19 June 2024

Day-Ahead System Services Auction (DASSA) Product Review & Locational Methodology Consultation

Industry Webinar

Drivers of Change: Whole of Electricity System Challenge

Supply
(IE/NI)

Offshore Wind
(+ 5 / 0.5 GW)

Onshore Wind
(+ 4.5 / 1 GW)

Solar
(+ 5.5 / 0.3 GW)

Microgen
(+ 2.5 / 0.1 GW)

Conventional
(+2.2 / 1 GW)

Shaping Our Electricity Future

Demand (+50%)
(IE/NI)

Large Energy Users
(~1.6 GW)

Electric Vehicles
(~950 / 300 k)

Heat Pumps
(~600 / 120 k)

Social & Economic Growth

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Consultation Paper

FASS Programme

Day-Ahead System Services Auction (DASSA) Product Review & Locational Methodology Consultation Paper V1.0

May 2024

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- Consultation paper focuses on a Product Review and locational requirements for the Reserve services that will be included in the initial Day-Ahead System Services Auction (DASSA).
- The paper addresses several trends and evolving risks that need to be mitigated by updated reserve product definitions.
- Responses to the questions set out in this paper should be submitted through either the EirGrid or the SONI portal by 18 July 2024.

Key Messages

The TSOs propose to:

1. Introduce 'downward' reserve products (FFR, POR, SOR, TOR1, TOR2, Replacement reserve) that will mirror the existing 'upward' products.
2. Reduce the current standard Full Activation Time (FAT) of FFR from 2 seconds to 1 second.
3. Procure FFR in three activation time sub-categories:

FFR subcategory	Full activation time
FFR Enhanced subcategory 1	150ms & sustainable up to 10s
FFR Enhanced subcategory 2	150ms ≤ FFR FAT <300ms & sustainable up to 10s
FFR Enhanced subcategory 3	300ms ≤ FFR FAT<1 second & sustainable up to 10s

4. Introduce minimum capability requirements on frequency deadbands, trajectories, reserve step sizes and reserve step triggers, that will remain configurable by the TSOs.
5. Combine RRS and RRD products into one Replacement Reserve (RR) product to be procured and dimensioned separately in upward and downward directions.
6. Maintain minimum reserve requirements within each jurisdiction to ensure the security of Ireland and Northern Ireland power systems following a 'system split' event.
7. Remove the majority of the existing scalars, apart from the Performance scalar, where two new scalars are proposed; Availability performance scalar and Event performance scalar.

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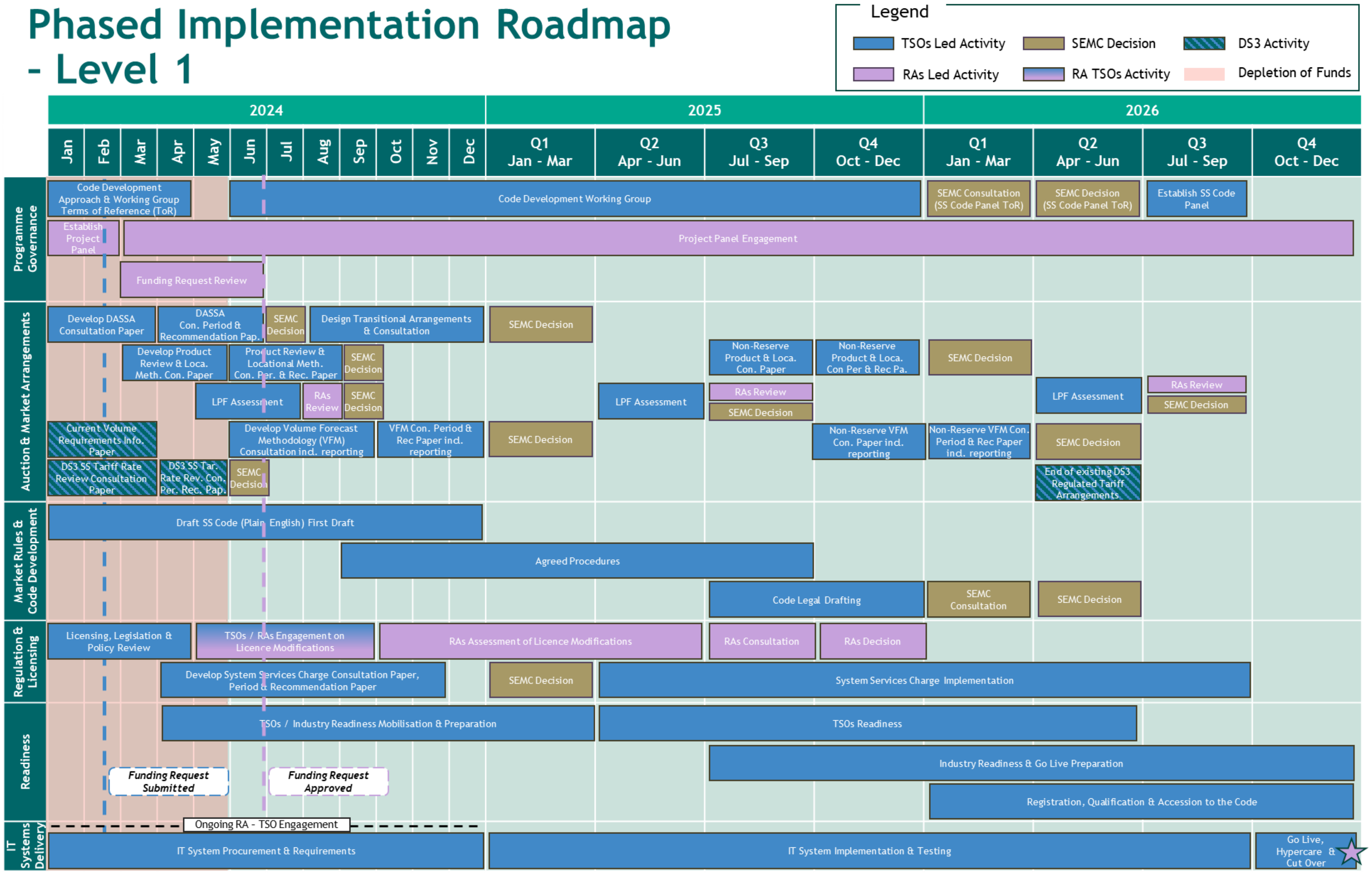
Agenda

1. Introduction
2. Current Reserve Product Definitions
3. System Needs
4. Changing Capabilities of Reserve Providers
5. Reserve Product Review
6. Locational Requirements
7. Reserve Product Scalars
8. Next Steps
9. Q&A

1. Introduction

1. Phased Implementation Roadmap (PIR) Deliverables: Product Review & Locational Methodology Consultation Paper



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1. Product Review & Locational Methodology Consultation Paper: Reserve Services

Services covered in this paper	Services not covered in this paper
FFR - Fast Frequency Response	RM1 - Ramping Margin 1
POR - Primary Operating Reserve	RM3 - Ramping Margin 3
SOR – Secondary Operating Reserve	RM8 - Ramping Margin 8
TOR1 – Tertiary Operating Reserve 1	FPFAPR - Fast Post Fault Active Power recovery
TOR2 - Tertiary Operating Reserve 2	SSRP- Steady State Reactive Power
RRS - Replacement reserve - Synchronised	DRR - Dynamic Reactive Response
RRD – Replacement Reserve - Desynchronised	SIR - Synchronous Inertia response

2. Current Reserve Product Definitions

2. DASSA Reserve Products Review - Existing DS3 Services

Daily Auction

Service Name	Abbreviation	Unit of Payment	Reserve Type (Upward /Downward)	Short Description
Synchronous Inertial Response	SIR	MWs^2h	N/A	(Stored kinetic energy)*(SIR Factor – 15)
Fast Frequency Response	FFR	MWh	Upward and some downward	MW delivered between 2 and 10 seconds
Primary Operating Reserve	POR	MWh	Upward	MW delivered between 5 and 15 seconds
Secondary Operating Reserve	SOR	MWh	Upward	MW delivered between 15 to 90 seconds
Tertiary Operating Reserve 1	TOR1	MWh	Upward	MW delivered between 90 seconds to 5 minutes
Tertiary Operating Reserve 2	TOR2	MWh	Upward	MW delivered between 5 minutes to 20 minutes
Replacement Reserve - DeSynchronised	RRD	MWh	Upward	MW delivered between 20 minutes to 1 hour
Replacement Reserve - Synchronised	RRS	MWh	Upward	MW delivered between 20 minutes to 1 hour
Ramping Margin 1 Hour	RM1	MWh	Upward	The increased MW output that can be delivered with a good degree of certainty for the given time horizon.
Ramping Margin 3 Hour	RM3	MWh	Upward	
Ramping Margin 8 Hour	RM8	MWh	Upward	
Fast Post-Fault Active Power Recovery	FPFAPR	MWh	N/A	Active power (MW) >90% within 250ms of voltage >90%
Steady-state reactive power	SRP	Mvarh	N/A	(Mvar capability)*(% of capacity that Mvar capability is achievable)
Dynamic Reactive Response	DRR	Mvarh	N/A	Mvar capability during large (>30%) voltage dips

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Daily Auction for Reserves first.

2. Product Review & Locational Methodology Consultation Paper: Contracted Volumes per Unit Type (Gate 9)

Service	FFR	POR	SOR	TOR1	TOR2	RRS	RRD	SSRP	SIR	RM1	RM3	RM8
Unit	MW	MW	MW	MW	MW	MW	MW	MVAR	MWS2	MW	MW	MW
Conventional	375	767	1157	1363	1985	4390	2083	6339	794856	6592	7872	8459
DSU	176	206	220	284	284	0	394	0	0	661	101	83
AGU	0	0	16	61	74	10	88	0	0	88	88	88
Wind	135	268	283	279	0	0	70	1568	0	0	0	0
Interconnectors	200	200	200	200	200	0	0	350	0	0	0	0
Battery	698	708	708	708	687	0	190	502	0	139	57	36
Hybrid	2	2	2	2	2	0	0	0	0	0	0	0
Solar	3	3	3	2	0	0	0	0	0	0	0	0
Total	1588	2154	2589	2898	3233	4400	2825	8759	794856	7480	8119	8666

3. System Needs

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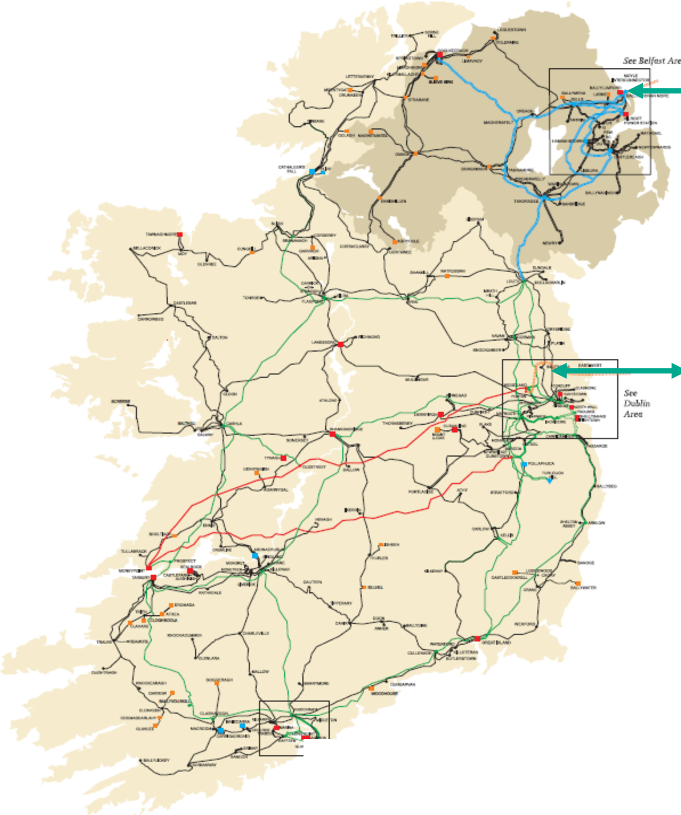
3. Size of the Power System Matters

- The All-Island Power System is smaller and has less interconnection than the Continental European Power System.
- As a result, frequency deviations tend to be quicker and have a larger magnitude during normal and abnormal system conditions (e.g., trips/faults) on the All-Island Power System.
- This is illustrated in the Figure below.



Moyle
+/- 500 MW
HVDC (LCC)
to Great Britain

EWIC
+/- 500 MW
HVDC (VSC)
to Great Britain

System Parameter	All-Island Power System	Continental European Power System
Peak Demand (GW)	7	~441
Minimum Inertia Level (GVA·s)	23	~1000
Largest Single Infeed (MW)	500	3000
RoCoF (Hz/s) = $\frac{50\ (Hz) \times Loss\ (MW)}{2 \times Inertia\ (MVA{\cdot}s)}$	0.54	0.075

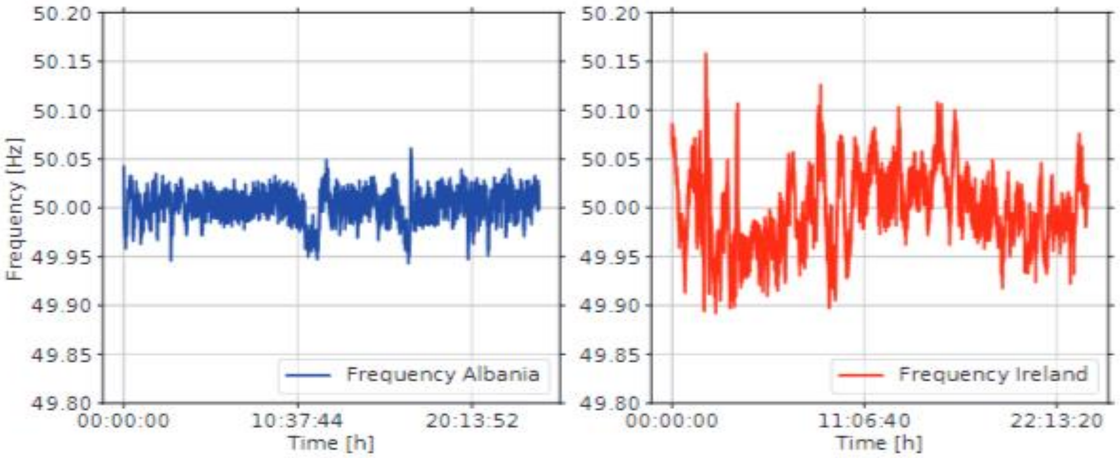


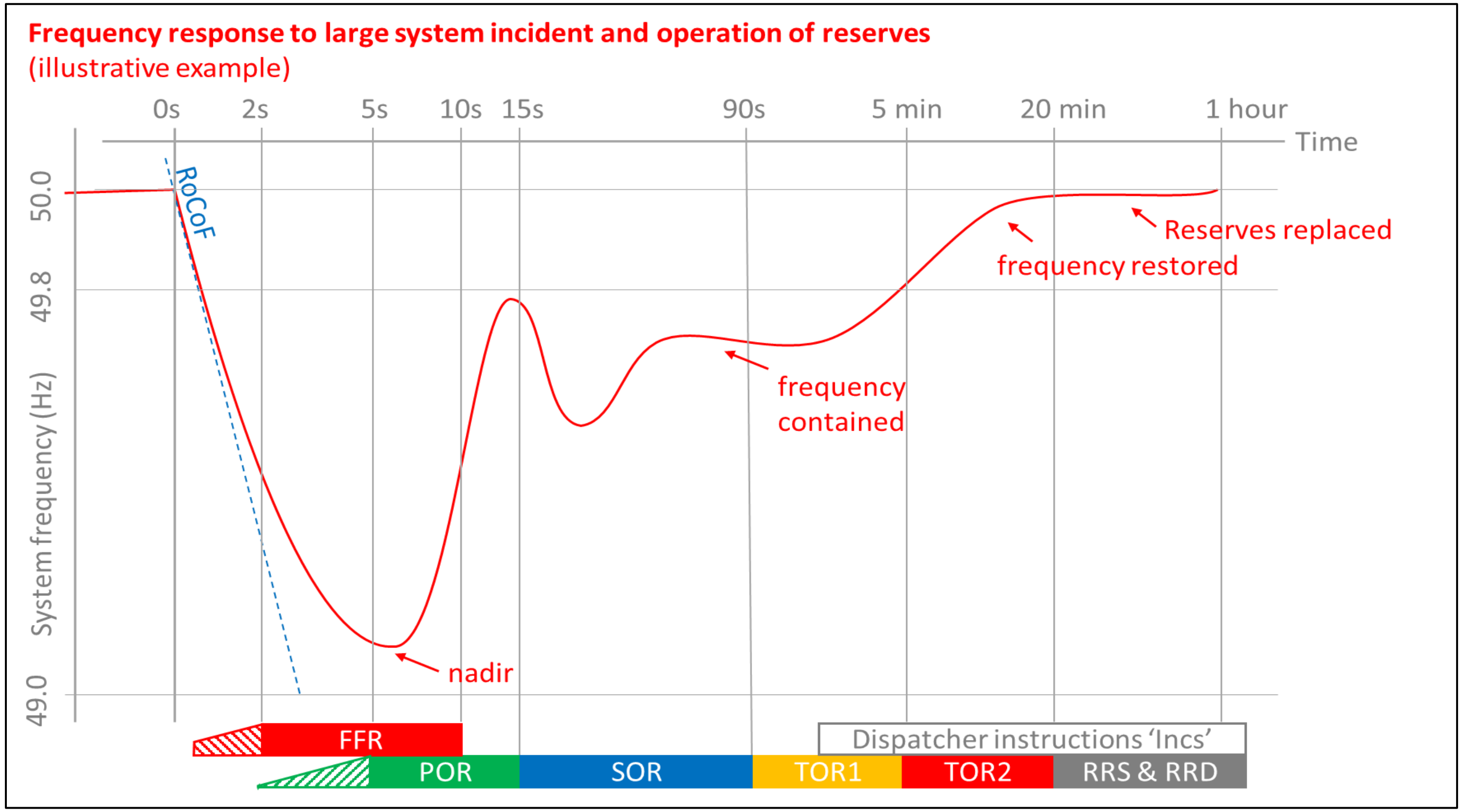
Fig. 1: Frequency in the CE and IE/NI power systems for 01.01.2021.

Source: T. Kërçi, M. Hurtado, M. Gjergji, S. Tweed, E. Kennedy and F. Milano, "Frequency Quality in Low-Inertia Power Systems," 2023 IEEE Power & Energy Society General Meeting (PESGM), Orlando, FL, USA, 2023, pp. 1-5.

3. Keeping Frequency Within Limits during Normal and Contingency Events

Three of the main tasks of the TSOs are to:

- Keep system frequency within the standard frequency range: 49.8 to 50.2 Hz.
- Mitigate large disturbances to avoid a maximum instantaneous frequency deviation larger than 1000 mHz from the nominal frequency of 50 Hz (i.e. the system frequency shall not go below 49.0 Hz or above 51.0 Hz).
- Keep RoCoF within ± 1Hz/s limit.



3. Evolution of Power System Needs

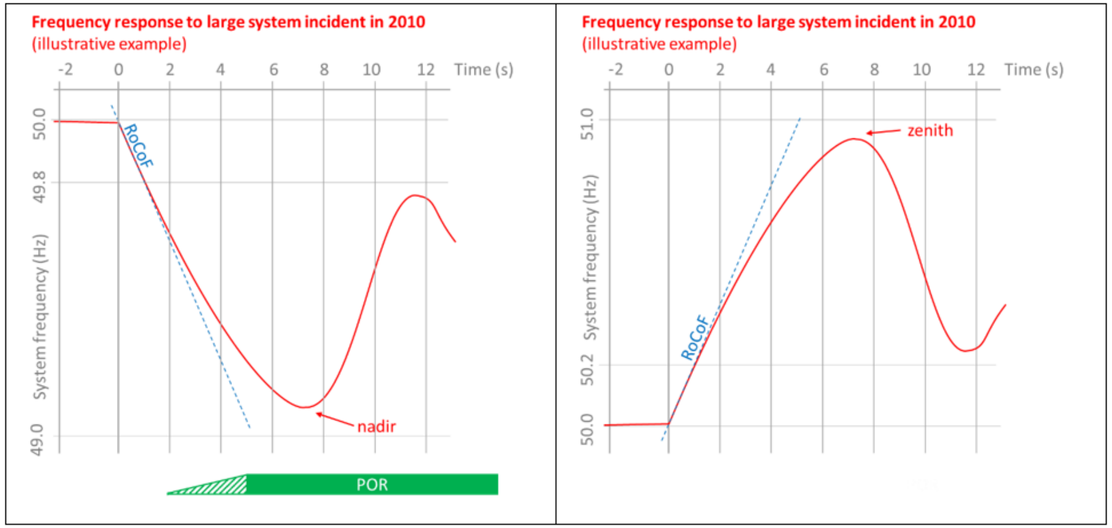


Figure 5 Illustrative example of a frequency trace following loss of largest single infeed (left) and largest single outfeed (right) in 2010

Figure 6 Illustrative example of a frequency trace following loss of largest single infeed (left) and largest single outfeed (right) in 2022

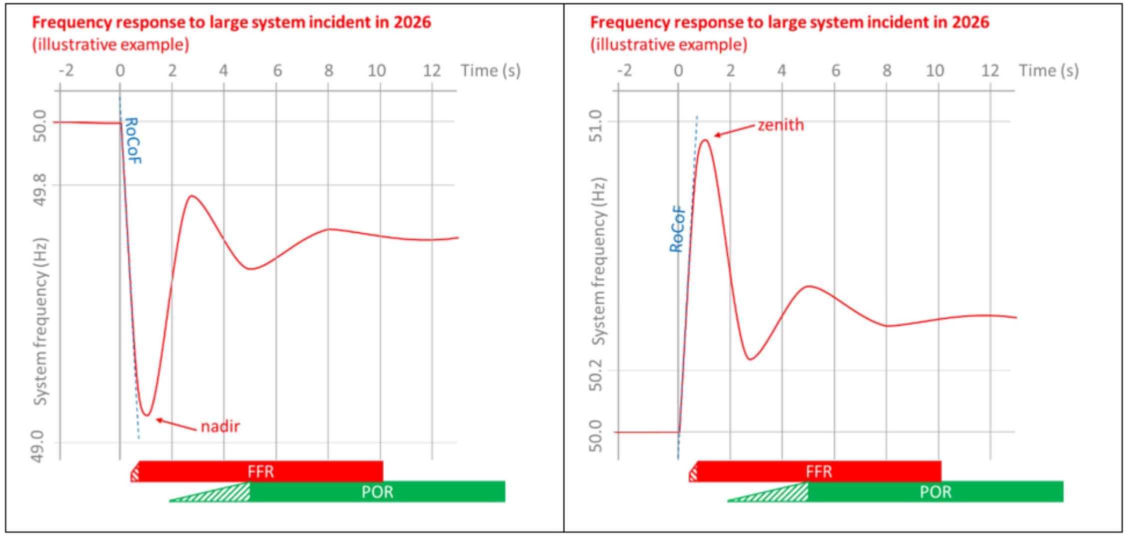


Figure 7 Illiustrative example of a frequency trace following loss of largest single infeed (left) and largest single outfeed (right) in 2026

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4. Changing Capabilities of Reserve Providers

4. Changing Landscape of Reserve Service Providers

- The All-Island system is evolving to integrate higher levels of renewable energy sources (RES), battery energy storage systems (BESS), interconnection, facilitating a changing demand mix (electrification of heat and transport and large volumes of LEUs and additional flexibility targets as required under governmental policies and EU Electricity Market Design reform).
- This coupled with the work on the operational policy roadmap, for example, reductions in minimum numbers of conventional units & reductions in inertia floor levels will mean that by 2030 system services will increasingly be provided by a range of low carbon technologies (RES, BESS), demand response and interconnectors.

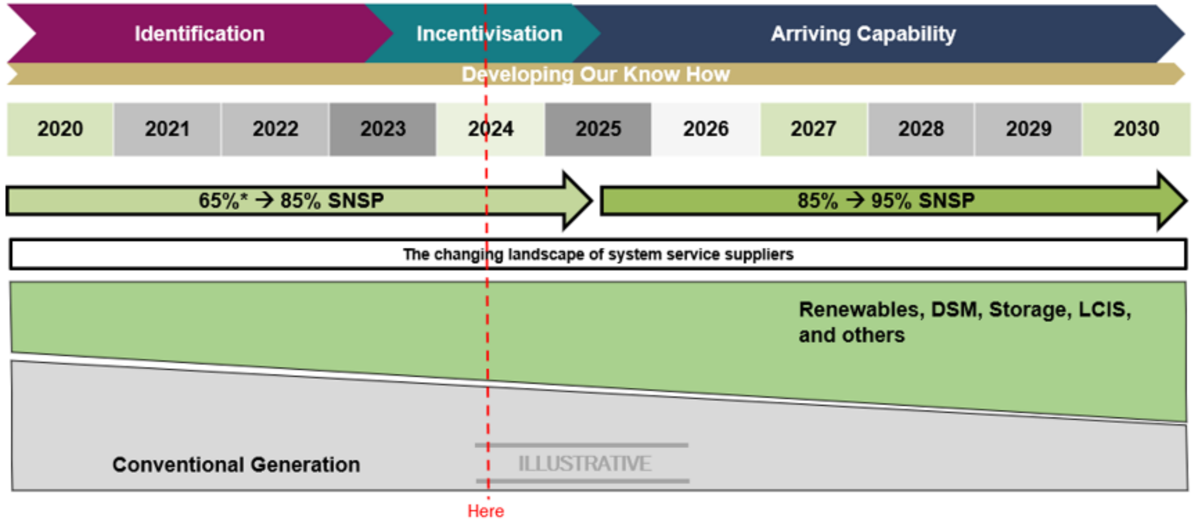

Figure 9 Increasing level of SNSP

	Plant	Full activation time	Time of sustained power	Dynamic/Static	Upward/Downward
Existing products based on:	Conventional plant	2-15s	Hours	Dynamic based on governor	Upward and Downward
Future providers of system services	Demand	< 150 ms	Seconds to hours	Static	Typically Upward
	HVDC interconnector	< 150 ms - 1000 ms	Seconds to hours	Static and Dynamic	Upward and Downward
	Hydro storage	<2-15s	Hours - dependant on resource availability	Dynamic based on governor	Upward and Downward
	Wind	0.5-1s	Few seconds with recovery (through virtual inertia), hours if operated below max output. Ineffective at low wind speed	Static and Dynamic	Already used for downward reserve, already contracted for upward for FFR, POR, SOR etc
	Solar PV	<150 ms - 1s	Seconds to hours if operated below max. output. Depending on sun.		Already contracted for POR, SOR etc in upward direction. Could provide downward
	Battery Energy Storage Systems (BESS)	<150 ms-1s	Seconds to hours	Static and Dynamic	Upward and Downward - depending on state of charge
	Super capacitor	<150 ms	Seconds	Static and Dynamic	
	Flywheel	<150 ms	< 15 minutes	Dynamic	Upward and Downward

Table 13 Comparison of generic capability of providers of FFR, POR, SOR, TOR1[38]

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5. Reserves Product Review

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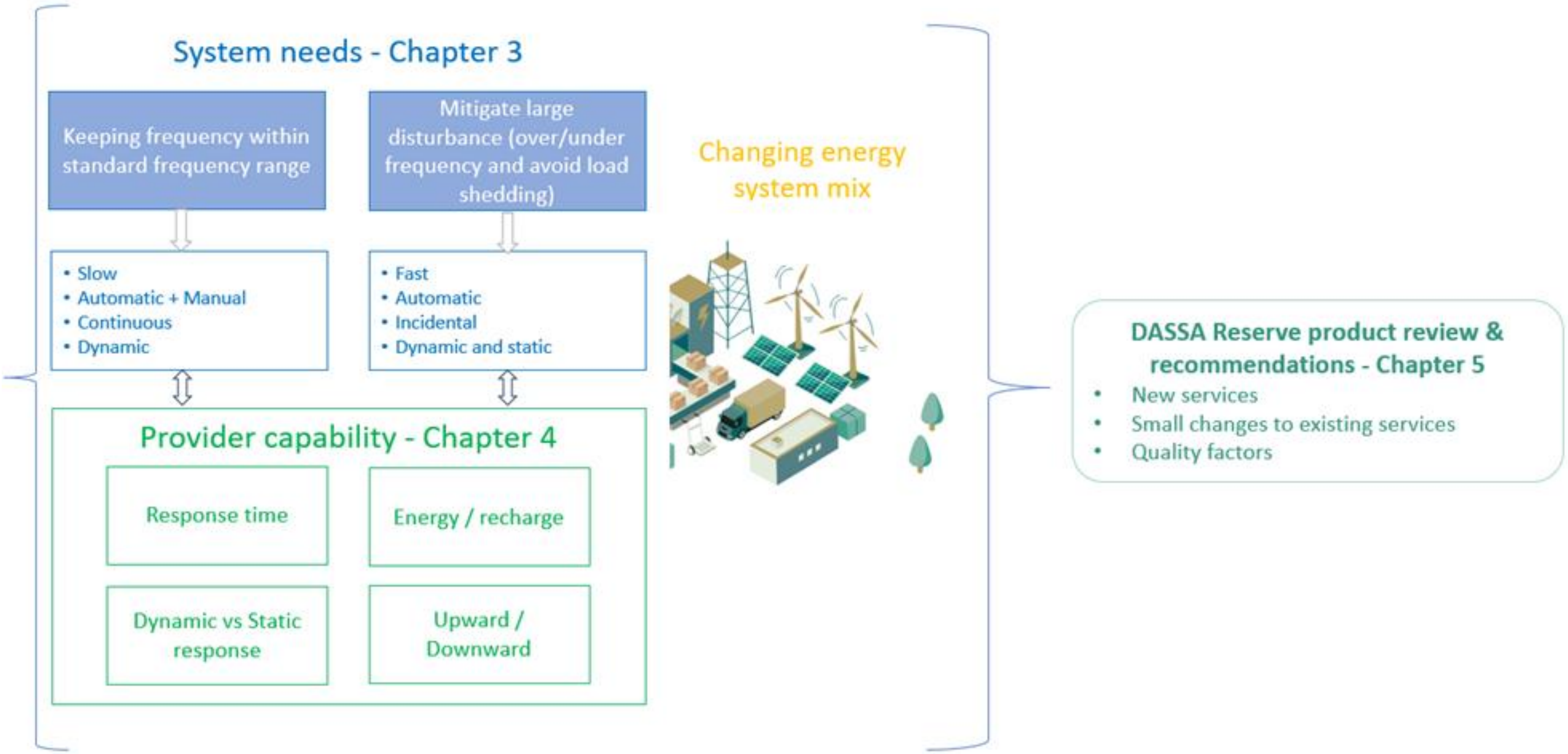
5. Illustration of Interactions between System Needs and Provider Capabilities



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5. Summary Reserve Product Proposals

- Table summarises the proposed response times and response duration for the different types of reserves and their categories. The table applies to both Upward and Downward Reserves which are to be procured separately.

Reserve product	Category	Full Activation Time	Response duration
FFR - Static response	I	150 ms	Response sustainable up to 10 s after the event
	II	≤ 300 ms	
	III	≤ 1s	
FFR - Dynamic response	IV	150 ms	
	V	≤ 300 ms	
	VI	≤ 1s	
Static POR	I	≤ 5 s	up to 15 s after the event
Dynamic POR	II		
Static SOR	I	15 s	up to 90 s after the event
Dynamic SOR	II		
Static TOR1	I	90 s	up to 5 minutes after the event
Dynamic TOR1	II		
Static TOR2	I	5 minutes	up to 20 minutes after the event
Dynamic TOR2	II		
RR		20 minutes	up to 1 hour after the event

5. Quality Aspects (Upward Reserves)

- The TSOs propose to introduce minimum capability requirements on frequency deadbands, trajectories, reserve step sizes and reserve step triggers, that will remain configurable by the TSOs.

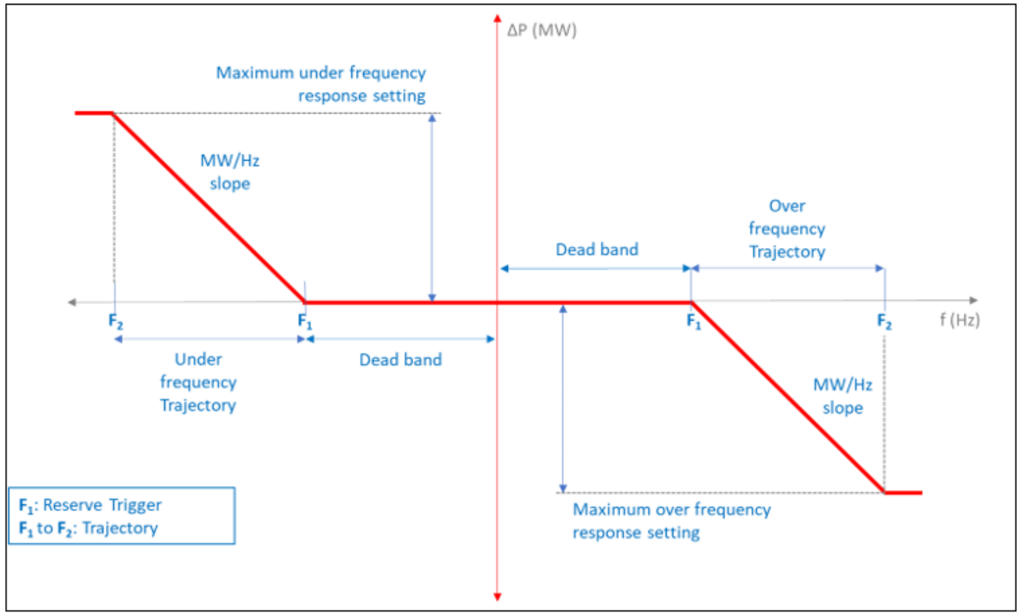

Figure 13: Illustration of Reserve Trigger F_1 and Trajectory F_1 - F_2

Criteria for	*Trigger F_1*	*End of trajectory F_2*	*Reserve Steps Sizes*	*Reserve Step Triggers*
Static FFR, POR, SOR, TOR1 and TOR2	configurable for each step between: $49.3 \leq F_1 \leq 49.8$ Hz	Not applicable	1 or more steps of ≤ 75 MW for a single discrete step.	Smallest available discrete step in response at any time must be no less than 20 % of the MW value of the Providing Unit's largest available step at that time
Dynamic FFR, POR, SOR, TOR1 and TOR2	configurable in range: $49.5 \leq F_1 \leq 49.985$ Hz	configurable in range: $49.3 \leq F_2 \leq 49.8$ Hz and $F_1 - F_2 \geq 200$ mHz	Not applicable	Not applicable

Table 31: Additional key requirements for Upward FFR, POR, SOR, TOR1 and TOR2 (refer to Figure 13)

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5. Quality Aspects (Downward Reserves)

- The TSOs propose to introduce minimum capability requirements on frequency deadbands, trajectories, reserve step sizes and reserve step triggers, that will remain configurable by the TSOs.

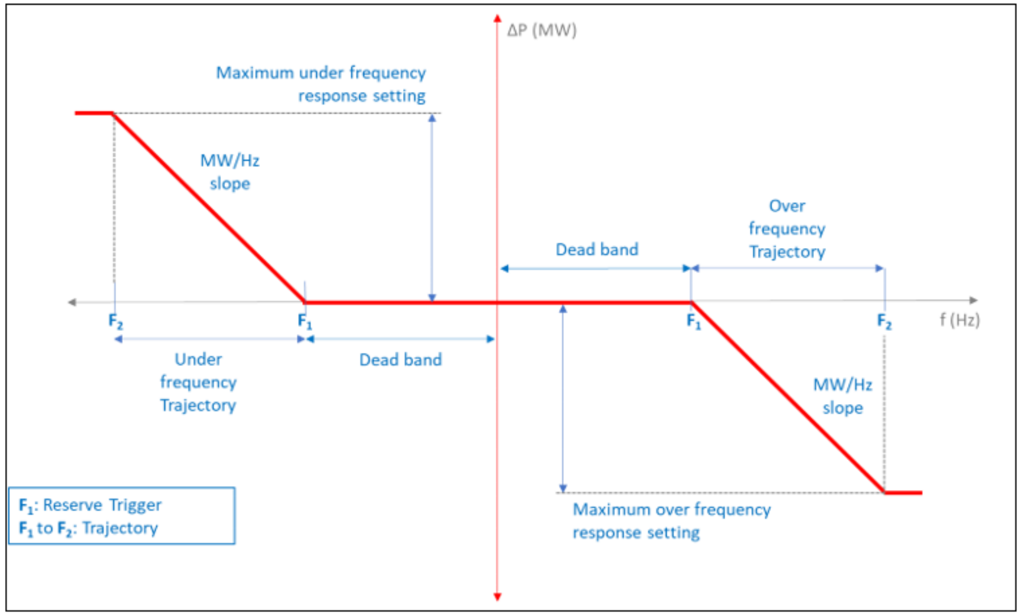

Figure 13: Illustration of Reserve Trigger F_1 and Trajectory F_1 - F_2

Criteria for	*Trigger F_1*	*End of trajectory F_2*	*Reserve Steps Sizes*	*Reserve Step Triggers*
Static FFR, POR, SOR, TOR1 and TOR2	configurable in range for each step: $50.2 \leq F_1 \leq 50.7$ Hz	Not applicable	1 or more steps of ≤ 75 MW for a single discrete step.	Smallest available discrete step in response at any time must be no less than 20 % of the MW value of the Providing Unit's largest available step at that time
Dynamic FFR, POR, SOR, TOR1 and TOR2	configurable in range: $50.015 \leq F_1 \leq 50.5$ Hz	configurable in range: $50.2 \leq F_2 \leq 50.7$ Hz and $F_2 - F_1 \geq 200$ mHz	Not applicable	Not applicable

Table 32: Additional key requirements for Downward FFR, POR, SOR, TOR1 and TOR2 (refer to Figure 13)

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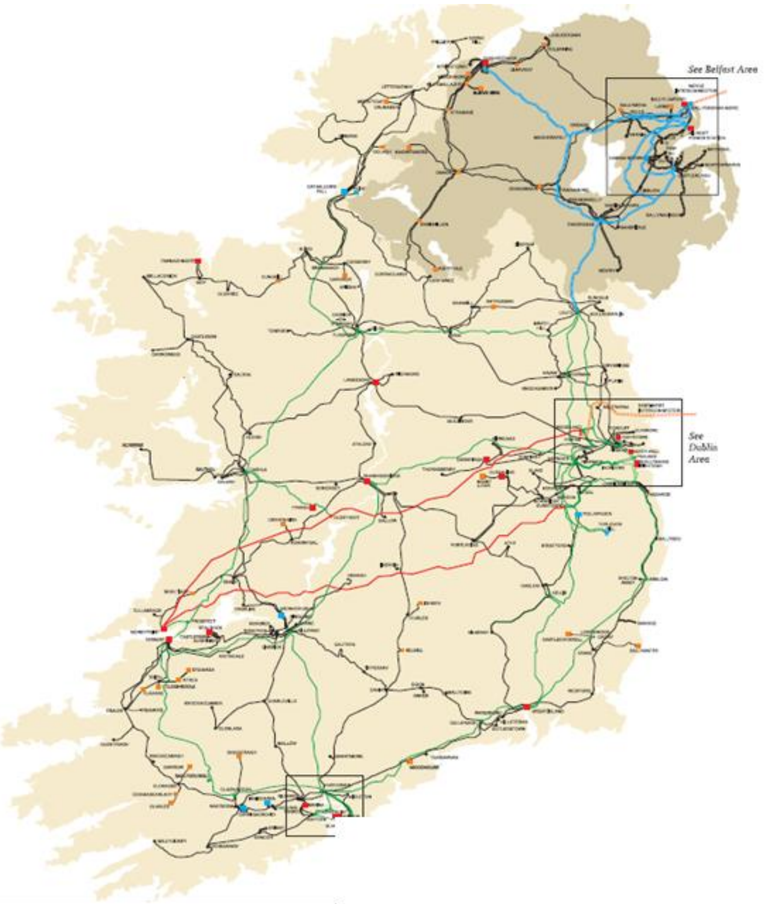
6. Locational Requirements

6. All-Island and Jurisdictional Requirements

- All-Island reserves requirements, and sharing of reserves between the jurisdictions, will remain in place to deal with loss of LSI and LSO and potential ‘system split’ event.
- In particular, in advance of the delivery of the second North-South Interconnector, the locational requirements for Reserve services are driven by the potential for a ‘system split’ event which would result in the electrical separation of the Ireland and Northern Ireland power systems. Therefore, minimum reserve requirements must continue to be held within each jurisdiction to ensure the security of each power system in such an event.



Pre-Trip Tie-Line Power-Flow	Post Trip Frequency Impact	Reserve Requirement
South to North	NI: frequency drops	NI: upward response
	IE: frequency rises	IE: downward response
North to South	NI: frequency rises	NI: downward response
	IE: frequency drops	IE: upward response

Table 33 Frequency response and reserve requirement re. Tie-line trip

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7. Reserve Products Scalars

7. Scalars Considerations

The TSOs propose to:

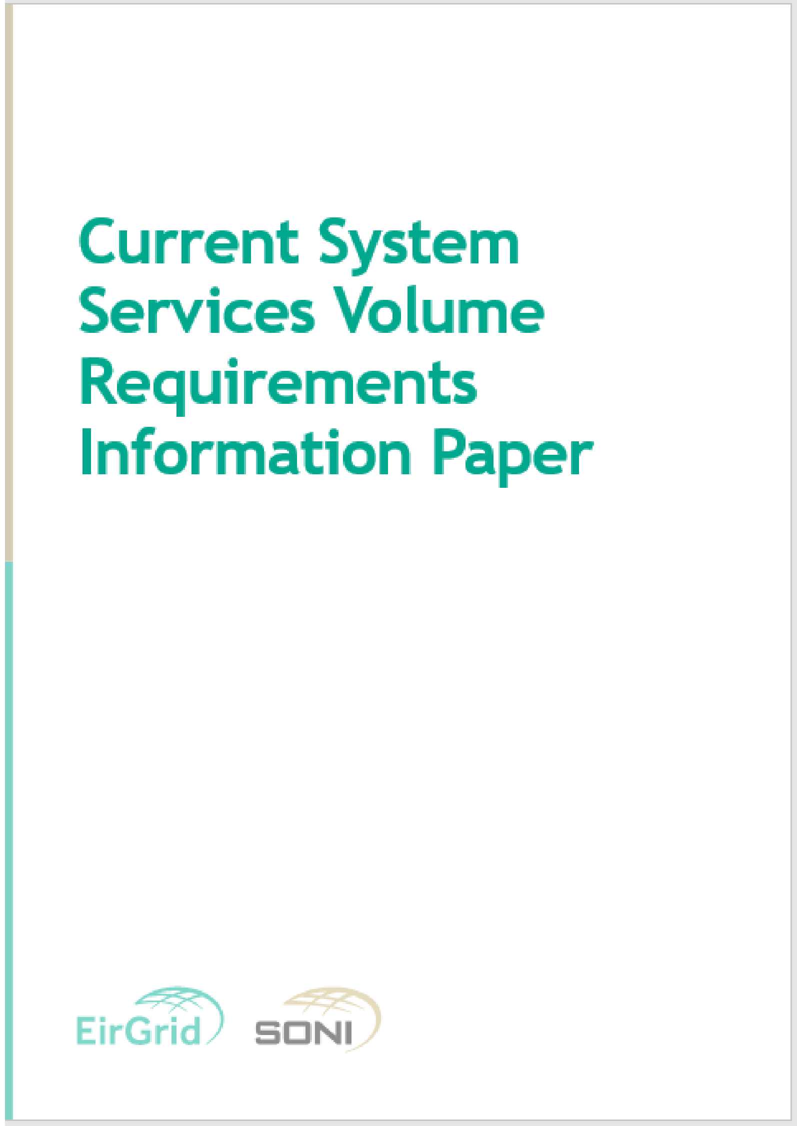
- Remove the temporal scarcity scalar based on current operational and energy system characteristics and in line with the proposed removal of the SNSP metric in the operational policy roadmap.
- Replace the performance scalar with the new Availability performance scalar and Event performance scalar as outlined in the DASSA Auction Design consultation paper.
- Remove the existing Faster response of FFR product scalar (i.e., creating a new definition of the FFR Product and new minimum quantities of faster subcategories).
- Remove the enhanced delivery provision scalar. The required system service technical requirements can most efficiently be delivered through the product design and auction mechanism.
- Remove continuous provision scalar and consider the introduction in the procurement of a bundled reserve product that can be continuously deployed from FFR or POR up to TOR1 or TOR2 by a single resource.

The application of locational scarcity scalars will require further examination by the TSOs and SEMC as we transition to FASS. For clarity, the application of locational scarcity scalars to the products under review in this paper is not proposed based on forecasted technical requirements within the DASSA implementation timeframes.

8. Next Steps

8. Next Steps

- This consultation paper outlines the TSOs' considerations on the required reserve products for a DASSA auction in 2026, taking into account a changing energy system and evolving generation and demand characteristics.
- The paper is open for responses until 18 July 2024 and the responses received will inform the final TSO recommendations on the Reserve service product definitions that will be proposed to the SEMC for procurement through the DASSA auctions.
- As part of the activities required to implement DASSA arrangements in 2026, the TSOs are also currently reviewing the Volumes Forecasting Methodology for the proposed Reserve Service products. The TSOs will consult on the outcome of this review towards the end of Q3 2024.


Current System Services Volume Requirements Information Paper

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- The TSOs have created this Information Paper in line with the FASS Phased Implementation Roadmap (PIR) to provide detail on the current System Service volume requirements and provide context for the FASS Programme.
- In particular, the paper aims to provide additional detail on the temporal impacts which alter both System Service requirements (e.g. as the Largest Single Infeed (LSI) varies) and the providers who can deliver those requirements (e.g. the market scheduled position of generators and Interconnectors).
- This is illustrated through the inclusion of actual example scenarios.
- The paper is not intended to provide any commentary on, or analysis of, any payment, procurement, or commercial aspect of the existing System Services arrangements.

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Thank You!

Questions?

Responses to the questions set out in the paper should be submitted through either the EirGrid or the SONI portal by 18 July 2024.

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