System Services
Future Arrangements
Scoping Paper

SEM-20-044

A Submission by EirGrid plc. & SONI Ltd.

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Contents

EXECUTIVE SUMMARY

The design and implementation of Future Arrangements is critical to the successful delivery of public policy objectives in Ireland and Northern Ireland for 2030 and beyond, while continuing to ensure a safe secure power system. It will take time to design, implement and mature appropriate arrangements, including a daily auction market as suggested by the Single Electricity Market Committee (SEMC), to deliver real and meaningful capability on the system. Given this, we consider that it is essential to expedite decisions on critical market design questions by Q1 next year. An inability to do this will undermine the Climate Change ambitions in both jurisdictions. Were this to materialise, it would be necessary to consider other arrangements including bespoke tenders to achieve the required public policy by 2030.

More specifically these Future Arrangements will have to incentivise the necessary investment in technology capability to regularly facilitate over 95% of the system needs coming from non-synchronous technologies in real time operation while maintaining the resiliency of the power system. To best achieve this, there needs to be stronger alignment between the energy, capacity and system services markets, a clear commitment from the TSOs to transform our operational policies to facilitate these ambitious System Non-Synchronous Penetration (SNSP) levels and provision of the necessary confidence and transparency in the arrangements to allow investors to carry out informed risk assessments and to make timely effective investments at an affordable cost.

We have responded to the consultation questions in a grouped fashion and have provided key design proposals to inform the decisions of the SEMC. It is only by appropriately designing the arrangements that the necessary technical challenges can be overcome. In advance of the completion of the detailed system services studies in Q1 2021, we see the need to be able to manage a system down to 15000 MWs of inertia and electromagnetism spread across 6-8 sites dispersed in the network,to increase the level of fast acting reserves by 200 MW relative to today, with much of this to be provided from non-conventional technologies which can operate in high wind, to provide over 30% more ramping capability in multiple timeframes and to solve a range of new issues including congestion, frequency regulation and oscillation damping.

We agree in principle that flexible volume regulation is the best mechanism for procuring these services. However for some critical, new or localised services it is more appropriate to acquire these using other market mechanisms. In addition given that the investment is required to be delivered in the period 2025 to 2030, practical considerations of efficacy and timeliness have to be taken into account. In our view there will be at least a four year time lag from when the design phase begins, with an intermediate phase of auction implementation, until the market is mature enough to provide appropriate investment. To account for this, we recommend that critical design decisions are made no later than Q1 2021 by the SEMC. In the absence of meeting these timelines, the use of other market mechanisms including competitive tenders and fixed term contracts may have to be employed. The question of what of the existing service arrangements would remain in that scenario would also need to be addressed. We caution that the issues for 2030 are considerably greater than those that the existing DS3 System Services arrangements were designed to manage to 2020 and that just extending the arrangements would not provide the momentum required to achieve the 2030 targets. Throughout the document we touch on a wide range of issues that require due consideration. We welcome early and frequent engagement between us as TSOs, the Regulatory Authorities, DSO, DNO and the wider industry participants.

EIRGRID PLC AND SONI LTD

EirGrid plc is the licenced electricity Transmission System Operator (TSO) in Ireland, and SONI Ltd is the licensed TSO in Northern Ireland. Both companies also hold Market Operator (MO) licences in Ireland and Northern Ireland respectively and collectively act as the Single Electricity Market Operator (SEMO), which operates the Single Electricity Market (SEM) on the island of Ireland. Thus, this response is submitted by EirGrid and SONI in their capacities as TSOs and MOs for Ireland and Northern Ireland respectively.

STRUCTURE OF OUR RESPONSE

While we have endeavoured to answer all questions posed in the SEMC's consultation paper, we have grouped certain questions together in our response, where we believe it was appropriate. In addition, we present an overview of technical scarcities and their mitigation in Section 2.1, as the fundamental need for system services originates in the current and future existence of technical scarcities. We also present options for short-term auction design in answer to Question 14 and in greater detail in Appendix 1.

BACKGROUND AND CONTEXT

EirGrid and SONI welcome the opportunity to respond to the SEM Committee's consultation on System Services Future Arrangements. The existing DS3 System Services arrangements have successfully been in place on an interim basis since October 2016 and on a full regulated basis since May 2018. Twelve system services addressing frequency and voltage needs have been procured to date, facilitating the power systems of Ireland and Northern Ireland to be operated with up to 65% instantaneous non-synchronous renewable energy on the system. An increasing number of the existing services, devised to address the technical scarcities arising from the displacement of synchronous generation, are being contracted from new technologies such as wind, demand side units, batteries and interconnectors. In addition, incentives offered by DS3 System Services, coupled with changes in the capacity market rules, have encouraged conventional units to re-examine their operational modes and to offer enhanced behavioural flexibility, optimising the levels of system services that they can provide. The behavioural changes effected by both conventional and new technologies in response to the current arrangements are exactly what the framework was designed to incentivise. Together with operational policy changes and the implementation of other aspects of the DS3 programme, the implementation of system services has facilitated the operation of the power systems of Ireland and Northern Ireland with increasing levels of instantaneous non-synchronous renewable energy on the system.

We note the SEMC's emphasis in the consultation paper on compliance with the latest EU regulations, specifically the Clean Energy Package and the Electricity Balancing Guideline. In addition, the paper highlights the Irish and UK governments' policies to transition to low carbon energy systems. Both EU compliance and government policy are very important considerations in the design of future arrangements for system services. However, the context of future power system needs, specifically addressing the technical scarcities that will arise in the low carbon electricity systems desired by both governments, should be central to the design of the future arrangements. Such technical scarcities will be present not just in Ireland and Northern Ireland, but also on a European level. A detailed overview of technical scarcities is presented in the next section. The design of the arrangements will need to be such that they ensure that there is continued investment by service providers in innovating to address these scarcities, both through the optimisation of existing technologies and through investment in new technologies. One of the criteria which the SEMC has identified in its consultation paper as being an important yardstick with which to assess whatever framework is put in place, is that of alignment. We strongly agree that there needs to be a coherent alignment between all revenue streams (energy, capacity, system services and others such as RESS auctions in Ireland), for market participants/service providers. In particular, implications from provisions of the Clean Energy Package (CEP) which impact the Single Electricity Market (SEM) energy market and the manner in which they are addressed by the SEM Committee will have a knock-on effect on the solutions which are viable for the creation of future arrangements for system services. The TSOs have separately made submissions to the Regulatory Authorities regarding the important issue of the implementation of the changes in relation to priority dispatch specified in Articles 12 and 13 of the CEP. The chosen implementation of the changes in the SEM required by these articles will have a profound effect in shaping the possibilities for a robust system services framework which is essential to ensuring secure operation of the electricity system with higher levels of non-synchronous generation for 2030 and beyond. In addition, regarding alignment with the capacity market, the current method by which the Best New Entrant Cost of New Entrant (BNE Net CONE) is arrived at, where both potential energy market and system services revenues are subtracted, should be reviewed.

A second important aspect is commitment on the part of the transmission system operators to change current operational practice, adapting it so that the benefits of system services can be fully utilised. This will need to comprise long, medium and short term operational policies. The long term operational policy is one of valuing the technical scarcities and designing appropriate system services to address them. Some element of flexibility for change within that design will be needed to meet evolving system needs. The medium term policy will be used to update the forecast of system needs, by running a new set of studies at intervals of every two years. Finally, the short term policy will apply to the day-ahead management of daily system service auction volumes. It is imperative that investor confidence is created in the future arrangements.

Based on our experience of system services to date, certainty regarding the length of time for which the SEMC decides that the arrangements remain in place is very important. While the arrangements will need to be flexible enough to evolve with changing needs, there must be a clear roadmap for how long they will be in situ. The rules of the arrangements need to be very transparent so that investors can model their likely returns. Central to this is having market arrangements that are flexible enough to procure what is needed for the system in a cost-effective manner for the consumer. However, this must be balanced against delivering investment in time to meet both governments' policy targets. Product and market design must precede investment. A realistic assessment of the time involved in each step needs to be made and the market arrangements should be designed accordingly.

The SEMC has indicated in the consultation paper that it considers daily auctions to be the most appropriate means of procuring at least the balancing capacity services. With this in mind and given the need for a timely decision, we have examined a number of potential auction designs and describe them later in this response. Finally, good governance is essential to developing investor confidence in the arrangements. We specifically comment on the governance proposals of the consultation paper in our response to Question 8 in which we emphasise the very specific responsibility which all TSOs have under EU legislation for the procurement of ancillary services to ensure operational security. It is vital that the governance of the arrangements is such that it continues to allow the TSOs to procure and use system services to ensure operational security. This becomes even more important in the context of increasing levels of non-synchronous generation on the power system, as the flexible use of system services to manage technical scarcities becomes more critical.

TECHNICAL SCARCITIES AND THEIR MITIGATION

In order to deliver on government policy, it will be necessary to accommodate large penetrations of renewable technologies, whilst keeping curtailment levels to a minimum. In order to do so, it is important to be able to operate the power system with System Non-Synchronous Penetration (SNSP) levels of up to 95% with significantly reduced numbers of conventional units online. However, operating at such SNSP levels is unprecedented and poses a number of technical challenges, many of which have not been experienced by other power systems.

The Facilitation of Renewables studies from 2010 outlined a range of scarcities and challenges associated with operating the power system in 2020 with high levels of renewables. The analysis concluded that it would be possible to operate the system beyond 60% SNSP if major changes to the power system were implemented. These changes were implemented and continue to be instigated through the DS3 programme, encompassing amendments to system policies, system tools and system performance. A central aspect of addressing system performance with increasing levels of SNSP has been the procurement of DS3 System Services.

In much the same way that the Facilitation of Renewables studies in 2010 identified the challenges of operating a power system with significant levels of wind, and laid the ground-work for the DS3 programme and the drive towards the 40% RES-E target, the EU-SysFlex project, which is being co-ordinated by EirGrid, can be viewed as scoping work for developing and planning the next programme which will enable us to transition to higher levels of SNSP and reach the 70% renewables target by 2030. EirGrid and SONI are finalising our “Pathways to 2030” work and this will build on the EU-SysFlex work.

2.1.1 TECHNICAL SCARCITIES IN 2030

Analysis from EU-SysFlex Task 2.4 *Technical Shortfalls for Pan European Power System with High Levels of Renewable Generation*[1] which was concluded at the start of this year, concurred with the findings in the Facilitation of Renewables studies, regarding the significant challenges with operating at very high levels of renewables. However, as the portfolio in 2030 will be dominated by non-synchronous renewable generation, the EU-SysFlex Task 2.4 report also noted additional technical issues as well as emerging areas of concern, which should be taken into account when designing the future arrangements. These issues are summarised below and Table 1 summarises the Technical Scarcities, Potential System Services and Technology Options.

[1] https://eu-sysflex.com/wp-content/uploads/2020/05/EU-SysFlex_D2.4_Scarcity_identification_for_pan_European_-System_V1.0_For-Submission.pdf

2.1.1.1 FREQUENCY STABILITY & CONTROL

- It was found that higher levels of SNSP lead to lower system inertia which is yielding faster frequency dynamics and higher RoCoF values. These RoCoF values were found to be wholly unacceptable and thus it was necessary to implement a RoCoF limit of 1Hz/s in all of the subsequent analysis. This highlights the need to ensure operational limits of 1Hz/s RoCoF. This RoCoF limit is currently being trialled and we expect to start the 70% SNSP trial by Q1 2021.
- Increasing the size of the largest infeeds and loss of same, due to the future Celtic interconnector, combined with the decreasing inertia levels and reduction in fast dynamic reserves, mean that frequency nadirs are lower. In cases with a reduced level of fast reserve magnitude, the frequency nadir will be reached before the static reserve response is triggered, resulting in a frequency overshoot. In the case that the total fast dynamic reserve magnitude is equal to or exceeds the magnitude of the infeed loss, an oscillatory response can develop. It was found that a system with low inertia is more likely to oscillate. The magnitude and response settings of fast dynamic reserve resources must be managed.
- As the generation portfolio evolves, more of the reserve services are being provided by non-conventional sources. We expect this trend to continue. These resources, such as battery energy storage, interconnectors and demand response, provide exactly the contracted reserve services, unlike conventional sources which historically provide slightly more response than contracted. This drives a need to contract more reserve than previously and increase the FFR and POR requirements.

2.1.1.2 VOLTAGE STABILITY

- As SNSP levels increase, there is a significant lack of steady state reactive capability due to renewables displacing conventional generation leading to larger deviations in steady-state voltage as well as increased occurrences of low voltage deviations.
- Weaker parts of the network with high levels of renewables are prone to requiring significant increases in steady state reactive power. This may be provided by STATCOMS, conventional and non conventional sources, D-FACTS devices, DSM etc.
- Reducing fault current contributions is leading to lower system strength, due to converter-based technology dominating and the associated limited fault current contribution from converter-based technology.
- Less reactive power online from conventional generation is leading to declining dynamic voltage performance. Analysis indicates the emergence of a system wide scarcity in dynamic voltage control during faults in some hours of the year, but localised scarcities in the majority of hours. Results also demonstrate that post-fault voltage oscillations are common, indicating a scarcity in system strength. This drives the need for more reactive compensation in the form of STATCOMS or for more service providers such as synchronous compensators or Dynamic Reactive resources to provide reactive compensations .

2.1.1.3 ROTOR ANGLE STABILITY

- Having fewer synchronous generators online decreases the synchronising torque (electromagnetism) on the system. While a system wide scarcity has not been identified, localised scarcities have been noted. The scarcities are sensitive to specific unit commitment combinations and certain contingencies but highlight the need for further detailed study based on future network configuration. The lack of synchronising torque can be addressed by synchronous compensators while the lack of damping torque can be mitigated by conventional generators, synchronous compensators, grid-forming control of non-synchronous generation, sourced via DRR system services or localised damping products.

2.1.1.4 CONGESTION

- As SNSP increases and as renewable generation connections increase, there is a significant rise in the frequency of overloading and the level of overloading above 100% of thermal capability. The studies have found that the areas of the network most affected by the loss of a single circuit are in the West of Ireland and in Northern Ireland. These are the regions with considerable renewable capacities and where the local load is not high enough to absorb the high levels of renewable generation resulting in overloads following a contingency. Similarly, the Dublin region, despite having high local load, can experience thermal overloads at both low and high SNSP levels due to the large numbers of thermal generators and offshore wind farms. Addressing this requires congestion products which increase or decrease the demand in the area, deployment of smart power flow devices, Power to Gas and ultimately new infrastructure.

2.1.1.5 RAMPING

- Although not studied as part of EU-Sysflex, variable generation forecast errors pose a unique challenge to the operation of the power system on the island of Ireland. The comparatively high installed capacity of variable generation (particularly wind) results in forecast errors that are a significant proportion of system demand. This is exacerbated by Ireland's location on the edge of Europe and the influence of the jet stream on its weather. EirGrid and SONI currently schedule the system to meet the median production forecast of variable generation. As the installed capacity of variable generation continues to grow, the magnitude of forecast errors will begin to exceed the capability of back-up resources. Therefore, ramping reserve products will be necessary to counteract probable forecast error events.

2.1.2 SUMMARY OF CHALLENGES FROM EU SYSFLEX

No Scarcity	Evolving Characteristic	Concern	Scarcity

	Continental Europe	Ireland & Northern Ireland	Nordic System
RoCoF	Localised concern	Inertia scarcity	Evolving characteristic
Frequency containment	Evolving characteristic	Evolving characteristic	Evolving characteristic
Steady State Voltage Regulation	SS reactive power scarcity	SS reactive power scarcity	Not analysed
Fault Level	No scarcity	Dynamic reactive injection scarcity	
Dynamic Voltage Regulation	No scarcity	Dynamic reactive injection scarcity	
Critical Clearing Times	Evolving characteristic	Evolving characteristic	
Rotor Angle Margin	Not analysed	Localised concern	
Oscillation Damping	Damping scarcity	Damping scarcity	
System Congestion	Global concern	Transmission capacity scarcity	
System Restoration	Not analysed	Evolving characteristic	

Figure 1: Summary of the Findings from Task 2.4 of EU-SysFlex

The work completed in EU-SysFlex Task 2.4 will need to be supplemented and complemented by further detailed analysis on the technical issues over the coming months, as well as extended to issues including oscillations, frequency regulation, ramping and negative reserve, which were not covered in EU-SysFlex. A thorough understanding of the issues will be needed for the design of future system services products.

It is important to note that the analysis in EU-SysFlex Task 2.4 clearly demonstrates that the scarcities are much more evident for the Ireland and Northern Ireland power system in comparison to the European power system. This is illustrated in Figure 1 which shows that there are many more scarcities evident in the analysis for Ireland and Northern Ireland in comparison to the analysis of the Continental European power system. This is a very important finding and indicates the uniqueness of the challenges we are facing in Ireland and Northern Ireland. However recent technical analysis from systems outside Europe with a high penetration of renewable generation, for example Australia[2], indicates that other power systems are beginning to see similar challenges.

If mitigations are not put in place, in 2030, the Ireland & Northern Ireland system will experience significant technical issues associated with high levels of renewable generation. **In the absence of appropriate mitigation, in the form of robust future arrangements for system services, it is likely that curtailment levels in 2030 will be high, that it will not be possible to change operational policy and the 70% RES-E target will not be achieved.**

[2] https://www.aemo.com.au/-/media/files/major-publications/ris/2020/renewable-integration-study-stage-1.pdf?la=en

2.1.3 WHAT DOES THIS MEAN FOR THE POWER SYSTEM IN 2030 AND BEYOND?

In summary, from the analysis conducted to date, the following groupings of technical scarcities will need to be addressed:

2.1.3.1 ELECTROMAGNETISM AND INERTIA

With the advent of more and more non-synchronous generators, it is likely that the number of hours for which existing conventional plants will be running in 2030 will be very limited. Currently we keep 8 large sets on the power system at all times, providing an equivalent of 23,000 MWs of inertia. This portfolio has a collective minimum generation of 1400 MW. Therefore in keeping these 8 sets on, to maintain inertia, system strength and provide significant dynamic reactive power sources, we inadvertently prevent wind and solar from rising to higher dispatch levels. A clear need of the system is that the electromagnetism is replaced with technologies that provide sufficient system strength without the need for significant fossil fuel MW and that provide inertia to manage frequency containment.

While the detailed technical studies have yet to be completed, it is likely that in 2030 we will need to be able to operate at an equivalent inertia level of at least 15000 MWs (or possibly lower) with appropriately located system strength and reactive sources. This could come from synchronous generators or rotating stabilisers. In addition, lowering the minimum generation of existing conventional plant to well below 10% registered capacity could also be considered, subject to emissions requirements still being met. In parallel with this, and depending on the evolution of network infrastructure, the use of grid forming technologies will need to be explored.

2.1.3.2 RESERVES

The bulk of system reserves have classically been provided by conventional plant. Going forward both the need for and source of reserves will change. From a system perspective, the reduction in minimum needed inertia on the system and an increase in the Largest Single Infeed/Outfeed (LSI/LSO) will necessitate an increase in the volume and speed of reserves. The exact nature needs further study, but with an expected increase in LSI to 800 MW (either the loss of offshore windfarms or new interconnectors) the dimensioning of additional reserves will most likely increase by over 200 MW per hour. In addition, associated with the lower inertia, there is likely to be an increased requirement of 400 MW of fast frequency reserves in high wind/LSI moments.

The source of the reserves will increasingly need to come from windfarms, solar, interconnectors, storage and demand side. Given the predicted congestion on the network in the future and the pathways being considered to address it, it will be challenging for positive frequency reserves to be provided by newly connected generators and storage to the extent required. However unlocking the demand side proposition appears to have many positives in that demand side units do not need to seek increases to their MIC to provide valuable positive frequency services including FFR. Coordination with the distribution system operators in relation to this will be critical. In addition, the use of non-synchronous resources for the provision of the reserves will also need to consider the probity of covering this, if there is a breach of the allowable SNSP level.

2.1.3.3 RAMPING

With the increase in weather dependent technology and the onset of a more participative demand sector, there are a range of scarcities that reveal themselves in the 1 hour to 10 hour ahead time horizons. Particularly concerning is the issue of phase differences in weather forecasts when a large part of the system demand is served by wind and solar. This will necessitate the need for a greater volume of ramping services to be available in the appropriate time frame.

The sources of ramping are increasingly likely to come from interconnectors, dispatched down wind and solar together with offline conventional plant. Further work is required to dimension these ramping needs and capabilities, but based on a previous analysis we estimate that there will be an increased need of 30% per decade on ramping services. At this point in time, a similar need is likely to meet 2030 requirements.

A particular extension of Ramping being explored is to cover off the risk of the power system not having any wind for a protracted period of time. This can potentially occur when a high pressure/anticyclone results in wind output being consistently low for periods of multiple days to a week. During such times, wind in France and GB is also anticipated to be low. Such periods can also be concurrent with a cold snap.

2.1.3.4 CONGESTION

An analysis of the network in EU-Sysflex indicates that without significant additional infrastructure, there will be congestion issues in many parts of the transmission system in 2030. These issues will be exacerbated with increased demand and new generation to meet the long term public policy objectives. Further work on this will be conducted through our consultation on our “Pathways to 2030” programme.

A key aspect of solving some of these issues is to get users to behave in a manner that can safely and securely alleviate the overloads/congestion. These types of products have to be developed and will require close collaboration with the Distribution System and Network Operators. Furthermore, as these products have a direct impact on the energy flows, the most appropriate manner in which to procure them is likely to be through daily auctions. However, given the challenges of first designing the products and then incorporating them into auctions, this is unlikely to be in place for 2023. In any event, the need and value of providing these services will have a locational dependency and be related to the cost of the deferment of any planned but delayed infrastructure.

2.1.3.5 MISCELLANEOUS

There are several technical issues that are being studied at this time. However some of these concerns may necessitate the development of new products in the future. Currently there is ongoing work on the need for frequency regulation, oscillation damping and negative reserve. Should the need be formally established then there will be a question of how these services should be procured. The need to integrate them into auctions will have to be balanced against the timeliness of the service provision. The use of market structures will require confidence in the arrangements to be established before including them in a market design.

2.1.4 FINANCIAL CHALLENGES IN 2030

In addition to the technical scarcities, analysis from the EU-SysFlex project, specifically EU-SysFlex Task 2.5 *Financial Implications of High Levels of Renewables on the European Power System* [3] found that there will be significant financial challenges in 2030 associated with transitioning to very high levels of renewables as well as considerable changes to the scheduling of generation.

With increasing levels of renewables, it was shown that the capacity factors for peaking plants such as OCGTs are also increasing. This indicates that system operation is fundamentally changing with higher levels of RES where high net load ramps are possible and more flexible, fast responding units are a necessity. While there is an increasing need for fast, flexible plants, it has been shown that if OCGTs are relied upon for providing the required flexibility at high penetrations of variable renewables, the potential carbon emission reduction benefits from the renewables may be impacted and could taper off at high levels of renewables. It has been shown for Ireland and Northern Ireland, however, that if the correct mechanisms are put in place the requisite capability and flexibility could come from other non-conventional sources, such as storage, demand-side participation and renewable generation and there will be less of a need for flexible gas/peaking generation and capacity factors for OCGTs will fall, resulting in greater decarbonisation benefits than those associated with increasing variable renewable generation capacity alone.

With energy prices falling due to the increased penetration of renewables, the analysis demonstrated that reliance on the energy market alone will not be sufficient for many technologies to make a return on investment and that there will be significant financial gaps. This applies to many technologies, not just to renewables. It was also found that the financial gaps will still persist even with a high carbon price. This indicates that a carbon price alone is an insufficient mechanism to drive the decarbonisation agenda.

[3] https://eu-sysflex.com/wp-content/uploads/2020/05/Task_2.5-Deliverable-Report_for_Submission.pdf

Crucially, the report also showed that, using the same methodology to evaluate system services as was employed in 2012[4] (EirGrid Group, 2012), there is likely to be sufficient value in System Services to at least mitigate the financial gap. It should be emphasised that, over the coming months, there will be an external peer review of the work in Task 2.5 taking place to corroborate and/or supplement the analysis from EU-SysFlex Task 2.5. Further analysis (outside of EU-Sysflex) did reveal benefits from decarbonisation of transport and not being exposed to Member State renewable incentives. It is arguable that these values could be transferred to the electricity system.

2.1.4.1 MITIGATIONS

A range of mitigations have been proposed for each of the technical scarcities and these will be tested and developed as part of ongoing studies. It is important to note that while some of these mitigations are already in place as part of the current DS3 System Services arrangements, based on the analysis in EU-SysFlex Task 2.4, discussed above, in some cases it will be crucial to procure greater volumes of the these services from non-conventional technologies and in other instances it may be necessary to evolve the product design and specifications.

In general, it is proposed, that in addition to the 14 existing system services, additional system services will be required, including a frequency regulation product, a congestion management product and a damping/oscillation product and a 7 day reserve product.

Category	Scarcity	Potential System Services	Technology Options
Frequency Stability & Control	Insufficient contingency reserve	DS3 FFR, POR, SOR, TOR, RR	Reserve from tech available during high wind (DSM, storage, wind, ICs), grid-forming inverters, power to gas etc.
	Lack of inertia	DS3 SIR	Synchronous generators, Synchronous compensators, Rotating Stabilisers
Voltage Control	Lack of Steady state reactive power	DS3 SSRP	STATCOMS, reactive support from conventionals and non conventionals, D-FACTS devices, DSM.
	Lack of dynamic reactive power	DS3 DRR, DS3 FPFAPR	Synchronous compensators, Dynamic Reactive resources
	Lack of system	DS3 DRR	Synchronous compensators,

[4] http://www.eirgridgroup.com/site-files/library/EirGrid/System-Services-Consultation-Financial-Arrangements-December_2012.pdf

	strength		Rotating Stabiliser
Rotor angle stability	Lack of synchronising torque	DS3 DRR	Synchronous compensators
	Lack of damping torque	DS3+ Damping product (localised)	Conventional generators, Sync comps, grid-forming control of non-synchronous generation.
Congestion	Lack of transmission capacity	DS3+ Congestion Product	DSM, Power-to-gas.
Adequacy/ Ramping	Uncertainty and lack of capacity during weather related events (hours -> days)	DS3 ramping products, DS3+ Capacity Product	Ramping from all technologies Standby peaking capacity, Forecasting, power to gas

Table 1. Technical Scarcities, Potential System Services and Technology Options

2.1.4.2 SUMMARY OF TECHNICAL ANALYSIS FINDINGS

- In the absence of appropriate mitigation, in the form of robust future arrangements for system services, it is likely that curtailment levels in 2030 will be high, as it will not be possible to change operational policy and the 70% RES-E target will not be achieved.
- With energy prices falling due to the increased penetration of renewables, we have an opportunity to refocus the investment signals to promote the services needed to operate a future secure power system with 70%+ RES-E. This applies to all technologies, not just to renewables.

In addition to mitigating the technical scarcities on the power system, system services are likely to have other positive impacts both for the power system and beyond it in other sectors. For example it is likely that congestion products, complemented by energy effiency measures, will help to defer the need for certain network investment. In addition, the heating and transport sectors will benefit from the decarbonisation brought through facilitating more active low carbon electricity generation technologies.

2.1.5 USE OF MARKET ARRANGEMENTS FOR SYSTEM SERVICES PROCUREMENT

2.1.5.1 MARKET ARRANGEMENTS USED WHERE POSSIBLE

In general the TSOs consider that, where possible, System Services should be procured using appropriate market arrangements. One of the key deficiencies of the existing DS3 System Services arrangements designed for 2020 is that they are based on price and not volume regulation. In such a design, there is a risk of under or over investment in service levels. We are beginning to see such an over investment materialise in the current arrangements for faster acting reserves. Meanwhile there is a shortfall in investment in low MW high inertia technologies such as synchronous condensors and/or rotating stabilisers. However the latter issue is related to an inadvertent barrier, as the energy associated with consumption instructions for such technologies are currently not allowed for in the SEM model. This is something which will need to be addressed in the next 12 months. Notwithstanding these issues, the TSOs in principle favour moving the Future Arrangements to more market based arrangements including a frequent volume regulation approach (daily auctions being a variant of this type of arrangement).

2.1.5.2 TIME TO IMPLEMENT AND FOR MARKET TO MATURE

Where flexible volume procurement makes sense in principle, there is a need to balance the inherent time it takes to design, consult, agree and implement such a market mechanism and for it to mature against the need for appropriate investment in a timely manner consistent with meeting the overarching public policy objectives in both jurisdictions. In that regard, allowing two years to implement the design and a further two years for a flexible volume market mechanism to mature and become sufficiently understood by industry to drive investment indicates that there is probably a 4 year lead time for such mechanisms to be effective.

2.1.5.3 NECESSARY TIMEFRAME TO START INVESTMENT

The need for investment in System Services is associated with the requirement to be able to operate over 95% of the system from non-synchronous resources by 2030. Given that the level of connected renewables will increase in 2024 when RESS 1 successful applicants build out, there needs to be associated investment in system services by 2025 to allow operation in excess of 75% SNSP. As the penetration of renewables increase, the level of system services across the five classes of services detailed in Table 2 below will need to increase. There will be a dimensional shift in service requirements with new interconnection and the connection of large scale offshore windfarms.

Class of System Service	Suitable for Volume Regulation in principle	Need for increased service provision	Likely time that product design implemented	Effective Investment allowing for lead time
Reserves	Yes	from 2025	2023	2025
Ramping	Yes	from 2025	2023	2025
Congestion	Yes	from 2025	Needs to be agreed with DSO/DNO and industry	Unlikely before 2027
Electromagnetism and Inertia	Yes	From 2025	Complicated for daily auction design	Depends on market mechanism used.
Miscellaneous	Unclear	To be fully established	Unclear at present until needs fully established	Currently post 2025

Table 2: System Services Classes and Procurement/Investment Timeframes

If Market Arrangements using daily auctions are to be effective, there is a need for a clear decision by April 2021 to allow sufficient time for the implementation of the design and the maturation of the market. This aligns with the completion of the system services detailed studies. Such a daily auction design is appropriate for reserve and ramping which are strongly related to energy markets. Congestion should also fall into that category, but given the time required for product design in advance of implementation, it would be ambitious to think that daily auctions for congestion could be in place in time. The products for Reserve and Ramping have already been developed (other than for covering the long term loss of wind). Once developed they should be considered for implementation in the daily auction process.

For other services there is a compelling argument that there is insufficient time to have an effective daily auction mechanism in place by 2023 to get investment by 2025 particularly if there is no overarching design decision by April 2021. In this case the initial mechanism to expedite the necessary investment could be Fixed Term Contracts/ Tender Competition for specific services. To the extent it is possible and relatively seamless they could be incorporated into the flexible volume regulation approach at a later stage. The design of a daily auction platform should be made as flexible as possible at the outset, to allow for that possibility.

RESPONSES TO CONSULTATION QUESTIONS

Consultation Question 1: *Are there additional requirements in EU legislation or national policy that should be considered as key guidance for the project?*

The TSOs note the relevance of the elements of EU legislation from the Clean Energy Package and Electricity Balancing Guideline that have been listed in the paper and their interpretation/applicability with respect to procurement of balancing capacity products and non-frequency ancillary services. There are additional relevant aspects of EU legislation that the TSOs recommend should be included for consideration in developing the design of the new arrangements.

These include:

(a) That an awareness should be maintained of the progression of the pan-EU Balancing Platforms MARI and TERRE. MARI - Manually Activated Reserves Initiative, is the European implementation project for the creation of the European manual Frequency Restoration Reserves (mFRR) platform. TERRE - Trans European Replacement Reserves Exchange is the European implementation project for exchanging replacement reserves (RR) in line with the Electricity Balancing guideline. Recent publications by the EU Commission[5] have made it clear that the SEM is not required to integrate with the TERRE and MARI platforms until the island of Ireland has a connection with another Member State (following the UK's exit from the European Union). However, the Commission considers that Ireland and Northern Ireland should join the EU platforms as soon as the island of Ireland becomes interconnected with the integrated electricity market of the EU. Therefore, while not immediately applicable, an awareness of the development of these platforms should be maintained so that the future arrangements design aligns with their requirements. And it is imperative that the future arrangements are in place to meet the needs of 2030, which must be done in advance of reconnection to an EU member state.

For clarity, the TSOs have submitted a proposal (as per Article 145 of the System Operation Guideline Regulation 2017/1485 (SOGL)) to the CRU and UR that an automatic Frequency Restoration Process (aFRP) should not be implemented on the island. Currently the TSOs do not utilise an automatic Frequency Restoration Process or automatic frequency restoration reserves (aFRR). The pan-EU PICASSO platform is being established to enable the exchange of aFRR reserves, and as aFRR products are not utilised on the island it is not intended to use this platform.

(b) EBGL also stipulates the characteristics of a standard product bid with which balancing capacity products must comply. Article 25, clause 2 of the EBGL, states that "*By two years after entry into force of this Regulation, all TSOs shall develop a proposal for a list*

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[5] https://ec.europa.eu/energy/sites/ener/files/documents/adopted_opinion_ireland_en.pdf

and https://ec.europa.eu/energy/sites/ener/files/documents/adopted_opinion_ni_en.pdf *of standard products for balancing capacity for frequency restoration reserves and replacement reserves."* ENTSO-E submitted a proposal, on behalf of TSOs, to respond to this provision in December 2019 and in June 2020 ACER issued a decision on standard products for balancing capacity [6]. This should also be considered in the design.

(c) As noted by the SEMC in the consultation paper, there is currently work underway on the scoping of local EBGL compliance. The analysis to date regarding EBGL implementation has only considered our current arrangements i.e. that balancing capacity is not procured in advance for the SEM as per our central dispatch integrated scheduling process and DS3 tariff arrangements for availability of service. There will be further work required in terms of assessing EBGL compliance requirements for future situations that may require advance procurement of balancing capacity.

(d) In addition to the requirements on DSOs noted in the CEP mentioned in the consultation paper, Article 15 of EBGL states that "*Each TSO may, together with the reserve connecting DSOs within the TSO's control area, jointly elaborate a methodology for allocating costs resulting from actions of DSOs pursuant to paragraphs 4 and 5 of Article 182 of Regulation (EU) 2017/1485. The methodology shall provide for a fair allocation of costs taking into account the responsibilities of the parties involved."* These provisions refer to the DSOs restricting the provision of services from distribution connected units for system reasons. The provisions of the System Operator Guideline (SOGL, EU 2017/1485) are also relevant with regard to other aspects of TSO/DSO co-operation in facilitating reserve provision from distribution-connected units, specifically Article 182.

(e) As contracting entities, EirGrid and SONI are subject to the provisions of *EU Directive 2014/25/EU* and the transposing regulations (the EU Award of Contracts by Utility Undertakings). As a matter of law, contracting entities (the TSOs in this case) are required to comply with the procurement principles of equal treatment, transparency, non-discrimination and proportionality. The current arrangements were designed to adhere to the provisions of the Utilities Directive and the future arrangements will also need to be compliant. While compliance with the Utilities Directive must be implicit in all facets of the future arrangements' design, it is particularly relevant when discussing potential contracts analogous to the Fixed Contracts competition which was run as part of the current arrangements. This point is elucidated in response to Question 15.

[6] https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/ACER%20Decision%2011-2020%20on%20standard%20products%20for%20balancing%20capacity.pdf

Consultation Question 2: *What should the role of DSOs be in development of the new arrangements?*

An increasing number of system service providers are, and will in future be, connected to the distribution system rather than the transmission system. Currently 35% of contracted service providers in Ireland and 60% of service providers in Northern Ireland are distribution connected. (Note this represents the number of contracted service providers rather than the overall relative volumes of service which they provide). The DSO and DNO have been heavily involved in facilitating the existing system services arrangements, coordinating with the TSOs in relation to system services testing and with the qualification of distribution-connected sites for service provision. In the future, services will be required both on transmission and distribution levels to mitigate future scarcities on both networks. Clearly the development of mitigation approaches should be aligned, to deliver a coherent transparent system services framework, both from an investment perspective and in terms of operational cohesion. The requirement for co-operation between DSOs and TSOs in developing a procurement strategy for system services is outlined in Article 31 of the CEP Market Directive 2019/944 "*Where a distribution system operator is responsible for the procurement of products and services necessary for the efficient, reliable and secure operation of the distribution system, rules adopted by the distribution system operator for that purpose shall be objective, transparent and non-discriminatory, and shall be developed in coordination with transmission system operators and other relevant market participants."* In the future, congestion management is likely to be a particular concern on both networks. In addition network usability and the rules which govern it will be a key issue, not just for congestion, but also with regard to curtailment. It will be critical that a balanced approach is taken with regard to who should take the risk regarding network usability.

It is therefore vital that the approach to addressing technical scarcities on both the distribution and transmission networks is done collaboratively between both TSOs, the DNO and the DSO.

Consultation Question 3: *Should any further assessment criteria be included in this workstream?*

The SEM Committee lists a number of assessment criteria for assessing the proposed framework in order to achieve its aim of delivering a competitive framework for the procurement of system services that ensures secure operation of the electricity system with higher levels of non-synchronous generation.

The TSOs note in particular the inclusion of *System Needs.* We believe that a design which delivers the technical system needs must be central to the framework.

Alignment with the energy and capacity market and all other relevant revenue streams is also essential to ensure consistency for investors. There are some additional criteria that might also be considered for inclusion in assessing the overall framework, some of which were used for assessment of potential market models in EU-Sysflex Task 3.2 *Conceptual market organisations for the provision of innovative system services: role models, associated market designs and regulatory frameworks*.[7]

These include:

- **Liquidity:** There is a need to ensure that there is a market for a given service which allows it to be traded at stable, transparent prices
- **Strategic Gaming and Market Power issues:** The design of the framework needs to be such that that gaming and market power issues can be mitigated.
- **Suitability for Investment/ Ability to Operate System in line with Public Policy Objectives:** The overall solution needs to be suitable for both existing units offering flexibility and for new-build units who want to invest.
- **Transition Costs :** Depending on the design, interfaces for TSO/DSO coordination and interfaces with service providers from both an SO and market platform perspective will need to be established. The auction mechanism will also have an associated implementation cost.
- **Transaction costs and ease of access:** Auction mechanisms must be easily accessible with non-barrier forming entry requirements to ensure participation of new and smaller service providers is facilitated.

These points relate to the overall framework. We suggest specific criteria to assess auction design options in answer to Q10 (and associated auction-related questions).

Consultation Question 4: *Is the general approach to the Project appropriate and complete?*

In order to meet the ambitious targets for 2030, as noted in our introduction, the SEM Committee has placed a strong emphasis on the need for future arrangements which are compliant with EU regulations. The TSOs note the importance of this emphasis. However, of paramount importance is that the design of the future arrangements is such that it delivers the required quality and volumes of system services which will be required to operate the power systems of Ireland and Northern Ireland with up to 95% SNSP. Implicit in this is that such arrangements will attract sufficient investment from a diverse portfolio of technologies.

To achieve the 2030 targets, it is vital that a decision is made regarding the design of the future arrangements in a timely fashion, both to provide a continued signal for investment in system services provision and to allow sufficient implementation time for the new design. The current arrangements are due to end at the end of April 2023. The Regulatory Authorities note, in their paper, that there is scope to extend the current contracts by two periods of 18 months should there be any delay in the implementation of the new

[7] https://eu-sysflex.com/wp-content/uploads/2020/06/EU-SysFlex_Task-3.2-Deliverable-Final.pdf

arrangements. It is worth revisiting the context in which the possibility of extending the contracts was included in the existing arrangements. The extension provisions were included as a backstop in case there was any delay to the implementation of the future arrangements (for example a couple of months). This was to prevent the possibility of having to run a full procurement and re-sign contracts with all service providers if new arrangements were not in place at the end of April 2023. At the time it was envisaged by the SEMC that the current arrangements might actually be terminated *before* April 2023 and replaced with auctions, as noted in their *DS3 System Services Regulated Arrangements System Services Contractual Arrangements Decision Paper SEM-17-094 pg.2 "The Standard Contracts may also be terminated with 12 months' notice. It is noted that this may be required at some point over the next five years, including where new system services arrangements are introduced to implement competitive auctions and/or facilitate compliance with the EU Electricity Balancing Guideline."* The current tariff arrangements have been successful in establishing a transparent platform for system services, prequalification mechanisms, standards of service provision and performance monitoring and a stimulus for investment in service provision. However, they were designed to address the technical scarcities of 2020 and are not suitable for stimulating the correct investment to address the challenges which will arise on the power system in 2030. In addition, they do not meet the requirements of the Clean Energy Package as the tariff arrangements have no element of competition or close to real-time auctioning of services. Therefore, if there is any extension to the current arrangements, it should predicated on it being for a short period to allow the completion of the implementation of the future arrangements. Within the industry workshops on this consultation, there has also been discussion of whether potential "transitional arrangements" should be put in place, noting that there were interim arrangements before the existing regulated arrangements. However, it should be borne in mind that both the interim and regulated arrangements were tariff-based. An evolution to an auction mechanism is a much bigger step. Careful thought needs to be given to whether transitional arrangements may run the risk of delaying the final implementation of future arrangements by diverting implementation effort away from the enduring design.

Consultation Question 7: *Do stakeholders believe the current qualification process, is the most efficient approach? Do stakeholders have any alternative proposals?*

Having clarified the intent of this question with the Regulatory Authorities, that it refers to qualification both in the sense of prequalification to provide services as part of the framework and also to the Qualification Trial Process, our response will address both in turn.

<u>Prequalification to Provide Services</u>

With regard to prequalification for the provision of system services as part of the future arrangements, we believe that there are many elements of the existing tender qualification process that will be transferable to the future arrangements' prequalification process, notwithstanding that the arrangements will be auction rather than tender based. Our current prequalification process was also recently reviewed and clarified to ensure it complies with Articles 155, 159 and 162 of EU Regulation 2017/1485 establishing a guideline on electricity transmission system operation (SOGL), which detail prequalification process requirements for reserve services. The prequalification process of future system services arrangements will also need to be designed to ensure that it continues to comply with the regulation.

The main elements of an auction prequalification process will be (a)financial/administrative and (b)technical qualification. Depending on the treatment of network usability there may be an additional step to verify that the unit will not cause congestion if it provides a given service. We effectively already have a similar step for distribution connected units in the current arrangements, whereby the DSO or DNO, as applicable, must give their consent for a unit to provide system services. The financial/administrative aspect of prequalification will consist of ensuring the service provider satisfies the financial and economic standing and health and safety and environmental and employment legislation (similar to those of an OJEU tender) and possibly, if there is a significant change to the funding arrangements, credit rating requirements.

The technical qualification phase will comprise of compliance testing (or submission of equivalent evidence that satisfies those testing requirements). As part of the current DS3 System Services arrangements a comprehensive testing process has been put in place, with testing procedures and test report templates specific to each individual product. Where possible such testing is coordinated with other Grid Code testing. The result is a very clear indication of a providing unit's capability to provide a service from the perspective of technical parameters and qualifying volume. There may however be aspects of the testing process which the TSOs can improve to ensure clarity where there are differences in the manner in which various technologies can provide a given system service. The current testing process largely evolved from standards and testing methods used for conventional units. In addition, the setting of appropriate technical standards for all technologies is very important to ensure that a delivered system service meets SO requirements from the perspectives of communications, metering, forecasting and scheduling and dispatch.

<u>Qualification Trial Process</u>

The Qualification Trial Process (QTP) was established as part of the system services arrangements both to trial new technologies, to allow them to prove their service provision capability and also to trial the provision of new services. It allows the TSOs to identify operational complexities that may be associated with either new technologies or the delivery of new system services and subsequently develop solutions for how best to integrate those technologies at scale into the power systems on the island of Ireland. The scope of the QTP is being expanded under FlexTech, the Flexible Technology Integration Initiative, which is being co-ordinated by EirGrid and SONI with the support of ESB Networks and NIE Networks. The aim of FlexTech is to facilitate the integration of renewables by removing barriers which present technical, operational, commercial, regulatory, and market challenges. In keeping with the principle of alignment, future evolutions of the QTP should align with other revenue streams for service providers. Indeed funding for the QTP is an area that warrants examination by the SEM Committee. The annual QTP budget currently limits the scope of what can be trialled and also limits the scale of what can be achieved. Increased allocation of funding to the QTP would allow more emphasis on the assessment of new technologies and in the preparation of appropriate standards. If the budget were increased, the procurement process would need to change to a full OJEU tender. Another existing limitation of the QTP is that a grid connection is necessary to participate. In response to the recent FlexTech consultation, where this was highlighted, the TSOs have undertaken to investigate the possibility of allowing for the connection of new technologies in future QTPs. Another area of which may be considered is the inclusion of the energy citizen and energy community in the QTP.

Consultation Question 8: *What are stakeholder views on the overall current governance arrangements including the contractual principles, the Protocol Document and the market ruleset? Should these be modified into an overall protocol document which captures all of the rules for providing and procuring System Services with increased regulatory oversight?*

The SEMC paper suggests the possibility of governance via a "Ruleset or Code document" akin to what currently exists for the energy market. However, the TSOs have a very specific responsibility under EU legislation for the procurement of ancillary services to ensure operational security as noted in ***DIRECTIVE (EU) 2019/944 Article 40 Tasks of transmission system operators***. *"Each transmission system operator shall be responsible for:….. (i) procuring ancillary services to ensure operational security;"*

Any governance arrangements must consider the context of this. And to be able to carry out our role in ensuring system security, we believe that the TSOs must have a central governance role in the system services arrangements.

Another important aspect is that the funding for system services is not the same as for the energy or capacity market. If the TSOs are to manage a budget with an upper limit, they must be able to exercise funding controls within the governance structure.

Consultation Question 9: *Should System Services continue to be funded through network tariffs? Are there views on any alternative arrangements?*

EirGrid and SONI welcome the SEM Committee's acknowledgement of the funding considerations that must be given to any significant change in the system services arrangements. In that context, the design of the funding mechanism should be done alongside the development of the new arrangements for system services, acknowledging that the design will inform the likelihood of increased price volatility and, hence, the extent to which services will no longer *"make up a relatively small and predictable portion of the TSOs' costs"*.

Any changes to the existing system services cost recovery mechanisms would need to be designed so as to ensure that the TSOs incur no further risk exposure in the procurement and draw down of these services. In their roles, the TSOs are subject to a number of unique risks and hence the proposed arrangements must not increase the likelihood of either, nor both, of financial and reputational damage. We look forward to continuing to work closely with the Regulatory Authorities to ensure that what is ultimately implemented achieves this in a way that aligns with other relevant regulatory frameworks.

Another principle which we consider worth exploring is that system services should be funded from all users who benefit from them. Currently the funding for system services is recovered 100% from demand users. The appropriateness of the current arrangements should be considered in light of the benefits that particular users (both demand and generation) derive from these services.

Consultation Question 5: *For which products is a market based approach appropriate? What sort of market based approach is most appropriate?*

Consultation Question 6: *For which products is a market based approach not appropriate? Why is a market based approach not appropriate for these products? Will an alternative approach be more economically efficient? What sort of alternative approach should be considered?*

Consultation Question 10: *Should all services be procured through a single daily auction framework or should bespoke arrangements be developed for the separate products?*

European legislation (both EGBL and the CEP), directs that system services should be procured in a market-based way, with more stringent requirements for close to realtime auctions for frequency products (day ahead with a contract length of not more than one day unless for reasons of economic efficiency or system security, as set out in *Article 6 of Regulation 2019/943 of the CEP*.)

Aside from the requirements of European legislation, short-term auctions are appropriate for frequency products and indeed, coupled with improved forecasting, should aid the participation of variable technologies such as wind and solar in the provision of reserves. Given that variable technologies will constitute a significant part of the future generation portfolio on the island, their contribution to reserve requirements will be important. Short-term auctions for frequency services are also appropriate for other technologies and are already used in a number of European countries.

While we envisage designing a flexible auction platform to which new services could be added dependent on system need, there are some services for which close to realtime auctions may not be appropriate. Voltage services will have a locational dependency that must be taken into account in their procurement in order for the procured volumes to be useful in addressing technical scarcities. An alternative competitive mechanism may be appropriate for voltage services. In addition, where services such as reactive power can be provided when a unit is operating at 0MW, but the unit has an associated energy consumption when operating in that mode, the energy should be accounted for in the SEM. (A modification *Mod_13_19 Payment for Energy Consumption in SEM for non-energy Services Dispatch* to address this is currently under discussion by the T&SC Modifications Committee). Providing incentives for units which can provide reactive power when operating at 0MW to do so reduces the need to dispatch more expensive units for locational voltage requirements. There may be other future services to which this is also applicable. This is one example of the need for greater alignment between system services and the energy market.

An important aspect of the arrangements must also be to encourage innovative investment. Rather than pre-judging what technologies are required on the power system in 2030 to address future technical scarcities, the arrangements should allow industry to innovate. The Qualification Trial Process is one vehicle for this. In addition there may be other mechanisms that may be needed to allow for the piloting of new technologies.

Consultation Question 11: *What are stakeholders' views on the timing of auctions?*

Consultation Question 12: *Do stakeholders have any proposals on how best to ensure commitment obligations are met?*

Consultation Question 13: *What are the significant interactions within potential System Services product markets and between Systems Services markets and the energy and capacity markets? How should issues arising be addressed?*

Consultation Question 14: *Do stakeholders have further views or proposals in relation to auction design?*

Short-term Auction Design Proposals

Given the need for the SEM Committee to make a timely decision regarding the future arrangements' design to ensure continued appropriate investment in system services and that 2030 targets are met, we have considered **five potential auction design options**, which are described below. Such short-term auctions would, we believe, be suitable for reserve services at a minimum. They have been formulated bearing energy market interactions in mind. Table 3 presents a summary of the five options, listing their main characteristics, while the design of each option is described in more detail subsequently. Table 4 presents a high-level evaluation of the options. A more detailed description of the options is presented in Appendix 1.

Design Characteristic	Before Day-Ahead	After Day-Ahead	Co-optimised	Hybrid	Ex-Post
Participant registration	System Services only or Balancing Market	System Services only or Balancing Market	All required to register in Balancing Market	System Services only or Balancing Market	System Services only or Balancing Market
Procurement platform	Simple auctions, optimise to minimise procurement cost, separate sequential per product in order from most to least scarce / commitment impacting	Simple auctions, optimise to minimise procurement cost, separate sequential per product in order from most to least scarce / commitment impacting	Market Management System (MMS) Long Term Schedule (LTS), co-optimise all products at same time, minimising energy cost of deviation from PNs with minimising all system services procurement costs, subject to all technical characteristics and system constraints	Flexible auctions, optimise to minimise procurement cost, subject to some constraints, potential for joint procurement, otherwise separate sequential per product in order from most to least scarce / commitment impacting	Simple auctions, optimise to minimise procurement cost, separate sequential per product in order from most to least scarce / commitment impacting
Platform granularity	15 min with rules for longer	15 min with rules for longer	30 min	15 min with rules for longer	15 min with rules for longer
Timing of procurement exercise	Before day-ahead energy market bid offer submission gate closure	After the first day-ahead LTS run	Start ~13:30 day-ahead	Combination of some before day-ahead energy market bid offer submission (complete before gate closure) and some after first day-ahead LTS run)	After real-time operations. Exact timing depends on data used
Participant offers	Single simple price per product per period. Single simple volume per product per period	Single simple price per product per period. Single simple volume per product per period	Single simple price per product per period (balancing market energy prices also considered in co-optimisation). Complex representation of unit capabilities with volumes determined by the optimisation	Single simple price per product per period. Single simple volume per product per period	Single simple price per product per period. Constrained ex-post position used to calculate actual volumes available to procure, based on complex representation of unit capabilities, real-time operation and availability of units, and real-time system constraints
TSO service requirement volume	TSO calculate based on estimates from fundamentals for some (e.g. inertia), and learned modelling for others (e.g. reserves)	TSO calculate based on actual results of first day-ahead LTS run for all requirements	Procurement platform calculates within the optimisation itself based on dynamic formulas with max and min parameters	TSO calculated, depending on timing if product procured before day-ahead energy market then based on estimates from fundamentals (e.g. inertia), or if product procured after first day-ahead LTS run then based on actual results of first day-ahead LTS run for	TSO calculate representation of actual real-time requirements based on combination of real-time system measurements and scheduling system outputs

Design Characteristic	Before Day-Ahead	After Day-Ahead	Co-optimised	Hybrid	Ex-Post
				all requirements	
Successful cleared volume obligation	Make system service physically available through maintaining availability and inputting PN level which enables provision of the service(s) (possible explicit requirement on reflecting service volume in offered volumes in each energy trading timeframe)	Make system service physically available through maintaining availability and inputting PN level which enables provision of the service(s)	Make system service physically available through maintaining availability and inputting PN level which enables provision of the service(s)	Make system service physically available through maintaining availability and inputting FPN level which enables provision of the service(s)	None: incentive to maintain service availability and position to provide the service in real-time
TSO approach to scheduling services	Participant obligation to have reflective PN if in BM, possibly soft constraints in scheduling	Participant obligation to have reflective PN if in BM, possibly soft constraints in scheduling	Initial scheduling exercise is the procurement platform, participant obligation to have reflective PN, possible need for some soft constraints in subsequent scheduling	Participant obligation to have reflective PN if in BM, possibly soft constraints in scheduling	System scheduled and dispatched as today ensuring minimum service margins are maintained and constraints representing services not breached

Table 3 : Summary of Design Characteristics of potential Auction Design Options

We have formulated the set of criteria below to assess the potential efficacy of the five options:

Criteria to assess auction design

- Closest alignment between system and market.
- Best value outcome (whether or not that is also least cost outcome).
- Flexible for future change (addition of services etc.).
- Aligns with real-time operation.
- Can accommodate all types of product/suitable for all types of service.
- Procures service volumes which meets technical scarcities (including locational requirements where they exist).
- Ensures RES can be physically accommodated with minimum curtailment.
- Minimises redispatch away from a physically infeasible system service schedule.
- Auction losers are handled appropriately
- Has a reasonable solution time.
- Ease of use for all participants (e.g. small parties)
- Pricing signals for investment

Criteria	Before Day-Ahead	After Day-Ahead	Co-optimised	Hybrid	Ex-Post	High Level Commentary
Closest alignment between system and market;	Low	Low	High	Medium	High	Ex-post cannot directly influence ex-ante market trading; Before Day-ahead and Hybrid allow trading in most liquid markets to reflect services; After Day-ahead and Co-optimised only leave intraday trading available; Co-optimised aligns closer to balancing market.
Best value outcome (whether or not that is also least cost outcome)	Medium	Medium	Medium	High	High	Ex-post would have no additional redispatch costs, but using constrained position would likely increase cleared price; Hybrid and Co-optimised reduce redispatch, optimising with constraints would likely increase cleared price; Before and After Day-ahead would have lower cleared prices from unconstrained auctions but higher redispatch.
Flexible for future change (addition of services etc.).	High	High	Low	High	Medium	Co-optimised impacts core scheduling systems with larger impacts and longer timelines; Ex-post relies on outputs from other systems; Hybrid, Before and After Day-ahead are standalone auction platforms giving more flexibility.
Aligns with realtime operation.	Low	Low	High	Medium	High	Ex-post considers actual constrained position of units; Co-optimised consider complex model of constraints; Before and After Day-ahead options are unconstrained; Hybrid considers simpler model of constraints.
Can accommodate all types of product/suitable for all types of service.	High	High	Low	High	High	Co-optimised solution cannot accommodate some products like voltage support; all standalone auction platforms can accommodate any products.
Procures service volumes which meets technical scarcities (including locational requirements	Low	Medium	High	Medium	Medium	Co-optimised includes most dynamic service capabilities, requirements, and constraints; Hybrid and Ex-post have simpler service capabilities, requirements, and constraints; Before and After Day-ahead have simplest capability and no constraints, After can use the energy market result for more accurate estimate of requirements.

Criteria	Before Day-Ahead	After Day-Ahead	Co-optimised	Hybrid	Ex-Post	High Level Commentary
where they exist).						
Ensures RES can be physically accommodated with minimum curtailment.	Medium	Low	High	Medium	High	Co-optimised and Ex-post schedule considering most complex interaction between energy, unit technical data, and service provision; Hybrid has simpler representations of important constraints; Before and After day-ahead have no constraints, Before allows all energy trading to more closely reflect service provision, After only allows some energy to do so.
Minimises redispatch away from a physically infeasible system service schedule	Low	Low	High	Medium	High	Ex-post only considers physically feasible options as an input; Co-optimised procures with the most complex representation of the requirements for physically feasible schedule; Hybrid uses simpler constraint representations of a physically feasible schedule; Before and After Day-ahead are completely unconstrained.
Auction losers are handled appropropriately.	Low	Low	High	Medium	High	In Ex-post only those who actually provided the service can succeed in auction; Co-optimised reduces volume of auction losers who provide service shortfall by optimising with complex constraints; Hybrid has simpler constraints to reduce this volume; both Before and After Day-ahead have unconstrained auctions.
Reasonable solution time.	High	Medium	Low	Medium	Medium	Have most time available to complete Before Day-ahead; Co-optimised schedule already time-consuming, adding this would increase the problem; After Day-ahead and Hybrid are simpler to solve but constricted timelines waiting on input from energy scheduling for requirements; Ex-post is not constricted by real-time deadline but less likely to ensure solution is available to inform next day offers.
Ease of use for all participants (e.g. small parties)	High	Medium	Low	Medium	High	Co-optimised potentially requires units to be registered in BM, all other options could allow non-registered units; Ex-post allows more passive approach of maintaining availability; Before day-ahead allows energy trading in all timeframes to reflect service provision; After Day-ahead and Hybrid need intraday trading to reflect service provision.
Pricing signals for investment	High	High	Low	Medium	Low	Co-optimised and Ex-post constrained scheduling is less transparent and forecastable; Before and After day-ahead are unconstrained; Hybrid has some simpler constraints, less complex than Co-optimised and Ex-post but more complex than Before and After Day-ahead.

Table 4 : High- Level Evaluation of potential Auction Design Options

Consultation Question 15: *Do stakeholders believe there would be benefit in maintaining the Fixed Contract Arrangements for future procurement runs?*

An OJEU tender for the Fixed Contracts was run on a one-off basis in 2019 to procure high-availability reserve services for the island of Ireland. The design of the Fixed Contracts arrangement was informed by industry feedback regarding the need for a level of certainty offered by longer-term contracts for new-build investment, together with the future system requirements for high-availability reserve services. Whereas the Volume Uncapped arrangements comprise a qualification system for which new applications are periodically invited (currently on a 6 monthly basis through procurement "gates"), the Fixed Contracts were designed as a one-off competition.

The two original motivations for the Fixed Contracts – providing a degree of investment certainty for new-build units and procuring appropriate services to meet future system requirements – remain important in the overall context of the design of suitable future arrangements. However, the question is how best they can both be satisfied - whether through auction arrangements which provide sufficient investment confidence for all service providers and also deliver the required system services or whether additional one-off competitions which may share some of the features of the Fixed Contracts competition are necessary to address both of these aspects.

It should be borne in mind that the provisions of *EU Directive 2014/25/EU* apply to services procured by the system operator. One implication of this is that it is not possible to restrict a competition for system services to new build entrants only, as the principles of equal treatment and non-discrimination must apply. In addition, if similar arrangements to the Fixed Contracts are envisaged, it is not allowable to have two competitions for the same service open in parallel (for example one instance of the services being procured through short-term auctions and another via long-term contracts). However it is permissible to have parallel procurement of similar services. For example, for the Fixed Contracts a bundle of reserve services were procured with somewhat different requirements to those of the Volume Uncapped arrangements. One of the assessment criteria noted by the SEMC in the consultation paper is *Adaptability*, that the "*framework should be sufficiently agile to meet any system changes caused by future policy developments".*

We strongly agree that the future framework should have a good degree of flexibility. There may be circumstances where it is appropriate to put a limited volume of longer-term contracts in place to allow, for example, the piloting of new technologies, or where there is a system need that is not appropriate to satisfy through market arrangements, as previously discussed. However, a framework which has a high degree of long-term contracts would not be flexible in meeting changing power systems needs, nor would it be compliant with the intent of European legislation. As noted earlier in our response to Question 10, an important aspect of the arrangements must be to encourage innovative investment. If, for example, the TSOs were to run a competition for long-term contracts for inertia provision, at the moment only conventional units would qualify to provide the Synchronous Inertial Response service, whereas the fast developing area of grid-forming converters offers promising solutions that would allow non-synchronous units to actively control their frequency output and thus support the system frequency. It is likely that, in the not too distant future, such innovation may allow non-synchronous units to deliver an equivalent inertial response. If all the service provision volume was locked into long-term contracts, there would be no opportunity for such welcome innovation which would add diversity and competition. Therefore while longer-term fixed contracts may be appropriate in certain instances, careful thought needs to go into the circumstances in which they are the best solution.

Consultation Question 16: *Do stakeholders have views on the list of additional considerations above? Are there any further issues to consider?*

Consultation Question 17: *What are stakeholders' views on the potential existence of, and options for mitigation of, market power?*

One of the SEM Committee's proposed criteria for assessing the future arrangements framework is *Consumer Value.* We agree that it is important that system services which address the technical needs of the power system are delivered in a cost-effective manner. A general risk exists in all auction arrangements of the possibility of participants exercising market power. With regard to system services unlike, for example, the trading of energy, there is quite a complex interaction between the different products. The order in which products are auctioned (if auctioned sequentially) may impact service providers' offers into subsequent product auctions. Therefore patterns of market abuse may be difficult to detect and prove. The use of appropriately formulated price caps per product would be a means of addressing this issue, while still allowing open participation in the auctions.

An additional consideration is the essential nature of performance monitoring to ensure that services are delivered to the required standard. Improving and refining performance monitoring should be a priority as part of the future arrangements. Mechanisms such as the use of a performance scalar which will impact service providers' payments in the case of substandard service provision should be extended to the future arrangements. Where a unit repeatedly does not meet performance standards, rules should apply regarding prohibiting its participation in daily auctions.

APPENDIX 1 DETAILED DESCRIPTION OF PROPOSED AUCTION OPTIONS

This Appendix presents a more detailed view of the five Short Term Auction Design proposals presented in the main body of our response.

OPTION 1: RUN SEQUENTIAL AUCTIONS BEFORE THE DAY-AHEAD ENERGY MARKET

Description:

- This option would involve developing a new auction platform to procure system services which would be distinct from both scheduling and energy market runs.
- Each service would be procured individually sequentially day-ahead using the auction platform.
- The auctions would be run before the Day-Ahead Energy Market.
- Trading periods should be of 15 minutes length.
- Trading periods could be amalgamated into longer procurement time periods with associated bidding rules if this was more suitable for a given service.
- Order in which services are procured to be determined based on two considerations:
    - Services with higher scarcity procured first.
    - Services which impact unit commitment procured first.

  As the relative scarcity of services will vary daily and with an evolving generation portfolio, there will need to be a process for determining the order in which services are auctioned.
- Units would submit simple offers comprising a service volume and a bid price per Trading Period.
- The volume requirements per service would be calculated based on factors such as network topology, demand requirement and wind contribution available prior to the day-ahead energy market coupled with operational policy requirements.
- The optimisation objective function will be a simple supply-demand clearing which minimises the cost of procurement.
  The outputs of this would be:
    - A firm cleared volume for each of the relevant system services for each unit for each trading period.
    - A firm cleared price for the volumes based on the highest offer price associated with a cleared volume in the period.

- A successful unit would be obliged to deliver the volume of the system service they procured. If it is necessary for them to adjust their position in the energy market to do this, they should do so.
- Rules around treatment of units which cannot provide services due to system reasons such as congestion would need to be developed.
- The outcomes of the system service auctions should be reflected for each unit in the TSO scheduler.
- Rules around treatment of units which were auction losers but were subsequently dispatched to provide the service would need to be developed.

Assessment of Option 1:

If the system services auctions are run before the day-ahead energy market, service providers will be able to reflect their auction results in all of their energy market trading, and may more easily trade to ensure that they can meet their system services obligations. This could be achieved either by placing an explicit obligation on service providers to do so in their trades, or implicitly through a unit's FPN. The required service volume would be estimated day-ahead before a lot of the information from the energy market which would govern the real-time volume requirement would be known and therefore would be less accurate or may need to be more conservative than other means of estimating at day-ahead. This could lead to a large amount of redispatch subsequently to take account of technical constraints.

OPTION 2: RUN SEQUENTIAL AUCTIONS AFTER THE DAY-AHEAD ENERGY MARKET

Description:

- This option would involve developing a new auction platform to procure system services which would be distinct from both scheduling and energy market runs.
- Each service would be procured individually sequentially day-ahead using the auction platform.
- The auctions would be run after the Day-Ahead Energy Market after the first day-ahead Long Term Scheduler (LTS) scheduling run is finished (LTS starts at 13:30, solution time may be up to a few hours).
- Trading periods should be of 15 minutes length.
- Trading periods could be amalgamated into longer procurement time periods with associated bidding rules if this was more suitable for a given service.
- The order in which services are procured would be determined based on two considerations:
    - Services with higher scarcity procured first.
    - Services which impact unit commitment procured first.

  As the relative scarcity of services will vary daily and with an evolving generation portfolio, there will need to be a process for determining the order in which services are auctioned.
- Units would submit simple offers comprising a service volume and a bid price per Trading Period.
- The volume requirements per service would be calculated based on the information from the first day-ahead LTS run (e.g.: Largest Single Infeed).

- The optimisation objective function will be a simple supply-demand clearing which minimises the cost of procurement.
  The outputs of this would be:
    - A firm cleared volume for each of the relevant system services for each unit for each trading period.
    - A firm cleared price for the volumes based on the highest offer price associated with a cleared volume in the period.

- A successful unit would be obliged to deliver the volume of the system service they procured. If it is necessary for them to adjust their position in the energy market to do this,they should do so.

- Rules around treatment of units which cannot provide services due to system reasons such as congestion would need to be developed.
- The outcomes of the system service auctions should be reflected for each unit in the TSO scheduler.
- Rules around treatment of units which were auction losers but were subsequently dispatched to provide the service would need to be developed.

Assessment of Option 2:

- If the system services auctions are run after the day-ahead energy market, service providers can only ensure that they meet their service provision obligations through reflecting them in their PN submission following trading in the intraday markets. There is a possibility that this trading may differ significantly from a unit's position from the day-ahead energy market. However, if system service obligations can be reflected in intraday trading, the amount of redispatch required, to ensure that the required operational policy levels of system services are available, will be minimised. The required service volume is based on a day-ahead estimate, but one which uses the day-ahead market outcome and information from LTS scheduling, and therefore may be more accurate than other means of estimating at day-ahead.

OPTION 3: RUN AN AUCTION WHICH CO-OPTIMISES ENERGY AND SYSTEM SERVICES

Description:

This option would involve co-optimising the procurement of system services with the trading of energy in the SEM. Rather than developing a new auction platform, the existing LTS MMS would need to be modified.

- All units providing system services (providing units) would need to be (a) registered in the balancing market or (b) a new type of system services unit would need to be created.
- Trading periods would be of 30 minutes length.
- Units would submit offer prices for each Trading Period for energy (as currently). They would also submit offers for each individual system service for which they are bidding. (Note: Reserve services would be included at a minimum with possibly inertia and congestion also included.)
- System services offer volumes would be based on their technical capability (for example reserve capability curves).
- Units would also submit their PNs based on their day-ahead market position, their TOD and their forecast availability for the day.
- Other information in the optimisation would include interconnector schedules, system security constraints, network topology, forecast demand and priority dispatch variable renewable generation, and requirements for each service.

- The LTS run, which would include the service procurement, would be run 13:30 day-ahead, and would co-optimise balancing energy with system service provision. The volume requirements per service would be calculated differently depending on the service, some based on factors such as network topology, demand requirement and wind contribution available prior to the first day-ahead LTS run and operational policy requirements, while others would be calculated dynamically within the optimisation. The objective function would minimise the cost of deviation from PN and the cost of provision of system services while ensuring system security requirements and other system constraints are not breached.
- The outputs of this would be:
  - An indicative, non-firm view of the required dispatch schedule for all energy balancing and non-energy actions, which is as close to being physically feasible as possible. The energy volumes would only become firm if dispatch instructions are issued to enact them.
  - A firm cleared volume for each of the relevant system services for each unit for each trading period
  - A firm cleared price for the service volumes based on the highest offer price associated with a cleared volume in the period
- A successful unit would be obliged to deliver the volume of the system service they procured. If it is necessary for them to adjust their position in the energy market to do this, they should do so.
- Rules around treatment of units which cannot provide services due to system reasons such as congestion would need to be developed.
- The outcomes of the system service auctions should be reflected for each unit in the subsequent iterations of the TSO scheduler.
- This method may not be suitable for some services which cannot be represented in the DC loadflow model in LTS, in particular reactive power. One possibility is to procure these services first through a simple unconstrained auction, in advance of the LTS.

<u>Assessment of Option 3:</u>

In this option the procurement engine takes into account all of the complex information regarding the technical capabilities and system dynamics available day-ahead, and co-optimises to procure all services to minimise the overall cost. Therefore it is the day-ahead option that is most likely to result in procured volumes of services which are closest to being realisable in real-time and is the only option which attempts to minimise the cost of all services and balancing energy at the same time, which is likely to result in an efficient outcome from an overall cost perspective.

However it is the most complex, with implications for transparency in the procurement and performance of the scheduling system. It would not completely remove the need for redispatching to result in realisable services, and there would still be a need for separate procurement approaches for services such as voltage support.

OPTION 4: HYBRID OPTION RUNNING FLEXIBLE CONSTRAINED EX-ANTE AUCTIONS

Description:

- This option would involve developing a new auction platform to procure system services which would be distinct from both scheduling and energy market runs.
- Each service would be procured individually sequentially day-ahead using the auction platform.
- Trading periods should be of 15 minutes length.
- Trading periods could be amalgamated into longer procurement time periods with associated bidding rules if this was more suitable for a given service.
- The timing of the auctions would vary depending on the service and could be either before or after the day-ahead energy market.
    - Services which impact unit commitment, requiring units to be synchronised, may better be auctioned prior to the day-ahead energy market.
    - Services which have requirements dependent on information from the energy schedule on the system such as Largest Single Infeed, may be best auctioned after the first day-ahead LTS run.
- Order in which services are procured should be determined based on two considerations:
    - Services with higher scarcity procured first.
    - Services which impact unit commitment procured first.

  As the relative scarcity of services will vary daily and with an evolving generation portfolio, there will need to be a process for determining the order in which services are auctioned.
- This auction platform needs to have the capability to allow joint procurement of multiple service and simplified representations of constraints based on unit characteristics.
- Units would submit simple offers comprising a service volume and a bid price per Trading Period
- The volume requirements per service would be service specific. For those services procured before the first day-ahead LTS run, they would be calculated based on factors such as network topology, demand requirement and wind contribution available prior to the day-ahead energy market and operational policy requirements. For those services procured after the first day-ahead LTS run, the volume requirements per service would be calculated based on the information available from the first day-ahead LTS run (e.g.: Largest Single Infeed).
- The optimisation objective function will vary depending on the service. For services where constraints do not need to be taken into account and where services are not being jointly procured, it will be a simple supply-demand clearing which minimises the cost of procurement. In other instances, it will also include a requirement not to breach any included constraints, or for jointly procured services ensuring that the demand-supply clearing minimises the cost of procurement of multiple products. The outputs of this would be:
    - A firm cleared volume for each of the relevant system services for each unit for each trading period
    - A firm cleared price for the volumes based on the highest offer price associated with a cleared volume in the period

- A successful unit would be obliged to deliver the volume of the system service they procured. If it is necessary for them to adjust their position in the energy market to do this,they should do so.
- Rules around treatment of units which cannot provide services due to system reasons such as congestion would need to be developed.
- Rules around treatment of units which were auction losers but were subsequently dispatched to provide the service would need to be developed.
- The outcomes of the system service auctions should be reflected for each unit in the TSO scheduler.

Assessment of Option 4:

This approach takes the positives of the sequential ex-ante auctions option (the greater flexibility and ease of operation and development, and relative simplicity and consistency of price clearing outcomes). It also layers over this the ability to add constraints or possible smaller instances of service joint procurement in order to come close to replicating some of the positives of the co-optimised option (in terms of efficiency in aligning the market procurement with the system, increasing short term usability of the services). The arrangements would include processes for finding the right balance between more constrained (higher complexity, higher usability) or less constrained (lower complexity, lower usability).

OPTION 5: RUN PARALLEL AUCTIONS BASED ON CONSTRAINED EX-POST POSITION

Description:

- This option would involve developing a new auction platform to procure system services which would be distinct from both scheduling and energy market runs.
- Each service would be procured individually in parallel ex-post using the auction platform.
- The auctions would be run after real-time operations, with the exact timing dependent on the data needed and processes for calculating this data.
- Trading periods should be of 15 minutes length.
- Trading periods could be amalgamated into longer procurement time periods with associated bidding rules if this was more suitable for a given service.
- Units would submit a simple offer price per Trading Period per service, but would have their offer volumes calculated for them based on what they could actually provide in real-time based on their constrained ex-post position.
    - The system would be scheduled and dispatched as it is today: minimise energy cost of deviation from PNs, meeting energy balancing requirements, ensuring system security constraints are not breached, and maintaining minimum service margins, considering all units’ technical capabilities (does not consider system services costs in scheduling).Constrained ex-post offer volumes would be calculated based on complex representation of unit capabilities, actual real-time operation and availability of units and actual

real-time system constraints (if a service could not be provided due to a unit being constrained, it would not be calculated as an offer volume).

- The volume requirements per service would be a calculated representation of actual real-time requirements based on a combination of real-time system measurements and scheduling system outputs.
- The optimisation objective function would be a simple supply-demand clearing which minimises the cost of procurement (all constraints already accounted for in volumes submitted).
  The outputs of this would be:
  - A firm cleared volume for each of the relevant system services for each unit for each trading period.
  - A firm cleared price for the volumes based on the highest offer price associated with a cleared volume in the period.
- No obligations would be placed on successful units since this is an ex-post process. Units would be incentivised to maximise their chances of being scheduled for the service in real-time based on their FPN and balancing market bids and to maintain real-time availability of services.
- Only units who could, and did, provide the service would be paid. No ruleset would be required for settlement of units which could not provide the service in real-time, or settlement of units who were not successful in the auction but which were dispatched to provide the service in real-time.

Assessment of Option 5:

This option continues real-time operation of the system in largely the same way as currently, and ensures that only useable services, based on ex-post information, are procured. The main differences with this new mechanism is that it is a competitive process where volumes are determined based on merit order and defined service requirement volume, and prices are based on participant bids. Instead of the approach under the current mechanism where all units with an FPN or dispatch position which provide the services are paid (even if the total amount provided is greater than required), under this new mechanism only in-merit volumes up to the TSO volume requirement will be paid (those who provided the service but did not clear to meet the service requirement volume will not be paid). Also in the new mechanism the price will be established based on the marginal price of a merit order of the units who provided the service based on their submitted service prices and their physically feasible constrained ex-post position as volume, rather than a regulated tariff as under the old mechanism. This would have less explicit alignment between energy market positions and procured services, with relatively more complexity than the simpler ex-ante options. However, it would ensure only useable services are procured in a way which is more accurate and less complex than co-optimisation.

POSSIBLE DAILY AUCTION OUTCOMES

There are some considerations that will need to be made to evaluate whether daily auction outcomes for reserves will deliver both the required service volumes in both the short (2023) and longer term (2030 and beyond) and whether those volumes will be provided by the correct service provider mix. The arrangements must continue to incentivise (a) increased investment so that required service volumes can be procured and (b) the trend of non-conventional technologies providing services.If both of these requirements are not met, mitigation strategies will need to be applied.

Scenario 1:

Auction results show:

Right Service Volume for now but Not Enough Service Volume for the future (e.g. reserves of 200 MW available, but 400 MW needed for 2030)

Possible Mitigations:

- Use future volume and show scarcity (regulated bid price);
- Let auction results stand but send medium term expectations with new service capability;

Scenario 2:

Auction results show:

Right volume for now and the future but wrong technology (e.g. right volume of reserves for future but auction winners are all conventional)

Possible Mitigations:

- Run auction with limit on service provision from existing technology;
- Send medium term expectations with new tech investment;

Dispatch away from Auction Outcomes

Given that we operate a central dispatch model, units may be dispatched away from their auction outcome position. Ensuring that the design aligns with that of both the SEM and operational policy should significantly reduce the need to do this.

Options to consider for dealing with this include:

- Pay Dispatched on Minimum (Price Cap, Bid price) for dispatch on
- Pay for additional usable needed services above Market Position (but not all);

- Pay Dispatched down Market position revenue; AND
- Pay for additional usable needed services at Physical Position (but not all);