Consultation on

Volume Calculation Methodology and Portfolio Scenarios

DS3 System Services Implementation Project

14th October 2015

EIRGRID SONI

Disclaimer

Executive Summary

Introduction and Background

The objective of the 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 (or Ancillary Services) work stream. The aim of the System Services work stream is to put in place the correct structure, level and type of service in order to ensure that the system can operate securely with higher levels of non-synchronous generation such as intermittent wind penetration (up to 75% instantaneous penetration). This will reduce the level of curtailment for wind farms and will deliver significant savings to consumers through lower wholesale energy prices.

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) ('the Decision Paper'). The Decision Paper followed a number of consultative processes run separately by the TSOs and the SEM Committee between 2011 and 2014 as well as a number of independent reports, including an economic analysis, and system services valuation.

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 levels of wind increase;
- 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.

Subsequent to the publication of the SEM Committee Decision Paper, EirGrid and SONI ('the TSOs') worked together with the Commission for Energy Regulation and Utility Regulator ('the RAs') to develop a project plan[1] for delivery of the market arrangements in line with the key milestones set out in the Decision Paper.

One of the central workstreams included in the plan is WS2 – System Services Volumes. The objective of this work stream is to determine the volume of System Services required to operate the system securely while facilitating increased levels of non-synchronous generation. For those services deemed to be competitive, this information will feed into the Capability Volume Requirements used in the auction.

[1] DS3 System Services Project Plan (Detailed Design and Implementation Phase): http://www.allislandproject.org/en/transmission_decision_documents.aspx?article=332ac31a-1224-44c7-97b6-00a7b6c8a8b9

In this paper, the TSOs are consulting on the proposed methodology for calculating the Capability Volume Requirements for each DS3 System Service.

Methodology for Calculating Volume Requirements

The Decision Paper requires the TSOs to determine System Services volumes for five years, beginning in the Tariff/Auction year 2017/18. We propose to carry out detailed analysis of volume requirements for the first year, 2017/18, and the third year, 2019/20; the latter is the year in which renewable electricity targets should be achieved. We will interpolate between these results to determine the 2018/19 volume requirements, and in the absence of certainty regarding the build out of renewable generation capacity beyond 2020 at present, we will set the volume requirements for 2020/21 and 2021/22 to the 2019/20 values.

The detailed analyses for 2017/18 and 2019/20 involve iterative Plexos studies on a number of portfolio scenarios to fine tune their capabilities to match system requirements. We will calculate the volume requirements for each System Service from the service capabilities contained within the refined portfolio scenarios.

Scenarios

We have created scenarios with different service provider portfolios that we propose to use in the Volume Requirement calculations for 2017/18 and 2019/20. The portfolio scenarios presented in this paper have been developed solely for the purpose of determining the appropriate volume requirement for each of the services and do not represent desired, expected or optimal portfolios. The portfolio scenarios will have no bearing on the outcome of the competitive procurement process other than informing the volumes to be procured.

The proposed portfolios to be used in the volume calculation methodology can be summarised as follows:

2017/18 – One portfolio scenario

- **2017/18**: a portfolio scenario based largely on the capabilities of the existing service providers with small additional volumes of services provided by new providers.

2019/20 - Two portfolio scenarios, which aim to cover a wide range of potential outcomes

There are a number of potential ways that the system services market may evolve over the next few years. Different portfolios of service providers may result in different volumes of services being required. We are therefore proposing two very different scenarios here in an effort to capture the volume requirements for all potential eventualities.

- **Enhanced Capability:** In this scenario we assume that the majority of the additional flexibility required is obtained from the enhancement of the existing portfolio. In addition to these enhancements, a significant volume of services are provided by windfarms, Demand Side Management (DSM) and interconnectors.
- **New Service Providers:** In this scenario we assume that new service providers contribute significantly to the additional volume of System Services required. Significant provision is also obtained from interconnectors, with a lower provision from windfarms and DSM as compared to the Enhanced Portfolio above.

Stakeholder Engagement

Responses to the consultation, preferably structured in line with the specific questions raised in this paper, should be sent to DS3@eirgrid.com or DS3@soni.ltd.uk by November 25th 2015. In advance of this date, we will host an industry forum in Dundalk on the week of the 9th November 2015.

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1 Introduction

1.1 Purpose of Document

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) (‘the Decision Paper’). Following on from this, EirGrid and SONI (‘the TSOs’) worked together with the Commission for Energy Regulation and Utility Regulator (‘the Regulatory Authorities’) to develop a project plan[2] for delivery of the market arrangements in line with the key milestones set out in the Decision Paper.

One of the central workstreams included in the plan is WS2 – System Services Volumes. The objective of this workstream is to determine the volumes of System Services required to operate the system securely while facilitating an increased level of non-synchronous generation by 2020. For those services deemed to be competitive, this information will feed into the Capability Volume Requirements used in the auction.

In this paper, the TSOs are consulting on the proposed methodology for calculating the Capability Volume Requirements for each DS3 System Service. The purpose of this document is to provide stakeholders with information about our proposals and a guide to the consultation process. We recognise that the publication of System Service volume forecasts is a key aspect of System Service design for market participants. This information is a key requirement for many to develop their proposals for System Service provision.

The Decision Paper states that “a **consultation** on the **methodology** for System Services volume requirements will be carried out by the TSOs in 2015. This will include **consideration of different scenarios** for estimating required volumes. Following this consultation and a decision by the SEM

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[2] DS3 System Services Project Plan (Detailed Design and Implementation Phase): http://www.allislandproject.org/en/transmission_decision_documents.aspx?article=332ac31a-1224-44c7-97b6-00a7b6c8a8b9

Committee on the methodology for estimating volumes, the TSOs will publish estimated volumes for each service."

The publication of this consultation paper fulfils this requirement. For the purposes of clarity the System Services implementation plan published jointly by the Regulatory Authorities and the TSOs in May 2015 indicated that the consultations on Methodology and Scenarios would be published separately and run in a parallel timeframe. However, due to the high level of interdependencies between the two papers both are presented as a single consultation in the form of this paper.

To comply with our respective statutory and licence obligations as TSOs, we are required to procure the System Services necessary to securely operate the power system and may need to procure additional services where system conditions require it.

1.2 Workstream 2 - System Services Volumes Plan

Table 1 shows the key milestones for Workstream 2. It is anticipated that following the SEMC decision on the volumes methodology, the DS3 System Services TSO Procurement Strategy[3] (Part D) will be updated to reflect the methodology.

The finalised volume requirements will feed into the determination of the quantities to be procured in the future System Service auctions. The first auction is scheduled to take place in Q1 2017. Further information regarding auction design and the use of the published volumes in the System Services auctions will be discussed in the upcoming Auction Design consultation.

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[3] DS3 System Services Draft TSO Procurement Strategy
http://www.eirgrid.com/media/Draft%20TSO%20Procurement%20Strategy%20-%20Published%2004062014.pdf

Table 1: DS3 System Services Workstream 2 key milestones

Key Milestones	Date
Consultation on Volume Calculation Methodology and Portfolio Scenarios	Q4 2015
SEM Committee decision on Volume Calculation Methodology and Portfolio Scenarios	Q1 2016
Completion of Volume Analysis	Q1 2016
Consultation on results from the Volume Analysis	Q2 2016
Publication of Volume Requirements	Q2 2016

1.3 System Services

In December 2013, the SEM Committee published a decision paper on the DS3 System Services Technical Definitions (SEM-13-098). That paper presented technical definitions of the seven existing System Services and the seven new System Services that are required in order to maintain a secure and reliable electricity system under conditions of high penetration of non-synchronous generation. The 14 System Services are presented here in Table 2.

Table 2: The 14 DS3 System Services

New System Services		Existing System Services	
SIR	Synchronous Inertial Response	SRP	Steady-State Reactive Power
FFR	Fast Frequency Response	POR	Primary Operating Reserve
DRR	Dynamic Reactive Response	SOR	Secondary Operating Reserve
RM1	Ramping Margin 1 Hour	TOR1	Tertiary Operating Reserve 1
RM3	Ramping Margin 3 Hour	TOR2	Tertiary Operating Reserve 2
RM8	Ramping Margin 8 Hour	RRD	Replacement Reserve (De-Synchronised)
FPFAPR	Fast Post-Fault Active Power Recovery	RRS	Replacement Reserve (Synchronised)

1.4 Terminology relating to Volumes

It is useful for the reading of this paper, to understand the following terms:

(i) Capability Volume Requirements

These are the volumes of System Services which are required within the portfolio to ensure that sufficient real-time volume requirement is technically realisable across a year. These will be used to set the quantity to procure in the System Service auctions.

(ii) Real-Time Volume Requirements

These are the volumes of System Services which are required at any point in time to ensure that system security is not jeopardised.

2 Methodology for Calculating Capability Volume Requirements

2.1 Approach to Calculations of Capability Volume Requirements

The SEM Committee's Decision Paper stated that "*volumes should be forecast for a minimum of a five year period*". The first auction is expected to take place in 2017 with the resulting contracts for System Services coming into place on 1st October 2017. The first year of the five year period is therefore 2017/18; the final year is 2021/22[4].

To determine the volumes efficiently, we propose to carry out detailed analysis of volume requirements for the first year, 2017/18, and the third year, 2019/20; the latter is the year in which renewable electricity targets should be achieved. We will interpolate between these results to determine the 2018/19 Capability Volume Requirements, and in the absence of certainty regarding the build out of renewable generation capacity beyond 2020 at present, we will set the Capability Volume Requirements for 2020/21 and 2021/22 to the 2019/20 values.

The detailed analyses for 2017/18 and 2019/20 will involve iterative Plexos studies on portfolio scenarios to fine tune their capabilities to match system requirements. The initial portfolio scenarios are described in detail in Section 3 of this paper.

The approach we intend to take to calculate the volume requirements for 2017/18 and 2019/20 is outlined in Figure 1. This approach will be used for calculating volume requirements for 11 of the services. The methodology for calculating volume requirements for Steady State Reactive Power is described in Section 2.5 and for Fast Post-Fault Active Power Recovery and Dynamic Reactive Response in Section 2.6.

In this approach, the initial portfolio scenarios presented in Section 3 of this paper will form the starting point for the detailed analysis. We will test the capability of these portfolio scenarios in facilitating increased System Non-Synchronous Penetration (SNSP) levels.

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[4] The Tariff/Auction year runs from 1st October to 30th September of the following year

SNSP has been identified as a useful proxy for the capability to operate the system safely, securely and efficiently while minimising curtailment of renewable generation. It covers a number of fundamental system requirements, namely: inertia/RoCoF, ramping, reactive power and transient stability.

Where necessary, we will refine the capability of the portfolio scenarios using the approach described in Section 2.2.

The volumes to be procured will be calculated based on the System Services capability of the refined portfolios, as described in Section 2.3.

For the year 2020, analysing two portfolio scenarios will result in more than one set of volume requirements being compiled for the various System Services. We propose to set the volume requirement for each service to the maximum value from the portfolio scenarios studied. This approach will ensure that prudent volumes of System Services are procured to cover the range of plausible scenarios.

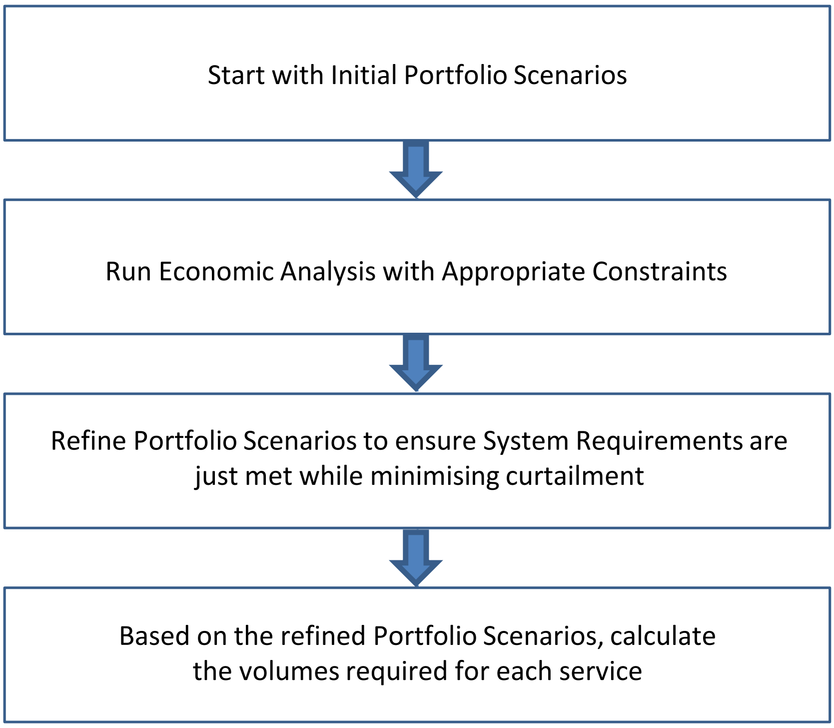

Figure 1: Proposed High-Level Approach to Volume Calculations

2.2 Methodology to Refine Portfolio Scenarios

In advance and outside of the System Services volume calculation process, we will develop the real-time requirements for System Services and the maximum volume of services from a single service provider to ensure operational security. These real-time requirements and limits will be input to the Plexos models as constraints. An example of a constraint is the requirement to carry sufficient Primary Operating Reserve to cover a certain percentage of the largest single infeed.

The methodology to refine the portfolio scenarios is presented in Figure 2. The process involves running the economic dispatch production costing program, Plexos, to determine the deployment of System Services throughout the year. We will iteratively refine the composition of the portfolio scenarios as follows:

- Where some of the providers have very low or zero utilisation, we will remove them from the portfolio scenario;
- Where there is not enough of a particular service, or where the results from the Plexos study indicate very high re-dispatch costs, we will add further service capability in line with the theme of the scenario, e.g. for the New Service Providers scenario, we could add capability in the storage category.

We will continue to refine the portfolios until they just meet the system requirements throughout the year while minimising curtailment levels.

2.3 Calculation of Capability Volume Requirements

The final refined portfolio scenarios will be used for calculating volume requirements. For each system service, we will initially calculate the Capability Volume Requirement as the sum of the service capability from each service provider in the portfolio scenario.

However, not all services may be binding within the Plexos run. If we sum the capabilities of each provider, we may overestimate the volumes required for these services. For example if Primary Operating Reserve is generally binding there may be an overprovision in Secondary Operating Reserve due

to inherent plant capabilities. We therefore intend to examine each service for potential over-provision by removing in turn the provider that provides the least amount of service throughout the year, and checking whether we still meet the requirement for that particular service throughout the year.

This calculation process is illustrated in Figure 3.

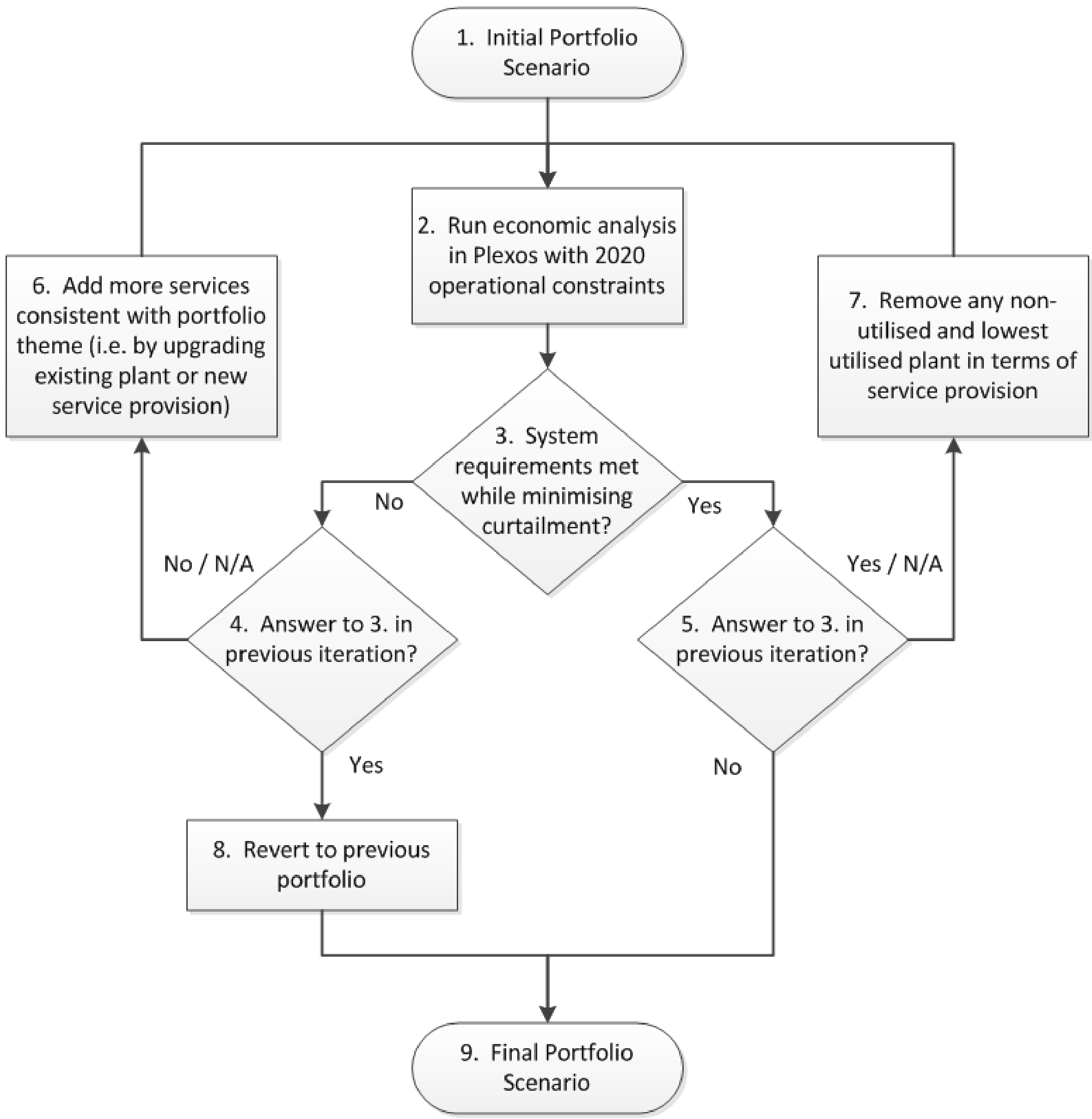

Figure 2: Proposed Methodology for Refining Portfolio Scenarios

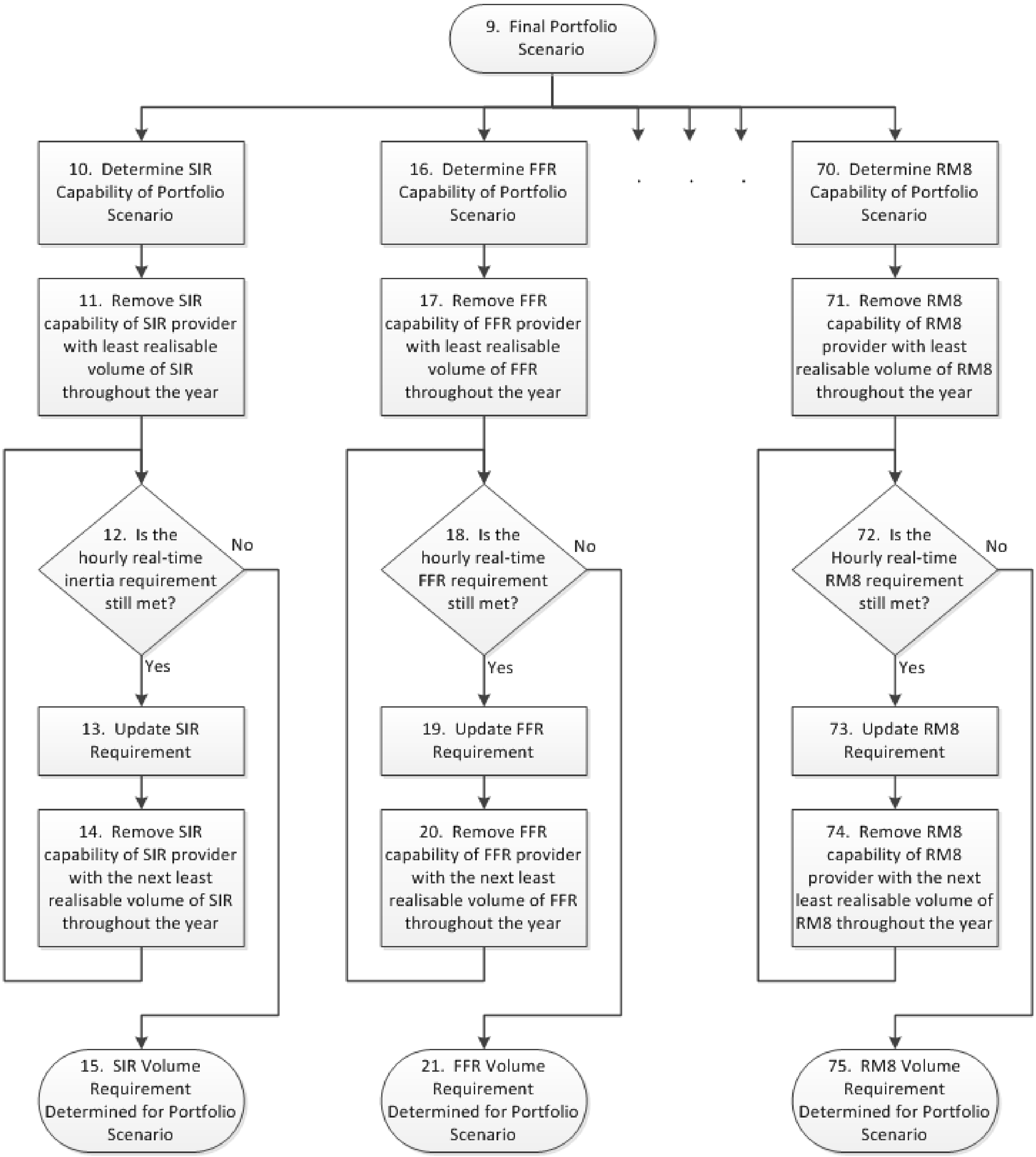

Figure 3: Proposed Methodology for Calculating Volume Requirements

2.4 Locational Considerations

Jurisdictional Capability Volume Requirements will be considered for all of the System Services in the years prior to the commissioning of the North South Interconnector, i.e. while the risk exists of the two systems separating because of a fault. To examine the requirements separately in each jurisdiction, specific local operational constraints will be input to Plexos for Ireland and Northern Ireland.

Other local constraints are likely to arise in relation to reactive power requirements. These are discussed in Section 2.5.

2.5 Steady-State Reactive Power

The Steady-State Reactive Power service is important for the control of system voltages. Both synchronous and non-synchronous sources can contribute to this requirement. The design of the Steady-State Reactive Power service is aimed at encouraging each service provider to maximise the active power range across which they can provide their reactive power capability, thus improving overall system voltage performance. Voltage issues that require addition of reactive power capability are likely to be very location specific.

We propose to use the refined portfolio scenarios as inputs to full network models, locating new devices at strong nodes around the network. We will study the voltage performance of these network models, testing whether the voltages remain within limits when the network is in its normal intact state and when any piece of equipment is out of service (known as the n-1 standard). Where the reactive power capability of the portfolio scenarios is inadequate to maintain system voltages within standards, we will add network devices (e.g. STATCOMs) of sufficient size to the network models just to meet the standards.

To calculate the volume of Steady-State Reactive Power required in each part of the network, we will sum the maximum reactive power generated and absorbed over the year by each provider and by all added network devices in

those areas. For the purposes of these calculations, we propose analysing requirements for nine areas:

1. Northern Ireland
2. Dublin
3. North East
4. North West
5. West
6. Mid-West
7. South West
8. South East
9. Midlands

Figure 4 describes the proposed methodology for calculating Steady-State Reactive Power Volume Requirements.

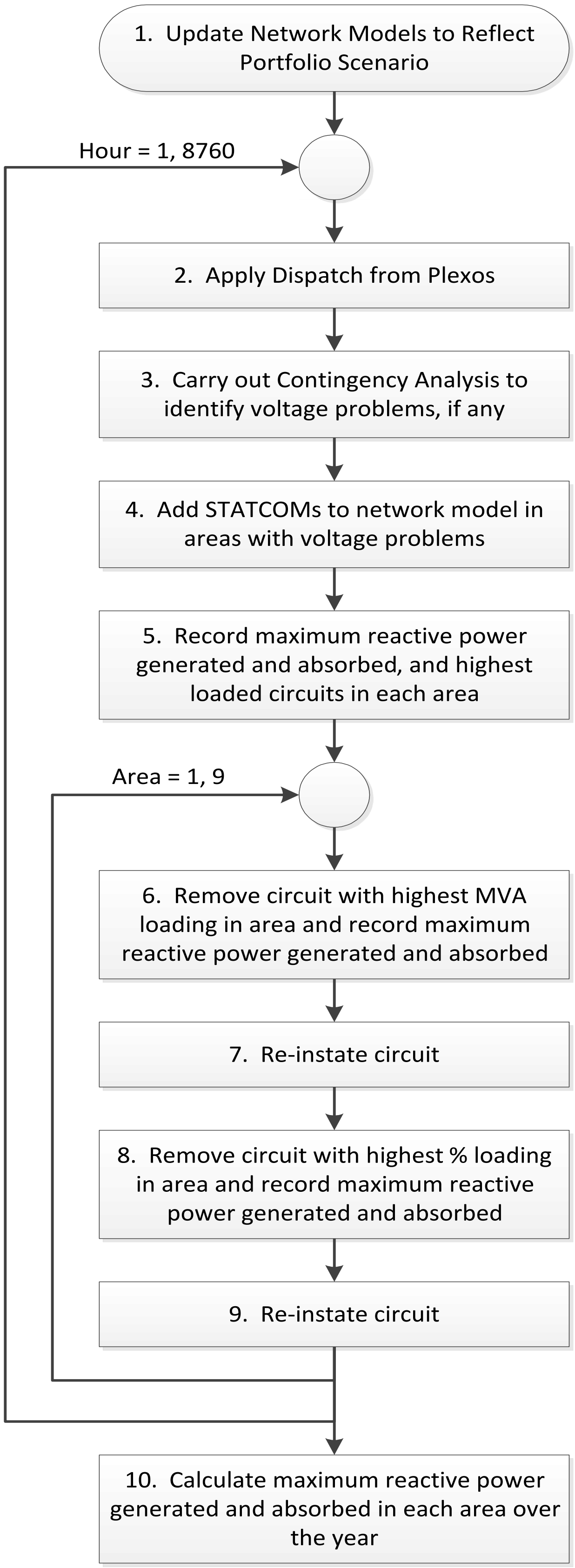

Figure 4: Proposed Methodology for Calculating Steady-State Reactive Power Volume Requirements

2.6 Dynamic Reactive Response and Fast Post Fault Active Power Recovery

The Dynamic Reactive Response and Fast Post Fault Active Power Recovery services relate to desired performance of service providers during and after a transmission fault to manage the stability of the system. All conventional generation units and some non-synchronous (e.g. wind turbine) generators provide the desired response. We need the appropriate response from all new generation connecting to the system.

As all conventional generation units can provide the desired response, it is only additional non-conventional generation that will be required to supply this service. The additional volume requirement for these services is therefore simply the capacity of any new non-synchronous generation connected.

Question 1: Do you agree with our proposed approach to determining the Capability Volume Requirements for the System Services? If not, please specify what alternative method you believe to be more appropriate.

3 Initial Portfolio Scenarios

3.1 Overview

The objective of this section is to propose portfolio scenarios for comment.

We aim in so far as possible to treat all technologies and service providers in a fair and impartial manner. In this regard, we wish to stress that the inclusion or exclusion of any service provider or technology from any of the portfolio scenarios should not be viewed as pre-empting the outcome of the qualification and procurement process. We have developed the scenarios of service provider portfolios solely for the purpose of determining the appropriate volume requirement for each of the services. They form an input into the volume analysis, rather than an output.

It should be noted that these scenarios are assumed to be adequate for meeting the System Services requirements of the future power system. This is based on the information and analysis performed in the Facilitation of Renewables studies and subsequent work as part of the DS3 Programme. These scenarios will act as starting points for the analysis presented in Section 2, which will refine and optimise the composition of their capabilities.

For each of the portfolio scenarios, a level of investment in enhanced / improved technology has been assumed that will be adequate to enable the delivery of the needed System Services in 2017/18 and 2019/20.

Each portfolio scenario has to be capable of resolving the four fundamental challenges identified, namely: inertia/RoCoF, ramping, reactive power and transient stability. In this regard, the TSOs have taken a view of possible sources of the required services from investment in different technologies.

The portfolio scenarios should be considered in the following context:

1. Any portfolio should be capable of meeting real-time system service requirements which will facilitate the increased SNSP levels. For example, in 2020:
    - Wind ranging from 0 MW to 4600 MW
    - Demand ranging from 2000 MW to 7000 MW
    - Full import to full export on interconnectors

- Largest single infeed / outfeed: up to 530 MW
- Transmission infrastructure build-out and outages

The real-time requirements for System Services will vary with these system conditions.

2. There are a range of potential portfolio solutions which would allow the system to be operated at 75% SNSP – the System Services capability of these portfolios will likely be different from those detailed in this report.

3.2 Portfolio Scenarios

We have presented portfolio scenarios for two years:

- 2017/18 – This is the first year of the 5 year period. Given the short lead time, one portfolio is presented.
- 2019/20 – This will be the primary focus of the System Services volume analysis, with two portfolios presented for comment. They reflect the many, credible portfolios that could come to fruition.

The following are high-level assumptions for all portfolios presented in this paper:

- Information from the Generation Capacity Statement 2015-2024[5] is used as the starting point for all portfolio scenarios. This includes the renewable generation build out, future plant closures and new plant connections.
- Rate-of-Change-of-Frequency (RoCoF) Grid Code requirement is assumed to be 1 Hz/s (calculated over 500 ms) in line with the RoCoF Grid Code modification[6], which has been approved in principle in both jurisdictions. We expect this to come into effect from the end of 2017. If this change in Grid Code standard is not achieved, the volume requirements for Synchronous

[5] All-Island Generation Capacity Statement 2015 - 2024
http://www.eirgrid.com/media/Eirgrid_Generation_Capacity_Statement_2015-2024.pdf

[6] 2015 RoCoF Workstream Plan
http://www.eirgrid.com/media/DS3_RoCoF_Workstream_Plan_2015.pdf

Inertial Response and Fast Frequency Response would need to be re-evaluated, but we would reasonably expect them to be greater.

- The SNSP limit will increase as per the most recent version of the TSOs' Operational Capability Outlook[7], accruing to a maximum of 75% in 2020.
- The North-South 400 kV Interconnector is assumed to be built and operational from the end of 2019 onwards.
- Fast Frequency Response capability was set at 50% of the corresponding Primary Operating Reserve figure for non-enhanced plant, 60% for enhanced plant.
- The heat status for conventional plant for the purposes of the Replacement Reserve (De-synchronised) and Ramping Margin services was assumed as cold.
- It has been assumed that windfarms will not contribute to reserve given its priority status per European RES Directive – however the TSOs note that wind does have the capability of providing these services.

The values listed in Tables 3, 4, and 5 relate to the capability of each technology group. For the Plexos analysis of real time requirements described in Section 2 of this paper, we need to also take account of the ability of each technology to provide the services when in different states, e.g. offline or in-service. For example, it is clear that thermal units must be operational to provide Primary Operating Reserve, whereas some new technologies may be able to provide Primary Operating Reserve from an offline state.

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[7] DS3 Operational Capability Outlook
http://www.eirgrid.com/media/DS3_Programme_Operational_Capability_Outlook_2015.pdf

3.2.1 2017/18 Portfolio Scenario

The 2017/18 portfolio is largely based on existing and planned connections of plant. We believe that the required lead times to build and commission new plant or to enhance existing units limit the extent that these can be considered in this scenario. However, we add a small quantity of new storage to learn how it may be utilised, without its inclusion materially impacting on the overall analysis.

The key differences between the current plant portfolio and the proposed 2017/18 portfolio are:

- Additional 140 MW of DSM capacity, with reserve capability similar to that delivered by the current Short Term Active Response (STAR)[8] scheme
- Additional 10 MW of new build storage devices will connect to the system, offering reserve and reactive power capabilities
- 3800 MW of windfarms will have connected to the system

[8] STAR is a scheme operated by EirGrid whereby electricity consumers are contracted to make their load available for short term interruptions

Table 3 – 2017/18 Plant Portfolio Scenario

Product	CCGT	OCGT	Wind	Thermal	CHP & Hydro	DSM, I/C & Storage
Capacity (MW)	4282	1104	3800	2794	390	1678
SIR (MWs^2)	65901	37186	0	145453	3466	55620
FFR (MW)	169	93	0	86	6	1055
POR (MW)	338	186	0	171	13	1100
SOR (MW)	463	242	0	214	32	1302
TOR1 (MW)	586	265	0	235	69	1297
TOR2 (MW)	655	348	0	257	159	1297
RR (S) (MW)	1947	872	0	797	204	1272
RR (D) (MW)	0	634	0	0	198	1448
RM1 (MW)	0	1103	0	0	228	1673
RM3 (MW)	0	1103	0	17	390	1392
RM8 (MW)	734	1103	0	125	390	1392
SSRP (Mvar)	2355	865	800	1813	253	669
DRR (MW)	4282	1104	0	2794	390	792
FPFAPR (MW)	4282	1104	0	2794	390	797

3.2.2 2019/20 Portfolio Scenarios

There are a number of potential ways that the System Services market may evolve over the next few years. Different portfolios of service providers may result in different Capability Volume Requirements. For example, we may need to contract greater volumes of capability with a portfolio of providers with low availabilities in comparison to an alternative portfolio of providers with higher availabilities. We are therefore proposing two very different 2019/20 portfolio scenarios here in an effort to capturing the volume requirements for all potential eventualities.

- **Enhanced Capability:** the majority of the additional flexibility required is obtained from the enhancement of the existing portfolio. In addition to these enhancements, a significant volume of services are provided by windfarms and interconnectors.
- **New Service Providers:** new service providers contribute significantly to the additional volume of System Services required. Significant provision is also obtained from interconnectors and DSM, with reduced provision from windfarms as compared to the Enhanced Portfolio above.

3.2.3 2019/20 Enhanced Capability Portfolio Scenario

In this portfolio scenario, it is envisaged that most of the required services will be provided by generation sources. The key differences between the 2017/18 and this 2019/20 portfolio are:

- Six of the existing Combined Cycle Gas Turbines (CCGTs) will provide more flexible performance through shorter start up times, improved reserve capabilities and a reduction in minimum load.
- Six of the existing Open Cycle Gas Turbines (OCGTs) will also provide more flexible performance through improved reserve capabilities.
- Two new OCGTs with replacement reserve and ramping capabilities will also connect to the system.

- There will be an additional 140 MW of DSM capacity, with reserve capabilities approximately 50% of that provided in the New Service Providers Portfolio Scenario.
- Approximately 1000 MW of additional windfarms will have connected to the system, with approximately 3000 MW of the entire wind portfolio of 4905MW providing Fast-Post Fault Active Power Recovery and Dynamic Reactive Response.
- Approximately 1400 Mvar of additional network devices (STATCOMs and synchronous compensators) will connect delivering in aggregate Synchronous Inertial Response, Steady-State Reactive Power and Dynamic Reactive Response.
- Approximately 100 MW of other renewables will connect to the system.

Table 4– 2019/20 Enhanced Capability Portfolio Scenario

Unit	CCGT	CCGT Enhanced	OCGT	OCGT Enhanced	OCGT New	Wind and Other Renewables	Thermal	Network devices	CHP & Hydro	DSM & I/C & Storage
Capacity (MW)	2047	2047	780	324	200	4905	2544	0	396	1802
SIR (MWs^2)	24876	146822	37186	0	3081	0	137837	60000	3466	55620
FFR (MW)	60	169	80	30	25	600	61	0	6	1075
POR (MW)	119	289	161	52	41	0	123	0	13	1140
SOR (MW)	170	347	216	52	41	0	147	0	32	1332
TOR1 (MW)	224	385	236	60	57	0	167	0	69	1327
TOR2 (MW)	275	385	236	124	170	0	190	0	159	1327
RR (S) (MW)	811	1178	636	236	170	0	654	0	204	1272
RR (D) (MW)	0	0	310	324	200	0	0	0	201	1472
RM1 (MW)	0	0	779	324	200	0	0	0	232	1547
RM3 (MW)	0	0	779	324	200	0	17	0	396	1542
RM8 (MW)	471	2230	779	324	200	0	125	0	396	1392
SSRP (Mvar)	1045	1592	664	201	200	1620	1627	1400	253	669
DRR (MW)	2047	2047	773	324	200	3000	2544	700	396	792
FPFAPR (MW)	2047	2047	773	324	200	3000	2544	0	396	797

3.2.4 2019/20 New Service Providers Portfolio Scenario

In this portfolio scenario, it is assumed that there is limited investment in enhanced performance by generation developers and as a consequence investment alternatives must be found that deliver the system capability to manage higher levels of renewables.

The key differences between the 2017/18 and this 2019/20 portfolio are:

- The portfolio scenario assumes the addition of 390 MW of storage technology capability – this is delivered by a range of storage technologies connected at both transmission and distribution level. Combined, these technologies deliver significant capability across all System Services.
- Approximately 1000 MWs of synchronous compensators with flywheels are assumed to connect at various locations on the system and provide inertia, fast frequency response and reactive support.
- There will be an additional 140 MW of DSM capacity, with significant reserve capabilities.
- Five of the existing CCGTs will also provide more flexible performance through shorter start up times. The remainder of the conventional plant are assumed not to have been enhanced.
- Approximately 100 MW of other renewable generation will connect to the system.
- Approximately 1200 Mvar of additional network devices (STATCOMs and synchronous compensators) will connect delivering in aggregate Synchronous Inertial Response, Steady-State Reactive Power and Dynamic Reactive Response.
- Approximately 1000 MW of additional windfarms will have connected to the system, with approximately 2000 MW of the entire wind portfolio providing Fast-Post Fault Active Power Recovery and Dynamic Reactive Response.

Table 5– 2019/20 New Service Providers Portfolio Scenario

Unit	CCGT	CCGT Enhanced	OCGT	Wind and Other Renewables	Thermal	Network devices	CHP & Hydro	DSM & I/C & Storage
Capacity (MW)	2449	1828	1104	4905	2544	50	396	2142
SIR (MWs^2)	24876	41025	37186	0	137837	60000	3466	64620
FFR (MW)	70	99	93	600	61	50	6	1230
POR (MW)	140	198	186	0	123	50	13	1360
SOR (MW)	207	256	242	0	147	50	32	1552
TOR1 (MW)	266	320	265	0	167	0	69	1582
TOR2 (MW)	317	338	348	0	190	0	159	1582
RR (S) (MW)	941	1006	872	0	655	0	204	1432
RR (D) (MW)	0	0	634	0	0	0	204	1592
RM1 (MW)	0	0	1103	0	0	0	234	1992
RM3 (MW)	0	0	1103	0	17	0	396	1812
RM8 (MW)	734	1828	1103	0	125	0	396	1652
SSRP (Mvar)	1271	1081	865	1620	1627	1400	253	909
DRR (MW)	2449	1828	1104	2000	2544	700	396	1142
FPFAPR (MW)	2449	1828	1104	2000	2544	0	396	1142

We have created scenarios with different service provider portfolios that we propose to use in the Volume Requirement calculations for 2017/18 and 2019/20. The portfolio scenarios presented in this paper have been developed solely for the purpose of determining the appropriate volume requirement for each of the services and do not represent desired, expected or optimal portfolios. The portfolio scenarios will have no bearing on the outcome of the competitive procurement process other than informing the volumes to be procured.

Question 2: Do you agree with the 2017/18 and 2019/20 plant portfolio scenarios and underlying assumptions presented as the starting point for carrying out the analysis of System Services Capability Volume Requirements? If not, please specify what alternative scenarios you believe to be more appropriate, and why.

4 Responding to this Consultation

4.1 Consultation Process

We value the input of stakeholders on all aspects of DS3 and as part of the System Services detailed design and implementation project we will consult with industry across a variety of topics.

In this consultation process we are seeking industry views on the portfolio scenarios and the methodology we intend to use to determine the System Services Capability Volume Requirements. To facilitate stakeholder engagement we will host an industry forum during the consultation period. This forum will provide an opportunity for discussion on the details of the consultation paper. The forum is scheduled to take place on the week starting November 9th and will be held in Dundalk. We are aiming to cover a number of consultation papers at the one workshop for efficiency. Further details regarding the date, venue and registration for this event will be issued shortly.

4.2 Responding to the Consultation

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

DS3@eirgrid.com or DS3@soni.ltd.uk by November 25th 2015

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.

Appendix: Links to Related Documents

Facilitation of Renewables Study - Published by: TSO (June 2010)

Ensuring a Secure, Reliable and Efficient Power System - Published by: TSO (July 2011)

First Consultation paper (System Services Review - Preliminary Consultation) - Published by: TSO (December 2011)

Second Consultation paper (New Services and Contractual Arrangements) - Published by: TSO (June 2012)

Third Consultation paper (Financial Arrangements) - Published by: TSO (December 2012)

TSO System Services Recommendations paper - Published by: TSO (May 2013)

DS3 System Services Consultation Paper - Published by: SEMC (SEM-13-060) (September 2013)

System Services Technical Definitions Decision Paper - Published by: SEMC (SEM-13-060) (December 2013)

Pöyry Paper on Procurement Options - Published by: SEMC (Consultant (Pöyry)) (SEM-14-007) (January 2014)

SEMC System Services Procurement Design Consultation Paper - Published by: SEMC (SEM-14-059) (July 2014)

Economic Appraisal of DS3 System Services - Published by: SEMC (Consultant (IPA)) (SEM-14-059b) (July 2014)

System Services Valuation Further Analysis - Published by: TSO (July 2014)

SEMC System Services Procurement Design Information Paper - Published by: SEMC (SEM-14-075) (August 2014)

System Services Portfolio Capability Analysis - Published by: TSO (November 2014)

DS3 System Services SEMC Decision Paper - Published by: SEMC (SEM-14-108) (December 2014)

DS3 System Services Project Plan (Detailed Design and Implementation Phase) - Published by: TSO / SEMC (May 2015)

DS3 System Services Draft TSO Procurement Strategy - Published by: TSO (June 2015)