review (November, December, January, February) – 22nd March

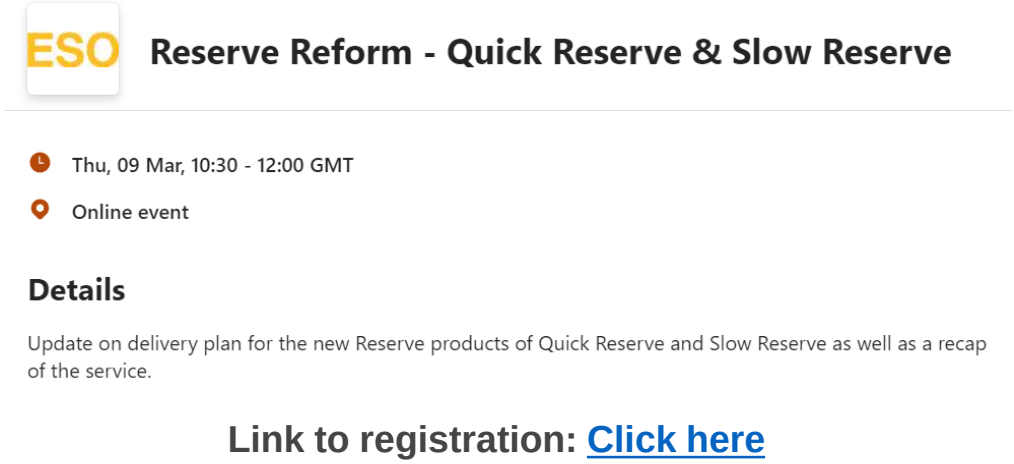
Future

Reserve Reform update – please see the webinar invite – 9th March

Response markets deep dive

System Inertia

Feedback welcomed on our proposed deep dive topics



Link to registration: Click here

Arrangements for today's forum

There is a lot of content in today's forum so we are providing a brief overview on the operational update for yesterday, Tuesday 7 March 2023, before presenting the focus topic on Interconnectors: SO-SO Trades, Emergency Assistance/Instructions

Unfortunately it has not been possible to extend the length of this session due to the availability of our experts.

Therefore in this session we will prioritise questions relating to today's Interconnector focus topic. We believe it is unlikely we will have time for questions relating to yesterday's operations (Tuesday 7 March) and will be taking these questions away.

We will come back next week with a deep dive into Tuesday 7 March using your questions to inform the content of the session. You will appreciate that there was a lot of work from a number of teams yesterday until late in the evening and we want to give a full overview at a future forum.

In order to capture as many of these questions as possible Sli.do will remain open until 12:30, so please add your questions here.

The regular content including Advanced and Previously Asked questions will not be presented today, but these slides have been included as an appendix to the published slide pack.

Operational Update – 7 March 2023

Electricity Margin Notice – for Tuesday 7th March 16:30-20:30

- An Electricity Margin Notice (EMN) was issued at 22:05 on Monday 6th March for the period 16:30 - 20:30 Tuesday 7th March due to a shortfall in reserve capacity.
- The shortfall expected at that time was 980MW.
- In addition, all 4 available Winter Contingency Coal units were warmed (Drax 5 and 6, West Burton A 1 and 2) for the Tuesday Darkness Peak period.
- The forecast demand for the Darkness Peak was 42.3GW.
- At 09:59 an Anticipated DFS Requirement Notice was issued for Wednesday 8th March, which was subsequently cancelled as not required.
- At 12:25 the EMN notice was re-issued with the expected shortfall reduced to 700MW.
- West Burton units 1 and 2 were instructed to synchronise at 13:50 hrs and 14:50hrs respectively.
- At 15:15hrs the EMN notice was cancelled.
- Demand over DP out turned at 40.8GW with wind output over the peak was over forecast by 900MW
- West Burton units 1 and 2 were desynchronised at 20:30 and 20:45 respectively.
- Margins for Wednesday 8th March are adequate with no additional contingency actions required.

Balancing Mechanism Reporting Service (BMRS) messages

System Warnings	
Warning Date/Time (GMT)	**Warning Text**
2023-03-07 20:51	From : Power System Manager - National Grid Electricity Control Centre NATIONAL GRID NOTIFICATION Nature of Notification WINTER COAL CONTRACTS. National Grid has allowed Winter Contingency Unit to De-Synchronise. BMU ID: WBUPS-2 De-sync time: 07/03/2023 20:45 Notification Issued at 20:50 hrs on 07/03/2023 Issued by Pat Stewart National Grid Electricity Control Centre.
2023-03-07 20:47	From : Power System Manager - National Grid Electricity Control Centre NATIONAL GRID NOTIFICATION Nature of Notification WINTER COAL CONTRACTS. National Grid has allowed Winter Contingency Unit to De-Synchronise. BMU ID: WBUPS-1 De-sync time: 07/03/2023 20:30 Notification Issued at 18:40 hrs on 07/03/2023 Issued by Pat Stewart National Grid Electricity Control Centre.
2023-03-07 15:24	From : Power System Manager - National Grid Electricity Control Centre NOTIFICATION CANCELLATION of GB TRANSMISSION SYSTEM WARNING The GB Transmission System Warning ELECTRICITY MARGIN NOTICE issued for the period from 16:30 hrs to 20:30 hrs on Tuesday 07/03/2023 has been cancelled The following GB Transmission System Warnings remain in force No GB TRANSMISSION SYSTEM WARNINGs still in force Notification Issued at 15:15 hrs on 07/03/2023 Issued by Pat Stewart National Grid Electricity Control Centre
2023-03-07 15:01	From : Power System Manager - National Grid Electricity Control Centre NATIONAL GRID NOTIFICATION Nature of Notification WINTER COAL CONTRACTS Winter Contigency Unit Synchronised by National Grid BMU ID: WBUPS-2. Estimated Capacity: 260MW, Sync Time: 07/03/2323 14:50 System Flag. Start-Up Price: ⍰0/hr Start-Up Cost:⍰0 Notification Issued at 15:00 hrs on 07/03/2023 Issued by Pat Stewart National Grid Electricity Control Centre.
2023-03-07 14:58	From : Power System Manager - National Grid Electricity Control Centre NATIONAL GRID NOTIFICATION Nature of Notification WINTER COAL CONTRACTS Winter Contigency Unit Synchronised by National Grid BMU ID: WBUPS-1. Estimated Capacity: 260MW, Sync Time: 07/03/2323 13:50. System Flag. Start-Up Price: ⍰0/hr Start-Up Cost:⍰0 Notification Issued at 15:00 hrs on 07/03/2023 Issued by Pat Stewart National Grid Electricity Control Centre.
2023-03-07 12:24	From : Power System Manager - National Grid Electricity Control Centre ELECTRICITY MARGIN NOTICE An ELECTRICITY MARGIN NOTICE has been issued by the System Operator to encourage market actions to increase System Margins. For the period: from 16:30 hrs to 20:30 hrs on Tuesday 07/03/2023 There is a reduced system margin. System margin shortfall 700 MW The current contingency requirement is 370 MW. 0 MW of generation is excluded from the available system margin due to system constraints. Maximum Generation Service may be instructed. Trading Points, Control Points and Externally interconnected System Operators are requested to notify National Grid of any additional MW capacity. Suppliers please advise National Grid of any additional Demand Control available The situation will be reviewed again by National Grid at 15:00 hours and an update issued. This Notification of Issue of a GB Transmission System Warning - ELECTRICITY MARGIN NOTICE Issued at 12:24 hrs on 07/03/2023 Issued by Peter Chandler National Grid Electricity Control Centre ********** Information Note:- As the System Operator, National Grid are responsible for balancing the electricity system in the final hours before real-time. We have a number of routine tools we can use to help us do this, this toolkit includes ELECTRICITY MARGIN NOTICES. An ELECTRICITY MARGIN NOTICE is used to send a signal to the electricity market. It highlights that, in the short-term, we would like a greater safety cushion (margin) between power demand and available supply. It does not signal that blackouts are imminent or that there is not enough generation to meet current demand.

2023-03-07 09:59	From: Power System Manager - National Grid Electricity Control Centre NATIONAL GRID NOTIFICATION - DEMAND FLEXIBILTY SERVICE. An Anticipated DFS Requirement Notice has been published for tomorrow Wednesday 08/03/2023 This is an indication that a DFS Service Requirement might be published today at 14:30. This will be Energy Tagged. For full details see the ESO Data Portal at . Notification Issued at 10:00 hours on 07/03/2023. Issued by Peter Chandler National Grid Electricity National Control Centre.
2023-03-07 02:49	From : Power System Manager - National Grid Electricity Control Centre Issue of BM Start-Up Instruction. National Grid has issued the following BM Start-Up Instruction. Instruction issued: 07/03/2023 02:22 BMU ID: DRAXX-5 Estimated Capacity: 645MW Earliest Sync Time: 07/03/2023 14:25 Energy/System Flag: System Start-Up Price: ⍰0/hr Start-Up Cost: ⍰0
2023-03-07 02:43	From : Power System Manager - National Grid Electricity Control Centre Issue of BM Start-Up Instruction. National Grid has issued the following BM Start-Up Instruction. Instruction issued: 07/03/2023 01:42 BMU ID: DRAXX-6 Estimated Capacity: 645MW Earliest Sync Time: 07/03/2023 13:55 Energy/System Flag: System Start-Up Price: ⍰0/hr Start-Up Cost: ⍰0
2023-03-07 02:31	From : Power System Manager - National Grid Electricity Control Centre Issue of BM Start-Up Instruction. National Grid has issued the following BM Start-Up Instruction. Instruction issued: 07/03/2023 01:40 BMU ID: WBUPS-1 Estimated Capacity: 400MW Earliest Sync Time: 07/03/2023 13:50 Energy/System Flag: System Start-Up Price: ⍰0/hr Start-Up Cost: ⍰0
2023-03-06 22:05	From : Power System Manager - National Grid Electricity Control Centre ELECTRICITY MARGIN NOTICE An ELECTRICITY MARGIN NOTICE has been issued by the System Operator to encourage market actions to increase System Margins. For the period: from 16:30 hrs to 20:30 hrs on Tuesday 07/03/2023 There is a reduced system margin. System margin shortfall 980 MW The current contingency requirement is 700 MW. 0 MW of generation is excluded from the available system margin due to system constraints. Maximum Generation Service may be instructed. Trading Points, Control Points and Externally interconnected System Operators are requested to notify National Grid of any additional MW capacity. Suppliers please advise National Grid of any additional Demand Control available The situation will be reviewed again by National Grid at 12:00 hours and an update issued. This Notification of Issue of a GB Transmission System Warning - ELECTRICITY MARGIN NOTICE Issued at 22:05 hrs on 06/03/2023 Issued by Ben Young National Grid Electricity Control Centre ********** Information Note:- As the System Operator, National Grid are responsible for balancing the electricity system in the final hours before real-time. We have a number of routine tools we can use to help us do this, this toolkit includes ELECTRICITY MARGIN NOTICES. An ELECTRICITY MARGIN NOTICE is used to send a signal to the electricity market. It highlights that, in the short-term, we would like a greater safety cushion (margin) between power demand and available supply. It does not signal that blackouts are imminent or that there is not enough generation to meet current demand.
2023-03-06 16:02	NGESO has requested a Transmission Owner discontinue an outage within relevant Emergency Return to Service time, under STC Section C Part 2 (7). Issued by Natasa Dinic at 15:45 on 06/03/2023
2023-03-06 15:37	From : Power System Manager - National Grid Electricity Control Centre Issue of BM Start-Up Instruction. National Grid has issued the following BM Start-Up Instruction. Instruction issued: 06/03/2023 14:35 BMU ID: WBUPS-2 Estimated Capacity: 400MW Earliest Sync Time: 07/03/2023 14:50 Energy/System Flag: System Start-Up Price: ⍰0/hr Start-Up Cost: ⍰0
2023-03-06 14:35	From : Power System Manager - National Grid Electricity Control Centre Issue of BM Start-Up Instruction. National Grid has issued the following BM Start-Up Instruction. Instruction issued: 06/03/2023 14:35 BMU ID: WBUPS-2 Estimated Capacity: 400MW Earliest Sync Time: 07/03/2023 14:50 Energy/System Flag: Energy Start-Up Price: ⍰0/hr Start-Up Cost: ⍰0

You can sign up to receive BMRS messages via email on the Elexon website: www.bmreports.com/bmrs

Winter Contingency Units

Service instructions (Monday 6th and Tuesday 7th March 2023)

The following instructions were issued over the period:

BMU ID	Start up	Synchronised	Cancelled	De-Synchronised	Notes
WBUPS-2	06/03/2023 14:35	07/03/2023 14:50		07/03/2023 20:45	SONAR & BMRS
WBUPS-1	07/03/2023 01:40	07/03/2023 13:50		07/03/2023 20:30	SONAR & BMRS
DRAXX-6	07/03/2023 01:42		07/03/2023 15:05		SONAR & BMRS
DRAXX-5	07/03/2023 02:22		07/03/2023 14:27		SONAR & BMRS

BM Start Up Instructions can be viewed on the ESO's SONAR system and on BMRS

Sonar (nationalgrid.com)

Electricity Data Summary | BMRS (bmreports.com)

Interconnectors:

SO-SO Trades, Emergency Assistance & Emergency Instruction

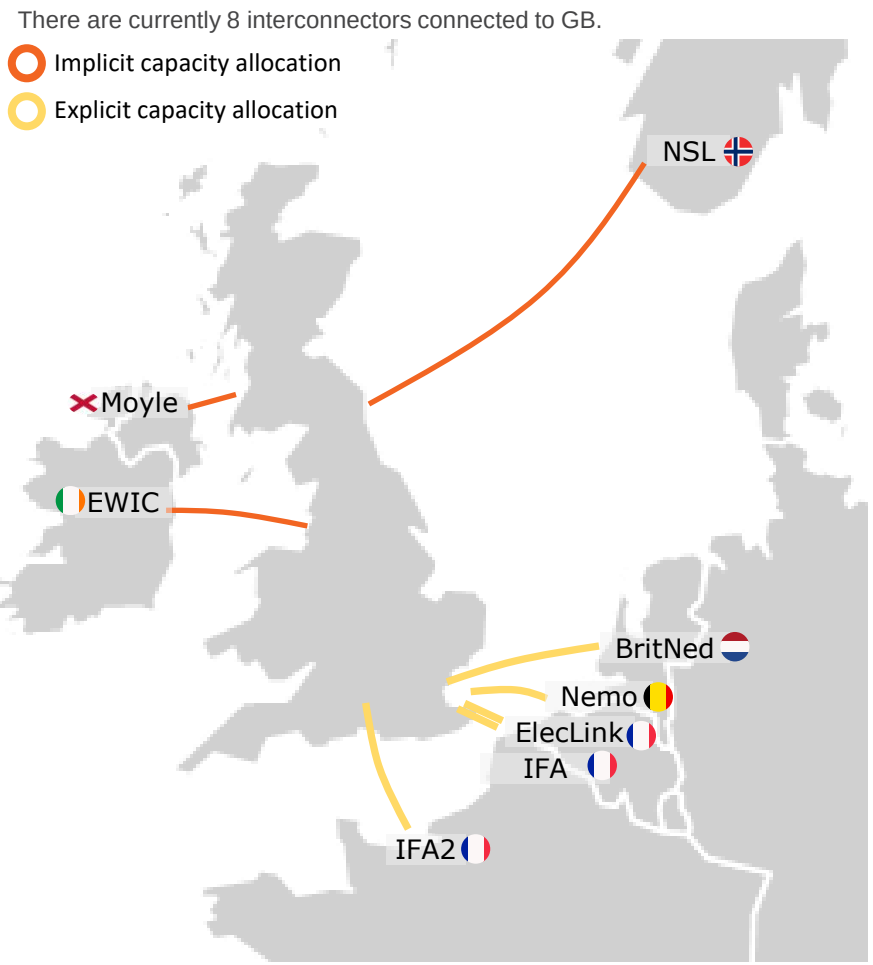
8th March 2023

ESO

What are we going to cover

- GB Interconnector - Context
- Day in the Life of an Interconnector (from both the control room and a trading perspective)
- SO-SO Trades
- Emergency Assistance (EA)
- Emergency Instruction (EI)
- Case Study: 25th January 2023
- Your input required…

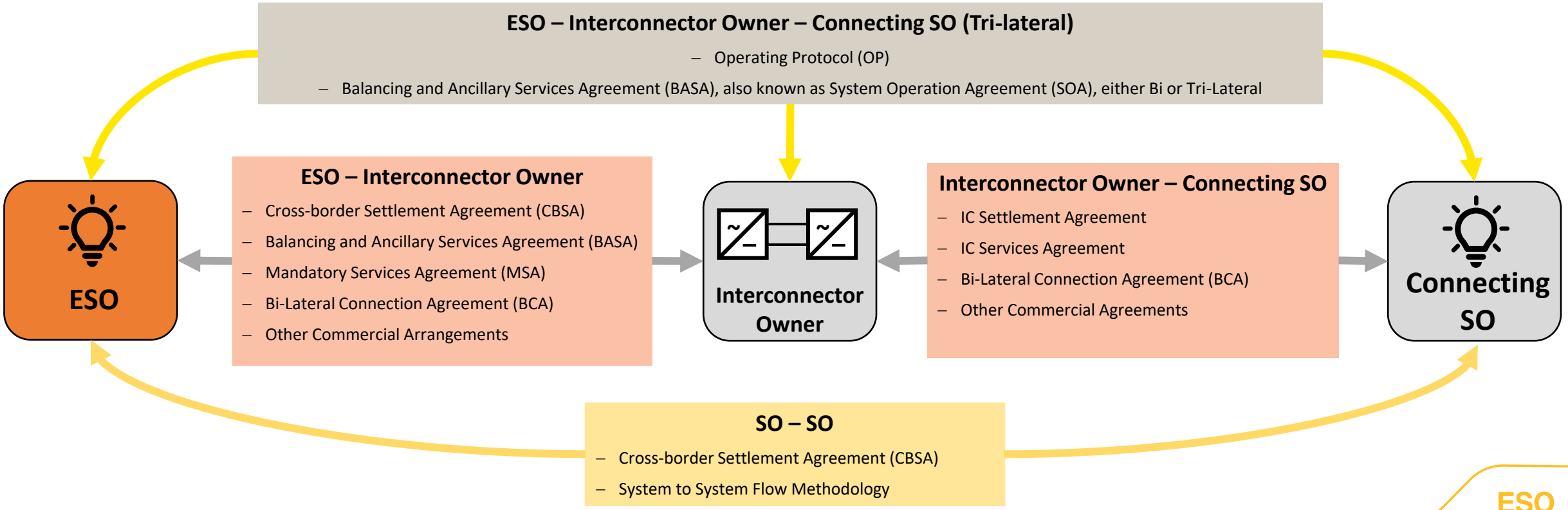
GB Interconnectors



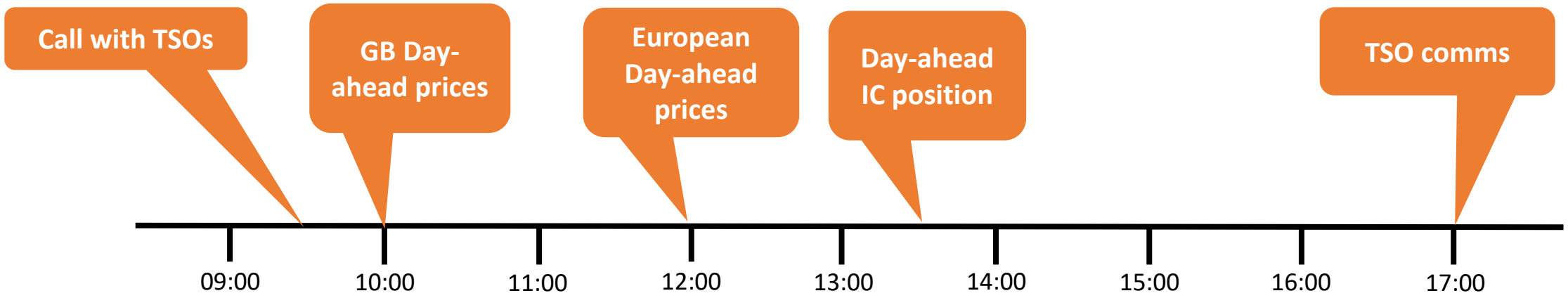
Name	Connecting Country	Nominal Capacity (MW)
NSL	Norway	1400
BritNed	Netherlands	1000
NEMO	Belgium	1000
ElecLink	France	1000
IFA(1)	France	2000
IFA2	France	1000
EWIC	Republic of Ireland	500
Moyle	Northern Ireland	500

Interconnector Stakeholders & Agreements

- Interconnectors (ICs) have a number of contractual arrangements & operational protocols, which allow them to provide services to GB's power system
- These are required in order to allow the ICs to facilitate markets and transport electricity between the connecting countries and to set out and govern the operations the operators and connected SOs must abide by, as well as the methods in which payments are made to the various parties.



Day in the Life of an Interconnector – Day-ahead



- Any trading at Day-ahead (DA) needs to be completed in the morning to allow the trades to be nominated ahead of the Day-ahead gate.
- Where there is an Intraday (ID) market, ESO will not usually trade in the Day-ahead market as these trades could be unwound in the subsequent Intraday auctions.
- ESO can only trade in Explicit Day-ahead (and Intraday) auctions to guarantee the resulting physical flows. Implicit auctions do not provide the required certainty.

Day in the Life of an Interconnector – Within Day

Interconnector capacity is sold in various Intraday auctions (volume determined based on the Day-ahead position)

Time	23:00	23:30	00:00	00:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00	04:30	05:00	05:30	06:00	06:30	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30	21:00	21:30	22:00	22:30
SP	47	48	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
IFA	18:45:00 D-1																04:45																12:45										16:45							
IFA2	18:45:00 D-1																								08:45								12:45										16:45				
BN	19:00:00 D-1																05:20								09:20								13:20																
NEMO	21:10:00 D-1																				02:55								08:55																14:55						
ElecLink	15:10:00 D-1																																08:50																

- Trading can take place for any period ahead of the Intraday nomination gate for that particular hour
- Where there is an operational requirement, either system or energy, where trading is a possibility, the-cost will be compared against the cost of any alternative action, if available, in the Balancing Mechanism (BM), using data submitted to the BM at the time. The trades are only instructed if they are cheaper than the available alternative action.
- Any Intraday trading is carried out by liaising with counterparties who can buy and sell energy in the various connected markets and can buy capacity and nominate flows on the required Interconnector(s).
- All trades are transacted ahead of the final Intraday nomination gate and published on the **data portal**.

Interconnector Actions available to ENCC

ESO will always try to secure required flows via Day-ahead (DA) or Intraday (ID) trading, if more economical, to ensure as much certainty ahead of real-time as possible.

- **Pre-(final) Gate Closure** – DA & ID Trading *(where possible)*
  - All requirements are shown on the data portal
  - Once trades are confirmed, a summary of the results is published alongside the requirement
  - All individual trades are shared here
  - All historic trades are recorded here
- **Post-(final) gate closure / within gate** – Options available to the ESO Electricity National Control Centre (ENCC) near to/in real-time in order

  Note: ESO does not have to use one before the other but will always try to use services in the order below if possible
  - SO-SO Trades – *if trilaterally agreed & available*
  - Emergency Assistance (EA) – *if available*
  - Emergency Instruction (EI)

Order of Action: Winter 2022/23

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Everyday Actions	Order	Comments
All deliverable Offer action on all available BM participants	#1 based on Cost	Scheduled at Day Ahead, action taken in real time – some offers may not be available due to network congestion
Issue warming instructions to cold BM participants	#1 based on Cost	Scheduled at Day Ahead, action taken in real time
Buy energy from continental Europe	#1 based on Cost	Scheduled at Day Ahead, action taken from Day Ahead to 4hrs ahead of time by ESO Traders
Reconfigure CCGTs to increase available energy (e.g. sync additional GTs)	#1 based on Cost	Scheduled at Day Ahead, managed within the control timescales within day
SO-SO trade in cost order	#1 based on Cost	SO to SO trade with other SO in Europe/Ireland
Reconfigure Transmission Network to reduce network congestion, including: Change substation running arrangements, Tap Quad Boosters, to control flow of energy and Making use of enhanced ratings	Normal operating practice – no cost	Changing daily operating conditions can result in different network configurations to reduce congestion
Review and refine reserve requirement within day dependent on system conditions	Normal operating practice – no cost	Changing system conditions can relieve requirements for reserve or increase requirements. This can change at any time as the conditions change.

Enhanced Actions (if everyday actions are insufficient)	Order	Comments
Recall TO assets from outage to increase network availability and increase available capacity	#3	Anytime through to control room timescales, depending on ERTS (Emergency Return to Service) time
Plan use of Emergency Assistance (EA) from other SO	#4	Enacted close to real-time. Only applicable if capacity is available on interconnectors. EA can be withdrawn at any time
Instruct Demand Flexibility product	#5	Decision made at timescales as determined by product created (instruction at 24 hours)
Instruct Winter Contingency Units	#6	Decision made at timescales as determined by dynamic parameters (warming at 12-48hrs)

Emergency Actions (if enhanced actions are insufficient)	Order	Comments
Emergency Instruction (EI) to other SO	#7	
OC6 demand control instructions to DNOs	#8	This could be via voltage control or demand control (disconnecting customers)
Recommend to BEIS to implement ESEC	#9	Ongoing conversations prior to this so all parties would be aware of risk

Notices are issued at any time as required	Comment
Issue Electricity Margin Notice (EMN)	Request to market to increase available energy or reduce demand. Likely to be issued at Day Ahead. Updated regularly
Issue a High Risk of Demand Reduction (HRDR) system warning	Warning network operators of high likelihood of demand control. Further request to market to increase available energy or reduce demand. Closer to real-time than ENM
Issue Demand Control Imminent (DCI) system warning	If possible, this system warning will be issued 30 minutes prior to demand control. Warning to network operators
AUTOMATICALLY TRIGGERED: A Capacity Market Notice (CMN) is automatically triggered to alert CM participants	Driven by calculation of Market data at 4 hours ahead of real time

SO-SO Trades

System Operator to System Operator (SO-SO) Trades are trades between ESO and the connected System Operator (SO).

Either SO can request a volume of energy from the connected SO. If the connected SO is able to assist, once the volume and change of flow timings are agreed, the resulting energy is exchanged via the relevant interconnector.

- **SO-SO Trades:**
  - Can be requested by either SO;
  - Can be requested for any reason, i.e. tagged as system or energy;
  - Does not require the Requesting SO to be in a particular System State;
  - Can only be requested for periods where nominations are firm, i.e. within gate;
  - Requires minimum 40 minutes notice prior to delivery;
  - Assisting SO can reject for any reason.
- **Price Information:**
  - If agreed in advance, price is published ahead of real-time (e.g. Excess Energy) on BMRS (SO-SO Trade Prices)
  - If agreed between SOs during requesting stage and therefore only available post-real time, published via BSAD reporting
  - Cost does feed into Cashout and recovered through BSUoS

SO-SO Trades cont.

ESO only has SO-SO Trading services with:

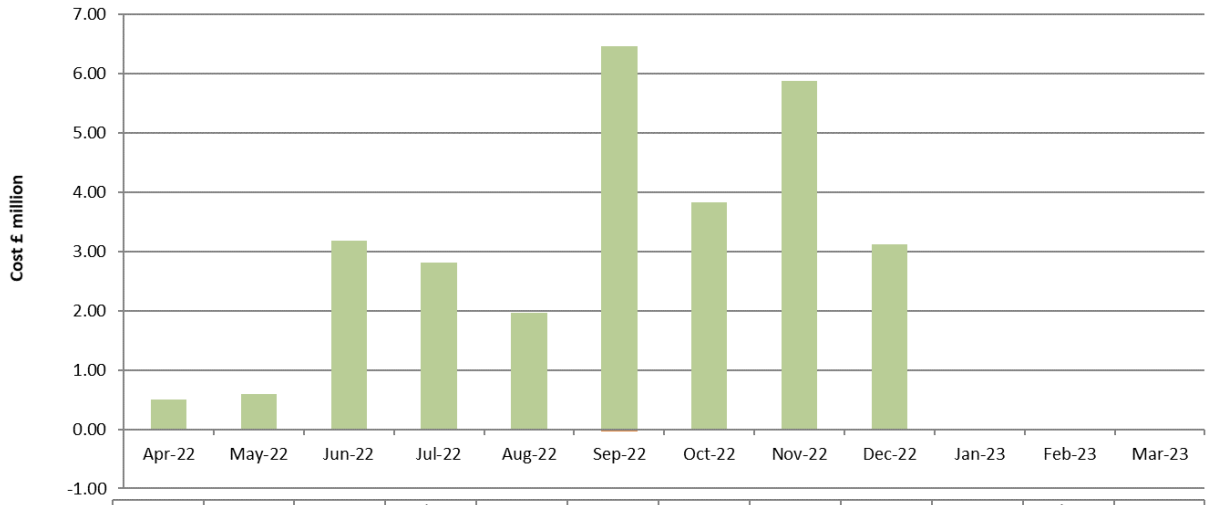
Connected SO	Country	Across Interconnector	Service Name	Can it be used by ESO?
RTE	France	IFA & IFA2	Excess Energy	No, since the introduction of hourly gates due to current required notice period being longer than hourly gates provides
Elia	Belgium	NEMO	Redispatch & Countertrading (RDCT)	
EirGrid	Republic of Ireland	EWIC	Cross Border Balancing (CBB) & Coordinated Third Party Trading (CTPT)	CBB – yes CTPT – no, EirGrid use trades via a 3rd party
SONI	Northern Ireland	Moyle	Cross Border Balancing (CBB) & Coordinated Third Party Trading (CTPT)	

MBSS SO-SO Trade Costs – this Financial year

AS – SO-SO Interconnector Capability (Commercial) refers to payment for the Net Transfer Capacity Compensation Scheme. The scheme is intended to compensate the operator for restricting the flow on their interconnector in order to meet GB system requirements.

For example:

- Constraints: this is where the GB transmission system between the interconnector and the generators (export flow) or demand consumers (import flow) does not have the capability to safely and securely carry all the energy if the interconnector were to operate at full volume. We restrict interconnector flow to suit the constraint limit.
- Securing largest loss: this means ensuring we have sufficient resource available to manage the full impact if any unit trips off the system. NSL is one of the largest units on the GB system and we use NTC to restrict the interconnector flow to the level we can secure against loss.



	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23
AS - SO-SO Interconnector Capability (Commercial)	0.50	0.59	3.18	2.80	1.96	6.45	3.83	5.88	3.11	0.00	0.00	0.00
SO-SO Constraints	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO-SO Invoked by External Parties	0.00	0.00	0.00	0.00	0.00	-0.02	0.00	0.00	-0.02	0.00	0.00	0.00
SO-SO Ramping	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO-SO Footroom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO-SO Constrained Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO-SO Margin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO-SO Energy Trades	0.00	0.00	0.00	0.00	0.00	-0.02	0.00	0.00	0.00	0.00	0.00	0.00

These costs are paid from BSUoS calculations and are included in the Monthly Balancing Services Summary published after 31 January 2023: MBSS

SO-SO Trades – EWIC & Moyle BMRS Notices

Trade Type	Date	Start Time (GMT)	Trade Direction	Contract Identification	Trade Quantity (MW)	Trade Price (£)
EWIC_EG	2023-02-28	00:00:00	A02	EG_20230228_0000_1	25	-0.010
EWIC_EG	2023-02-28	00:00:00	A02	EG_20230228_0000_2	25	-0.020
EWIC_EG	2023-02-28	00:00:00	A02	EG_20230228_0000_3	25	-0.030
EWIC_EG	2023-02-28	00:00:00	A02	EG_20230228_0000_4	25	-0.040
EWIC_EG	2023-02-28	00:00:00	A02	EG_20230228_0000_5	25	-0.050

- The prices of the Cross Border Balancing (CBB) service with the Republic of Ireland and Northern Ireland are exchanged and agreed between ESO and EirGrid/SONI at Day-ahead (DA).
- Applies across the EWIC & Moyle interconnectors.
- The ESO prices are calculated daily for the DA based on forecast system conditions e.g. wind, inertia, etc.
- The service design is that the trade volumes are made available in 5 blocks of 25MW each.
- SOs can request trades for some of or all available blocks.

SO-SO Trades – Excess Energy BMRS Notices

SO-SO Trad **Message Text**

Message Date/Time (GMT)	Message Text
2023-02-28 13:32	NATIONAL GRID NOTIFICATION of excess energy prices used for settlement outside of BALIT for SO to SO Transactions over the National Grid/RTE Interconnector. Prices cover 23:00Hrs Today to 05:00Hrs Tomorrow (UK local time) and are in Euro/MWh. From RTE: Offer 350.00; Bid 0.00 From NGC: Offer 684.00; Bid -205.00 Prices cover 05:00Hrs Tomorrow to 19:00Hrs Tomorrow (UK local time) and are in Euro/MWh. From RTE: Offer 350.00; Bid 0.00 From NGC: Offer 1141.00; Bid 0.00 Prices cover 19:00Hrs Tomorrow to 23:00Hrs Tomorrow (UK local time) and are in Euro/MWh. From RTE: Offer 350.00; Bid 0.00 From NGC: Offer 1141.00; Bid 0.00
2023-02-27 13:47	NATIONAL GRID NOTIFICATION of excess energy prices used for settlement outside of BALIT for SO to SO Transactions over the National Grid/RTE Interconnector. Prices cover 23:00Hrs Today to 05:00Hrs Tomorrow (UK local time) and are in Euro/MWh. From RTE: Offer 350.00; Bid 0.00 From NGC: Offer 684.00; Bid -205.00 Prices cover 05:00Hrs Tomorrow to 19:00Hrs Tomorrow (UK local time) and are in Euro/MWh. From RTE: Offer 350.00; Bid 0.00 From NGC: Offer 1141.00; Bid 0.00 Prices cover 19:00Hrs Tomorrow to 23:00Hrs Tomorrow (UK local time) and are in Euro/MWh. From RTE: Offer 350.00; Bid 0.00 From NGC: Offer 1141.00; Bid 0.00

The prices of the Excess Energy service with France are exchanged and agreed between ESO and RTE at Day-ahead

Applies across the IFA & IFA2 interconnectors

The prices from ESO (historically NGC) are:

- Fixed but reviewed annually or ad-hoc depending on significant market price changes
- Aimed to be a higher cost than normal market actions

Note: the “BALIT” (Balancing Inter-TSO) service was removed with the introduction of TERRE as RTE could not facilitate both. As a result of the UK’s EU Exit, GB is not permitted to participate in TERRE. ESO is in the process of changing “BALIT” in these messages to “Excess Energy” but has some IT limitations to resolve.

Order of Action: Winter 2022/23

Sli.do code #OTF

Everyday Actions	Order	Comments
All deliverable Offer action on all available BM participants	#1 based on Cost	Scheduled at Day Ahead, action taken in real time – some offers may not be available due to network congestion
Issue warming instructions to cold BM participants	#1 based on Cost	Scheduled at Day Ahead, action taken in real time
Buy energy from continental Europe	#1 based on Cost	Scheduled at Day Ahead, action taken from Day Ahead to 4hrs ahead of time by ESO Traders
Reconfigure CCGTs to increase available energy (e.g. sync additional GTs)	#1 based on Cost	Scheduled at Day Ahead, managed within the control timescales within day
SO-SO trade in cost order	#1 based on Cost	SO to SO trade with other SO in Europe/Ireland
Reconfigure Transmission Network to reduce network congestion, including: Change substation running arrangements, Tap Quad Boosters, to control flow of energy and Making use of enhanced ratings	Normal operating practice – no cost	Changing daily operating conditions can result in different network configurations to reduce congestion
Review and refine reserve requirement within day dependent on system conditions	Normal operating practice – no cost	Changing system conditions can relieve requirements for reserve or increase requirements. This can change at any time as the conditions change.

Enhanced Actions (if everyday actions are insufficient)	Order	Comments
Recall TO assets from outage to increase network availability and increase available capacity	#3	Anytime through to control room timescales, depending on ERTS (Emergency Return to Service) time
Plan use of Emergency Assistance (EA) from other SO	#4	Enacted close to real-time. Only applicable if capacity is available on interconnectors. EA can be withdrawn at any time
Instruct Demand Flexibility product	#5	Decision made at timescales as determined by product created (instruction at 24 hours)
Instruct Winter Contingency Units	#6	Decision made at timescales as determined by dynamic parameters (warming at 12-48hrs)

Emergency Actions (if enhanced actions are insufficient)	Order	Comments
Emergency Instruction (EI) to other SO	#7	
OC6 demand control instructions to DNOs	#8	This could be via voltage control or demand control (disconnecting customers)
Recommend to BEIS to implement ESEC	#9	Ongoing conversations prior to this so all parties would be aware of risk

Notices are issued at any time as required	Comment
Issue Electricity Margin Notice (EMN)	Request to market to increase available energy or reduce demand. Likely to be issued at Day Ahead. Updated regularly
Issue a High Risk of Demand Reduction (HRDR) system warning	Warning network operators of high likelihood of demand control. Further request to market to increase available energy or reduce demand. Closer to real-time than ENM
Issue Demand Control Imminent (DCI) system warning	If possible, this system warning will be issued 30 minutes prior to demand control. Warning to network operators
AUTOMATICALLY TRIGGERED: A Capacity Market Notice (CMN) is automatically triggered to alert CM participants	Driven by calculation of Market data at 4 hours ahead of real time

Emergency Assistance (EA)

- Grid Code requirement BC2.9.6
  - Required on at least 1 interconnector per interconnected country – i.e. not mandatory for each interconnector so long as available on another to the same country
- Principle is to provide a method of near-to real-time support between connected SOs
  - Having the service on all interconnectors gives SOs additional flexibility & support
- EA is an enhanced action once all other available actions have been exhausted (excluding Emergency Instruction) regardless of cost
- Either SO can request a change in energy flow from the connected SO over a specific interconnector. If the connected SO is able to assist, the EA flow profile (MWs & timings) is agreed after which, the interconnector owner enacts the EA flow profile.
- EA can be partially withdrawn by some SOs across some interconnectors in real-time.
- Emergency Assistance (EA) - *a comparison table to SO-SO Trades is on the next slide*:
  - Can be requested by either SO;
  - Can be requested for any system reason, i.e. tagged as system;
  - Requires the Requesting SO to be in at least an Alert State, to avoid entering an Emergency, or already in an Emergency State;

    Note: *EA can be agreed prior to the Requesting SO changing it's declared system state via EAS. Priority is to secure the system*
  - Can only be requested for periods where nominations are firm, i.e. within gate;
  - Requires minimum 15 minutes notice prior to commencing delivery;
  - Assisting SO can only reject a request if it will cause their system to enter Emergency State.
- If an EA is accepted, ESO will publish a message to BMRS

  Note: *the BMRS message states the Requesting SO, resulting flow & start/end times. It does not contain the interconnector name or price information.*

Emergency Assistance vs. SO-SO Trading

Emergency Assistance	SO-SO Trading
Can be requested by either SO	Can be requested by either SO
Can be requested for any system reason i.e. tagged as system	Can be requested for any reason, i.e. tagged as system or energy
Requires the Requesting SO to be in at least Alert State, to avoid entering Emergency, or already in Emergency State ***Note:*** *EA can be agreed prior to the Requesting SO changing it's declared system state. Priority is to secure the system*	Does not require the Requesting SO to be in a particular System State
Can only be requested for periods where nominations are firm, i.e. within gate	Can only be requested for periods where nominations are firm i.e. within gate
Requires minimum 15 minutes notice prior to commencing delivery	Requires minimum 40 minutes notice prior to delivery
Assisting SO can only reject a request if it will cause their system to enter Emergency State	Assisting SO can reject for any reason

Emergency Assistance (EA) cont.

EA is available on the following interconnectors:

Connected SO	Country	Interconnector	Service Name
RTE	France	IFA	EA
RTE	France	IFA2	EA
RTE	France	ElecLink	EA
Elia	Belgium	NEMO	EA
TenneT	Netherlands	BritNed	XBAR *(same as EA)*
Statnett	Norway	NSL	EA
EirGrid	Republic of Ireland	EWIC	EA
SONI	Northern Ireland	Moyle	EA

ESO referring to Emergency Assistance (EA)

Reasons why the ESO may refer to use of EA in operational topics:

1. RTE or ESO partially withdraw EA across IFA & IFA2 if it foresees that full EA cannot be facilitated;

2. a connected SO requests EA;

3. ESO requests EA.

EA – Pricing, Cashout & BSUoS

Sli.do code #OTF

- Interconnector Owners are always kept whole in both countries markets. This is achieved either by the Requesting SO:
  - moving the resulting imbalance to its own account; or,
  - Paying the Interconnector Owner the value of any imbalance penalty.
- EA pricing between the connected SOs is via one of the following methods. Which of the option is contained in the Bilateral Settlement Agreements and is therefore confidential:
    a. Fixed price;
    b. Average cost for the relevant settlement period (SP);
    c. Most expensive action take in the relevant settlement period;
    d. Actual cost of any rebalancing actions taken by the Assisting SO
- EA costs & volumes are included in & reported via the final Balancing Services Adjustment Data (BSAD) submission the following day (D+1);
  - This may be adjusted if required post-event.
  - BSAD is published on the data portal (here) & provided to Elexon for Cashout calculations
- System tagged actions do not feed into Cashout,
  - However, if the cost is less than an Energy tagged action, Elexon will remove the EA's System tag meaning the cost will feed into Cashout
- Any outstanding costs to ESO are recovered through Balancing Services Use of System (BSUoS) Recovery Daily costs
  - Achieved by allocating the Weighted Average Volume Allocation to each settlement period
- Worked example for an interconnector using pricing strategy b. (above):
  - Connected SO requests 500MW of EA from ESO for a total of 4 hours;
  - Average price for all 8 SPs = £200/MWh;
  - Actual price ESO of required rebalancing actions in GB = £1000/MWh;
  - Connected SO pays £400k for EA received
  - ESO recovers remaining £1.6m via BSUoS

Emergency Instruction (EI)

Sli.do code #OTF

- Grid Code requirement BC2.6.4 & BC2.9
  - Mandatory requirement on each interconnector & therefore non-commercial
- Gives SOs an emergency and almost immediate method of securing breaches of system security
- EI is an emergency action once all other available actions have been exhausted regardless of cost
- Instructing SO gives verbal instruction to Interconnector Owner via telephone to reduce flow to a specified level. The Interconnector Owner enacts the instruction immediately and without delay.
- Emergency Instruction (EI):
  - Can be instructed by either SO
  - Can only reduce the flow towards 0MW & cannot change the direction of flow
  - Can be instructed for any system reason, i.e. tagged as system

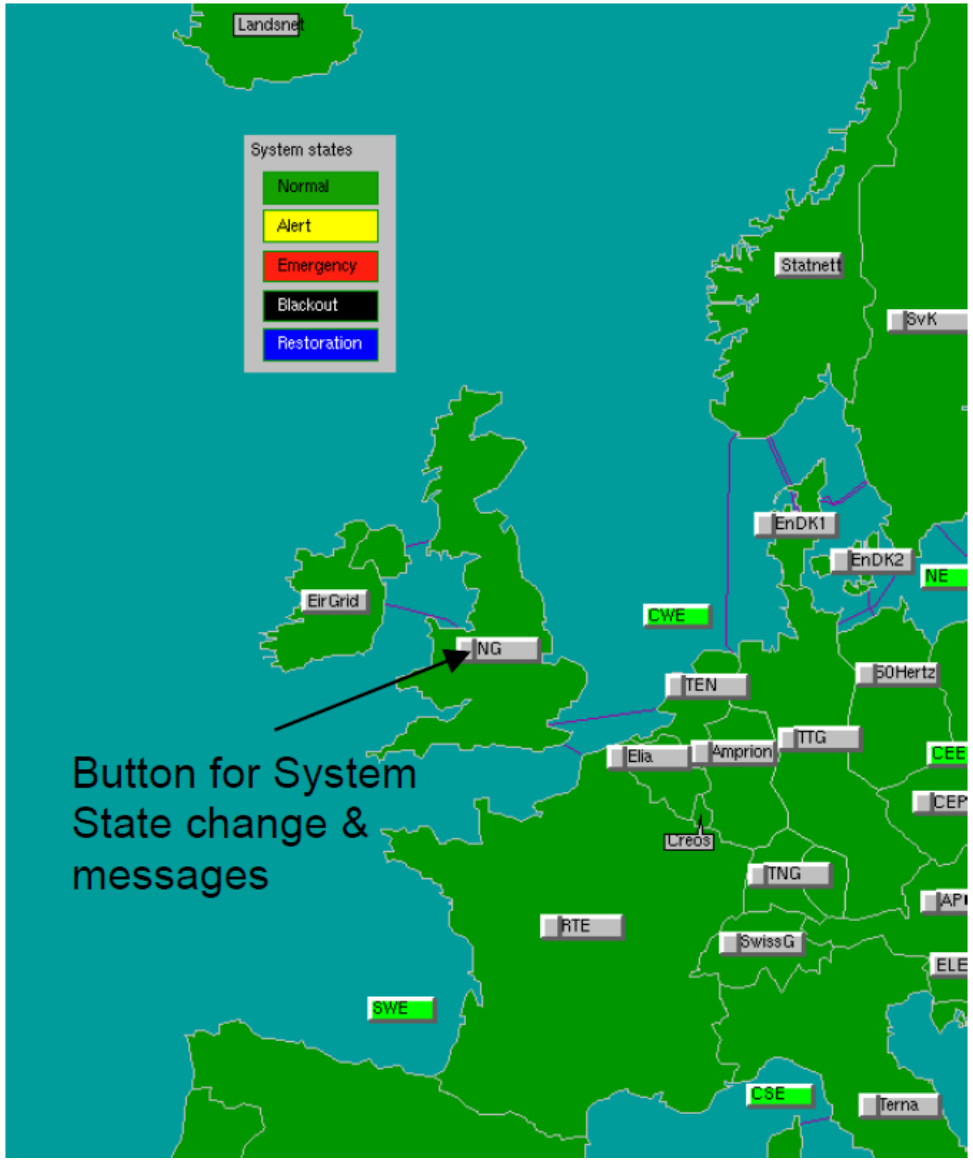
    Note: *EI can be instructed prior to the Instructing SO changing it's declared system state via EAS. Priority is to secure the system.*
  - Requires the Requesting SO to be in an Emergency State;
  - EI instructions are open-ended. The flow can only be change when agreed by the Instructing SO or as a result of a subsequent EI from either SO
  - No minimum notice
  - Can only be rejected by the Interconnector Owner if it will endanger personnel or equipment safety
- If the Assisting SO has declared an Emergency State via the European Awareness System (EAS) , the Instructing SO will contact the Assisting SO to discuss their ability to manage their system resulting from an EI
  - The Assisting SO may have declared an Emergency State for a reason which may not be impacted by the Instructing SO's EI
- If both SOs are in an Emergency State, coordination will take place to agree a volume which would share the impact across both SOs in line with the relevant interconnector governance documents.
- EI is applied on all GB interconnectors
- ESO does not publish/report EIs in real-time, only through BSAD (next slide)
  - Priority is to secure the system rather than to publish. Publishing post-event is of no benefit as the situation will have already been resolved.

EI – Pricing, Cashout & BSUoS

- EI is a mandatory, non-commercial service;
- Therefore, the Instructing SO does not pay any costs incurred by the Assisting SO when rebalancing as a result of an EI:
  - When carrying out an EI the Instructing SO does not have time to consider costs, it must re-secure the system as soon as possible and may be restricted in what actions can be taken
- Interconnector Owners are always kept whole in both countries markets. This is achieved either by the Requesting SO:
  - Moving the resulting imbalance to its own account; or,
  - Paying the Interconnector Owner the value of any imbalance penalty.
- EI is reported through BSAD
- System tagged actions do not feed into Cashout
- Any costs to ESO are recovered through BSUoS

European Awareness System (EAS)

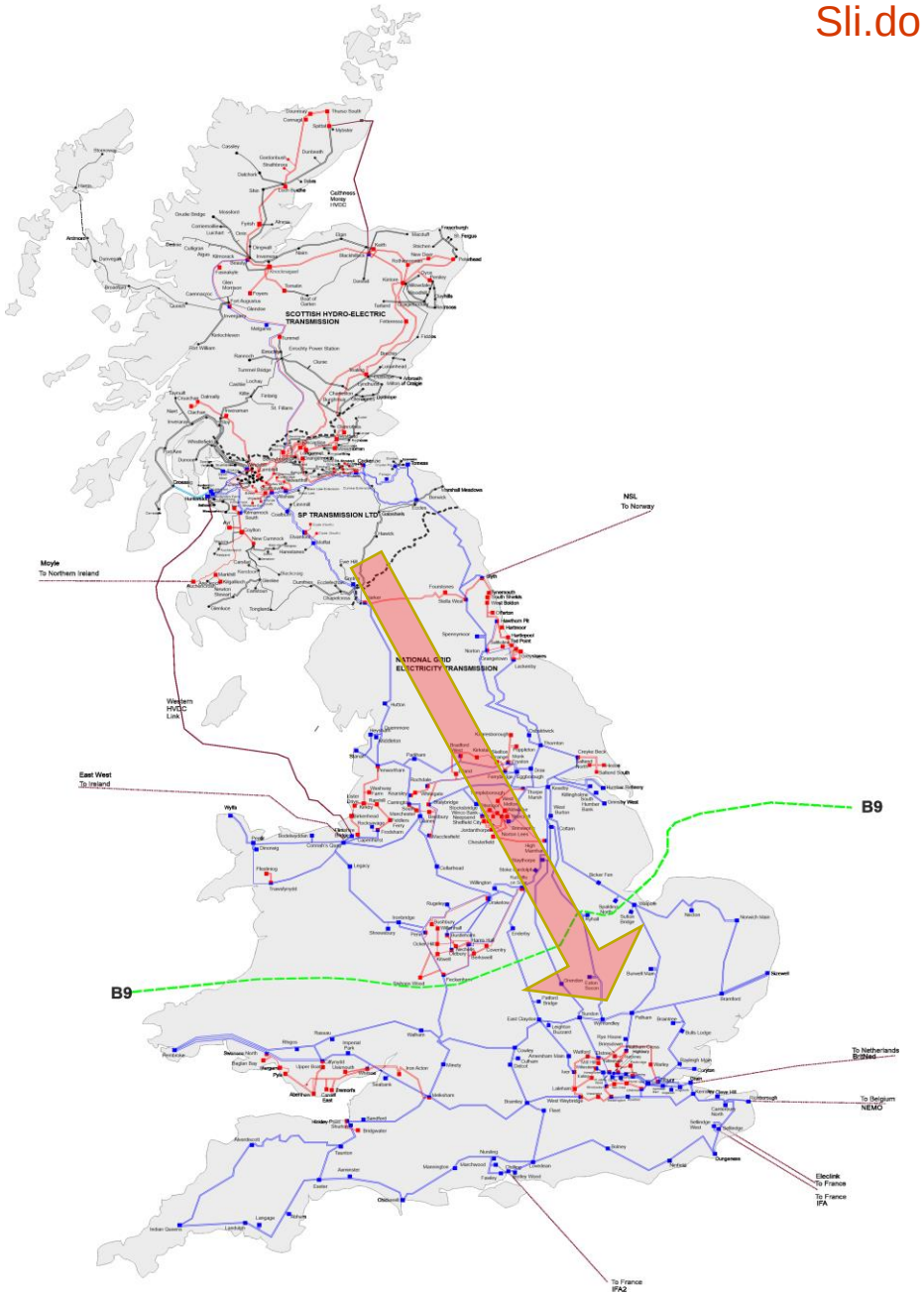
- The EAS platform is hosted and maintained by ENTSO-E;
- It allows System Operators (SOs) to exchange operational information in real-time;
- EAS gives SOs the ability of declaring their System State to other SOs.
- There are five levels of System State:
  - Normal
  - Alert
  - Emergency
  - Black-out
  - Restoration



Case Study: 25th January 2023

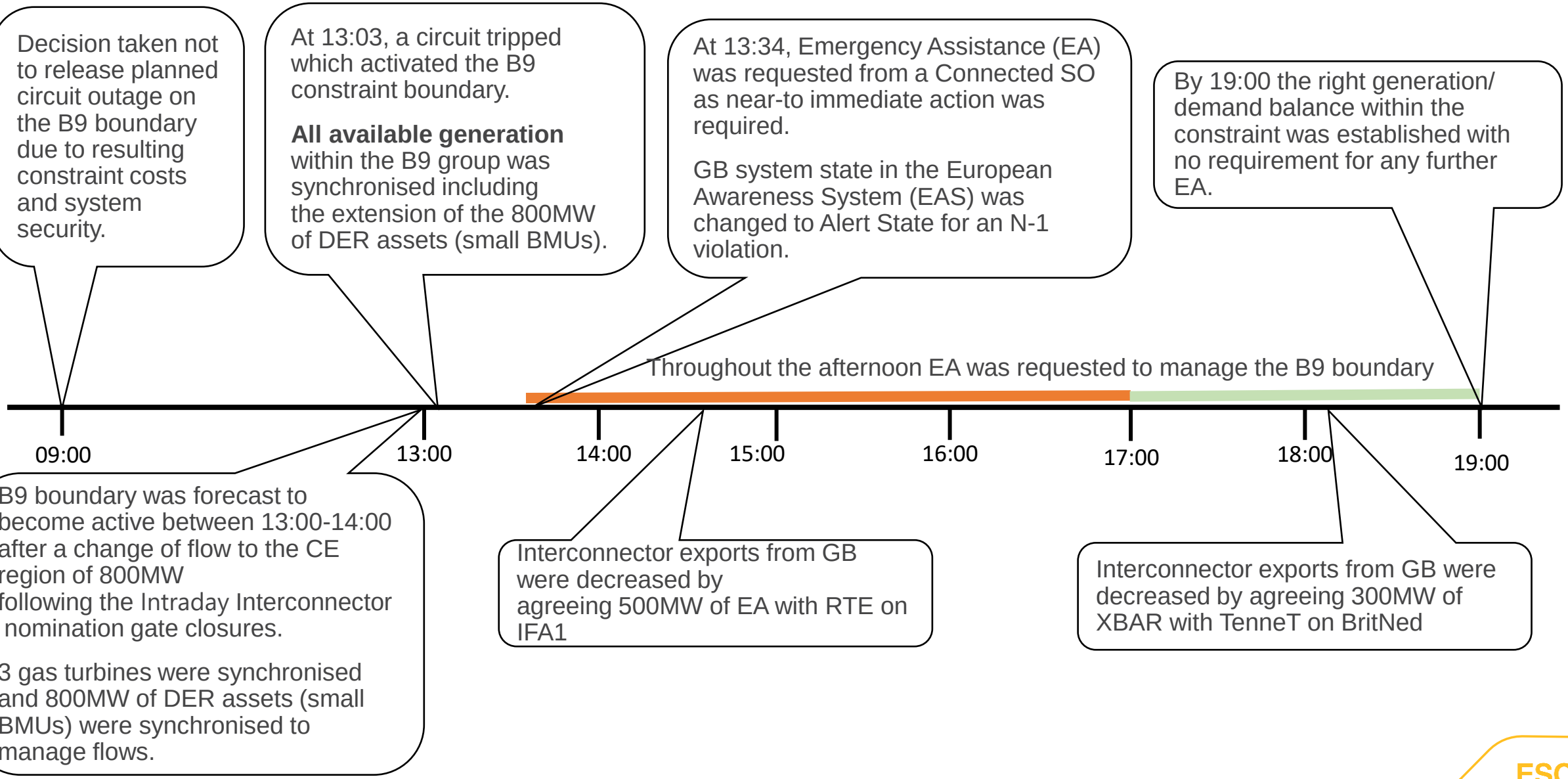
- On the 25th January 2023
  - High wind generation
  - Interconnectors were exporting
  - Resulting large north-south flows on the network
  - Margins were adequate

- The B9 boundary cuts through 5 double circuits and can become heavily loaded at times of:
  - High wind
  - Interconnector exports
  - High demands



Sli.do code #OTF

Case Study: 25th January 2023



Case Study: 25th January 2023

Reminder of the Capacity gates

Time	23:00	23:30	00:00	00:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00	04:30	05:00	05:30	06:00	06:30	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30	21:00	21:30	22:00	22:30
SP	47	48	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
IFA	18:45:00 D-1																04:45														12:45												16:45							
IFA2	18:45:00 D-1																								08:45						12:45											16:45							
BN	19:00:00 D-1																05:20								09:20						13:20																			
NEMO	21:10:00 D-1												02:55												08:55																	14:55							
ElecLink	15:10:00 D-1																														08:50																		

Your input appreciated….

There have been a number of questions over the last few weeks that seem to imply that we could have avoided using EA if the market had more information.

So:

- What additional support could you (the market) have provided on the 25th January to support the system?
- What information would you have needed?

Operational system requirements meant:

- Support required below B9 boundary
- Required in short timescales

- Email your responses to: **.box.NC.Customer@nationalgrideso.com**

Poll Questions (via Microsoft Teams)

slido

Audience Q&A Session

ⓘ Start presenting to display the audience questions on this slide.

Feedback

Please remember to use the feedback poll in sli.do after the event.

We welcome feedback to understand what we are doing well and how we can improve the event for the future.

If you have any questions after the event, please contact the following email address: box.NC.Customer@nationalgrideso.com

Appendix

Previously asked questions

Q: How is your real-time inertia monitoring project and work with GE / Reactive Power technologies going and when can you publish RT inertia levels. We've had confirmation the Mkt Outturn inertia levels u publish are incorrect so the mkt needs the RT data to compare / for assurance etc. thanks

A: As first-of-their-kind implementations for a network of our size, we are currently continuing to assess the output data from the two products to ensure that they are accurate ahead of introducing into our operational processes this summer. Our ability to publish data from these systems is restricted by our commercial contracts with the providers.

We have planned a Stability Deep Dive on 28th of March which will address aspects of this question in more detail. Communications on how to register for this event will be available in the coming weeks.

The methodology for estimating the market provided inertia has been outlined on the data portal. The published values are an estimate based on the data available at the time of publication. As part of recent analysis, several periods have been identified where we experienced a problem with the data feeding into the estimation. We are in the process of backfilling this data.

Advanced questions

Q: Why does the ESO Action/Constraint Cost Breakdown show zero cost or volume associated with reducing largest loss when the ESO restrictions on the NSL interconnector are still in effect?

A: The ESO Actions slides presented at the OTF are intended to provide an overview of costs during the week leading up to the OTF with a brief insight into the reasons for higher or lower cost days. The graphs show the output of an initial analysis before any settlement actions have taken place and should be considered indicative only. Data for some services obtained outside the Balancing Mechanism (BM), including the Net Transfer Capability Compensation Scheme, is simply not available in time for inclusion at the OTF.

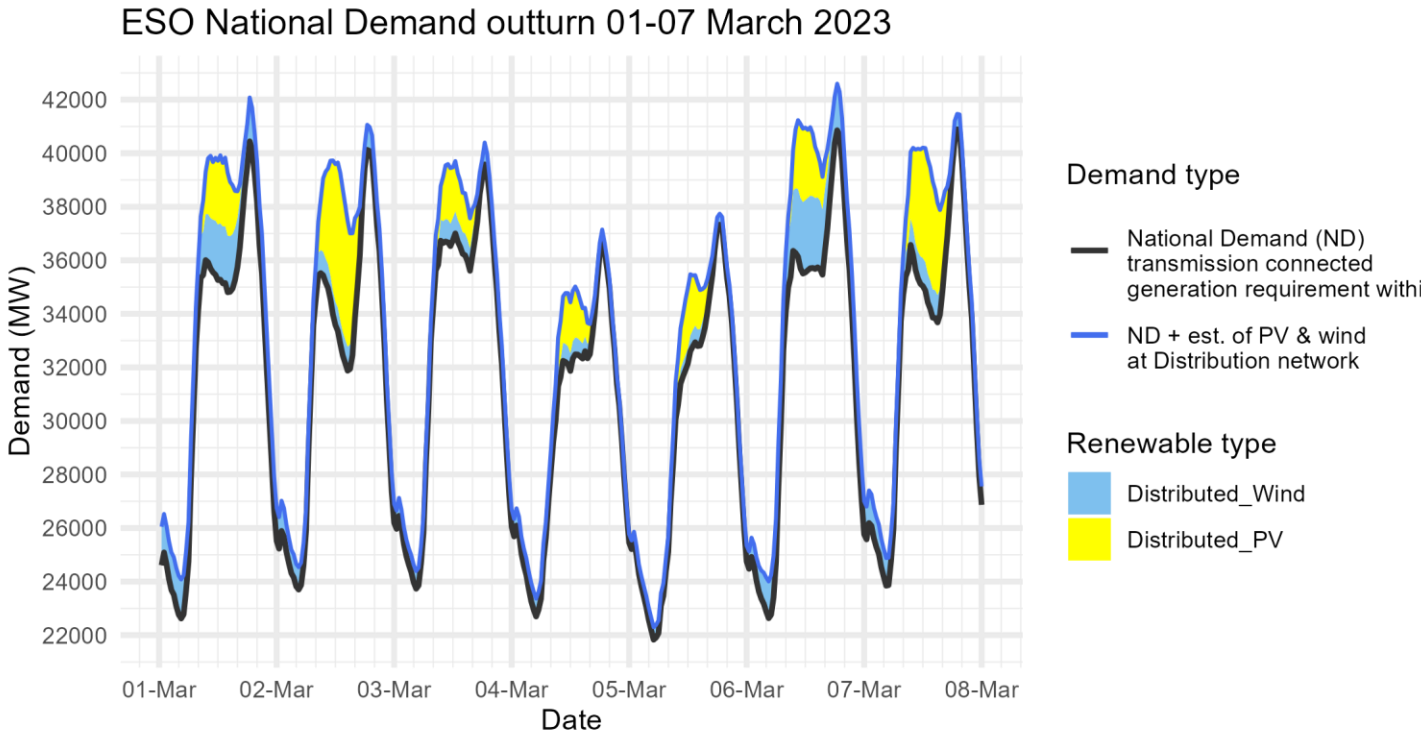
NTC costs and volumes data can now be found in the Monthly Balancing Services Summary (MBSS) published after 31 January 2023. This is available on the ESO data portal at this link: MBSS link.

Advanced questions we are still working on:

Q: On the ESO Data Portal a dataset called “Historic GB Generation Mix and Carbon Intensity” is published. Amongst the different generation types included is one labelled “OTHER”. Output from this “OTHER” category has been increasing over time since early 2018 and now averages more than 300MW with maximum monthly values as high as 1800MW.The ESO does provide a list of BMUs to Elexon identified as “OTHER” that is published on the Generation by Fuel Type tab of the Elexon Kinnect Insights Solution and there is a similar but not identical list published on BM Reports. However the limited number of BMUs in these lists does not explain the magnitude of generation output attributed to “OTHER”. Note that some of the BMUs in the “OTHER” list published on BM reports are even labelled as “dummy”.

Please can you provide more detail on the units that are included in the “OTHER” category of generation output published in your “Historic GB Generation Mix and Carbon Intensity” dataset and ideally a comprehensive list of these units.

Demand | Last week demand out-turn



		FORECAST (Wed 01 Mar)		OUTTURN	
Date	Forecasting Point	National Demand (GW)	Dist. wind (GW)	National Demand (GW)	Dist. wind (GW)
01 Mar	Evening Peak	40.1	1.5	40.4	1.6
02 Mar	Overnight Min	23.6	0.8	23.7	0.8
02 Mar	Evening Peak	40.2	0.7	40.1	0.9
03 Mar	Overnight Min	23.8	0.5	23.7	0.7
03 Mar	Evening Peak	39.4	0.5	39.6	0.7
04 Mar	Overnight Min	22.5	0.6	22.7	0.7
04 Mar	Evening Peak	36.2	0.5	36.8	0.4
05 Mar	Overnight Min	22.0	0.5	21.8	0.5
05 Mar	Evening Peak	37.6	0.6	37.3	0.4
06 Mar	Overnight Min	22.6	1.0	22.6	1.4
06 Mar	Evening Peak	40.7	1.5	40.9	1.7
07 Mar	Overnight Min	23.1	1.6	23.8	1.0
07 Mar	Evening Peak	41.1	1.4	40.9	0.6

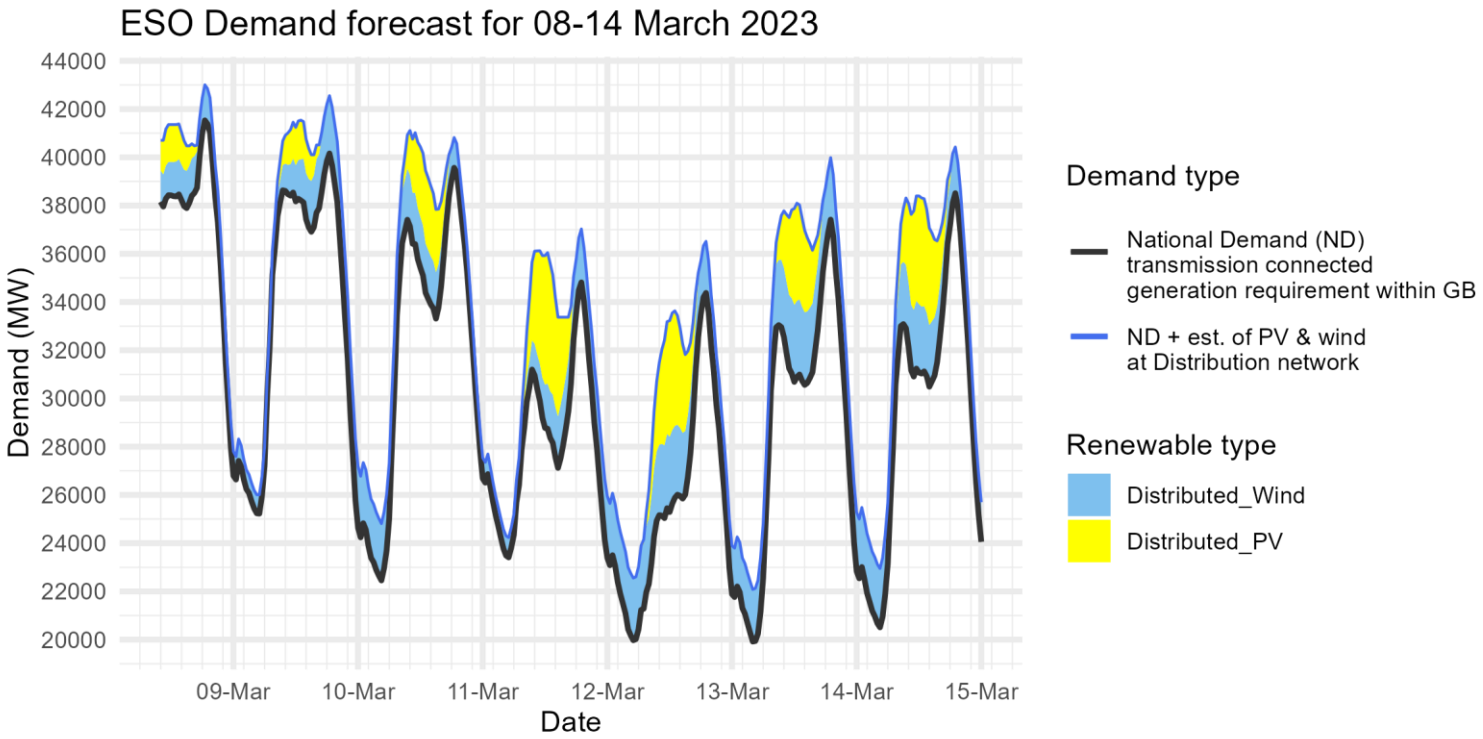
The black line (National Demand ND) is the measure of portion of total GB customer demand that is supplied by the transmission network.

ND values **do not include** export on interconnectors or pumping or station load

Blue line serves as a proxy for total GB customer demand. It includes demand supplied by the distributed wind and solar sources, but it does not include demand supplied by non-weather driven sources at the distributed network for which ESO has no real time data.

Historic out-turn data can be found on the ESO Data Portal in the following data sets: Historic Demand Data & Demand Data Update

Demand | Week Ahead



		FORECAST (Wed 08 Mar)	
Date	Forecasting Point	National Demand (GW)	Dist. wind (GW)
08 Mar 2023	Evening Peak	41.5	1.5
09 Mar 2023	Overnight Min	25.2	0.8
09 Mar 2023	Evening Peak	40.2	2.4
10 Mar 2023	Overnight Min	22.5	2.4
10 Mar 2023	Evening Peak	39.6	1.3
11 Mar 2023	Overnight Min	23.4	0.8
11 Mar 2023	Evening Peak	34.8	2.2
12 Mar 2023	Overnight Min	20.0	2.6
12 Mar 2023	Evening Peak	34.4	2.1
13 Mar 2023	Overnight Min	19.9	2.2
13 Mar 2023	Evening Peak	37.4	2.6
14 Mar 2023	Overnight Min	20.5	2.4
14 Mar 2023	Evening Peak	38.5	1.8

The black line (National Demand ND) is the measure of portion of total GB customer demand that is supplied by the transmission network.

ND values **do not include** export on interconnectors or pumping or station load

Blue line serves as a proxy for total GB customer demand. It includes demand supplied by the distributed wind and solar sources, but it does not include demand supplied by non-weather driven sources at the distributed network for which ESO has no real time data.

Historic out-turn data can be found on the ESO Data Portal in the following data sets: Historic Demand Data & Demand Data Update

Operational margins: week ahead

How to interpret this information

This slide sets out our view of operational margins for the next week. We are providing this information to help market participants identify when tighter periods are more likely to occur such that they can plan to respond accordingly.

The table provides our current view on the operational surplus based on expected levels of generation, wind and peak demand. This is based on information available to National Grid ESO as of 8 March and is subject to change. It represents a view of what the market is currently intending to provide before we take any actions. The interconnector flows are equal to those in the Base case presented in the Winter Outlook.

The indicative surplus is a measure of how tight we expect margins to be and the likelihood of the ESO needing to use its operational tools.

For higher surplus values, margins are expected to be adequate and there is a low likelihood of the ESO needing to use its tools. In such cases, we may even experience exports to Europe on the interconnectors over the peak depending on market prices.

For lower (and potentially negative) surplus values, then this indicates operational margins could be tight and that there is a higher likelihood of the ESO needing to use its tools, such as issuing margins notices. We expect there to be sufficient supply available to respond to these signals to meet demand.

Margins are adequate for the next week. This is based on our current assessment and is subject to change.

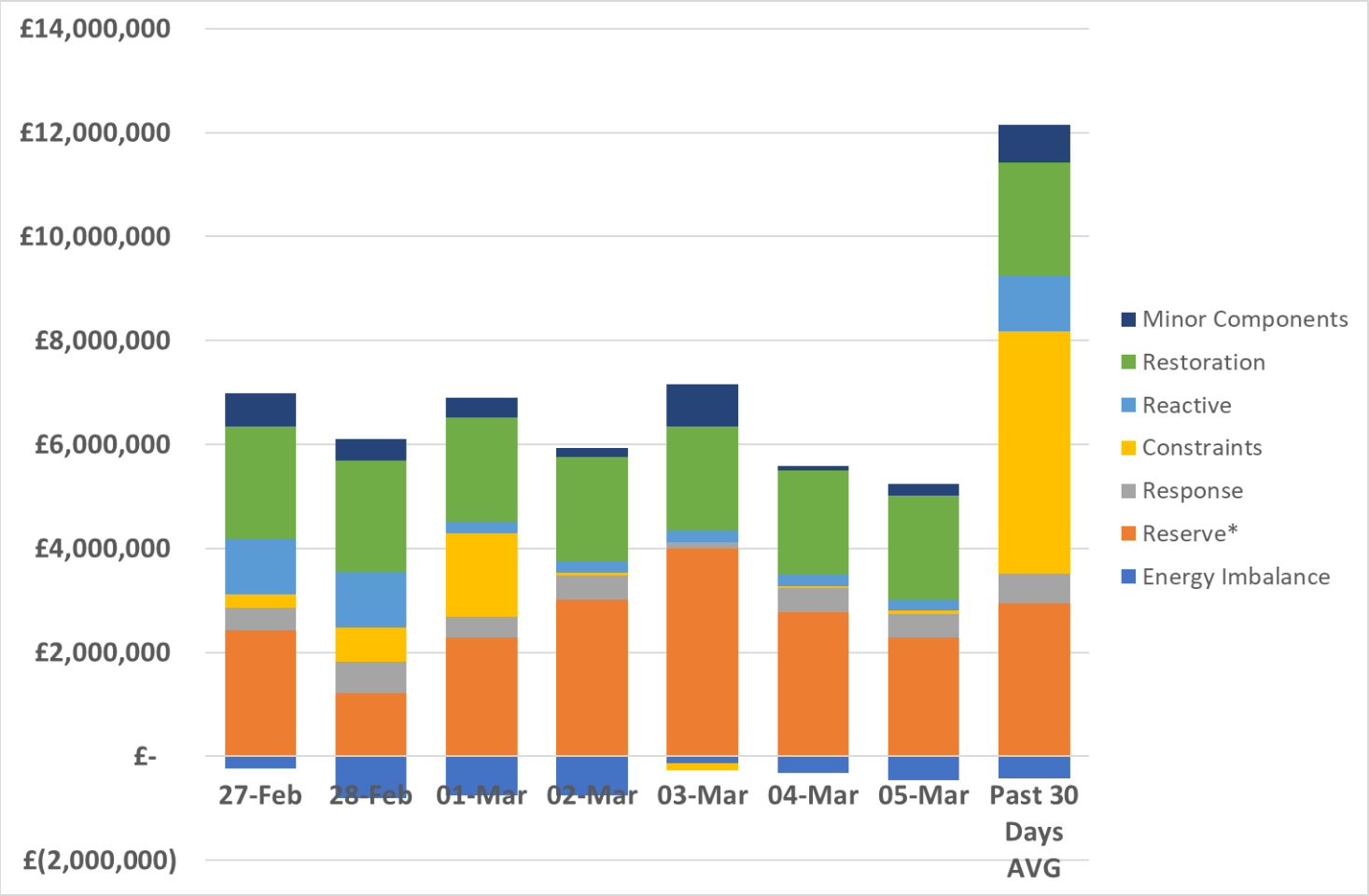
Day	Date	Notified Generation (MW)	Wind (MW)	IC Flows* (MW)	Peak demand (MW)	Indicative surplus (MW)
Thu	09/03/2023	41970	10870	4400	40010	12390
Fri	10/03/2023	41899	7430	4400	39090	10020
Sat	11/03/2023	39864	9450	4400	35660	13470
Sun	12/03/2023	40564	11420	4400	34850	16810
Mon	13/03/2023	42659	12750	4400	37940	16840
Tue	14/03/2023	42659	8760	4400	38400	12680
Wed	15/03/2023	42659	6770	4400	39580	9550

*Interconnector flow in line with the Winter Outlook Report Base Case but will ultimately flow to market price

Margins do not include NGESO enhanced or emergency actions (Outlined here: download (nationalgrideso.com))

Adequate when Indicative Surplus >= 1000 MW

ESO Actions | Category costs breakdown for the last week



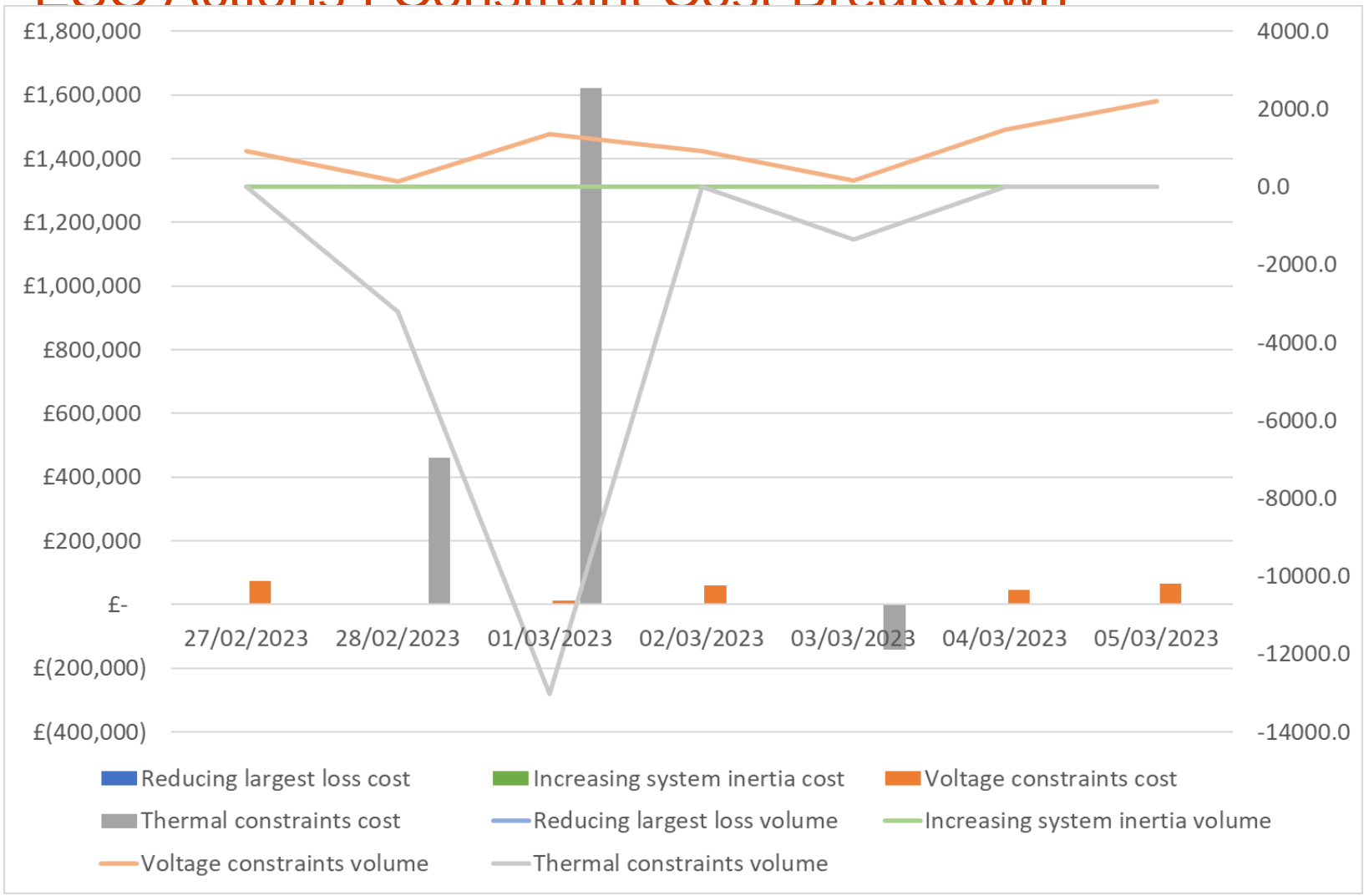
Date	Total (£m)
27/02/2023	6.8
28/02/2023	5.3
01/03/2023	6.1
02/03/2023	5.2
03/03/2023	6.9
04/03/2023	5.3
05/03/2023	4.8
Weekly Total	40.3
Previous Week	69.5

Reserve and Constraints costs were the key cost component throughout the week.

Please note that all the categories are presented and explained in the MBSS.

Data issue: Please note that due to a data issue on a few days over the last few months, the Minor Components line in Non-Constraint Costs is capturing some costs on those days which should be attributed to different categories. It has been identified that a significant portion of these costs should be allocated to the Operating Reserve Category. Although the categorisation of costs is not correct, we are confident that the total costs are correct in all months. We continue to investigate and will advise when we have a resolution.

ESO Actions | Constraint Cost Breakdown



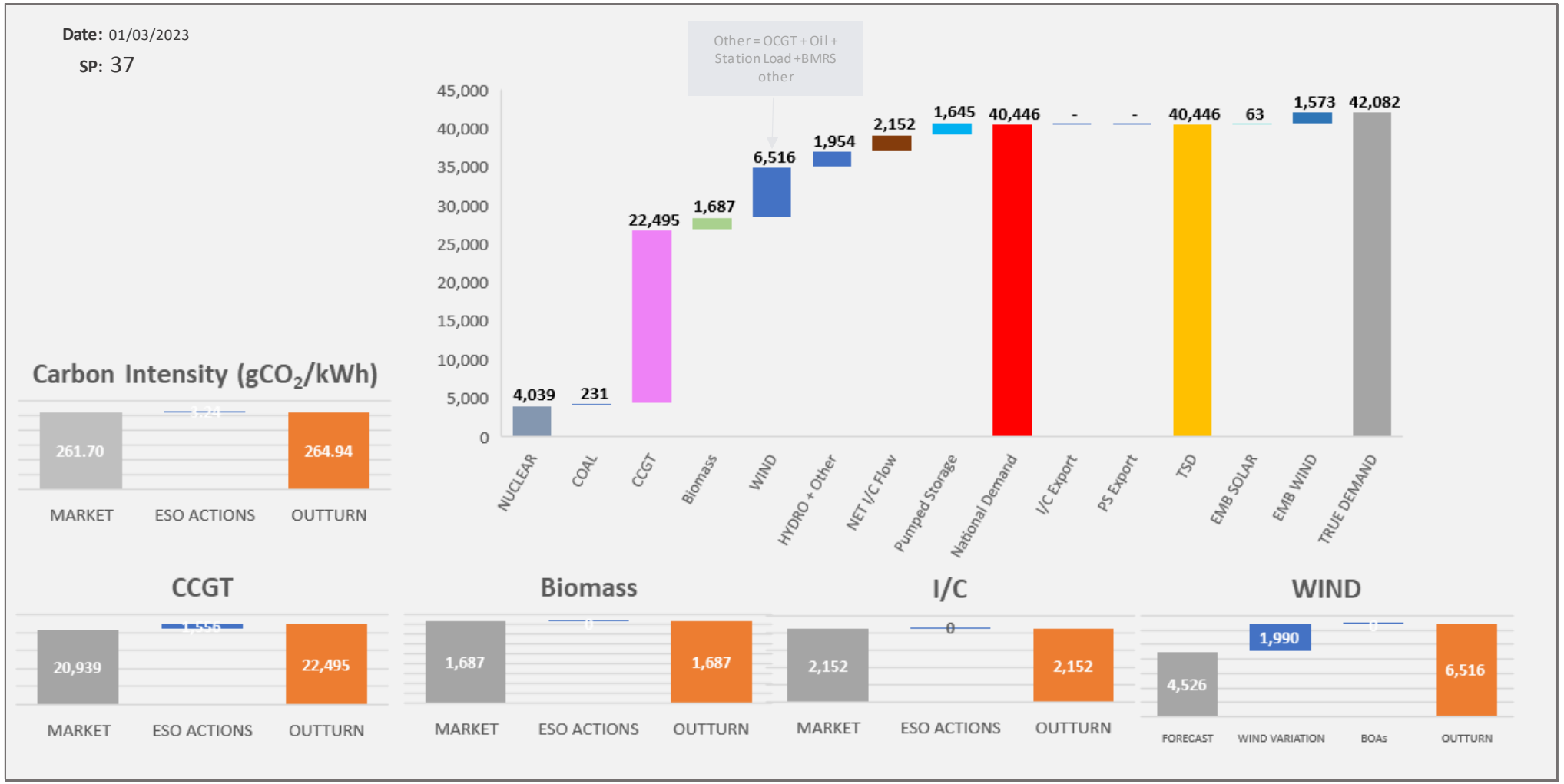
Thermal – network congestion
Actions required to manage Thermal Constraints Tuesday, Wednesday and Friday with highest costs on Wednesday.

Voltage
Intervention was required to manage voltage levels on Mon, Wed, Thu, Sat & Sun.

Managing largest loss for RoCoF
No intervention was required to manage largest loss.

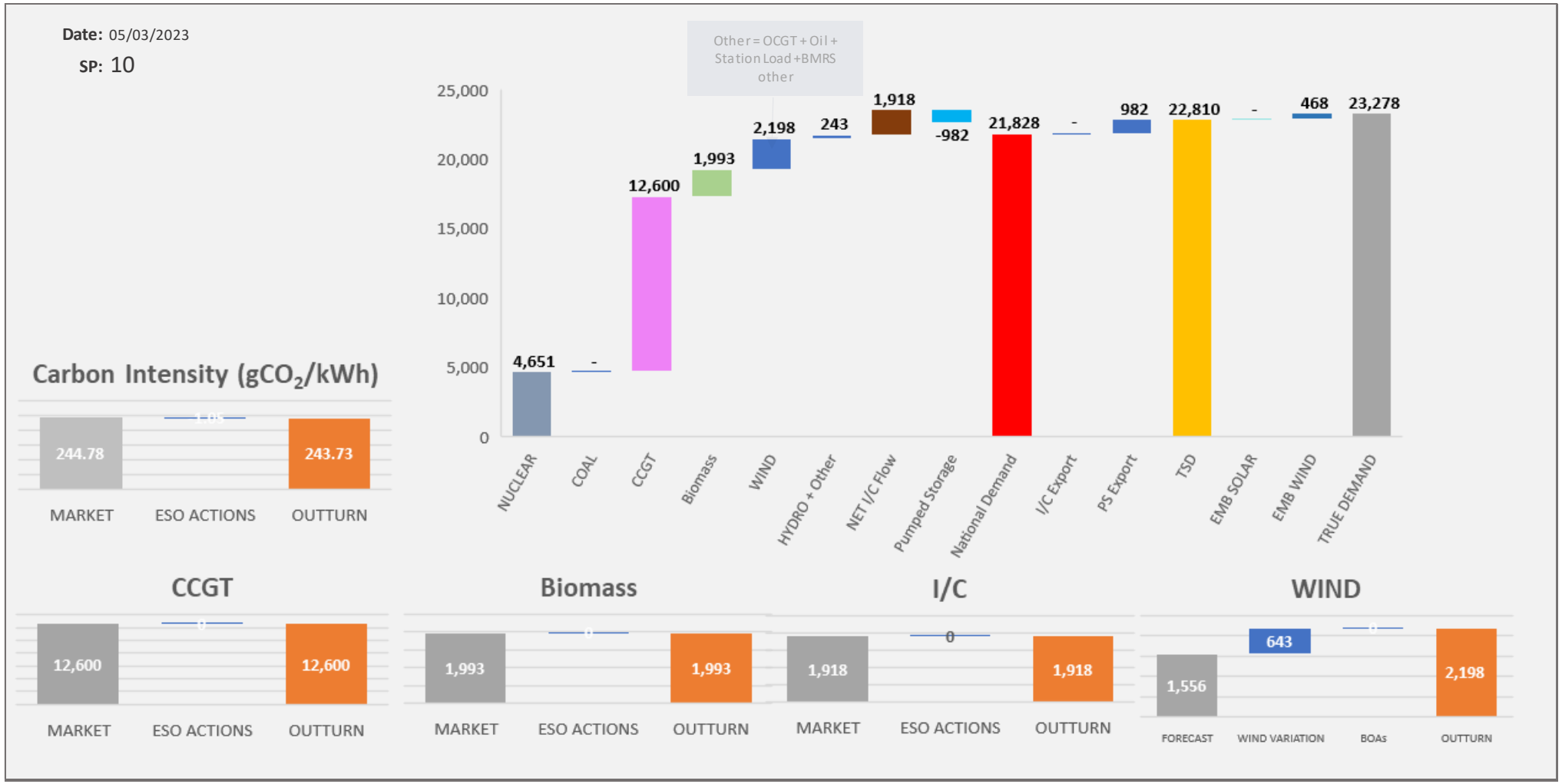
Increasing inertia
No intervention was required to manage system.

ESO Actions | Wednesday 1 March – Peak Demand – SP 37 spend ~£48k



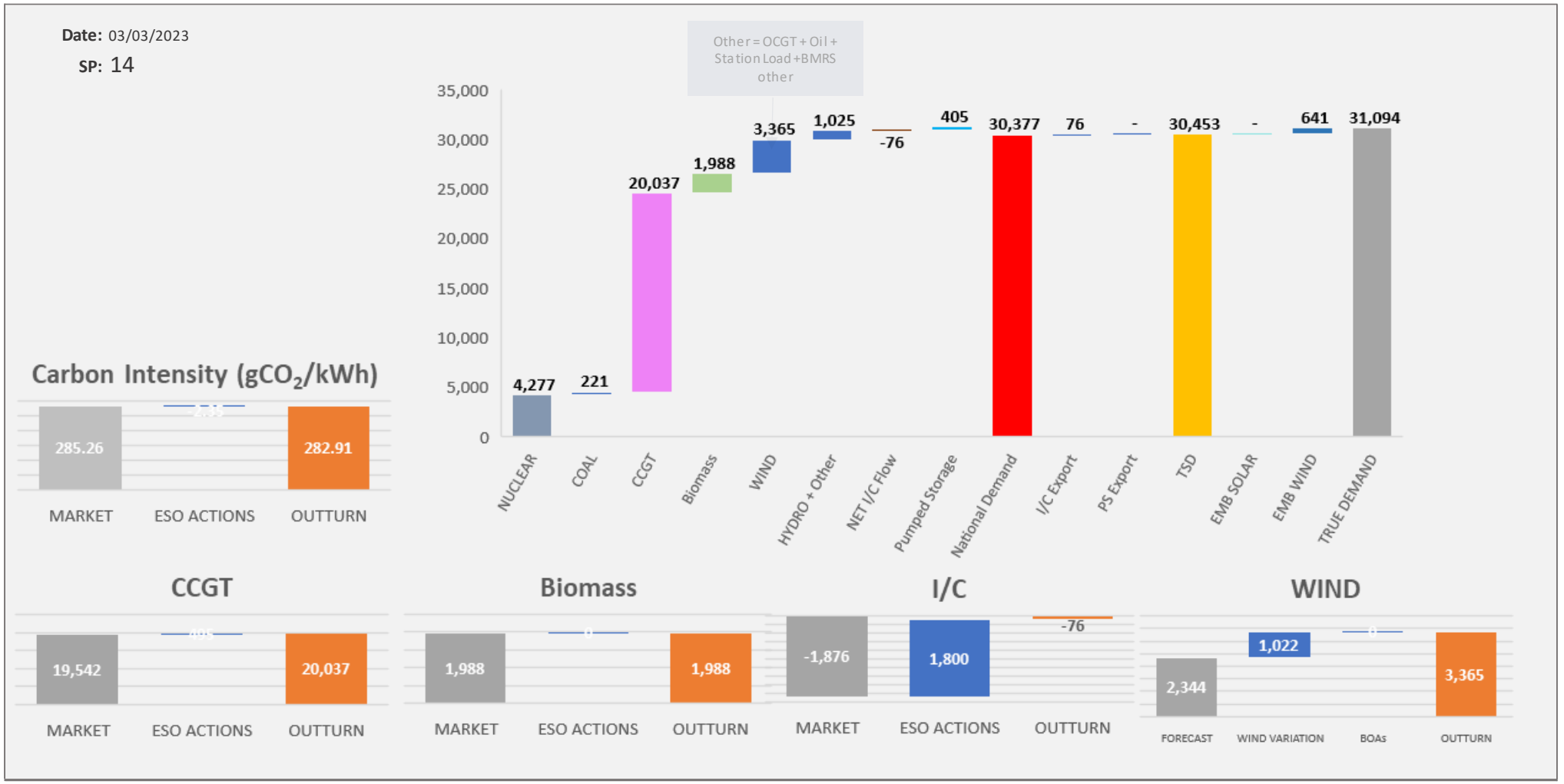
Carbon Intensity data on data portal: https://data.nationalgrideso.com/carbon-intensity1/carbon-intensity-of-balancing-actions

ESO Actions | Sunday 5 March – Minimum Demand – SP 10 Spend ~£34k



Carbon Intensity data on data portal: https://data.nationalgrideso.com/carbon-intensity1/carbon-intensity-of-balancing-actions

ESO Actions | Friday 3 March – Highest SP Spend ~£159k



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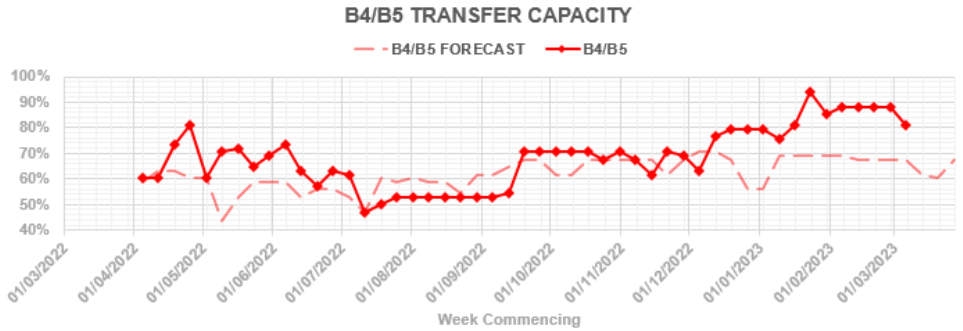
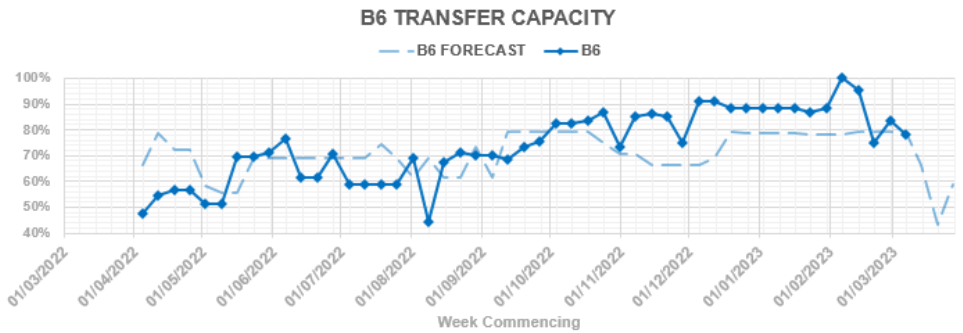
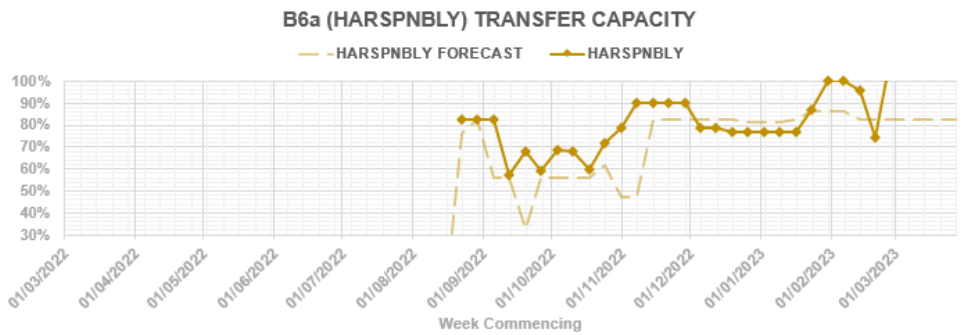
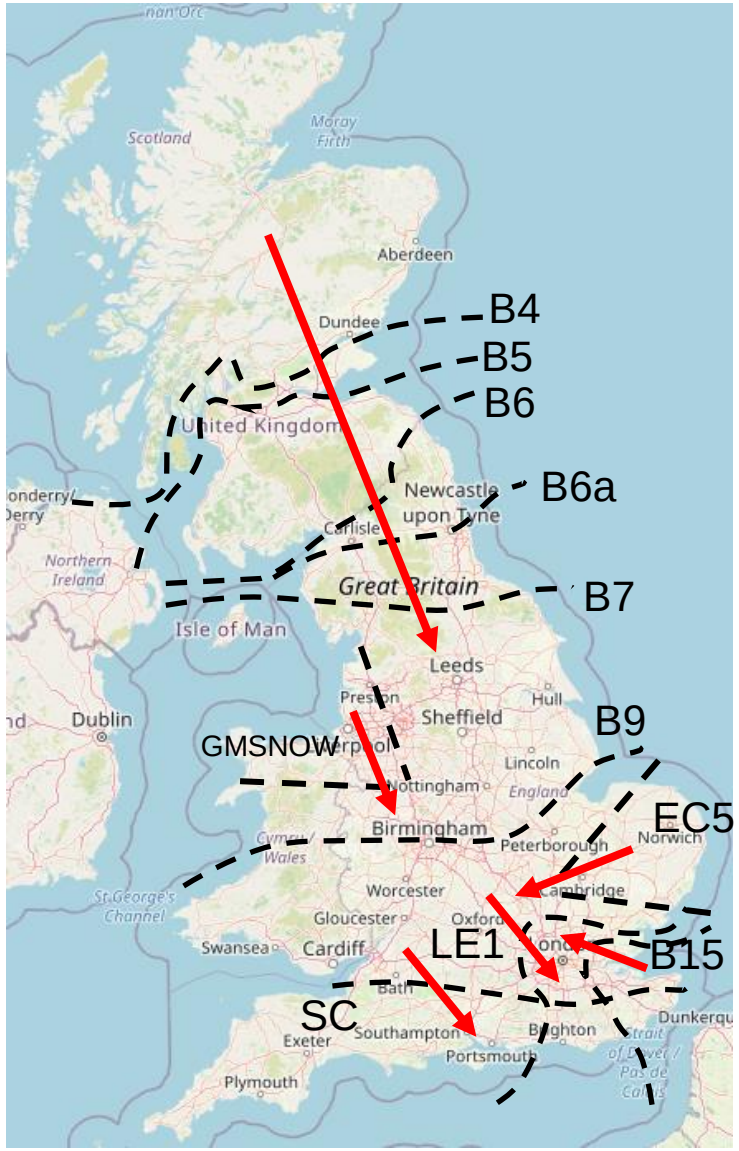
Transparency | Network Congestion







Boundary	Max. Capacity (MW)
B4/B5	3000
B6	5700
B6a	5200
B7	7000
GMSNOW	3400
B9	10500
EC5	5000
LE1	8500
B15	7500
SC	7300



Day ahead flows and limits, and the 24 month constraint limit forecast are published on the ESO Data Portal:
https://data.nationalgrideso.com/data-groups/constraint-management

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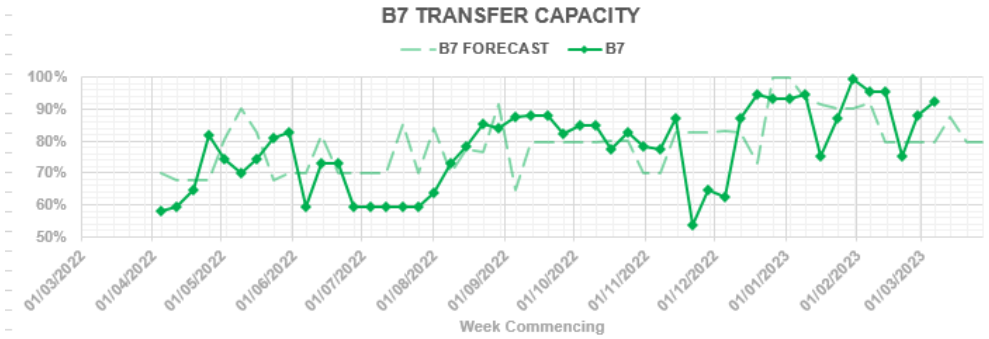

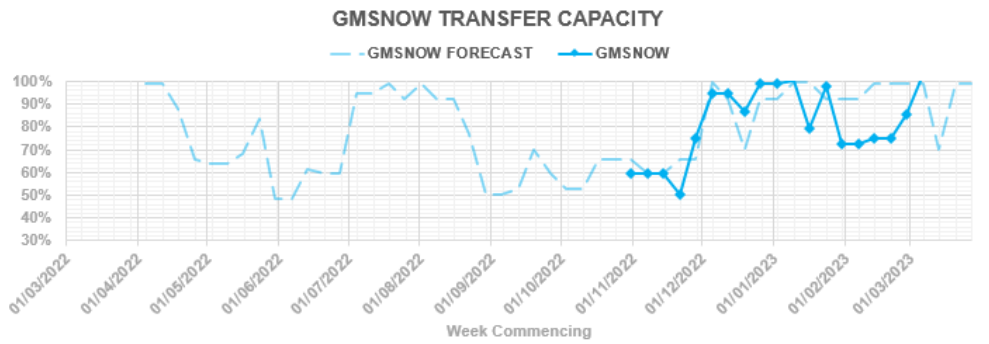

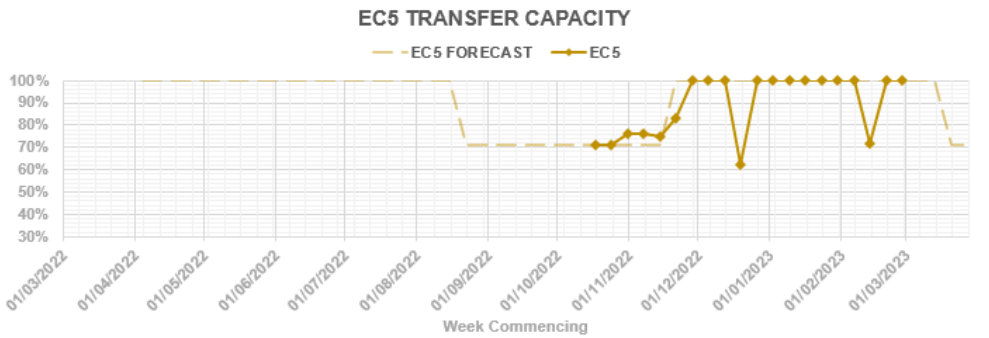

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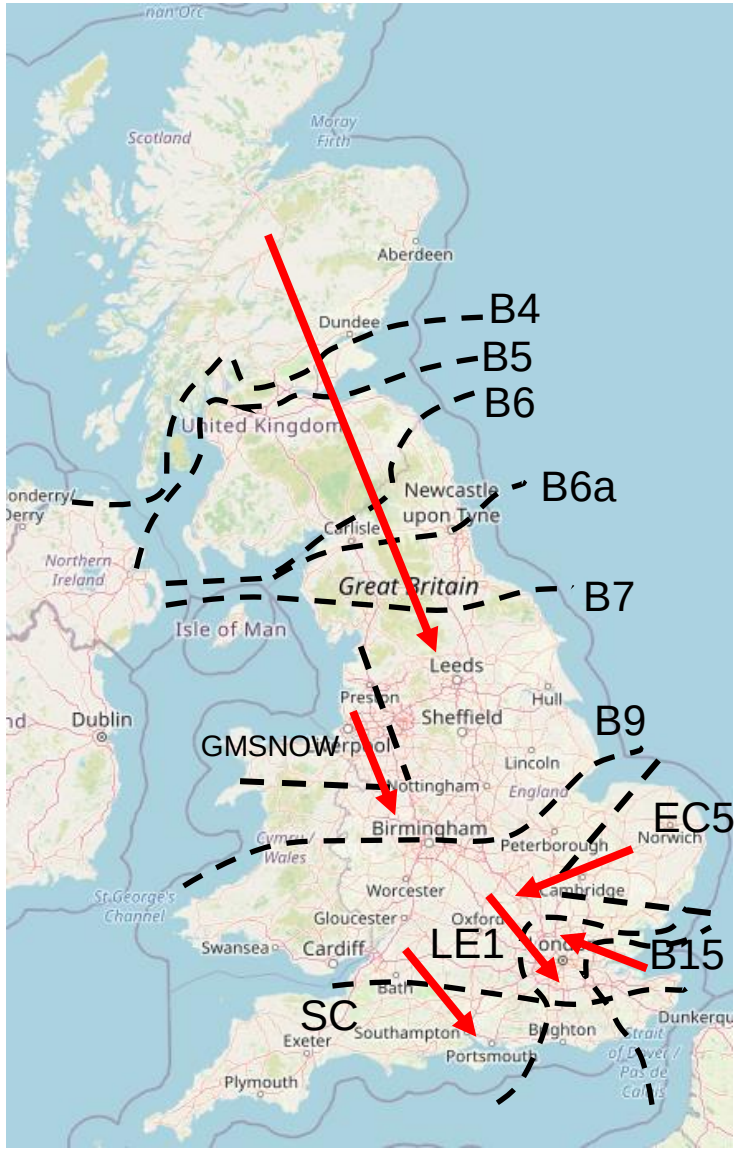

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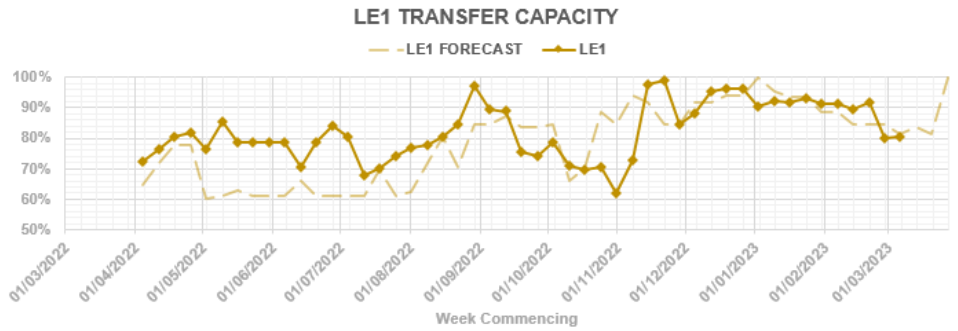

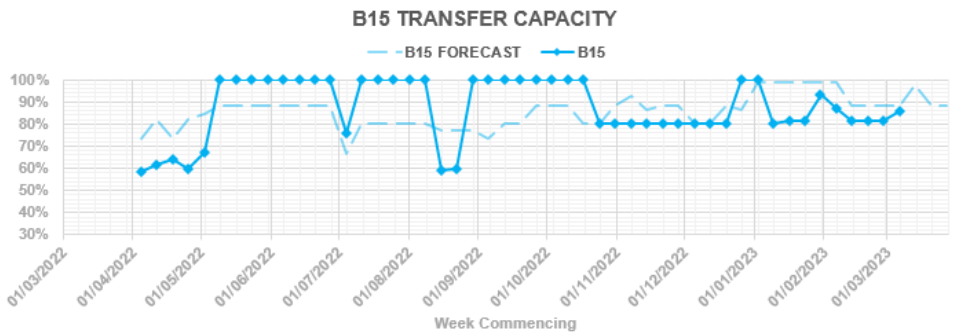

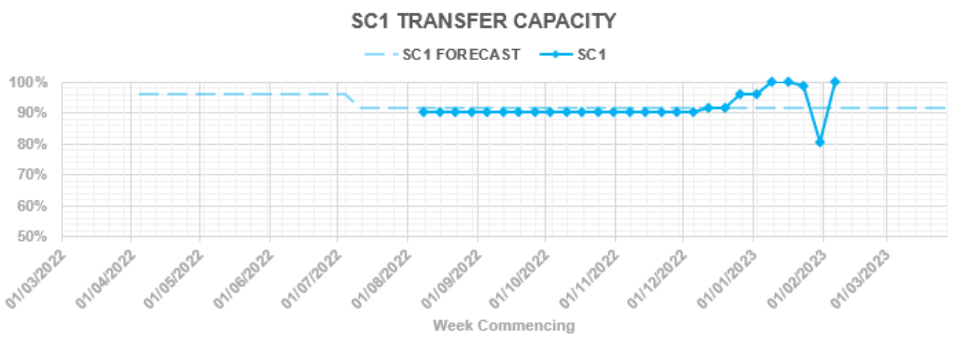

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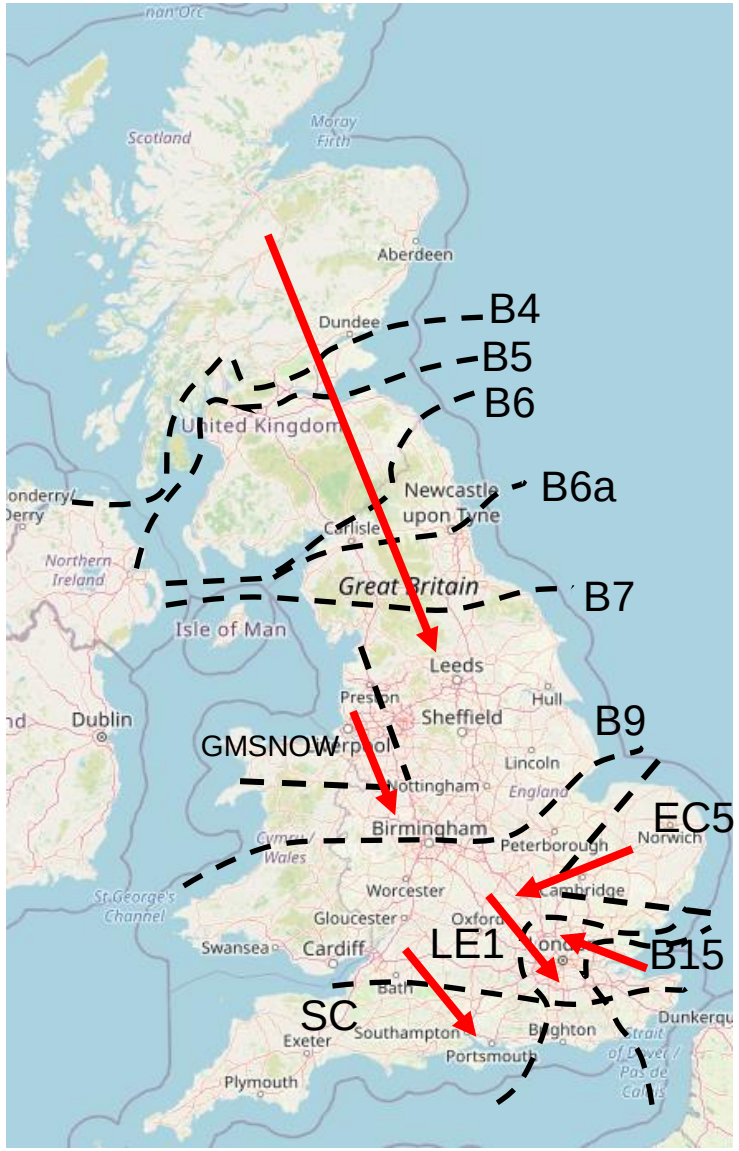

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