Future Power Markets

Stakeholder Engagement

Industry Workshop: 19th February 2025

This presentation provides an update on the Future Power Markets Programmes.

Achievable – Valuable – "Simple"

Future Power Markets - Industry Outreach

Why Are We Here?

Inform

We are here to provide information about the ongoing programmes of work in the Future Power Markets space and the impact on the market participant community. We will provide a view of the programmes' drivers, functional details, structure, timelines, and stakeholder engagement.

Discuss

We will discuss the changes and how this impacts you and your portfolio. We will discuss the functional, technical, and formal arrangement changes, stakeholder engagement, and programme management updates. We are happy to field all questions – and we may not be able to answer all of them today.

Listen

We are here to listen. What are your thoughts on the FPM programmes, the functional, technical, and regulatory details and the impacts to your business? What questions do you need answers to? What clarity do you need?

Ask

We will ask for your participation throughout – we are better together.

FPM - Industry Workshop

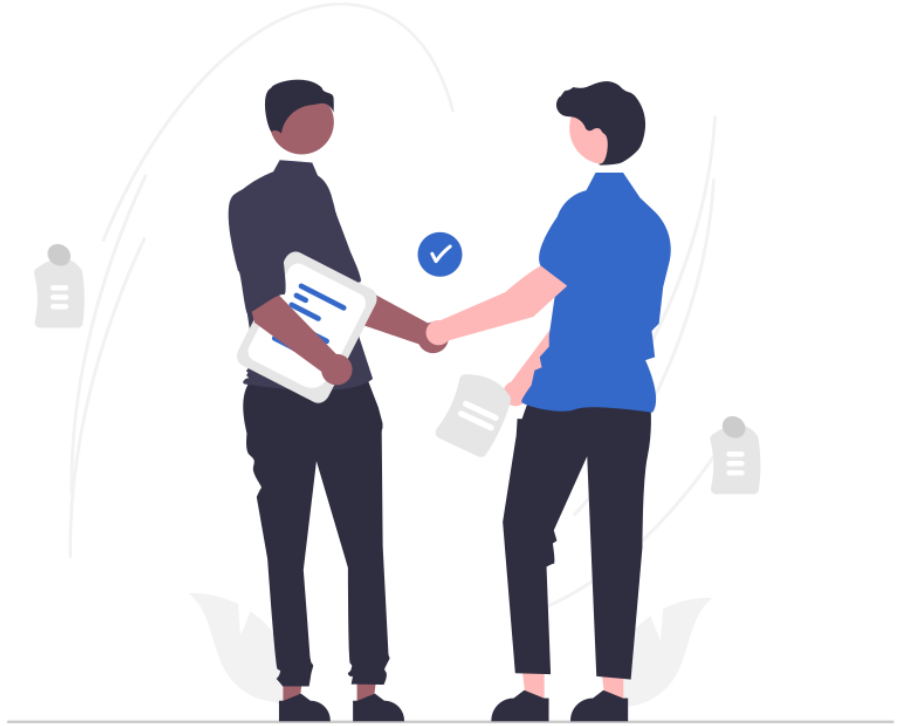
Setting Expectations

Meeting Rules

1. **Engage**: actively listen and ask questions. This session is for you.

2. **Show Courtesy**: allow everyone the time and space to participate in the discussion. Don't talk over another speaker.

3. **Scope Discipline**: maintain focus on FPM.



FPM: Industry Workshop (19th of February 2025)

Agenda for today's workshop

Time	Topic
10:30 - 10:35	Introduction & Housekeeping
10:35 – 11:05	FASS Programme Status update and brief overview of the DS3 System Services Tariffs to FASS ('The Gap') Consultation Paper
11:05 – 11:30	Strategic Markets Programme Status update and Core Capacity Calculation Region presentation
11:30 – 12:15	Scheduling & Dispatch Programme Status and Market Participant update

Future Arrangement System Services – Status Update

FASS: Programme Summary Status

As planned, no issues
Minor - moderate concern
Significant issue / concern
Improving
Steady
Worsening

FASS — Summary Status

Overall Status	↓	The Future Arrangements for System Services (FASS) Programme continues at pace; however, programme status has moved to red reflecting vendor mobilisation delays impacting critical path since mid-January. The schedule for business activities remains challenging due to overlapping design activities.
Schedule	↓	Programme schedule is red reflecting delays to vendor mobilisation. Additionally, recent delays in review timelines and decisions are increasing risk of impact to schedule which will be assessed as part of PIR V3.0.
Resourcing	→	Resourcing status green, following notice of approval of programme funding. TSO programme teams are staffed and engaged to continue work at pace.
Finances	→	Formal funding approval letter received from the RAs December 2024.

Workstream Updates

Detailed Market Design	Delays in confirmation of core DASSA design components; Overlapping consultation periods potentially required to avoid impact to programme critical path. Schedule to be reviewed as part of PIR. 3.0.
Detailed Operations Design	VFM (reserves) SEMC decision expected in February. TSOs' analysis of non-reserve services' product design, locational methodology and volume forecasting ongoing—RA-TSO workshop scheduled for 19/02 to reach 'minded to position'.
IT Systems Design	Vendor mobilisation delays impacting commencement of onboarding—TSOs working to mitigate impact and where possible, have started initial vendor engagement activities.
Regulation & Licencing	TSOs' proposed list of licence modifications and suggested approach shared with RAs 06/12, closing milestones FASS.08 and FASS.25. TSOs currently awaiting RA feedback and next steps. Grid Code review underway.
SS Code Development	SS Code working group session held 23/01. Publication of the System Services Code Plain English Version First Draft & Cover Note published to TSOs' websites on 31/01. Dependency on timely SEMC decisions to maintain momentum.

Status of Business Design Papers

As part of the FASS Programme there are a number of consultations and publications in progress. Phased Implementation Roadmap (PIR) V2.0 was published on the 11th of October following agreement with the RAs.

Open Design Activities	Status	Update
DS3 SS Tariffs to FASS (Transition Period)	Consultation Paper Published	The DS3 SS Tariffs to FASS "The Gap" Consultation Paper published on 11/02; a 6-week consultation period is underway ending 25/03.
System Services Charge	Recommendations Paper with RAs	System Services Charge Recommendations paper finalised and shared with RAs 29/11. SEMC Decision now expected by end of February, one month delayed against PIR schedule.
Volume Forecasting Methodology (Reserves)	Recommendations Paper with RAs	Submission of the DASSA Volume forecasting Methodology to the RAs on 30/01, with RA TSO workshop held early February. SEMC decision expected in February per PIR schedule.
Residual Availability Determination Mechanism (FAM Alternative)	Draft Consultation Paper with RAs	Draft consultation paper on the DASSA RAD mechanism ('Residual Availability Determination', i.e. the FAM Alternative), shared to RAs on 29/01. Pending RA feedback prior to publication to industry.
Parameters & Scalars	Work in progress (TSOs)	Workstream analysis in progress. Target to publish consultation paper mid-March, reflecting minor delay against baseline PIR schedule.
Non – Reserves Services	Work in progress (TSOs)	Early design activities underway with RA TSO workshop scheduled for 19/02 where TSOs will present design considerations. Target to publish consultation April 2025.

Phased Implementation Roadmap Milestones

Milestone #	Milestone Description	Milestone Dependencies	Milestone Owner	Milestone Target Date	Status
FASS.12	SEMC Decision on FASS Daily Auction/Procurement Design	FASS.11	SEMC	July 2024	Complete
FASS.13	Publish Annual Layered Procurement Assessment Recommendations Paper 2024	-	TSOs	July 2024	Complete
FASS.14	Publish FASS Daily Auction Product Review and Locational Methodology Recommendation Paper	FASS.09	TSOs	August 2024	Complete
FASS.15	Commence Grid Code Review	FASS.14	TSOs	September 2024	Complete
FASS.16	Publish Phased Implementation Roadmap 2	FASS.04	TSOs	September 2024	Complete
FASS.17	SEMC Decision on FASS Daily Auction Product Review and Locational Methodology	FASS.14	SEMC	September 2024	Complete
FASS.18	SEMC Decision on Annual Layered Procurement Assessment 2024 (As required)	FASS.13	SEMC	September 2024	Descoped
FASS.19	Publish System Services Charge Recommendations Paper	-	TSOs	November 2024	Complete
FASS.20	Publish High Level Readiness Approach	FASS.12	TSOs	November 2024	Complete
FASS.21	Publish Volume Forecasting Methodology Recommendation Paper including Volumes Requirements Reporting	FASS.17	TSOs	December 2024	Complete
FASS.22	Draft Plain English Version of SS Code	FASS.07 FASS.12 FASS.17	TSOs	January 2025	Complete
FASS.23	Commence Analysis of options for Non-Reserve Procurement, including LPF	-	TSOs	October 2024	Complete
FASS.24	Mobilise Real Time Security Arrangements workstream (FAM Alternatives)	FASS.12	RAs & TSOs	October 2024	Complete
FASS.25	Share suggested approach to TSO licence modifications	-	TSOs	November 2024	Complete
FASS.26	RAs agreement on Analysis of options for Non-Reserve Procurement, including LPF	FASS.23	RAs	January 2025	Delayed
FASS.27	SEMC Decision on System Services Charge	FASS.19	SEMC	January 2025	Delayed
FASS.28	Publish Parameters and Scalars Consultation Paper	FASS.12 FASS.17	TSOs	February 2025	At risk
FASS.29	SEMC Decision on DS3 SS Tariffs to DASSA	FASS.12	SEMC	January 2025	Delayed
FASS.30	SEMC Decision on Volume Forecasting Methodology including Volumes Requirements Reporting	FASS.21	SEMC	February 2025	On Track
FASS.31	Publish Phased Implementation Roadmap V3.0	-	TSOs	March 2025	In Progress
FASS.32	Commence DASSA System Implementation**	-	TSOs	March 2025	At Risk

DS3 SS Tariffs to FASS ('The Gap') Consultation

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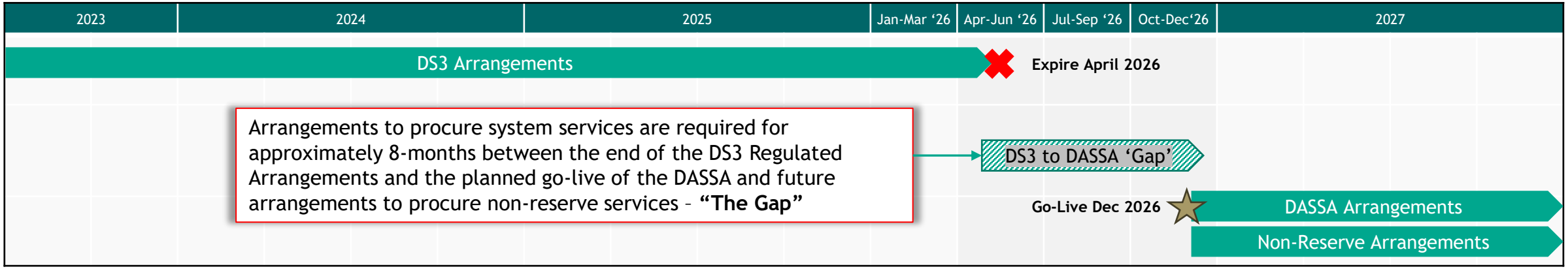


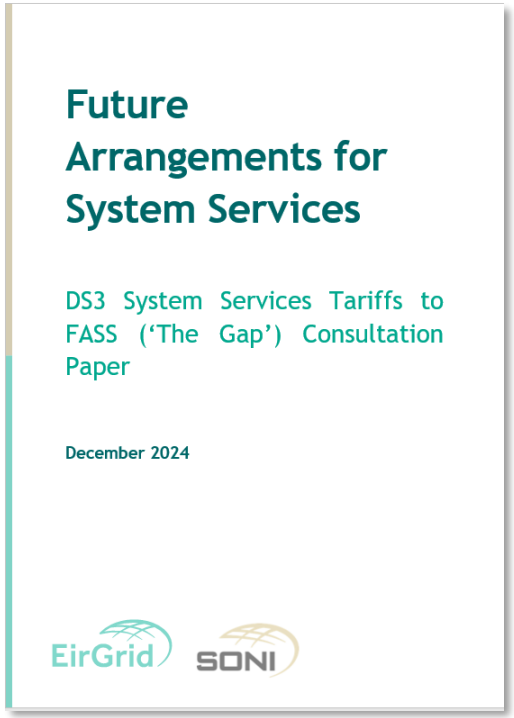
In the Consultation, the TSOs set out four shortlisted proposals (incl. TSOs recommendation option) to address 'the Gap'…

1. **Layered Procurement Framework:** Introducing LPF arrangements to procure system services via a monthly or quarterly auction.
2. **Market-based Volume Capped Contracts (without an availability requirement):** Establishing fixed-term contracts with no availability obligations.
3. **Market-based Volume Capped Contracts (with an availability requirement):** Establishing fixed-term contracts with availability obligations.
4. **Extension of the DS3 Regulated Arrangements:** to extend tariffs on all products under DS3 Regulated Arrangements.

…and analyse them against a set of criteria, with the key factors listed below

Option	Impact to DASSA Go Live	Estimated Time to Implement	Additional IT Changes
1	Yes	c. 21 Months	Yes
2	Yes	c. 26 Months	Yes
3	Yes	c. 28 Months	Yes
4	No	c. 3 Months	No

DS3 SS Tariffs to FASS ('The Gap') Consultation



Consultation Question: Do you agree with the TSOs' proposal below?

- ✓ To extend the DS3 System Services Regulated Arrangements to cover the gap between the DS3 contracts' expiry date (30th April 2026) and the Go Live of the DASSA Arrangements and the future arrangements for the procurement of non-reserve services (planned for December 2026).
- ✓ The termination of the DS3 Regulated Arrangements would be triggered by the earlier of (i) a long stop date or (ii) the go-live date of new procurement arrangements for system services (FASS go-live), which would be triggered by certain pre-defined events applicable to each individual service, for both reserve and non-reserve services.
- ✓ The TSOs will continue to submit quarterly expenditure reports to the RAs on the DS3 Regulated Arrangements to monitor ongoing expenditure. Further tariff reviews may be required prior to the commencement of the future arrangements for system services.

Next Steps

- Consultation published on 11/02. Responses to the question set out in this paper should be submitted through either the EirGrid or SONI consultation portals by 5pm, Tuesday 25th March.
- An information session will be facilitated through a dedicated session in the coming weeks.
- TSOs to begin drafting Recommendations Paper—SEMC Decision expected in April 2025.

Thank You

Questions can be submitted to

FASS@Eirgrid.com or
FASSProgramme@soni.ltd.uk

Next Steps:

- The TSOs will host an information session on the 'DS3 Tariffs to FASS' Consultation Paper on 06th March.
- The TSOs will publish the DASSA RAD mechanism ('Residual Availability Determination', i.e. the FAM Alternative) Consultation Paper following RA feedback.
- SEMC Decisions expected on System Services Charge and Volume Forecasting Methodology papers, by end of February.
- Next code Working Group scheduled for 12th March to go through Agreed Procedures.

Strategic Markets Programme: Status Update

As planned, no issues
Minor - moderate concern
Significant issue / concern
Improving
Steady
Worsening

Strategic Markets Programme - Status

SMP

Summary Status		
Overall Status	↑	Overall programme status is Amber. Baseline plan approved with programme board and shared with RAs pending feedback. Closure on majority of high level requirements by end of December and continued progress on detailed requirements have allowed the programme status to continue to improve.
Schedule	→	Programme delivery continues to progress, with detailed requirements under development from business and operational teams, progressing in line with plans to facilitate timely vendor engagement.
Resourcing	↑	Programme resourcing is ongoing to enable delivery within the programme timelines
Finances	→	Programme funding for first phase of programme has been approved by Regulatory Authorities.

Key Messages

Key Activities For Action

- Engagement with RAs on TCM (Terms, Conditions, Methodologies).
- Ongoing vendor engagement to finalise system development planning
- Scope change items to be progressed through change process

Positive Developments

- Baseline plan approved by SMP programme board
- All workstreams now activated
- Increased alignment with Joint RTE Programme Governance forums

High-level SMP Programme impact on Market Participants

The SMP programme will have differing impacts to Market Participants operational and system processes depending on the individual deliverable.

PROGRAMME SCOPE

EU REINTEGRATION

a) SEM joining Single Day Ahead Coupling & Single Intra-Day Coupling (SDAC & SIDC):

- Increased number of auctions over a wider timeframe throughout the trading day
- Increased operation and monitoring actions required by TSO including

b) SEM joining Coreso Regional Control Centre (RCC):

- Management of defence and restoration plan in line with Coreso requirements

c) FTRs introduced for SEM-FR Border:

- Optional participation in FTR auctions on the SEM-FR border

Focus for today's presentation

d) SEM joining Core CCR (Capacity Calculation Region):

- Change to current market and system operations arrangements to manage capacity calculations across all timeframes for Core.
- IT tools and hardware needed by TSO to manage inputs, submissions, and validation in real time to optimise cross-zonal capacities

EU REINTEGRATION & BALANCING MARKET REFORM

e) Multi-NEMO Arrangements in Ex-Ante and Balancing Markets

- Potential to trade with other NEMOs within the SEM

f) Integration with EU Balancing Platform MARI

- Expected increased monitoring and validation from TSOs once MARI platform is implemented

BALANCING MARKET REFORM

g) Implementation of Dispatchable Consumption

- Impact on current teams operations, once Dispatchable Consumption unit type is implemented in registration, market and energy management systems

h) Demand Response

- Updates to treatment of demand response in the SEM will require changes to registration and operational processes

i) Implementation of LDES/ enduring ESPS

- Too premature to properly assess impact of this

l) Enduring Non-Priority Dispatch Renewable Generators

- Low operational impact on current team operations

POST-BREXIT TRADING ARRANGEMENTS

m) Implementation of MRLVC

- Impact on TSO and SEMO systems yet to be identified - changes likely to be at the central systems level
- Trading arrangement to be decided

Key:

- Operational Impact on Market Participant
- Operational impact on Market Participant - optional
- Operational Impact on TSOs only

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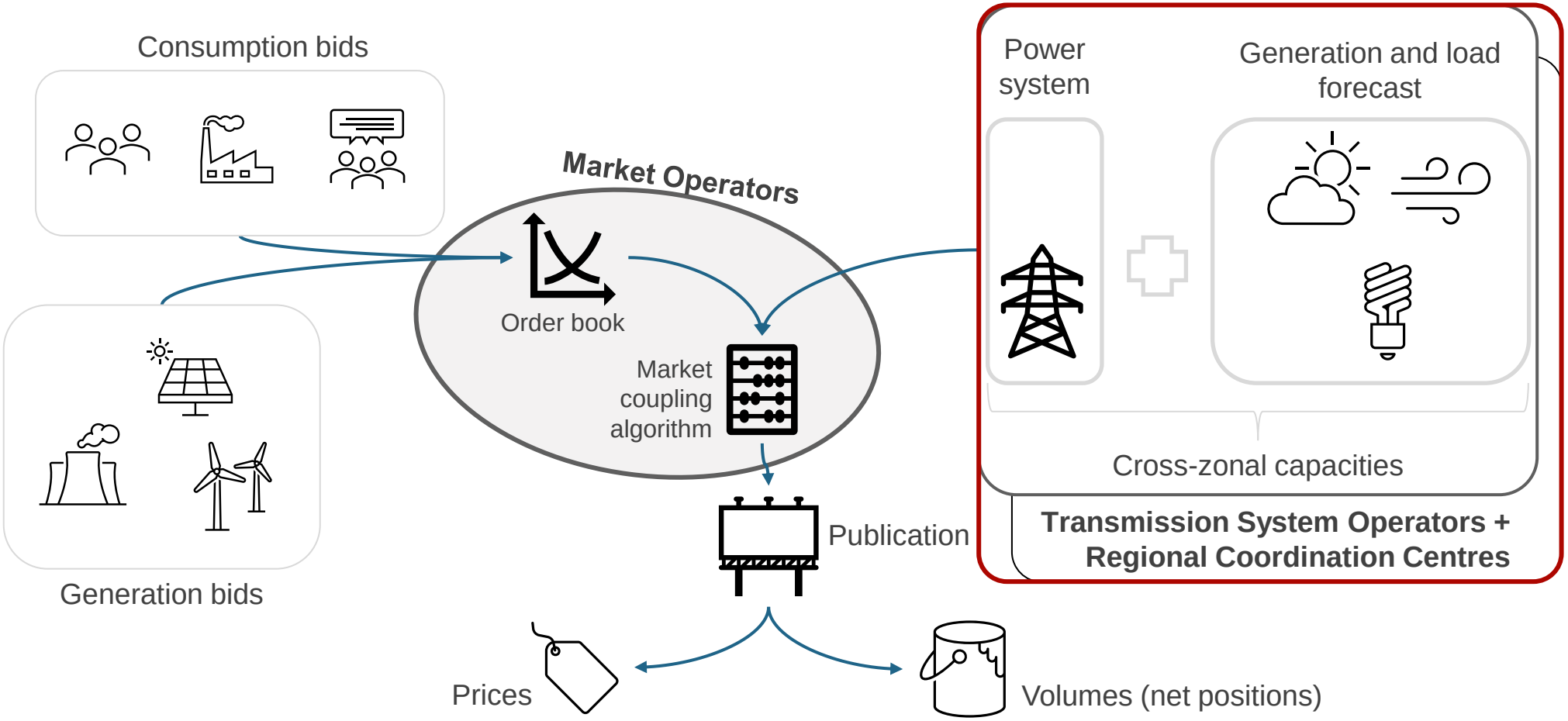
Core CCR (Capacity Calculation Region)

Market Operation



Celtic IC and EU requirements

- The Single Electricity Market (SEM) is currently not connected to the Integrated European Market (IEM)
- SEM will reconnect to the IEM and directly to the continental grid in 2026 with the Celtic Interconnector go-live.
- The 700 MW high-voltage direct current (HVDC) interconnector is a 500km of subsea cable which will connect the SEM with France and the EU power system and markets in 2026
- Deep changes to EirGrid systems and processes required
  - Compliance with EU Network Codes (NCs), Guidelines (GLS) and Methodologies
  - The SEM-FR BZB to be part of a CCR for:
    - the Common Grid Model (CGM) and
    - Coordinated Capacity Calculation (CCC) in LT, DA and ID time frames
    - Regional Operation Security Coordination (ROSC)

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What does Capacity Calculation mean?

- Demand = Supply
- Trade changes the demand/supply balance for a TSO
- It's very hard to control flows at borders with standard alternating current (AC) connections
- A TSO cannot control anything outside of its jurisdiction

  → Trade between regions brings in uncontrolled disturbances
- Need to control how much trade is allowed in the markets depending on power system conditions: Coordinated Capacity Calculation (CCC)
- Required by EU Regulation 2015/1222 on Capacity Allocation and Congestion Management (CACM)

Why CGM, CCC and ROSC? European Blackout 04 November 2006

- E.On Netz GmbH (German TSO) planned to switch out high voltage line over Ems river at 01:00 on 04-Nov-06 to allow a ship from inland shipyard to pass out to sea.
- Neighbouring TSOs ran security analysis and modified cross-border flows for 00:00-06:00 to compensate.
- On day before, the shipyard requested earlier switch-off at 22:00 04-Nov-06, approved by E.On Netz
- Other TSOs informed too late to rerun security analysis and the transfer capacity had been sold for flows.
- Several lines became overloaded and tripped, resulting in a cascade of line trips from northern to southern Europe.
- 15 million people without power across DE, FR, IT, BE, ES.
- The European Commission used this incident to justify greater coordination (2007 Report)

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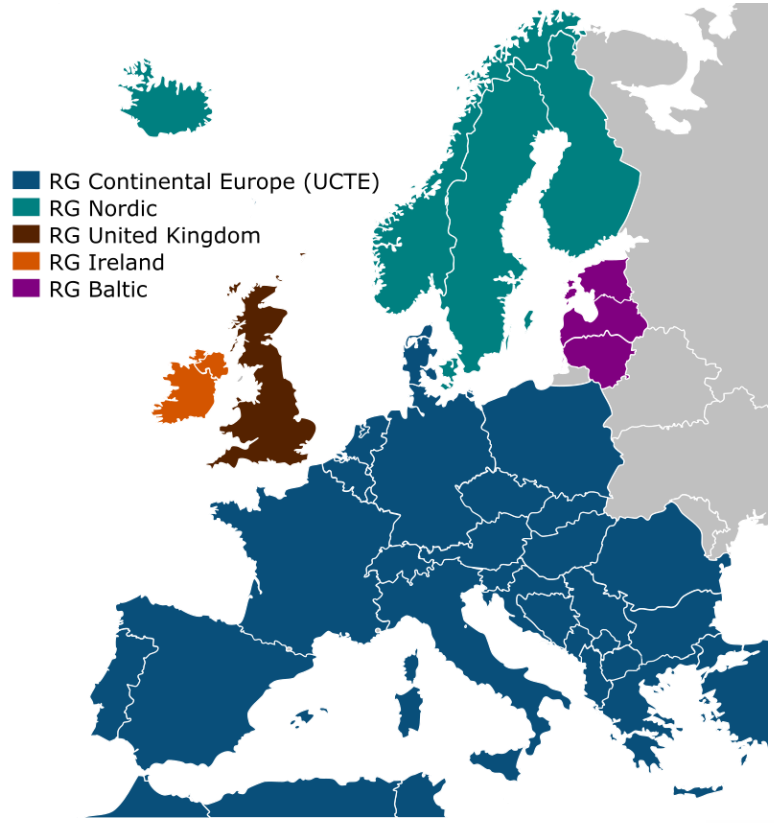
Source: ENTSO-E PowerUp Training

Synchronous areas in Europe and Blackout 04 November 2006

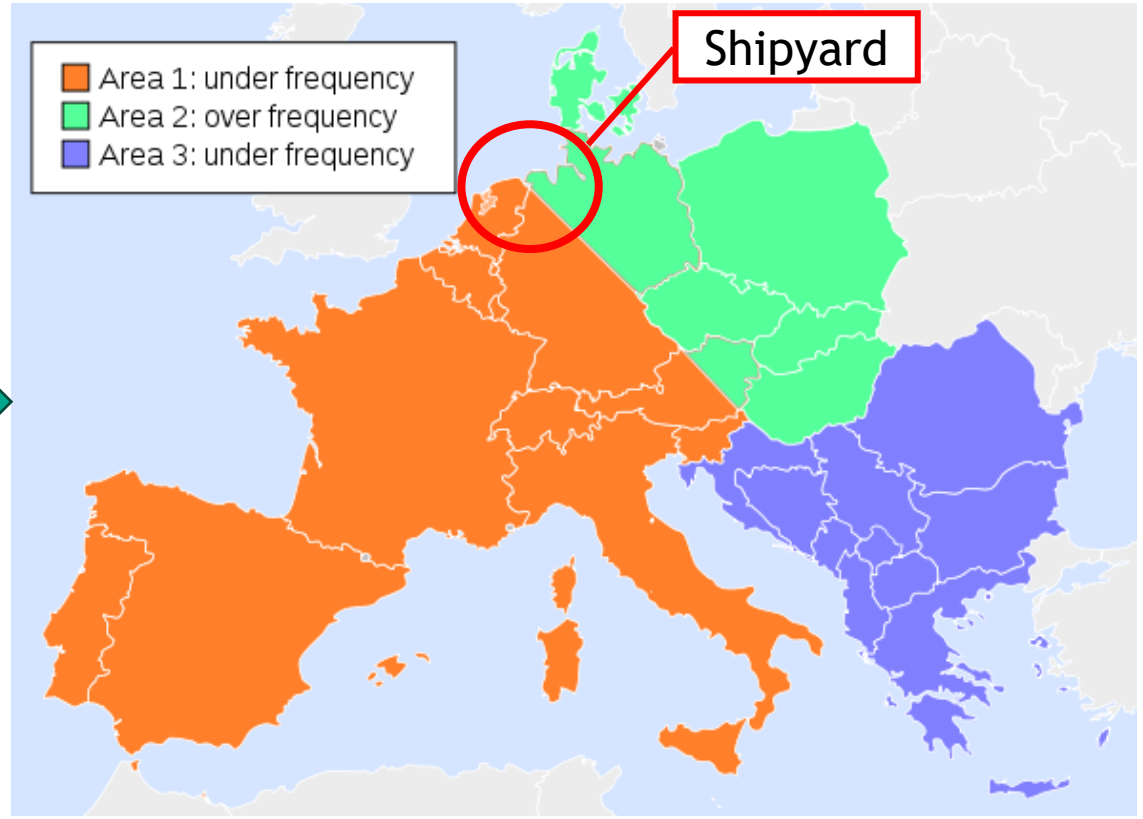
Europe's Power System

Synchronous areas in Europe



After incident

Separation of UTCE area on 04.11.2006



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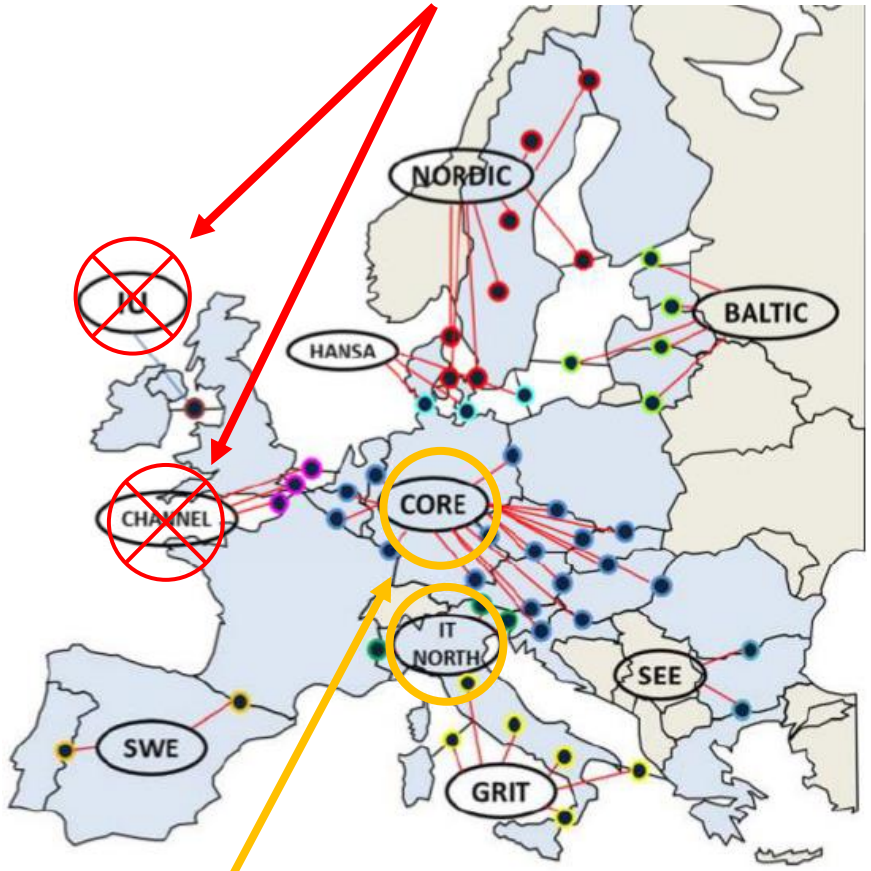
Source: ENTSO-E PowerUp Training

What are Capacity Calculation Regions (CCRs)?

- **Definition**: Capacity Allocation and Congestion Management Guideline (CACM) has defined the Capacity Calculation Region (CCR) as "***the geographic area in which coordinated capacity calculation is applied***".
- **Key-Elements**: TSOs and Bidding Zone Border(s)
- **Legal Basis & Methodologies**: The determination of the CCRs is the basis for further implementation of terms and conditions or methodologies. Each CCR shall develop a set of methodologies to be compliant with the EU Network Codes (CACM, FCA, EBGL and SOGL).
- Some of these methodologies affect very important aspects such as:
  - Max/Min Import/Export (i.e. capacity calculation*)
  - Costs (i.e. Redispatch and Countertrading (RDCT) cost sharing)
  - Operations (i.e. ROSC)
  - Governance (e.g. voting rules)
  - Other (e.g. third countries involvement)

The former IU CCR (SEM-GB CCR) is no longer existing, due to Brexit.
Channel CCR ceased to exist for the same reason.



Ongoing merger

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Who are the Regional Coordination Centres (RCCs)?

Coordinating virtual border calculations

- **For each CCR, the relevant RCC is appointed as coordinated capacity calculator**
- **Key RCC services:**

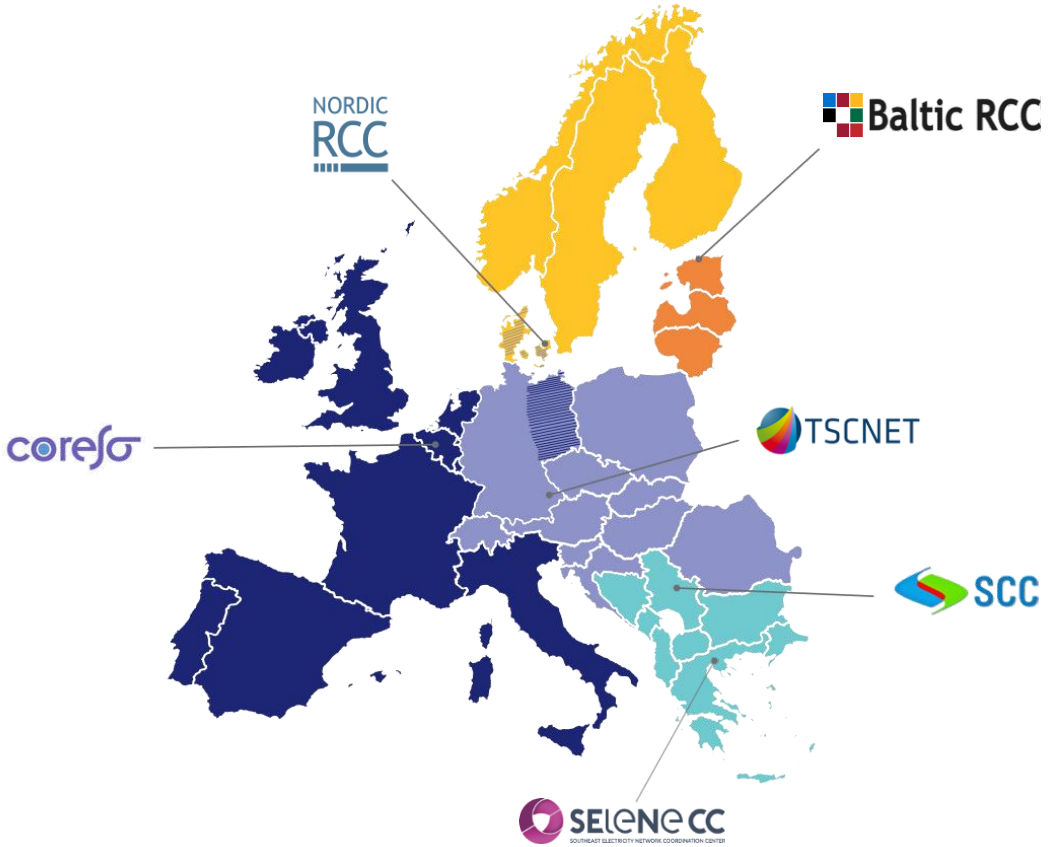
Common Grid Model (CGM)
Provide the common transmission grid model for all timeframes and use cases

Coordinated Security Analysis (CSA)
Identify operational security violations in the planning phase and the most efficient remedial actions.

Coordinated Capacity Calculation (CCC)
Calculate available transfer capacities across borders. Maximize the capacity offered to the market.

Short-Term Adequacy (STA)
Provide TSOs with an adequacy forecast to anticipate and manage potential critical network situations

Outage Planning Coordination (OPC)
Detect outage planning incompatibilities and the solutions to solve the incompatibilities.



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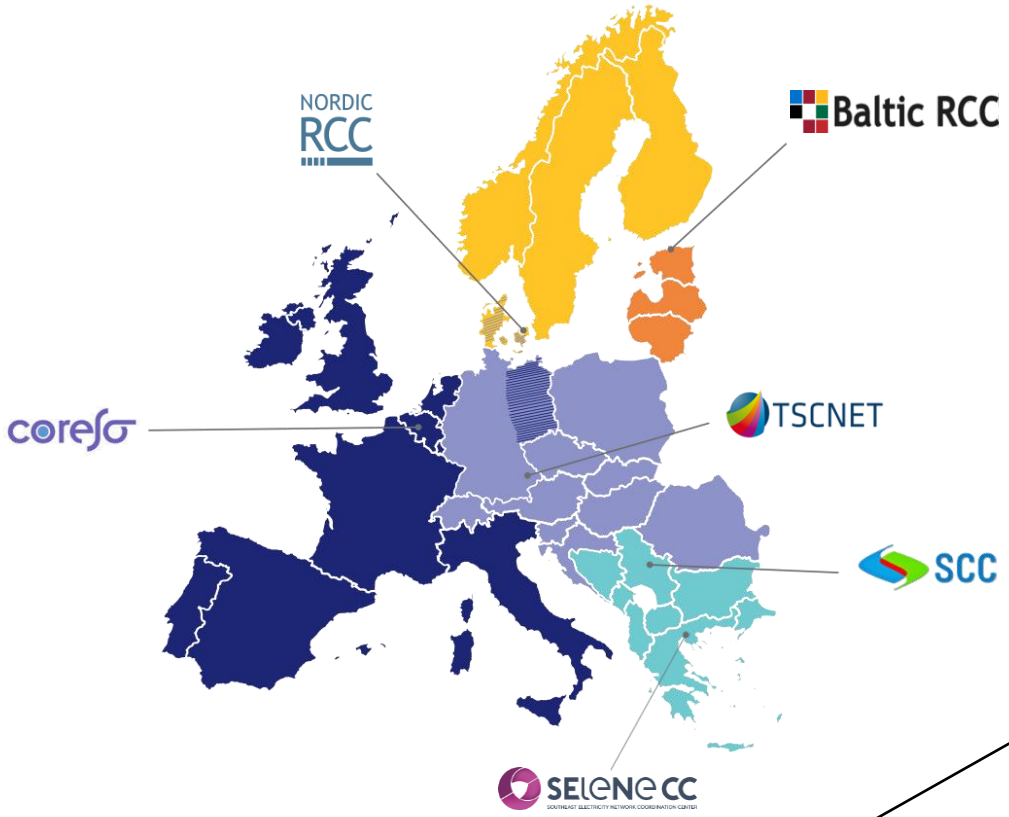
Source: ENTSO-E PowerUp Training

RCCs gather IGMs and merge to make the CGM



Nordics

Baltics

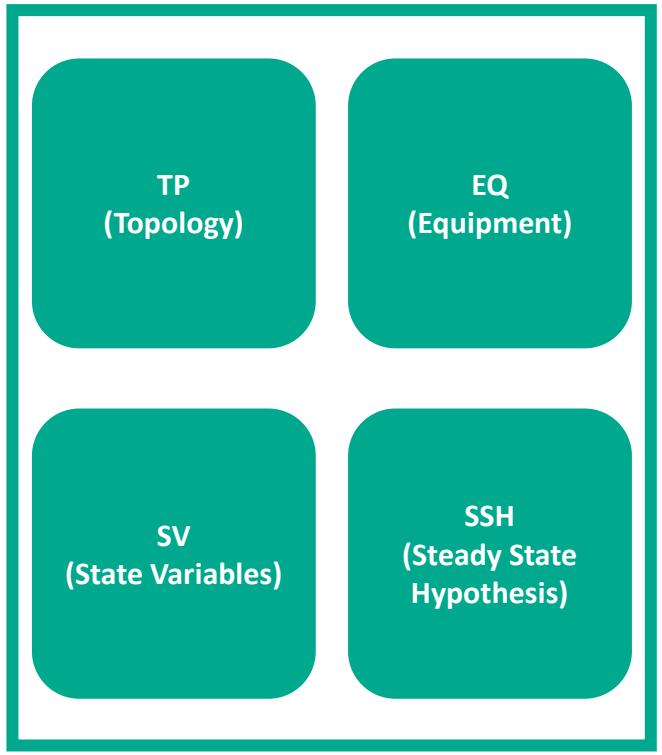
Central Europe (CE)

Southeast Europe (SEE)

Central Western Europe (CWE)

Pan-EU CGM

What makes up IGM and other RCC Service data?



	Individual Grid Model (IGM) 4 files per IGM, 1 IGM per hour	Pre-Processing Data (PPD)	Contingency List, Remedial Actions and Additional Constraints (CRAC)	Generation and Load Shift Key (GLSK)	Outage Planning Coordination (OPC)	Short-Term Adequacy (STA)
ID	24 IGMs (3x8) = 96 files daily	-	-	-	-	-
D-1	24 IGMs = 96 files daily	-	1 file daily	1 file daily	-	-
D-2	24 IGMs = 96 files daily	1 file daily	1 file daily	1 file daily	-	-
W-1	-	-	-	-	1 file weekly	2 files daily
Y-1	4 IGMs = 16 files yearly	-	-	-	1 file annually	-

Net Position
Feasibility Range
Max Import & Export
DC Flows

Contingencies
Remedial Actions
Monitored Resources
Additional Constraints

Co-dictionary*

Merit Order Cost List of Available Generation/ Load

Unavailability Plan containing all outages during that time horizon

Element List* containing all relevant list of assets

Load file containing forecasted national demand per hour for 7 days

Generation file containing forecasted generation per fuel type per hour for 7 days

- All IGMs must be sent in CGMES (CIM) format
- We will also need to use the older UTCE-DEF format until all services migrate to CGMES.

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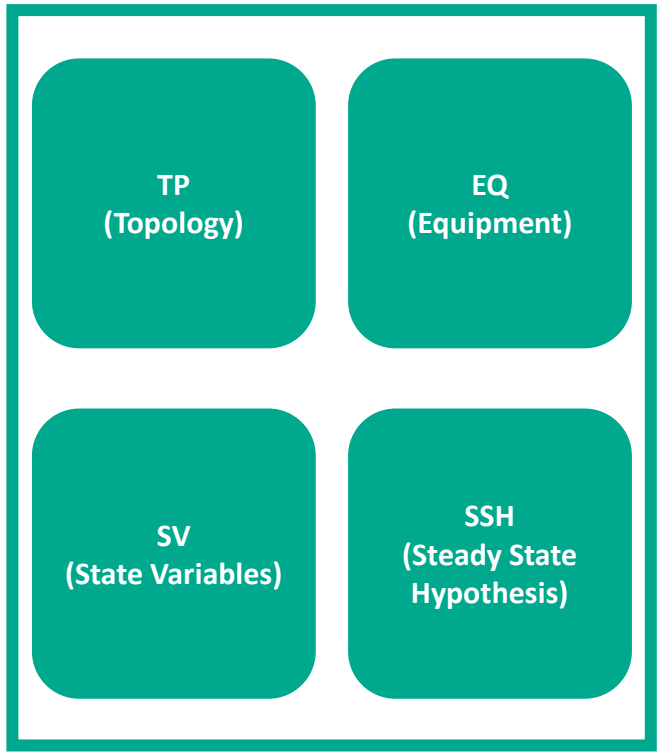
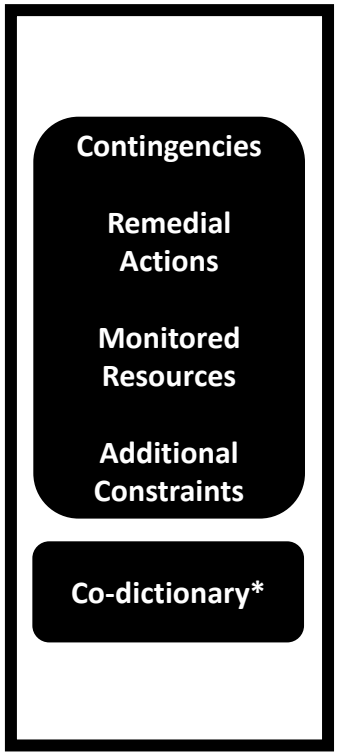
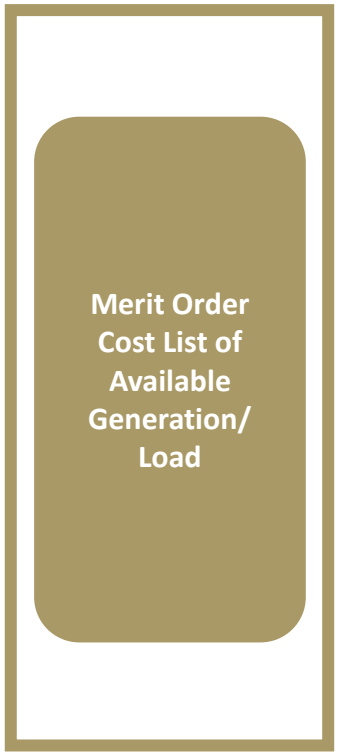
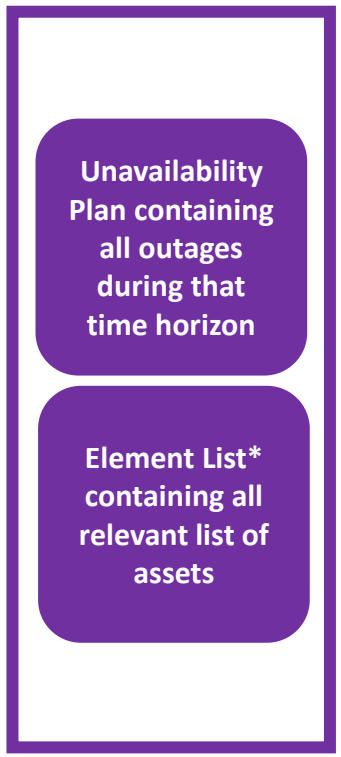
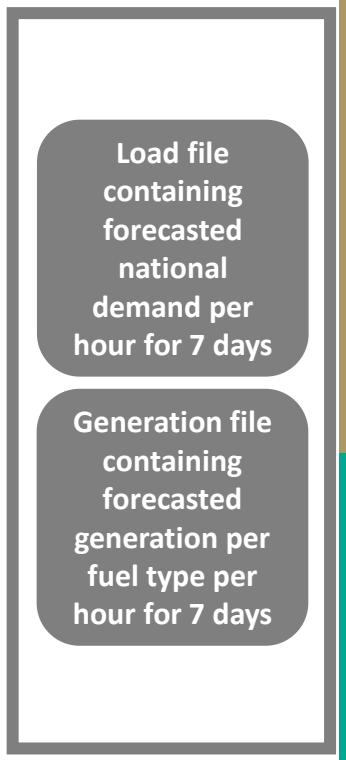
What makes up IGM and other RCC Service data?











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Y-1	4 IGMs = 16 files yearly	-	-	-	1 file annually	-

- All IGMs must be sent in CGMES (CIM) format
- We will also need to use the older UTCE-DEF format until all services migrate to CGMES.

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Cross-border transfer capacities

Initially, transmissions constraints were only cross-border transfer capacity within a country was supposedly infinite (copper-plate assumption)

- → Bidding zones were defined, with congestion between BZs
- → BZBs are virtual and multiple cross-border lines exist between a pair of BZs
- → Limited cross-border transmission rights allocated per isolated border
- → Cross border trade constraints can be deep inside a network: a feeder, transformer, tie line
- → Flow Based Market Coupling (FBMC) offers more capacity by considering network inter-dependencies:
  - → Critical Network Elements and Contingencies (CNECs)
  - → Power Transfer Distribution Factors (PTDFs) and
  - → Generation Load Shift Keys (GLSKs)

Figure 3.1 Bidding zones in Europe as of November 2019

ENTSO-e definitions of transfer capacities

Definitions of Transfer Capacities in liberalised Electricity Markets

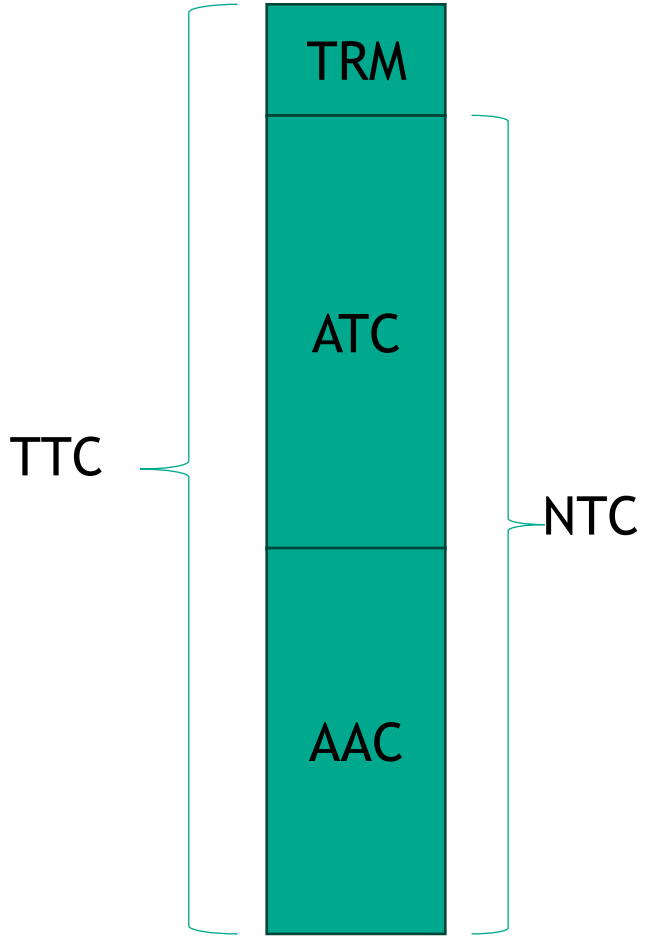
TTC: **Total Transfer Capacity**
Thermal limit

TRM: **Transmission Reliability Margin** (also FRM):
a security margin that copes with uncertainties on the computed TTC values

NTC: **Net transfer capacity:** $NTC = TTC - TRM$

AAC: **Already Allocated Capacity**:
the total amount of allocated transmission rights

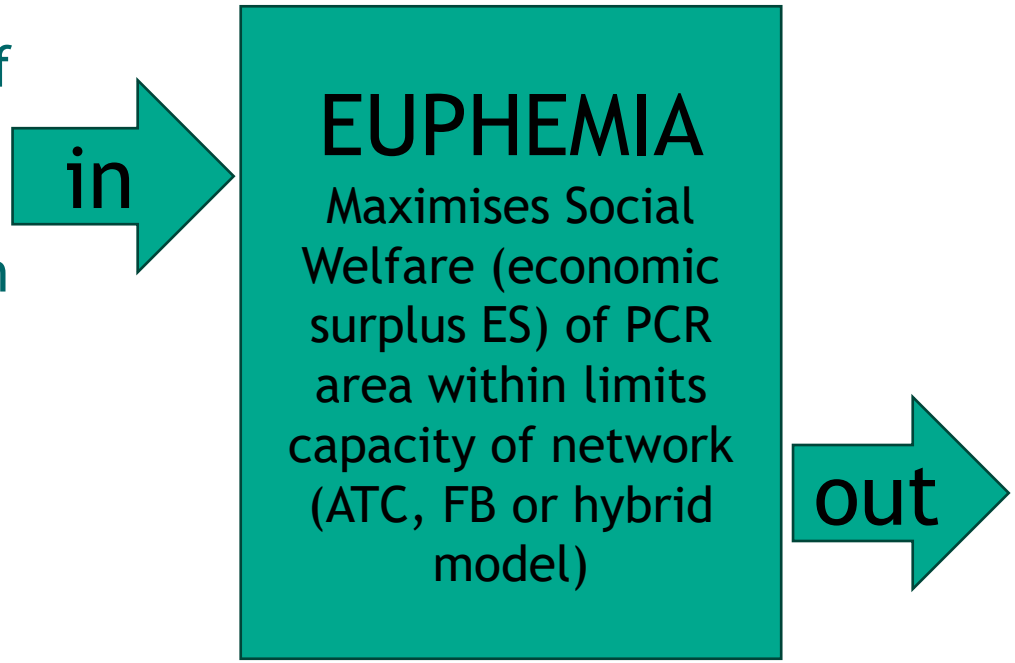
ATC: **Available Transfer Capacity**: $ATC = NTC - AAC$
the part of NTC that remains available, after each phase of the allocation procedure, for further commercial activity



EUPHEMIA: Market Coupling Algorithm

Information about state of transmission networks (D2CF)

- ATCs and/or FB domain
- Ramping limits
- Bidding zones (and network constraints between BZs)
- Buy and sell orders collected by NEMOs



- A MCP for each BZ and each MTU
- Net position (difference between matched supply and demand belonging to that BZ, e.g. net exports)
- Selection of block, complex, scalable complex, merit and PUN orders, % acceptance of curtailable blocks

$$ES = CS + PS + CI$$

$$CI = (MCP_B - MCP_A - T) \times F_{AB}$$

$$\begin{aligned} F &= 0 && \text{if } (MCP_B - MCP_A) < T \\ F &= F_{max} && \text{if } (MCP_B - MCP_A) > T \\ 0 < F &< F_{max} && \text{if } (MCP_B - MCP_A) = T \end{aligned}$$

ES: Economic Surplus
CS: Consumer Surplus
PS: Producer Surplus
CI: Congestion Income
MCP: Market Clearing Price
F: Flow of MWs
T: Tariff

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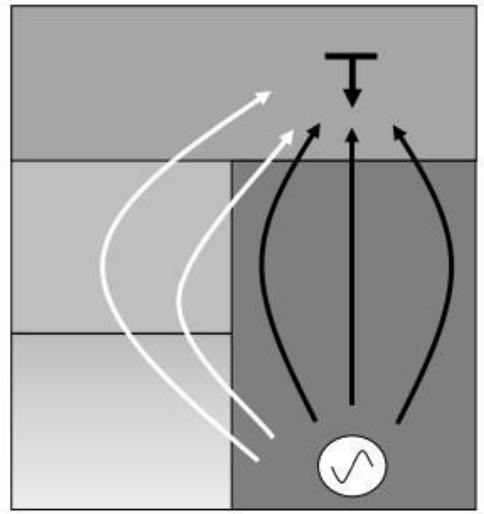
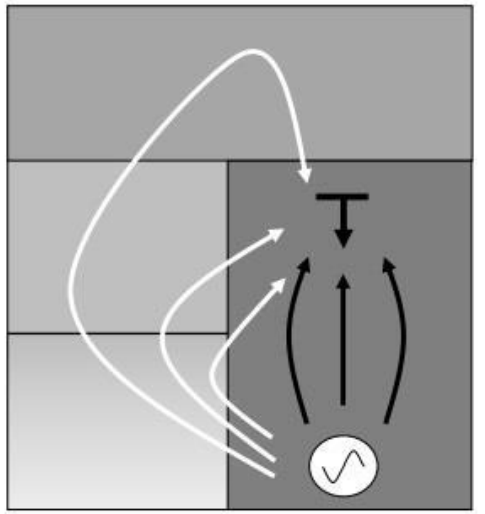
Loop flows and transit flows in a meshed AC network

- The physics of electricity means that it's not easy to calculate ATCs between BZs (virtual borders) on a meshed alternating current (AC) network.
- AC power does not flow directly from a selling generator to a buying consumer:
  - it takes all possible paths from supply to load to varying degrees
  - generators feed into a common pool of electricity
- Transit flows (scheduled; caused by trades between BZs) and Loop flows (unscheduled; caused by a trade within a BZ) cannot easily be controlled
- Physical limits of CNECs, such as transmission lines, transformers, circuit breakers, can limit transmission capacity.



Scheduled flows in black. Transit flows in white.



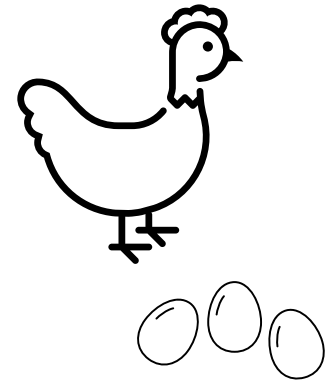
Scheduled flows in black. Loop flows in white.

Available Transfer Capacity (ATC) & Net Transfer Capacity (NTC) calculation

ATCs & NTCs depends on:

1. How flow will be distributed over different border lines,
2. The consumption and generation pattern (the market),
3. Which is known after the trades that took place

Chicken and egg problem: ATC depends on gen/load pattern, but gen/load pattern depends on ATCs made available

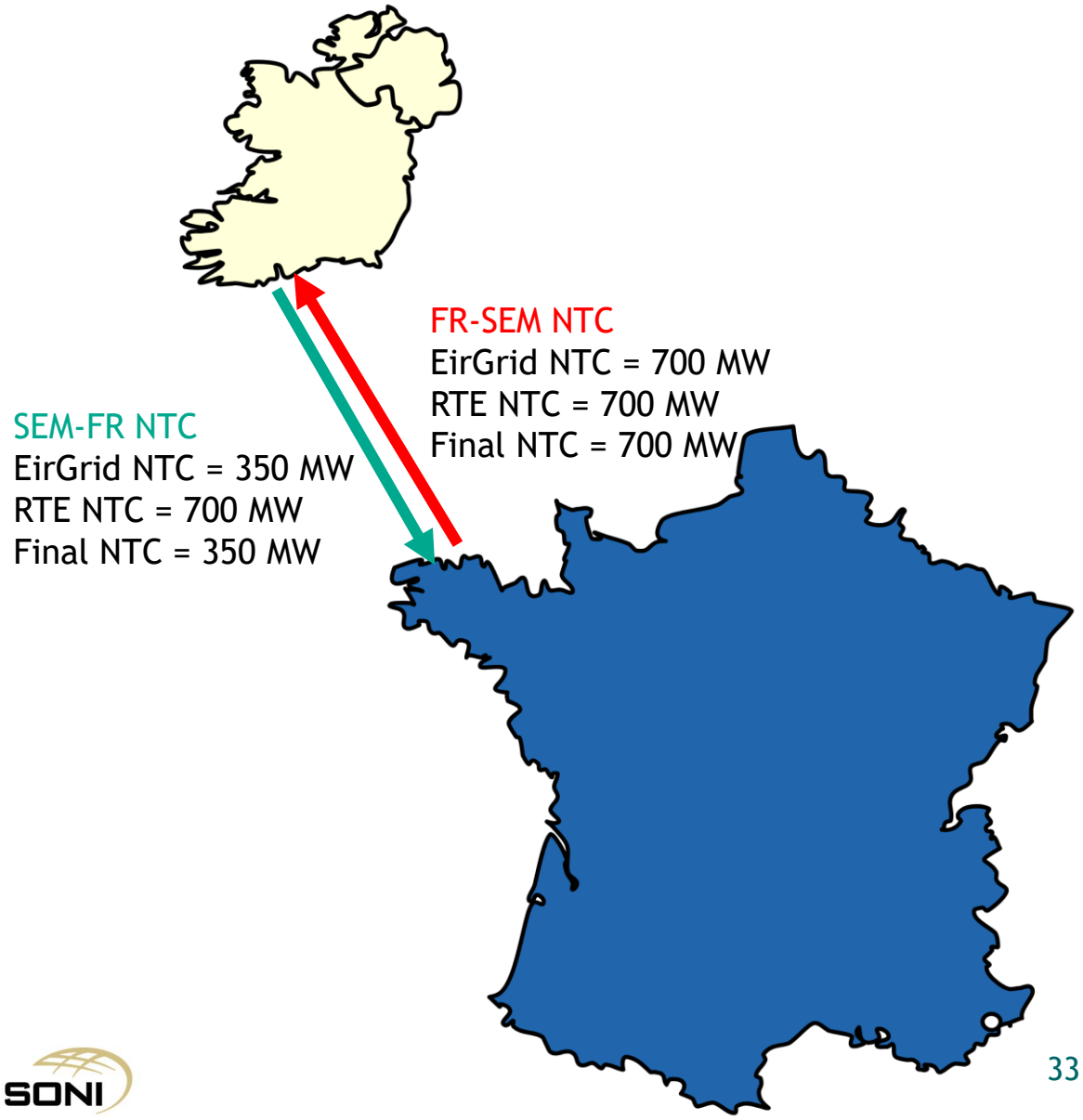


TSOs:

- Predict the state of the network (D2CF)
- Calculate cross-border trade capacities,
- Have limited control over (re-)directing flows through AC meshed network,
- Provide conservative capacities to the market to avoid penalties incurred for not delivering the capacity made available

Available Transfer Capacity (ATC) & Net Transfer Capacity (NTC) calculation

- Each TSO decides its own allowable ATC/NTC based on their own local system status,
- TSOs can do this in different ways, as they only submit the MW value to the Market Coupling Operator (MCO)
- The MCO takes the lowest value for day-ahead coupling
- Example:
  - Wind generation is low in SEM, so EirGrid limits export capacity to 350 MW instead of full 700 MW
  - There are no transmission issues or risk of line overloading, so EirGrid could receive up to 700 MW from France without technical issues
  - French TSO (RTE) has no issues with local transmission capacity or generation and can send or receive up to 700 MW
  - The MCO makes 350 MW available to the market in the SEM-FR direction and 700 MW in the FR-SEM direction



Available Transfer Capacity (ATC) & Net Transfer Capacity (NTC) calculation

- Available Transfer Capacity:

  > "a bilaterally agreed value per border direction that equals the lesser amount for maximum possible imports or exports defined by the two TSOs"

- ATC/NTC calculation assumes isolated independent borders
- Other borders and their flows are ignored by coupling algorithm and TSOs account for this in submitting conservative NTC value

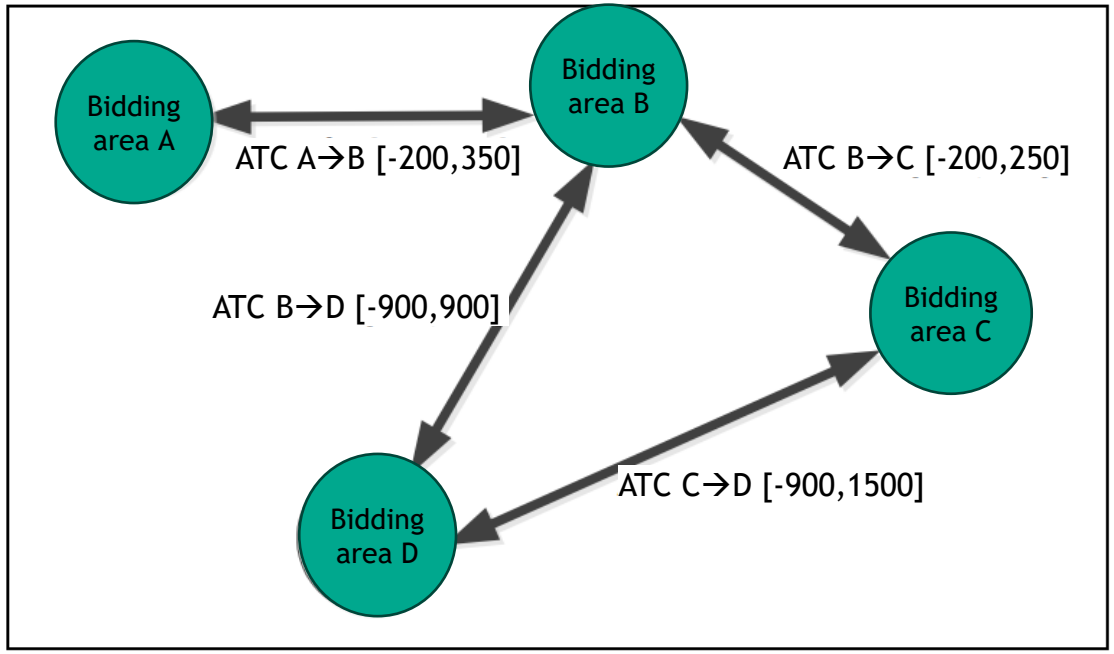
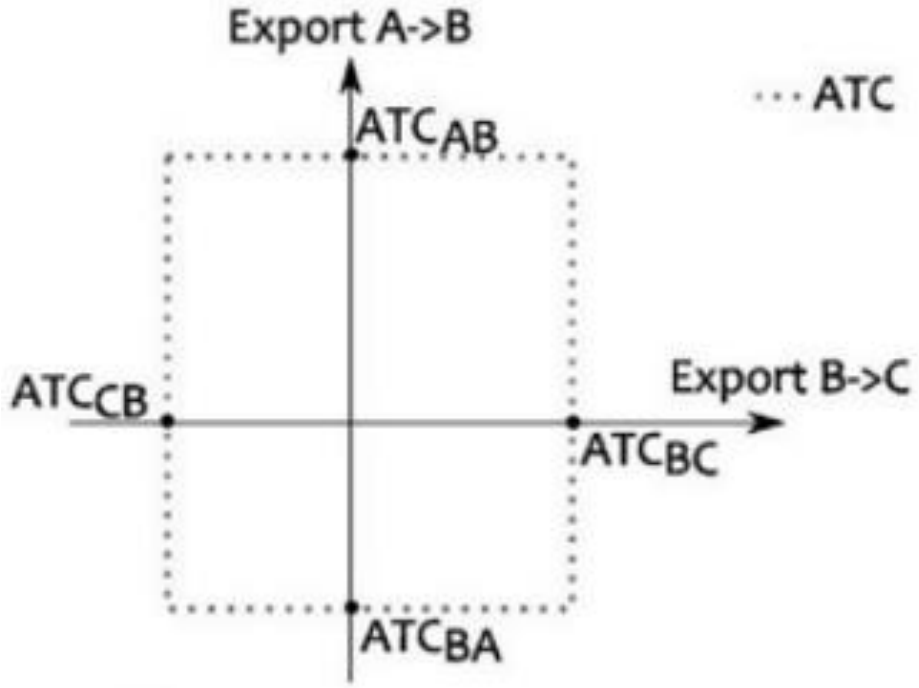
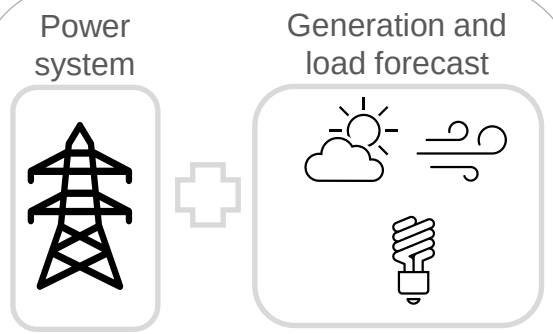


Figure 2 – *Bidding zones* connected in ATC model



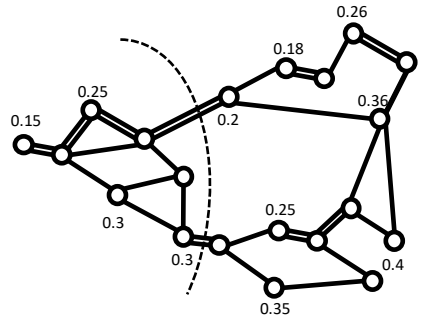
Primary Inputs for Core Flow Based Market Coupling (FBMC)



IGM
Individual Grid Model

EirGrid's piece of the common grid model

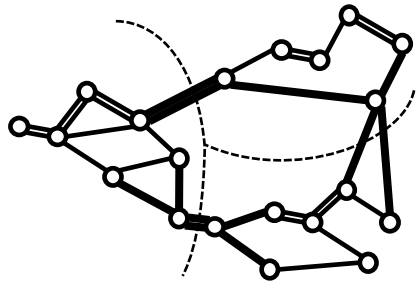
→ Expected state of transmission system as well as generation and load on nodal level



GSK
Generation Shift Key

Translate nodal generation/ consumption to changes in BZ's Net Position (NP = exports - imports)

→ Generators and loads that act on market signals



CNECs
Critical Network Elements and Contingencies

List of critical network elements
and N-1 contingencies

→ Relevant network elements for cross-zonal exchanges

Flow Based Market Coupling (FBMC)

- FBMC model is physically more precise than ATC:
  - Cross-border flow interdependencies are considered using Power Transfer Distribution Factors (PTDFs) in the market coupling algorithm
  - Virtual border capacity is based on calculated virtual flow distribution factors (Zone-to-Zone PTDFs)
  - Zonal PTDFs: linear relationship between physical flow on a CNE and net exchange position (=zonal production – zonal consumption)

- TSOs can be less conservative in making capacity available to market and provides:
  - D2CF: D-2 congestion forcecast providing reference flows
  - CNECs: cross-zonal lines, internal lines or transformers limiting power exchanges
  - GLSK: translating changes in generation/consuption at nodal level to net position based on predictions of market outcome, subject to forecast error

- CACM GL: FBMC primary approach for DACC and IDCC, but NTC still allowed

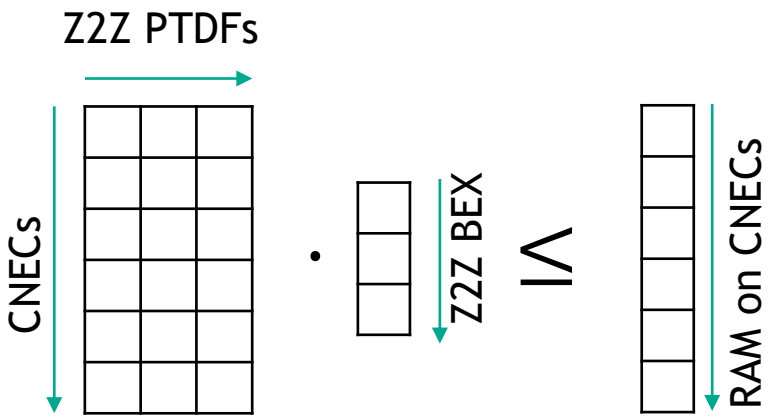
- Market coupling and allocation of cross-zonal capacity performed jointly

Flow-Based (FB) model

FB network constraints calculated using:

- RAM (on each CNEC)
- PTDF

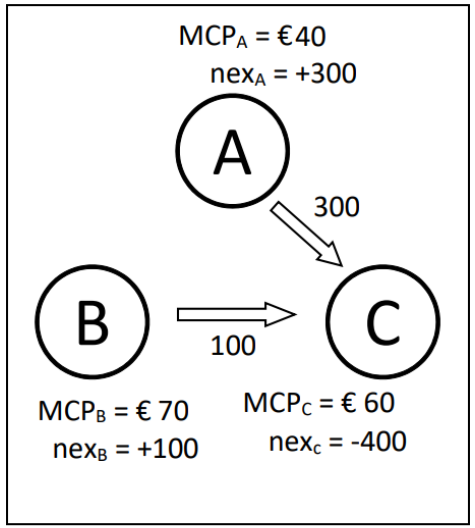
$$\boldsymbol{PTDF \cdot \Delta NP \leq RAM}$$



X-border maximum exchanges (FBMC) depend on critical network elements (CNEs) associated with N-1 Contigencies (CNECs) limiting flows

Non-intuitive flows are possible:
Reducing exchanges on one BZ border can free up capacity on other BZ borders, allowing larger exchanges

The market has to clear within the FBMC domain (envelope bounded by CNECs)



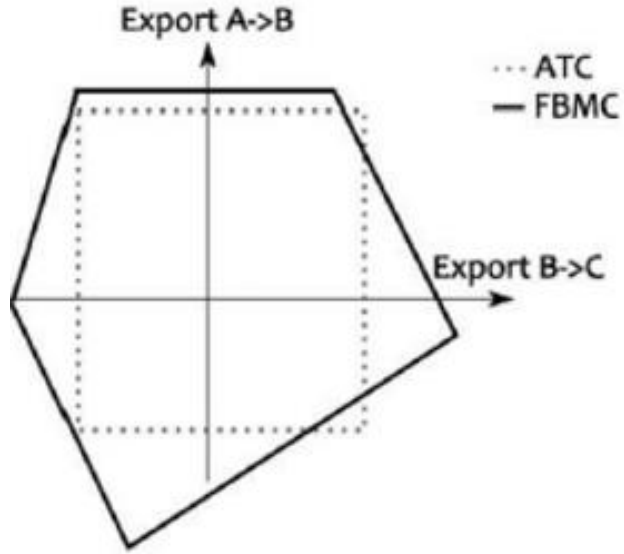
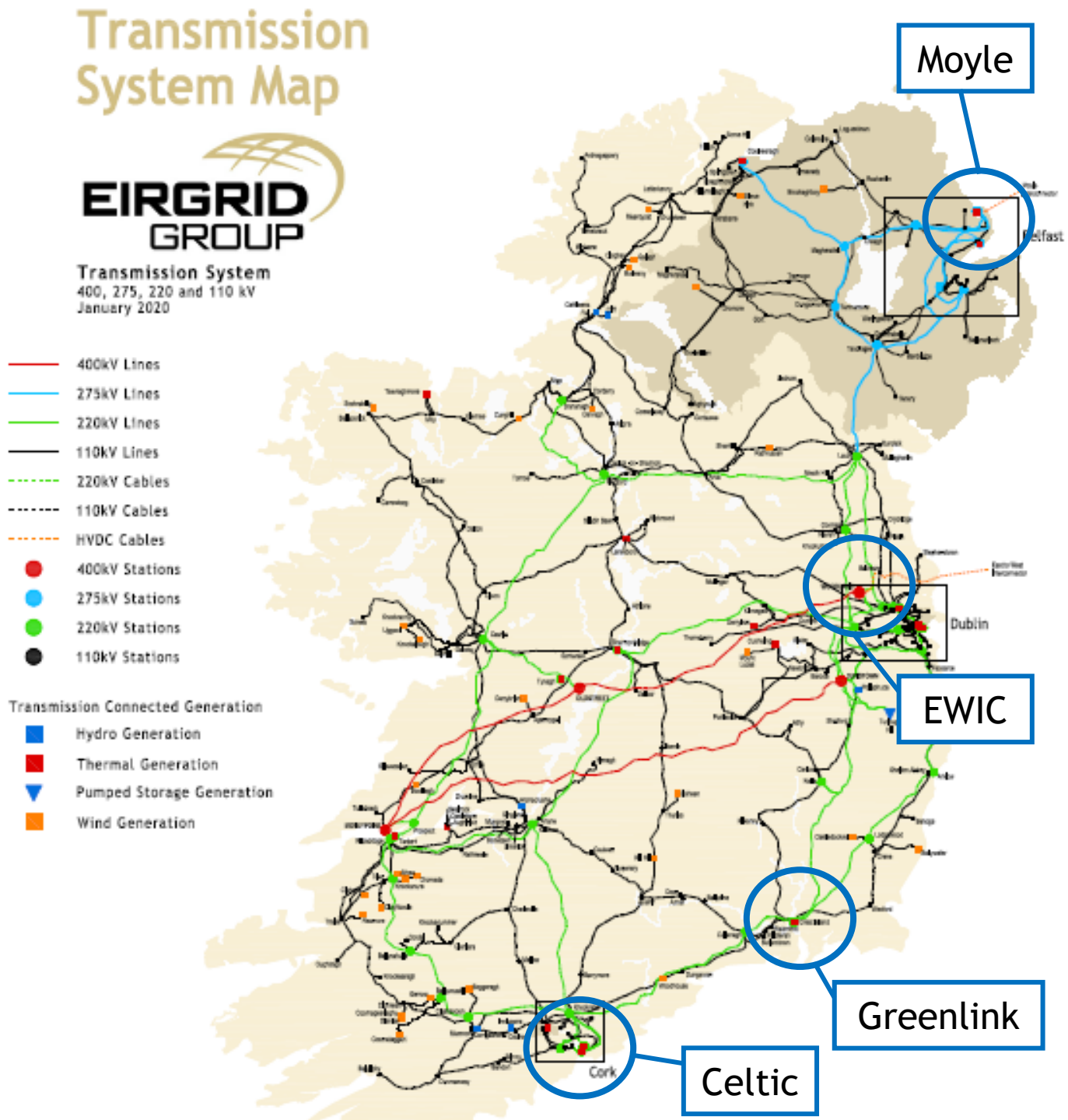


Figure 5 – Example of *net positions* decompositions into flows

CC inputs: Individual Grid Model (IGM)

Best available forecast of the grid situation at a given moment (one IGM per hour), including:

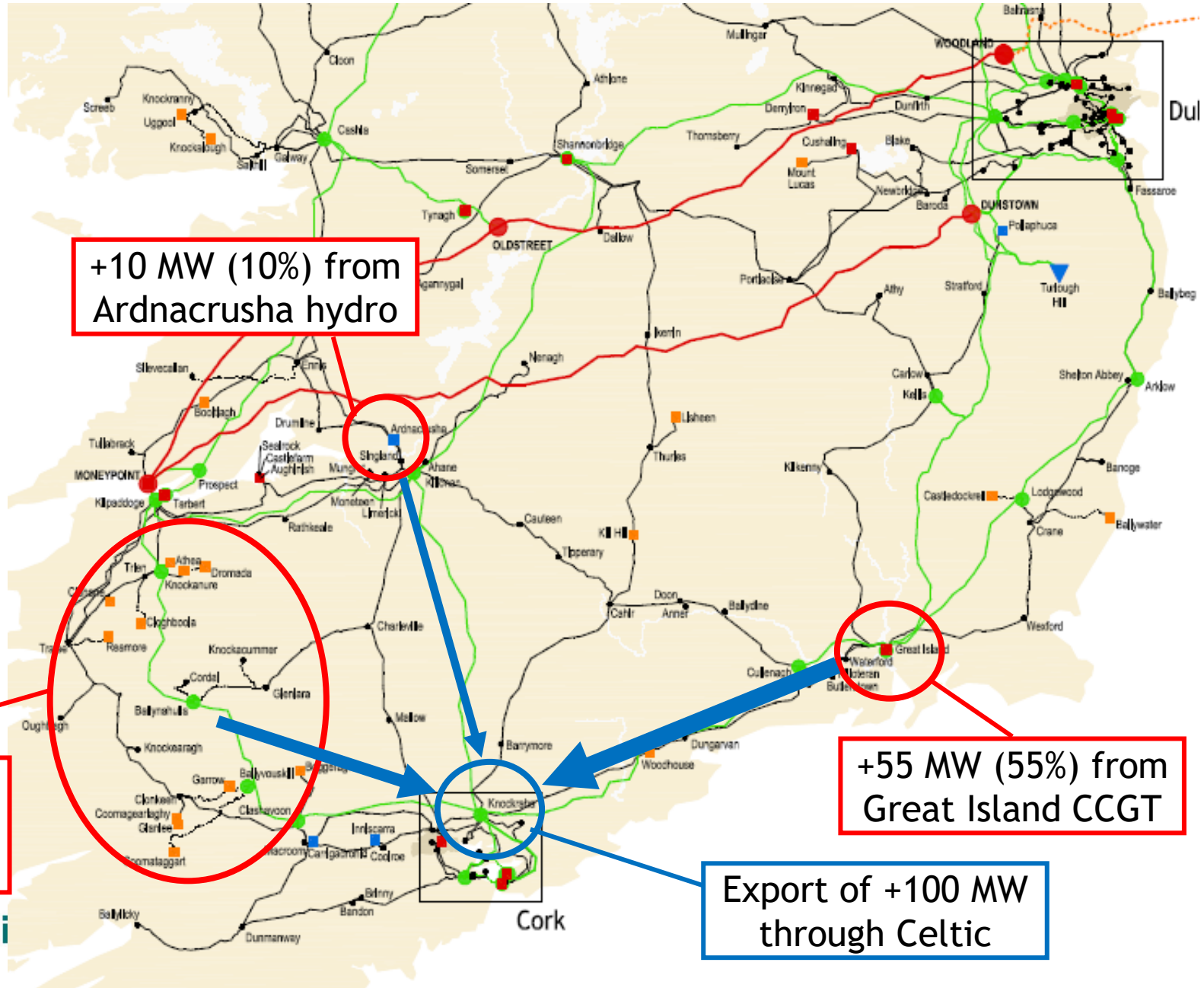
- Parameters and status of all lines, cables, transformers, circuit breakers, cap banks, reactors, etc
- Grid topology (planned outages)
- Distribution of nodal generation forecast (incl RES)
- Distribution of nodal load forecasted
- Forecasted flow over HVDC interconnectors



CC inputs: Generation Shift Key (GSK)

Describes the relation between a Net Position (NP) change and the nodal injection/consumption

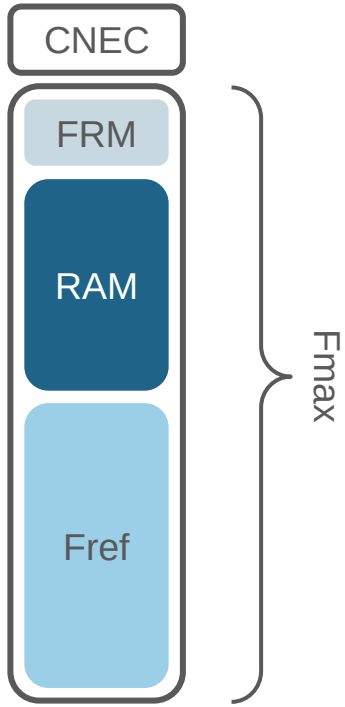
- NP = Exports - Imports
- Map of change in NP to generating (and/or load) units in a BZ
- Example: 0.05 for a certain node means that 5% of the NP change in a zone will be met by that node
- GSKs can vary per hour
- Hypothetical example of additional 100 MW export and how it's mapped to the power system
  - A real GSK would actually include all SEM generators and could be very different



CC inputs: Critical Network Elements and Contingencies (CNEC)

Physical network elements that can potentially limit exchange, on which FB calculation is performed

- Typically a sub-set of network elements with rated voltage ≥ 220 kV
  - All cross-border lines
  - Internal network elements with PTDF > 5%
- Can also be a transformer



Definition of a CNEC: Critical Network Element associated with a Contingency

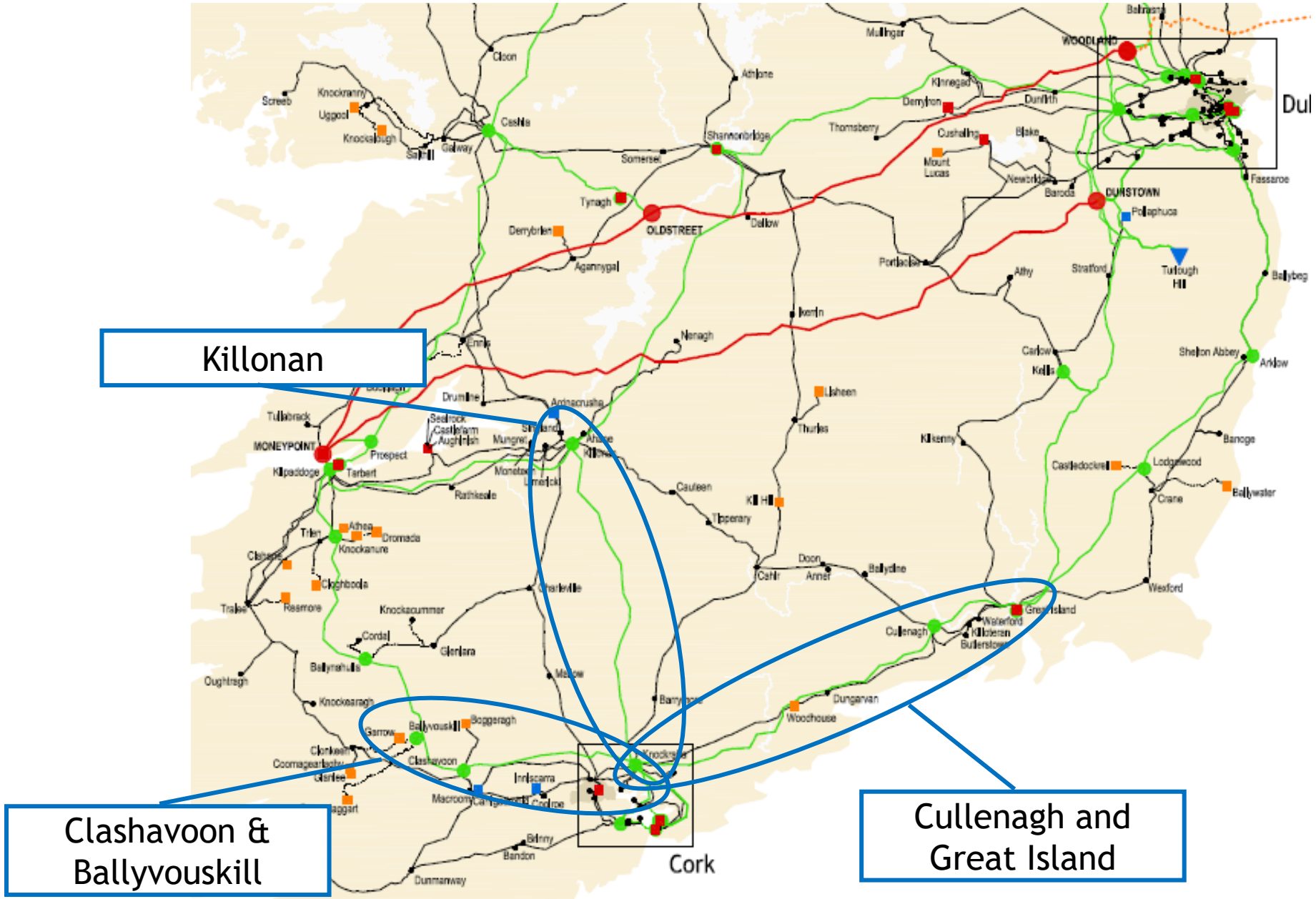
- Fmax: (thermal) power limit, can vary over time (e.g. DLR, seasonal ratings)
- Fref: reference flow of the base case, determined from CGM.
- FRM: flow reliability margin: A safety margin catering for uncertainties, assumptions and linearisation
- RAM: remaining available margin that can be given to the market, i.e. used for trades

$$RAM = F_{max} - FRM - F_{ref}$$

Contingency:

- What is the impact on the green line of an outage of the red line?

CC inputs: CNEC 220 kV Examples



Thank You - Q&A

EirGrid

Scheduling and Dispatch Programme

Scheduling and Dispatch - Programme Summary Status

As planned, no issues | Improving
Minor - moderate concern | Steady
Significant issue / concern | Worsening

SDP		Summary Status
Overall Status		Mod_13_23 Treatment of NPDRs and SEM-24-044 Definition of Curtailment, Constraint and Energy Balancing are required for the delivery of Tranche 1 initiatives SDP-01 NPDR and SDP-04 Wind Dispatch Improvements. The final Tranche 1 system vendor test is progressing along revised plan and is on track to complete in Mar-25. The TS&C modification related to Tranche 2 SDP-06 Synchronous Condensers was presented to the Mod Committee at Committee meeting 127 and will be brought for a vote at meeting 127b
Schedule Tranche 1		The final system vendor test is progressing along revised plan and is on track to complete in Mar-25. On site System test for the other systems is in progress. We expect that Mod_13_23 Treatment of NPDRs (SDP_01 NPDR) and SEM-24-044 Definition of Curtailment, Constraint and Energy Balancing related to SEM-13-011 (SDP_04 WDI) will be included on the agenda for SEM-C meeting on in March. The NPDR unit designation approach is well progressed, and the programme will present details of this once the SEM-C decision on Mod_13_23 has been issued. Tranche 1 cutover planning has started.
Schedule Tranche 2		The TS&C modification related to SDP-06 Synchronous Condensers was presented to the Mod Committee at Committee meeting 127. A follow-on workshop is scheduled with committee members for the last week in February and the programme is targeting presenting the modification for a vote at Committee meeting 127b in mid-March. System design for Tranche 2 is continuing with the programmes system vendors.
Resourcing		TSO/MO programme teams are fully staffed
Finances		SEMC All-Island Programme sub-committee approved the full funding request for the S&D (phases 3-5) programme on 22nd March 2024.
RA Update on NPDR Mod		The modification proposed is part of a complex work package and the SEM Committee have requested additional time to understand the full proposed operation and treatment of Non-Priority Dispatch Renewables. The SEM Committee requested that the modification is brought back for deliberation. The RA team intend to discuss the proposal during March's SEM Committee, with both the RA and TSOs working collaboratively to progress this initiative and ensure that SEM Committee have all details necessary to make an informed decision.
Participant Readiness		Market participant Point Of Contact Survey has completed. Market participants readiness survey has completed. Details of the findings and the actions the programme is taking are included in today's presentation.

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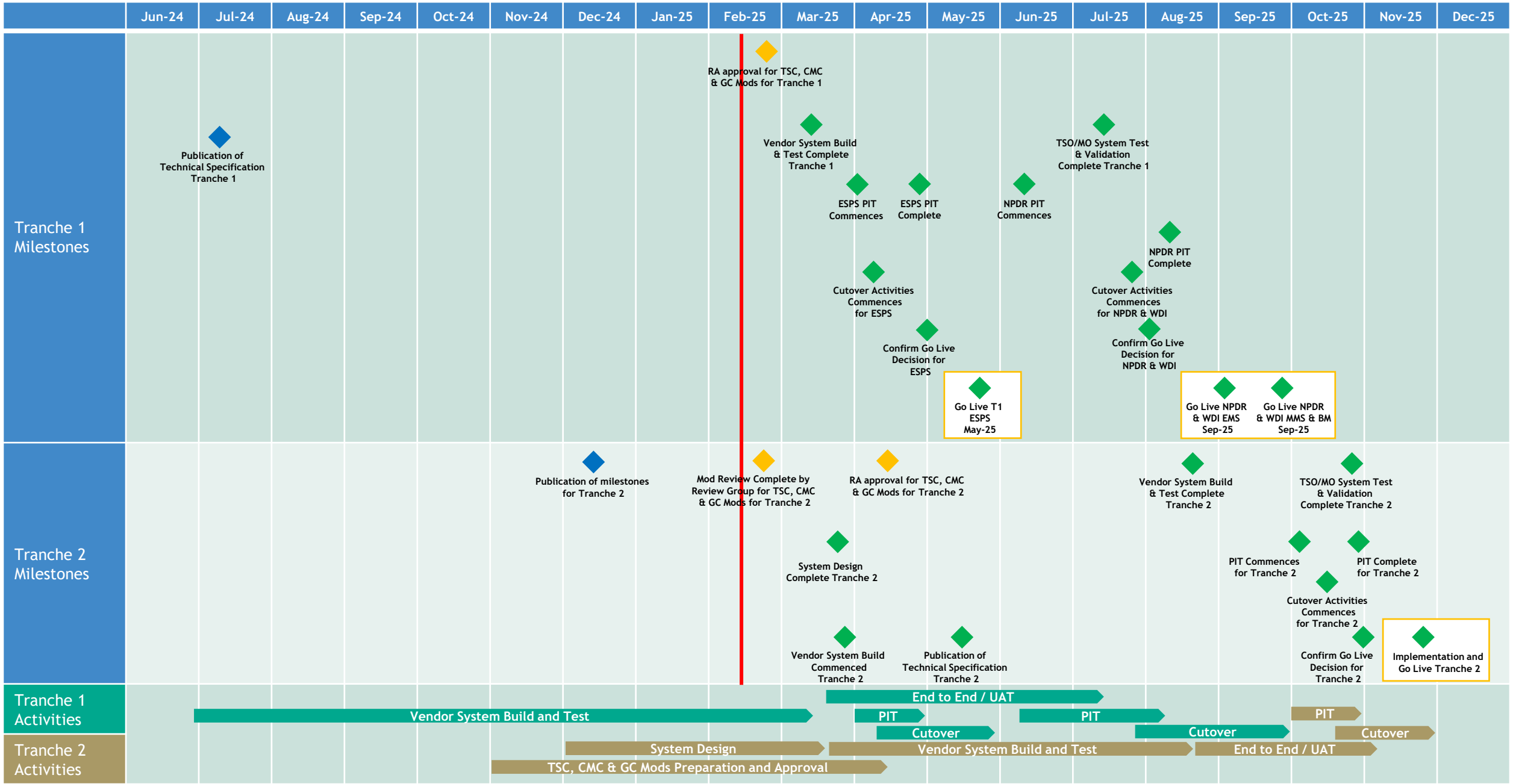
Scheduling and Dispatch: Milestone Plan



Scheduling and Dispatch - Tranche 1 & 2 Phase 2 Milestones

Tranche	Milestone	Dates
Tranche 1	Requirements Definition Complete for Scheduling and Dispatch Programme Tranche 1 Initiatives	September 2023
Tranche 1	System Design Complete for Scheduling and Dispatch Programme Tranche 1 Initiatives	March 2024
Tranche 1	TSC, CMS & GC Mods Review Complete for Scheduling and Dispatch Programme Tranche 1 Initiatives by the relevant review group (Mods Committee, Grid Code Review Panel, Capacity Market Workshops respectively)	March 2024
Tranche 2	Requirements Definition Complete for Scheduling and Dispatch Programme Tranche 2 Initiatives	July 2024
Tranche 2	Publication of milestones for Scheduling and Dispatch Programme Tranche 2 Initiatives	September 2024 (Completed December 2024)
Tranche 2	System Design Complete for Scheduling and Dispatch Programme Tranche 2 Initiatives	Jan – Mar 2025
Tranche 2	TSC, CMS & GC Mods Review Complete for Scheduling and Dispatch Programme Tranche 2 Initiatives by the relevant review group (Mods Committee, Grid Code Review Panel, Capacity Market Workshops respectively)	Jan – Mar 2025

Scheduling and Dispatch - Tranche 1 Phase 3 Milestones

Tranche	Milestone	Dates
Tranche 1	Regulatory Authority approval for Trading and Settlement Code (TSC), Capacity Market Code (CMC) & Grid Code Mods (GC) for Scheduling and Dispatch Programme Tranche 1 Initiatives	Feb 2025
Tranche 1	Publication of Technical Specification for Scheduling and Dispatch Programme Tranche 1 Initiatives	July 2024
Tranche 1	Vendor System Build and Test Complete for Scheduling and Dispatch Programme Tranche 1 Initiatives	Mar 2025
Tranche 1	TSO/MO System Test and Validation Complete for Scheduling and Dispatch Programme Tranche 1 Initiatives	July 2025
Tranche 1	*ESPS* Participant Interface Test (PIT) Commences (*Revised Milestone as part of re-baseline*)	Apr 2025
Tranche 1	*ESPS* Participant Interface Test (PIT) Complete (*Revised Milestone as part of re-baseline*)	Apr 2025
Tranche 1	*ESPS* Cutover activities Commences (*Revised Milestone as part of re-baseline*)	Apr 2025
Tranche 1	*ESPS* Confirm Go Live Decision (*Revised Milestone as part of re-baseline*)	April 2025
Tranche 1	*ESPS* Go Live (*Revised Milestone as part of re-baseline*)	May 2025
Tranche 1	*NPDR* Participant Interface Test (PIT) Commences (*Additional Milestone as part of re-baseline*)	June 2025
Tranche 1	*NPDR* Participant Interface Test (PIT) Complete (*Additional Milestone as part of re-baseline*)	Aug 2025
Tranche 1	*NPDR and WDI* Cutover activities Commences (*Additional Milestone as part of re-baseline*)	Aug 2025
Tranche 1	*NPDR and WDI* Confirm Go Live Decision (*Additional Milestone as part of re-baseline*)	Sep 2025
Tranche 1	*NPDR and WDI* Go Live (*Additional Milestone as part of re-baseline*)	Sep 2025

Scheduling and Dispatch - Tranche 2 Phase 3 Milestones

Tranche	Milestone	Dates
Tranche 2	System Build Commenced for Scheduling and Dispatch Programme Tranche 2 Initiatives	Jan – Mar 2025
Tranche 2	Regulatory Authority approval for Trading and Settlement Code (TSC), Capacity Market Code (CMC) & Grid Code Mods (GC) for Scheduling and Dispatch Programme Tranche 2 Initiatives	Apr - June 2025
Tranche 2	Publication of Technical Specification for Scheduling and Dispatch Programme Tranche 2 Initiatives	Apr - June 2025
Tranche 2	Vendor System Build and Test Complete for Scheduling and Dispatch Programme Tranche 2 Initiatives	Jul – Sep 2025
Tranche 2	TSO/MO System Test and Validation Complete for Scheduling and Dispatch Programme Tranche 2 Initiatives	Oct – Dec 2025
Tranche 2	Participant Interface Test (PIT) Commences for Scheduling and Dispatch Programme Tranche 2 Initiatives	Oct – Dec 2025
Tranche 2	Participant Interface Test (PIT) Complete for Scheduling and Dispatch Programme Tranche 2 Initiatives	Oct – Dec 2025
Tranche 2	Cutover activities Commences for Scheduling and Dispatch Programme Tranche 2 Initiatives	Oct – Dec 2025
Tranche 2	Confirm Go Live Decision for Scheduling and Dispatch Programme Tranche 2 Initiatives	Oct – Dec 2025

ISEM Technical Specification (ITS) - V16.1 February Update

Summary	Following the initial publication of ITS v16.0 covering upcoming changes to be delivered as part of SDP Tranche 1, a number of minor clarifications /amendments are being made based on industry feedback and comments. No changes have been made to the supporting schemas and sample files with updates centred on ensuing clarity on the SDP elements to be delivered as part of Release N. Updated version is currently being processed for approval and is due to be published later this month. Redline version will be included to highlight changes.

Area	What's New or Changed
Registration – Resourcing Balancing	Prior to Release N, the 'Max/Min Storage Quantity' fields within the Resourcing Balancing Registration were submitted/displayed as 'Max/Min Storage Capacity'. With the introduction of Release N, these field names are being updated to 'Max/Min Storage Quantity' to align with naming as per T&SC. This change was captured in the updated schema but was not called out in v16.0. This has now been corrected within v16.1.
Commercial Offer Data – Generator Offers	In Section 16.0, a number of ESPS specific data elements were added under the Battery Storage Parameters. These parameters are optional for ESPS units as flagged under the Submission (Mandatory/Optional) column. However, The Battery Storage Parameter header incorrectly stated the group of parameters being mandatory for ESPS units however In v16.1, this header has been updated to correctly state that Battery Storage Parameters are applicable for ESPS units only.
Physical Notifications - Data elements and validations	Unchanged in this release is the validation which governs PN Curve Type for each PN submission. It states that all 'Dispatchable Generator Units with registered capacity < 10MW' shall submit using the A01 PN Curve Type. All NPDRs (as controllable generators) will also submit using A01 PN Curve Type. As this validation would apply to SDP related units, a number of queries were received in relation to A01 PN submissions. In response, two clarifying points have been added to 'Start/End Time' and 'To/From MW' validation descriptions to ensure clarity. Namely: ▪ "For A01 type, both start_time and end_time must be on a 30 minute boundary. The minutes portion should always be either '00' or '30'." ▪ "A01 adheres to the block format validation i.e. Both From MW should equal To MW on the current row."

SDP Market Participant Survey Responses – Executive Summary

The below information provides an executive summary of the SDP Market Participant Survey

1. How and when was the survey conducted?

1. The SDP market participant survey was first highlighted to participants at the FPM Industry Workshop on 11th December 2024 with survey details subsequently shared with market participants via market message.

2. The SDP market participant survey was open **for 7 weeks** and closed to market participants **on 31st January**.

3. 23 market participant organisations completed the survey.

- **NB:** 92% of survey responses were submitted in advance of the rebaselined SDP delivery plan being shared with market participants.

2. What questions were in the survey?

Participant were asked to provide feedback on:

1. How clear was their organisation's **understanding of the changes** that were being delivered as part of SDP Tranche 1.

2. How **confident were they that their organisation is prepared for the changes** that will be implemented as part of Tranche 1 of the SDP Programme?

3. **What support, if any, would their organisation require** in advance of SDP go-live?

3. What were the main findings?

There were several key topics of feedback shared by market participants:

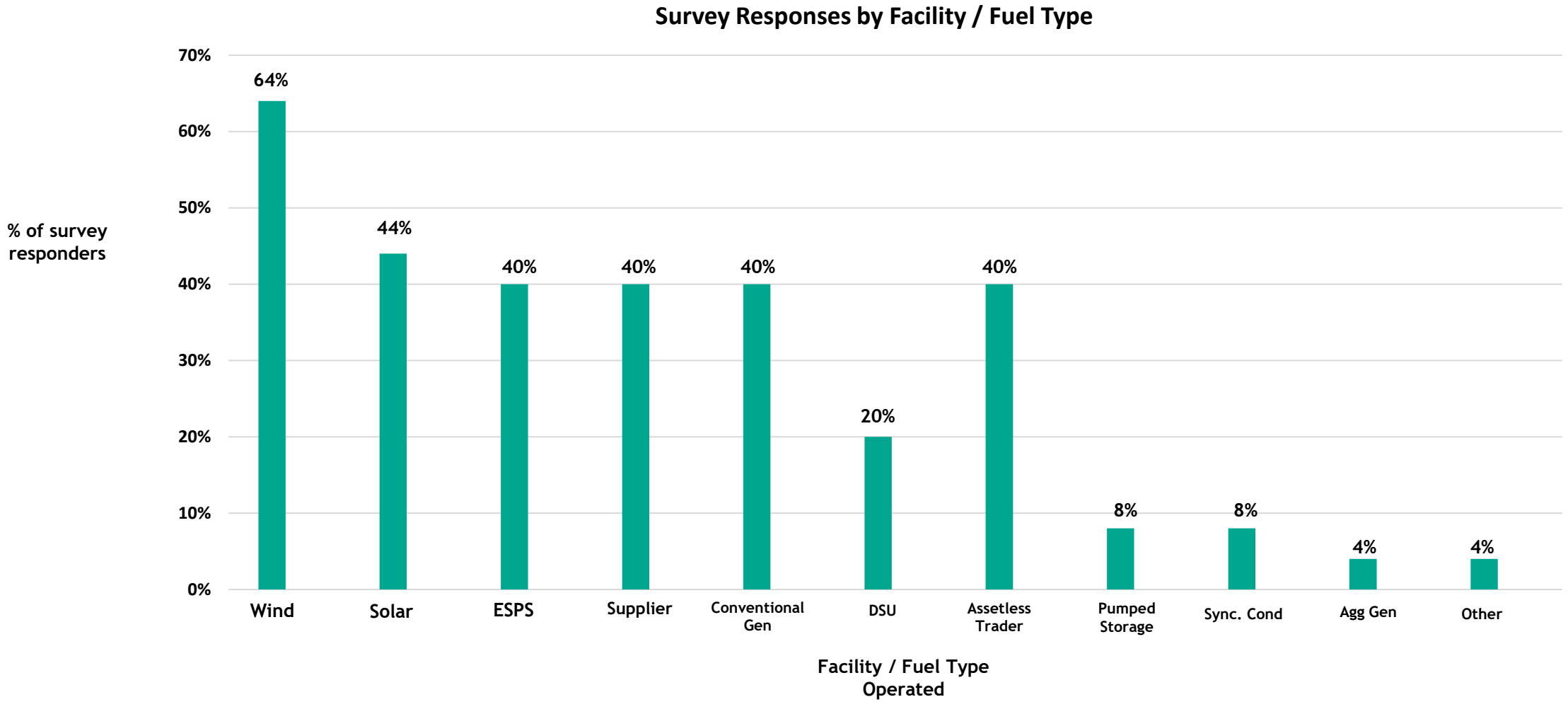
1. **SDP Delivery Timelines**: Market participants highlighted the condensed nature of previous SDP delivery timelines and the overlap with the MATS/MTU delivery timelines (feedback shared in advance of revised SDP delivery plan being shared in January)

2. **Further information on SDP T1 changes**: 10 market participants requested further information on changes being delivered by the SDP Programme for T1 initiatives.

3. **Other areas of feedback shared by market participants include**: (1) Confirmation of NPDR units, (2) detail on the Registration process for ESPS and NPDR units (3) publication of query log to see SDP queries previously responded to by SDP Programme, (4) longer PIT period and (5) request for regular meetings to be scheduled with SDP team during PIT and in advance of go-live.

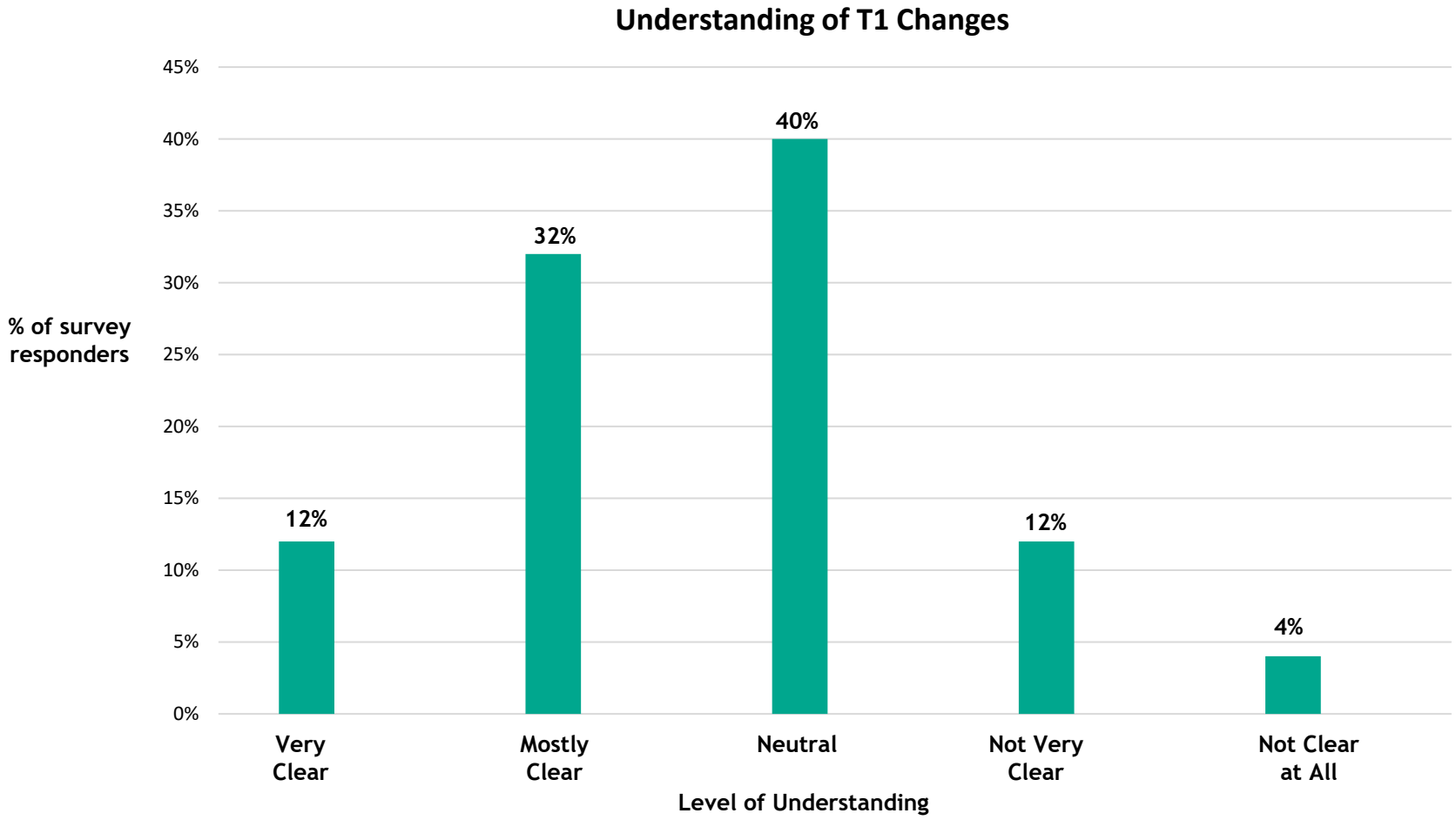
SDP Market Participant Survey Responses - Facility Types

Q1. What type of facility do you operate?



SDP Market Participant Survey Responses - Understanding of SDP T1 Changes

Q2. How clear is your organisation's understanding of the changes that will be implemented as part of SDP Tranche 1?



Very Clear: Fully understand. No questions.

Mostly Clear: Mostly understand. Some questions.

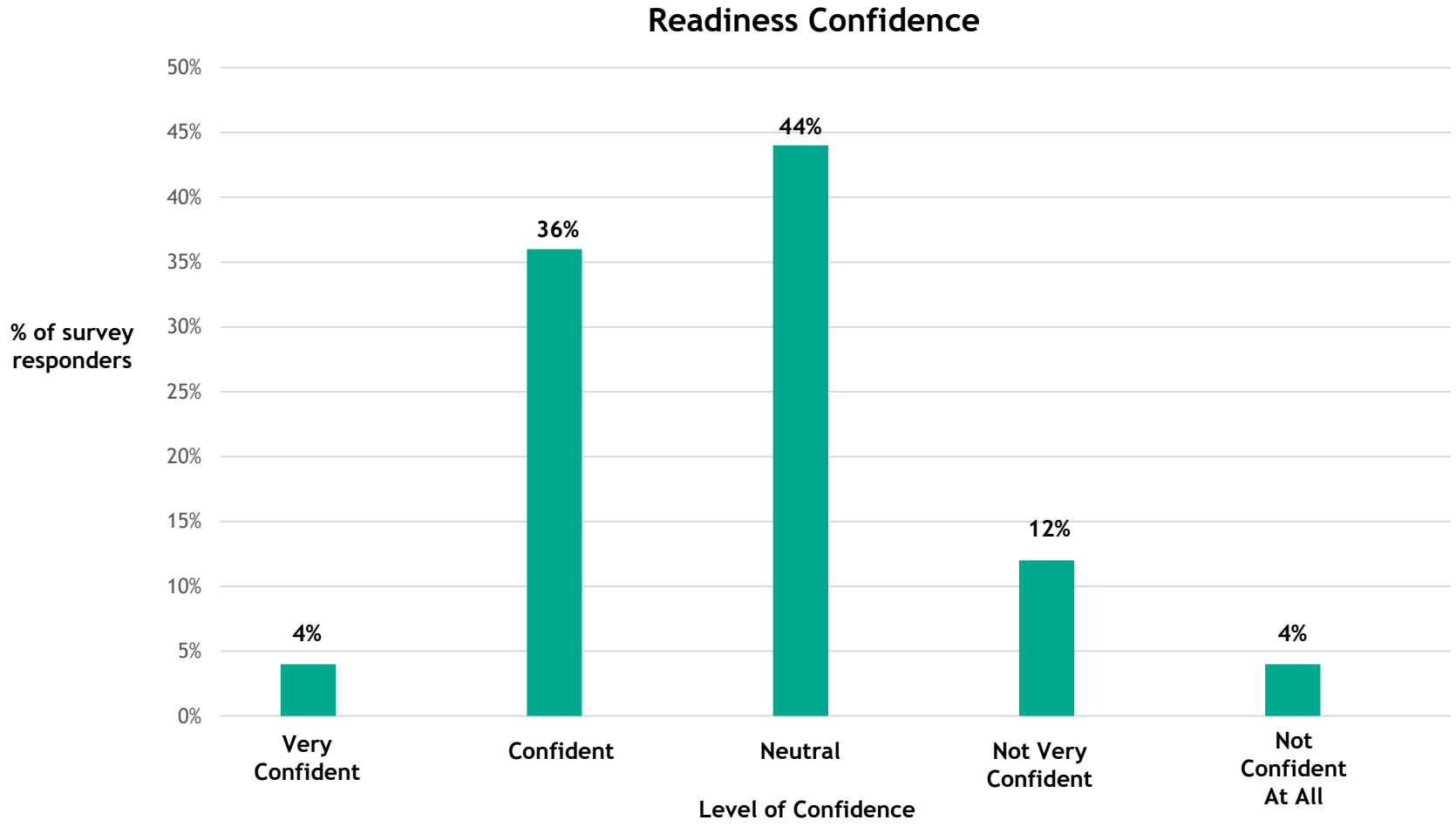
Neutral: Somewhat understand. More information required

Not Very Clear: Limited Understanding.

Not Clear at All: No understanding.

SDP Market Participant Survey Responses - Readiness confidence for T1 go-live

Q3. How confident are you that your organisation is prepared for the changes that will be implemented as part of SDP Tranche 1?*



*92% of responses provided in advance of rebaselined SDP plan being published.

SDP Market Participant Survey Responses – SDP Programme Considerations

The below highlights the key points of market participant feedback and action the SDP Programme plans to take in response to this feedback

	Feedback Received	What we have done / plan to do
1 **SDP Delivery Timelines**	• 4 market participants highlighted the level of **market change being delivered under the previous SDP delivery timelines** with overlap of MATS/MTU go-live. • 2 market participants requested an extension to the duration of PIT.	• **Revised SDP Programme timelines shared with market participants in January**. Revised delivery plan includes a phased delivery approach with SDP_02 go-live scheduled for May with SDP_01 and SDP_04 go-live planned for September. • Revised SDP Programme timelines includes an **extended PIT (2 months) scheduled** in advance of SDP_01 and SDP_04 go-live.
2 **Further Information on SDP Changes**	• 10 market participants requested **further information on the changes being delivered by the SDP programme**. This information ranged from introductory information to the SDP programme to more detailed information on technical changes SDP is delivering. • Market participants requested tr**aining material on key elements of change for NPDR units.** • 3 market participants requested for **more 'Day in the Life' scenarios to be covered by the SDP Programme.**	• SDP Programme **consolidating information on SDP changes previously shared** with market participants. SDP programme plans to publish **a summary of key changes being delivered by the SDP programme for T1 initiatives** (priority is information on ESPS changes). • NPDR training material in development in advance of NPDR training. SDP Programme aiming to share NPDR training material with industry in advance of virtual training. • SDP Programme reviewing how **'Day in the Life' scenarios can be covered as part of future workshops with market participants.**
3 **Other Feedback & Support Requests**	• 2 market participants requested the SDP programme to be available for **more regular meetings with market participants** during PIT and cutover windows. • 2 market participants requested **confirmation of their units which meet the criteria for no longer receiving priority dispatch** (NPDR). • 1 market participant asked for confirmation to be provided on the **registration implications for ESPS and NPDR units.** • 1 market participant requested for **SDP query log** to be published for market participants to review	• SDP programme exploring how additional meetings with market participants during **critical market participant engagement periods** can be provided (PIT, Cutover) • NPDR unit confirmation approach underway **with SDP programme to confirm NPDR units ASAP.** • SDP Programme to **provide update on Registration implications** for ESPS and NPDR units. • SDP to **publish FAQ document** of key queries received from market participants

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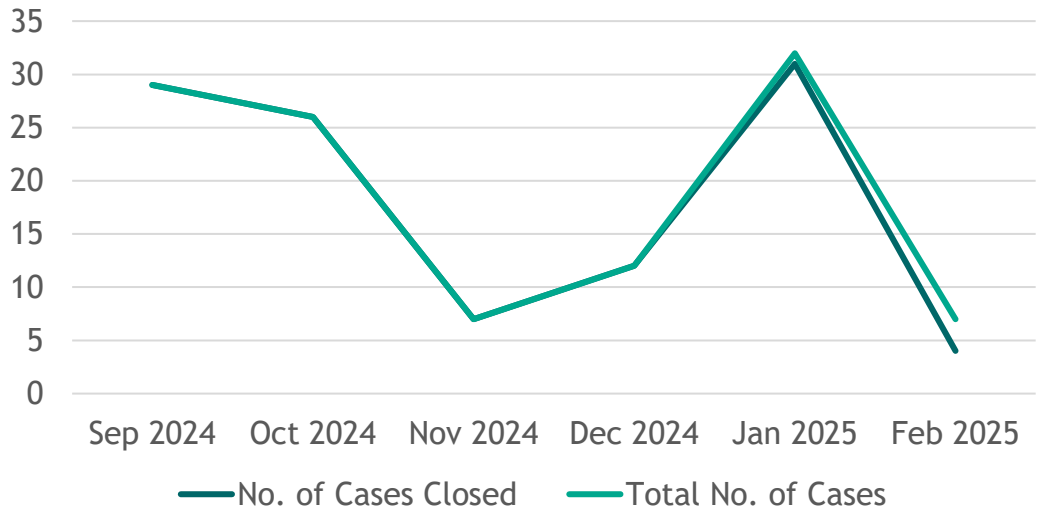
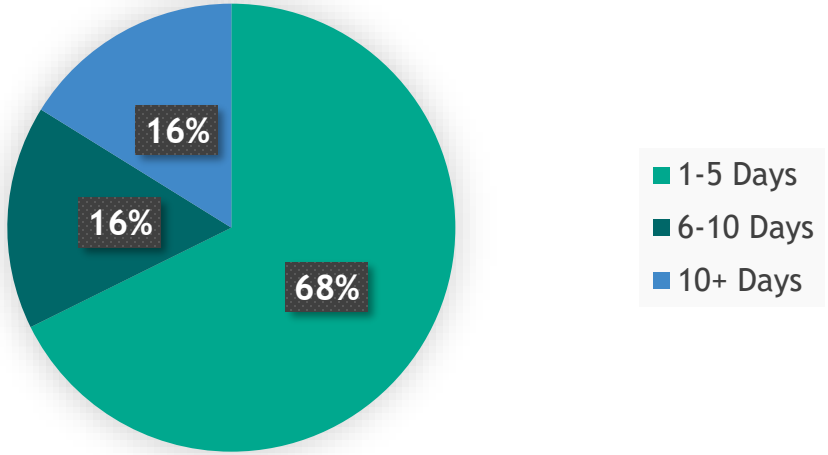
SDP – Query Management Overview

The below is an overview of key metrics associated with the queries received by the Scheduling & Dispatch Programme between September 2024 and February 2025.

SDP Case Query Volume



Working Days to Close out Cases



Most Common Query Topics (Sep – Feb)

1. NPDR / ESPS Technical Queries
2. NPDR Unit Confirmation
3. MPI Data Submission Queries
4. Support Material Requests
5. Test Environment Access Requests

Current Query Case Volumes

5	4 days
Cases Currently Open	Average Duration Open

Stakeholder Engagement: FPM Industry Workshop

Contacting FPM Programmes

To raise an issue or query for the Future Markets Programmes:

Contact	
	**SDP Queries** SchedulingandDispatch@Eirgrid.com SchedulingandDispatch@soni.ltd.uk **LDES Queries** LDES@Eirgrid.com LDESProgramme@soni.ltd.uk **FASS Queries** FASS@Eirgrid.com FASSProgramme@soni.ltd.uk **SMP Queries** SMP.PMO@Eirgrid.com **FPM Policy** FuturePowerMarkets@Eirgrid.com futurepowermarketsNI@soni.ltd.uk

Information to Provide
• Your Name • Your email & phone number • Your organisation • Topic of Issue/Query & Programme Name • Description of the issue or query • Any additional information to aid in understanding the issue or query • (*No requirement to email the same query to both EirGrid and SONI email addresses for a relevant programme*)

Future Power Markets: Future Workshop Schedule

Future Discussion Topics

SDP

- Additional Tranche 2 Details
- Non-Priority Dispatch Renewables Designation
- Participant Interface Test
- NPDR Training

FASS

- Real Time Security Arrangements (FAM Alternative) consultation – workshop on paper

SMP

- Overview of the plan
- Overview of impacts of EU Reintegration on SEM Market Participants

EMP

- CACM 2.0
- FCA 2.0
- CRM27 + (guided by SEMC)

Indicative Date	Location
19 March 2025	Virtual
April	TBC