Consultation on DS3 System Services Enduring Scalar Design

DS3 System Services Implementation Project

4 July 2017

EIRGRID SONI

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Executive Summary

This consultation paper on DS3 System Services Enduring Scalar Design is being published in parallel with the consultation paper on DS3 System Services Enduring Tariffs.

The SEM Committee decision paper SEM-14-108 directed that System Services scalars should be implemented to incentivise flexibility, reliability, value for money and performance. Scalars are categorised under four categories: Performance, Scarcity, Product and Volume.

This consultation paper details the TSOs' minded to position as to how scalars are to be implemented for each category for Regulated Arrangements, which are set to go live on 1 May 2018. The scalar design set out in this paper has been developed in the context of the previous consultation on DS3 System Services scalar design carried out in Q1 2016 in advance of Interim Arrangements go-live on 1 October 2016, including the report, "High Level Principles of Scalar Design for DS3 System Services", completed by TNEI and Pöyry. Responses received from interested parties to that consultation, together with the experience derived from the operation of those scalars implemented for Interim Arrangements, have informed our current scalar design proposals. Importantly, the proposed tariffs for Regulated Arrangements have underpinned the rationale for both the choice of scalars and their values; the proposed scalars must be considered in that context.

Additionally, this paper sets out our initial thoughts relating to the implementation of Frequency Response Curves as a means of defining the provision of the Fast Frequency Response Service. It is being included in this document due to its material relationship to scalars that we propose to apply to the Fast Frequency Response Service. There will be further communication and interaction with stakeholders on the design of these curves ahead of the commencement of the procurement process.

TSOs' System Services Scalar Proposals for Regulated Arrangements

The TSOs propose that the scalars detailed below are implemented for Regulated Arrangements. These proposals include scalars already implemented for Interim Arrangements, modifications to the design of scalars previously consulted upon, as well as a number of new scalar proposals. These scalar proposals must be viewed in the context of the proposed tariffs for Regulated Arrangements detailed in the consultation paper on DS3 System Services Enduring Tariffs, which has been published in parallel with this paper.

The TSOs are minded to implement the following scalars for Regulated Arrangements:

- Performance Scalar
- Product Scalar for the Faster Response of FFR
- Product Scalar for the Enhanced Delivery of FFR, POR, SOR and TOR1
- Product Scalar for the Continuous Provision of Reserve from FFR to TOR1
- Product Scalar for the Enhanced Delivery of SSRP with an AVR
- Product Scalar for SSRP with Watt-less MVars
- Temporal Scarcity Scalar for DRR and FPFAPR
- Temporal Scarcity Scalar for FFR
- Temporal Scarcity Scalar for 11 Existing System Services
- Locational Scarcity Scalar for All System Services

In this document, the TSOs describe our proposals for the specific design features of the scalars, summarise the responses to the 2016 scalar consultation paper where applicable, and put forward the rationale behind our proposed design.

System Services Scalars Not Proposed for Regulated Arrangements

The TSOs do not propose to implement the following scalars for Regulated Arrangements. While these do not include any scalars already implemented for Interim Arrangements, they do include a scalar (volume scalar) that we were previously minded to implement for Regulated Arrangements.

The TSOs are minded not to implement the following scalars for the duration of Regulated Arrangements:

- Locational scarcity scalar for SSRP
- Product scalar for enhanced delivery of DRR with more reactive current
- Product scalar for enhanced delivery of SSRP with a PSS
- Product scalar for SIR with Reserve
- Product scalar for Faster Response of FPFAPR
- Temporal scarcity scalar for Reserve Products
- Temporal scarcity scalar for SIR
- Volume scalar

In this document, the TSOs summarise the responses to the 2016 scalar consultation paper where applicable, and put forward the rationale behind our proposal not to implement these scalars.

Frequency Response Curves Proposed for Regulated Arrangements

The TSOs propose to implement 2 frequency response curves for the purpose of defining the provision of the Fast Frequency Response Service for Regulated Arrangements. The curves are intended to include control parameters that are to be specified bespoke to each providing unit, depending on the unit's capabilities and system requirements. Arising from the completion of initial TSO studies on the suitability of selected curves, the TSOs are minded to implement a response curve for units capable of a dynamic response to frequency events and a separate curve for units capable of delivering static responses.

Stakeholder Engagement

Views and comments are invited on all aspects of this document. Responses to this consultation should be sent to:

DS3@eirgrid.com or DS3@soni.ltd.uk by 21 August 2017.

Responses should be provided using the associated questionnaire template. It would be helpful if answers to the questions include justification and explanation. If there are issues pertinent to System Services that are not addressed in the questionnaire, these can be addressed at the end of the response.

It would be helpful if responses are not confidential. If you require your response to remain confidential, you should clearly state this on the coversheet of the response. We intend to publish all non-confidential responses. Please note that, in any event, all responses will be shared with the Regulatory Authorities.

To facilitate stakeholder engagement we will host an industry workshop during the consultation period. This workshop, which is scheduled for 1 August 2017 in Dundalk, will provide an opportunity for discussion on the details of this consultation paper.

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1. Introduction and Background

1.1. DS3 Programme

The objective of the 'Delivering a Secure Sustainable Electricity System (DS3)' Programme, of which System Services is a part, is to meet the challenges of operating the electricity system in a safe, secure and efficient manner while facilitating higher levels of renewable energy.

One of the key work streams in the DS3 Programme is the System Services work stream. The aim of the System Services work stream is to put in place the correct structure, level and type of services in order to ensure that the system can operate securely with higher levels of non-synchronous renewable generation (up to 75% instantaneous penetration). Operating in this manner will reduce the level of curtailment for wind farms and should deliver significant savings to consumers through lower wholesale energy prices.

1.2. DS3 System Services

In December 2014, the SEM Committee published a decision paper on the high-level design for the procurement of DS3 System Services (SEM-14-108)[1].

The SEM Committee's decision framework aims to achieve the following:

- Provide a framework for the introduction of a competitive mechanism for procurement of System Services;
- Provide certainty for the renewables industry that the regulatory structures and regulatory decisions are in place to secure the procurement of the required volumes of System Services;
- Provide certainty to new providers of System Services that the procurement framework provides a mechanism against which significant investments can be financed;
- Provide clarity to existing providers of System Services that they will receive appropriate remuneration for the Services which they provide;
- Provide clarity to the TSOs that the required System Services can be procured from 2016 onwards in order to maintain the secure operation of the system as the level of wind increases;

[1] DS3 System Services Procurement Design and Emerging Thinking Decision Paper (SEM-14-108): https://www.semcommittee.com/sites/semcommittee.com/files/media-files/SEM-14-108%20DS3%20System%20Services%20Decision%20Paper.pdf

- Provide clarity to the Governments in Ireland and Northern Ireland (and indeed the European Commission) that appropriate structures are in place to assist in the delivery of the 2020 renewables targets;
- Ensure that Article 16 of Directive 2009/EC/28 is being effectively implemented (duty to minimise curtailment of renewable electricity);
- Provide assurance to consumers that savings in the cost of wholesale electricity which can be delivered through higher levels of wind on the electricity system, can be harnessed for the benefit of consumers;
- Provide assurance to consumers that they will not pay more through System Services than the benefit in terms of System Marginal Price (SMP) savings which higher levels of wind can deliver[2].

Table 1 below provides a high-level summary of the DS3 System Services products.

Table 1: Summary of DS3 System Services Products

Service Name	Abbr.	Unit of Payment	Short Description
Synchronous Inertial Response	SIR	MWs^2h	(Stored kinetic energy)* (SIR Factor – 15)
Fast Frequency Response	FFR	MWh	MW delivered between 2 and 10 seconds
Primary Operating Reserve	POR	MWh	MW delivered between 5 and 15 seconds
Secondary Operating Reserve	SOR	MWh	MW delivered between 15 to 90 seconds
Tertiary Operating Reserve 1	TOR1	MWh	MW delivered between 90 seconds to 5 minutes
Tertiary Operating Reserve 2	TOR2	MWh	MW delivered between 5 minutes to 20 minutes
Replacement Reserve – Synchronised	RRS	MWh	MW delivered between 20 minutes to 1 hour
Replacement Reserve – Desynchronised	RRD	MWh	MW delivered between 20 minutes to 1 hour
Ramping Margin 1	RM1	MWh	The increased MW output that

[2] Note: the composition of the price that will be paid by end consumers for wholesale electricity will change significantly following the introduction of the I-SEM trading arrangements. The savings delivered by DS3 will be split across the imbalance settlement, balancing costs, the price in the ex-ante markets and the Capacity Remuneration Mechanism.

Ramping Margin 3	RM3	MWh	can be delivered with a good degree of certainty for the given time horizon.
Ramping Margin 8	RM8	MWh	
Fast Post Fault Active Power Recovery	FPFAPR	MWh	Active power >90% within 250 ms of voltage >90%
Steady State Reactive Power	SSRP	MVArh	MVAr capability*(% of capacity that MVAr capability is achievable)
Dynamic Reactive Response	DRR	MWh	MVAr capability during large (>30%) voltage dips

1.3. DS3 System Services Scalars

The SEM Committee decision paper SEM-14-108 directed that scalars should be applied to the remuneration rates of the 14 System Services in order to incentivise flexibility, reliability, value for money and performance.

The paper classified scalars under four categories – Product, Scarcity, Volume and Performance – and described their purpose as follows:

Product Scalar: "Incentivising both the more effective delivery of a service and for faster response times for certain services."

Scarcity Scalar: "To create marginal incentives for providers to make themselves available during periods or in locations of scarcity, therefore enhancing the performance of the system where it is most needed."

Volume Scalar: "To ensure consumers are protected from unnecessarily high prices and maintain the integrity of the overall procurement process."

Performance Scalar: "To reward and incentivise high levels of performance" and "to ensure lower payments from the consumer for a lower level of performance."

1.4. DS3 System Services Volumes and Tariffs

The proposed design of the System Services scalars has been developed alongside that of the tariffs for Regulated Arrangements. The underlying principles for determining those tariffs – including ensuring that payments for System Services stay within the overall expenditure set out by the SEM Committee, the need to drive investment in necessary System Services provision, and the appropriate coordination between energy, capacity and System Services payments – have informed the design and values of the scalars. The consultation paper on DS3 System Services Enduring Tariffs describes the proposed tariffs and their underlying rationale in detail.

Figure 1 illustrates the interaction between tariffs and scalars for Regulated Arrangements.

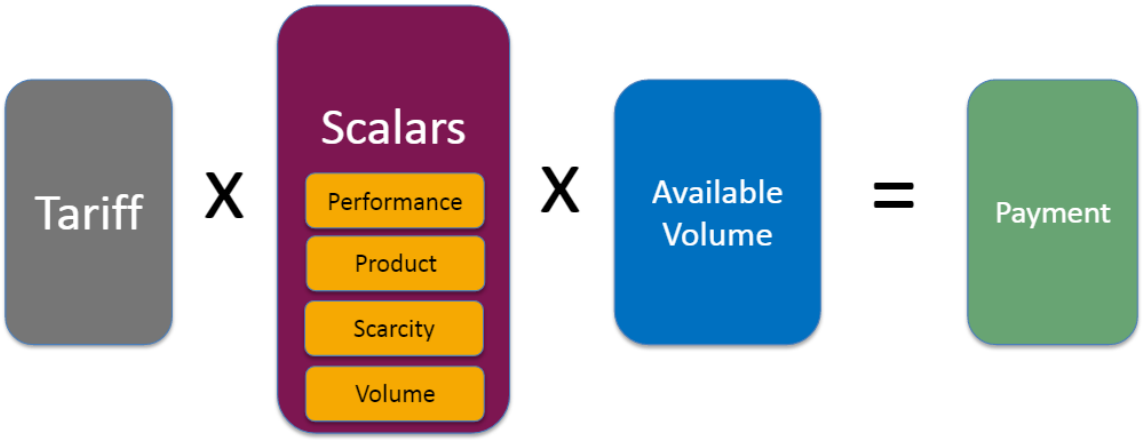

Figure 1: System Services Regulated Tariffs, Scalars and Volumes

1.5. 2016 Consultation on Scalar Design

In March 2016, the TSOs published the Consultation on DS3 System Services Scalar Design[3]. This consultation paper proposed a number of scalars to be implemented across the 4 scalar categories and provided stakeholders with the opportunity to feed into the design process through consultation.

A key input to the consultation paper was analysis conducted by TNEI and Pöyry on the design of the Product, Scarcity and Volume Scalars, which was commissioned by the TSOs. Their report, "High Level Principles of Scalars for DS3 System Services", was published along with the consultation paper[4]. In the consultation paper, the TSOs provided its views with regard to the recommendations made in the TNEI / Pöyry report: while the latter considered multiple scalars, only a subset of these was initially recommended for implementation in the consultation paper.

Separate to the work carried out by TNEI and Pöyry on the design of the Product, Scarcity and Volume Scalars, the TSOs conducted our own analysis on the design of the

[3] Consultation on DS3 System Services Scalar Design: http://www.eirgridgroup.com/site-files/library/EirGrid/DS3-System-Services-Scalar-Design-Consultation-FINAL.pdf

[4] High Level Principles of Scalars for DS3 System Services: http://www.eirgridgroup.com/site-files/library/EirGrid/High-Level-Principles-of-Scalars-for-DS3-System-Services-FINAL.pdf

Performance Scalar. The consultation paper presented the TSOs' early thoughts on how this scalar might be implemented in order to incentivise required levels of performance.

The consultation paper invited feedback from stakeholders through the presentation of a series of questions relating to specific scalar proposals, both those recommended for implementation by the TSOs and those not. A total of 24 responses were received, including 3 where the respondents requested confidentiality.

Excluding those responses marked confidential, feedback on the consultation paper was received from the following parties:

AES	Bord Gáis Energy	Bord Na Mona
Brookfield Renewable	EirGrid Interconnector Ltd	Electric Ireland
Electricity Exchange	Energia	EnerNoc Ireland
ESB GWM	Freqcon GmbH	Gaelectric
IWEA	Kelwin Power Plant	Moyle Interconnector Ltd
PowerNI PBB	Renewable Energy Systems Ltd	Schwungrad Energie
SSE	Systemex Energies	Tynagh Energy Limited

1.6. Purpose of This Document

The purpose of this document is to describe the scalars that the TSOs propose to apply to System Services for Regulated Arrangements. The quantity and design of the proposed scalars differ from those suggested in the 2016 consultation paper: this reflects the proposed tariffs for Regulated Arrangements, feedback received from stakeholders as part of the 2016 scalar consultation process, additional detailed analysis and studies carried out by the TSOs, and learnings gleaned from the Interim Arrangements.

1.7. Structure of This Document

This document will provide an overview of the scalar designs from the previous consultation, give a summary of responses received from that consultation and put forward proposals for new scalar designs.

Section 2 describes the System Services scalars that the TSOs propose to implement for Regulated Arrangements.

Section 3 details those scalars that the TSOs are not minded to implement for Regulated Arrangements.

Section 4 puts forward our initial thinking regarding the introduction of Frequency Response Curves as a means of defining the provision of the FFR Service from contracted parties.

The final section describes the next steps in the consultation process.

2. Proposed Scalars for Regulated Arrangements

The following scalars are proposed for implementation by the TSOs for the duration of Regulated Arrangements:

- Performance Scalar
- Product Scalar for the Faster Response of FFR
- Product Scalar for the Enhanced Delivery of FFR, POR, SOR and TOR1
- Product Scalar for the Continuous Provision of Reserve from FFR to TOR1
- Product Scalar for the Enhanced Delivery of SSRP with an AVR
- Product Scalar for SSRP with Watt-less MVars
- Temporal Scarcity Scalar for DRR and FPFAPR
- Temporal Scarcity Scalar for FFR
- Temporal Scarcity Scalar for 11 Existing System Services
- Locational Scarcity Scalar for All System Services

The following sections describe each of the above proposed scalars in detail, including, where applicable, the initial design as considered in the 2016 consultation paper, the feedback to that design received from stakeholders, the scalar as implemented for Interim Arrangements, and, finally, the proposed scalar design to be implemented for Regulated Arrangements from 2018 onwards.

2.1. Performance Scalar

Summary

This section sets out the TSOs' proposal for a performance scalar to incentivise the reliable provision of System Services, including the ongoing utilisation of the Protocol Document to define this scalar and its underlying methodologies, and the introduction of an assessment of *certainty of availability* for Regulated Arrangements.

Introduction

Performance reliability is a key aspect of the System Services arrangements. A unit that performs consistently when called upon to provide a Service gives a greater degree of certainty to the TSOs than a unit that performs sporadically. The SEM Committee decision paper SEM-14-108 proposed that a performance scalar be introduced that rewards and incentivises high levels of performance as well as ensuring lower payments for lower levels of performance.

The 2016 consultation paper detailed the TSOs' underlying principles for the Performance Scalar: at a high level, a unit's achieved response to a system event / dispatch instruction is to be compared against that expected of it and a binary pass or fail awarded; a unit's 'reliability' – its percentage of events passed within an assessment period – in turn determines the value of the Performance Scalar.

Interim Arrangements

Given the inherent complexity in designing performance assessment methodologies, together with dependencies on data sources and internal TSO systems, the specification of the Performance Scalar and its related performance assessment methodologies were included in the Protocol Document accompanying the contractual framework for Interim Arrangements. The Protocol Document allows for the amendment of the Performance Scalar on a quarterly basis from the commencement of Interim Arrangements (subject to approval by the Regulatory Authorities). This measure facilitates the continuous development of the Performance Scalar for the duration of Interim Arrangements, reflecting advanced thinking on its design, feedback from stakeholders and periodic system deliverables.

In response to consultation feedback from stakeholders on the design of the Performance Scalar as implemented at the commencement of Interim Arrangements, the TSOs have sought to address issues relating, but not limited to, the binary nature of the pass / fail award and the infrequency of relevant system events and its impact on a unit's 'reliability'. We recently ran a separate consultation proposing changes to the

performance scalar arrangements. A decision paper[5] was published on 28 June 2017 setting out the revised DS3 System Services Interim Performance Methodologies, which will be reflected as appropriate in the Protocol Document for the remainder of the Interim Arrangements.

TSO Proposal for Regulated Arrangements

Protocol Document for Regulated Arrangements

The TSOs propose that the contractual definition of the Performance Scalar, and underlying performance assessment methodologies, will be described in a Protocol Document to accompany the contractual framework for Regulated Arrangements, as per the Interim Arrangements. This will allow for the ongoing development of these methodologies as required and as dependent TSO systems allow.

Consultation on Regulated Arrangements

For Regulated Arrangements, further communication and consultation relating to the design and implementation of the Performance Scalar will be carried out in a separate process, distinct from that of Enduring Tariffs.

Certainty of Service Availability

The focus on performance to date has predominantly been on reliability of service provision. However, in this paper, we introduce a new concept that we propose to integrate into the "performance" assessment domain. This relates to certainty of service availability and is set out below.

Given that certainty of service availability will become increasingly important as more providing units with greater variability in their service availability provide System Services, the TSOs propose that, for Regulated Arrangements, the underlying performance assessment methodology to determine the value of the Performance Scalar will include an additional measure to incentivise a unit to supply to the TSOs an accurate forecast of its availability to provide Reserve and Ramping Margin Services.

We propose that a unit is to be required to supply a forecast, in advance, of its availability to provide any of the aforementioned Services; discount factors would apply where an ex-post evaluation of a unit's declared forecasted availability against its actual availability has shown an over-forecast of availability to provide said Services.

At this time, the TSOs are minded to require the provision of a forecast of availability for a block of 6 hours, i.e. 12 trading periods, at a minimum of 6 hours (latest provision time) in advance of that block commencing.

[5] Decision Paper on the Revised DS3 System Services Interim Performance Methodologies: http://www.eirgridgroup.com/site-files/library/EirGrid/Decision-Paper-Interim-Performance-Scalars-Revised-Methodology.pdf

This measure will be allowed for in contracts for Regulated Arrangements. In acknowledgement of the system and signal availability dependencies, the proposal may not be implemented at the commencement of Regulated Arrangements in 2018. However, the principle of certainty of service availability will be a key driver and component of the development of System Service performance monitoring methodologies and systems by the TSOs.

The TSOs welcome the views of interested parties on the design and implementation of this element of performance monitoring.

Figure 2 below illustrates at a high level how an over-forecast of availability may be evaluated.

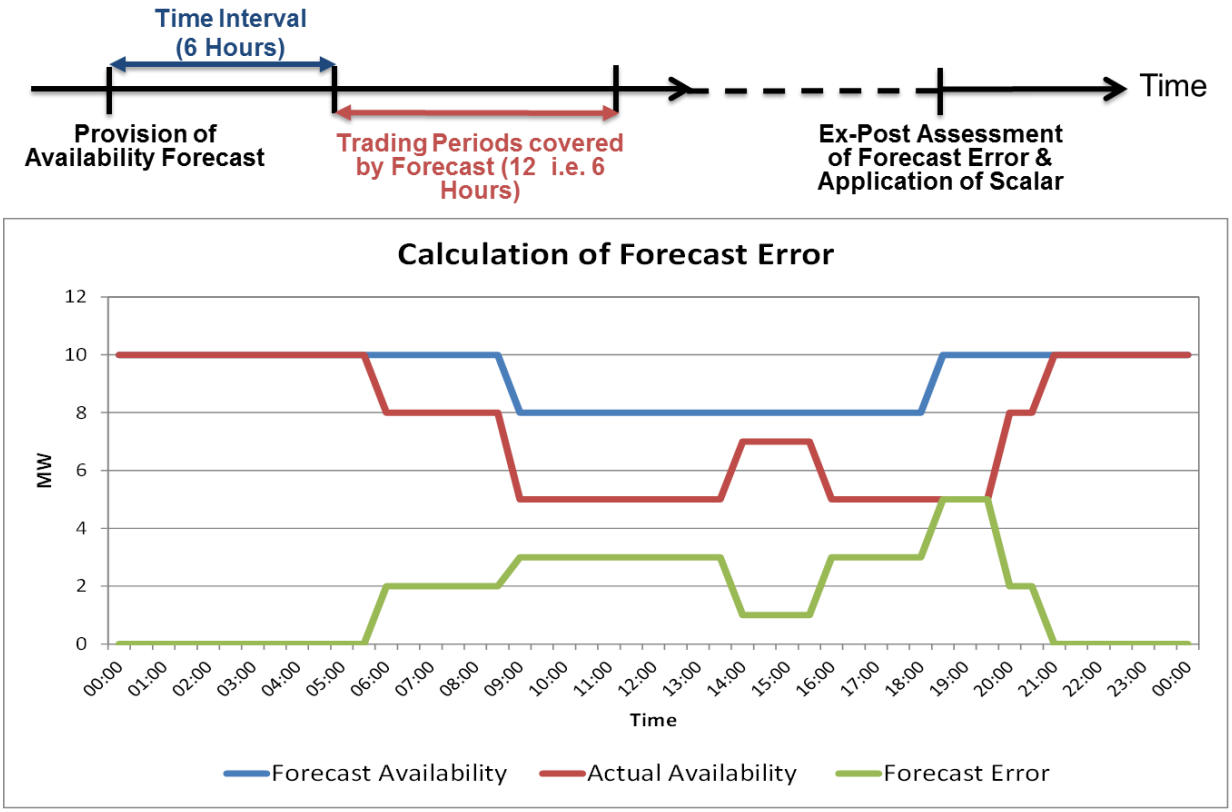

Figure 2: Evaluation of Certainty of Availability

Question 1: Do you agree with our proposal to include in the performance assessment methodology to determine the value of the Performance Scalar an additional measure to incentivise a unit to supply to the TSOs an accurate forecast of its availability to provide Reserve and Ramping Margin Services? If not, please specify why or identify what element of the proposal you believe requires amendment?

2.2. Product Scalar for Faster Response of FFR

Summary

This section sets out the TSOs' proposal for a product scalar to incentivise the faster provision of FFR up to an upper threshold of 0.15 seconds following a frequency event.

Introduction

FFR is not being procured under Interim Arrangements. It is scheduled to go live on 1 September 2018.

2016 Consultation Paper – Scalar Description

In the 2016 scalar design consultation paper, the TSOs proposed that a product scalar for the faster response of the FFR product be implemented, whereby a speed of response quicker than 2 seconds would be rewarded with a scalar greater than 1 on a sliding scale up to a maximum value of 2 at an upper threshold of 0.5 seconds. This is illustrated in Figure 3 below.

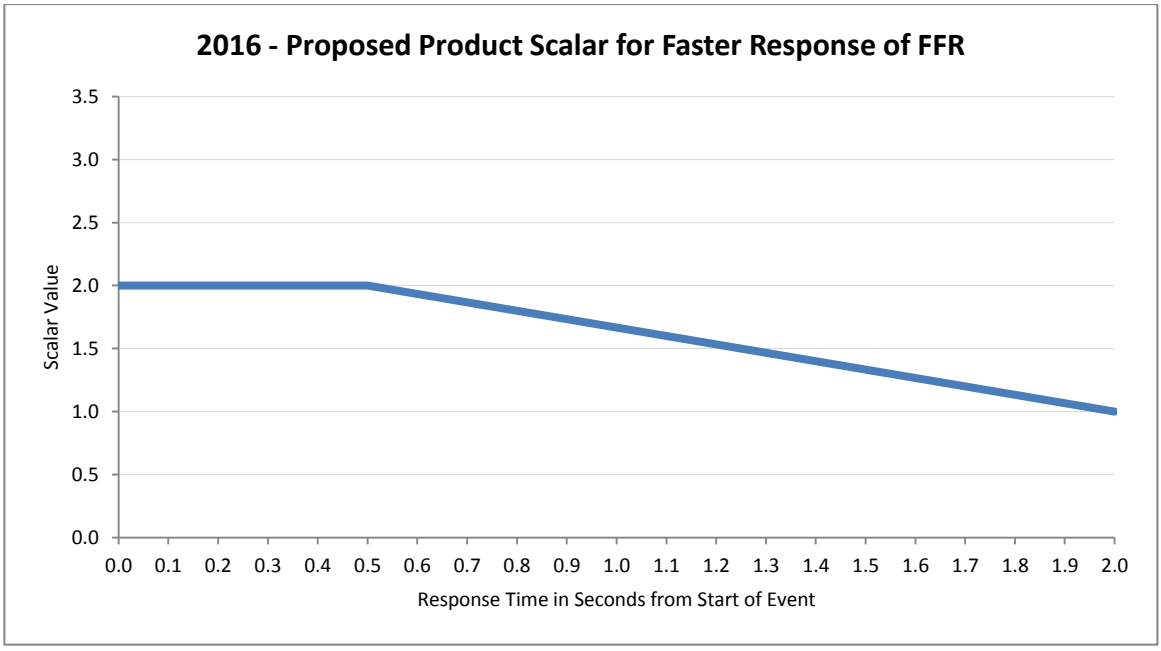

Figure 3: 2016 consultation paper – proposed Product Scalar for Faster Response of FFR

Mathematically this scalar was represented as:

If TR <= 0.5 secs, Scalar = 2

If 0.5 secs < TR < 2 secs, Scalar = ((2-TR)/(1.5)) + 1

Where: TR = Response time from event start time

2016 Consultation Paper – Question Asked

"Do you agree with our proposal to implement a product scalar for faster response of the FFR product? If not, please specify why or identify what element of the scalar design you believe requires amendment?"

Comments Received on 2016 Consultation Paper

The majority of respondents welcomed the proposal to introduce a product scalar for a faster response of FFR, with one respondent commenting “that fast response provides the TSO with a higher quality product and the customer with improved security of supply.”

Several respondents commented that there is increased value to the system of the provision of FFR with response times faster than 0.5 seconds and that these should be incentivised accordingly with a scalar greater than 2. One responded suggested that response times up to 0.1 seconds should be rewarded.

One respondent suggested that if value has been identified in the provision of FFR at 0.5 seconds, it should be procured as a separate enhanced product.

Several respondents questioned the linear design of the scalar and whether system benefits actually accrue in such a fashion. Some respondents commented that the linear design appears arbitrary and requested that the TSOs publish any supporting analysis that underpins it. One respondent expressed concern that this design would make the measurement and settlement of the Service too complex and suggested a more simplified stepped approach.

One respondent requested that the TSOs consider further the implications of any trade-off between the incentivisation of FFR and system requirements for inertia. Another respondent commented that this scalar has the potential to reduce the pot for system inertia.

One respondent commented that the design of the scalar must restrict the amount of revenue that can be earned by parties with locational market power by ensuring that only those who exceed the system standard in areas of locational constraint are rewarded.

TSO Proposal for Regulated Arrangements

The TSOs propose to implement the product scalar for the faster response of FFR for Regulated Arrangements as described in the 2016 consultation paper, with one amendment. It is proposed to incentivise the faster provision of FFR as follows:

For a speed of response quicker than 2 seconds a scalar greater than 1 is to be applied on a sliding scale up to a scalar value of 2 at a response time of 0.5 seconds; and

For a speed of response quicker than 0.5 seconds a scalar greater than 2 is to be applied on a sliding scale up to a maximum scalar value of 3 at a response time of 0.15 seconds

Figure 4 below graphically represents this scalar.

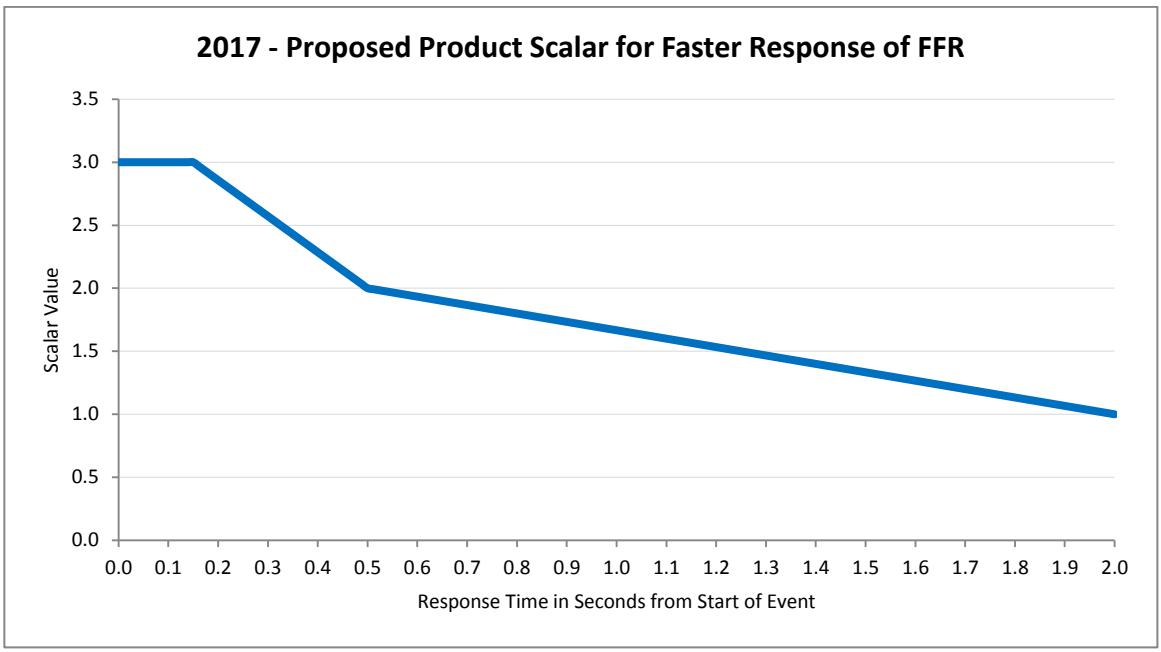

Figure 4: TSO Proposal 2017 – proposed Product Scalar for Faster Response of FFR

Mathematically this scalar is represented as:

If TR <= 0.15 secs, Scalar = 3

If 0.15 secs < TR < 0.5, Scalar = ((0.5-TR) / (0.35)) + 2

If 0.5 secs <= TR < 2 secs, Scalar = ((2-TR) / (1.5)) + 1

Where: TR = Response time from event start time

Rationale for Proposed Scalar

The TSOs acknowledge the feedback from respondents noting the value to the system of a response quicker than 0.5 seconds. This position is supported by internal studies carried out by the TSOs in Q2 2017. The upper threshold of 0.15 seconds at which the faster response of FFR is to be incentivised reflects standard system protection times. Responses above this upper threshold, i.e. faster than 0.15 seconds, are within the bounds of system inertia, the provision of which is to continue to be incentivised through the SIR product.

With reference to respondents' feedback relating to the linear form of the scalar, while the TSOs acknowledge that the benefits to the system do not accrue in such a linear fashion, the complexity in identifying the exact and proportionate value of responses to system events along the proposed timeline of 0.15 to 2 seconds determines that a more simplistic approach be implemented.

The value of the scalar applicable to each unit is to be derived from the unit's contracted capability to provide the FFR Service at a specified time, e.g. 1.5 seconds, following the commencement of the frequency event. This will be agreed during the procurement process and form the basis for Settlement. Performance monitoring mechanisms will

assess whether the unit responded within its contracted timeframe, with discount factors to apply in the form of a reduced performance scalar if the contracted timeframe is established not to have been met.

In response to concerns expressed regarding any trade-off between system inertia and the provision of FFR, the TSOs wish to emphasise that SIR and FFR are distinct System Services designed to incentivise meeting the system requirements for inertia and containment following a frequency event respectively.

With regards to respondents' comments relating to location market concerns, please refer to the Locational Scarcity Scalar for All System Services in Section 2.10.

Question 2: Do you agree with our proposal to implement a Product Scalar for the Faster Response of FFR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

2.3. Product Scalar for Enhanced Delivery of FFR, POR, SOR and TOR1

Summary

This section sets out the TSOs' proposal for a product scalar to incentivise the enhanced provision of FFR, POR, SOR and TOR1. This scalar is a modified version of that implemented for Interim Arrangements, comprising:

- a trigger scalar (representing the highest frequency set-point between 49.985Hz and 49.3Hz at which a unit is capable of, and willing to, provide a MW output response); and
- a provisional proposal for a type scalar (representing the capability of a unit to respond in a dynamic or static manner to a frequency event).

With regard to the latter, consideration is given to the existing type scalar implemented for POR, SOR and TOR1 and the distinct requirements for FFR.

Introduction

The POR, SOR and TOR1 Services are currently being procured under Interim Arrangements and will continue to be procured for Regulated Arrangements from 1 May 2018. FFR is scheduled to go live from 1 September 2018.

The product scalar for the enhanced delivery of FFR, POR, SOR and TOR1 was originally proposed in the 2016 consultation paper. An amended version of this proposal was implemented for Interim Arrangements for POR, SOR and TOR1.

This section will detail:

- the initial scalar design as originally proposed in the 2016 Scalar Design consultation;
- the feedback received to that proposal;
- the amended version as implemented for Interim Arrangements; and
- the scalar that we propose to implement for Regulated Arrangements.

2016 Consultation Paper – Scalar Description

In the scalars consultation paper, the TSOs proposed that a product scalar for the enhanced delivery of the FFR, POR, SOR and TOR1 products be implemented, whereby the enhanced characteristics were to be defined by the frequency trigger capability[6] of the providing unit (Trigger Scalar) and the type and profile of its response curve (Type Scalar).

This scalar was defined as follows:

[6] This is the frequency value at which a service provider is capable and willing to start providing the frequency response i.e. the frequency at which the response is triggered.

Product Scalar = (Trigger Scalar + Type Scalar) / 2 *if Trigger Scalar is greater than 0; or*

Product Scalar = 0 if Trigger Scalar is equal to 0.

Where:

- The Trigger Scalar, as illustrated in Figure 5, was a function of the highest frequency set-point (≤ 50 Hz) at which the unit is capable and willing to provide a MW output response, with a linear scale between 0, where the frequency trigger ≤ 49.3Hz, and 1, where the frequency trigger = 50Hz.
- The Type Scalar was 1 for a fully dynamic response and between 0.5 and 0.75 for a response provided in discrete steps, as illustrated in Figure 6.

For units that could provide a dynamic response it was proposed that the TSOs specify in real-time whether the response should be enabled or disabled, the frequency trigger, which will be at or below the contracted capability of the provider, and the droop setting.

For a response provided in discrete steps it was proposed that the TSOs specify in real-time whether the response should be enabled or disabled, the frequency trigger, which will be at or below the contracted capability of the provider, and the step sizes.

It was proposed that units would have 60 seconds to implement any changes in real-time.

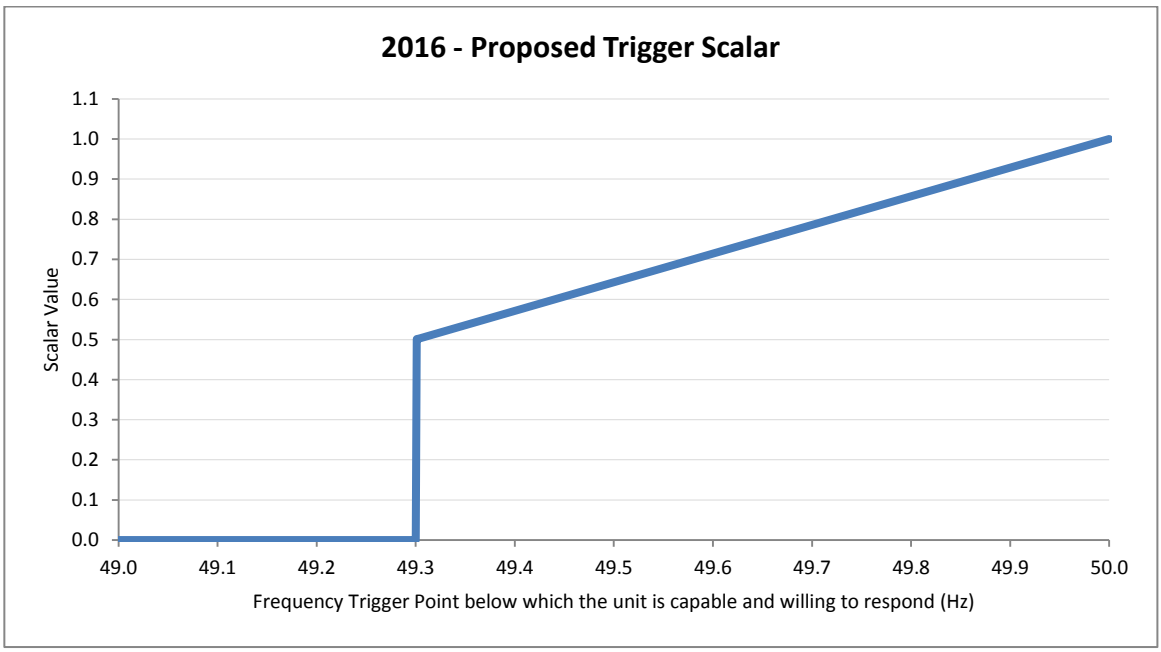

Figure 5: 2016 consultation paper – proposed Trigger Scalar for enhanced delivery of FFR, POR, SOR & TOR1

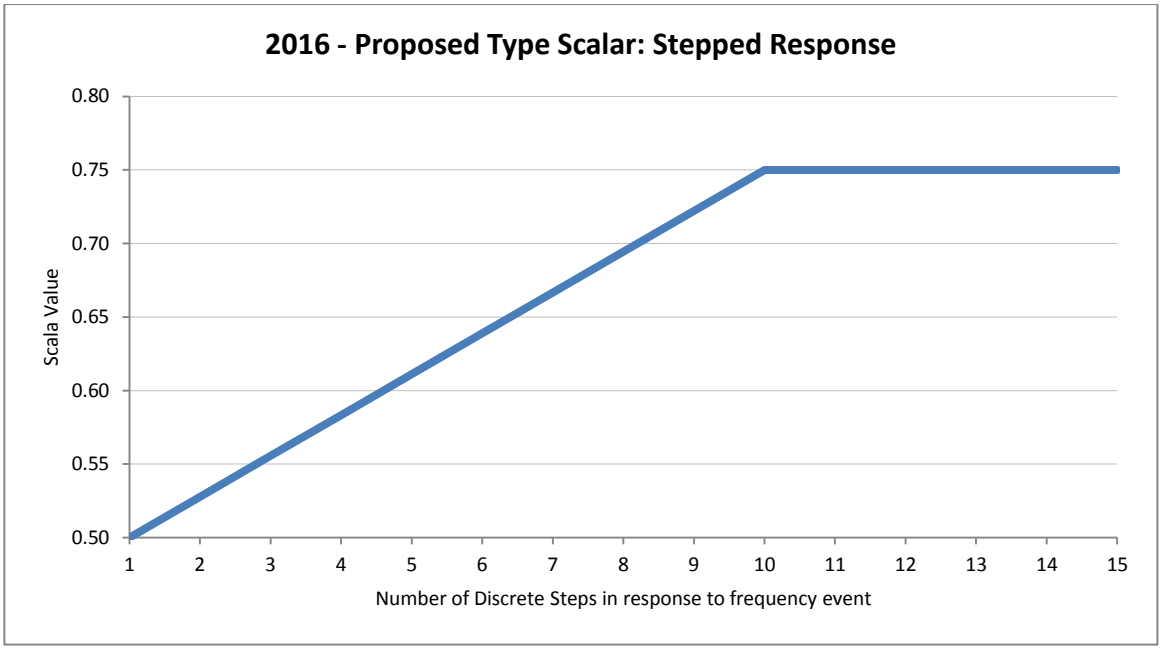

Figure 6: 2016 consultation paper – proposed Type Scalar (discrete steps) for enhanced delivery of FFR, POR, SOR, TOR1

2016 Consultation Paper – Question Asked

"Do you agree with the implementation of a product scalar for the enhanced delivery of the FFR, POR, SOR and TOR1 products? If not, please specify why or identify what element of the scalar design you believe requires amendment?"

Comments Received on 2016 Consultation Paper

The majority of respondents were broadly in favour of introducing a product scalar for the enhanced delivery of the FFR, POR, SOR and TOR1 Services, with one respondent commenting that it "encourages units to enhance their capabilities and to be more flexible in the provision of reserve."

Two respondents questioned the rationale for the scalar and commented that the scalar design appeared to be arbitrary. Two respondents commented that the product definition of FFR made no reference to trigger and type scalars, while one respondent stated that the definition of the scalar was not sufficiently clear. Two respondents commented that the scalar should be a minimum of 1 and increase depending on the enhanced manner of the provision of the Services. One respondent expressed concerns relating to the linear design of the scalar and how provision of the Service is to be measured.

Several respondents commented specifically on the design of the trigger scalar. Two respondents stated that the lower threshold of 49.3Hz is too low, will rarely be called upon, and questioned whether responding to an event at this point was worth 50% of a response very close to 50Hz. By contrast, one respondent asserted that the lower threshold of 49.3Hz is too high and more demanding than that required of STAR.

Relating to the upper threshold of the trigger scalar, one respondent commented that 50Hz is too high given that the reserve products are not intended to respond at this

frequency. One respondent questioned the need for this scalar as the Grid Code already mandates that units respond to frequency deviations at 49.985Hz. Two respondents commented that trigger scalar values should be greater than 1 for responses closer to 50Hz. One respondent asserted that attaching a value to the trigger scalar so close to 50Hz implies pre-fault regulation, which is mutually exclusive to post-fault response, and that further consideration needs to be given to how System Services volumes are allocated in this respect.

There were several responses specific to the type scalar. Two respondents commented that the definition of the type scalar substantially refined the proposal as outlined in the TNEI / Pöyry report. One respondent stated that it is not representative of the 4 Scalar types as defined in the SEM Committee's decision paper SEM-14-108. One respondent requested additional information on specific values applicable to each step in the stepped response. One respondent asserted that 10 steps is too many for a DSU to achieve the higher scalar value and accordingly may disincentivise investment.

Respondents provided contrasting views on the value to the system of a response provided in discrete steps. Respondents in favour of dynamic responses commented that a scalar value greater than 1 should apply to those providers and that the values attached to responses provided in discrete steps were too high in comparison. One respondent stated that the use of discrete steps to emulate a dynamic response represented a system risk, requiring power studies prior to any implementation.

In contrast, two respondents commented that higher scalar values should be applicable to responses provided in discrete steps. One respondent suggested that the design of the type scalar discriminates in favour of dynamic providers. One respondent commented that the capability to provide a response to a frequency event in more than 10 discrete steps should be rewarded with a higher scalar than a response delivered in 10 discrete steps or less.

Elsewhere, two respondents questioned the mechanics of how trigger instructions were to be transmitted and whether 60 seconds was adequate time to respond to a request to disable systems. One respondent suggested that a fuel scalar could offset the preference toward dynamic units. Finally, one respondent requested that consideration be given to the responses capable of being provided by DSUs and that aggregated Individual Demand Sites (IDS) steps could provide a good dynamic emulation.

Implementation for Interim Arrangements

A simplified version of the product scalar for the enhanced delivery of POR, SOR and TOR1, to that proposed in the 2016 consultation paper, has been implemented for Interim Arrangements, as follows:

Product Scalar = (Trigger Scalar + Type Scalar) / 2 *if Trigger Scalar is greater than 0; or*

Product Scalar = 0 if Trigger Scalar is equal to 0.

Where:

- The Trigger scalar is calculated as:
    - 1 – ((50 – absolute value of Reserve Trigger Capability) x (5 ÷ 7)), if the value of the Reserve Trigger Capability is > 49.3 Hz;
    - Zero if the value of the Reserve Trigger Capability is ≤ 49.3 Hz.
- The Type Scalar is 1 for a dynamic response and 0.5 for a static response

For the Interim Arrangements, a dynamic response has been defined as either the capability to respond continuously to frequency disturbances (as illustrated in Figure 7) or with a minimum of 10 discrete steps in a continuously controlled manner proportional to the power system frequency (as illustrated in Figure 8). During the procurement process for Interim Arrangements, the classification of dynamic and static responses was set out in a Clarification Note on Dynamic versus Static Response[7].

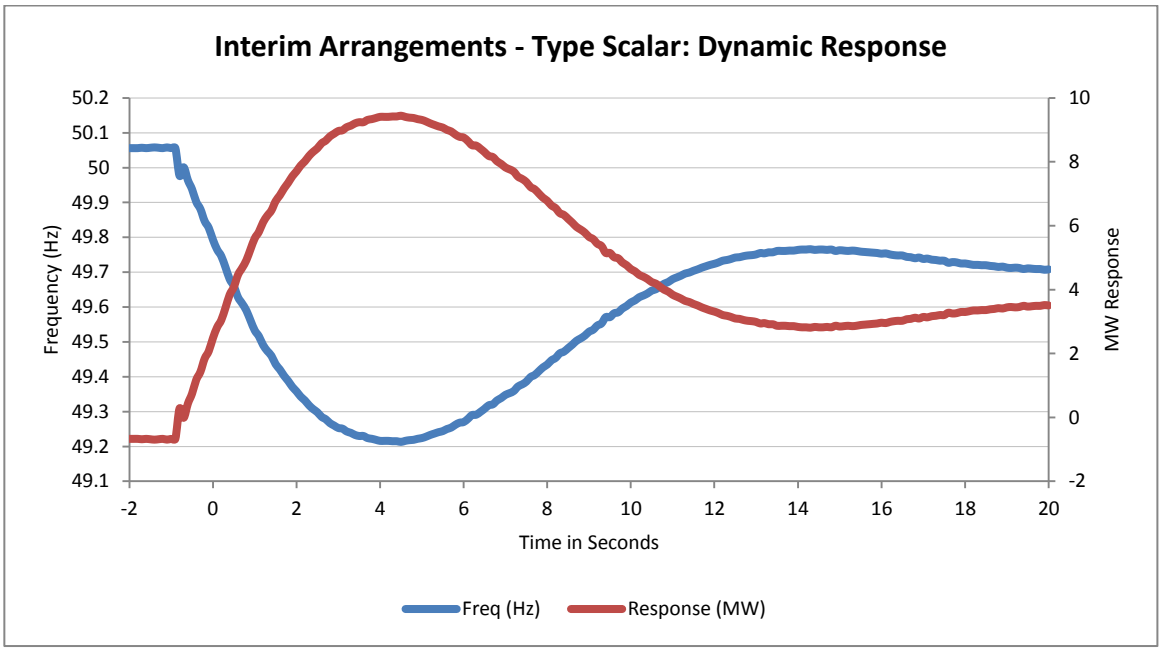

Figure 7: Interim Arrangements – Type Scalar: Fully Dynamic Response

[7] Clarification Note on Dynamic vs Static Response: http://www.eirgridgroup.com/site-files/library/EirGrid/Clarification-Note-on-Dynamic-vs.-Static-Response.pdf

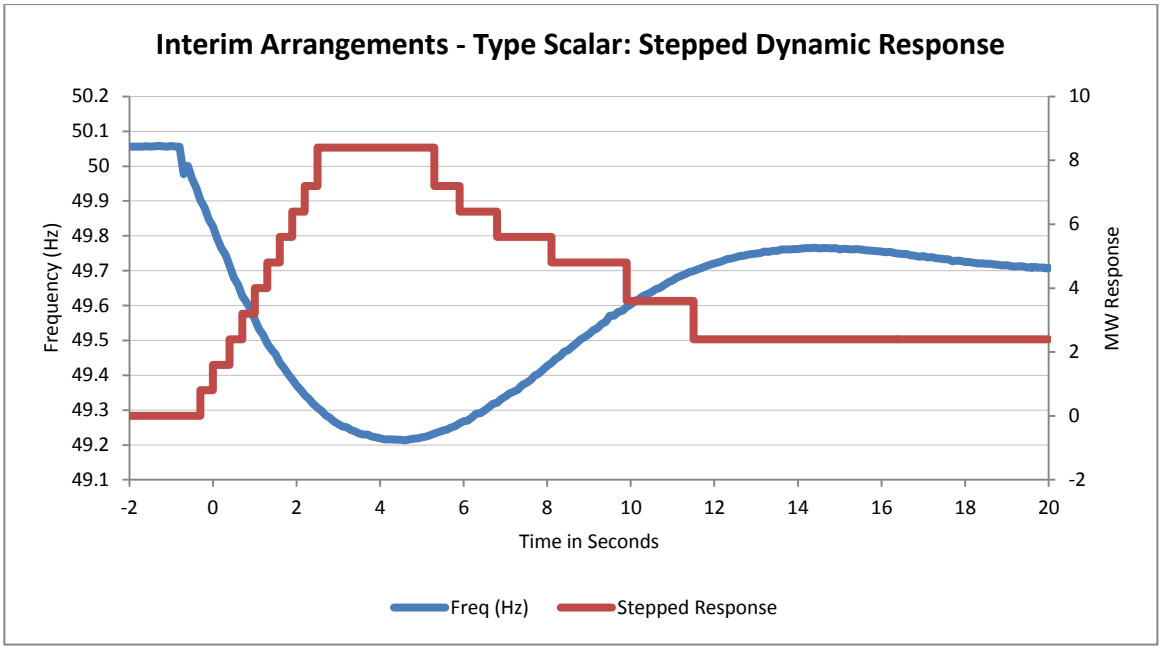

Figure 8: Interim Arrangements – Type Scalar: Dynamic Response (10 steps continuously tracking frequency)

For Interim Arrangements, a response to a frequency event provided in less than 10 discrete steps, whether it tracks the power system frequency or not (Figure 9), or a response provided in 10 or more discrete steps that does not track the power system frequency (Figure 10), are defined as static responses.

During the procurement process for the Interim Tariffs arrangements, one service provider argued that its providing unit could provide an “enhanced static” response owing to the providing unit’s capability to provide a pre-emptive response ahead of an event. More generally, the concept of a providing unit using a secondary signal to trigger its response does not in itself mean that the service should be classified as either dynamic or static. For the avoidance of doubt, the TSOs’ view is that this classification will be determined by the relevant criteria applying to dynamic/static (as communicated during the procurement process) with the ability to provide pre-emptive response capability not considered relevant.

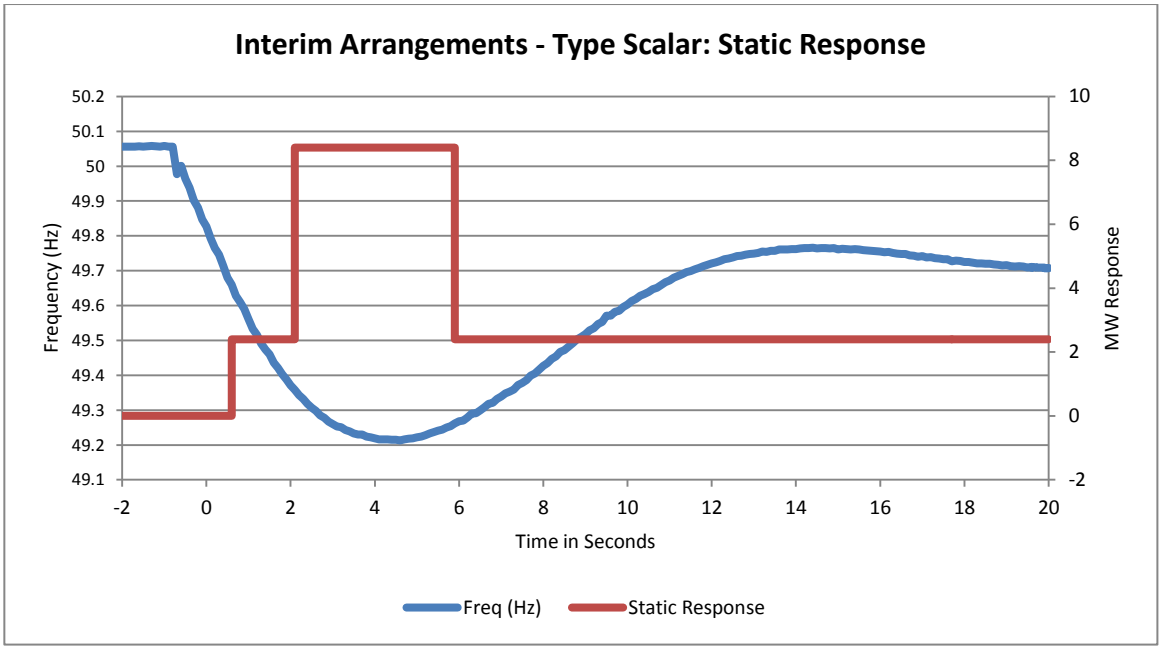

Figure 9: Interim Arrangements - Static Response (2 steps – response tracks frequency)

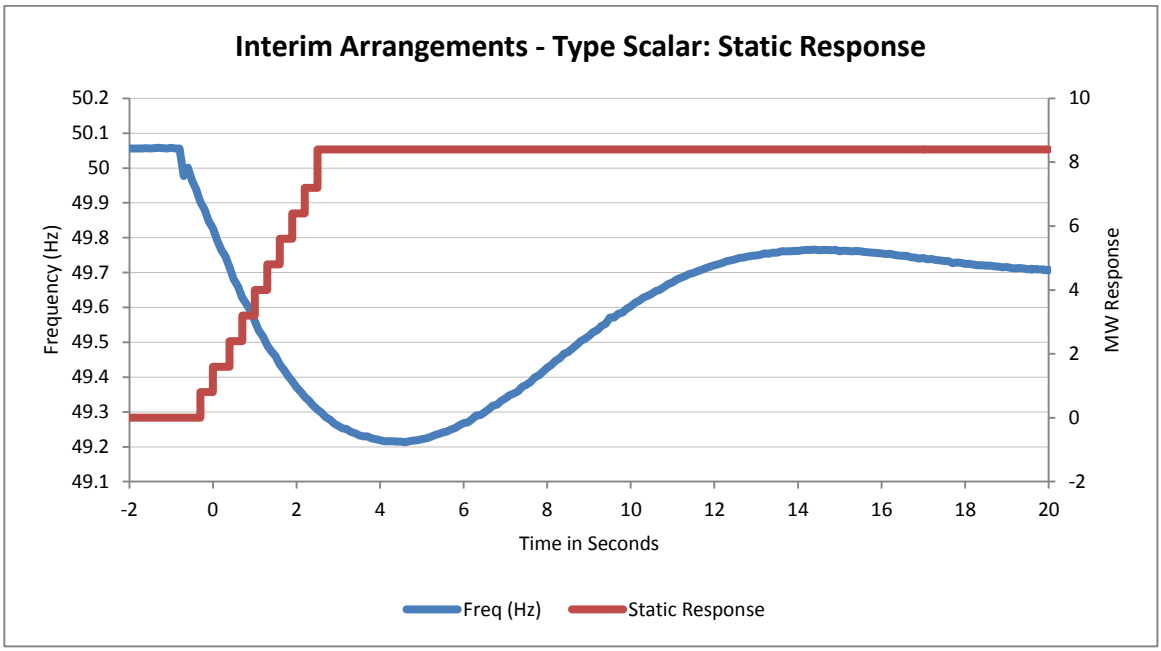

Figure 10: Interim Arrangements - Static Response (10 steps – response does not continuously track frequency)

TSO Proposal for Regulated Arrangements

The TSOs propose to implement the product scalar for the enhanced delivery of FFR[8], POR, SOR and TOR1 for Regulated Arrangements as follows:

Product Scalar = (Type Scalar + Trigger Scalar) / 2 *if Trigger Scalar is greater than 0; or*

Product Scalar = 0 if Trigger Scalar is equal to 0.

The Trigger Scalar is to remain a linear scale between a lower threshold of 49.3Hz with a value of 0.5 and a revised upper threshold of 49.985Hz with a value of 1.

The Type Scalar for POR, SOR and TOR1 as implemented for Interim Arrangements (see definitions and figures above) is provisionally proposed to continue for Regulated Arrangements. Please refer to further notes in this section under the Rationale for Proposed Scalar.

The design of the Type Scalar for the FFR Service continues to be under consideration by the TSOs. We are evaluating the use of frequency response curves as a means for defining the provision of FFR; it is envisaged that finalised response curves will inform the final design of the Type Scalar for FFR. Please see Section 4 of this paper.

Where:

- The Trigger scalar is calculated as:
    - 1 – ((49.985 – absolute value of Reserve Trigger Capability) x (5 ÷ 6.85)), if the value of the Reserve Trigger Capability is > 49.3 Hz;
    - Zero if the value of the Reserve Trigger Capability is ≤ 49.3 Hz.
- The (provisional) Type Scalar is 1 for a dynamic response and 0.5 for a static response

The revised Trigger Scalar is graphically illustrated in Figure 11 below.

[8] The proposed frequency response curves detailed in Section 4 may inform the specific design of the Product Scalar for the Enhanced Delivery for FFR.

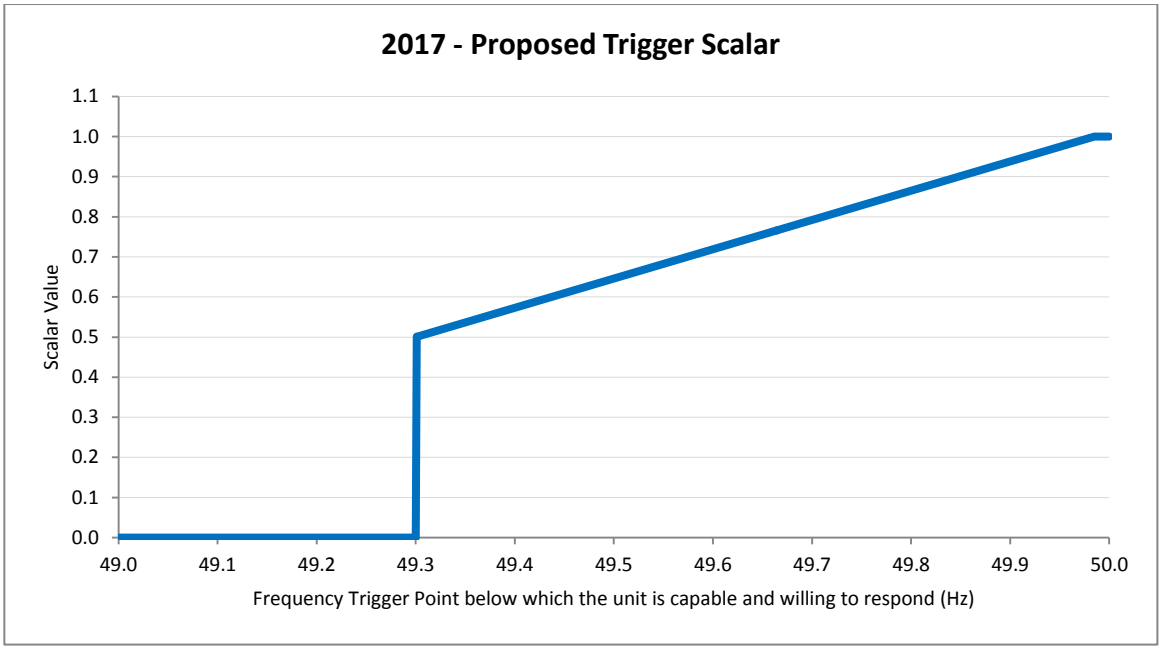

Figure 11: TSO Proposal 2017 – proposed Trigger Scalar for enhanced delivery of FFR, POR, SOR & TOR1

It is proposed that the requirement, implemented for Interim Arrangements, for units to respond within 60 seconds to TSO instructions relating to the enablement and configuration of the trigger and type scalars, is to be maintained for Regulatory Arrangements. The TSOs require this level of flexibility from service providers.

Rationale for Proposed Scalar

The revised upper threshold of the Trigger Scalar of 49.985Hz reflects the maximum frequency deadband of 15mHz for Governor Control Systems allowable under the Grid Code. Restricting the upper threshold of this scalar to 49.985Hz ensures that there is no conflict between incentivising the containment of large frequency disturbances through the frequency response products and the pre-fault regulation of reserve. The mandated maximum frequency deadband is separate to the contracted provision of System Services.

The agreed capability of a unit, together with system requirements, is to determine at what frequency set point a unit is operationally placed at. Please note that the value that we set the frequency trigger at will not affect payment. Payment will be based on the frequency trigger at which the provider is capable and willing to provide the response.

The lower threshold of the Trigger Scalar of 49.3Hz is to be retained as it reflects the existing response threshold in place for STAR. The STAR scheme is to be retained until the termination of Interim Arrangements at the end of April 2018. On the termination of STAR, the TSOs expect that there will remain devices capable of responding at 49.3Hz; in the medium term, the TSOs may seek to migrate those providers over to DS3 System Services. In the longer term, this legacy lower threshold will be assessed for ongoing suitability.

With reference to respondents' feedback relating to the linear form of the Trigger Scalar, while the TSOs acknowledge that the benefits to the system do not accrue in such a linear fashion, and that a response provided just above 49.3Hz may well deliver less than 50% of the value to the system than that which a response close to 50Hz provides, the complexity in identifying the exact and proportionate value of responses to system events along the proposed frequency set points determines that a more simplistic approach be implemented.

The value of the Trigger Scalar applicable to each unit is to be derived from the unit's contracted capability and willingness to provide the FFR, POR, SOR and/or TOR1 Service at a specified frequency set point. This will be agreed during the procurement process and form the basis for Settlement. Performance monitoring mechanisms will assess whether the unit responded by its contracted frequency set point, with discount factors to apply in the form of a reduced performance scalar if the contracted set point is demonstrated not to have been met.

Relating to the provisional retention of the design of the Type Scalar from Interim Arrangements for POR, SOR and TOR1, the TSOs wish to acknowledge the comments that have been received, in particular regarding the provision of a response in multiple discrete steps, and to advise that we continue to review the possible impacts of implementing this scalar, through studies and other analysis. The provisional proposed design for Regulated Arrangements is therefore subject to possible change depending on the outcome of this analysis.

The design of the Type Scalar was, in part, aimed at incentivising emerging technologies to provide FFR, POR, SOR and TOR1 in a continuous manner, and reflects our initial thoughts on how this might best be achieved. The TSOs continue to welcome industry feedback on this design.

While the TSOs acknowledge that the maximum scalar value of 1 may not align with the SEM Committee's decision paper SEM-14-108 (which states that scalars default to 1 and then increase), its value reflects the holistic approach applied to the overall volumes and tariffs considerations applicable to the commercial arrangements for System Services. This approach is described in detail in the Consultation Paper on Enduring Tariffs.

Question 3: Do you agree with our proposal to implement a Product Scalar for the Enhanced Delivery of FFR, POR, SOR and TOR1? If not, please specify why or identify what element of the scalar design you believe requires amendment?

2.4. Product Scalar for Continuous Provision of Reserve from FFR to TOR1

Summary

This section sets out the TSOs' proposal for a product scalar, not previously consulted upon, to incentivise the continuity of provision of reserve from FFR through to TOR1.

Introduction

FFR is scheduled to go live on 1 September 2018.

TSO Proposal for Regulated Arrangements

The TSOs propose to implement a new product scalar for Regulated Arrangements to incentivise providers of FFR to also provide POR, SOR and TOR1, i.e. to be capable of delivering a sustained MW output between 2 seconds and 5 minutes. This scalar is to be implemented as follows:

Scalar of 1.5: Providers of FFR which also provide all of POR, SOR & TOR1

Scalar of 1: Other providers of FFR

Rationale for Proposed Scalar

Studies conducted by the TSOs in Q2 2017 have demonstrated the benefits to the system of providers of the FFR Service continuing to maintain, at the end of the FFR timeframe of 10 seconds following a frequency event, a MW response for the duration of the timeframe demanded of POR, SOR and TOR1, as required depending on the frequency event.

Question 4: Do you agree with our proposal to implement a Product Scalar for the Continuous Provision of Reserve from FFR to TOR1? If not, please specify why or identify what element of the scalar design you believe requires amendment?

2.5. Product Scalar for Enhanced Delivery of SSRP with an AVR

Summary

This section sets out the TSOs' proposal for a product scalar to incentivise the provision of the SSRP product with an Automatic Voltage Regulator (AVR).

Introduction

SSRP is being procured under Interim Arrangements and will continue to be procured under Regulated Arrangements.

2016 Consultation Paper – Scalar Description

In the scalars consultation paper, the TSOs proposed that a product scalar for the enhanced delivery of the SSRP product be implemented, where the provider has an Automatic Voltage Regulator (AVR) installed that is both functional and in operation. This maintained an existing practice under HAS arrangements.

This scalar reflected the value to the system of a unit having an Automatic Voltage Regulator installed and was defined as follows:

Scalar of 2: AVR installed, turned on and fully operational

Scalar of 1: Otherwise

This scalar has been implemented for Interim Arrangements.

2016 Consultation Paper – Question Asked

"Do you agree with our proposal to implement a product scalar for the enhanced delivery of the SSRP product with an AVR? If not, please specify why or identify what element of the scalar design you believe requires amendment?"

Comments Received on 2016 Consultation Paper

The majority of respondents were in favour of maintaining a product scalar for the enhanced delivery of SSRP with an AVR.

Two respondents suggested that the value of an installed, functioning AVR may be worth more than double to the system compared to the absence of such, so a higher scalar greater than 2 should be considered. Other respondents questioned the need for the scalar if the use of an AVR could be mandated by the Grid Code or become a prerequisite for the procurement of the SSRP Service.

Additionally, two respondents requested clarity that the definition of an AVR encompasses voltage controllers for non-synchronous generators that meet specified performance criteria. The same respondents also requested clarity that embedded generators will be permitted to operate under voltage control, unless the DSOs can provide rationale why this is not suitable.

TSO Proposal for Regulated Arrangements

The TSOs propose to continue with the product scalar for the enhanced delivery of SSRP with an AVR, as currently implemented for Interim Arrangements, for Regulated Arrangements. To confirm, the scalar is defined as follows:

Scalar of 2: AVR is installed, turned on and fully operational

Scalar of 1: Otherwise

It is proposed that the definition of AVR currently in place for Interim Arrangements, as set out in the Framework Agreement[9], is to continue for Regulated Arrangements.

The TSOs are working with the DSO on putting in place the arrangements that would allow embedded generators to provide the SSRP Service. The nature of these arrangements will be communicated to stakeholders in advance of the procurement process.

Rationale for Proposed Scalar

The SEM Committee decision paper (SEM-13-098)[10] stated that the variant of the SSRP product in the HAS arrangements, where providers provide the service under the control of an AVR, be retained.

Question 5: Do you agree with our proposal to implement a Product Scalar for Enhanced Delivery of SSRP with an AVR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

[9] "Automatic Voltage Regulation" means the automatic maintenance of a Providing Unit's terminal voltage or the automatic maintenance of a Providing Unit's Voltage setpoint, Reactive Power setpoint or Power Factor setpoint at its Connection Point, as appropriate

[10] SEM DS3 System Services Technical Definitions Decision Paper SEM-13-098: https://www.semcommittee.com/sites/semcommittee.com/files/media-files/SEM-13-098%20%20DS3%20System%20Services%20Technical%20Definitions%20Decision%20Paper%20-%20FINAL_0.pdf

2.6. Product Scalar for SSRP with Watt-less VArs

Summary

This section sets out the TSOs' proposal for a product scalar to incentivise the provision of the SSRP product with Watt-less VArs i.e. the capability of providing reactive power at a zero MW output level.

Introduction

SSRP is being procured under Interim Arrangements and will continue to be procured under Regulated Arrangements. The TSOs were previously not minded to implement a product Scalar for SSRP with watt-less VArs, but now propose that it be implemented for Regulated Arrangements.

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider the introduction of a product scalar for the provision of the SSRP Service with Watt-less VArs i.e. with the capability of providing reactive power at a zero MW output level.

In the scalars consultation paper the TSOs advised that that we did not intend to implement this scalar at that time, but that we would allow for its future implementation should it be required. It was our view then that the redefinition of the SSRP product, which remunerated the provision of the Service using a scaling factor that takes account of the power output range over which the reactive power range can be delivered, already incentivised to some degree the provision of SSRP at lower MW output levels.

2016 Consultation Paper – Question Asked

"Noting that our minded-to position is to not implement a product scalar for the SSRP product with Watt-less VArs, do you believe there is a material requirement to implement this scalar? If so, please provide justification as to why you believe this."

Comments Received on 2016 Consultation Paper

A majority of respondents were in favour of not introducing this scalar, or made no comment. Several respondents commented that the redefinition of the SSRP product was sufficient to incentivise the provision of SSRP at low MW output. Two respondents asserted that certain technologies can already provide this Service by design without the additional incentive of a scalar.

Respondents in favour of the introduction of this scalar noted the value that watt-less MVars add to the system. One respondent suggested that investment in watt-less VAr devices such as STATCOMs should be encouraged due to the future lack of reactive power on the system. One respondent commented that the scalar would incentivise

investment in new assets by industry and hence reduce the need for the TSOs to invest in reactive compensation assets.

Finally, one respondent suggested that a scalar that recognises the value of voltage control at low active power outputs, such as from storage plant with power electronics installed, is needed.

TSO Proposal for Regulated Arrangements

The TSOs propose that a product scalar for SSRP with Watt-less VArs is implemented for Regulated arrangements.

The scalar is to be defined as follows:

Scalar of 2: Unit is capable of providing SSRP at 0MW

Scalar of 1: Otherwise

In any given trading period, the upper scalar would only apply when the TSOs dispatch a unit operating at 0MW output to provide SSRP. This is linked to the cost of providing SSRP at 0MW output, which is discussed further below.

Rationale for Proposed Scalar

While we note that the revised definition of SSRP as implemented for Interim Arrangements incentivises the provision of SSRP at lower MW output levels, following further consideration the TSOs consider that there is further benefit in incentivising the provision of SSRP right down to 0MW output levels.

Cost of Providing SSRP at 0MW Output

The TSOs recognise that there is an inherent energy cost to the provision of reactive power at 0MW output. It is the TSOs position that this cost must be assigned either to the dispatch instruction against the energy market or to an operational support contract.

In the short term, should I-SEM systems implementation preclude assigning these costs to dispatch instructions against the energy market, operational support contracts may be required for a period. In any case, the energy cost of providing reactive power at 0MW output will not be compensated for through DS3 System Services contracts.

Question 6: Do you agree with our proposal to implement a Product Scalar for SSRP with Watt-less VArs? If not, please specify why or identify what element of the scalar design you believe requires amendment?

2.7. Temporal Scarcity Scalar for DRR and FPFAPR

Summary

This section sets out the TSOs' proposal for a temporal scarcity scalar to incentivise the provision of the DRR and FPFAPR Services at high levels of SNSP, specifically when SNSP is greater than 70%.

Introduction

DRR and FPFAPR are not currently being procured under Interim Arrangements. Both Services are scheduled to go live on 1 September 2018 for Regulated Arrangements.

2016 Consultation Paper – Scalar Description

In the scalars consultation paper, the TSOs proposed that a temporal scarcity scalar for the DRR and FPFAPR Services be implemented.

This scalar was designed to reward the provision of DRR and FPFAPR only during periods of high non-synchronous penetration. It was proposed to apply it on a sliding scale based on a metric linked to either the volume of non-synchronous generation or the percentage of SNSP with regard to demand in a given trading period; the actual determinant had not been chosen at the time of the publication of the consultation paper.

Figure 12 illustrates a sample scalar based on percentage SNSP that was published in the consultation paper, where:

Scalar of 1: was to apply when SNSP = 75%

Scalar between 0 and 1: was to apply when SNSP ≥ 50% and <75%

Scalar of 0: was to apply when SNSP < 50%

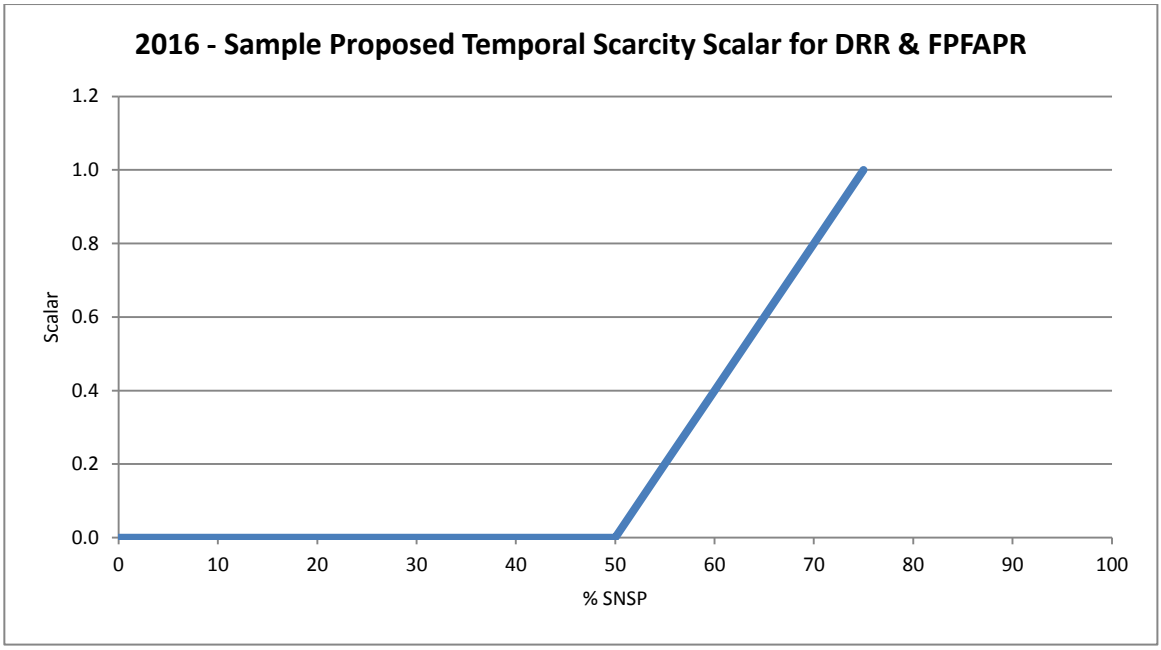

Figure 12: 2016 consultation paper – sample Temporal Scarcity Scalar based on % SNSP

2016 Consultation Paper – Question(s) Asked

"A: What are your views on the temporal scarcity scalars presented for implementation of the DRR and FPFAPR products respectively?

B. Do you agree with the principle behind the scalar and, if not, could you explain your rationale?"

Comments Received on 2016 Consultation Paper

The majority of respondents were broadly in favour of introducing a temporal scarcity scalar for the DRR and FPFAPR products. One respondent commented that "these products are intended to incentivise plant running during periods of high wind output to have enhanced fault ride through capabilities."

Several respondents commented on the potential use of high levels of SNSP as the determinant for executing the scalar. Two respondents asserted that these Services should be rewarded at all times, not just at high SNSP, as they always provide value to the system. One respondent commented that a threshold of SNSP above 50% is too infrequent to provide an adequate return and to encourage investment. One respondent stated that the scalar should be based on the current SNSP limit applicable at the time, where the upper limit would equate to a scalar of 1, and not on a future SNSP target of 75%. One respondent commented that any scalar metric should be based on an indicative run, not on an ex-post position.

Respondents also commented on the scalar design and value. Two respondents commented that the maximum scalar value of 1 is too low, with one asserting that it contradicts the SEM-14-108 paper, which stated that scarcity scalars would have a value greater than 1 in times of scarcity. One respondent commented that the scalar will not

encourage investment in the retro-fit of turbines. Two respondents asserted that it would not encourage synchronous machines to enhance capability and invest in flexibility. One respondent expressed concern that post-2020, when the scalar is likely to be most relevant, the value will be capped at 1. Two respondents suggested a sliding scale of between 1 and 2 between 50% and 75% SNSP. One respondent commented that there should be a sliding scale scalar through the full range of SNSP.

One respondent noted that there will be revenue uncertainty if the scalar is linked to real-time metrics and suggested that the scalar could be adjusted ex-post if wind output falls below forecast levels. One respondent commented that any return on the provision of these Services will be dependent on DS3 System Services progress in general. One respondent requested that consideration be given to income certainty for new entrants on long-term contracts.

Two respondents commented that the scalar is not technology neutral when taken in conjunction with the priority dispatch of wind power i.e. that it targets remuneration at non-synchronous technologies. One respondent stated that SNSP must be unconstrained and not dispatch curtailed, otherwise it requires providers to predict the success of the DS3 Programme. One respondent requested that the precise design of the scalar be published as soon as possible, given the current wind farm build-out.

TSO Proposal for Regulated Arrangements

The TSOs propose to implement a temporal scarcity scalar for DRR and FPFAPR that is to be applied based on a metric linked to the percentage of SNSP with regard to demand in a given trading period.

The scalar is to be defined as follows:

Scalar of 8.5: to apply when SNSP > 70%

Scalar of 0: to apply when SNSP ≤ 70%

The exact values of the scalars will be linked to the certainty that can be provided in the overall arrangements in the final decision by the SEM Committee.

This proposal should be considered in conjunction with the Scarcity Scalar Framework set out in the Enduring Tariffs Paper.

Figure 13 below graphically illustrates this scalar.

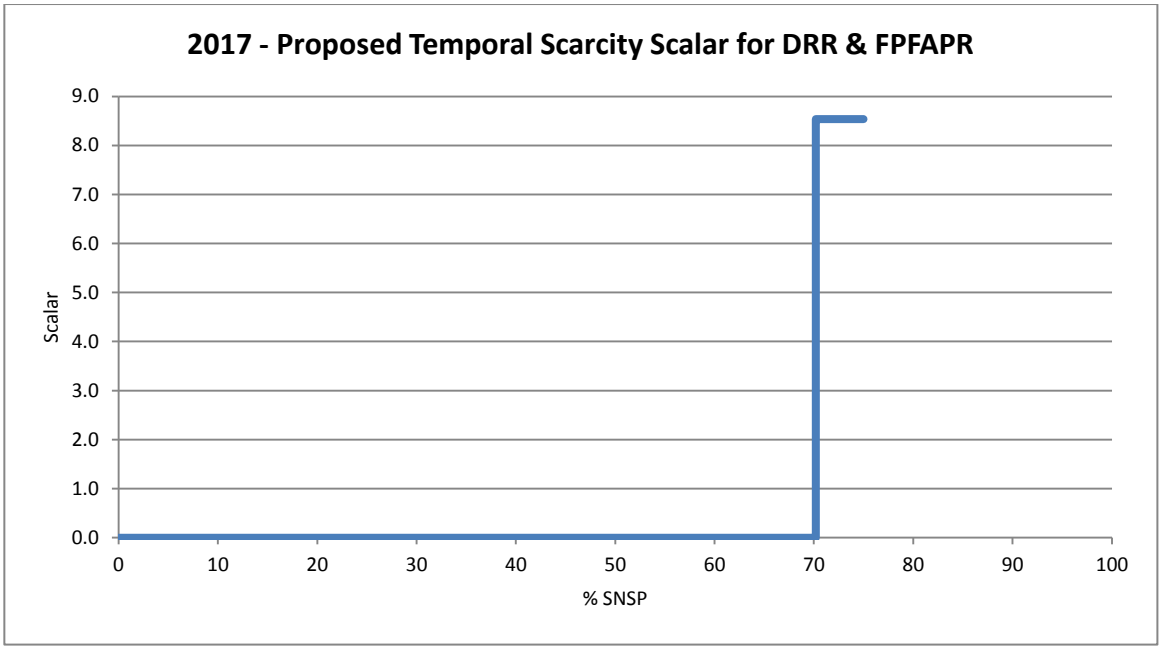

Figure 13: TSO proposal 2017 - Temporal Scarcity Scalar for DRR and FPFAPR

Rationale for Proposed Scalar

It is the TSOs' position that, as the system stability issues that DRR and FPFAPR are designed to address (voltage-dip induced frequency dips and transient stability respectively) are not seen until high levels of wind, there is no justification for the payment of FPFAPR and DRR at low levels of wind penetration.

The broader rationale for the implementation of scarcity scalars, including targeting the required investment and protecting the consumer from over-expenditure of System Service payments, is described in detail in the Consultation Paper on Enduring Tariffs published in parallel with this paper.

Question 7: Do you agree with our proposal to implement a Temporal Scarcity Scalar for DRR and FPFAPR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

2.8. Temporal Scarcity Scalar for FFR

Summary

This section sets out the TSOs' proposal for a temporal scarcity scalar to incentivise the provision of FFR at high levels of SNSP, specifically when SNSP is greater than 60%. While a Temporal Scarcity Scalar for FFR was previously proposed in the TNEI / Pöyry report, but not implemented, its rationale differed from that now proposed for Regulated Arrangements.

Introduction

FFR is not being procured under Interim Arrangements. It is scheduled to go live on 1 September 2018.

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider further whether or not to introduce a temporal scarcity scalar for the FFR product. The concept behind this scalar was to vary the rate at which FFR is paid based on the real time requirement for FFR. The TSOs proposed not to implement this scalar at that time for reasons of system complexity.

TSO Proposal for Regulated Arrangements

The TSOs propose to implement a temporal scarcity scalar for FFR for Regulated Arrangements to incentivise the provision of the FFR Service during periods of high non-synchronous penetration. It is proposed to apply this scalar on a metric linked to the percentage of SNSP with regard to demand in a given trading period.

The scalar is to be defined as follows:

Scalar of 8.5: to apply when SNSP > 70%

Scalar of 6.2: to apply when SNSP > 60% and ≤ 70%

Scalar of 0: to apply when SNSP ≤ 60%

The exact values of the scalars will be linked to the certainty that can be provided in the overall arrangements in the final decision by the SEM Committee.

This proposal should be considered in conjunction with the Scarcity Scalar Framework set out in the Enduring Tariffs Paper.

Note that the design of this scalar is different to that proposed for a temporal scarcity scalar for FFR in the 2016 consultation paper.

Figure 14 below graphically illustrates this scalar.

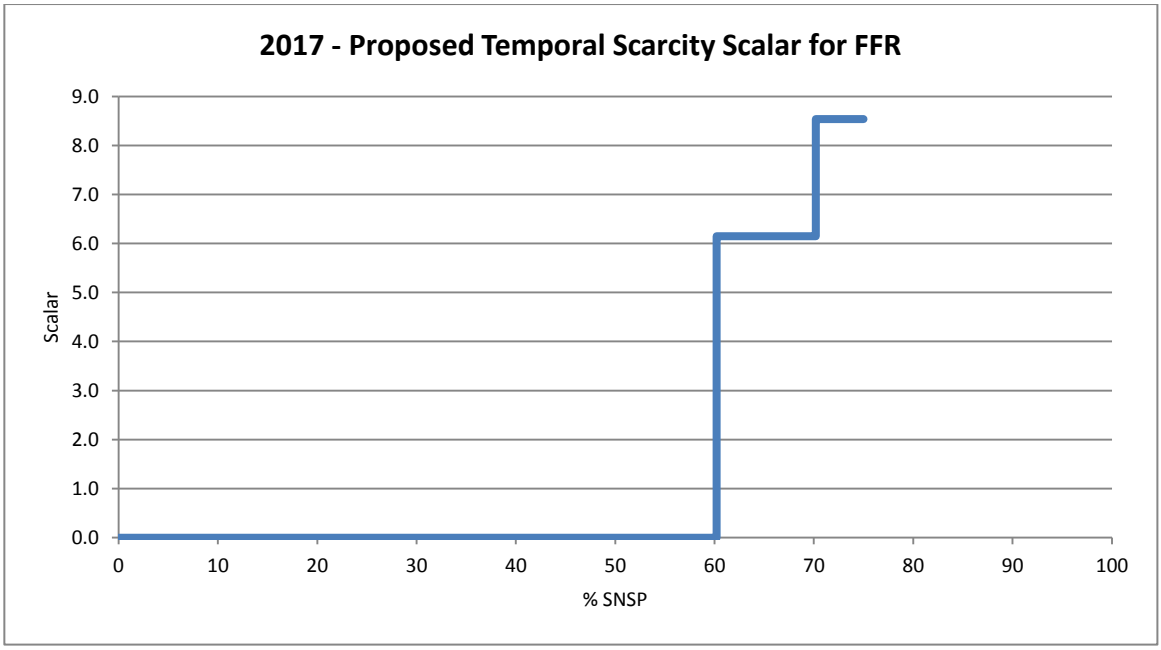

Figure 14: TSO proposal 2017 - Temporal Scarcity Scalar for FFR

Rationale for Proposed Scalar

This scalar is designed to incentivise the provision of FFR at high levels of SNSP. The TSOs have operated the system securely below 60% SNSP, where it has been deemed that synchronous inertia levels have been sufficient. We consider that the requirement for the FFR Service will increase as the TSOs begin to operate above 60% SNSP for sustained periods.

The broader rationale for the implementation of scarcity scalars, including targeting the required investment and protecting the consumer from over-expenditure of System Service payments, is described in detail in the Consultation Paper on Enduring Tariffs published in parallel with this paper.

Question 8: Do you agree with our proposal to implement a Temporal Scarcity Scalar for FFR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

2.9. Temporal Scarcity Scalar for 11 Existing System Services

Summary

This section sets out the TSOs' proposal, not previously consulted upon, for a temporal scarcity scalar to incentivise the provision of all System Services, excluding FPFAPR, DRR and FFR, at high levels of SNSP, specifically when SNSP is greater than 60%.

Introduction

11 System Services, excluding FPFAPR, DRR and FFR, are currently being procured under Interim Arrangements and will continue to be procured under Regulated Arrangements.

TSO Proposal for Regulated Arrangements

The TSOs propose to implement a temporal scarcity scalar for Regulated Arrangements to incentivise the provision of the 11 existing Services during periods of high non-synchronous penetration. It is proposed to apply this scalar on a metric linked to the percentage of SNSP with regard to demand in a given trading period.

The scalar is defined as follows:

Scalar of 8.5: to apply when SNSP > 70%

Scalar of 6.2: to apply when SNSP > 60% and ≤ 70%

Scalar of 1: to apply when SNSP ≤ 60%

The exact values of the scalars will be linked to the certainty that can be provided in the overall arrangements in the final decision by the SEM Committee.

This proposal should be considered in conjunction with the Scarcity Scalar Framework set out in the Enduring Tariffs Paper.

Figure 15 below graphically illustrates this scalar.

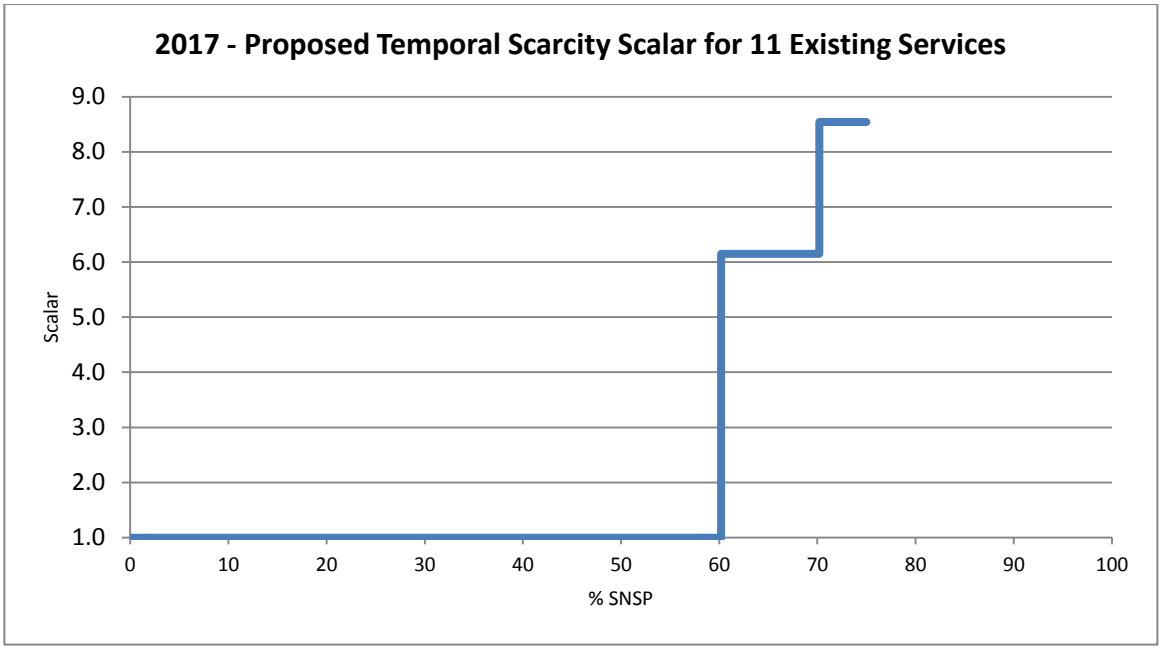

Figure 15: TSO Proposal 2017 - Temporal Scarcity Scalar for 11 Existing Services

Rationale for Proposed Scalar

Given that the TSOs consider that the provision of the existing 11 System Services is important at all SNSP levels, the value of the scalar is to be 1 at low levels of SNSP, i.e. ≤ 60%.

The broader rationale for the implementation of scarcity scalars, including targeting the required investment and protecting the consumer from over-expenditure of System Service payments, is described in detail in the Consultation Paper on Enduring Tariffs published in conjunction with this paper.

Question 9: Do you agree with our proposal to implement a Temporal Scarcity Scalar for 11 Existing System Services? If not, please specify why or identify what element of the scalar design you believe requires amendment?

2.10. Locational Scarcity Scalar for All System Services

Summary

This section sets out the TSOs' proposal, not previously consulted upon, for a locational scarcity scalar to incentivise the provision of all System Services, or a subset of Services, in the future from to-be-determined geographical locations. This was requested in the SEM Committee paper SEM-17-017 on the DS3 System Services Future Programme Approach[11]. This scalar will be allowed for in contracts for the duration of Regulated Arrangements.

TSO Proposal for Regulated Arrangements

The TSOs propose that a locational scarcity scalar for all System Services is to be implemented for Regulated Arrangements.

The scalar is to be defined as follows:

Scalar is to be a minimum value of 1.

Scalar of a value greater than 1 may apply, at the behest of the TSOs, to the provision of any System Service from to-be-determined geographical locations.

This scalar will be allowed for in contracts for the duration of Regulated Arrangements. However, we do not intend to apply scalars greater than 1 in the foreseeable future. Any future implementation will be subject to the TSOs establishing a strong requirement for incentivising the provision of Services from particular locations.

[11] SEM Committee DS3 System Services Future Programme Approach SEM-17-017: https://www.semcommittee.com/sites/semcommittee.com/files/media-files/SEM-17-017%20DS3%20System%20Services%20Future%20Approach%20Information%20Paper.pdf

Rationale for Proposed Scalar

The SEM Committee paper SEM-17-017 on the DS3 System Services Future Programme Approach, with reference to the decision paper SEM-16-081 on Capacity Remuneration Mechanism Locational Issues[12], details the rationale for this scalar.

Question 10: Do you agree with our proposal to implement a Locational Scarcity Scalar for All System Services? If not, please specify why or identify what element of the scalar design you believe requires amendment?

[12] SEM Committee I-SEM Capacity Remuneration Mechanism Locational Issues SEM-16-081 https://www.semcommittee.com/sites/semcommittee.com/files/media-files/SEM-16-081%20CRM%20Locational%20Issues%20Decision%20Paper.pdf

3. Scalars Not Proposed for Implementation

The TSOs do not propose to implement the following scalars for the duration of Regulated Arrangements:

- Locational scarcity scalar for SSRP
- Product scalar for enhanced delivery of DRR with more reactive current
- Product scalar for enhanced delivery of SSRP with a PSS
- Product scalar for SIR with Reserve
- Product scalar for Faster Response of FPFAPR
- Temporal scarcity scalar for Reserve Products
- Temporal scarcity scalar for SIR
- Volume scalar

These scalars are described below.

3.1. Locational Scarcity Scalar for SSRP

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider the introduction of a locational scarcity scalar for the SSRP product. The concept behind this scalar was to incentivise the provision of SSRP in locations that have been identified as having a scarcity of reactive power provision and thus where reactive power control is more challenging.

In the scalars consultation paper the TSOs advised that that we did not intend to implement this scalar at that time given that TSO analyses had indicated likely system-wide scarcity of the SSRP service by 2020 and also due to the complexity in establishing locational requirements for reactive power in real-time.

2016 Consultation Paper – Question Asked

"Noting the rationale provided as to why we are minded to not implement a locational scalar for SSRP at this time, do you agree with this proposal and the rationale behind it? If not, can you provide rationale to support your views?"

Comments Received on 2016 Consultation Paper

A majority of respondents were in favour of not introducing this scalar, or made no comment. One respondent commented that the introduction of this scalar would favour the distribution of System Services to providers with locational market power.

In favour of the implementation of this scalar, one respondent commented that, in the absence of the required incentives, reactive power capability could be built in the wrong locations. Two respondents asserted that a scalar should be based on a multi-year projected basis, and not on real-time or day ahead locational requirements, and linked to long-term contracts in order to incentivise investment. One respondent suggested that a scalar be set for longer than 1 year in locations considered to have a likely shortfall in supply of reactive power, with a scalar value greater than 1 to apply in such instances.

TSO Proposal for Regulated Arrangements

The TSOs propose that a locational scarcity scalar for all 14 System Services is to be implemented for Regulated Arrangements, not simply for SSRP. Please refer to Section 2.10 on the Locational Scarcity Scalar for All System Services.

3.2. Product Scalar for Enhanced Delivery of DRR with more reactive current

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider the introduction of a product scalar for the enhanced delivery of the DRR product with more reactive current. The idea behind this scalar was that if a service provider had the capability to deliver a greater level of reactive current than required in the default product definition, the extra reactive current could compensate for other generators in the same electrical area that were not able to provide the DRR product.

The TSOs decided not to implement this scalar due to the complexity of designing and implementing associated systems, as well as the possibility of transient events occurring

if providing units were to over-respond or under-respond based on incorrect set points or communication issues.

2016 Consultation Paper – Question Asked

"Noting that our minded-to position is to not implement a product scalar for the enhanced delivery of the DRR product, do you believe there is a material requirement to implement this scalar? If so, please provide justification as to why you believe this scalar to be required."

Comments Received on 2016 Consultation Paper

A majority of respondents were in favour of not introducing this scalar, or made no comment. One respondent asserted that this scalar should be implemented as all reactive current helps to maintain system voltage and questioned the complexity attached to its implementation.

TSO Proposal for Regulated Arrangements

The TSOs propose not to implement this scalar for Regulated Arrangements.

We retain our previous rationale for proposing not to introduce this scalar: the complexity of implementing the scalar, together with the possibility of transient events occurring if providing units were to over-respond or under-respond based on incorrect set points or communication issues.

Question 11: Do you agree with our proposal NOT to implement a Product Scalar for Enhanced Delivery of DRR with more reactive current? If not, can you provide rationale to support your views?

3.3. Product Scalar for Enhanced Delivery of SSRP with a PSS

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider the introduction of a 'decreasing' product scalar which would apply to the provision of the SSRP product where a Power System Stabiliser is installed but not operating correctly. The idea behind this scalar was that providers of the SSRP product, which had a Power System Stabiliser

(PSS) installed but where the PSS was not operating correctly, could cause system issues which would not arise had the PSS not been installed or had been turned off.

The TSOs proposed not to implement this scalar as, while we supported the principle of the scalar, we did not believe that it met the objectives of a product scalar as set out in SEMC-14-108. Instead the TSOs proposed that the issue of poor PSS performance be addressed instead through performance monitoring of the SSRP product. This was in line with the conclusions drawn by TNEI / Pöyry.

2016 Consultation Paper – Question Asked

No specific question was asked; the TSOs proposed that this should fall under the remit of the Performance Scalar.

TSO Proposal for Regulated Arrangements

The TSOs propose not to implement this scalar for Regulated Arrangements.

We retain our previous rationale for proposing not to introduce this scalar: it does not meet the objective of a product scalar as set out in SEM-14-108; performance monitoring of SSRP can address any issues around PSS capability.

Question 12: Do you agree with our proposal NOT to implement a Product Scalar for Enhanced Delivery of SSRP with a PSS? If not, can you provide rationale to support your views?

3.4. Product Scalar for SIR with Reserve

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider the introduction of a product scalar for the provision of the SIR product for service providers that could provide Reserve Services at Minimum Generation (as defined in the Grid Codes). The idea behind this scalar, which was originally conceived by the TSOs and included in the 2013 TSO Recommendations Paper, was to incentivise service providers to maximise their flexibility, and thus revenue streams, by providing the SIR product at low MW output levels while also offering reserve services. This was to be achieved through the lowering of Minimum Generation levels where possible.

The TSOs proposed not to implement this scalar at that time. We believed that there was an inherent potential for this scalar to introduce the undesired outcome of potential providers deciding not to offer their true lowest possible Minimum Generation level

because the additional revenue received for the SIR product from lowering their Minimum Generation level may be less than that received from the scaled SIR payment at a higher Minimum Generation level coupled with payments for reserve being technically realisable. This was in line with the conclusions drawn by TNEI / Pöyry.

2016 Consultation Paper – Question Asked

"Noting that while our minded-to position is to not implement a product scalar for this service at this time, do you agree with our proposal to potentially reassess the impact of introducing this scalar at a later stage, or do you believe there is a material requirement to implement this scalar at an earlier opportunity? If so, please provide justification as to why you believe this scalar to be required."

Comments Received on 2016 Consultation Paper

A majority of respondents were in favour of not introducing this scalar at this time, or made no comment. One respondent commented that the scalar would affect the interaction between the incentives to provide SIR and Reserve products.

In favour of the implementation of the scalar, one respondent commented that not implementing this scalar discriminates against flexible generators that can co-supply inertia and reserve services over a wide output range from very low load to full load. One respondent asserted that the provision of reserve services at minimum generation should be rewarded.

TSO Proposal for Regulated Arrangements

The TSOs propose not to implement this scalar for Regulated Arrangements.

We retain our previous rationale for proposing not to introduce this scalar: there is an inherent potential for this scalar to introduce the undesired outcome of potential providers deciding not to offer their true lowest possible Minimum Generation level.

Question 13: Do you agree with our proposal NOT to implement a Product Scalar for SIR with Reserve? If not, can you provide rationale to support your views?

3.5. Product Scalar for Faster Response of FPFAPR

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider the introduction of a product scalar for the provision of faster response for the FPFAPR product. The idea behind this scalar was primarily to incentivise non-synchronous FPFAPR service providers to reduce the time taken to recover their active power post-fault.

The TSOs proposed not to implement this scalar as, while we acknowledged the rationale for the consideration of this scalar and the technical benefits to system stability if non-synchronous providers were able to recover quickly following faults, we believed that its introduction would dilute the revenue for the FPFAPR product away from the non-synchronous providers who may have to make material investment to provide the product; synchronous service providers who inherently provide this service would likely receive the maximum scalar. This was in line with the conclusions in the TNEI / Pöyry report.

2016 Consultation Paper – Question Asked

"Do you agree with the rationale as to why we propose not to implement this scalar? Can you propose an alternative approach as to how this scalar could be introduced?"

Comments Received on 2016 Consultation Paper

A majority of respondents were in favour of not introducing this scalar, or made no comment. One respondent commented that it would dilute the revenue available to non-synchronous generators. Another respondent asserted that if there was value to an enhanced FPFAPR service, it should be procured separately.

In favour of the implementation of the scalar, one respondent commented that fast recovery should be incentivised to prevent system collapse.

One respondent commented that any scalar should be technology neutral or not implemented at all, while another stated that there should be appropriate market signals that allow for the provision of this Service by both synchronous and non-synchronous providers.

TSO Proposal for Regulated Arrangements

The TSOs propose not to implement this scalar for Regulated Arrangements.

We retain our previous rationale for proposing not to introduce this scalar: the introduction of this scalar would dilute the revenue from the FPFAPR product away from

non-synchronous providers that may need to make material investment in order to provide the product.

Question 14: Do you agree with our proposal NOT to implement a Product Scalar for Faster Response of FPFAPR? If not, can you provide rationale to support your views?

3.6. Temporal Scarcity Scalar for Reserve Products

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that further analysis be conducted on the potential benefits of implementing a temporal scarcity scalar for reserve products. This scalar was intended to ensure that the payment for each of the reserve products is targeted towards the timeframes when the products were most scarce.

The TNEI / Pöyry report outlined a design concept whereby payments would be increased during timeframes in which the reserve services were most scarce and reduced at times when they were being over supplied and therefore of a lesser value to the system.

The TSOs proposed not to implement this scalar at that time. Our position was that the only way in which this scalar could definitively deliver the correct incentive would be to base it on the real time requirements for reserve, as opposed to, for example, seasonal or daily reserve requirements. However, implementing the scalar in this manner would add significant complexity to the TSOs' settlement systems, as the over or under-provision would need to be calculated on a per-trading period basis before being settled ex-post.

2016 Consultation Paper – Question Asked

"Do you agree with the rationale as to why we are proposing not to implement this scarcity scalar at this time? If not, can you provide rationale to support your views?"

Comments Received on 2016 Consultation Paper

A majority of respondents were in favour of not introducing this scalar until issues relating to design and system complexity were resolved, or made no comment. Two respondents commented that the scalar would introduce uncertainty around potential revenue. Two respondents raised concerns that a provider could potentially declare some of its units unavailable in order to increase the temporal scarcity scalar received by

its other generators. One respondent asserted that the scalar would favour distribution of System Services to those with locational market power.

Of those in favour of implementing a temporal scarcity scalar for the reserve products, one respondent noted it as a potential source of revenue for modern configurable plant, while another respondent asserted that not to implement this scalar would undercompensate flexible generators.

TSO Proposal for Regulated Arrangements

The TSOs propose that a temporal scarcity scalar for the 11 existing System Services is to be implemented for Regulated Arrangements. Please refer to Section 2.9 on Temporal Scarcity Scalar for 11 Existing System Services and note that its underlying driver (SNSP metric) differs to that proposed in 2016 for the Temporal Scarcity Scalar for Reserve Products.

Question 15: Do you agree with our proposal NOT to implement a specific Temporal Scarcity Scalar for Reserve Products? If not, can you provide rationale to support your views?

3.7. Temporal Scarcity Scalar for SIR

2016 Consultation Paper – Scalar Description

The TNEI / Pöyry report recommended that the TSOs consider the introduction of a temporal scarcity scalar for the SIR product. The concept behind this scalar was to vary the rate at which SIR was paid based on the level of inertia on the system. This would remunerate SIR providers at a greater value at times of low system inertia and could reduce the payment rate at times of high system inertia.

The TSOs were not minded to implement this scalar as we did not believe that it would result in any additional flexibility being offered or obtained, and thus the scalar's only outcome would be the redistribution of payments.

2016 Consultation Paper – Question Asked

"Do you agree with the rationale as to why we are proposing not to implement this scalar? If not, can you provide rationale to support your views?"

Comments Received on 2016 Consultation Paper

A majority of respondents were in favour of not introducing this scalar, or made no comment. One respondent commented that the tariff for SIR would need to increase before this scalar could be considered for implementation. One respondent stated that SIR should be paid for at all times that a unit is synchronised. One respondent asserted that the scalar would favour distribution of System Services to those with locational market power.

Of those in favour of the temporal scarcity scalar for SIR, one respondent commented that it would incentivise generators to have lower minimum generation and to remain synchronised during times of high wind. Another respondent asserted that not to implement this scalar would discriminate against flexible generators.

One respondent noted that any future implementation of this scalar needs to be linked to seasonal or daily cycles in order to avoid discouraging investment in the provision of SIR.

TSO Proposal for Regulated Arrangements

The TSOs propose that a temporal scarcity scalar for the 11 existing System Services is to be implemented for Regulated Arrangements. Please refer to Section 2.9 on Temporal Scarcity Scalar for 11 Existing System Services and note that its underlying driver (SNSP metric) differs to that proposed in 2016 for the Temporal Scarcity Scalar for SIR.

Question 16: Do you agree with our proposal NOT to implement a specific Temporal Scarcity Scalar for SIR? If not, can you provide rationale to support your views?

3.8. Volume Scalar

2016 Consultation Paper – Scalar Description

In the scalars consultation paper, the TSOs proposed that a volume scalar be implemented for Regulated Arrangements to be applied, where necessary, to regulated tariffs in order to protect consumers from overpayment and allow the TSOs to manage the overall scale of payments for System Services.

The TNEI / Pöyry report put forward options for a volume scalar, outlined in Figure 16.

Volume Scalar Options	
Option 1	**Targeted, expenditure-based, annual, ex-ante (forecast)** $Volume\ Scalar = \frac{Annual\ DS3\ System\ Services\ Budget}{Forecast\ Annual\ Expenditure\ based\ on\ Base\ Tariff\ Rates}$
Option 2	**Targeted, requirement based, trading period, ex-post (actual)** $Volume\ Scalar = \frac{Requirement\ for\ the\ service\ in\ the\ Trading\ Period}{Volume\ of\ the\ service\ made\ available\ in\ the\ Trading\ Period}$

Figure 16: 2016 consultation paper - Volume Scalar options

For the purposes of simplicity the TSOs proposed to implement Option 1 – the expenditure-based option, with the volume scalars for all 14 System Services being calculated annually on an ex-ante basis. This was considered less complex to implement, as well as affording more certainty to service providers than an ex-post trading period calculation. The scalar would have a value of 1 if the forecast annual expenditure was lower than the annual budget. The maximum value of the scalar would be capped at 1.

In addition, in line with the TNEI / Pöyry proposal, the TSOs proposed that the scalar design would retain some flexibility to target all System Services or a subset of Services.

2016 Consultation Paper – Question Asked

"Do you agree with the volume scalar proposal set out by the TSOs? If not, what part of the scalar design proposal do you believe requires amendment?"

Comments Received on 2016 Consultation Paper

There was a mixed response to the proposal to introduce a volume scalar for System Services. Several respondents broadly agreed with the implementation of the scalar, with some providing suggestions relating to its implementation. Others questioned the rationale for the volume scalar in the first instance. A minority of respondents made no comment.

Income and price certainty were the key concerns for respondents relating to the design of the volume scalar, particularly as they relate to future investment. Multiple respondents commented that the chosen expenditure-based option, with the volume

scalars for all 14 System Services being calculated annually on an ex-ante basis, is the preferred design given that it provides greater revenue certainty to providing units.

Two respondents commented on the application of a lower limit (floor) to the volume scalar. One respondent commented that capping the upper limit of the scalar at 1 represented a missed opportunity to send an enhanced investment signal to the industry in the event that System Service volume forecasts were lower than system needs.

Two respondents commented that consideration needs to be given to large variances between forecast and actual availability, with an allowance for corrective measures to be applied to the scalar if required.

Several respondents commented on the general concept of the volume scalar, including that it represents price intervention and a failure of System Service procurement, that it should not be required if the budget has been set correctly, and that it is an artificial concept based on the SEM decision to base payments entirely on availability (and not on a combination of availability and capability).

Noting that the scalar design would include the flexibility to target all System Services or a subset of Services, three respondents stated that the volume scalar should be applied to all Services, with one respondent commenting that the application of the scalar on a selective basis could increase investor uncertainty. One respondent asserted that providing some Services with an exemption from this scalar could be seen as technology biased, as certain technologies will be more likely to provide some Services than others. In addition, one respondent commented that the volume scalar made no reference to the diverse values that distinct System Services provide to the system.

Several respondents asserted that the volume scalar should not apply to new entrants to the market, where certainty of income is paramount. One respondent commented that the scalar should only apply to tariffs, with contract payments for new entrants being protected. In contrast, one respondent asserted that the scalar should be applicable to all and that long-term contractors should not be exempt. Another respondent suggested that any volume scalar applied to the first year's payments must act as a lower bound of potential scalars to be applied in subsequent years.

Finally, one respondent suggested that the calculation of the volume scalar should be undertaken and published well in advance of the delivery year, while another questioned if the calculations were to be independently verified.

TSO Proposal for Regulated Arrangements

The TSOs propose not to implement this scalar for Regulated Arrangements.

The Consultation Paper on Enduring Tariffs describes a proposal to conduct a conditional review of the tariff structure within the duration of Regulated Arrangements should any of a set of circumstances relating to expenditure on System Services occur. Please refer to the appropriate section in the Enduring Tariffs paper.

Question 17: Do you agree with our proposal NOT to implement a specific Volume Scalar for Regulated Arrangements? If not, can you provide rationale to support your views?

4. FFR Frequency Response Curves

Summary

The TSOs propose to introduce 2 frequency response curves as a means to define how the FFR Service is to be provided from diverse technologies with distinct capabilities. A curve will define how a unit with dynamic capabilities is to provide FFR; a second curve will define the provision of FFR from static units. These curves will instruct how the TSOs procure the FFR Service for Regulated Arrangements. Control parameters, bespoke to providing units, are applicable to each curve.

Introduction

Fast Frequency Response is defined as the additional increase in MW output from a generator, or reduction in demand, following a frequency event that is available within two seconds of the start of the event and is sustained for at least eight seconds. The extra energy provided in the two to ten second timeframe by the increase in MW output must be greater than any loss of energy in the 10 to 20 second timeframe due to a reduction in MW output below the initial MW output (i.e. the hatched blue area must be greater than the hatched green area in Figure 17 below).

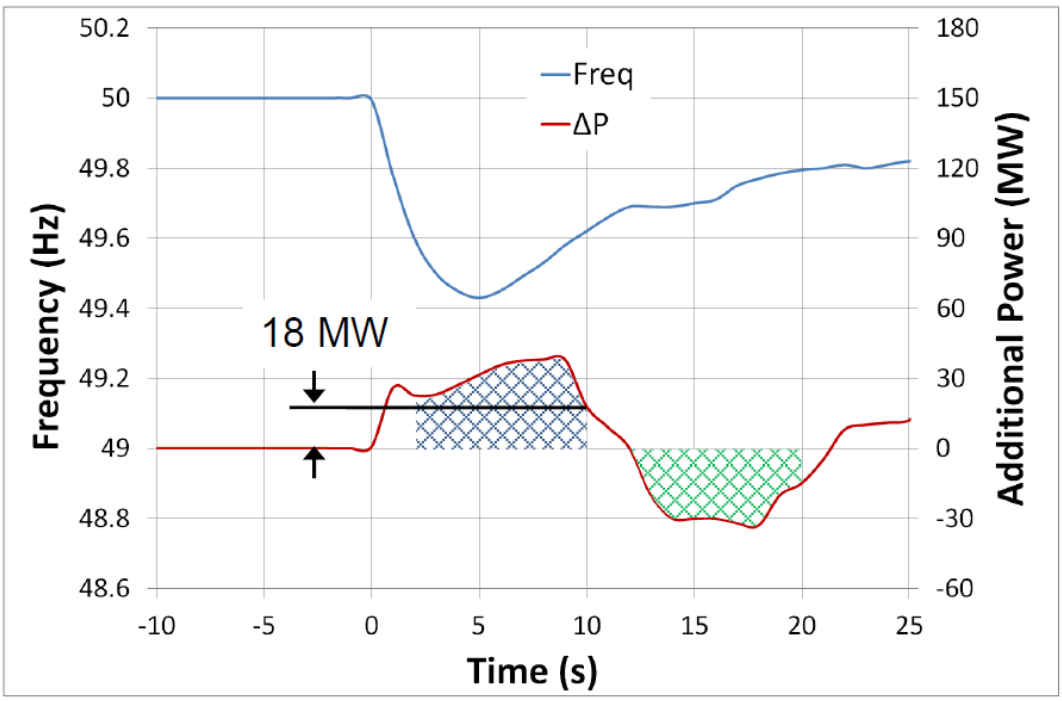

Figure 17: Fast Frequency Response

FFR is not being procured under Interim Arrangements. It is scheduled to go live on 1 September 2018.

For Regulated Arrangements, the TSOs propose that product scalars be implemented to further incentivise the effective delivery of FFR:

- Product Scalar for the Faster Response of FFR
- Product Scalar for the Enhanced Response of FFR, POR, SOR and TOR1
- Product Scalar for the Continuous Provision of Reserve from FFR to TOR1

The proposed design of these scalars is described in Section 2 of this document.

In addition to the core product design and accompanying product scalars, given the fast-acting nature of FFR, the TSOs consider that frequency response curves are required to maximise the benefits of the Service to the system while also ensuring that system security is not compromised. It is proposed that these curves will allow for the TSOs to define how each contracted unit is to provide FFR based on system requirements and a unit's confirmed capabilities. The values derived from the curves will form an input to a unit's contracted values for Regulated Arrangements.

TSO Studies

The TSOs conducted a focused simulation study on selected candidate frequency response curves with a view to investigating their suitability and determining the preferred curve and its desired characteristics.

The study methodology consisted of simulating various combinations of system conditions, FFR resource configurations and candidate response curves; factors such as loss of various infeeds (including largest and smaller) and loss of largest outfeed/export were introduced as stimuli.

This process was executed for each candidate curve and the resulting system frequency profile examined to determine the curve's suitability.

The focus of these studies was to identify the suitable frequency response curve shape and not to evaluate any of the control parameters shown on the generic curves.

Proposed Curves for FFR for Regulated Arrangements

Frequency response curves represent the percentage of available FFR resource magnitude (as % of FFR capacity) that a contracted FFR unit must provide for a given system frequency deviation. The response curve can consist of a deadband and 1 or more response trajectories.

Following the simulation study, 2 curves are presented separately for static and dynamic resources, and for the sake of simplicity, the curve design for an under frequency event is being shown. At times of over frequency, the curve design is identical (the control parameters may differ), except mirrored about the nominal frequency.

Control parameters applicable to each curve, which will be assigned to providing units during the procurement process based on their capability and system requirements, can include, but are not limited to, frequency trigger set points (both in response to an event and in recovery), response slope (akin to a droop characteristic), the number of discrete steps, energy recovery profiles, and MW output.

For the purpose of this section, a dynamic response is defined as a change in MW output in a continuously controlled manner proportional to the system frequency; a static response is a response provided in discrete step increases in MW output or discrete steps in MW reduction.

<u>Dynamic Responses</u>

For units capable of dynamic responses, it is proposed that the curve as illustrated in Figure 18 will be utilised by the TSOs to define the required provision of FFR. The curve shows 2 frequency triggers (F_1 and F_3) to provide a MW response (although the parameters could be changed to make the droop value the same for both); the response to a frequency event and the recovery follow the same trajectory.

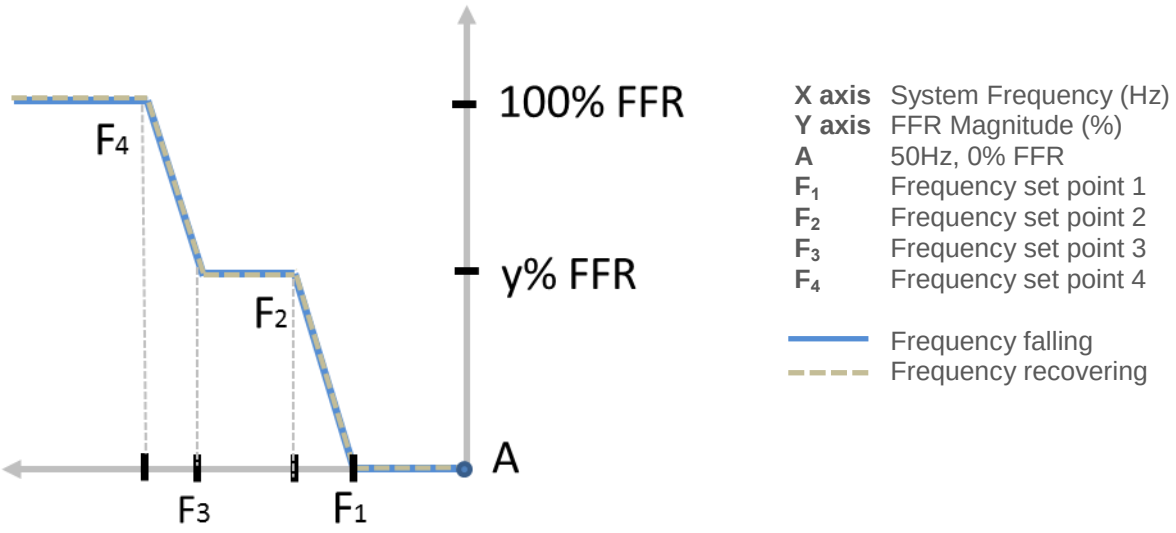

Figure 18: Proposed Frequency Response Curve for Dynamic Response

Static Responses

For units capable of static responses, it is proposed that the curve as illustrated in Figure 19 will be utilised by the TSOs to define the provision of FFR. The response to a frequency event and the recovery are implemented in multiple steps, i.e. there are multiple frequency trigger points; however, the recovery steps follow a separate trajectory to the response. For the purposes of simplicity, the example shows 2 steps; a unit may wish to provide FFR in more than 2 steps.

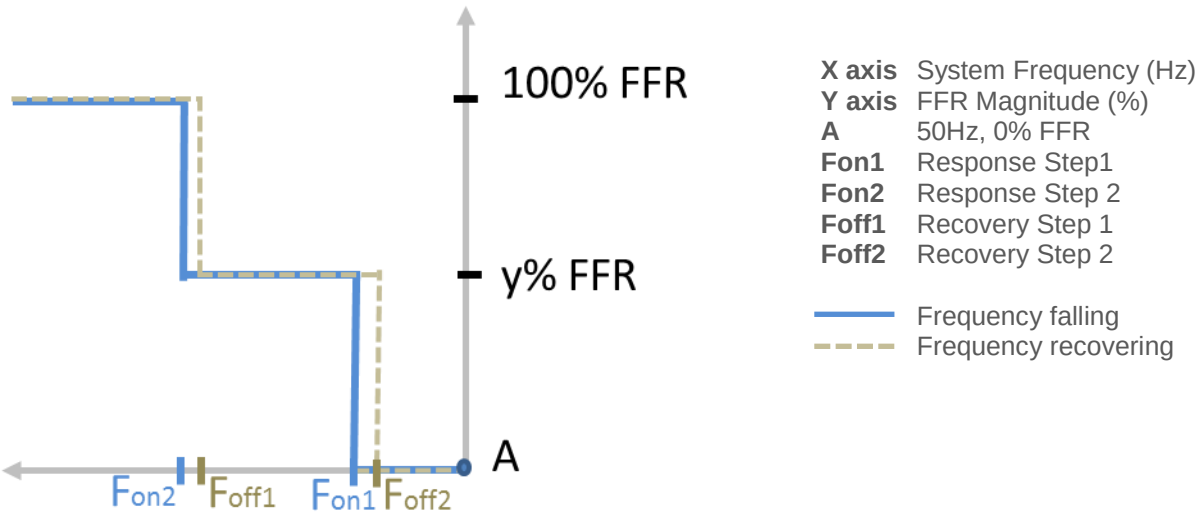

Figure 19: Proposed Frequency Response Curve for Static Response

Next Steps

The proposed response curves detailed above may inform the design of the Product Scalar for the Enhanced Delivery of FFR, POR, SOR and TOR1 for Regulated Arrangements.

The TSOs plan to proceed with conducting a detailed evaluation of the control parameters applicable to the response curves for FFR providers of varying magnitudes, with a view towards maintaining system security. This will be done in conjunction with the development of the associated commercial, contractual and procurement arrangements.

The TSOs welcome feedback from interested parties on the design and implementation of the proposed frequency response curves.

Question 18: Do you agree with our proposal to implement Frequency Response Curves to define the provision of the FFR Service? If not, please specify why or identify what element of the curve design you believe requires amendment?

5. Next Steps

5.1. Consultation Responses

SONI and EirGrid welcome feedback on the questions posed within this paper, which will be used to inform the scalar design submitted to the RAs for approval.

Responses should be submitted to DS3@soni.ltd.uk or DS3@EirGrid.com before 21 August 2017 using the associated questionnaire template. It would be helpful if answers to the questions include justification and explanation. If there are pertinent issues that are not addressed in the questionnaire, these can be addressed at the end of the response.

It would be helpful if responses are not confidential. If you require your response to remain confidential, you should clearly state this on the coversheet of the response. We intend to publish all non-confidential responses. Please note that, in any event, all responses will be shared with the Regulatory Authorities to inform their approval of the enduring scalar design for Regulated Arrangements.

5.2. Stakeholder Workshop

To facilitate stakeholder engagement we will host an industry workshop during the consultation period. This workshop, which is scheduled for 1 August 2017 in Dundalk, will provide an opportunity to discuss the details contained in this consultation paper. The workshop will also focus on other core aspects of the Regulated Arrangements (e.g. tariffs, contracts and procurement). Should you wish to register, please contact DS3@soni.ltd.uk or DS3@EirGrid.com

5.3. List of Consultation Questions

Question 1: Do you agree with our proposal to include in the performance assessment methodology to determine the value of the Performance Scalar an additional measure to incentivise a unit to supply to the TSOs an accurate forecast of its availability to provide Reserve and Ramping Margin Services? If not, please specify why or identify what element of the proposal you believe requires amendment?

Question 2: Do you agree with our proposal to implement a Product Scalar for the Faster Response of FFR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 3: Do you agree with our proposal to implement a Product Scalar for the Enhanced Delivery of FFR, POR, SOR and TOR1? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 4: Do you agree with our proposal to implement a Product Scalar for the Continuous Provision of Reserve from FFR to TOR1? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 5: Do you agree with our proposal to implement a Product Scalar for Enhanced Delivery of SSRP with an AVR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 6: Do you agree with our proposal to implement a Product Scalar for SSRP with Watt-less VArs? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 7: Do you agree with our proposal to implement a Temporal Scarcity Scalar for DRR and FPFAPR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 8: Do you agree with our proposal to implement a Temporal Scarcity Scalar for FFR? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 9: Do you agree with our proposal to implement a Temporal Scarcity Scalar for 11 Existing System Services? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 10: Do you agree with our proposal to implement a Locational Scarcity Scalar for All System Services? If not, please specify why or identify what element of the scalar design you believe requires amendment?

Question 11: Do you agree with our proposal NOT to implement a Product Scalar for Enhanced Delivery of DRR with more reactive current? If not, can you provide rationale to support your views?

Question 12: Do you agree with our proposal NOT to implement a Product Scalar for Enhanced Delivery of SSRP with a PSS? If not, can you provide rationale to support your views?

Question 13: Do you agree with our proposal NOT to implement a Product Scalar for SIR with Reserve? If not, can you provide rationale to support your views?

Question 14: Do you agree with our proposal NOT to implement a Product Scalar for Faster Response of FPFAPR? If not, can you provide rationale to support your views?

Question 15: Do you agree with our proposal NOT to implement a specific Temporal Scarcity Scalar for Reserve Products? If not, can you provide rationale to support your views?

Question 16: Do you agree with our proposal NOT to implement a specific Temporal Scarcity Scalar for SIR? If not, can you provide rationale to support your views?

Question 17: Do you agree with our proposal NOT to implement a specific Volume Scalar for Regulated Arrangements? If not, can you provide rationale to support your views?

Question 18: Do you agree with our proposal to implement Frequency Response Curves to define the provision of the FFR Service? If not, please specify why or identify what element of the curve design you believe requires amendment?