SINGLE ELECTRICITY MARKET COMMITTEE

DS3 System Services Procurement Design

Clarifications to SEM-14-059
Information Paper

SEM-14-075

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1 Introduction

The review of System Services is one of the key work streams under the DS3[1] Programme. On the 9th July 2014 the SEM Committee published a Consultation Paper (SEM-14-059) on the proposed options for the procurement design of the new System Services framework. As part of the consultation process the Regulatory Authorities held an open forum in Dundalk on 29th July 2014. The Regulatory Authorities' outlined the SEM Committee's favoured option – Option 5, Multiple Bid Auctions – at the forum and the rationale for the SEM Committee favouring this approach. Over the course of the forum, industry stakeholders requested that the Regulatory Authorities would provide greater clarity on the practical operation of the Multiple Bid Auction. This Information Paper answers that request.

It should be noted that the examples set out in this paper are for **information purposes only** and represent an illustration of the SEM Committee's high level thinking around the operation of the Multiple Bid Auctions. The subject of the current consultation is the high level design of the procurement mechanism; there is a further piece of work on the detailed design and the implementation of the mechanism to be carried out once the design of the procurement mechanism has been chosen. Therefore, nothing in this Paper should be construed as determining those elements of the auction design that will be decided upon during the detailed design, should option 5 (Multiple Bid Auction) be the design approved by the SEM Committee following the current consultation process.

The examples set out in this note are for illustrative purposes only, and several simplifying assumptions have been made. Furthermore no attempt has been made to select realistic figures regarding price or quantities and therefore the figures used should not be taken as being indicative of actual auctions. The focus of this Paper is the mechanics of the auction and it would be a decision for each individual service provider to decide upon their own auction strategy.

1.1 Scope

The SEM Committee's proposals are currently under public consultation and the procurement design for system services will not be decided upon until after a review of the responses to SEM-14-059. The scope of this Information Paper is limited to providing additional clarification on the issues raised at the Open Forum and does not introduce any new proposals from those set out in SEM-14-059.

In particular this explanatory paper focuses on the two main issues raised at the forum – the proposed payment basis for the services and the mechanics of the Multiple Bid Auction. Many of the issues raised at the forum, as explained by the Regulatory Authorities on the day, are issues that must be addressed (and consulted upon) in the detailed design and

[1] Delivering a Secure, Sustainable Power System

cannot be decided in advance of the high level design of the procurement mechanism. The details of the system services regime will to a large extent depend on which of the options for the procurement design the SEM Committee selects as a result of the current consultation process. Issues such as market power mitigation, contractual arrangements (entry criteria, lead times, provider obligations etc.) and the interaction between the market schedule and TSO dispatch decisions will be considered in the detailed design phase..

2 Payment Basis

There was an active discussion at the workshop on the payment basis for system services proposed in the Consultation Paper (SEM-14-059). Therefore the Regulatory Authorities consider that it may be beneficial to expand upon the explanation of the proposals set out in SEM-14-059. The table on page 5 and the text below provide clarity around the three payment bases discussed in SEM-14-059.**Capability:** The provider is paid for its technical capability to provide the services regardless of its actual physical running or market position. Under Option 5, the clearing price is set in the annual auction.

Availability: The provider is paid for the volume of the service that is provided to the TSO regardless of the TSO's real-time requirement for that service. The higher of a unit's market position or physical dispatch is used to determine the available volume. Where a provider does not need to be physically exporting to provide a service it is considered available even when not exporting. Under Option 5, the clearing price is set in the annual auction.

Dispatch: Only services required by the TSO are paid. This is similar to Availability above but the volume of services paid for is limited by the TSO's real-time requirement. Any "surplus" providers who are ready to provide a service to the TSO (due to their market position or physical dispatch) but are not required to do so will not be paid. Under Option 5, the clearing price is set in each trading period based on bids submitted in the annual auction. Accordingly there may be a different clearing price in each trading period depending upon which service providers are required.

Status of unit	Applicable Payment Basis	Examples
Technically available but not exporting	**Capability** In the case of some technologies that can provide certain services without exporting energy; they will also be eligible for availability payments under these circumstances.	A CCGT capable of providing SIR, and is available to export but is not exporting (e.g. is out-of-merit) would receive a payment for its full capability (on a capability basis). It would receive no payment if payment was on an availability or dispatch basis.

		A battery capable of providing FFR when not exporting prior would be eligible for payment on both an availability and capability basis.
Exporting at full load (higher of market or physical dispatch)	**Availability** (for most services) In the case of reserve products the unit's availability is zero because the unit is exporting its full load	For example, a CCGT would earn revenues for its full capability of SIR but zero for TOR2.
Exporting at part load (higher of market or physical dispatch)	**Availability** For most services the volume considered Available is with reference to the exporting volume. For reserve products, it is the volume of energy the unit could deliver within the required timeframe but is not currently exporting.	For example the CCGT above would not receive payment for its full capability only for the volume associated with its energy output. And it would be considered available for the volume of energy it could deliver (taking account of its export volume)
Exporting at part load and required by the TSO (higher of market or physical dispatch)	**Dispatch** For reserve products, the difference between the Availability payment above and the Dispatch payment is that for the Dispatch payment, the TSO only pays for the volume of reserve that it requires from that generator/ service provider in that trading period. Units that are providing reserve but are surplus to the TSO's reserve requirement will not be paid. Under an Availability based payment they would be paid i.e. as they are "available" to provide the reserve product irrespective of whether they are actually called upon by the TSO to provide it or not.	Discussed in more detail in Section 2.2.

2.1 Energy and Non Energy Payments

As discussed in SEM-14-059 there is a distinction between "energy" and "non-energy" payments. All system services payments will be "non-energy" payments (i.e. the provider is paid for the service that they are providing to the system rather than any energy which may be associated with provision of that service), any costs associated with energy will be recovered in the energy market (this is being addressed under the I-SEM project). The rationale for the proposed payment basis is that it will allow the market to optimise the energy and system services revenues such that the physical nominations selected by the day-ahead market should include units which provide system security and minimise the need for the TSO to intervene by constraining on units. This is not to say that market is being co-optimised, however it will give market participants the opportunity to optimise bids reflective of the revenues it will receive in both markets that should allow for an optimal energy market solution. Secondly it explicitly avoids any risk of double payment as units will be paid for service provision separate to energy provision.

Impact of Payment Basis on Energy Payments	
Capability	No interaction. A provider's market or physical dispatch will not affect the level of system service revenues and therefore it is not considered that there will be any impact.
Availability	Interaction. A provider must be in the market (or constrained on by the TSO) to receive system service revenues. Therefore units must bid into the energy market in such a way so as to ensure they are in the market schedule. Energy costs (whether in-merit or constrained on) will be paid separately to system service payments. The clearing price for "availability" services is set in the annual auction.
Dispatch	Interaction. A provider must meet the "Available" criteria in addition to being in-merit for system services dispatch. Therefore as above units must ensure they are in the market schedule. Energy costs (whether in-merit or constrained on) will be paid separately to system service payments. The prices/bids for "dispatch" services are the prices submitted in the annual auction in the provider's bid. The clearing price for "dispatch" services is set in the trading period not the annual auction.

2.2 Availability and Dispatch Payments

In SEM-14-059 the SEM Committee proposes that reserve services are paid on a dispatch basis. In this section the differences between the payment bases for reserves is discussed.

2.2.1 Scenario One

Where the TSO *does not* need to take any non-energy actions in the balancing market (i.e. the schedule required for real-time physical dispatch is the exact same as the schedule produced by the market) all in-merit units (who were successful in the system services auction) will receive availability payments for services paid on an availability basis. Those units that are part-loaded in the market will be eligible for reserve payments.

If reserve payments are on an availability basis all these part-loaded units (who were successful in the auction) will receive reserve payments. The price would be the clearing price set in the annual auction. In other words, each annual auction would set a clearing price (annually) for reserve products. A part-loaded unit that has been successful in the annual reserve auction (i.e. it has in its possession a reserve contract) would receive the clearing price on an availability basis for each MW of reserve product that they are available to provide (they will be receiving the I-SEM energy price for their scheduled energy).

If reserve payments are made on a dispatch basis (as proposed in SEM-14-059) the units will be selected in ascending order of cost i.e. cheapest first. This cost assessment is made by the TSO with reference to the reserve price (auction bids) not the energy bids of the units (in this scenario they are already in the energy market and paid for in the energy market). The marginal unit for reserve (i.e. the unit with the most expensive reserve price but still required) sets the price for reserve. Therefore if the market is providing 600MWs of reserve but the TSO only requires 300MWs in that trading period, only 300MWs of reserve is paid for. In this scenario, a generator may have in their possession a contract for the provision of reserves, but they will only be paid where they are dispatched by the TSO to provide reserve.

The price of reserve in a trading period will also depend on the units on the system at the time. An implication of the different treatment of dispatch and availability payments is that because a clearing price for dispatch is not set in the annual auction no unit is excluded from reserve payments. Therefore units can be unsuccessful in the auction for the availability based services but still be eligible for payments for reserve, depending on the system conditions in a given trading period. For the availability based services (for example SIR) the setting of a clearing price implies that some units will be unsuccessful in the auction and will therefore not get a system services contract. Such units would therefore provide services to the system as is required under the Grid Code (where it is an existing capability for example) but would not receive a system services payment.

2.2.2 Scenario Two

Where the TSO *does* need to take non-energy actions in the balancing market (i.e. where the schedule required for real-time dispatch is not precisely the same as the schedule produced by the market) then there are further considerations.

- All in-merit units (who were successful in the reserve auction) will receive availability payments for their market volume whether or not they are constrained off.
- All units constrained on (who were successful in the auction) will receive availability payments for the period and volume for which they are constrained on.
- For the dispatch services (for example POR, SOR etc.) all units in the market and constrained on (for non-reserve reasons) would be considered for reserve and the clearing price for that trading period would be set in the same way as discussed above.
- Where there was insufficient reserve on the system and the TSO is required to constrain on units to provide reserve, the TSO would have to consider the total cost of that non-energy action including the price of reserve when selecting the unit to constrain on. As far as System Services is concerned only the price of reserve will impact the reserve clearing price in that trading period. All other costs (energy, start-up etc.) will be recovered according to the I-SEM arrangements for non-energy actions.

Therefore the TSO will first look at the reserve available to it first and only constrain units on where there is insufficient reserve. When making this decision, much as it must today, the TSO will take the total cost of the unit to be constrained on into account (obligation for least cost dispatch).

3 Multiple Bid Auction Process

3.1 Generator constructing a bid

The auction is designed to minimise the complexity in a generator's bidding strategy that would be present if the process consisted of multiple simultaneous or sequential auctions for each service. As the auction is instantaneous and the bids sealed participants do not need to consider the bidding strategies of other participants in the way that could be required in an auction consisting of several rounds of bidding. Finally the pay-as-cleared approach incentivises the lowest bid possible whereas a pay-as-bid approach requires an estimate of the clearing price before bidding. The provider will need to understand its own costs, required revenues and an estimate of its likely running in the market.

Therefore a provider is likely to be best served by submitting bids for each service that reflect the lowest price possible while still recovering their costs over the term of the contract.

Because the bids are mutually exclusive the provider can consider the revenue adequacy across all services within a given bid. If a bid for a given service is "out-of-merit[2]" then the entire bid is rejected e.g. a bid may include a service provider's price for, say, four services. If a bid for one of these services is out of merit, then the service provider will not be bound to the bid for the other three services regardless of whether these were in merit. In other words a generator cannot be left in a situation where it has won a contract on some services and lost on others – resulting in an obligation to fulfil a loss making contract.

Because multiple bids are permitted it is open to the generator to submit separate bids for different investment decisions or for different contract lengths reflecting the differing costs of different financing arrangements.

The example in this information paper has three generators:

Generator A	Is a new entrant. "A" decides to submit two bids for the same plant design. The difference between the two bids is the contract length, with the longer contract period having a lower annual cost.
Generator B	Is an existing unit that has decided to retrofit. "B" submits three bids. One for its existing capability and two further bids for its options to provide enhanced capability.
Generator C	Is an existing unit. "C" has no plans to invest in further enhanced capability and so submits one bid.

For simplicity they are each proposing to provide four services[3], FFR (Fast Frequency Response), FPRAPR (Fast Post-Fault Active Power Recovery), SRP (Steady State Reactive Power) and POR (Primary Operating Reserve). A further simplification is that generators bid their annual capability and the TSO assumes full use of this volume. For the avoidance of doubt the figures are purely illustrative and it has not been attempted to provide realistic assumptions for price/quantity.

[2] The bid is unsuccessful as the auction volume has been filled by lower/ cheaper bids
[3] In reality a service provider may construct a bid which includes any combination of the 14 approved system services (approved as per SEM-13-098).

Generator A Bids:

	A1			A2		
	Price	Quantity	Length	Price	Quantity	Length
FFR	19.1	66,000	10	20	66,000	8
FPFAPR	2.1	3,600,000	10	2.2	3,600,000	8
SRP	0.6	1,900,000	10	0.7	1,900,000	8
POR	2.3	110,000	1	2.3	110,000	1

Generator B bids:

	B1			B2			B3		
	P	Q	L	P	Q	L	P	Q	L
FFR	18	100,000	1	19.8	150,000	5	19.9	175,000	10
FPFAPR	1.5	785,000	1	2	800,000	5	2.3	815,000	10
SRP	0.15	650,000	1	0.4	700,000	5	0.4	700,000	5
POR	2	170,000	1	2	170,000	1	2	170,000	1

Generator C bids:

	C1		
	P	Q	L
FFR	15	50,000	1
FPFAPR	0.5	2,400,000	1
SRP	0.13	1,600,000	1
POR	1.9	84,000.00	1

It is envisaged that the TSOs will publish estimates of required volumes. For this example it is assumed that the TSO will require approximately the volumes set out in the table below.

Service	Volume Min	Volume Max
FFR	216,000	270,000
FPFAPR	6,785,000	6,800,000
SRP	4,150,000	4,200,000

3.2 The Auction

This set of bids from the three illustrative generators results in six distinct outcomes (i.e. the full range of possible outcomes). These are summarised in the table below.

Outcomes	Bids			Comment
1	A1	B1	C1	New entrant and existing capability
2	A1	B2	C1	New entrant, retrofit and existing capability
3	A1	B3	C1	New entrant, retrofit and existing capability
4	A2	B1	C1	New entrant and existing capability
5	A2	B2	C1	New entrant, retrofit and existing capability
6	A2	B3	C1	New entrant, retrofit and existing capability

Each service is auctioned individually within a given outcome. This provides a clearing price for each individual service for that set of bids. Bidders must be successful in all services for which they have submitted a bid. All unsuccessful bidders are removed from the auctions in all other services (i.e. including the ones they may have been successful in) and the clearing prices for those services are recalculated. It is noted that the sequencing of the removal of bidders will be a matter for the detailed design should the Multiple Bid Auction be the chosen procurement mechanism.

The methodology for the removal of unsuccessful bidders will be an important part of the detailed design of the auction process. The auction for all services for a given set of bids can be considered to be a two-stage process; the first stage is to construct the supply curve for each service based on all the bids received (within that outcome); the second stage is then to remove unsuccessful bidders. Given that each bid is mutually exclusive, it follows that if a bid is unsuccessful in one service it is removed from all services. This second stage may require the TSO or the auction algorithm to carry out some optimisation between the services in order to select the final optimum outcome (e.g. a higher than necessary clearing price in one service may result in an overall lower cost when the other services and likely market running of the units are considered). This complicates the demand curve for each service as it will be, to some extent, a function of the volumes for the other services.

Taking Outcome 1, the auctions for FFR, FPFAPR and SRP are run separately[4] (but simultaneously).

[4] In reality, this means 14 separate auctions for each of the 14 separate approved services.

3.2.1 Outcome 1 Auction:

FFR				
	P	Q	L	Q*
C	€ 15.00	50,000.00	1	50,000.00
B	€ 18.00	100,000.00	1	150,000.00
A	€ 19.10	66,000.00	10	216,000.00

As shown in the table above Generator C submitted a bid of €15.00, B a bid of €18.00 and A a bid of €19.10. In this example the TSO has determined it requires a quantity of at least 216,000MWh, therefore all three generators are required and Generator A is the marginal unit. This results in a clearing price of €19.10 for FRR. If the TSO had determined that 150,000MWh was sufficient then the clearing price would have been €18.00 and Generator A would have been removed from all the auctions for Outcome 1.

FPFAPR				
	P	Q	L	Q*
C	€ 0.50	2,400,000.00	1	2,400,000.00
B	€ 1.50	785,000.00	1	3,185,000.00
A	€ 2.10	3,600,000.00	10	6,785,000.00

The table above shows the bids for FPFAPR: C bids, €0.50, B €1.50 and C bids €2.10. In this example we assume the TSO has determined it requires the volume from all three generators, therefore generator A is the marginal unit. This results in a clearing price of €2.10. If the TSO had determined a lower quantity were required, or if a lower quantity had been required in the FFR auction then Generator A would have been removed and the clearing price would have been €1.50.

SRP				
	P	Q	L	Q*
C	€ 0.13	1,600,000.00	1	1,600,000.00
B	€ 0.15	650,000.00	1	2,250,000.00
A	€ 0.60	1,900,000.00	10	4,150,000.00

As with the previous services we assume the TSO requires all three generators, resulting in a clearing price of €0.60. The clearing price would be €0.15 if Generator A were to be removed.

So for Outcome 1 (A1, B1, C1) the result is:

Service	Clearing price	Quantity
FFR	19.10	216,000
FPFAPR	2.10	6,785,000
SRP	0.60	4,150,000

The auctions for the other possible outcomes are similarly run. The results are summarised below:

	FFR		FPFAPR		SRP	
Outcome 1	€19.10	216,000.00	€2.10	6,785,000.00	€0.60	4,150,000.00
Outcome 2	€19.80	266,000.00	€2.10	6,800,000.00	€0.60	4,200,000.00
Outcome 3	€19.10	150,000.00	€2.10	6,800,000.00	€0.60	1,900,000.00
Outcome 4	€20.00	216,000.00	€2.20	6,785,000.00	€0.70	4,150,000.00
Outcome 5	€20.00	266,000.00	€2.20	6,800,000.00	€0.70	4,200,000.00
Outcome 6	€15.00	50,000.00	€0.50	2,400,000.00	€0.13	1,600,000.00

The Outcomes are then compared against one another to find the least cost outcome. For this example it is assumed that the full capability will be paid for. It is noted that in practice, due to the proposed payment basis, that not all units will be eligible for payment in every trading period. Therefore a market model may be used by the TSO to estimate the total cost for the year.

Outcome	Total Cost	Technically Viable[5]
Outcome 1	€ 20,864,100	Yes
Outcome 2	€ 22,066,800	Yes
Outcome 3	€ 16,605,000	No
Outcome 4	€ 22,152,000	Yes
Outcome 5	€ 23,220,000	Yes
Outcome 6	€ 2,158,000	No

In this example Outcome 1 is the least cost viable outcome. Note that Outcomes 3 and 6 resulted in the lower clearing prices and volumes (and therefore lowest total cost) but are not viable and can be considered infeasible outcomes. This is because the bids associated with Outcome 6 (A2, B3, C1) produced the highest volumes of all the possible outcomes. For the purposes of this example it is assumed that these volumes were in excess of those required by the TSO. Therefore under Outcome 6 neither Generator A or B were successful in the auction, only Generator C was. As the volumes available from Generator C alone are not sufficient this outcome is not considered technically viable and is therefore eliminated from consideration. In Outcome 3 (A1, B3, C1) B was eliminated in the FPFAPR auction, this elimination produced volumes in the other services that were too low.

The least cost outcome, Outcome 1, therefore results in Generator C (the existing unit) receiving a one year contract for all services. Generator B gets a one year contract for its existing capabilities and Generator A (the new entrant) gets a 10-year contract. Therefore Generators B and C will participate in the auction next year and Generator A will not (except

[5] This example assumes the technical viability of the outcome is assessed after the auction. In practice it may be more appropriate to set the technical constraints after the bids have been received but before the auction is run.

for POR). Generator A will receive the clearing price (FFR €19.10, FPFAPR €2.10 & SRP €0.60) for the duration of the contract (regardless of the outcome of subsequent auctions). It can be seen that contract length is not a deciding variable in the auction, however as noted in SEM-14-059 the SEM Committee may impose limits on the number of long-term contracts issued.

3.2.2 Inframarginal Rents

As can be seen above Generator A is the marginal unit in all the services and so does not receive any inframarginal rent on its provision of system services, while Generator B and Generator C both earn inframarginal rent.

Generator	FFR	FPFAPR	SRP
A	€ -	€ -	€ -
B	€ 1.10	€ 0.60	€ 0.45
C	€ 4.10	€ 1.60	€ 0.47

3.2.3 Dispatch Based Payments

In the example above a clearing price for POR was not determined. This is because, as it is paid on a dispatch basis, an annual clearing price is not required. For simplicity above the estimated cost of POR was not included in the total cost calculation. In practice an estimate would need to be included to allow a comparison of the outcomes where the bid prices for the reserve services differed between bids. The reserve prices contained in the winning bids (A1, B1, C1) plus Generator D who we will assume was an unsuccessful participant in the auction are:

Generator	Bid Price	POR Available (MWh)
A	2.3	13
B	2.0	20
C	1.9	10
D	2.2	20

The POR clearing price each trading period will be determined by the marginal unit providing POR. If we assume that all four units are “available” to provide reserve but that only three are required by the TSO for POR, then the POR price in that trading period will be €2.2/MWh and Generator A will not receive any POR payment. Generator A will of course still receive its payments for the availability based services. Therefore, it is possible to be successful in the annual auction but not receive payments for dispatch based services. Similarly, it is possible for a unit to be unsuccessful in the annual auction but still receive revenues for the dispatch based services (i.e. the reserve services).

In the case of Generator D, notwithstanding the fact that D was unsuccessful securing a system services contract for the availability based services it still has an obligation to make its operating reserve available to the TSO at the price contained in its bid which was in the least cost viable outcome – in this case Outcome 1. If called to provide reserve D will receive at least its bid price. Generators will remain bound to their Grid Code obligations to provide reserve to the TSO.

	Trading Period 1	Trading Period 2	Trading Period 3
POR Requirement	50	60	45
POR Dispatch	A: 0 B: 20 C: 10 D: 20	A: 10 B: 20 C: 10 D: 20	A: 0 B: 20 C: 10 D: 15
Clearing Price	€2.20	€2.30	€2.20

3.2.4 Revenues Received

Trading Period 1		
	Generator A: Output 300MW POR: 13	Generator D: Output 300MW POR: 20
FFR	€5,730	€0
FPFAPR	€630	€0
SRP	€180	€0
POR	€0	€44
Total	€6,540	€44

A simple one-for-one relationship is assumed between the volume of the service available to the TSO and the generator's output.

3.3 Interaction with the Energy Market

SEM-14-059 discussed the interaction between the proposed System Services procurement design and proposed energy trading arrangements under I-SEM. Availability based payments are likely to incentivise units to be in the market, all things equal. Added to this some units will be earning inframarginal rents on the provision of system services. This will allow the most efficient providers of system services to make greater discounts on their energy bids than those earning less system service revenues. Also because the system services auction is a competitive process it should be the case that the units/technology most needed by the system will also earn relatively higher inframarginal rent (i.e. a relatively inefficient unit will be the marginal unit due to scarcity of the service(s)). This will allow such units to be in the merit order for energy more frequently than they would be without a system services contract.

4 Conclusion

This Information Paper has set out a high level example to illustrate the mechanics of the SEM Committee's preferred option, the Multiple Bid Auction, set out in its consultation paper SEM-14-059. The purpose of this paper is to provide further clarification on the SEM Committee's proposals and for the avoidance of doubt it should be noted that, if the Multiple Bid Auction is chosen by the SEM Committee as the procurement mechanism for System Services, the detailed design phase will address issues such as the detailed auction rules, bidding rules etc. Therefore the above examples should be considered as illustrative only.

Comments on the proposals set out in SEM-14-059 are requested by 17.00 Friday 22nd August, 2014.