



**Integrated Single Electricity Market
(I-SEM)**

**Capacity Remuneration Mechanism
Detailed Design**

Third Consultation Paper

SEM-16-010

11 March 2016

Ireland and Northern Ireland has until the end of 2017 to change its wholesale electricity markets to meet the requirements of the European 3rd package of energy legislation. This legislation places a number of requirements on the wholesale electricity markets of Member States with the aim of improving energy trade within the EU. The Regulatory Authorities (Regulatory Authorities) for Ireland and Northern Ireland have agreed the High Level Design¹ of the market required for the third package - and called that market the I-SEM (Integrated Single Electricity Market).

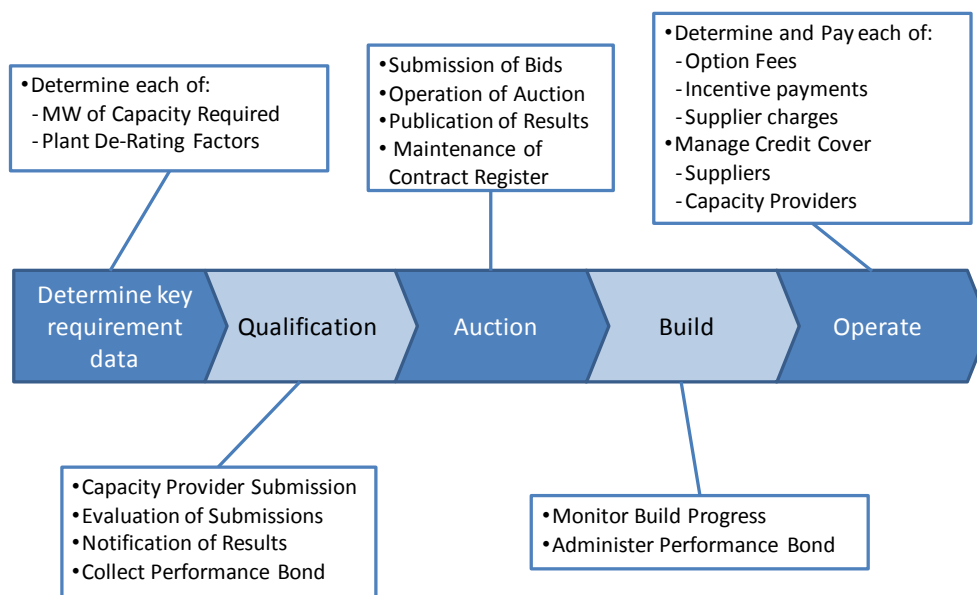
In addition to reform of energy market, the High Level Design includes a Capacity Remuneration Mechanism (CRM) based around Reliability Options. The detailed design for the I-SEM CRM is being developed over the course of three consultations, this document being third consultation:

- Decision 1 set out a number of key elements of the I-SEM CRM process and the Reliability Option design, including: the methodology for setting the Capacity Requirement; key elements of the Reliability Option product design such as the Reference Price and the high level Strike Price design; eligibility to participate in the CRM; Supplier Arrangements; and the institutional framework. In addition, Decision 1 sets out the Administrative Scarcity pricing in the I-SEM Balancing Mechanisms in conjunction with the protection afforded to Suppliers by the Reliability Option hedge and socialisation of any shortfall in the hedge. These issues were consulted on in SEM 15-044, with the decisions set out in SEM 15-103;
- Consultation 2 consulted on other key elements of the I-SEM CRM design including: interconnector and cross-border arrangements; more detailed elements of the Reliability Option design; the level of the Administrative Scarcity Price; and transitional arrangements. These issues were consulted on in SEM-15-014 issued on 21 December 2015, with the consultation closing on 8 February 2016. The SEM Committee is now considering the responses and will issue the decision document in May 2016. This paper also sets out the SEM Committee's minded to decision on a number of items covered in Consultation 2 that overlap with considerations in this paper;
- Consultation 3 focuses primarily on the design of the CRM auction which will award Reliability Options to capacity providers, including the arrangements to mitigate market power in the auction. As a follow on to SEM 15-103, this document also considers the socialisation arrangements to cover times when Reliability Option difference payments received from capacity providers are insufficient to provide a complete hedge to Suppliers, and detailed design aspects of the Strike Price.

As illustrated in Figure 1 below, the auctions play a key role in the allocation of Reliability Options, and appropriate auction design is central to the efficient operation of the I-SEM CRM and in delivering reliable capacity at an appropriate price.

¹ http://www.semcommittee.eu/en/wholesale_overview.aspx?article=d3cf03a9-b4ab-44af-8cc0-ee1b4e251d0f

Figure 1: CRM Process Overview



The I-SEM CRM auctions will be auctions to procure capacity. The auctioneer (i.e. the CRM Delivery Body) is the buyer, and it is looking to buy multiple MW of capacity in each auction from multiple bidders. The “bidders”² are offering to make capacity available by competing to obtain a physically backed Reliability Option.

We envisage that there will be a range of different auctions, including:

- T-4 auctions. These auctions will take place annually and will procure capacity with an approximate 4 year lead time to the delivery year;
- T-1 auctions. These auctions will take place annually and will procure capacity in the year preceding the capacity delivery year;
- Transitional auctions. These are auctions to cover the period up to the delivery year of the first T-4 auction. Transitional auctions were considered in Consultation 2 and the SEM Committee are minded that for each of the transitional years, the capacity auction should take place in the year preceding the capacity delivery year, similar to the T-1 auctions.

Beyond the transitional period, the majority of the Capacity Requirement would be procured at the T-4 auctions. This will ensure that the price which will have the biggest impact on customer bills will be determined in an auction where new capacity is competing alongside existing capacity (apart from during the transitional period), which will:

- Help to mitigate the market power of existing capacity providers; and

² Note that whilst the auction participants may be considered to be making “offers” we shall continue to call them “bidders” throughout this document, and to refer to their price offers as “bids”

- Ensure that the price paid by consumers substantially reflects the costs of new entry, where relevant.

Procurement auctions for multiple units, whether in electricity (e.g. capacity auctions, virtual power plant auctions) or in telecommunications (e.g. spectrum auctions) usually take one of a number of auction formats. As illustrated in Figure 2, the key elements of multiple unit auction design typically include:

- **Auction format.** The choice of auction format (e.g. simple sealed bid, multiple round descending clock, combinatorial and other hybrid auctions);
- **Winner determination.** How to decide auction winners- in our case who gets a Reliability Option. Identifying the auction winner may seem self evident. Bids are lined up in price (merit) order, and the cheapest bids which meet the Capacity Requirement are the winners. However, as we shall discuss, there are potential complications if the auctioneer cannot award a Reliability Option to half a generation unit (the “lumpiness” problem). If the next Capacity Market Unit in the merit order is a 400MW CCGT, but the auctioneer only has a procurement requirement of 50MW, what does it do?
- **Price determination.** In our case, the price determined by the auction is the Reliability Option fee. Again setting the market price may appear a simple affair- all winners are typically paid the same price, the price of the most expensive offer accepted. This approach is typically known as “pay-as-clear”, or alternatively “uniform clearing price” or “second price”. However, variants are possible, particularly where out of merit providers are selected as winners in response to the “lumpiness” problem;
- **Information and communication policies.** We need to define what information is provided to the bidders before qualification, between qualification and the auction, during the auction and after the auction. Clearly, transparency of information is generally positive. However, under certain circumstances provision of too much information can help bidders with market power to exercise that market power. Certain auction formats (such as the multiple round descending clock format) lend themselves to the provision of such information and are more prone to facilitating the exercise of market power.

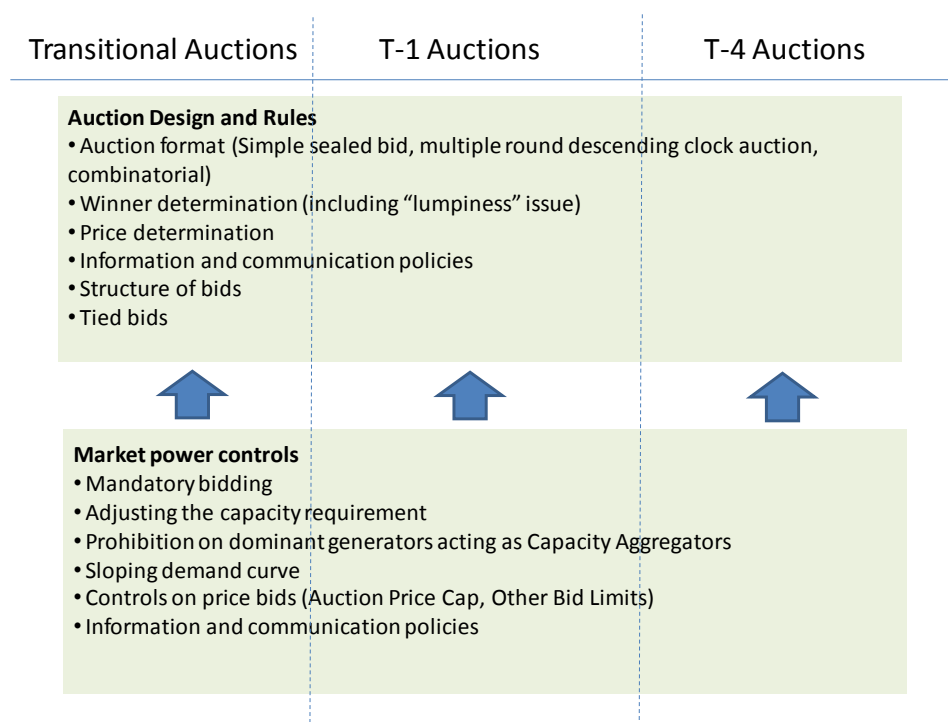
Typically in electricity and telecommunications auctions, there are a limited number of bidders who have a degree of market power. The I-SEM is no exception, and arguably the all-island market is more concentrated than many other markets which have held capacity auctions, such as certain US markets and GB.

Therefore a key element of the auction design is restricting the scope for these bidders to exercise market power. The scope to exercise market power can be restricted by a combination of:

- Appropriate choice of auction format- a simple sealed bid format give dominant players less scope to exercise market power than others than sealed bid formats;
- Appropriate winner and price determination rules;
- Appropriate information and communication policies; and
- A range of other market power controls that constrain the volumes and prices that dominant bidders (or all bidders) can bid, including:
 - Mandatory bidding (addressed in CRM Decision 1);

- Adjusting the Capacity Requirement (addressed in CRM Decision 1);
- Prohibitions on dominant generators acting as Capacity Aggregators for other smaller players;
- Using a sloping demand curve, rather than a fixed Capacity Requirement (a vertical demand curve);
- Controls on the price that bidders can bid.

Figure 2: Auction design framework



In SEM-15-103, the SEM Committee set out its decision is to use the Rules Based Model for the detailed contractual terms that cover the settlement of Reliability Options. Those detailed terms will be captured within a section of the future T&SC (the Capacity Market Rules), with the details of each Reliability Option being retained in a Contract Register to be maintained by the TSOs. SEM-15-103 further stated that the Capacity Market Rules will form part of the TSOs’ licences. However, other elements of the governance of the I-SEM Capacity Remuneration Mechanism will be set out in a separate Capacity Market Code, which will be subject to a separate change control process

The TSOs (i.e. EirGrid and SONI) will have the overall responsibility for managing the qualification process and will be the Auctioneer. These roles will be defined in the Capacity Market Code (CMC) as CRM Delivery Body and provided for in the TSOs’ licences. The CRM Delivery Body will be responsible for the following auction related tasks:

- Procuring software to run the auction, and software to run the qualification process if necessary /appropriate;
- Developing auction guidelines, including developing appropriate user guides and agreed procedures [for approval by the SEM Committee];
- Publishing key auction parameters in accordance with the Capacity Market Code, Auction Guidelines or as otherwise directed by the SEM Committee

- Running the qualification process, including obtaining and validating and bid bonds; and
- Running the auction, calculating and publishing the auction results in accordance with the auction guidelines;

A number of stakeholders have previously expressed a concern that EirGrid has a conflict of interest between its role as the CRM Delivery Body, and its role as a shareholder of EWIC as well as other roles that EirGrid will carry out in the I-SEM such as the balancing market operator. Perceived conflicts of interest will be mitigated through the auction design and rules set out in the Capacity Market Code including:

- Clear and transparent rules for the carrying out of the functions of the obligations of the CRM Delivery Body to be set out in the Capacity Market Code which will be subject to a Modification Process and approved by the SEM Committee.
- The role of the Auction Monitor and Auditor in ensuring that the CRM Delivery Body carries out its obligations in accordance with the Capacity Market Code including:
 - The setting of the capacity requirement in accordance with the procedure set out in the Capacity Market Code
 - The carrying out of the derating of capacity providers in accordance with the derating methodology set out in the Capacity Market Code
 - The running of the qualification process for the auction
 - The running of the T-4, T-1 and transitional auctions including and audit and rerun of the auctions to ensure the results can be replicated
- Approval by the SEM Committee of methodologies and parameters set out in the Capacity Market Code including the Capacity Requirement, the Derating process and endorsement by the SEM Committee of the results of the Qualification Process and the auctions.

This consultation also considers more detailed arrangement relating to the socialisation of Reliability Option difference payments (as set out in SEM-15-103) which include consulting on principles for determining a contribution rate and options should a situation arise where there is insufficient funds available to pay difference payments.

In addition further consideration is given to the strike price formula set out in SEM-15-103. This includes consideration of whether to use a month ahead gas reference price, the treatment of carbon, a value that the thermal efficiency within the formula should be set at and the governance of price indices.

A public workshop presenting an overview of this consultation will be held on 16th March 2016 at the Crowne Plaza Hotel, Dundalk. Further information on this event will be published on the All-Island project website.

Responses to the consultation paper should be sent to Karen Shiels (Karen.Shiels@uregni.gov.uk) and Thomas Quinn (tquinn@cer.ie) by 17:00 on Wednesday 27 April 2016. Please note that we intend to publish all responses unless marked confidential.

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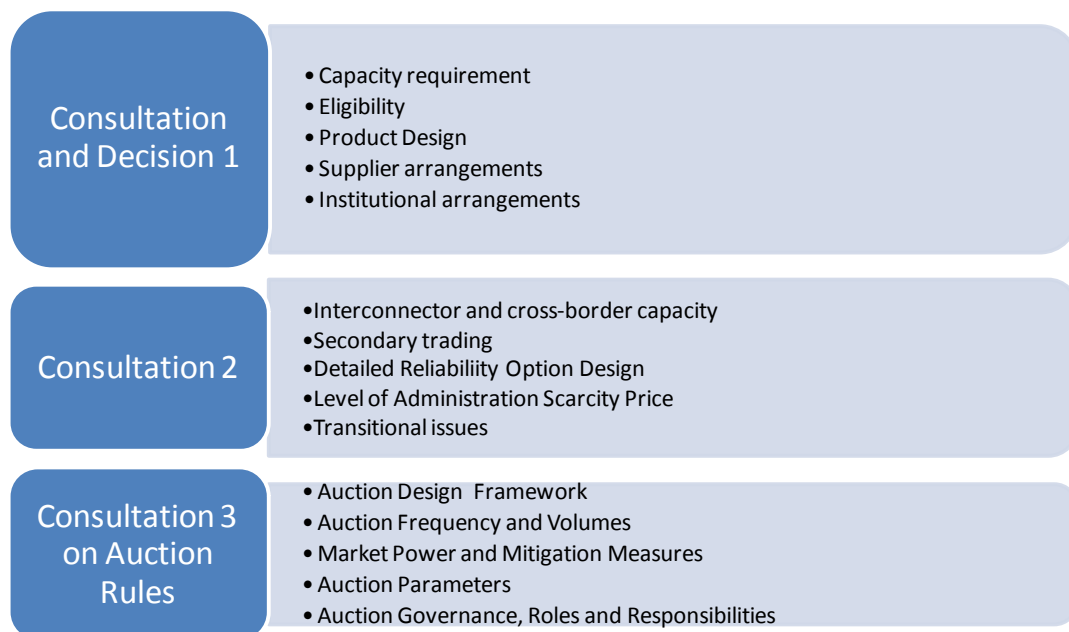
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1. INTRODUCTION

1.1 BACKGROUND

- 1.1.1 The purpose of the CRM Detailed Design is to develop through consultation the specific design features of the new capacity mechanism. As illustrated in Figure 3, this consultation paper is the third of three stages of consultation in the development of the CRM Detailed Design.

Figure 3 : Overview of CRM Policy Development



- 1.1.2 This document focuses on the design of the CRM auction including the market power mitigation measures that will be incorporated into the auction design.
- 1.1.3 Whilst this consultation represents the third stage of the CRM policy development, there will be subsequent consultation on parameter values and the detailed de-rating and capacity requirement methodologies will also be consulted upon separately. These consultations are planned for Quarter 3 2016.

1.2 ROLE OF AUCTIONS WITHIN THE CRM PROCESS

- 1.2.1 At a high level, an auction is a selection process designed to procure or allocate goods and services competitively. Auctions have played a key role in matching supply and demand in the electricity sector since the early 1990s and they are an important part of coordinating long term investment signals in capacity markets worldwide. An auction to procure capacity for the

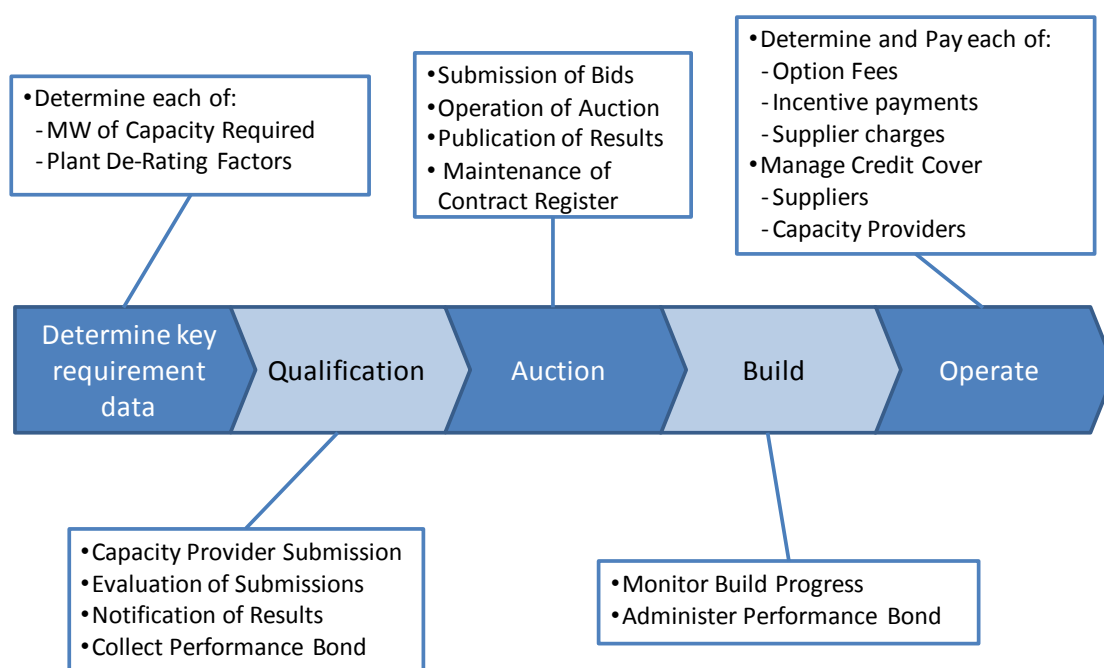
I-SEM CRM is therefore in line with international best practice as well as EU State Aid Guidelines which require a competitive bidding process for the CRMs³.

1.2.2 At its core, the auction process involves three key processes: bidding, clearing and pricing. Figure 4 illustrates how these process will be implemented for Auctions in the CRM:

- Qualified capacity providers will submit bids to the auction
- The CRM Delivery Body (EirGrid/SONI) will then operate the auction in accordance with the Capacity Market Code, using software developed in accordance with specifications set out in our decision following this consultation. The auction will select the winners (who will be awarded Reliability Option contracts) and determine the auction clearing price(s).
- The auction clearing price(s) will be the Option Fee payable per MW of de-rated capacity.

1.2.3 The auction design (including market power mitigation controls) which is being consulted upon in this document will be the key to ensuring an efficient and equitable selection of capacity providers with fair competition between different capacity providers, and appropriate prices for capacity providers, and ultimately consumers.

Figure 4: End to End Process for the I-SEM CRM



³ World Bank Study "Electricity Auctions: an overview of efficient practices"
<https://openknowledge.worldbank.org/bitstream/handle/10986/2346/638750PUB0Ext00Box0361531B0PUBLI00.pdf?sequence=1>
 EC Guidelines on State aid for environmental protection and energy 2014-2020
[http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628\(01\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628(01)&from=EN)

1.3 INTERACTION WITH DS3 PROGRAMME

- 1.3.1 The SEM Committee has recognised that for providers seeking to deliver new plant or significantly refurbish existing plant there will be a preference to gain investment certainty based on projected revenue streams, and that for many new entrants this will mean securing both DS3 System Services and CRM revenues. Such coordination of long run investment could be achieved by having a single joint auction for the procurement of capacity and DS3 System Services. However, the SEM Committee also recognises that there is significant project risk associated with introducing a single auction at this stage and that the costs and benefits of joint procurement would need to be fully assessed before implementing a combinatorial auctions of capacity and DS3 products.
- 1.3.2 As a result, the CRM and DS3 programmes are currently progressing the development of separate auctions to procure Capacity and DS3 System Services respectively. SEM-15-105 (published December 2015) consulted on the management of interactions between the CRM and DS3 programmes, but stated that:
- It is envisaged that we will hold separate CRM and DS3 auctions in 2017;
 - Notwithstanding this, the SEM Committee's view is that the design and deployment of CRM and DS3 System Services auctions should not preclude the development of such a combined auction in the future. To ensure a consistent approach is taken to the procurement of capacity and DS3 System Services, the SEM Committee have recognised there is a requirement to achieve a level of consistency regarding the procurement of capacity and DS3 System Services where possible.
- 1.3.3 The following principles and actions were agreed by the SEM Committee relating to current and continued DS3 System Services and I-SEM design, and were set out in SEM-15-015:
- Develop, where possible, a consistent DS3 System Services and Capacity Implementation Agreement (recognising the specific differences of each). The second CRM consultation paper (SEM-15-014) consulted on the Implementation Agreement;
 - Develop, where possible, a consistent DS3 System Services and Capacity qualification process (recognising the specific differences of each);
 - Develop a DS3 System Services auction platform that can accommodate an extra product (i.e. Capacity);
 - Separately develop a capacity only auction platform in parallel.
- 1.3.4 As a result, this document assumes that, at least for 2017, the capacity auction format can be independent of the DS3 auction format. However, given the potential to move towards a joint auction in later years, design options which are consistent with the DS3 auction format will score positively against adaptive criteria, and may score highly against practicality and cost criteria, if they result in synergies in the development of the auction platforms.

1.4 KEY IMPLICATIONS OF CRM CONSULTATION 1 AND 2 FOR AUCTION DESIGN

1.4.1 The SEM Committee issued its decision on CRM Consultation 1 in December 2015 (SEM-15-103). This paper made a number of decisions designed to mitigate some market power concerns. These decisions were:

- Existing dispatchable plant with firm transmission access must qualify for the auction and must bid a volume within a tolerance band of the centrally determined de-rating factor for that plant, unless it declares that it will close before the end of the delivery period.
- Non-firm transmission access generators and intermittent generators will have the discretion to not submit a bid. However, all generators above a de-minimis threshold will be required to submit qualification information, and notify the CRM Delivery Body how many MWs of Reliability Options it is going to bid for, although this number could be zero. The TSOs will use the qualification information from both dispatchable and intermittent generators to adjust the amount of capacity bought, where any generation chooses not to participate or to bid higher or lower than its central determined de-rating. Adjusting the capacity requirement downwards mitigates market power by ensuring that the surplus of bidding MW over capacity bought remains the same as if the generator had bid.

1.4.2 These measures, whilst key to controlling market power do not constitute a complete CRM market power control framework, and this consultation seeks to flesh out the remainder of the framework.

1.4.3 The second CRM consultation paper (SEM-15-014) was also issued in December 2015 and the decision paper is forthcoming in May 2016. This consultation raised a number of issues which impact on auction design and/or market power. Hence, to aid responses to Consultation 3 we have set out the SEM Committee's minded to position on a few key issues. These relate to:

- Contract length;
- Lead time from auction to delivery of capacity; and
- Transitional auction arrangements.

Contract Length

1.4.4 Consultation 2 set out a number of options for the duration of contracts to be offered, depending upon the level of investment required. These include:

- Option 1 (Same length contracts for new and existing capacity):
 - Option 1a (Short): All Reliability Options are for 1 year only;
 - Option 1b (Long): All Reliability Options are for multiple years
- Option 2 (Different length contracts). Multi-year Reliability Options would be awarded for new plant, whereas existing plant would only receive a one year duration contract. We also discussed the additional possibility of introducing a third category of plant,

upgraded plant, which might receive shorter contracts than new plant, but longer duration contracts than existing plant.

1.4.5 Additionally, the Consultation looked at whether different new plant might have different contract durations, either because contract duration for new plant should be technology specific, or because the bidder should have the discretion to opt for less than the maximum duration contract.

1.4.6 The SEM Committee's minded to positions is as follows:

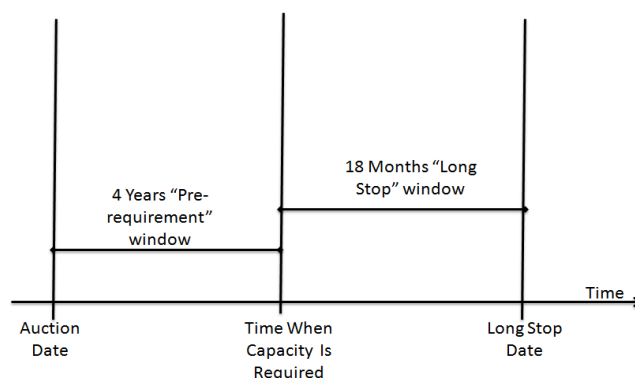
- Existing capacity should be limited to receiving a one year duration contract;
- Plant requiring significant new investment will be able to opt for a multi-year contract;
- The maximum contract duration may be 10 years, although new investment may opt for a contract of less than this maximum duration;
- The financial threshold for such new investment will be high;
- There will not be a separate 'upgraded' category;
- In any given auction different bidders seeking a range of single year and multi-year contracts of different durations may compete alongside each other; and
- These decisions will be kept under review with a view to moving to shorter term contracts in the future.

1.4.7 Final Decisions on these minded to positions along with our decisions on issues consulted on in Consultation 2 (including maximum contract length, participation of cross border capacity, secondary trading, indexation, level of and trigger for Administrative Scarcity Pricing, Stop Loss provisions and implementation agreements) will be published in our Decision Paper 2 in May.

Lead time from auction to delivery of capacity

1.4.8 In Consultation 2 we proposed a 4 year lead time and an 18 month long stop date as set out in the figure below.

Figure 5: The Commissioning Window – Two part lead-time



1.4.9 The SEM Committee are minded to have auctions approximately 4 years ahead of delivery, with new build plant allowed a further 18 months to complete their projects.

Transitional auction arrangements

1.4.10 Consultation 2 sets out the need to consider transitional arrangements to cover the period up to the delivery year of the first T-4 auction. This paper set out three broad options to manage this transition:

- **Option 1: Auction each year separately:** Under this option, during the transitional period, each year's Capacity Requirement would be procured in T-1 auctions for the following delivery year;
- **Option 2: Auction as a block:** Under this option the first (e.g. June 2017) round of capacity auctions would procure the bulk of the required capacity required for each of the transition years, as well as all of the requirement for the first Capacity Year (2017/18). There would then be subsequent T-1 auctions, to cover the remaining requirement as well as fine-tune the level of contracted capacity for the remaining transitional years;
- **Option 3: Do Nothing:** Under this option, Capacity Providers receive no Capacity Payments during the transition period.

1.4.11 The SEM Committee are minded to go with Option 1 and auction each transitional year separately. Further consideration will be given to the demand curve in the transitional period so as to mitigate a capacity shortage in later years.

1.4.12 This choice will also avoid the need to employ a more complex combinatorial auction format, which would be required for Option 2.

1.5 ASSESSMENT CRITERIA

1.5.1 The assessment criteria for the detailed design of the CRM (including the auction design) are based on the same principles as those applied to the I-SEM High Level Design and as agreed with the Departments in the Next Steps Decision Paper March 2013. We have developed detailed descriptions of these criteria to focus on issues that are relevant to procuring capacity and tailored to the detailed design elements of the capacity remuneration mechanism.

1.5.2 These assessment criteria are set out below:

- **The Internal Electricity Market:** the market design should efficiently implement the EU Target Model and ensure efficient cross border trade.
- **Security of supply:** the chosen wholesale market design should facilitate the operation of the system that meets relevant security standards.
- **Competition:** the trading arrangements should promote competition between participants; incentivise appropriate investment and operation within the market; and should not inhibit efficient entry or exit, all in a transparent and objective manner.

- **Equity:** the market design should allocate the costs and benefits associated with the production, transportation and consumption of electricity in a fair and reasonable manner.
- **Environmental:** while a market cannot be designed specifically around renewable generation, the selected wholesale market design should promote renewable energy sources and facilitate government targets for renewables.
- **Adaptive:** The governance arrangements should provide an appropriate basis for the development and modification of the arrangements in a straightforward and cost effective manner.
- **Stability:** the trading arrangements should be stable and predictable throughout the lifetime of the market, for reasons of investor confidence and cost of capital considerations.
- **Efficiency:** market design should, in so far as it is practical to do so, result in the most economic overall operation of the power system.
- **Practicality/Cost:** the cost of implementing and participating in the CRM should be minimised; and the market design should lend itself to an implementation that is well defined, timely and reasonably priced.

1.6 STAKEHOLDER ENGAGEMENT

- 1.6.1 The stakeholder engagement approach for the detailed design stage begins with the publication of this consultation paper for which responses are welcome.
- 1.6.2 Following publication a public workshop presenting an overview of this consultation will be held on the 16 March 2016 in the Crowne Plaza Hotel, Dundalk. Further information on this event will be published on the All-island project website.
- 1.6.3 Feedback from both the stakeholder forum and the consultation responses will assist with informing our CRM Decision 3 due for publication July 2016.

2. OUR AUCTION DESIGN FRAMEWORK

- 2.1.1 In this section we set out our auction design framework, introduce some of the key auction design concepts which are used throughout this document, and highlight some of the key issues in the context of the I-SEM CRM auction design.
- 2.1.2 The I-SEM CRM auctions will be auctions to procure capacity. The auctioneer (i.e. the CRM Delivery Body, EirGrid/SONI) is the buyer, and is looking to buy multiple MW of capacity in each auction from multiple bidders. The “bidders”⁴ are offering to make capacity available by competing to obtain a physically backed Reliability Option.
- 2.1.3 Procurement auctions for multiple units, whether in electricity (e.g. capacity auctions, virtual power plant auctions) or in telecommunications (e.g. spectrum auctions) usually take one of a number of auction formats. As illustrated in Figure 6, the key elements of multiple unit auction design typically include:

- **Auction format.** The choice of auction format. Capacity auctions, where there are multiple MWs of a homogeneous good to be bought, typically use one of two format:
 - **Option 1: Sealed-bid, multi-unit auction.** Bidders simultaneously submit sealed offers comprising their supply curves, or a price-quantity pair. The bids are then aggregated, and the clearing price at which supply equals the demand is determined. Each bidder wins the quantity that it supplied at the clearing price. The winners’ payments may be based solely upon the uniform clearing price (“pay-as-clear”), or the amount of each winning offer (“pay as bid/offer”), with some variants around these options.
 - **Option 2: Multiple round descending clock auction.** The auctioneer announces prices to bidders, and bidders simultaneously submit offers indicating the quantities supplied at those prices. If aggregate supply exceeds demand, then the auction proceeds to a new round of bidding, in which the price “clock” has been decreased. When a round occurs in which aggregate supply no longer exceeds demand, the auction concludes. Each bidder wins the quantity that it offered at the final price (“pay-as-clear”).

The choice between these auction formats typically hinges on the concerns about the exercise of market power. Option 2 provides more opportunity for dominant players to exercise market power. Where multiple products are being auctioned, such as the DS3 auction, the auctioneer may use a combinatorial auction format, which allows bidders to express their price for a package of products. This format will need to be considered when CRM and DS3 auctions are to be combined. This auction format is more complex, and given our minded to position on transitional auctions (see Section 1.4), this format does not need to be developed further at this time.

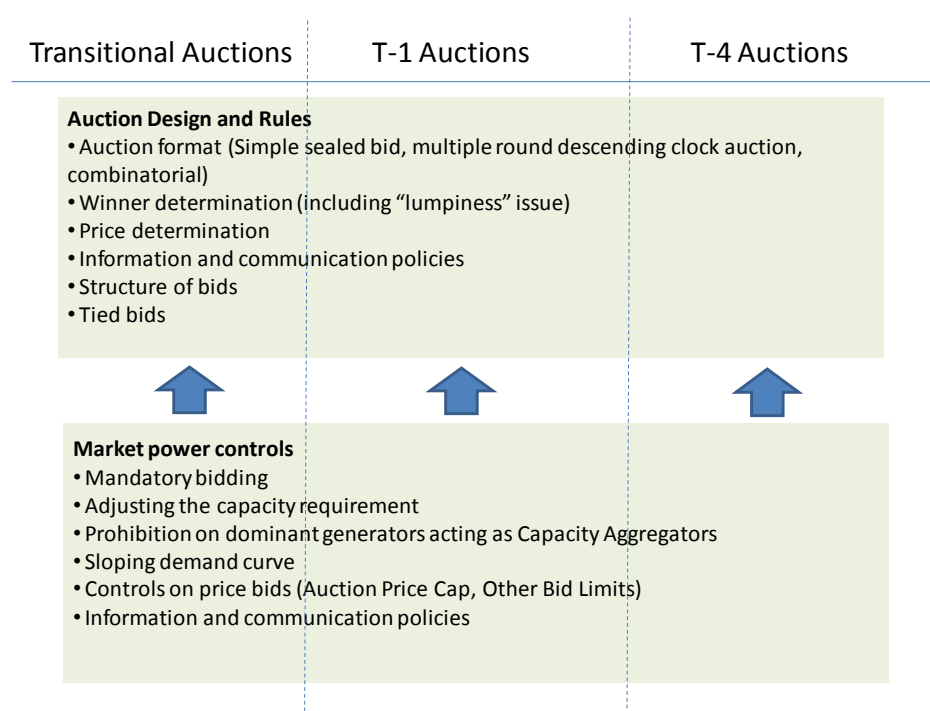
- **Winner determination.** How to decide auction winners- in our case who gets a Reliability Option. Identifying the auction winner may seem self evident. Bids are lined

⁴ Note that whilst the auction participants may be considered to be making “offers” we shall continue to call them “bidders” throughout this document, and to refer to their price offers as “bids”

up in price (merit) order, and the cheapest bids which meet the Capacity Requirement are the winners. However, as we shall discuss, there are potential complications if the auctioneer cannot award a Reliability Option to half a generation unit (the “lumpiness” problem). If the next Capacity Market Unit in the merit order is a 400MW CCGT, but the auctioneer only has a procurement requirement of 50MW, what does it do?

- **Price determination.** In our case the price determined by the auction is the Reliability Option fee. Again setting the market price may appear a simple affair- all winners are typically paid the same price, the price of the most expensive offer accepted. This approach is typically known as “pay-as-clear”, or alternatively “uniform clearing price” or “second price”. However, variants are possible, particularly where out of merit providers are selected as winners in response to the “lumpiness” problem;
- **Information and communication policies.** We need to define what information is provided to the bidders before qualification, between qualification and the auction, during the auction and after the auction. Clearly, transparency of information is generally positive. However, under certain circumstances provision of too much information can help bidders with market power to exercise that market power. Certain auction formats (such as the multiple round descending clock format) lend themselves to the provision of such information and are more prone to facilitating the exercise of market power.

Figure 6: Auction design framework



2.1.4 Typically in electricity and telecommunications auctions, there are a limited number of bidders who have a degree of market power. The I-SEM is no exception, and arguably the all-island market is more concentrated than many other markets which have held capacity auctions, such as certain US markets and GB.

2.1.5 Therefore a key element of the auction design is restricting the scope for these bidders to exercise market power. The scope to exercise market power can be restricted by a combination of:

- Appropriate choice of auction format- some formats give dominant players more scope to exercise market power than others;
- Appropriate winner and price determination rules;
- Appropriate information and communication policies; and
- A range of other market power controls that constrain the volumes and prices that dominant bidders (or all bidders) can bid, including:
 - Mandatory bidding (addressed in CRM Decision 1);
 - Adjusting the Capacity Requirement (addressed in CRM Decision 1);
 - Prohibitions on dominant generators acting as Capacity Aggregators for other smaller players;
 - Using a sloping demand curve, rather than a fixed Capacity Requirement (a vertical demand curve);
 - Controls on the price that bidders can bid.

2.1.6 The auction design and rules (format, winner and price determination rules and some more detailed rules such as the structure of bids, treatment of tied bids) along with some of the potential market power controls will underpin the development of functional requirements for the auction platform and the procurement of the auction platform.

2.1.7 Given the interactions described above, in Section 4 we start with a discussion of potential market power in the I-SEM CRM auctions, and potential market power controls to be applied in the auction, before returning to a discussion of auction design in Section 5. However, before commencing the discussion of market power, it is useful to set out a high level description of how the different auction formats work, in order to frame the debate.

3. AUCTION FREQUENCY AND VOLUMES

3.1.1 We envisage that there will be a range of different auctions, including:

- **Transitional auction(s)**, to cover the period up to the delivery year of the first T-4 auction. The key feature of these auctions is that there is expected to be little scope for new entry due to time constraints (although new entrants will be permitted);
- **T-4 auctions**. These auctions will take place annually and will procure capacity with an approximate 4 year lead time to the Capacity Delivery Year; and
- **T-1 auctions**. These auctions will take place annually and will procure capacity in the year preceding the Capacity Delivery Year.

Transitional year auctions

3.1.2 The minded to position is that we will conduct separate T-1 auctions for each of the Capacity Delivery Years up to the delivery year of the first T-4 auction. Each of these auctions will procure the total Capacity Requirement for that year in that T-1 auction.

3.1.3 The first auction, to be held in June 2017, will be to procure the entire Capacity Requirement for 2017/18⁵. Lessons learnt from this auction will then be factored into subsequent T-1 auctions for Capacity Delivery Years during the transitional years. These T-1 auctions will differ materially from subsequent:

- T-1 auctions because they will be procuring the total Capacity Requirement, unlike the later T-1 auctions, which will be procuring a relatively small MW volume; and
- T-4 auctions since there will be limited scope for new entry.

3.1.4 As a result, it will be even more imperative that appropriate market risk controls are applied in these transitional auctions.

T-4 Auctions

3.1.5 Beyond the transitional period, the majority of the Capacity Requirement would be procured at the T-4 auctions. This will ensure that the price which will have the biggest impact on customer bills will be determined in an auction where new capacity is competing alongside existing capacity, which will:

- Help to mitigate the market power of existing capacity providers. However, as discussed in Section 4, we still expect market power to be a concern in T-4 auctions, and expect the T-4 auctions to have a suite of market power controls; and
- Ensure that the price paid by consumers substantially reflects the costs of new entry, where relevant. All categories of capacity provider, i.e. existing and new capacity as well as DSUs will be eligible to submit price bids, in the T-4 auctions, although we recognise that the participation of DSUs may be limited in the T-4 auction.

3.1.6 In the T-4 auction, the auctioneer will determine the amount to be auctioned in each auction as:

⁵ With appropriate adjustments for non-bidding capacity

Amount auctioned = Capacity Requirement – Amount already contracted for the Capacity Delivery Year via previous T-4 auctions – Amount withheld for T-1

- 3.1.7 Note that if projections of future capacity in four years' time are such that no new contracts are required, the SEM Committee may cancel the T-4 auction for that year. This may happen if, for instance, there is already a lot of capacity already contracted under long-term contract, and there is a decline in expected peak demand, leaving no, or only a very small additional procurement requirement. Any small amount of capacity can then be procured in a T-1 auction nearer the time when the exact supply/demand balance is better understood.
- 3.1.8 The SEM Committee plans to hold T-4 auctions annually, approximately 4 years in advance of the Capacity Delivery Year. We note that within GB their T-4 auction can be held anytime within a period ranging from 4 years and 1 month to 3 years and 2 months before the start of the delivery year for which the auction is to be held. In considering the timeframe in which to hold the annual T-4 auction we propose having the flexibility of 6 months either side of a 4 year period.

T-1 Auctions

- 3.1.9 The rationale for holding T-1 auctions is that:
- It is envisaged that some Demand Side Units may have difficulty predicting their ability to commit to reducing load 4 years ahead of the Capacity Delivery Year; and
 - The Capacity Requirement cannot be forecast with complete accuracy 4 years in advance of the Capacity Delivery year, so procuring 100% of the expected requirement 4 years in advance may result in procuring more capacity than is required.
- 3.1.10 The SEM Committee will consult periodically on the volume of the Capacity Requirement to withhold from T-4 auctions to T-1 auctions, and this amount may grow over time if the contribution of DSUs increases.
- 3.1.11 The auctioneer will hold a T-1 auction for the residual capacity requirement in the year preceding the Capacity Delivery Year, based on an updated estimate of the Capacity Requirement for the Capacity Delivery Year in question. This amount may differ from the amount originally withheld from the T-4 auction to the extent that:
- The Capacity Requirement required to meet the security standard has changed;
 - Any new capacity originally contracted in the T-4 auction has had its capacity contract cancelled, and has not already been re-tendered.
- 3.1.12 We note that the practice of holding Capacity Requirement back from T-4 auctions to T-1 auctions is employed in other markets such the US PJM (Pennsylvania-Jersey-Maryland) and MISO (Mid-Continent ISO) markets, as well as in GB. PJM and MISO hold back about 2.5% and

5% of their Capacity Requirement for T-1 auctions respectively, and GB procures under 2% of the Capacity Requirement at T-1 auctions⁶.

- 3.1.13 All categories of capacity provider will be eligible to compete in the T-1 auction, including new capacity, although new capacity will need to prove during the qualification process that it can feasibly deliver within the Capacity Delivery Year. However, any new capacity which meets the new capacity definition⁷, but which opts to participate in the T-1 auction will only receive a 1 year contract whereas if it participates in the T-4 auction it can receive a multi-year contract.
- 3.1.14 This allows for some forms of capacity that meet the investment threshold to be “new capacity” but can be installed within a year- e.g. smaller reciprocating engines, some solar farms, onshore wind farms to potentially enter in the T-1 auctions.
- 3.1.15 We are considering the timeframe in which to hold the annual T-1 auction and note that within GB their T-1 auction can be held anytime within a period ranging from 13 months to 2 months before the start of the delivery year for which the auction is to be held.

Other auctions

- 3.1.16 If any new capacity fails to meet its Implementation Agreement, milestones to the extent that its capacity contract is cancelled, the SEM Committee may choose to re-auction the capacity for that Capacity Delivery Year as a T-3 or T-2 auction (depending on when the capacity contract is cancelled). Alternatively the SEM Committee may choose to wait and re-auction the capacity shortfall in the T-1 auction. These other auctions to replace new capacity which failed to meet relevant Implementation Agreement milestones will be infrequent, and on an ad hoc basis.
- 3.1.17 In deciding whether to re-auction any shortfall as a result of cancelled contracts immediately or whether to wait until the scheduled T-1 auctions, the SEM Committee will be mindful of:
- Any change in forecasts of the Capacity Requirement for the Capacity Delivery year in question and the time when the capacity contract is cancelled; and
 - A risk assessment of the likelihood of being able to procure the additional capacity requirement in T-1 auctions at reasonable cost to customers⁸.

⁶ In the recent January 2016 GB T-1 auction, GB procured 800MW of capacity, compared to the Dec 2014 T-4 auction Capacity Requirement of around 45.4GW. Whilst these figures do not relate to precisely the same Capacity Delivery years, they provide a broad indication. Note also that supported renewables is not included in the 45.4GW, so the proportion procured in T-1 auctions is a smaller proportion of the total GB Capacity Requirement, inclusive of capacity provided by supported renewables, which is netted off the auction procurement requirement

⁷ or upgraded capacity definition, if relevant

⁸ For instance the SEM Committee may decide not to conduct a T-2 auction if it judges that it is too close to the start of the Capacity Delivery Year to generate competition from new capacity, and that it is too far in advance of the Capacity Delivery Year to generate material competition from DSUs

3.2 SUMMARY OF QUESTIONS

The SEM Committee welcomes views on all aspects of this section, including:

- 3.2.1 Do respondents agree with the proposed approach for transitional auctions, T-4 auctions and T-1 auctions? If not, please explain.
- 3.2.2 What is respondents view in relation to the flexibility around the timing of the T-1 and T-4 auctions?

4. MARKET POWER

4.1 INTRODUCTION

- 4.1.1 In this section we discuss how market power is a significant concern in the I-SEM capacity market, and set out a market power control framework. Gaming and the exercise of market power, both supply side and buy side, is a significant concern with capacity auctions and much attention has been given to this in the literature and in capacity auction design in the US and Latin America⁹. More recently, DECC have introduced a capacity market in GB in 2014 and implemented a suite of measures to prevent anti-competitive behaviour in their auction¹⁰.
- 4.1.2 The SEM Committee described market power in the context of the all-island electricity market in its Discussion Paper on I-SEM Market Power Mitigation (SEM-15-031) published on 9th May 2015, noting that *‘in developing the SEM, the Regulatory Authorities tended to consider market power as the capability that a market participant has to consistently enhance its profitability by raising or reducing electricity prices in the all-island wholesale spot market from levels consistent with appropriate competition. While a market participant may or may not exercise market power, the key issue is that it has the capability to do so. It is expected that a similar definition, at least in part, would be relevant for I-SEM, albeit with differences taking account of the emerging I-SEM design as discussed below. Such a definition could also account for the fact that a generation company with market power might also have the ability and incentive to foreclose competition in other ways; for example, by weakening existing competition, raising entry barriers or slowing innovation’*.
- 4.1.3 Broadly speaking, anti-competitive behaviour in capacity auctions can take the form of unilateral abuse of a dominant position (market power) by a single player or collusive behaviour by a number of players such that the auction clearing price is set above competitive levels (sell side) or suppressed below competitive levels (buy side). If the auction were perfectly competitive, gaming would not be possible as raising or lowering the price would deliver no benefit to the seller or buyer as they would lose market share to their competitors. Therefore, gaming is only possible where the auction is not competitive.
- 4.1.4 The I-SEM capacity market is likely to exhibit structural market power, creating challenges for the design of the auction. The Economic Social and Research Institute (ESRI) considered this issue in a recent research paper on the I-SEM¹¹ which cautioned that there could be a danger that if the total amount of Reliability Options cannot be sold without the participation of one

⁹ See for example FERC Assessment of Market Power Mitigation in US Capacity Markets (2013): <https://www.ferc.gov/CalendarFiles/20130826142258-Staff%20Paper.pdf>

¹⁰ For an assessment of gaming and market power issues and mitigation measures in the GB Capacity Market see Report by Charles Rivers from 2014:

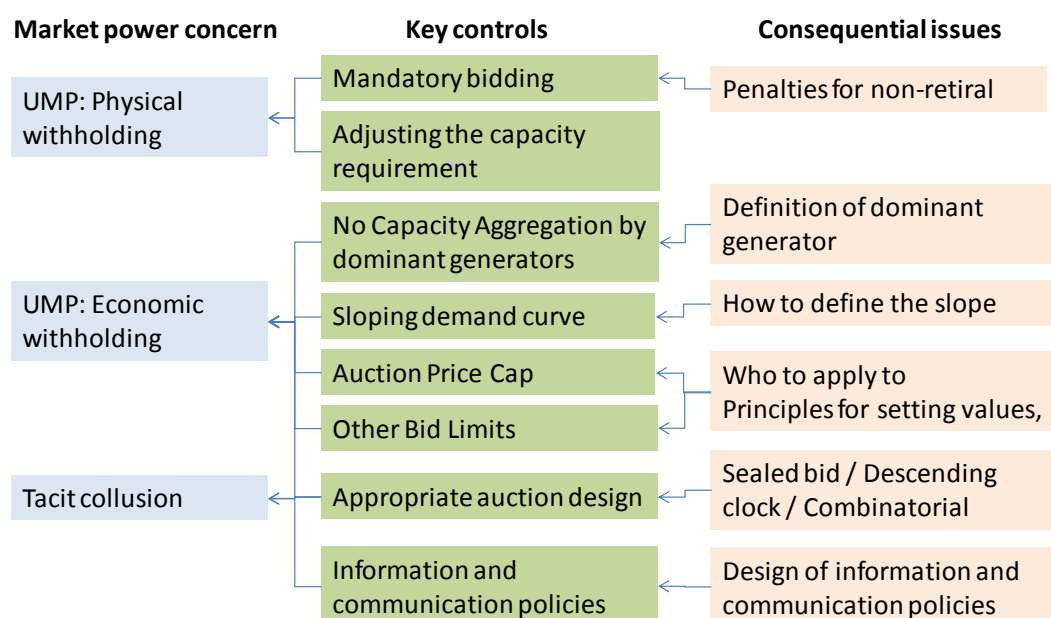
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/252746/CRA_Report_on_the_Capacity_Market_Gaming_Risks.pdf

¹¹ ‘The Irish Electricity Market: New Regulation to Preserve Competition’
<https://www.esri.ie/pubs/RN20150101.pdf>

particular firm, this firm will have both the ability and incentive to bid a high price for holding these options, which will lead to the auction clearing at a high price.

- 4.1.5 Given concerns of mitigating market power in capacity auctions worldwide and the specific challenges that these present in a relatively small and concentrated market such as the I-SEM, it is important to identify how market power abuse can damage the competitive outcomes in the capacity auction and identify proportionate measure to mitigate these based on international best practice.
- 4.1.6 For the purposes of the I-SEM, given the ‘single buyer’ model of the Reliability Option (where the TSOs centrally auction capacity on behalf of all consumers), we are mainly concerned with ‘sell side’ market power, that is the ability and incentive of capacity providers bidding into the auction to physically withhold capacity or economically bid into the auction in such a way that the auction clears above efficient levels, and thereby damaging long run investment signals and imposing costs on consumers. A range of factors, from the elasticity of the supply curve (i.e. the level of new entrants competing in the auction) to the market size and structure and slope of the demand curve and technology mix all play a part in how significant a problem market power is in capacity auction design. All these factors will play a part in the I-SEM capacity auction as set out in more detail below.
- 4.1.7 The high level framework is illustrated in Figure 7, which highlights our key market power concerns, the key controls that we are considering applying to mitigate potential market power abuse and consequential issues arising from the imposition of these measures. These issues are elaborated on throughout this section.

Figure 7: Market power control framework



- 4.1.8 It is important to note that the key controls set out in Figure 7 are ex-ante interventions to prevent anti-competitive behaviour through the capacity auction design. In addition to these

measures, gaming in the capacity auction falls under EU antitrust rules, relating both to abuse of dominant position and collusive practices. Furthermore, specific anti-gaming provisions may be included in the CRM contractual rules and applied alongside other specific market manipulation legislation or licence conditions which apply to the energy sector, most notably REMIT¹². Finally, robust market monitoring by the Regulatory Authorities and an independent Market Monitor/Auditor will be additional protection against non-competitive behaviour in the I-SEM CRM auctions. The role and responsibilities regarding the Auction Monitor/Auditor and the Regulatory Authorities are discussed in Section 7 while the specific market power concerns and suite of measures we are considering to address these are set out in this section.

- 4.1.9 In Section 4.2, we discuss the market power concerns at a qualitative level. The key market power concerns are that dominant generators will be able to exert unilateral market power by either physical or economic/financial withholding (i.e. by bidding a high price to increase the auction clearing prices) or through predatory pricing (where generators offer at prices below competitive levels to suppress prices to the detriment of their competitors, thereby increasing their market share). A further concern is the potential for collusion, including tacit collusion between market participants to affect auction outcomes.
- 4.1.10 Section 4.4, discusses the impact of new entry in I-SEM CRM on competition and considers the differences in market power concerns across the auction delivery timeframes in this respect.
- 4.1.11 Section 4.5 highlights the key competition metrics which are most relevant to measuring market power in capacity auctions, such as the **Pivotal Supplier Indicator**, the **Three Pivotal Supplier Test** and **Herfindahl-Hirschman Index (HHI)** and how they translate across to the assessment of ability and incentive of firms to exercise market power in the I-SEM capacity market.
- 4.1.12 It will not be possible for the Regulatory Authorities to establish precisely how competitive any given auction will be until the CRM Delivery Body (the TSOs) have run the qualification and derating processes and identified the MW of de-rated qualified capacity for that auction. This will be especially so for auctions in which new entrants are capable of participating. Notwithstanding this, in Section 4.6 we set out some high level quantitative analysis to illustrate the level of concentration amongst currently installed capacity. It shows that ESB will certainly have the capability to exercise market power in the transitional auctions, where the potential for new entry is more limited.
- 4.1.13 In Section 4.7 we set out a range of market power mitigation measures that we are considering employing in the I-SEM capacity auctions to ensure that anti-competitive behaviour is prevented. In CRM Decision Paper 1 (SEM-15-094) we made decisions to introduce two market power mitigation measures, mainly targeted at physical withholding. These are mandatory bidding and adjusting the capacity requirement¹³. Further market power mitigation measures are proposed in this section include:

¹² We will also consider including in the CRM Code and/or licences specific provisions such as the 'no market manipulation clause' and the requirement to sign a Certificate of Ethical Conduct both of which were provided for in the GB auction rules.

¹³ In addition, the I-SEM High Level Design provided that the CRM would be based on centralised reliability options. While the Reliability Option itself can serve to mitigate market power in the reference market by removing the incentive to submit offers above the strike price,

- The **Auction Price Cap**, which would limit the price at which all bidders could bid; and
- Other Bid Limits, most notably a **Price Offer Cap**¹⁴, which would apply at a lower level and limit the price at which existing non-intermittent firm transmission access generators could bid.

4.1.14 A key consultation question regarding market power mitigation measures are whether the Bid Limits should apply to:

- All existing generators¹⁵ or
- Only those which are deemed to be dominant as measured by the specific competition metrics applied to the auctions.

4.1.15 In addition, we consider whether:

- Bid Limits should apply to all existing generators at the same level, or apply on a technology specific basis
- A generator, with higher “going forward costs” can apply to the Regulatory Authorities for an exemption to the Bid Limit applied.

4.2 RELEVANT MARKET

4.2.1 Defining the relevant market is the starting point of any competition analysis and is standard practice for competition authorities when assessing anti-competitive behaviour. Market definition is also becoming an increasing element of competition assessment in energy markets in Europe with increasing cross border trade and market integration. The relevant market for consideration of market power in the CRM is the capacity auction. As set out in the I-SEM Market Power Consultation Paper, the following elements are generally taken into account when considering the relevant market:

- The product(s) or services offered in the market;
- The timeframe in which the relevant products are traded;
- The stage of the supply chain where the activity takes place (in this case production, transmission, distribution);
- The geographic area in which the supply and demand for the product interact.

4.2.3 Regarding the capacity auction these are:

- **Product** – clearly the product definition is the forward capacity product that is auctioned for the delivery year in each capacity auction.
- **Geographical market** – The I-SEM capacity market will be a single zone and therefore the geographical market definition for measuring competition is the island of Ireland.

the centralised design – i.e. a single auction that procures capacity for the whole market – concentrates liquidity and is less susceptible to market power manipulation than a decentralised capacity market.

¹⁴ The market power mitigation measures discussed in this section can be applied and adapted regardless of the form of the auction (i.e. simple sealed bid format, multiple round descending clock, combinatorial). For example, the price offer cap applied in a sealed bid auction becomes a price taker threshold in descending clock auction.

¹⁵ non-intermittent firm transmission access

- **Time** – In the same way as when energy market competition differs across timeframes, capacity markets may be assessed for competition differently depending on how far in advance of delivery they are run. Auctions with longer lead times allow new entrant capacity provider to compete whilst shorter lead time auctions or transitional auctions are less conducive to new entrant participations though may facilitate more demand side participation.

4.3 KEY MARKET POWER CONCERNS

4.3.1 Market power can take a number of forms. In the context of an auction, competition policy authorities and the auctioneer may be concerned about the exercise of:

- **Unilateral market power.** Unilateral market power exists where an individual firm has the ability to profitably raise prices above competitive levels (or reduce the value of its offer to consumers in other ways), independently of the behaviour of rival firms; or
- **Co-ordinated market power.** Co-ordinated market power can take the form of:
 - **Explicit co-ordination**, through direct sharing of information with cartel like behaviour.
 - **Tacit coordination** is where firms in the market participants can anticipate each other's future actions and can tacitly establish a coordinated course of action (such as to raise prices above competitive levels), without communicating directly or sharing information.
 - Cartel like behaviour is clearly contrary to competition law, and no auction design features can mitigate deliberate cartel like behaviour, where bidders explicitly share information on what price and quantity they are going to bid before the auction. Preventing cartel like behaviour is a matter of ensuring robust monitoring of auctions, and having the capability to identify suspicious bidding behaviour and investigation by the appropriate regulatory and competition authorities.

4.3.2 In the remainder of this section we focus on unilateral market power concerns and tacit co-ordination concerns, and discuss how auction design/ auction rules can be developed to mitigate them.

4.3.3 One key characteristic of electricity markets is the fact that demand is price inelastic (in the absence of a significant volume of price sensitive large industrial load) with the demand curve being near-vertical. The inelasticity of demand is widely recognised as having an impact on pricing in the energy market, and the ability of certain market participants to exert market power at times of system stress. This issue was extensively discussed in SEM-15-094.

4.3.4 The inelastic nature of demand for energy also translates to an inelastic demand for capacity (which is the provision of availability at times of system stress). Given the inelastic demand for capacity, there is significant potential for existing market participants to exert market power in capacity auctions, either by withholding capacity from the auction or through artificially suppressing prices through below cost bidding or predatory pricing or alternatively withdrawing

capacity from the auction by bidding significantly above costs. Withholding of capacity from the auction is considered in detail in this section. The two key forms of capacity withholding are:

- Physical capacity withholding: Market participants decide not to enter capacity in the auction; and
- Economic capacity withholding: Market participants decide to withdraw capacity from the auction by bidding significantly above costs.

4.3.5 Both physical and economic withholding of capacity may enable a capacity provider to artificially increase the clearing price for capacity determined in the auction. Physical or economic withholding strategies may be employed unilaterally by a portfolio generator in an energy market or in a capacity market. A portfolio generator hopes that by withholding one unit in its portfolio, the gains that it makes by achieving a higher price on its remaining units will outweigh the loss of income on the unit it withdrew from the market.

4.3.6 In an energy market, at times of system stress, a generator may increase prices through withholding tactics (which are not legal), since:

- By definition, at times of system stress, there is little competition from other generation;
- In markets such as the SEM at the current time there may be insufficient demand side response to provide meaningful competition to generators; and
- The price elasticity of demand for electricity is typically high, with System Operators required to balance the system at any price up to an Administered Scarcity Price.

4.3.7 It may be more difficult for a generator (or group of generators) to increase prices through withholding strategies in a capacity market, because there is potentially scope for new entry in capacity markets, whereas there is limited time for new entrants in spot energy markets¹⁶.

4.3.8 Withholding strategies are most likely to be profitable for a large portfolio generator (in both energy and capacity markets), which can withhold one unit from the market, and hopes to increase the price it earns on its many remaining units¹⁷.

4.3.9 A further source of unilateral market power is below cost bidding or predatory pricing where capacity bidders in the auctions submit offers below cost in order to suppress auction clearing prices and thereby force their competitors to exit the market. This form of market power abuse has mainly come from 'buy side' bids in the US capacity markets where there may be incentives from regulated load to reduce and may be less relevant for the I-SEM. However, it is conceivable that firms with market power in the I-SEM capacity market may have the ability

¹⁶ In time to affect the delivery period in question, though a new entry response may occur if the strategy is repeated over a number of delivery period over an extended period of time

¹⁷ However, in theory, it may also be possible for a single generator to withhold part of its capacity. For instance, a 400MW nameplate CCGT could bid only 350MW of (say) 360MW de-rated capacity and hope to increase the price by more than 2.9% so that it earns more on the 350MW than it would have done on the 360MW.

and incentive to engage in predatory pricing, particularly during auctions with shorter lead times such as the transitional auction¹⁸.

Potential for Exercise of Unilateral Market Power

4.3.10 The extent to which an existing capacity provider can cause an increase in the capacity price in the auction through unilateral action depends *inter alia* on the:

- **Potential for new entry.** In contestable markets where there are low barriers to entry and exit, new entrants have a significant role in increasing competition. If new entrants can enter the market easily, even if there are few firms (or a single firm), as with oligopolistic and monopolistic markets, a market with no barriers to entry is more likely to be competitive¹⁹. However:
 - There may be significant barriers to entry, due to the availability of sites with existing grid connections and planning permission;
 - The scope for new entry will vary between transitional auctions, T-1 auctions and T-4 auctions, given the lead times between the auction and the start of the Capacity Delivery Year.
- **Level of concentration amongst existing market participants and new entrants.** Where existing market participants have a high market share, the potential for withholding strategies to increase price is greater. A unilateral withholding strategy is more likely to increase prices where a single market participant has a large market share, and is most likely to increase prices where a single capacity provider is pivotal- i.e. the capacity requirement cannot be met if the capacity provider in question withholds its capacity. As discussed in Section 4.5, using these measures, the I-SEM is likely to be highly concentrated, and certain market participants such as ESB, and possibly SSE and AES are likely to have a degree of market power in the auctions;
- **Excess of existing capacity over the capacity requirement.** Where the existing capacity significantly exceeds the capacity requirement, there is likely to be relatively strong competition between existing capacity providers in the auction. Whilst a large portfolio generator may still be able to unilaterally influence the market price by withholding capacity, if there is a large surplus of existing capacity over the capacity requirement, the generator is more likely to have to withhold a large volume of capacity to materially influence the price and the strategy is less likely to be profitable. Conversely, where withholding a small amount of existing capacity is likely to trigger the requirement for new entry, a withholding strategy is more likely to increase prices; and

¹⁸ For example, a vertically integrated market participant could theoretically have the incentive to bid a new generation plant at below cost into the Capacity Auction to suppress the capacity price that it supply business pays.

¹⁹ Low barriers to entry are a necessary but not sufficient condition to a competitive market.

- **Ex-ante Market power mitigation rules built into the auction design.** As discussed in Section 4.7, there are a number of market power mitigation measures that can be implemented in the auction rules, which can mitigate market power even where there is an adverse supply –demand balance, there is limited potential for new entry and the market is fairly concentrated.

Tacit Co-ordination Concerns

- 4.3.11 Tacit coordination occurs where market participants can anticipate each other's future actions and can tacitly establish a coordinated course of action (such as to raise prices above competitive levels), without communicating directly or sharing information.
- 4.3.12 Economists generally think about tacit coordination as resulting from repeated interactions between rival firms. At its simplest, a coordinated outcome occurs where firms eschew actions that would maximise their own profits in the short term because they fear that this may provoke 'punishment' from rivals in later periods. Instead, each firm would expect to earn greater profits by sticking to a 'coordinated' strategy than by deviating from it and then facing punishment from rivals. The coordination is tacit where this happens without any explicit agreement or direct communication between the coordinating parties (as by contrast would be the case with a fully-fledged cartel).
- 4.3.13 In general, three necessary conditions for the ability of firms to exercise coordinated power are that firms are able to:
- Reach and monitor an understanding on withholding;
 - Internally sustain an understanding, for example through a punishment mechanism; and
 - Exclude competition from outside the coordinating group²⁰.
- 4.3.14 Markets with certain key features are more amenable to tacit co-ordination than others. Like other electricity markets, the I-SEM capacity market has a number of features which make it more susceptible to tacit co-ordination, including:
- A relatively stable environment with few firms and relatively stable demand conditions;
 - A standardised product. De-rated capacity is a homogenous product, even if the technologies underpinning the service are non-homogenous;
 - Firms which are relatively symmetric in terms of cost structures. Where one firm has a clear cost lead, it may have limited incentive to co-ordinate with rivals it can beat.
- 4.3.15 In addition, the high degree of concentration in the all-island generation market, with a limited number of players including ESB, SSE and AES (see Section 4.5) increases the potential for tacit co-ordination.
- 4.3.16 However, there are a number of features of the I-SEM / I-SEM capacity market design which can be expected to reduce the scope for tacit co-ordination:

²⁰ Energy market investigation: Market power in generation, UK Competition and Markets Authority, 5 March 2015

- Infrequency of auctions. Auction are expected to occur annually²¹, i.e. much less frequently than energy market, so the period between any breakdown of tacit co-ordination and punishment is longer than in energy markets, where any retaliation can occur next day, if not sooner.
- Long term contracts available at T-4 auctions. With multi-annual contracts on offer to new investors, there is a strong incentive on new entrants not to collude, as they will retain the benefits of any break in collusion for the full 10 years on that plant.

4.3.17 Coordination can only continue if there are no significant competitive constraints coming from beyond the existing rivals. Factors which reduce the ability of existing firms to co-ordinate include:

- Barriers to entry or expansion of non co-ordinating firms;
- The number and size of the non-coordinating rivals and, in particular, their ability and incentive to expand to take significant business from the main coordinating parties.
- The existence of one or more 'maverick' suppliers, with different incentives to the coordinating group, which have the potential to disrupt coordination.

4.3.18 The choice of auction design will, to some extent impact the potential for tacit collusion. A multiple round descending clock auction, which provides feedback to bidders on the bidding behaviour of other bidders at the end of each round allows bidders with greater scope for tacit co-ordination, by providing more instantaneous feedback on the bidding behaviour of other market participants. As discussed in Section 5.2, the extent to which the multiple round format allows bidders to exercise unilateral market power or to tacitly collude is one the key factors that will determine the choice of format.

4.3.19 Regardless of the auction design, the auction rules should seek to prevent some of more explicit forms of tacit co-ordination. For instance, the rules should prevent a significant player giving a tacit pre-auction signal of what price it is going to bid in the auction (and therefore signalling what price others should bid to co-ordinate withdrawal) by forbidding capacity providers from making public statements of their expectation of the auction clearing price.

4.3.20 Furthermore, any collusion by capacity providers in the auction will come under the REMIT and wider EU competition law.

4.4 IMPACT OF NEW ENTRY ON COMPETITION

4.4.1 The scope for new entry to impact competition will vary significantly between the Transitional Auctions, T-4 auctions and T-1 auctions, due principally to the lead times between the auctions and the start of the capacity delivery period. This could result in different levels of market power controls being applied to different auctions.

²¹ Both T-4 and T-1 auctions are expected to occur annually, following any transitional period

Transitional Auctions

- 4.4.2 The Transitional Auctions relate to the period where we are not expecting material new investment. In general, market power in shorter term auctions is more severe due to the inelasticity of the supply curve (i.e. the lower chance of new entrants' competing).
- 4.4.3 As set out in Section 1, the SEM Committee are minded to go with an auction each transition year separately: Under this option, during the transitional period, each year's Capacity Requirement would be procured in T-1 auctions for the following delivery year. A final decision on this will be published in May 2016.
- 4.4.4 The first Transitional Auction is expected to take place in June 2017 for delivery year 2017/18. There will therefore be limited time for new capacity providers to enter the market and compete with existing generators, if they are relying on a Reliability Option to finance their investment.
- 4.4.5 The ability and incentive to exercise market power in the Transitional Auctions is likely to be a function of existing installed generation capacity (the elasticity of the supply curve) and we discuss this in quantitative terms in Section 4.6.

T-4 Auctions

- 4.4.6 The SEM Committee are minded to have auctions approximately 4 years ahead of delivery, with new build plant allowed a further 18 months to complete their projects. A final decision on this will be published in May 2016.
- 4.4.7 The timing of these auctions has been designed to facilitate new entry²². Most if not all relevant²³ generation technologies can be built in this timeframe, and new investors have a further 18 month period after the start of the Capacity Delivery year before they miss the long-stop date. The impact of new entry in restraining market power in T-4 auctions may be dampened, if there are significant barriers to entry for new generation entrants, such as not having access to sites with planning permission or existing grid connections. Withholding may also be a concern in T-4 auctions if the new plants are being offered by parties that already have a high market share of existing capacity, who may choose to withhold either their existing or new capacity.
- 4.4.8 Market power in T-4 auctions would be a significant concern since:
- T-4 auctions are where the majority of capacity will be procured;
 - T-4 auctions commit the CRM Delivery body to long term contracts, so the effect of market power in any given auction could impact customers for, say, 14 years²⁴.

²² Balancing development lead times needed for most plant against the desire not to auction too far ahead at a point in time when the Capacity Requirement is more uncertain

²³ Not including nuclear, which is not relevant to the I-SEM

²⁴ E.g., if the contract is for 10 years, with a 4 year construction window, the consumer impact will be from year 4 to year 14

- 4.4.9 If the Cost of New Entry (i.e. Long Run Marginal Cost of Capacity) is significantly higher than the Recurring Costs (i.e. the Fixed Operating and Maintenance Costs or the Short Run Marginal Cost of Capacity, SRMC) of existing Capacity Market Units, then existing Capacity Market Units may be able to exert a degree of market power even if the ownership is fragmented.
- 4.4.10 Market conditions which result in reduced demand or an oversupply in the market can influence existing Capacity Market Units to tacitly collude to set the auction price. This would be a further rationale for apply bidding controls in T-4 auctions, and to apply them to more than just generators with a large market share.

T-1 Auctions

- 4.4.11 Whilst it may be possible for some generation technologies and demand side response to enter the market in these timeframes, the extent of competition from new entrants will necessarily be more limited. However, we are less concerned about the potential to exercise market power in T-1 auctions, since:
- The percentage of capacity expected to be procured is small, and the SEM Committee will take into account the expected level of competition in T-1 auctions in deciding how much of the Capacity Requirement to hold back for these auctions;
 - The ability of Demand Side Units to participate in these auctions, where we believe the market is more fragmented, and with potential for new entry greater; and
 - If auction volumes to be procured are small, a sloped demand curve can be relatively effective in constraining market power.

4.5 APPROPRIATE MARKET POWER METRICS IN THE I-SEM CRM

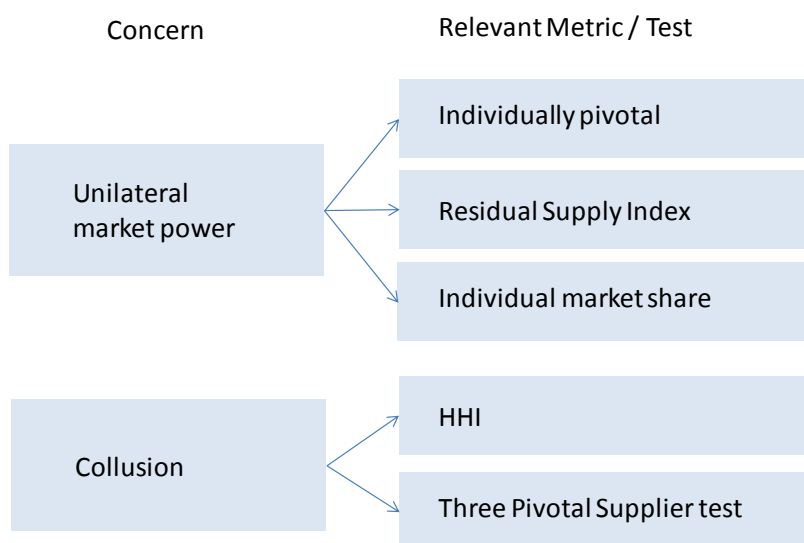
- 4.5.1 In this section we review metrics used to assess market power, and the available evidence on the level of market power in the I-SEM CRM. We show that available quantitative evidence suggests a *prima facie* reason for concern, and for imposing market power controls. In Section 4.7 we discuss the potential controls to be applied.
- 4.5.2 Some of the market power controls discussed in Section 4.7 will, by their nature, be applicable to the generality of the market (e.g. a sloping demand curve), whilst some of the measures could be applied only to market participants with market power or to all participants (e.g. a Price-taker Offer Cap). We therefore discuss how these metrics could be used to determine whether a particular bidder has market power and hence should be subject to participant specific market power controls.

Market power metrics and critical values

- 4.5.3 Competition policy authorities use a range of market power metrics/tests to assess static market power (i.e. excluding the potential impact of new entry). As illustrated in Figure 8, some of these metrics / tests are more applicable to measuring the scope of an individual market participant to exercise unilateral market power, whilst other metrics / tests are more

applicable to measuring the scope of a group of market participants to jointly exercise market power.

Figure 8 : Market power concerns and metrics



Market shares

- 4.5.4 Market share is the simplest measure of a market participant’s ability to exercise unilateral market power. The EC guidelines on horizontal mergers quote 50% as the point above which the market share of the single largest market players may in itself be evidence of the existence of a dominant market position²⁵. However, the EC does not state the converse, that market shares of under 50% may not confer market power.
- 4.5.5 As shown in Section 4.6, at the current time, the best estimate is that the de-rated market share of ESB, the largest player is likely to be of the order of 40%, once interconnectors and de-rated wind capacity are included.

Pivotal Supply Indicator and Associated Tests

- 4.5.6 The Pivotal Supplier Indicator (PSI) is an indicator that makes an assessment that combines supply and demand conditions in the electricity markets, with a supplier’s market share. The PSI assesses if a particular generator is “pivotal” in serving demand.
- 4.5.7 A capacity provider (i.e. a supplier in the auction context) is deemed pivotal in any given period if demand could not be met if it withdrew all its capacity from the market- with the clear implication it has the capability to increase prices by economic withholding. The Pivotal Supplier Indicator is therefore a binary metric- either a supplier is pivotal or it is not, with the implication that if it is pivotal it clearly has unilateral market power (although one cannot infer it has no market power if it is not pivotal).

²⁵ According to well-established case law, very large market shares — 50 % or more — may in themselves be evidence of the existence of a dominant market position, paragraph 17 of the Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings (2004/C 31/03), Official Journal of the European Union

4.5.8 In the context of an I-SEM CRM auction, to fully prove that any given generator is pivotal it will be necessary to have:

- Established specified de-rating factors for each plant;
- Completed the calculation of the de-rated Capacity Requirement; and
- Completed the Qualification process to know which new plant is entering the auction.

4.5.9 Clearly, these processes have not been completed yet for the first auctions. However, as demonstrated in Section 4.6 , given that ESB has over 4,000MW of existing nameplate capacity in a system where the Capacity Requirement is around 7,000MW²⁶, ESB is almost certain to be pivotal. Depending on the results of the Qualification process it is conceivable that other players such as SSE and AES may also be pivotal. This would be grounds for applying a range of participant specific market power controls to ESB, and possibly to SSE and AES in the auctions.

4.5.10 Some electricity markets (both energy and capacity markets) apply an extension of the Pivotal Supply Indicator to assess the potential for more than one supplier to jointly exercise market power. The tests are known as the Two Pivotal Supplier test or Three Pivotal Supplier depending on the number of suppliers considered²⁷. With a Three Pivotal Supplier Test, supplier X is deemed to fail the Three Pivotal Supplier test in any auction, if the withholding of supplier X's capacity plus the withholding of all the capacity of the two largest suppliers would mean that demand cannot be met.

4.5.11 Assuming that ESB was, on its own, pivotal in any given auction, it would mean all participants would fail the Two Pivotal Supplier test or the Three Pivotal supplier test. Thus if we are concerned at the prospect of two or three bidders acting jointly to exercise market power, failure of the Two or Three Pivotal Supplier test would be the basis of applying the whole suite of market power controls to all bidders, not just individually dominant bidders²⁸.

4.5.12 The Regulatory Authorities have previously also discussed the Residual Supply Index (RSI) as a relevant metric in the context of the energy market²⁹. The RSI is a more complicated metric which takes into account the pivotality of a supplier in a range of hours, not just peak stress hours. This metric may impose unnecessary complexity in the consideration of capacity market power.

The Hirschmann Herfindahl Index (HHI)

4.5.13 The HHI is one of the most commonly used market power metrics and is calculated as the sum of the squares of the markets shares of the market participants in the relevant market. The

²⁶ Based on the approach for the existing CPM, not using the de-rated approach to be applied in the I-SEM.

²⁷ For example the New York ISO uses a pivotal supplier test for the forward capacity auctions. Any entity, in combination with its affiliates, controlling 500 MW or more of unforced capacity necessary to meet New York City's capacity requirement is deemed a pivotal supplier and is therefore subject to mitigation.

²⁸ PJM uses the Three Pivotal Supplier test as the criteria for applying controls in the both energy markets (day-ahead, real time, regulation markets) and the capacity market. See <http://www.pjm.com/~media/committees-groups/task-forces/gofstf/20150722/20150722-item-02-imm-tps-education.ashx>

HHI can vary between 0 and 10,000. The HHI is a measure of overall industry concentration and as such, is a measure of the ability of a group of market participants to jointly exercise market power.

4.5.14 The Regulatory Authorities used the HHI as their main metric when controlling SEM market power via Directed Contracts (DCs). The Regulatory Authorities applied the HHI metric separately to the baseload, mid-merit and peak market segments in order to calculate the appropriate MW level of DCs. An HHI of 1,150 is used as the benchmark for setting the level of DCs.

4.5.15 As shown in Section 4.6, at the current time the HHI of de-rated capacity is estimated to be around 1,900. Therefore if an auction was conducted immediately, this metric would reinforce the fact that there would be a *prima facie* concern that a handful of larger players could jointly exercise market power. If the HHI were to be used as a metric to measure market power in the capacity auction, consideration would need to be given to whether the aim of the mitigation measures is to reduce the HHI to an acceptable level of market concentration (e.g. to competitive levels below, say, 1,150) or to apply those mitigation measures to all capacity providers as a result of the HHI analysis.

4.6 MARKET POWER OF EXISTING MARKET PARTICIPANTS

4.6.1 By most of the measures outlined above, the all-island capacity market will be relatively concentrated. Whilst we cannot be sure of the level of new entry in any auction, as illustrated in Table 1, based on the current installed capacity, there are a number of generators who may be able to exercise market power in capacity auctions, unless appropriate market power controls are inserted into the auction design/rules.

Table 1 : Market shares of current installed capacity

	Name-plate MW	Estimated de-rated MW	De-rated market share	HHI Contribution (de-rated capacity)
ESB PG (Non Wind)	4,073	3,590	38%	1,451
SSE (Non Wind)	1,264	1,065	11%	128
AES	1,022	896	10%	90
Viridian Huntstown 1&2	736	648	7%	47
NIE PPB	587	517	5%	30
BG Energy	444	391	4%	17
Tynagh Energy	386	340	4%	13
BnM	234	212	2%	5
Aughinish	162	146	2%	2
Other dispatchable generators	185	163	2%	
Demand Side	235	235	2%	
Moyle Interconnector	450	338	4%	13
EWIC Interconnector	500	375	4%	16
Total wind	3,573	511	5%	
Total	13,851	9,425	100%	1,813

- 4.6.2 The estimates in Table 1, are **indicative only** to give context to the market power analysis. The numbers are based on plant capacity figures presented in the 2016-2025 Generation Capacity Statement³⁰ and are calculated using GB de-rating factors (which are likely to be different from those that appropriate for the I-SEM). They assign a 75% capacity credit to the interconnectors, following the approach used in the Generation Capacity Statement. The I-SEM CRM de-rating factors will be consulted up on in Quarter 3 2016.
- 4.6.3 Notwithstanding the uncertainty around new entry and de-rating factor assumptions, the estimates suggest that ESB will have market power in the auctions, and that some other generators such as SSE and AES may have market power in the auctions too.
- 4.6.4 ESB will almost certainly be a pivotal supplier since it has around 3,600MW of estimated de-rated capacity out of a total of 9,400MW. Subtracting this estimated capacity from the total leaves around 5,800MW of other de-rated capacity, compared with a peak demand of around 6,600MW. With the absence of appropriate controls they could exercise that market power by withholding capacity and driving up the auction clearing price. The data also confirms that any supplier is likely to fail the Three Pivotal Supplier test, as any group of three suppliers will be pivotal if ESB is one of them (as required by the Three Pivotal Supplier Test).
- 4.6.5 It is less clear cut whether SSE and AES will also be pivotal suppliers, but generators do not have to be pivotal in order to have market power. SSE has over 1,200MW of non-wind nameplate capacity, plus additional wind capacity. AES has around 1,200MW of nameplate thermal capacity.

4.7 MARKET POWER MITIGATION APPROACHES

- 4.7.1 The concerns about market power can be mitigated by auction design choices and by rules governing the participation in the CRM auctions.
- 4.7.2 The key market power mitigation strategies are:
- Rules on physical withholding- making bidding mandatory;
 - Adjust the capacity requirement down for physical withholding (non-bidders);
 - Price controls on economic withholding, including:
 - An Auction Price Cap, which is a form of reserve pricing, which limits the amount that the auction can clear at, and by extension, the maximum amount that a bidder can bid;
 - Other Bid Limits set at levels below the Auction Price Cap, to apply to existing generation which is mandated to bid;
 - Introducing a sloping demand curve;
 - Prohibitions on provision of aggregation services by dominant capacity providers; and
 - Information strategy.

³⁰http://www.soni.ltd.uk/media/documents/Operations/CapacityStatements/Generation_Capacity_Statement_20162025.PDF

- 4.7.3 These market power remedies can be applied to any of the auction formats under consideration (simple sealed bid, multiple round descending clock auction or combinatorial), although the mechanics of how the controls apply may differ.

Rules on physical withholding and adjusting the capacity requirement

- 4.7.4 Physical withholding occurs in a market where a seller decides not to bid into the market in the hope that it causes the market price to rise. As discussed above, the scope for the exercise of unilateral market power (or co-ordinated market power) depends on *inter alia*:

- The potential for new entry, which is greater in T-4 auctions than in T-1 auctions;
- The excess of supply (bidders) over demand (the capacity requirement); and
- The level of concentration amongst existing market participants and new entrants.

- 4.7.5 The scope for use of withholding strategies remains a concern due to the level of concentration amongst existing market participants. If, for instance, ESB was allowed to and decided to withhold a substantial proportion of its estimated de-rated capacity market share, then this could have a substantial impact on the capacity market clearing price for the first T-1 auction.

- 4.7.6 In SEM-15-103, the SEM Committee took a number of decisions which either restrict the scope of **physical withholding** or mitigate the market power effects of physical withholding. These include:

- **Mandatory bidding for dispatchable generators with firm transmission access rights**, who expect to be operating at the end of the capacity delivery year in question. However, dispatchable plant planning to retire before the delivery year may choose not to bid in the auction, as can dispatchable plant without firm transmission access and any intermittent plant; and
- **Adjusting the capacity requirement** for existing generators who exercise their right not to bid.

- 4.7.7 However, there may be a case for additional controls to be applied to plant that opts out of auctions, and is either:

- Still operating at the end of the capacity delivery year (in the case of dispatchable firm access generation that used decommissioning as the reason for withdrawing from the auction, but does not decommission); or
- Wants to opt back in to auction at a later date (including, for instance intermittent plant that exercises its right to bid zero volume in a T-4 auction, but subsequently wants to bid in the T-1 auction).

Limiting future participation by opted-out capacity (physical withholding)

- 4.7.8 Whilst reducing the amount of capacity bought in the auction from which they have withdrawn will remove some of the opportunities for gaming, we may wish to consider additional rules/sanctions, such as:

- Preventing existing plant which has opted out of the T-4 auction from subsequently bidding in the T-1 auction for the same delivery year; and
- Taking further enforcement action on existing dispatchable plant which opted out of an auction on the grounds that it was going to retire before the end of the capacity delivery year, but is subsequently found to be still operational at the end of the year. Any penalty for “falsely” declaring may be strengthened further by limiting participation for one or more years following that delivery year.

4.7.9 A plant owner may also engage in physical withholding in the T-4 auction on existing plant (e.g. by claiming it is going to retire) in order to:

- Increase the T-4 price and gain a higher priced 10 year contract on its new investment. Its strategy could then be to bid the existing plant into a subsequent T-1 auction, claiming that it has changed its mind on retiring the plant because of changed market circumstances. When it bids the existing plant into the later T-1 auction it will have no effect on the long term contract price it receives on its new plant.
- Avoid a given T-4 auction in the expectation of getting better prices in the later T-1 auction that focus on the same delivery year, e.g. it chooses not to bid in the T-4 auction held in 2017 for 2021 capacity delivery, and then wants to bid in a T-1 auction held in 2020 for the 2021 capacity delivery.

4.7.10 The former activity is clearly a type of gaming/market manipulation which should be prevented. However, the latter activity is arguably normal arbitrage activity which market participants can engage in most markets which are unregulated (over and above the application of normal competition law), and which increases the efficiency of markets by reducing the scope for mis-pricing. However, it may not be possible to distinguish between bidders employing the two strategies, and allowing the latter strategy may provide a route to bidders to pursue the former strategy whilst they are actually employing the latter.

4.7.11 However, a plant owner which opts out of a T-4 auction may genuinely change its mind (e.g. due to revised economic forecasts, changes in fuel prices) and allowing them to bid in later auctions may promote economic efficiency and security of supply, it could also allow gaming of auctions and adversely affect competition objectives. **So should we allow a plant to opt back in to later auctions, if it does not retire?**

4.7.12 There may be a stronger case for giving dispensation for the following plant types, which did not bid originally but have been able to re-assess their risk exposure between the T-4 and T-1 auction. To some extent any plant may receive new information which causes it to re-assess the risk associated with holding a Reliability Option, but the scope for new information to affect the risk assessment is greater for intermittent plant and non-firm transmission access plant:

- Intermittent plant-at least for an introductory grace period. There may be a case for allowing intermittent plant, who may be uncomfortable in participating in the first T-4 auctions that occur before the start of I-SEM to participate in the T-1 auctions to be held in say 2020 for 2021. By 2020 they will have had significant experience of

operating under the I-SEM and better understanding of the risks. Such an approach may have a material impact on promoting environmental objectives, economic efficient and equity objectives whilst having a minimal effect on the risk of market power adversely affecting competition objectives.

- Non-firm transmission access generation. A non-firm generation may be granted firm transmission access between the T-4 auction and T-1 auction. Alternatively, even if it has not been granted firm transmission access rights, it may decide that there has been a material change in the probability that it will be constrained off, due to new information. Allowing a non-firm transmission access plant to re-assess its risk may also promote economic efficiency and equity objectives³¹.

4.7.13 There may also be a need to exempt any plant which has subsequently been requested by the TSOs to remain operational for other reasons (e.g. for ancillary service reasons) from sanctions.

4.7.14 If plant was allowed to opt back in, capacity which had been subtracted from the capacity requirement in the T-4 auction to reflect their non-participation would need to be added back in to the T-1 auction.

Price control on bids (economic withholding)

4.7.15 Rules on physical withholding will not, on their own, prevent abuse of market power. Requiring a potential capacity provider to bid a certain volume has no practical effect in restraining the exercise of market power, if the bidder can bid that volume at a very high price. Therefore rules on physical withholding will only be effective in conjunction with rules on the maximum price that bidders can bid (i.e. rules on economic withholding).

4.7.16 The SEM Committee will consider implementing economic withholding rules governing:

- **An Auction Price Cap**, i.e. a maximum price which bidders can bid, which is also the maximum amount that the auctioneer will pay for capacity. If the auctioneer is unable to meet the capacity requirement, then the auctioneer pays all bidders who have bid at or below the Auction Price Cap, and the capacity requirement goes unmet. The Auction Price Cap effectively sets a “reserve price” in the situation where the auctioneer is procuring rather than selling.
- **Bid limits** for existing capacity that is mandated to bid (i.e. a maximum price it can bid). Therefore, not only must mandated bidders bid a minimum volume, they must bid this volume at a price no greater than a regulated price.

4.7.17 The Auction Price Cap will apply to all plant and to all bidders. The Auction Price Cap is intended to:

³¹ For example, whilst a firm transmission access dispatchable plant is prevented from fully physically withholding its plant, it has discretion over how many MW to bid into the T-4 auction within narrow tolerance bands of its centrally determined de-rating factor. Consider the case of a 400MW CCGT unit which has a centrally determined de-rating factor of 90% and is allowed a tolerance of $\pm 2\%$. The CCGT can choose to bid anywhere between 352MW and 368MW in the T-4 auction. If the generator has chosen to bid 352MW in the T-4 auction, should it subsequently be allowed to choose to bid the other 16MW in the T-1 auction? Whilst this bidding behaviour may reflect a partial withholding strategy, it may also reflect improved operational performance.

- Limit any market power of new entrant plant (e.g. where there are limited sites which have planning permission and ability to connect to transmission network), or any other plant which has discretion whether to bid or not;
- Limit gaming by plant which has the discretion to bid zero volume. It prevents a portfolio generator pre-qualifying a high number of MW in order to avoid any adjustment to the capacity requirement, and then bidding a price which has no chance of being accepted.
- Provide a back-stop on the amount that customers will pay for capacity, in the event of exercise of market power, or some other market failure (such as the absence of new plant able to get planning permission and/or connection agreements)³².

4.7.18 Additionally, we may be concerned that even where there is excess of existing capacity, the exercise of market power might prevent prices falling to reflecting the short run cost of capacity provision, as it would in a market with a more competitive structure.

4.7.19 There are a number of different forms of Bid Limits which can be applied to bidders to regulate the withdrawal of existing capacity. These include:

- **Option 1: Price-taker Offer Cap.** This approach sets a single upper limit which all mandated bidders cannot bid above, and is the approach applied in GB;
- **Option 2: Based on technology going forward costs:** This approach limits bids to generic going forward costs by unit type, so for various classes of units there would be a generic upper limit or 'safe harbour' bid. This approach is applied in a number of US markets.

4.7.20 There are different variants of these approaches, whereby they can apply to:

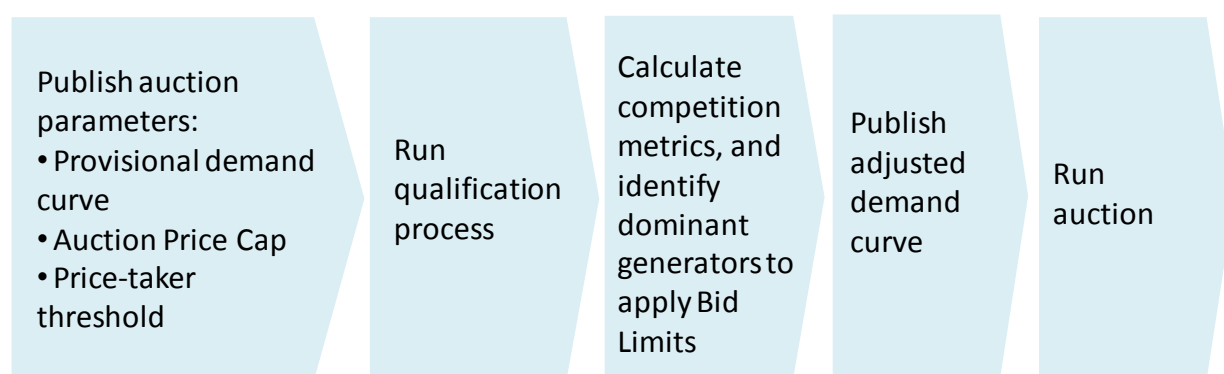
- **Option A: All mandated bidders.** This approach is applied in GB; or
- **Option B: Only those mandated bidders who fail some dominance test,** such as the Pivotal Supplier indicator or the Three Pivotal Supplier test, such as applied in the US PJM capacity market. As discussed in Section 4.6, if the Three Pivotal Supplier test is used, in practice, given the position of ESB, the bid limits would currently apply to mandated bidders anyway.

4.7.21 In implementing Bid Limits a provision could be provided which would allow participants to prove that their existing plant's going forward costs are above the price limit. A unit could bid over the bid limit if it demonstrates it has higher unit specific costs. This could also facilitate a participant to reflect in their existing plant's bids full costs of any incremental investments required for refurbishment (e.g. to improve efficiency/environmental performance).

4.7.22 Logically, where bid limits can be participant specifically applied, then there is a case for only applying the controls to dominant market participants. Controls could be selectively applied according to a process described in Figure 9.

³² The security standard is set predicated on an assumed cost of capacity (Cost of New Entry, CONE), and if the actual cost of capacity is much higher than CONE, the economically efficient trade-off between the cost of incremental capacity and the benefit of a reduced value of lost load may occur if less capacity than the capacity requirement is bought. Therefore it is not rational to procure to the capacity requirement whatever the outturn auction price

Figure 9 : Applying Bid Limits only to dominant generators



4.7.23 As discussed, in Sections 6.3 and 6.4, Auction Price Caps and Bid Limits are common features of capacity auctions, and are employed in the GB capacity auction and US capacity auctions. They will be Auction Parameters which are set from time to time and we discuss the potential basis for setting the value of these parameters in Section 6.

4.7.24 The practical implication of the suite of controls on physical and economic withholding is shown in Table 2.

Table 2: Summary of volume and bid price controls considered

Plant type	Required to bid non-zero volume?	Maximum bid price, if bidding
Existing dispatchable firm transmission access plant	Yes	Bid limit, whether Price-taker Offer Cap or Technology Specific Going Forward Costs
Existing non-dispatchable plant	No	Auction Price Cap
Existing dispatchable non-firm transmission access plant	No	Auction Price Cap
Existing demand side units	No	Auction Price Cap
Any new plant (including demand side)	No	Auction Price Cap

Use of a sloping demand curve (physical and economic withholding)

4.7.25 One of the key causes of market power in the electricity industry is the fact that demand is price inelastic (the demand curve is vertical), so a given amount of energy has to be bought at any price up to the value of lost load. In the energy market, demand is typically price inelastic unless there is a large volume of price-sensitive industrial load.

4.7.26 Where the demand curve is a function of price, the bidder faces “competition” from reduced capacity purchasing as well as other generators. If a bidder knows that the auctioneer has a fixed capacity requirement it may exercise market power by bidding up to the expected value of the next cheapest bidder. The fact that the auctioneer has the opportunity to buy less capacity may mean that a bidder may not exercise any market power it has, for fear that the auctioneer might exercise its right to move along the demand curve, and is not merely a price

taker who has to pay for new investment at any price (up to the Auction Price Cap)³³.

Therefore a sloped demand curve can be additional constraints on the bidding behaviour of existing generators, which could be a control on the market power of new capacity, where there are significant barriers to entry for new competitors. Furthermore, an appropriate balance will need to be struck between the gradient of the demand curve and the level of price regulation of bids (whether aggregate price offer cap or technology specific costs)³⁴.

4.7.27 There are a number of other reasons for employing a sloping demand curve, other than the impact in restraining market power, and these may also help determine the optimum slope of the curve. This is discussed further in Section 6.2.

Prohibitions on provision of aggregation services by dominant capacity providers

4.7.28 It is envisaged that Capacity Aggregators will be able to enter the market, sub-contract capacity providers and bid the capacity into the market on behalf of the physical owners of the capacity. The rationale for allowing Capacity Aggregators to enter the market is that they can:

- Provide a service to small generators (particularly intermittent generators) and DSUs, allowing the pooling of risk, and share the risk diversification benefits, increasing the I-SEM CRM participation rates amongst these classes; and
- Encourage the adoption of storage technologies, which can “couple” with intermittent technologies connected to a different meter (including on a different site), whose output is negatively correlated. Between them they may provide insurance to each other that if one is not exporting power to the system, with the Capacity Aggregator facilitating this cross-insurance.

4.7.29 Clearly if ESB or other dominant generators are allowed to provide Capacity Aggregation services to third parties, the potential for market power abuse is increased, adversely affecting competition criteria. However, if abuse of market power is adequately controlled through (for instance) controls on economic withholding the competition concerns may be limited. Should there be a prohibition on ESB and other dominant generators providing aggregation services?

4.7.30 In the case of ESB, whilst the vertical ring-fence between ESB Generation and Wholesale Markets (GWM) and Electric Ireland is maintained, it may be feasible to allow Electric Ireland

³³ Consider the case where there are existing generators A and B, each of which is a 100MW unit. Suppose that they are subject to a Price-take Threshold down to a net CONE of €40k/MW/year. Suppose that the Capacity Requirement is 225MW, indicating that new investment is required, and that the Auction Price Cap is €60k/MW/year, but that the auctioneer has a sloping demand curve. The curve slopes down from €60k/MW/year at 200MW to €20k/MW/year at 250MW. Suppose that the only new unit which meets the qualification criteria is C, which is a 25MW unit, and that C knows, or strongly suspects that it is the only qualified new investor. If the auctioneer had to buy the full Capacity Requirement, C could exercise its market power and bid up to the Auction Cap of €60k/MW/year. However, with the sloping demand curve, C knows that if it bids at €60k/MW/year it will not be accepted, but if it bids at anything up to €40k/MW/year it will be. Depending on the auction rules, C could face competition from other smaller but more expensive bidders. For instance, a 12.5MW bidder, bidding at €50k/MW/year would equate aggregate demand with aggregate supply.

³⁴ A gentler slope in the demand curve would be accompanied by a stricter bid mitigation cap and vice-versa.

to provide Capacity Aggregation, whilst still prohibiting ESB GWM from providing Capacity Aggregation services.

Information and communication rules and policies

- 4.7.31 Information and communication rules and policies need to be appropriately designed to limit the potential for the abuse of unilateral market power / gaming by individual bidders and to limit the potential for collusion amongst groups of bidders. The rules and policies relate to:
- What an individual bidder should be allowed to disclose publicly or to any other bidder before, during or after the auction.
 - What information the auctioneer gives back to bidders and winners, before the auction (e.g. qualification results), during the rounds (of a multi-round auction), and after the auction.
- 4.7.32 A multiple round auction format necessarily provides feedback to bidders between rounds on the fact that aggregate supply exceeds aggregate demand at the end of round price. The multiple round format therefore provides more information to bidders during the course of the auction than a sealed bid format. The increased price transparency and price discovery is sometimes deemed to be a positive feature of multiple round auctions (where bidders are information-weak and have no market power). However, it can be a negative feature where bidders have market power and can use the information provided to abuse their market power.
- 4.7.33 To some extent, the scope for market power abuse under both sealed bid and multiple round formats can be reduced by providing data which is more rounded. This and other issues related to the information policy are discussed further in Section 5.8.

Market Monitoring

- 4.7.34 International experience suggests that there is a continued need for proactive market monitoring even as electricity markets become more competitive. The basis for any ex-post enforcement action is active monitoring and investigation of the conduct of market participants and the overall performance of the market.
- 4.7.35 The existing of the market monitoring function will act to mitigate unilateral market power, economic and physical withholding and predatory pricing. This function will be important in informing the SEM Committee of the effectiveness of existing controls and considering the need for new or existing controls for future auctions.
- 4.7.36 In light of this, the SEM Committee considers that, for the foreseeable future at least, there will be a need for robust Market Monitoring activity by the Regulatory Authorities, as a strong ex-post market power mitigation measure in the various I-SEM market timeframes, including the capacity market.

Conclusion – Package of Market Power Mitigation Measures for the CRM

- 4.7.37 As set out the above paragraphs, we are proposing to implement a package of measures to mitigate the abuse of market power in the I-SEM capacity auctions. It is important that this package of measures is proportionate and builds on lessons learned from international best practice in capacity auctions. An appropriate balance must be struck between market power measures that adequately mitigate market power whilst at the same time achieve the long term objective of the capacity market to coordinate efficient entry and exit³⁵.
- 4.7.38 This is particularly the case for the potential abuse of ‘sell side’ unilateral market power (economic and physical withholding) and the mitigation measures employed to address this. There are trade-offs to be considered in this sense between price controls on bids and the use of a sloped demand curve in the auctions to manage market power. The direction of travel in Capacity Markets in the United States (New York ISO, PJM and ISO New England, as well as in the new Capacity Auctions in GB) has been away from steep or vertical demand curves and ‘loose’ regulation of bids to relatively strict bids mitigation and gradual demand curves.

³⁵ See discussion on market power mitigation in capacity markets in FERC’s paper on centralised capacity market design:

<https://www.ferc.gov/CalendarFiles/20130826142258-Staff%20Paper.pdf>

4.8 SUMMARY OF QUESTIONS

- 4.8.1 The SEM Committee welcomes views on all aspects of this section, including:
- 4.8.2 Do respondents agree that market power is a material concern in the I-SEM CRM? If no, why not? Should the SEM committee be concerned with unilateral market power, the potential for collusion or both?
- 4.8.3 Do respondents think that the overall market power control framework and package of mitigation measures set out in this section is comprehensive and proportionate? Are there any additional market power concerns that the SEM Committee should be focussing on? Should the SEM Committee bar any existing firm transmission access intermittent generator which has opted out of an auction (on grounds of retiral) from bidding in subsequent auctions, if it subsequently does not retire and/or apply other sanctions?
- 4.8.4 Do you think that firm transmission access plant which has bid at a certain point within the tolerance band in the T-4 auction (below the maximum) should be allowed to bid more capacity (up to the top of the tolerance band) in the T-1 auction?
- 4.8.5 What metrics should be used to assess whether a capacity provider is dominant, for the purpose of either applying other Bid Limits and/or controls on aggregation (the approach to setting the level of bid controls is discussed in section 6)?
- 4.8.6 Do you agree that dominant /pivotal generators should be prohibited from acting as Capacity Aggregators? Should associated businesses of dominant / pivotal generators (e.g. their Supply arms) also be prohibited from acting as Capacity Aggregators too?
- 4.8.7 Should there be a prohibition on ESB and other dominant generators providing aggregation services?

5. AUCTION DESIGN

5.1 INTRODUCTION

5.1.1 In this section we discuss the following elements of the auction design:

- Auction format: Single round sealed bid versus Multiple round descending clock versus combinatorial
- Structure of bids;
- Winner determination;
- Pricing rules (pay as bid vs. pay as clear, other);
- Dealing with lumpiness/discrete bids;
- Tie break rules; and
- Information and communication rules

5.2 AUCTION FORMAT

5.2.1 For standard auctions of a single item, where the auctioneer is the buyer (not the seller) the following auction formats are typically considered:

- **First-price auction:** Bidders³⁶ simultaneously submit sealed offers for the item³⁷. The lowest bidder wins the auction and receives the amount of its offer.
- **Second-price auction:** Bidders simultaneously submit sealed offers for the item. The lowest bidder wins the auction and receives the amount offered by the second lowest bidder.
- **English auction:** Bidders dynamically submit successively lower bids for the item. The final bidder wins the auction and receives the amount of its final offer.
- **Dutch auction:** The auctioneer starts at a low price and announces successively higher prices, until some bidder expresses its willingness to sell the item by offering. The first bidder to offer wins the auction and receives the current price at the time it offers.

5.2.2 In other words, there are two auctions in an open format (English and Dutch) and two in a sealed bid format (first-price and second-price)³⁸. Under plausible assumptions, and if revenue minimisation is the only criteria, the English format is better than or equal to the second-price format which is better than or equal to the first-price format. However, other than revenue minimisation, the list of selection criteria will often include:

- Allocative efficiency
- Relative simplicity

³⁶ Note that in the above description, the bidder is strictly speaking making an offer to sell, rather than a bid to buy, but we use the generic term bidder to include an “offerer”.

³⁷ This form of auction may be called a tender, but in this document we shall use the term auction to include a sealed bid tender

³⁸ It is easy to see that in terms of outcome, the first-price sealed bid and the Dutch formats are equivalent. The second-price sealed bid and the English format are only weakly equivalent since the open format of the English auction allows bidders to observe the bids from other bidders and therefore adjust their own valuation of the item as the auction progresses

- Cost and speed of transaction
- Transparency of transaction
- Risk of collusion

5.2.3 This goes some way towards explaining why the English format is so widely used but also not used in all circumstances.

5.2.4 Unfortunately, there is limited academic literature offering guidance when multiple items are on offer. In principle, open format (often referred to as “dynamic”) auctions are more efficient and are better at minimising revenue than sealed bid formats (first- and second-price). It is often noted that open formats provide greater transparency and price discovery which supports stronger participation and more aggressive bidding from information-weak bidders. Also, in a second-price format, bidders are not forced to second-guess the valuation of other bidders but can instead, in a straightforward manner, continue bidding until bidding reaches their own minimum valuations.

5.2.5 However, as for single item auctions, other criteria play a role in selecting the preferred format. In particular, market power and the risk of collusion need to be considered quite carefully. In an open format, the risk of bidders being able to exercise market power or engage in collusion is often mitigated through the information policy and through the use of reserve prices. By reporting more rounded information about the gap between supply and demand after each round (e.g. to the nearest 100MW), one can attempt to balance the need for some information relevant to bidders with the need to avoid collusion or the exercise of market power. The use of reserve prices is simply a way of limiting the possible gains from exercising market power or from collusion.

5.2.6 The point to make is that if concerns about market power and collusion are significant, and the information given to bidders after each round is therefore highly restricted, the inherent advantages of an open (dynamic) format compared to a sealed bid format will diminish or may even disappear altogether. Then, add to that the higher transaction costs associated with the open format and the greater complexity, the choice of preferred auction format becomes less clear.

5.2.7 When there are multiple units of a homogeneous good to be bought, it is preferable to use an auction format that explicitly permits bidders (i.e. parties bidding to sell) to express quantities of units at various prices. The following multi-unit auction formats are typically considered:

- **Option 1: Sealed-bid, multi-unit auction.** Bidders simultaneously submit sealed offers comprising their supply curves. The bids are then aggregated, and the clearing price at which supply equals the demand is determined. Each bidder wins the quantity that it supplied at the clearing price. The winners’ payments may be based solely upon the uniform clearing price (“pay-as-clear”), or the amount of each winning offer (“pay as bid/offer”), with some variants around these options.
- **Option 2: Multiple round descending clock auction.** The auctioneer announces prices to bidders, and bidders simultaneously submit offers indicating the quantities supplied at those prices. If aggregate supply exceeds demand, then the auction proceeds to a new round of bidding, in which the price “clock” has been decreased.

When a round occurs in which aggregate supply no longer exceeds demand, the auction concludes. Each bidder wins the quantity that it offered at the final price (“pay-as-clear”).

- 5.2.8 Additionally, **Option 3: Sealed bid combinatorial auction** may also be considered. Bidders simultaneously submit one or more bids, per Capacity Market Unit, with each bid consisting of a single price quantity pair for that Capacity Year. If the bidder chooses to submit multiple bids for a Capacity Market Unit, e.g. for a 400MW CCGT at €80/kWyear and for a 200MW CCGT at €50/kWyear, then these bids are mutually exclusive, i.e. the auctioneer cannot accept both bids for the same unit. The auctioneer then chose the optimum combination of bids to meet the capacity requirement. The winners’ payments may be based solely upon the uniform clearing price (“pay-as-clear”), or the amount of each winning offer (“pay as bid/offer”), with some variants around these options.
- 5.2.9 This option is normally considered in the context of a multi-product auction, such as the DS3 auction. It is more complex, and offers little additional benefit in the context of a single product auction.
- 5.2.10 A worked example of Option 1 is described below.

Simple sealed-bid, multi-unit auction

- 5.2.11 Bidders simultaneously submit sealed offers comprising either a price quantity pair (e.g. 100MW at €20/kW/year), or their supply curves where they are allowed to vary the quantity bid as a function of price. The bids are then aggregated, and the clearing price at which supply equals the demand is determined. Each bidder wins the quantity that it supplied at the clearing price.
- 5.2.12 The winners’ payments may be based solely upon the uniform clearing price (“pay-as-clear”). Other payment rules, such as “pay-as-bid” are possible, but as discussed in Section 5.5, we would propose to use a uniform clearing price. In a typical sealed bid format, the auctioneer takes the bids, ranks them in “merit-order”, i.e. cheapest to most expensive. The auctioneer accepts all the bids up to the point where the bid volume is equal to the quantity it wants to purchase. The auction winners are those bidders who have had their bids accepted, and one bidder may be a partial winner, i.e. have part of its bid accepted, if not all of its bid is needed to meet the auction procurement requirement. All winners are paid the same price, the bid price of the most expensive bid accepted (the marginal bid), and the pricing rule is known alternatively as “uniform clearing pricing”, “second pricing” or “pay-as-clear”.
- 5.2.13 Consider the following example whereby the auctioneer in a given auction is procuring 25 MWs. In this example, we have assumed that bidding is restricted to a simple price quantity pair, rather than a supply curve. Now let us assume that the auction format is a sealed bid auction, and that there are 5 qualified bidders A to E, who qualify the quantities specified in the third column of Table 3 below.

5.2.14 Now in an auction where bidders may want to set their bid volume as a function of price, the bidder may be allowed to submit a “supply curve” between a given maximum price and zero³⁹. However, in a capacity auction where the bidder is bidding each capacity unit separately, it may be possible to simplify the bid format to a single price quantity pair as illustrated in Table 3 below. In such an auction, it is likely for existing units, the owner of the unit will want to bid all of its capacity or nothing at a given price, in which case this bid can be expressed in the form of a single price quantity (PQ) pair. However, it may be the case that where new investment is required, the owner of the capacity may wish to use the site to build (for instance) an OCGT at one price, and a CCGT at another price and may wish to submit more than one PQ pair. We discuss this issue further in Section 5.3, but for the example below we assume that the bid format allows for one PQ pair per capacity unit.

5.2.15 Assume that before the auction, the auctioneer declares that the maximum price it is prepared to pay is €50/kW/year, and that the bids of A to E are all below this value.

Table 3 : worked example for simple sealed bid auction

Summary of bids			Ranked bids			
Bidder	Price	Quantity	Bidder	Price	Quantity	Accepted volume
A	12	10	A	12	10	10
B	40	10	E	15	10	10
C	30	4	C	30	4	4
D	35	15	D	35	15	1
E	15	10	B	40	10	0

5.2.16 Having received the sealed bids, the auctioneer orders the bids from lowest price to highest price, i.e. in the order A, E, C, D and B. The auctioneer then accepts all of bid A, E and C and the first unit of bid D, to make a total of 25 MWs. If the auction adopts a “pay-as-clear” rule (see Section 5.5), the auction price is €35/kW/year.

5.2.17 This simplified example assumed that D is prepared to sell only 1 of its 15 MWs. If the auction was to purchase widgets, a bidder may be equally willing to supply 1 widget as well as 15 widgets. With capacity auctions, this is typically not the case. In capacity auctions, where the capacity owner may only be willing to offer an entire Capacity Market Unit or nothing. We have termed this the “lumpiness” issue and it is discussed further in Section 5.6.

5.2.18 See Appendix J for a work example of Option 2 (Multiple round descending clock auctions).

5.2.19 Ultimately the choice between a sealed bid format and a multiple round descending clock format will be strongly influenced by market power concerns, and the extent to which market power mitigation measures can mitigate the additional concerns under a multiple round descending clock format. If they can be appropriately mitigated a multiple round descending

³⁹ For instance, suppose there was a hypothetical bidder, F, that was prepared to offer a different amount at different prices, then F may be able to submit a “supply curve”, rather than just a price/quantity pair. For instance suppose F was prepared to offer 10 MWs at a price of between €50.00/kW/year and €40.01/kW/year, 8 MWs at a price of €40.00/kW/year to €37.50/kW/year, 5 MWs between €37.49/kW/year and €30.00/kW/year and nothing at €29.99/kW/year and below

clock format can deliver additional price transparency benefits without exposing consumers to undue risk of market power being wielded.

International experience

5.2.20 Most capacity auctions in the electricity sector take the form of either a simple sealed bid auction, or a multiple round descending clock auction:

- The Pennsylvania – Jersey- Maryland (PJM) auction, which is the world's largest capacity auction is a simple sealed bid auction;
- The New York ISO auctions also take a simple sealed bid format;
- The Colombian firm energy auctions originally took the form of a multiple round descending clock auction, but moved to a sealed bid auction, amid concerns that the multiple round format allowed bidders too much scope to exercise market power/game the auction. According to Harbord and Pagnozzi (2014), *"the Colombian Commission for the Regulation of Energy and Gas (CREG) held two capacity auctions using the descending clock auction format. The first was held in May 2008 and the second in December 2011. The 2008 auction ended early at the first point at which a large bidder could see that it had become pivotal and was able to withdraw one of its offers to set a high capacity price. To avoid this happening again, in 2011 the CREG adopted measures to make this strategy harder by reducing the amount of information on demand and supply revealed to bidders during the auction. This was not sufficient, and the auctioneers abandoned the auction after the initial two rounds and effectively held a sealed-bid auction in its place"*⁴⁰.
- GB: The 2014 and 2015 T-4 GB auctions and the 2016 T-1 auctions all took the format of a multiple round descending clock auction format. However, no single bidder in the GB auctions has as big a market share as ESB in the I-SEM;
- New England: The ISO-NE auction takes the form of a multiple round descending clock auction.

Assessment of Options for Auction Format

5.2.21 The pros and cons of these options are summarised in Table 4 below. At this stage, Option 1: simple sealed bid looks the strongest option for all auctions (Transitional, T-4, T-1).

Option 1 (simple sealed bid) assessment

5.2.22 Option 1 has the lowest potential for market power abuse. Unlike Option 2, bidders cannot exploit information provided between rounds to abuse market power. Market power controls are simple and easy to apply.

5.2.23 A sealed bid auction is easier for small unsophisticated bidders to participate in. A bidder can submit a sealed bid on paper, whereas multiple round auctions typically require electronic submission. The simple sealed bid auction has lower administrative costs.

⁴⁰ [http://www.market-analysis.co.uk/PDF/Academic/Britain's electricity capacity market final 10 April 2014.pdf](http://www.market-analysis.co.uk/PDF/Academic/Britain's%20electricity%20capacity%20market%20final%2010%20April%202014.pdf)

Option 2 (multiple round descending clock) assessment

- 5.2.24 The use of a multiple round descending clock auction (Option 2), provides greater price discovery, better price transparency and richer information on market depth, as compared to a sealed-bid auction format (whether Option 1 or Option 3) . This occurs because multiple round formats are designed to allow the feedback of information to bidders between rounds, with the level of the detail of the feedback based upon the information policy. This has both pros and cons in the context of the I-SEM CRM auctions.
- 5.2.25 Before the first auctions there will not be any market references to enable bidders to price the option risk embedded in Reliability Options. Whilst bidders can use fundamental analysis to price this risk, bidders may be concerned that they have mis-priced the risk and be subject to winners' curse. Price discovery and transparency that bidders could obtain via feedback between rounds could provide valuable feedback which allows bidders to confirm that they are not pricing this risk materially differently from the rest of the market. The price discovery inherent in multiple round auctions is therefore potentially more valuable than in auctions for other contracts whose value is easier to price.
- 5.2.26 As discussed in Section 4, market power is a significant concern in the I-SEM, more so than in some other capacity auctions where the ownership of existing assets is less concentrated. The downside of providing information back to market participants between rounds in an auction is that they may be able to use that information to abuse their market power. However, if appropriate market power controls can be put in place, the potential for market power abuse can be reduced. GB has clearly taken the view that market power can be appropriately mitigated, but the GB market is arguably less concentrated than the I-SEM, with no single player approaching the market share of ESB. We note that:
- Many US auctions, such as PJM and New York ISO operate a sealed bid process, in part because of market power concerns;
 - Colombia experienced issues with the exercise of market power in their multiple round auctions, to the extent they abandoned this approach.
- 5.2.27 A multiple round approach may take 2 or 3 days to complete, which may tie up key staff for the whole of that duration, which is not good for small players. A multiple round approach is also arguably more complex for small bidders, although there are ways in which the impact on small unsophisticated bidders will be / can be managed:
- A multiple round auction can be structured to allow a bidder to specify a single Exit Bid at the start of the process- which is analogous to submitting a single price bid in the context of a sealed bid auction;
 - Interfaces to the electronic software used by auction software vendors for multiple round auctions are web enabled, and do not require any material IT support, and are a little more onerous than paper based auctions;
 - Mock auctions are used to ensure that bidders familiarise themselves with how to operate the software and that the software is tested before the event; and
 - The facilitation of aggregators.

Option 3 (combinatorial) Assessment

- 5.2.28 A combinatorial auction format has clear advantages to a bidder in a multi-product auction, such as the DS3 auction, where it ensures that a bid cannot have an offer for Product A accepted but not for Product B.
- 5.2.29 However, in the context of a single product auction like the T-4 auctions or T-1 auctions, it offers little benefit to the bidder. Most of the benefit⁴¹ of being able to submit multiple mutually exclusive proposals for the same site can be achieved within a simple sealed bid format, if the bidder is allowed to submit its bid in the form of supply curve, rather than a simple price quantity pair.
- 5.2.30 The key drawback of a combinatorial auction is the complexity for the auctioneer⁴² in solving multiple combinations of offers, some of which are mutually exclusive and some of which are not. In principle, the auctioneer may need to evaluate all logical possible combinations of bids, in order to identify the optimum combination⁴³. The number of potential combinations grows exponentially with the number of bids, and at some point, it will cease to be possible to solve the optimisation problem with the available computing power⁴⁴.
- 5.2.31 Some combinatorial auction formats may be more amenable to the abuse of market power than a simple sealed bid formats. For instance, in the context of the DS3 auctions, the SEM Committee needs to make sure that a bidder with market power in the provision of one DS3 service cannot abuse this position across a range of DS3 services.
- 5.2.32 These issues will need to be solved before the SEM Committee endorses a move to a single integrated CRM and DS3 auction, but would represent significant additional project risk to both the CRM and DS3 projects at this stage.
- 5.2.33 The SEM Committee seeks consultation feedback from stakeholders on which auction format option you favour for the Transitional auctions, T-4 auctions and the T-1 auctions.

⁴¹ In a simple sealed bid format the auctioneer typically requires the bidder to submit a supply curve that is monotonically increasing. It cannot, for instance submit a bid for decreasing function such as a 100MW at €50 and a bid for 10MW at €60, whereas this could be possible in a combinatorial format

⁴² Note that there is no necessary additional complexity for the bidder in a sealed bid combinatorial auction format. If a bidder wishes to submit a single price quantity pair bid, it can do so, in which case bidding is no more complex than in the simplest sealed bid format

⁴³ It may be possible to identify some clearly inferior bids, so that combinations involving these bids do not have to be evaluated

⁴⁴ This problem is discussed in more detail in relation to the DS3 auctions in the DotEcon paper, SEM-15-105a, and the DotEcon report suggests that the problem is solvable for the DS3 auction. If it is solvable for the DS3 auction it is probably solvable for a CRM auction (e.g. if necessary for an auction as a block solution). However, the dimensions of the number of combinations in the CRM auction may be bigger than for the DS3 auction if there are more units capable of providing capacity than DS3 services

Table 4: Pros and cons of T-4 auction formats

	Option 1: Sealed Bid	Option 2: Multiple round descending clock	Option 3: Combinatorial auction format
Pros	Lower potential for market power abuse, including unilateral market power and tacit collusion (Competition criteria)	Provides greater price discovery and transparency for bidders, which may encourage participation and: - result in lower capacity prices - reduce the risk of winner's curse (Efficiency and competition criteria)	Quick and simple for unsophisticated bidders to participate (simplicity criteria)
	Quick and simple for unsophisticated bidders to participate (simplicity criteria)		Consistent with format proposed for DS3 auctions (adaptive criteria)
	Easy to solve and easy for an independent Auction Monitor to validate the results (simplicity, practicality and cost)		Could use same auction platform as DS3? (practicality and cost criteria)
	Relatively less complex and low cost (practicality and cost criteria)		
Cons	Does not provides price discovery and price transparency for bidders during auction, which may discourage participation and increase the risk of winner's curse (Efficiency and competition criteria)	Greater potential for market power abuse, including unilateral market power and tacit collusion (competition criteria), but potential for abuse may be mitigated by market power control measures set out in Section 4.7	Greater potential for unilateral market power abuse (competition criteria)
		May tie up bidders for 2-3 days of auction duration, and slightly more complicated (simplicity criteria)	Auction may be difficult to solve in reasonable time. This risk can be partially mitigated by limiting the number of mutually exclusive bids per site/Capacity Market Unit (practicality / cost criteria)
			Harder for an independent Auction Monitor to validate the results (simplicity, practicality and cost)

5.3 STRUCTURE OF BIDS

5.3.1 Bidding will be unit based for non-aggregated plant. The structure of bids will depend upon the format of the auction. If we opt for a simple sealed bid auction, bidders could be allowed to:

- Option 1: Only submit a price quantity pair P_i , Q_i per Capacity Market unit i , for that Capacity Delivery year t ; or
- Option 2, be allowed to submit a supply curve which is a function $Q_i(P_i)$.

5.3.2 Under Option 1, P_i and Q_i are subject to the constraints that:

- Q_i must be the qualified amount in respect of that Capacity Market unit i ;
- Depending on the outcome of this consultation (see section 6), P_i may be required to be equal to or less than:
 - The Bid Limits for all/ dominant existing dispatchable firm transmission access generators⁴⁵;
 - The Auction Price Cap for new generators;

5.3.3 Under Option 2, the function is subject to the constraints that:

- Q_i is a monotonically increasing function of P_i
- Depending on the outcome of this consultation, Q_i must equal the qualified volume
 - For new capacity, at or below the Auction Price Cap;
 - For all/ dominant existing dispatchable firm transmission access generators, below the Bid Limits.

5.3.4 If we opt for a multiple round descending clock auction then each bidder bids its supply for a specified interval of prices in every round. There are a variety of approaches that can be applied in a multiple round descending clock auction. These are set out in Appendix H, as are the bid structure options for a combinatorial auction format.

5.4 WINNER DETERMINATION

5.4.1 In a standard multi-unit procurement auction, the winner determination process is simple. Bidders submit bids (whether via a single sealed bid (Option 1), or over a number of rounds in a multiple round descending clock auction (Option 2). The auctioneer selects the cheapest bids as the winners, with the number of winners depending on the number of units needed.

5.4.2 The key complexities occur if:

- Bids have more than just the price dimension. In the case of the CRM auction, the other dimension which the auctioneer might want to take into account is contract length, given that we envisage that existing capacity will receive only one year

⁴⁵ a Capacity Market Unit may have partly firm transmission access and partly non-firm transmission access

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contracts, but new capacity could receive multi-year contracts (e.g. up to 10 years in length, at the bidder's option⁴⁶).

- The auction rules require an auctioneer to accept all or nothing of the marginal bid, when it only needs part of the marginal bid to meet the auction procurement requirement. For instance, suppose that the auction procurement requirement is 6000MW, and that the cheapest 30 offers account for 5,900MW. The next cheapest bid is a 400MW CCGT, and the auctioneer cannot accept only 100MW of this bid. Does the auction have to accept this bid, reject this bid or can it accepted another more expensive (out-of-merit") bid for 100MW. This is a common problem in capacity auctions where it is not possible to build half a generating set. We have termed it the "lumpiness" / discrete bid issue, and discuss it separately in Section 5.6.

Winner and price determination with contracts of differing lengths

- 5.4.3 The issue potentially does not arise in the T-1 auctions or transitional auctions, but does arise in the T-4 auctions. In the T-4 auctions, existing capacity will be competing alongside new investors. At minimum, we will potentially be awarding different length contracts to new and existing capacity, with existing capacity being awarded a one year contract and new capacity being awarded contracts of up to 10 years, in line with the minded to position discussed in Section 1.4.
- 5.4.4 By way of example, a 2017/18 T-4 auction, could end up with (for example):
- An existing Capacity Market Unit bidding to obtain a single year Reliability Option for delivery year 2021/22;
 - A new investor who wants a 10 year Reliability Option covering the period 2021/22 to 2030/31; and
 - A new investor who only wants a 5 year Reliability Option covering the period 2021/22 to 2025/26.
- 5.4.5 The key question is whether winners should be selected purely on the basis of a straight price comparison, or whether contract length should be taken into account⁴⁷ (other than as a tie-breaker- see discussion of tie-breaking rules in Section 5.7).
- 5.4.6 The simplest approach, and the one that is used in ISO New England and in the GB capacity auction, which face the same "winner determination" issue is to choose the cheapest and to ignore any differences in the length of contract they are bidding for.
- 5.4.7 The DS3 auctions also face this issue. The SEM Committee consulted on the same "winner determination" issue in the context of the DS3 auctions (see SEM-15-105 and the accompanying paper SEM-15-105a, produced by DotEcon), where bidders may also be bidding

⁴⁶ The bidder will need to specify the contract length when bidding- it cannot wait to see the auction clearing price and then decide what length of contract it wants

⁴⁷ For instance, how should a bid of €20/kW/year for a 5 year contract be compared with a contract of €19/kW/year for 10 years? Should the €19/kW/year bid always be chosen because it is the lower price bid, or should any weighting (whether positive or negative) be given to the fact that one contract entails a 5 year commitment for customers and the other a much longer 10 commitment?

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for contracts of different durations in the same auction. In SEM-15-105a, the following winner determination options were set out and explained in more detail:

- Option 1: winner determination with no adjustment, i.e. purely on a price basis, ignoring contract duration, as per the US capacity auction and the GB capacity auction approach;
- Option 2: winner determination with a discount rate calculation. In this option, we would need to determine an appropriate discount factor, and the choice of winners could be quite sensitive to the choice of discount factor, and further work would need to be done to develop the simple example set out in SEM-15-105a;
- Option 3: winner determination with an adjustment for contract length, such as to multiply each bid amount by a parameter equal to the bid's contract length divided by the maximum possible contract length; and
- Option 4: winner determination with an expectation of prices in future auctions. Such an approach might favour longer term contracts, if, for instance prices were expected to rise in future auctions. This approach would be dependent upon the outcome of market forecasting and be sensitive to forecasting assumptions, and therefore subject to forecasting error.

5.4.8 Regardless of the approach to winner determination, the DotEcon paper proposes a uniform clearing price based on the marginal bidder with no adjustments for contract length.

5.4.9 We consider Option 1 to be the most appropriate for the following reasons:

- Auction efficiency and competition: Judged purely on price offered for Capacity Delivery year, this approach will ensure efficient procurement, at least for the first delivery year (Nevertheless this approach might score less favourably on a score measuring efficiency over the whole contract horizon, since Option 2 and Option 4 would be designed to take conditions over the entire contract horizon into account).
- Simplicity, practicality and cost:
 - This approach is clearly the simplest and most transparent; and
 - It is not clear how the relevant adjustments for the other options would be implemented in practice, and how the parameters would be appropriately estimated.

5.5 PRICING RULES

5.5.1 Different alternative payment rules may be used in a multi-unit auction, including:

- Variants of uniform clearing pricing (pay-as-clear) :
 - All bidders could be paid the price of the highest accepted offer, which is the normal practice; or
 - All bidders could be paid the price of cheapest rejected offer. Consider the following example to illustrate the difference between the two variants of uniform clearing prices. The auctioneer wishes to buy two units, and there are

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four bidders who each bid 1MW. A bids €10, B bids €11, C bids €12 and D bids €13. Clearly the auctioneer is going to accept the bids A and B, but under the first variant of uniform clearing prices, it pays both A and B at €11, whereas in the second variant, it pays both A and B the price of C's bid, €12, since C is the cheapest rejected bid;

- Pay-as-bid, where each winning bidder is paid its individual offer price; and
- Various algorithms used to determine prices for individual service in a combinatorial auction, where bidders have bid a package price for multiple services rather than a price for each service. This approach will need to be considered in the context of a move to a single integrated CRM and DS3 auction, but is a complexity that does not need to be considered in the context of a single product auction.

5.5.2 In the context of a standard sealed bid auction or a multiple round descending clock auction, the clearing price is typically set as pay-as-clear with the clearing price set equal to highest accepted bid⁴⁸. This pricing is used in the single zone GB capacity auction, and in multiple zone US capacity auctions, where there is potentially a different clearing price in each zone.

5.5.3 Pay-as-clear pricing, based on highest accepted bid is generally accepted in the academic literature as economically efficient, since it both incentivises truthful cost based bidding and ensures that bidders are not paid more than is required. It could be argued that in an imperfectly competitive market, paying highest accepted offer also creates some weak incentives for a bidder to bid up to a value just below the cheapest rejected offer. However, this incentive only exists if a bidder expects it has a reasonable probability of being the most expensive accepted offer, since only the most expensive accepted offer will affect the clearing price. The variant of uniform pricing where the clearing price is set at the cheapest rejected offer removes even this weak incentive to bid up to the price of the next bidder in the merit-order. However, it comes at the cost of paying a higher price- a price greater than any of the providers require to provide the service. This pricing format is therefore rejected on efficiency grounds.

5.5.4 Pay-as-bid models are rarely favoured in auctions for a homogenous product (such as capacity). It is argued that using a "pay-as-bid" pricing rule would result in a lower total purchase cost⁴⁹ if bidders bid their true costs. However, the "pay-as-bid" approach has a number of drawbacks:

- Inefficiency. In an imperfectly competitive market, "pay-as-bid" pricing can incentivise bidders to not bid their costs, but rather to bid a price just below their expectation of the cheapest rejected offer;
- Anti-competitive and iniquitous. The potential for cost-plus (or "non-truthful") bidding strategies is likely to favour big players with greater information who are better able

⁴⁸ In a descending clock format, it is typically not possible to deploy a "pay-as-bid" pricing rule, even if the auctioneer wanted to, since the auction closes before the remaining bidders have completed their bidding, and knowing that they are winners, they would no longer have any incentive to bid their true costs. Whilst a "pay-as-bid" rule could feasibly be employed in a sealed bid auction (where the full set of bids are declared at the outset)

⁴⁹ since some bidders are likely to be paid less than the uniform "pay-as-clear" price

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to estimate the marginal bid price and to discriminate against small and information-weak bidders.

5.5.5 Nevertheless, there might be circumstances specific to the capacity auction under consideration that are different from the typical auction situation and which mean that a pay-as-bid model is worth further consideration:

- For new capacity in particular, it would seem unusual to create a situation that could award a contract at a price higher than that at which it was offered. Usually in procurement of new capacity the project developer would be expected to offer a price that, if accepted, they would be happy to live with. Rather, the price offered would be expected to cover their costs given the assumptions they have made. To pay them more than this amount could be argued to be over-remunerating new capacity.
- Pay-as-clear might be more applicable to short-term commodity markets (e.g. the energy market) where the difference between a participant's bid at marginal cost and the market-clearing price is a contribution to that participant's recovery of fixed cost. In a capacity market, for new capacity and long-term contracts at least, the bid *is* for recovery of fixed cost.
- There is relatively little international precedent of procurement procedures having paid a common price for multiple units of new capacity; rather than simply rejecting or accepting the bids as made, at the prices that were made⁵⁰.
- Pay-as-clear might become complicated due to the lumpiness issue, as described below, whereas pay-as-bid should not face this problem.

5.5.6 There are pros and cons to be considered, and **pay-as-clear pricing, based on highest accepted bid might nevertheless be the strongest option**. However, if so, there is the particular question that arises, if the winner determination process allows the auctioneer to select an "out-of-merit" bid, due to the "lumpiness" problem. This issue as well as the implications for price setting are discussed in Section 5.6.

5.6 DEALING WITH LUMPINESS AND DISCRETE BIDS

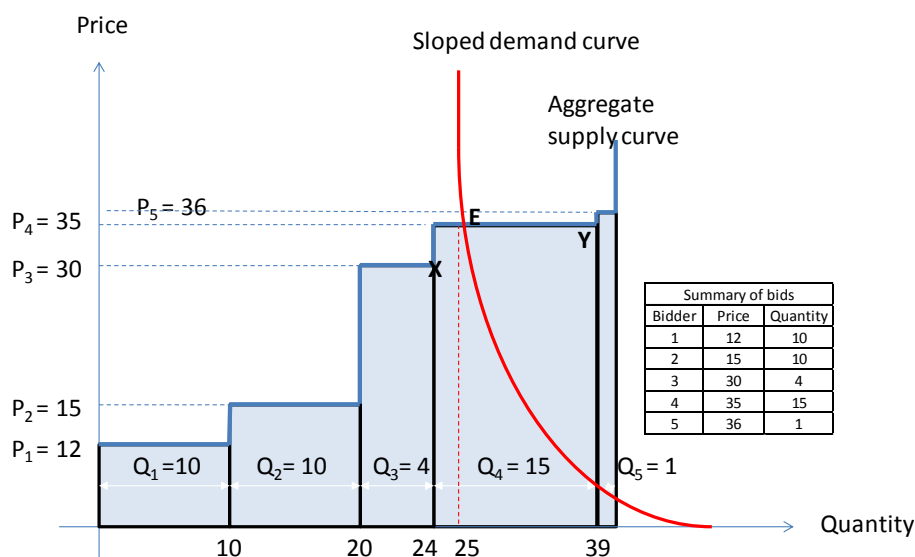
5.6.1 Capacity, particularly generation capacity is typically offered in discrete units, which reflect the typical size of unit offered by turbine manufacturers. Of course, the size of existing units is already fixed, and there are limits on the ability of new investors to vary their MWs offered. Rules are required to determine how the auctioneer copes with this problem of lumpiness / discrete units issue, where ranking bids in order from lowest to highest does not precisely equate supply and demand.

⁵⁰ A current large procurement auction in Mexico, for example, is simultaneously (i.e. in the same auction) purchasing homogeneous multi-year capacity products from multiple potential new generators, but is pay-as-bid.

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- 5.6.2 Consider the example in Figure 10 below, which illustrates a sealed bid auction, although the same problem could occur in a multiple round descending clock auction⁵¹ or a combinatorial auction. In this auction, when the bids are ranked, Bids 1 to 3 are the cheapest and have a combined volume of 24MWs.
- 5.6.3 Bidder 4 is the next cheapest, and is the marginal bidder. Ideally, the auctioneer would like to accept 1 unit of Bidder 4's offer, and not accept the remaining 14 units. If the auctioneer can do this, the auction clears exactly where supply equals demand at point E. However, if bidders have the right to submit all or nothing bids, the auction will not clear at point E. If Bidder 4's entire bid is accepted then the total volume bought is 39MWs (and the auction clears at point Y), much more than the requirement of 25MWs. However, if the auctioneer does not accept Bidder 4's bid then it procures 24 MWs, 1MW less than the capacity requirement, and the auction clears at point X.
- 5.6.4 A better alternative may be to allow the auctioneer to accept Bidder 5, instead of Bid 4, since Bidder 5 is offering precisely the 1MW required, and is not much more expensive in €/kWyear terms. Although Bidder 5 is "out-of-merit", accepting Bidder 5 is better for customers.

Figure 10: Example of discrete bidding and "lumpiness" problem



- 5.6.5 In the above example, selecting Bids 1, 2, 3 and 5 and paying a clearing price of €36/kW/year for 25MWs costs consumers €0.9m, which is much cheaper than paying a price of €35/kW/year for 39MW at a cost to consumers of €1.365m. However, this example highlights another issue. If Bidder 5 was accepted "out-of-merit", should the clearing price be set at:

- Approach 1: €36/kWyear, the price offered by Bidder 5; or
- Approach 2: €30/KWyear, the price of the last "in-merit" bid accepted (Bid 3), with Bid 5 being paid its offer price. Using this approach is analogous to the treatment of out-of-merit plant that is constrained-on in the energy market, which does not affect the

⁵¹ although in a descending clock auction the auctioneer will not know the Exit Bids of all bidders at the end of the round in which the auction clears, so may not be able to describe the full supply curve below the end of the final round price

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marginal energy price, but is kept “whole” through a pay-as-bid regime for constrained-on plant.

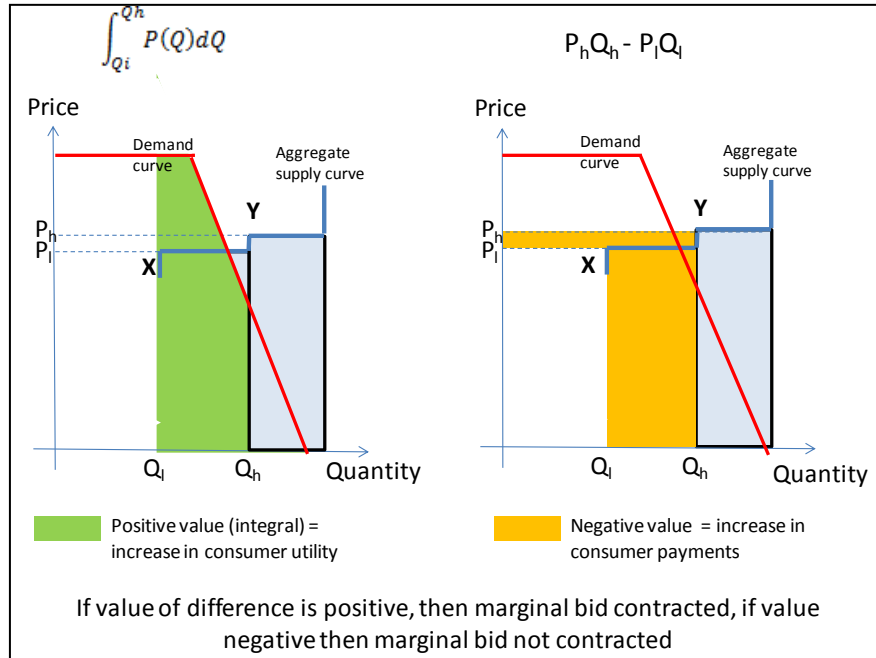
- 5.6.6 The choice of pricing approach can also affect winner determination, assuming that winners are picked to minimise the cost (price paid times quantity purchased).
- 5.6.7 The auctioneer needs deterministic rules to help it determine the winners and set prices under such circumstances.
- 5.6.8 The auction rules could either:
- Option 1: requires the auctioneer to accept the marginal bid in all circumstances, i.e. to clear the auction at point Y, and does not allow the auctioneer to accept an out-of-merit offer instead;
 - Option 2: requires the auctioneer to either accept or reject the marginal bid (under this option, the auctioneer is not allowed to accept an out-of-merit bid). The decision to accept the marginal bid could be based on either:
 - Option 2a: a net welfare function calculation, which calculates whether net welfare is greater if the marginal bid is accepted or rejected; or
 - Option 2b: some simpler rules based on MW tolerances, e.g. don't accept the marginal bid if the aggregate of cheaper bidders is within a specified number of MW of demand⁵².
 - Option 3: allows the auctioneer to accept out-of-merit bids, based on an optimisation of either:
 - Option 3a: Least total purchase cost in €m or is €/kW-year (criteria would need to be developed to determine the minimum quantity purchased);
 - Option 3b: Net consumer welfare; or
 - Option 3c: Social welfare (consumer surplus plus producer surplus).
- 5.6.9 Some US capacity auctions allow the auctioneer to accept an out-of-merit offer, whereas the GB auctions to date have not.
- 5.6.10 It should be noted that Option 3 could result in a situation where one or more in-merit bids is potentially not accepted, as a result of the optimisation. It might be rejected to “make more room” for the marginal bid, for example, if doing so would improve the value of the factor being optimised (whether that be a measure of cost in Option 3a or a measure of welfare in Option 3b and 3c).
- 5.6.11 As illustrated in Figure 11, in GB, the net welfare function is specified as the difference between the incremental:

⁵² In the above example, if a volume tolerance of 1MW is allowed, the auctioneer is allowed to accept only Bids 1 to 3, for a total of 24MW at a price of €30/MW- a cost to the consumer of only $24,000 \times 30 = €0.72\text{m}$, a saving of nearly 50%, for being 1MW short of equating supply with demand

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- Consumer utility of the marginal unit, measured as the area under the demand curve in the range covered by the marginal bid; and
- Cost to consumers if the marginal bid is accepted.

Figure 11: Net welfare calculation



5.6.12 If the demand curve is entirely vertical (at any price), then applying the net consumer welfare function will always result in the marginal bid being accepted since a fully vertical supply curve implies that the customers are prepared to pay for the fixed capacity requirement at any price. If the amount of capacity bought is even the slightest bit lower, the loss in consumer welfare is unlimited.

5.6.13 However, if the net consumer welfare calculation is applied, the marginal bid may be rejected if, as we propose:

- There is a sloping demand curve, which reflects a limit on customer's willingness to pay for incremental capacity. If the marginal bid falls within this range, then the marginal cost can exceed the marginal benefit. The slope of the demand curve should be influenced by the trade-off between the value of lost load and the marginal cost of capacity, and if the demand curve is sloped in the range where the marginal bid is sited, applying the net welfare function could result in the marginal bid being rejected and the auction clearing at X.
- There is an Auction Price Cap. As illustrated in Figure 11, employing an Auction Price Cap means that we draw the demand curve *horizontal* at that price. The Auction Price Cap reflects an assumption that customers are not prepared to pay more than this price for capacity.

5.6.14 Option 3b appears a strong option, as this should deliver **more efficient** outcomes for customers, since they do not end up paying for marginal units if the marginal cost exceeds the marginal benefit of the capacity. In the I-SEM, with its small size, allowing only in-merit bids to

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be accepted could lead to purchasing significantly less than the optimum in percentage terms. Some larger generators may regard this approach as iniquitous, but arguably the efficiency benefits that accrue to customers outweigh any equity concerns. It should be noted that all Option 3 sub-options have the potential for a “constrained off” situation, where one or more in-merit bids is potentially not accepted, as a result of the optimisation.

5.6.15 There are potential advantages to employing a pricing rule which would pay a clearing price only to in-merit bids, and pay out-of merit bid accepted on a pay-as-bid basis. This approach is potentially consistent with efficient pricing, as it avoids the clearing price being affected by the market imperfections introduced by the “lumpiness” of generation (Pay-as-bid pricing to all accepted bids would of course remove the distinction in the payment regime between in-merit bids and out-of merit bids by paying all accepted bids on a pay-as-bid basis).

5.6.16 The SEM Committee seeks consultation feedback on the following points:

- Do stakeholders agree with the proposed approach of adopting Option 3b to deal with the lumpiness/discrete bid problem? If not, please explain why not, and your preferred alternative approach.
- Do stakeholders agree with the approach of setting the clearing price based on the highest accepted in-merit winner, and paying any out-of-merit winners based on a pay-as-bid basis? If not, please explain why not, and your preferred alternative approach.

5.7 TIED BIDS

5.7.1 Auctions typically need tie break rules to choose between tied bids⁵³, where two bidders have submitted the same bid price. This problem most commonly occurs where Bid Limits apply at the same level to many bidders, and a number of bidders bid just below the cap.

5.7.2 For instance, in ranking bids with the same price, the GB capacity auctions used the following rules to do the following:

- Rank exit bids from highest to lowest capacity (so that higher capacity bids exit first), and if still some of equal price and capacity
- Rank from shortest to longest duration (so that shorter duration bids exit first), and if still some of equal price, capacity and duration
- Apply random selection (each bid when entered is automatically assigned a random number).

5.7.3 Logically, it would make sense to use the net welfare function to rank bids, and it is not clear that the highest capacity bid will always have a higher net welfare than a lower capacity bid or vice-versa. However, using the net welfare algorithm may be more computationally intensive.

5.7.4 The SEM Committee seeks feedback on whether, in the context of the relatively small size of the I-SEM, and the likely sensitivity of consumer welfare to the choice of marginal unit, the I-

⁵³ Choosing between tied bids only matters where one of them may be the marginal bid

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SEM should apply a net welfare function or could use a simpler set of rules to split tied bids, such as those employed in GB.

5.8 INFORMATION AND COMMUNICATION POLICIES

5.8.1 Information and communication rules and policies need to be appropriately designed to limit the potential for the abuse of unilateral market power / gaming by individual bidders and to limit the potential for collusion amongst groups of bidders. The rules and policies relate to:

- Information policies: What information should the auctioneer provide to bidders and winners:
 - Before qualification;
 - Between qualification and the start of the auction;
 - Between rounds in the case of a multiple round auction (see Appendix J);
 - After the end of the auction that might be of use to bidders in subsequent auctions or in the secondary market.
- What an individual bidder should be allowed to disclose publicly or to any other bidder before, during or after the auction.

Information provided before qualification

5.8.2 Before the close of the qualification process for a given auction, the CRM Delivery Body will announce an estimate of the key auction parameters including:

- How much capacity has already been procured for the relevant Capacity Delivery year(s), if relevant;
- The demand curve function, or the amount of capacity to be procured in the auction (if there is to be a vertical demand curve);
- The Auction Price Cap and other Bid Limits;
- Capital expenditure thresholds which define the boundary conditions for new, upgraded (if relevant) and existing capacity; and
- Key auction dates.

5.8.3 This information will assist new generation capacity and DSUs to decide whether to qualify for the auction, and will assist generators who have discretion over what volume to bid, to decide how much volume to seek to qualify.

Between qualification and start of the auction

5.8.4 Having received qualification bids, the CRM Delivery Body will run the qualification process, and determine how many MW of each Capacity Market Unit has qualified.

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5.8.5 Before the start of the auction, the CRM Delivery Body will then provide an updated demand curve function. This demand curve function may be updated, for, *inter alia*:

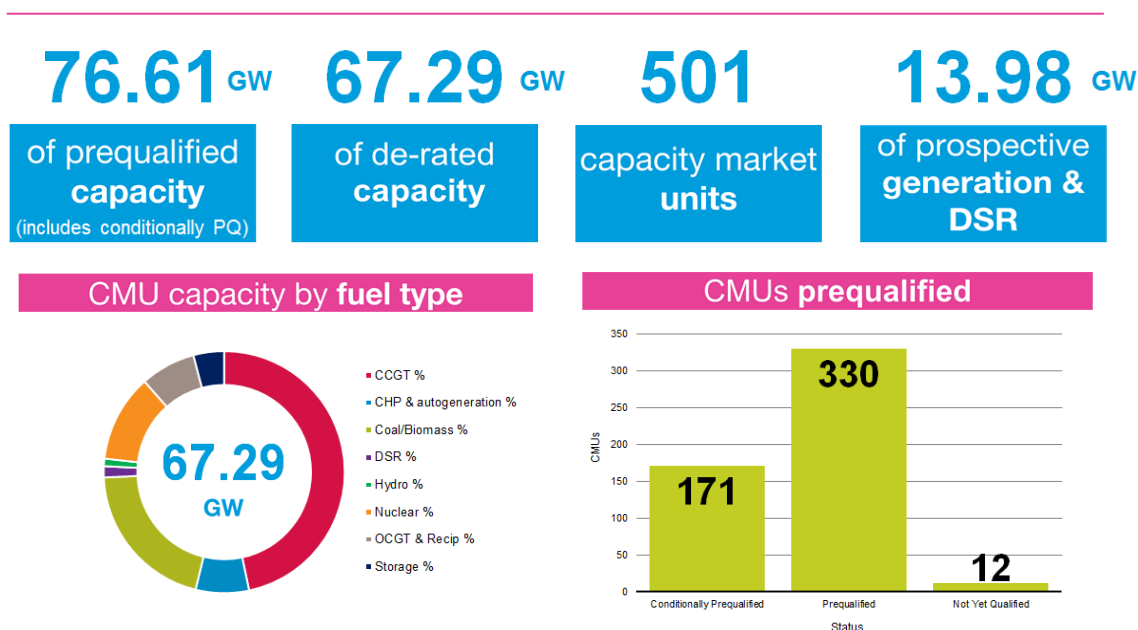
- Changes to demand forecasts;
- Volumes opted out of the auction, i.e. any existing generators who have exercised their discretion not to qualify the number of MW consistent with their centrally determined derating factors; and
- Competition considerations.

5.8.6 There is then a question as to whether the CRM Delivery Body should tell bidders the total MW of capacity that qualified for the auction. If they are told the total MW qualified they can work out the excess of supply over demand, and work out whether they are pivotal or not.

5.8.7 In the GB 2014 T-4 auction, as illustrated in Figure 12 below, the auctioneer provided the aggregate level results of the qualification process, and showed the number of Capacity Market Units qualified and the breakdown by technology. In GB, these results demonstrated that there was strong competition, since over 67GW of capacity had qualified (of which 53GW was existing capacity) compared to a capacity requirement of approximately 46GW. Therefore publishing the results may have demonstrated that there was strong competition and served to incentivise bidders to bid their true costs.

5.8.8 In the I-SEM there is expected to be an excess of existing capacity over the procurement requirement for the transitional auctions and the first T-4 auction, so publishing results may incentivise cost reflective bidding. However, in the I-SEM there are not many generating units, and publishing the same level of detailed breakdown (for instance by technology and fuel type) may allow bidders to infer information about individual bidders.

Figure 12 : Publicly available information from GB qualification, December 2014 T-4 auctions



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The CRM Delivery Body would not publicly disclose the identities of any individual qualified Capacity Market Units.

At end of auction

5.8.9 At the end of the auction (regardless of format), all bidders have to be told the clearing price, and the MW of Reliability Option contract they have won on each of their qualified Capacity Market Units. The volumes won on each Capacity Market Unit do not necessarily have to be publicly disclosed, but we would propose to do so, on grounds of:

- General transparency; and
- Since this may aid secondary trading⁵⁴.

Restrictions on bidder communications

5.8.10 The SEM Committee may consider putting in place rules which prevent a bidder:

- Giving an explicit or tacit signal of what price it is going to bid in the auction (and therefore signalling what price others should bid to co-ordinate withdrawal), whether before during or after the auction. Even disclosing bidding activity after the auction may signal intent in subsequent auctions.
- From making public statements of their expectation of the auction clearing price, which can be regarded as signalling what they are going to bid themselves.

5.8.11 Communication rules should not prevent Capacity Aggregators agreeing with their clients at what price their capacity should be bid into the auction.

⁵⁴ If secondary trading is supported by intermediaries such as an exchange, bulletin board or broker then market participants who wish to trade can discover who the other players are via the intermediary, but if trading is not supported by intermediaries, then it helps to know who the other potential trading counterparties are

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5.9 SUMMARY OF QUESTIONS

- 5.9.1 The SEM Committee welcomes views on all aspects of this section, including:
- 5.9.2 Which auction format (simple sealed bid, multiple round descending clock, combinatorial format, i.e. Option 1 to 3 in Section 5.2) do you think is most appropriate for the **transitional auctions, T-4 and T-1 auctions**, and why?
- 5.9.3 Do you have any preference for the structure of bids for the auctions? Explain your rationale.
- 5.9.4 Do stakeholders agree with the proposed approach of adopting Option 3b to deal with the lumpiness/discrete bid problem? If not, please explain why not, and your preferred alternative approach.
- 5.9.5 Do stakeholders agree with the approach of setting the clearing price based on the highest accepted in-merit winner, and paying any out-of-merit winners based on a pay-as-bid basis? If not, please explain why not, and your preferred alternative approach.
- 5.9.6 Should the SEM Committee introduce a sloped demand curve, either as a market power control, or for other reasons?
- 5.9.7 Winner determination. Do you agree with winners being determined purely on price offered for each Capacity Delivery Year?
- 5.9.8 Winner determination. Do you agree that the auctioneer should be able to accept “out-of-merit” bids to manage the lumpiness problem or should only in-merit bid be accepted? What rules should be used to determine whether the marginal bidder is accepted (if only in-merit bids can be accepted) or to determine which out-of-merit bid should be accepted?
- 5.9.9 Price determination. Do you agree that it appropriate to pay auction winners on a “pay-as-clear” basis, with this uniform clearing price being based on the highest accepted in-merit bid price? Should any out-of-merit winners be paid a different price to in-merit winners?
- 5.9.10 How do you think the lumpiness / discrete bid issue should be dealt with?
- 5.9.11 Do you have any comments on the treatment of tied bids?
- 5.9.12 What is the appropriate level of information to be provided: before qualification; between qualification and the auction start; between rounds in the case of a multiple round auction; and after the end of auction?
- 5.9.13 Are any additional restrictions on bidder communications (over and above existing competition law) required?

6. AUCTION PARAMETERS

6.1 INTRODUCTION

6.1.1 The CRM Delivery Body / SEM committee will publish some auction parameters, prior to Qualification, and between Qualification and the Auction. The parameters required will in part reflect decisions made in this consultation. However, the parameters for each auction are likely to include:

- Prior to Qualification:
 - The Auction Date;
 - De-rating factors;
 - Indicative Demand Curve, before adjustments, which will include the slope;
 - The Auction Price Cap;
 - The Bid Limits for mandated bidders, whether in the form of a Price-taker Offer Cap or Technology Specific Going forward costs ;
 - Capital expenditure thresholds which define the boundary conditions for new, upgraded and existing capacity if relevant
- Between Qualification and the auction:
 - Adjusted demand curve.

6.1.2 In addition, if relevant, market participants who fail a dominance test during the qualification phase will need to be informed privately. In the remainder of this section we discuss the issues around the approach to setting the following key Auction Parameters:

- Demand Curve;
- Auction Price Cap; and
- Other Bid Limits.

6.2 DEMAND CURVE

6.2.1 Decision 1 and Consultation 2 referred to the concept of a fixed MW Capacity Requirement. The amount of capacity procured at any given T-4 or T-1 auction might be adjusted for:

- Any capacity which exercised its right to no-bid; and
- Any capacity previously procured under long term contract in previous auctions;
- Any capacity deliberately withheld from T-4 auctions to sell in T-1 auctions.

6.2.2 The application of these deductions of these fixed amounts would still not change the fact that the auction procures a fixed MW requirement, i.e. a vertical demand curve. There are a

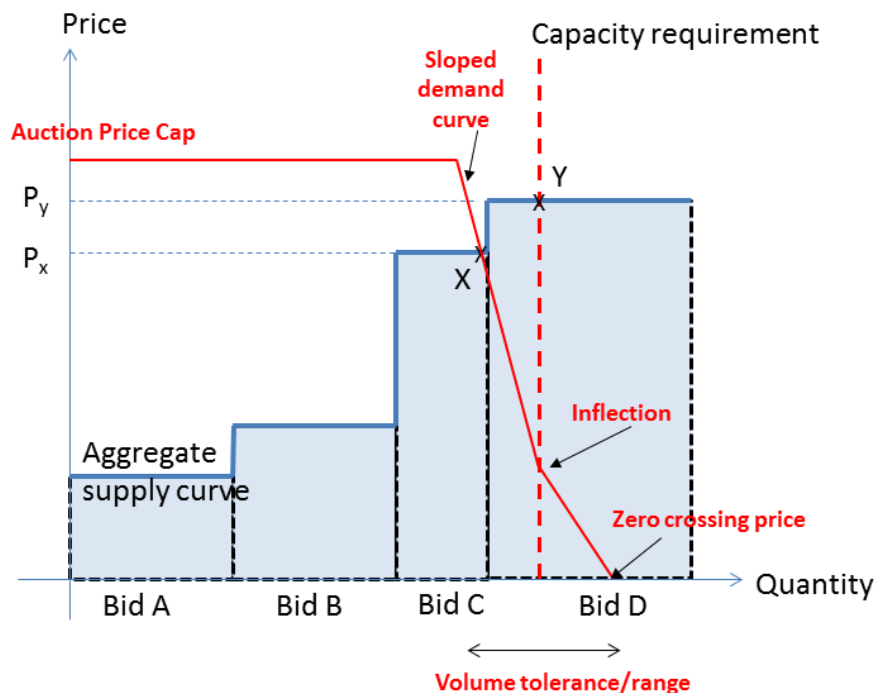
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number of potential reasons to specify a sloping demand curve, and hence factors which determine the optimum slope of the demand curve, including:

- Competition and market power mitigation. A sloping demand curve may serve to mitigate market power of bidders as bidders face “competition” from reduced demand as well as from other bidders;
- Economic efficiency. It may be economically efficient to procure more capacity if it is cheap (so reducing lost load costs less than anticipated), and less capacity if it is expensive (so reducing lost load is more expensive than anticipated); and
- Smoothing out volatility in auction clearing prices between time periods.

6.2.3 Figure 13 below illustrates an auction where there are four bids A to D, whose bids jointly form the aggregate supply curve (only revealed during the auction). Before the auction, it would be possible to set a sloping demand curve (solid red line) so that the auctioneer buys more than the capacity requirement (vertical dotted red line) if bidders bid low prices. Equally, the auctioneer buys less than the capacity requirement if bidders bid high prices. The use of a sloping demand curve means that supply equals demand at point X rather than point Y. The use of a sloping demand curve in this case potentially results in the purchase of less capacity than the capacity requirement.

Figure 13: Sloping demand curve



Competition considerations

6.2.4 Where the demand curve is a function of price, i.e. a sloping demand curve, the bidder faces “competition” from reduced capacity demand as well as from other generators. If a bidder knows that the auctioneer has a fixed capacity requirement, i.e. a vertical demand curve, the bidder might have market power which it can profitably exert. However with a sloping

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demand curve the auctioneer has the opportunity to buy less capacity and that might potentially mean that a bidder would not exercise market power, either because it is no longer profitable to do so, or because it is no longer able to do so. With a sloping demand curve the auctioneer is not merely a price taker who has to pay for new investment at any price (up to the Auction Price Cap). Therefore a sloped demand curve can bring additional constraints on the bidding behaviour of both existing and new generators.

- 6.2.5 It is also important to consider the role of the demand curve as a transitional tool. In capacity markets in the United States, sloping demand curves have been implemented in part to smooth transitions between market design changes. It is clear that an appropriate balance needs to be struck between assigning a value to capacity above the target threshold and ensuring that consumers do not overpay for capacity.
- 6.2.6 There appear to be strong competition and efficiency arguments in favour of a sloping demand curve. However, we would welcome consultation feedback on the appropriateness of applying a sloping demand curve.

Economic efficiency considerations

- 6.2.7 It may be economically efficient to buy more capacity if the price is low than if the price is high. The use of sloped demand curve, allows consumers to benefit from potential efficiency gains where capacity provider's bids are materially different from the capacity cost implicit in the security standard.
- 6.2.8 In addition, making the purchased quantity a function of price may make sense in the context of buying a mix of one year contracts and longer term contracts, if auction clearing prices are low in the current auction it may be economic to buy more longer term capacity now, if the price for longer term contracts is expected to rise in future. The slope of the demand curve therefore could potentially be a function of the length and/or quantity of the longer term contracts.

Smoothing out volatility in auction clearing prices

- 6.2.9 The price of capacity during times of excess is a key driver of the price required to attract new entry and the degree to which investment is cyclical⁵⁵. An additional benefit of a sloping demand curve is that it can be expected to smooth out the volatility in auction prices from year to year as supply and demand conditions change, particularly where the scale of entry is large relative to market size (i.e. the 'lumpiness problem') as will be the case for the I-SEM.
- 6.2.10 Capacity Markets in the United States (PJM, New England ISO and New York ISO) have all introduced sloping demand curves due to concerns about volatile capacity prices and this has

⁵⁵ If potential new entrants anticipate depressed prices over a large portion of the investment cycle then the price needed to attract entry will need to be high enough to compensate for such prices.

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been recognised by the Federal Regulatory Energy Commission (FERC) in its deliberations on capacity market design⁵⁶.

Design aspects of Sloping Demand Curve

6.2.11 Appendix I sets out detailed arrangements for demand curves in other jurisdictions. However, there are a number of design aspects of a sloping demand curve which influence the price and quantity outcomes in an auction, these include:

- **Slope and shape of demand curve:** A flatter demand curve would result in a tight distribution of price outcomes but with relatively more uncertain quantity outcomes. In contrast a steeper demand curve will produce greater price volatility but will tend to minimise quantity uncertainty.
- **Positioning of the demand curve:** This refers to the amount of excess capacity the auction is designed to procure. Positioning means that a demand curve with defined slope and shape can be moved left or right (the same price associates with less or more capacity). A demand curve positioned to procure more excess capacity will have a higher level of reliability and a higher cost.

6.2.12 Key parameters that determined the demand curve in the auction are:

- The **auction price cap**
- The **zero crossing point**, that is the level of excess capacity at which the auction should be able to clear at a zero price
- The **inflection point** (usually net cone) at which the curve changes from very steep in price to a more gradual price reduction.

6.2.13 The auction price cap and the inflection point are considered in more detail in Section 6.3 below and Annex I. The zero crossing point is a key parameter in setting the demand curve as it determines the value that consumers place on excess capacity. Zero crossing points that exist in smaller markets tend to have larger percentage values compared to those used in larger markets. For example in NYISO its New York City zone uses an 18% zero crossing point, while larger ISO-NE and PJM and GB capacity auctions use zero crossing points of less than half this value (in % terms).

6.2.14 The slope of the demand curve could potentially be designed to approximate (i.e. by stepwise linearization) the Loss of Load Probability (LOLP), multiplied by the Value of Lost Load (VOLL), as a function of system capacity. $LOLP * VOLL$ represents a theoretical approximation of the marginal value of capacity to the system. The slope of the demand curve could also potentially be reflective, as touched upon earlier, of the value associated with the length and/or quantity of any longer term contracts.

⁵⁶ See for example FERC Assessment of Market Power Mitigation in US Capacity Markets (2013): <https://www.ferc.gov/CalendarFiles/20130826142258-Staff%20Paper.pdf>

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- 6.2.15 Appendix I sets out in more detail the arrangements for demand curves and how they have been implemented in other jurisdictions. Should the SEM Committee decide to adopt a sloped demand curve the parameters related to such slope will be consulted further in a separate CRM parameters consultation, scheduled for Quarter 3 2016.

6.3 AUCTION PRICE CAP

- 6.3.1 The Auction Price Cap parameter should be set at a level which balances:

- The risk that the Auction Price Cap is set at too low a level to incentivise new investment when it is needed, jeopardising **system security**; and
- The risk that the Auction Price Cap is set at too high a level, allowing market participants with market power to abuse their market power and drive up the auction clearing price, i.e. have negative effects with respect to **competition** and **efficiency objectives**.

- 6.3.2 The GB and a number of US capacity auctions set an Auction Price Cap as a function of an administratively estimated net Cost of New Entry (Net CONE). Net CONE is typically defined as the estimated fixed costs of a Best New Entrant (BNE) Peaking Plant, minus revenues from infra-marginal rent in the energy market and ancillary services.

- 6.3.3 In practice Net CONE is calculated as:

- Gross CONE, which has two key elements:
 - Investment costs, including depreciation, interest financing and return on capital on investment; and
 - Fixed operating and maintenance (O&M) cost.
- Net of infra-marginal rent earned by the reference new entry plant from energy income and ancillary service income.

- 6.3.4 The use of Net CONE based upon a reference BNE cost is well established as a methodology for setting the Annual Capacity Payment Sum in the SEM. Generally, the SEM Committee has adopted the principle of not changing methodologies that do not need to be changed when moving from the SEM to the I-SEM.

- 6.3.5 The rationale for bid caps based on Net CONE (Net CONE or a function of Net CONE) is that Net CONE, as defined represents the “missing money”, the extent to which it cannot cover its total revenue requirement from energy income and ancillary service revenue. To the extent that a generator earns energy and ancillary service revenues in excess of its variable costs it reduces any missing money. Indeed, if infra-marginal rent equals or exceeds Gross CONE, the maximum amount that can be bid reduces to zero. In a market with “missing money”, the Net CONE is the minimum amount of capacity payment necessary to bring forward the investment required to maintain the security standard- assuming of course that Net CONE is accurately estimated, and that the administratively determined estimate of Net CONE accords with investors’ views.

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- 6.3.6 If Net CONE can be accurately estimated, then there is a strong case for setting the Auction Price Cap at $1 \times$ Net CONE. However, there may be significantly greater uncertainty in estimating Net CONE four years in advance of the Capacity Delivery Year for an I-SEM T-4 auction than there is estimating net CONE 6-9 months in advance of the Capacity Delivery Year as required by the current SEM Capacity Mechanism process. There is also additional uncertainty being introduced as a result of contemporaneous reforms to the energy market, capacity market and ancillary service market.
- 6.3.7 Uncertainty associated with estimating infra-marginal rent and ancillary service revenue four years advance is not unique to the I-SEM, and has to be catered for in the design of capacity auctions in the US and GB too. The level of uncertainty around estimating Net CONE argues in favour of introducing a margin for uncertainty when setting the Auction Price Cap. For instance:
- GB: the Auction Price Cap was set at 1.5 times estimated Net CONE in the 2014 and 2015 T-4 auctions;
 - US PJM: the equivalent of the Auction Price Cap was set at 1.5 times Net CONE , or the gross CONE if that is higher;
 - ISO New England: the equivalent of the Auction Price Cap was set at 2 times Net CONE.
- 6.3.8 There appears to be merit in setting the Auction Price Cap as a multiple of Net CONE. A multiple of $1 \times$ Net CONE would ensure that consumers do not end up paying more for capacity as a result of the introduction of the I-SEM CRM, and the current level of capacity remuneration based on Net CONE has proved adequate to attract sufficient capacity in the SEM. However, the SEM Committee welcomes feedback on:
- Whether the Auction Price Cap should be set as a multiple of Net CONE;
 - What multiple of Net CONE the Auction Price Cap should be set at.

6.4 BID LIMITS FOR MARKET POWER REASONS

- 6.4.1 As discussed in Section 4.7, the SEM Committee may include other Bid Limits, which may apply to all existing generators, or only those deemed dominant. These Bid Limits could take the form of:
- **Option 1: Price-taker Offer Cap.** This approach sets a single upper limit which all mandated bidders cannot bid above, and is the approach applied in GB;
 - **Option 2: Based on technology going forward costs:** This approach limits bids to generic going forward costs by unit type, so for various classes of units there would be a generic upper limit.
- 6.4.2 As Option 2 is applied in a number of US markets, the approach to setting these values has been defined by US precedents, although clearly the values of the parameters would need to be calibrated to the I-SEM market, reflecting local costs in local currencies. Applying Option 2

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would therefore potential entail significant work in validating technology specific values- more work than for the current BNE process, which is based on a specific technology.

- 6.4.3 Option 1 can be regarded as a non-technology specific “going forward” cost, and would logically be based on a generic “going forward” cost, and could also include a reasonable margin for estimation error.
- 6.4.4 Whilst a new investor needs to have an expectation that it can cover its Net CONE from capacity payments, existing plant owners have sunk costs, and once these are committed, need not necessarily receive Net CONE to justify continuing to run the plant. Hence in theory, the bids of existing generators can be capped at a lower level than Net CONE without jeopardising security of supply.
- 6.4.5 Previous SEM analysis of BNE costs has estimated BNE SEM generator’s categorises recurring costs as⁵⁷:
- Market operator costs;
 - Electricity transmission use of system charges⁵⁸;
 - Operation and maintenance costs;
 - Insurance;
 - Business rates; and
 - Ongoing fuel working capital costs.
- 6.4.6 This definition does not include any costs for new investment, repayment of debt⁵⁹ or return on equity.
- 6.4.7 As illustrated in Table 5, in SEM-15-032a, which sets out the breakdown of BNE costs, the SEM Committee’s consultants estimated that recurring costs, account for only €26.50/kW/year of the €76.24/kW/year of the estimated Gross CONE, and around 40% of Net CONE. However, it could be argued that these costs are for an efficient new plant, and older plant incurs higher going forward costs. Nevertheless, these estimates are not much different to the approach employed in GB of capping the bids of existing generators to 50% of Net CONE.

⁵⁷ See for instance SEM-15-032/SEM-15-032a

⁵⁸ If a gas fired plant was used as the BNE reference plant, gas transmission would also be included

⁵⁹ If the recurring costs are not met over a sustained period, then the plant will have negative Free Cashflow (Cashflow before meeting interest payments), and will be incentivised to close. If the capacity payment covers the recurring costs of existing plant, then even if the plant owner is unable to meet its interest payments, it may be rational for the debt owner to continue to run the plant. Plant equity owners may lose their equity, but the debt holders who will assume control may then be incentivised to keep the plant open if revenue exceeds recurring costs, as at least it will allow them to earn back a portion of the debt. On this assumption, bids of existing generators could be capped at a level which allows them to only recover their recurring costs. However, whilst keeping the plant open would be rational for the owner of single plant, a debt holder which owned the debt on multiple plants may be incentivised to close at least one Free Cashflow positive plant, in order to boost profitability on the remaining portfolio

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Table 5: Estimates of SEM Best New Entrants costs for 2016

	€/kW/year	% of Net CONE
Gross CONE	76.24	116.4%
Recurring costs:		
Market operator charges	0.05	0.1%
Electricity transmission charges	4.13	6.3%
Operation & Maintenance	9.91	15.1%
Insurance	7.73	11.8%
Business rates	3.85	5.9%
Fuel working capital (ongoing)	0.84	1.3%
Total	26.50	40.5%
Infra-marginal rent	6.1	9.3%
Ancillary services	4.64	7.1%
Net CONE	65.5	100.0%

Source: SEM-15-032 and SEM-15-032a

6.4.8 In considering what level to set the Bid Limits at in the I-SEM, the SEM Committee considers that it should seek to achieve an appropriate balance between the following considerations:

- Competition: Avoiding the abuse of market power is particularly important, particularly amongst existing generators when no new capacity is required. The SEM Committee is aware that ownership of existing generators is more concentrated in the all-island market than in some other comparable markets (e.g. GB), and that certain companies, particularly ESB will have market power in the capacity auctions.
- Security of supply: The Bid Limits should not be set too low so that a significant proportion of plant is at risk of being unable to cover its costs. However, the additional proviso (see paragraph 4.7.21), that a plant could apply to have this restriction lifted if it had significantly higher going forward cost would mitigate this risk;
- Efficiency: The SEM Committee will be keen to ensure that capacity is procured at a low cost to customers.

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6.5 SUMMARY OF QUESTIONS

- 6.5.1 The SEM Committee welcomes views on all aspects of this section, including:
- 6.5.2 Do you have any comments on the overall scope / process of auction parameter setting outlined above?
- 6.5.3 If a sloped demand curve is introduced, what principles should be used to determine the slope of the demand curve, and the range within which the demand curve is sloped?
- 6.5.4 If introduced, should the sloped demand curve be different for the transitional period?
- 6.5.5 What impact do you think the sloped demand curve will have on competition?
- 6.5.6 Do you agree with the requirement for an Auction Price Cap? What principles should be used to determine the level for the Auction Price Cap/what level should it be set at?
- 6.5.7 Do you agree with the requirement for other Bid Limits?
- 6.5.8 Should the other Bid Limits be applied at the same level to all existing non-intermittent firm transmission access generators, or should the limits be technology specific?
- 6.5.9 Should the other Bid Limits be applicable to all bidders, or just dominant/ pivotal generators?
- 6.5.10 What principles should be used to determine the level for the other Bid Limits/what level should they be set at?

7. AUCTION GOVERNANCE, ROLES AND RESPONSIBILITIES

7.1 INTRODUCTION

7.1.1 Clear and transparent governance arrangements and allocation of roles and responsibilities is important to ensure that the I-SEM capacity market provides a stable and adaptable framework that protects consumers' interests, delivers competitive outcomes and ensures long run market confidence. The governance arrangements will be set out in the new Capacity Market Code and will provide for strong regulatory oversight of the auction process through the Regulatory Authorities approval and market monitoring functions as well as through an independent Auction Monitor to oversee and audit the role of the CRM Delivery Body. A robust modification process for the capacity market rules as well as provisions for disputes will also be important elements of the governance framework. In this section we set out our proposals for:

- The legal and governance framework for the auctions (the Capacity Market Code (CMC) and subsidiary documents);
- A mechanism to deal with disputes arising;
- The Capacity Market Code (CMC) modification process;
- The key roles and responsibilities associated with qualification⁶⁰ for the auctions, and conducting the auction, including:
 - The role of the TSOs as CRM Delivery Body;
 - The role of an Independent Auction Monitor and audit;
 - The role of the SEM Committee / Regulatory Authorities; and
- Managing Conflicts of Interest.

7.2 AUCTION LEGAL AND GOVERNANCE FRAMEWORK

7.2.1 In our Decision Paper 1 on the Detailed Design of the I-SEM Capacity Remuneration Mechanism (SEM-15-103), the SEM Committee set out its decision on the institutional arrangements that will underpin the new CRM. Specifically, this set out that we will implement a Rules Based Model for the detailed contractual terms that cover the settlement of Reliability Options. These detailed terms will be captured within a section of the revised Trading and Settlement Code for the I-SEM, with the details of each Reliability Option being retained in a Register of Capacity Agreements to be maintained by the TSOs.

7.2.2 In SEM-15-103 we further stated that the Capacity Market Rules will form part of the TSOs' licences and in our recent paper on the I-SEM Governance Arrangements published on 26 February, (SEM-16-007) we clarified that 'the CMC, like the TSC, will be implemented as a

⁶⁰ called pre-qualification in some previous documents

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multilateral contract to which parties would accede via a Framework Agreement and which will oblige such parties contractually to comply with the CMC provisions. This approach will give potential investors in future generation confidence in the stability of the arrangements over the period of their Capacity Market Agreements’.

7.2.3 The Capacity Market Code will specify the process by which generators and demand side units can qualify to take part in the capacity auction and gain a Capacity Market Agreement. The Capacity Market Code will set out the contractual rules for:

- Eligibility and de-rating rules;
- Roles and responsibilities, including that of the CRM Delivery Body and Auction Monitor (although some elements of the roles and responsibilities of the CRM Delivery Body may be included with the updated TSOs licence);
- Auction Qualification;
- The operation of the Capacity Market Auction;
- The key terms and conditions of the Reliability Option contract (with the exception of settlement terms contained with the TSC);
- The obligation on the CRM Delivery Body to maintain a Capacity Market Register and make data available as required to support settlement, and to support secondary trading; and
- Implementation Agreements.

7.2.4 In this consultation we seek input from stakeholders on the elements of the Capacity Market Code. We plan to issue a Heads of Terms of the Capacity Market Code along with our decision document for this consultation.

7.2.5 The SEM Committee is seeking to align, where possible the qualification (previously referred to as pre-qualification) requirements for the CRM auctions, DS3 auctions and the Implementation Agreements. As a result the:

- Qualification requirements for both CRM and DS3 auctions are being consulted on in SEM-15-091, and the SEM Committee expects to issue a decision in respect of this consultation in April 2016; and
- Implementation Agreements were consulted on for both CRM and DS3 in SEM-15-014, and the SEM Committee expects to issue a decision in respect of this consultation in May 2016.

7.2.6 As part of this process, we will review the governance of the Qualification process and Implementation Agreements for the CRM and DS3 to ensure alignment where possible whilst acknowledging the different contractual arrangements that underpin the CRM and the procurement of ancillary services.

7.2.7 The Capacity Market Code will set out the following with respect to the operation of the CRM auctions:

- Requirement on the CRM Delivery Body to develop Auction Agreed Procedures for approval by the SEM Committee, and the required content of these Agreed Procedures;

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- The governance of the auction timetable, including:
 - How long before the start of each auction the qualification window opens, and closes and when results will be published
 - How long before each auction, key auction parameters will be published
- Role of the CRM Delivery Body as Auctioneer;
- Rules for qualification to bid in the capacity auction;
- Rules for disqualification from future bid submission;
- Capacity auction format;
- Format of bids in the capacity auction;
- Capacity auction clearing and pricing rules;
- Publication of capacity auction results;
- Rules governing the capacity auction suspension or cancellation;
- Prohibition on market manipulation;
- Prohibition on other unreasonable business methods; and
- Role of the Auction Monitor and audit of capacity auctions.

7.2.8 The Capacity Market Code will also be required to contain *inter alia* the following information:

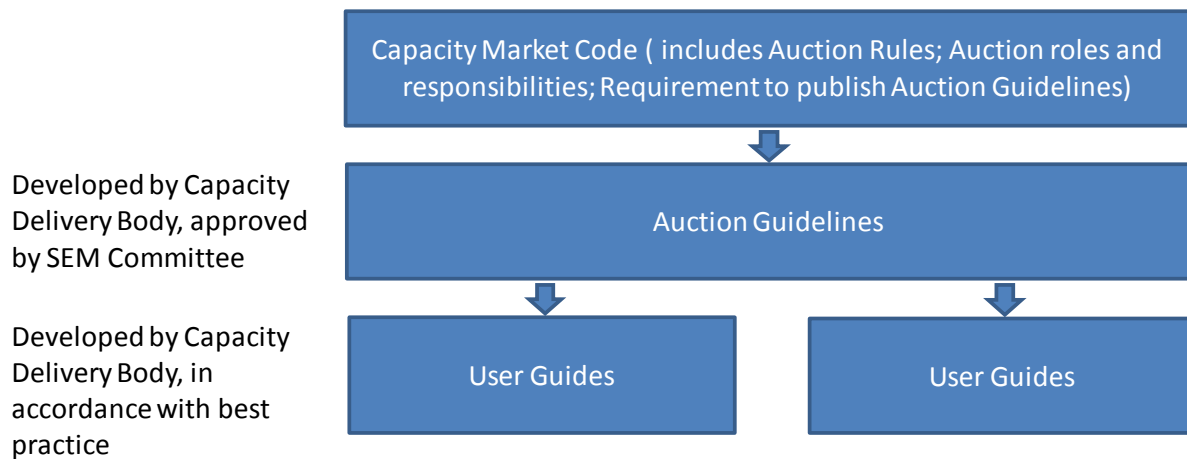
- The key auction parameters determined by the SEM Committee from time to time, such as the amount to be purchased, and if relevant, the Auction Price Cap, the Auction Bid Limits and the slope and points of the demand curve;

7.2.9 The Auction Agreed Procedures will contain operational detail relating to:

- Instructions on using the auction system, including qualification systems, if relevant. Alternatively these instructions could be included in a separate IT user guide;
- Where to access the relevant forms to be completed by applicants as part of the Qualification process and relevant file formats for the application and such additional information as may be required;
- Detail on any other processes and procedures which the SEM Committee may deem relevant or appropriate.

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Figure 14 : Auction Governance



7.3 DISPUTES

7.3.1 We are considering whether an independent Dispute Resolution Process should be developed as part of the Capacity Market Code, in the same way that a dispute resolution procedure is captured within the text of the existing TSC for SEM. The purpose of this would be to resolve disputes between parties to the Capacity Market Code regarding any of the obligations, rules and procedures of the CRM Delivery Body set out under therein⁶¹. It should be noted that disputes related to the capacity settlement would be covered within the provisions of the dispute resolution process in the TSC, as this code will contain the settlement provisions relating to the capacity market.

7.3.2 Rules governing any proposed Dispute Resolution Process, would be set out in the Capacity Market Code (to be drafted). The objectives of such a process will be comparable (to the extent possible) to that of the TSC, and may include but would not be limited to:

- Preserve or enhance the relationship between the Disputing Parties;
- Resolve the Disputes on an equitable basis in accordance with the Capacity Market Code and its objectives;
- Allow for the continuing and proper operation of the Capacity Market Code having regard to its objectives;
- Take account of the relevant skills and knowledge required; and
- Encourage resolution of Disputes without formal legal representation or reliance on legal procedures.

7.3.3 We are considering whether a panel of experts would be nominated, a subset of which would form a Dispute Resolution Board to hear disputes with a chairperson of the panel appointed

⁶¹ These could relate, for example, to processing of qualification applications by the CRM Delivery Body

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by the RAs⁶². We are considering how the respective roles of the Disputes Panel and the Regulatory Authorities can best be exercised in the review of any determinations of the CRM Delivering Body in order to strike the appropriate balance between efficiency and equity within the legal framework that the I-SEM will operate in⁶³. Ultimately, any party will have the right to raise an appeal or dispute through the Courts.

7.4 CAPACITY MARKET CODE MODIFICATION PROCESS

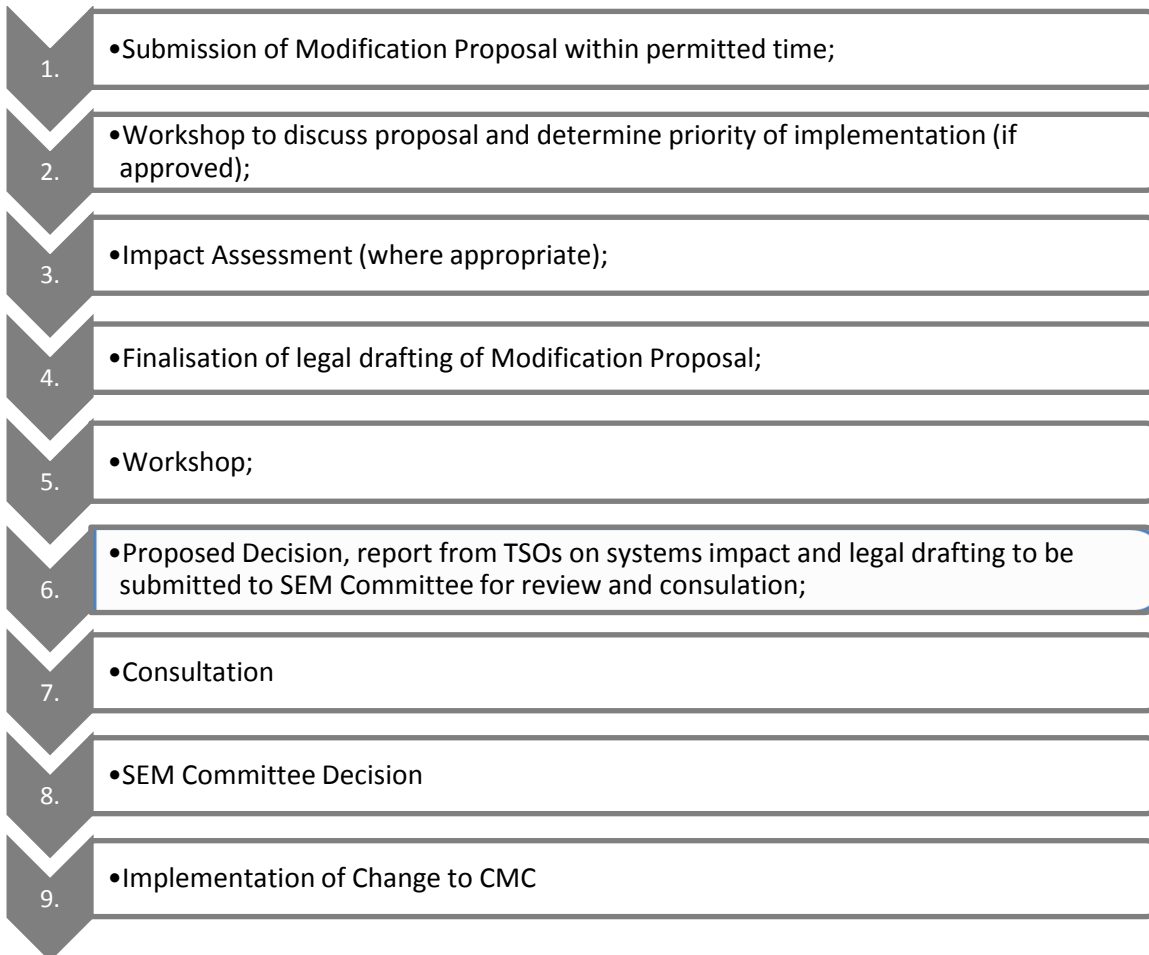
- 7.4.1 Modification Proposals to amend the Capacity Market Code may arise from consideration of the performance of the operation of the qualification and auction process and, if possible and appropriate should be implemented before the start of the process for the next relevant auction.
- 7.4.2 Given that the CRM auction process will take place on an annual basis, the Regulatory Authorities are of the initial view that the timeline for changes to the CMC must run to a more precise timeline than that provided for the Modification Proposals to the existing Trading and Settlement Code.
- 7.4.3 Furthermore, given that a prudent level of regulatory oversight of the qualification and auction process is anticipated to be necessary, the Regulatory Authorities are minded to use a different process to affect Modifications of the Capacity Market Code than the process currently used with respect to the TSC.
- 7.4.4 The initial process to define for the modification process is who should be able to raise proposals. We consider that it would be appropriate, in a similar manner to the existing TSC, that Modification Proposals to the Code be proposed by any person including the TSO, CRM Delivery Body (and Market Operator) and the Regulatory Authorities.
- 7.4.5 As Modification Proposals may need to be implemented before the start of the process for the next relevant auction, it would seem imperative that the proposal would contain sufficient detail so that consideration of both the substantive question and the prioritisation (in terms of the implementation and systemisation of any proposed amendment), is possible. In addition, this process (since it results in both a substantive decision on the Modification Proposal and a decision on the priority of a Modification Proposal) must have a consultation element. We consider that the workshop approach (similar to that operated by Ofgem in GB) appears to have the necessary elements and is an appropriate model to be applied to the I-SEM CRM. Such a process would involve the following elements in the I-SEM CRM context: workshop; decision on priority; impact assessment (where appropriate); finalisation of legal drafting; workshop; proposed decision; consultation; SEMC decision; implementation of change to Capacity Market Code. (See Figure 15 below).

⁶² A Members of the CRM Code disputes panel may or may not comprise those who were appointed to hear disputes with respect to the TSC.

⁶³ In the GB Capacity Market, an appeals mechanism to Ofgem was provided for in legislation. Given the contractual nature of the I-SEM Capacity Code a disputes panel and potentially some form of review process by the RAs of Delivery Body decisions is likely to be more appropriate.

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Figure 15: Pictorial Depiction of Proposed CMC Modification Process



7.4.6 It is proposed that the Capacity Market Code modification process should have the following elements:

1. A Modification Proposal is submitted to the CRM Delivery Body within the time prescribed. There will be an annual deadline by which proposals must be raised. Any person including the Regulatory Authorities, TSOs and the CRM Delivery Body (and Market Operator) may raise a Modification Proposal. All modification proposals which are to be considered within a modification period must be submitted by the deadline together with:
 - Detailed description of the justification of the proposed change;
 - Detailed outline of the legal drafted changes necessary;
 - Outline of areas of impact on users and systems; and
 - Explanation of how it would further the objectives of the Capacity Market Code.

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2. Priority should be determined via discussion at a Workshop organised by the CRM Delivery Body. All accepted Modification Proposals will be considered in a two stage workshop process, whose purpose is to enable the SEM Committee to decide which proposals will progress to the next stage.
3. Once the priority has been determined, it is proposed that in the first instance, an impact assessment be carried out where the Modification Proposal would require changes to the associated systems software. Indeed, before making a decision in relation to any proposed change, the SEM Committee may need to know the impact of that change both in terms of impact on systems and resources and on the operation of the qualification and auction process.
4. In addition, the initial proposal must be developed into detailed legal drafting of the proposed change to the Capacity Market Code.
5. An additional Workshop will be held to discuss the substantive Modification Proposal.
6. It is proposed that both the impact assessment and legal drafting (where appropriate) be carried out by the TSOs and the results set out in a report to the SEM Committee which proposes (and justifies) which of the proposals should be implemented;
7. The SEM Committee publishes the report and a minded-to view for consultation (probably for a relatively short period - four to six weeks). This minded-to view may be on the basis of the TSOs proposal or otherwise;
8. The SEM Committee makes a decision on the Modification Proposal and directs the changes that should be implemented before the start of the next qualification and auction cycle.
9. The relevant changes are implemented to the Capacity Market Code and software systems where required.

7.5 ROLE OF TSOS AS CAPACITY REMUNERATION MECHANISM DELIVERY BODY

7.5.1 The TSOs (i.e. EirGrid and SONI) will have the overall responsibility for managing the qualification process and will operate the auction. These roles will be defined in the Capacity Market Code as CRM Delivery Body and provided for in the TSOs' licences. The CRM Delivery Body will be responsible for the following auction related tasks:

- Procuring software to run the auction, and software to run the qualification process if necessary /appropriate;
- Developing auction guidelines, including developing appropriate user guides and agreed procedures;
- Publishing key auction parameters in accordance with the Capacity Market Code, Auction Guidelines or as otherwise directed by the SEM Committee;

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- Running the qualification process, including obtaining and validating bid bonds; and
 - Running the auction, calculating and publishing the auction results in accordance with the auction guidelines.
- 7.5.2 Given that the Capacity Market Code (and the Trading and Settlement Code (TSC)) will set out the contractual relationship between Capacity Providers who clear in the auctions, the Capacity Market Code will set out the Capacity Agreements and provisions for performance bonds (i.e. capturing any contractual relationships that Capacity Providers will be entering into).
- 7.5.3 The TSOs' obligations as CRM Delivery Body will be subject to monitoring by the Auction Monitor and the Regulatory Authorities/ SEM Committee.

7.6 ROLE OF AN INDEPENDENT AUCTION MONITOR AND AUDIT

- 7.6.1 Many auctions employ an Independent Auction Monitor to monitor the conduct of the auction and to ensure that the rules are complied with in addition to wider regulatory arrangements to monitor and take action against anti-competitive behaviour. While it is standard practice in capacity markets in the United States to employ market monitors to monitor capacity auctions for anti-competitive behaviour and report directly the Regional Transmission Organisations (RTOs) and the US Federal Energy Regulatory Commission, the approach taken in the GB capacity market has been to rely more on a compliance auction auditor and monitor as well as wider ex-post competition enforcement. We envisage that the role of I-SEM CRM monitoring will be split between the Regulatory Authorities and an Independent Auction Monitor as follows:
- The Regulatory Authorities will monitor market participants' activity during the qualification and auctions (including attending auctions) and perform a similar role to that undertaken by the existing SEM Market Monitoring Unit with respect to the energy market or the US Market Monitoring Units which cover the spot and forward capacity markets. This will include seeking to identify any abuse of market power and gaming, and monitoring compliance against REMIT regulations.
 - Independent Auction Monitor. The Independent Auction Monitor will assist the Regulatory Authorities in monitoring that the CRM Delivery Body and market participants have complied with the Capacity Market Code. The Independent Auction Monitor will be expected to bring additional skills and experience in capacity auctions from other markets.
- 7.6.2 The Independent Auction Monitor role would likely be competitively tendered by the SEM Committee, and would report to the SEM Committee, not the CRM Delivery Body, but its costs would be funded by the CRM Delivery Body⁶⁴. At the end of the auction process, the Auction Monitor will provide the SEM Committee with an assurance (audit) report. The terms of reference for the audit report will be consulted on from time to time, but we envisage that, at

⁶⁴ In much the same way as the oversight and financing of the TSC Market Audit for SEM currently operates.

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least for the first auctions, the Auction Monitor will include a validation of the auction results. The settlement of the ROs will be governed by the TSC, and covered under the TSC audit.

7.6.3 The appointment of an Independent Auction Monitor is justified in the light of the amounts of money at stake, and consistent with international best practice. In the US PJM market, for instance, there is an independent market monitor, and part of its remit is to report on the PJM Reliability Pricing Model (i.e. capacity market). GB also appointed an Independent Auction Monitor, and included a duty to provide a report to the Secretary of State within two days of the auctions setting out, inter alia, a view on whether the CRM Delivery Body has conducted the auctions in accordance with its rules and regulations.

7.6.4 In the context of the I-SEM CRM, the duties of the Independent Auction Monitor will include all or some of the following tasks:

- Monitoring the pre-qualification process to ensure that the CRM Delivery Body complied with the rules. Such a duty would entail appointing the Monitor early in the process;
- Be present at the auctions, with full read access to all key software, including access to all bids and all communications between the auctioneer and all bidders;
- Reporting on whether it considers that the CRM Delivery Body has conducted the Capacity Auction in accordance with the relevant rules and regulations;
- Auditing of any calculations made during the auction and confirming the auction results;
- Where applicable, identifying any actual or potential breach of the rules and regulations or other actual or potential irregularities in the conduct of the Capacity Auction by the CRM Delivery Body and an assessment of the consequences; and
- Making recommendations on the changes to the Capacity Market Code / Auction Guidelines /User Guides.

7.6.5 The incorporation of the capacity settlement rules into the TSC will have implications for the audit of the TSC carried out by the TSC auditor. For instance, the TSC audit scope is likely to need to include calculation of the Reliability Option fees, Supplier charges, the Strike Price and difference payments and ensuring that they are made in accordance with the rules incorporated into the TSC.

7.7 ROLES OF SEM COMMITTEE AND THE REGULATORY AUTHORITIES

7.7.1 The SEM Committee will have the following roles/powers with respect to the auction:

- Approving the de-rating methodology determined by the CRM Delivery Body;
- Determining the timings of the qualification processes and auctions for each time period;
- Approval of key Auction Parameters;

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- Instructing the CRM Delivery Body to cancel an auction, if it deems cancellation appropriate;
- Setting the terms of reference for the Independent Auction Monitor, in consultation with stakeholders;
- Directing changes to Capacity Market Code and Auction Guidelines according to the process set out in Section 7.4 of this Paper.

7.7.2 In addition, the Regulatory Authorities will continuously monitor the capacity market (including qualification, auctions and the operation of the secondary market) for signs of market abuse, gaming and for compliance with REMIT as part of their overall monitoring function regarding the all-island wholesale electricity market.

7.8 MANAGING CONFLICTS OF INTEREST

7.8.1 A number of stakeholders have previously expressed a concern that there is a conflict of interest regarding the TSOs (EirGrid and SONI) between their role as the CRM Delivery Body and other roles that they will be undertaking, notably regarding the role of current and future ownership of interconnection assets and operator of balancing and ancillary service markets.

7.8.2 In SEM-15-014, the SEM Committee set out a number of options for the treatment of interconnectors in the I-SEM CRM. In two of these options (the Interconnector led availability and interconnector performance based approaches) interconnectors (including the East West Interconnector (EWIC) and any future interconnectors that may be owned by EirGrid) would be a direct bidder in the auction. In other provider based options, the value that GB capacity providers might be prepared to pay for FTRs (including on EWIC) might be a function of the auction outcome⁶⁵. The consultation closed on 8 February and the SEM Committee has not yet decided which option to adopt but, notwithstanding this, it is important that perceived or actual conflicts of interest are mitigated through the design and rules set out in the Capacity Market Code including:

- (a) Clear and transparent rules for the carrying out of the functions of the obligations of the CRM Delivery Body to be set out in the Capacity Market Code which will be subject to a Modification Process and approved by the SEM Committee.
- (b) The role of the Auction Monitor and Auditor in ensuring that the CRM Delivery Body carries out its obligations in accordance with the Capacity Market Code including:
 - The setting of the capacity requirement in accordance with the procedure set out in the Capacity Market Code;

⁶⁵ We note that the same perceived conflict between the role of Capacity Delivery Body and auction participant occurs in GB. National Grid is the GB Capacity Delivery Body, and has a stake in the IFA interconnector (England – France) and the BritNed (England – Holland) interconnector. In the GB 2015 T-4 auction, interconnectors were bidders, but GB has employed a similar oversight structure with an independent Auction Monitor monitoring the auction, and providing an assurance report. National Grid Interconnectors Ltd won 1033.76MW in this auction, and the BritNed interconnector won 828MW.

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- The carrying out of the derating of capacity providers in accordance with the derating methodology set out in the Capacity Market Code;
- The running of the qualification process for the auction;
- The running of the T-4, T-1 and transitional auctions including an audit and rerun of the auctions to ensure the results can be replicated; and
- Approval by the SEM Committee of methodologies and parameters set out in the Capacity Market Code including the Capacity Requirement, the derating process and endorsement by the SEM Committee of the results of the Qualification Process and the auctions.

7.8.3 The SEM Committee set out in the Decision Paper on I-SEM Roles and Responsibilities (SEM-15-077) its approach to assessing and managing conflicts of interest and realising synergies of the EirGrid Group roles in the I-SEM to ensure the long term interests of consumers are protected. To that end, the Regulatory Authorities are carrying out an assessment of conflicts of interest and synergies regarding the EirGrid's Group role in I-SEM and a suite of proportionate mitigation measures (behavioural, ring-fencing etc.) will be implemented to manage these.

7.8.4 As set out in the I-SEM Roles and Responsibilities Decision Paper there are four main categories of measures under consideration to mitigate conflicts of interest, as set out in the table below. The mitigation measures set out in this paper relate to the Control/Responsibility and Transparency measures to be applied through the Capacity Market Code while wider mitigation measures, if required, will be developed as part of the overall governance and licence framework for I-SEM.

Table 6 Mitigation of Conflicts of Interest in Context

Mitigation Measure	Description
Ringfencing	These measures cover a spectrum of organisational or structural changes as set out in Table 6. They may be implemented in isolation or in combination with other measures. Some may be costly as they restrict the ability to exploit synergies.
Behavioural	These relate to Codes of Conduct for staff, incentives etc.
Control/Responsibility	These measures relate to regulatory oversight of market design including the energy market, the CRM and DS3 Auctions.
Transparency	Publication of information in a non -discriminatory manner, independent audit of functions under codes and licences

7.8.5 The Regulatory Authorities will have further engagement with stakeholders on this in April 2016. Notwithstanding this wider process the Regulatory Authorities intend that the overall design and governance framework for I-SEM will develop so that conflicts of interest are

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managed. To that end, we intend that the Capacity Market Code will contain transparent rules for the CRM Delivery Body in carrying out its functions, auditing and monitoring and regulatory approval of methodologies and parameters related to the CRM as set out above.

7.8.6 The prior sections described how the SEMC proposes to address conflicts of interest related to:

- **Control/responsibility:** Decision making by SEMC etc. and
- **Transparency:** Publication of audit results, role of auction monitor etc.

7.9 SUMMARY OF QUESTIONS

The SEM Committee welcomes views on all aspects of this section, including:

- A) Do you agree on the proposed role of the TSOs with respect to the auctions?
- B) Do you agree on the requirement for an Independent Auction Monitor and its proposed roles and responsibilities? If not, please specify what changes you would make? Should this role be combined with the role of SEM/I-SEM Market Auditor?
- C) Do you agree with the SEM Committee's proposed approach to managing conflicts of interests in the Capacity Market Code? Are any other steps appropriate to ensure that any actual or perceived conflicts of interest are managed?
- D) Do you have any comments on the proposed auction governance arrangements?
- E) Do you have any views on the model and process for making modifications to the Capacity Market Code?
- F) Do you think that disputes in respect of the Capacity Market Code should be resolved by a similar process to TSC disputes? Should there be a separate panel for Capacity Market Code dispute resolution?

8. OTHER RESIDUAL ISSUES

8.1 INTRODUCTION

8.1.1 Any other business that we do not finalise in Decision 2.

- Reliability Option Strike Price; and
- Difference payment socialisation arrangements.

8.2 STRIKE PRICE

Introduction

8.2.1 In SEM-15-103, the SEM Committee decided that the Strike Price for the ROs would be based on a hypothetical low efficiency peaking unit, as per the example in New England. The Strike Price would also include an element of the formula which reflects costs of DSUs related to reducing demand⁶⁶. SEM-15-103 stated that the Strike Price formula would be of the form⁶⁷:

$$\text{Strike Price} = \text{Max} [1/T\% \times \text{Max} [\text{GRP}, \text{ORP}], \text{DSU}]$$

Where:

T% is the reference thermal efficiency for the hypothetical Peak Energy Rent unit

GRP is the gas reference price, which will be consulted on further, but which is likely to be a gas spot reference price (e.g. an NBP spot reference price plus a transport adder)⁶⁸

ORP is the oil reference price, which is likely to be a gas oil spot reference price (e.g. an ARA gas oil reference price plus a transport adder)⁶⁹

DSU is the cost of a reference demand side unit, €/MWh which reflects the cost incurred by demand side in switching off, which may not be related to the cost of energy

⁶⁶ Such as lost production value

⁶⁷ The formula contains two key elements. The first is intended to reflect the marginal cost of a hypothetical reference peaking generator, which could be either gas fired or oil fired. The second is the cost faced by a DSU related to reducing energy consumption. That cost might for instance reflect lost output, and is not necessarily related to the cost of fuel for generation. These two elements are not additive. Whichever of the two is higher at any given time will set the Strike Price.

⁶⁸ Converted to the appropriate units

⁶⁹ Converted to the appropriate units

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8.2.2 In this section we consult on the following:

- **The inclusion of carbon** in the above formula;
- **Spot or forward prices:** Whether to use a forward (month-ahead) gas and oil price rather than a daily spot gas and oil price. If we adopt a month-ahead gas and oil price, the Strike Price will be constant within any calendar month;
- **The reference thermal efficiency** (value of the parameter T): The key issue is to choose the reference low thermal efficiency unit (i.e. low value of T) which achieves an appropriate trade-off between minimising interference with the energy market whilst preserving the value of the Reliability Option hedge; and
- **The process and governance for selection of fuel and carbon input data.**

8.2.3 The following elements of the Strike Price calculation will be defined in the subsequent CRM parameter consultation:

- DSU floor price. As discussed in SEM-15-103, to facilitate DSU participation we plan to set the DSU element of the formula around €500/MWh, although the precise value of the DSU element of the formula will be consulted on closer to I-SEM go-live; and
- The value of transport adders⁷⁰; and

Carbon intensity factors, which are introduced in the following section.

Treatment of Carbon in the Strike Price Formula

8.2.4 In SEM-15-103, the SEM Committee noted, “that it may also be appropriate to adjust this [i.e. the Strike Price] formula to include an element of the carbon price in the formula”⁷¹. We have now considered the issue further, and consider that the Strike Price formula should be extended to recognise the existence of carbon pricing in European markets.

8.2.5 We propose that the formula should be extended as follows:

$$\text{Strike Price} = \text{Max} [1/T\% \times \text{Max} [\text{GRP} + \text{CIG} \times \text{CP}, \text{ORP} + \text{CIO} \times \text{CP}], \text{DSU}]$$

Where:

CP is the carbon reference price in €/tonne of CO₂;

CIG is a parameter to denote the Carbon Intensity of a reference gas fired plant in tonnes of CO₂ per MWh of electricity output;

CIO is a parameter to denote the Carbon Intensity of a reference oil fired plant in tonnes of CO₂ per MWh of electricity output;

All other terms are as defined previously above.

8.2.6 The value of CIG and CIO will be published along with other parameters prior to the CRM auction. The current calculation of Directed Contract prices contains assumptions on the

⁷⁰ E.g. to adjust from an NBP quote to delivery in Ireland / Northern Ireland

⁷¹ see paragraph 3.4.45 of SEM-15-103

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carbon intensity per unit of gas and oil burnt⁷², and the SEM Committee is of the opinion that the same approach would be applicable for the Strike Price calculations. The values of these parameters will reflect these assumptions on carbon content of the fuel, and the thermal efficiency of the reference plant.

Spot Versus Forward Gas Reference Price

- 8.2.7 The objective of setting the Strike Price is to provide the appropriate balance between ensuring that the ROs don't interfere with the energy market and providing a hedge of value to suppliers. So as not to interfere with the energy market, the strike price needs to be higher than the marginal cost of the plants operating on the day.
- 8.2.8 To achieve this objective, the Strike Price should exceed the Short Run Marginal Cost (SRMC) of a peaking plant⁷³.
- 8.2.9 A peak gas fired OCGT is unlikely to know precisely in advance when it will be required to run, and would generally buy its gas in the NBP Day Ahead or On-The-Day Commodity Market (OCM) spot markets. Its SRMC will reflect the spot price of gas, which was why we originally favoured the use of spot prices in the Strike Price formula. This theory was underpinned by practical experience from US capacity markets, such as New England, which have found that peaking capacity providers have failed to make themselves available where the cost of spot market gas leads to their marginal cost exceeding the Strike Price.
- 8.2.10 An alternative approach would be to use forward monthly gas and oil prices. This has the following advantages:
- The introduction of Administrative Scarcity Pricing (ASP) at an appropriate level will provide sufficiently strong incentives to be available, and override concerns about interference with the energy market. Where energy markets have marginal cost based bidding requirements, if the gas price spikes, at best, the peaking gas generator is only just able to recover its marginal fuel cost. With a high Strike Price, it does not lose money if it runs. However, if the Strike Price is below the cost of gas, it actually loses money when it runs, and is disincentivised from running. However, in the I-SEM, by implementing ASP, we ensure that peak generators are strongly incentivised to run, provided that the level of ASP is well above the cost of spot gas⁷⁴, even if scarcity is not reflected in generators' bids;

⁷² For Round 15 of the Directed Contracts it was 0.20 tCO₂/GJ of gas burnt, 0.265 tCO₂/GJ of Gasoil burnt and 0.277tCO₂/GJ of Low Sulphur Fuel Oil burnt

⁷³ According to these articles, "the strike price should be set at least at the level of the marginal variable cost the regulator estimates as the most expensive in the system..... Additionally, to avoid any negative impact that an under-estimation of this value could have, the Strike Price could be 10-15% above this value" Vazquez, Batlle, Riviere and Perez- Arriaga. Security of Supply in the Dutch electricity market: the role of reliability options, Instituto de Investigacion Tecnologica (IIT), Universidad Pontifica Comilla, Madrid for the Office of Energy Regulation of The Netherlands, December 2003

⁷⁴ By way of example, suppose that a peaker has a short run marginal cost of €510/MWh, and the Strike Price is set at €500/MWh. In a period of scarcity, where the electricity price rises to €3,000/MWh, if the peaker

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- Recent GB gas market cashout reforms to introduce the GB gas ASP into cashout prices, with GB Gas VoLL applying at £14/therm, which are likely to make the NBP spot price more volatile, could materially reduce the value of the hedge to Suppliers. While it is unlikely to happen, in the extreme event that GB Gas VoLL was priced into the gas spot market price included in the Strike Price formula, the Strike Price could rise to over €4,000/MWh⁷⁵, compared to the historic peak NBP Day Ahead Market spot price of around 180p/therm in March 2006. Based on a reference thermal efficiency of 15%, this would have equated to a Strike Price of around €530/MWh (excluding carbon costs)⁷⁶. Hence the impact of the cash out reform could greatly reducing the hedge value for Suppliers, if the Strike Price was based n the daily gas price.; and
- There are simplicity benefits in using monthly prices.

8.2.11 It is also questionable whether in the event of expected involuntary load shedding of GB gas customers, any peaking generator on the island of Ireland could buy gas in the NBP spot market to alleviate an I-SEM security of supply issue. Therefore the GB gas VoLL could be reflected in the Strike Price with no realistic prospect of an I-SEM generator being able to procure gas at that price.

8.2.12 Therefore we propose to use the month-ahead value for NBP gas as the basis for setting the component of the Strike Price associated with gas fired generation, which will adjust to variations in the fuel price, but will not reflect ASP in the GB gas market. We propose to set the NBP price for each day in month M, based on the forward value of gas in month M on the last trading day of month M-1. For example, the value of March 2016 gas as traded on 29 February 2016 would be the relevant NBP gas price for each day during March 2016. The benefits are:

- Less risk to Supplier hedge value. Month ahead forward gas prices are less volatile, and much less likely to materially reduce the value of the Reliability Option hedge to Suppliers; and
- Simplicity. The Strike Price would be the same for each day in a Calendar month, rather than varying each day.

8.2.13 In the case of the oil price, the choice between a forward price and a spot reference price is likely to make little difference. The greater storability of oil, means there is much less difference in the volatility of a month ahead price and a spot price. However, we would propose to apply a similar approach for simplicity and consistency across gas and oil.

generates, it earns €3,000/MWh in electricity revenue. It incurs €510/MWh of gas cost, and has to pay €2,500/MWh of difference payments so loses €10/MWh overall. If it does not generate, it is still exposed to the difference payment of €2,500/MWh, without having any energy revenue or gas cost, so loses €2,500/MW per hour of unavailability. This is a much worse outcome than if it runs and only loses €10/MWh. The fact that we have implemented ASP and assuming that the ASP is at a level above the gas purchase cost, the incentive on capacity providers is preserved. Only if we set the ASP too low, below the gas purchase cost is the incentive to run blunted (because the generator spends more money in gas purchase costs than it earns in electricity revenue

⁷⁵ £14/therm = £478/MWh of gas (34.1 therms / MWh) = £4789/15% = £3,185/MWh = €4,140/MWh at assumed exchange rate of €1.3/£

⁷⁶ £1.794/therm = £61.21/MWh of gas (34.1 therms / MWh) = £61.21/15% = £408/MWh = €530/MWh at assumed exchange rate of €1.3/£. We have ignored transport adders, assumed small in relation to the commodity cost in this example

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8.2.14 The frequency of updates to the DSU component to the Strike Price formula will be determined as part of the relevant parameter consultation.

Choice of Reference Thermal Efficiency

8.2.15 The choice of reference thermal efficiency, like the choice of fuel price, needs to strike a balance between:

- Not interfering with the operation of the energy market and threatening security of supply, which it could do if the Strike Prices are below the SRMC of a peaking plant; and
- Providing an effective hedge for Suppliers, which it will not do, if the Strike Price is too high.

8.2.16 The implementation of ASP means that the level of the strike price has less of an impact on the incentives of generators to be available at times of scarcity, and hence lowers the risk of a particular level of the Strike Price interfering with the energy market and the short run. However, in the longer run, if the reference thermal efficiency is set too high, so that the Strike Price exceeds the marginal cost of a peaker, such, a generator may decide to:

- Price in a premium into its capacity auction bids to reflect expected energy market losses, to the extent permitted by our auction bids limits; or
- Close in response to the exit signal contained within the Strike Price.

8.2.17 Whilst appropriate exit signals are desirable, we wish to avoid excessive risk premiums being reflected into auction bids, or causing wholesale plant exit, particularly in transitional auctions before significant new entry is likely. Therefore, the choice of reference plant should still allow the majority of existing plant to recover its short run marginal costs of operation the majority of the time.

8.2.18 The key complexity in setting the reference thermal efficiency is that the SRMC can include not just the incremental fuel and carbon cost per MWh, but Variable Operating and Maintenance costs (VOMs) per MWh, and start-up costs. In the case of a peaking plant, the start-up costs need to be recovered over the period in which it is running, which could be a very short period (e.g. 1 hour) or a longer period.

8.2.19 To identify an appropriate level of thermal efficiency that would meet the objectives above, we have estimated the thermal efficiencies of all existing gas and oil fired plant, under circumstances where they are required to start-up and run for a period of only one hour. There are some old and low efficiency plant (approximately 25% thermal efficiency) remaining on the system, which are likely to have much lower thermal efficiencies than new entrant plant.

8.2.20 If the plant is running at full load for only one hour, the efficiency ratio⁷⁷ of the least efficient natural gas and HFO units drops to just below 14%, based on a cold start. There are a number

⁷⁷ Energy content of fuel input / energy content of electricity output, to start-up and run at full load for a full 1 hour settlement period, the shortest period for which scarcity could occur. These efficiency values (i.e. ratio of energy consumed to energy produced) were calculated for hot starts, warm starts and cold starts. In calculating

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of units including at Aghada Unit 1, Ballylumford Units 4, 5 and 6, Dublin Bay CCGT, and Tarbert units 3 and 4 which have cold start values of 14% around⁷⁸. Together they account for nearly 1,700MW, nearly 20% of installed non-intermittent capacity on the system.

- 8.2.21 These values are similar to the thermal efficiency of the Peak Energy Rent reference unit used to set the Strike Price in New England, which is about 15.5%.
- 8.2.22 There should not be any commitment that all plant should be able to recover its start-up costs under all circumstances, and it is not very likely that much plant would be required to start-up and run for only one hour. **Therefore it would suggest that it appears a reasonable compromise between the objectives of ensuring that a peak generator can cover its variable costs of operation, whilst protecting Suppliers from price spikes to set the value of T at 15%.**
- 8.2.23 At this value of T, the DSU floor price is likely to set the Strike Price the majority of the time. If fuel price rebound to levels of previous peaks the oil or gas price may exceed the DSU floor price, but the Strike Price will not exceed €600-700/MWh unless fuel prices spike higher than previously. Suppliers will be protected from price spikes at around €500/MWh most of the time, which is considered an acceptable level of hedge.
- 8.2.24 Whilst Gasoil prices are higher in terms of €/GJ, Heavy Fuel Oil plant have much lower thermal efficiencies, when instructed to start up and run for short periods. Therefore, the marginal cost of a heavy fuel oil plant is higher than that of a gasoil plant; therefore, a further conclusion from the analysis is that the relevant oil price to use in the Strike Price is the Heavy Fuel Oil price, not the Gasoil price.

Process and Governance for Fuel and Carbon Input Data

- 8.2.25 The CRM Delivery Body will choose the fuel, carbon and exchange rate price index data sources subject to principles define by the SEM Committee, with the choice of data source being subject to approval by the SEM Committee.
- 8.2.26 The CRM Delivery Body will also calculate the fuel transport adders periodically, and submit them to the SEM Committee for approval.
- 8.2.27 The SEM Committee is consulting now on what principles should be used to choose between data sources. The SEM Committee also seeks feedback on whether any special governance procedures are required to govern the change of data source.
- 8.2.28 In deciding which indices to approve, the SEM Committee proposes to take into account the following factors:

this value we have not assigned incremental fuel costs in ramping to full load prior to that settlement period assuming that those costs will be covered in payments for energy delivered in that period. However, we have assumed that the unit only starts up in order to deliver the scarcity period and therefore assign the full start-up cost to the 1 hour scarcity period

⁷⁸ to the nearest whole percentage point

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- The indice(s) from which the reference price is drawn must be sufficiently liquid to have confidence that it is a robust representation of market prices
- The price of the indice(s) should reflect the price that a generator could reasonably expect to achieve through trading in the physical market
- Data should meet a Data Quality Gold Standard. The Gold Standard could include:
 - Provision of data to be used for the index is: Accurate, Complete, and Capable of audit (parties keep records),
 - Methodology for deriving the index or benchmark is robust, documented and does not include judgement (i.e. Is deterministic)
 - Methodology is subject to change control that protects against conflicts of interest (e.g. Through an oversight committee)
 - Procedures exist in data providers and the index / benchmark to manage conflicts of interest and confidentiality
 - The index is subject to external audit against its methodology – including a sample of data from data providers.

8.2.29 The SEM Committee will review the CRM Delivery Body's choice of data sources prior to Qualification for the first auctions, and publish the indices and transport adders prior to the date on which capacity providers have to enter the Qualification process.

8.2.30 The SEM Committee will require the CRM Delivery Body to keep the choice of data source under review, and may at its discretion, direct a change the data source, if, at any time it considers that any other indice(s) better meet the criteria.

Summary Questions

The SEM Committee welcomes views on all aspects of this section, including:

- A) Do you agree with the proposed approach to incorporating the carbon price into the Strike Price formula?
- B) Do you agree with the approach of moving to a month-ahead index?
- C) Do you agree that a reference thermal efficiency of around 15% is appropriate? If not, why not?
- D) Do you agree that the appropriate oil price is the Heavy Fuel Oil price?
- E) Do you agree with the principles / criteria set out in Section 8.2.28, that the SEM Committee proposes to use to choose between data sources for fuel and carbon prices, exchange rates?
- F) Do you agree with the proposed governance / process for changes to fuel and carbon prices, exchange rates and transport adders used in the calculation of the Strike Price?

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8.3 DIFFERENCE PAYMENTS SOCIALISATION ARRANGEMENTS

- 8.3.1 SEM-15-103 set out the SEM Committee's decision that any shortfall in Reliability Option difference payments for any given Supplier will be socialised across all Suppliers. It further stated that socialisation will:
- Be funded by charges to all Suppliers as well as by any surplus difference payments that arise when difference payments from Reliability Option providers exceed those required to hedge Suppliers;
 - Recover those charges from all Suppliers as an adjustment to the price Suppliers are charged to cover the annual cost of Reliability Option Fees;
 - That any short-fall or surplus in the fund in one year will be used to adjust the total charge recovered from Suppliers in subsequent years.
- 8.3.2 Whilst the concept of this fund is relatively simple, its design and governance needs to be carefully considered to ensure that it is appropriately managed. The socialisation fund will build up a balance of money to be used to cover a potential deficit in payments (should receipts from Reliability Option difference payments be insufficient to cover the equivalent difference payments to Suppliers). The SEM Committee expects to have visibility of the movements of this fund including interest attributable to the fund.
- 8.3.3 The socialisation arrangements will also have similarities with other mechanisms being considered in the wider I-SEM programme (for example, in relation to the recovery of currency costs, or the recovery of unsecured bad energy debt arising in exceptional circumstances). In this context we intend to consult on the principles of difference payment socialisation within this paper and work closely with the I-SEM Market Rules Working Group on the detail of the mechanism.
- 8.3.4 The following paragraphs separately consider:
- The arrangements to determine the rate at which Suppliers contribute to the fund; and
 - What happens in exceptional cases where there are insufficient difference payment funds to cover the cost of any shortfall in difference payments.

Setting the Rate that Suppliers Contribute to the Fund

- 8.3.5 The costs of socialisation will be recovered from Suppliers by increasing the amount they are charged for capacity. As set out in SEM-15-103, Capacity Providers will receive an option fee set in €/MW de-rated capacity. These payments to Capacity Providers will be funded through a charge to Suppliers – based on the consumption of each Supplier's customers at specified times.
- 8.3.6 The following paragraphs consider the principles to determine the level of incremental Supplier's Capacity Charge (that Supplier's "Contribution Rate") that is required to ensure adequate contributions to the socialisation fund.

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8.3.7 The principles to guide the setting of the increment for the Supplier's Contribution Rate needs to consider two objectives, notably:

- **Adequate funding:** Ensuring that contributions to the fund from Supplier charges are sufficient to cover the likely payments by the fund; and
- **Avoiding price shocks:** Avoiding significant changes in the Contribution Rate from one year to the next.

8.3.8 A set of principles consistent with the above objectives are:

- **Sufficient:** That the contribution rate for a given year should be set such that socialisation is sufficient to provide a 90% confidence level.
- **Avoid Shocks:** That the contribution rate, when expressed in €/MWh should ideally not change by more than 2 x CPI between successive years;
- **Pragmatic:** That in normal circumstances, the above two objectives should be considered as constraints in setting the contribution rate. Where it is not possible to set a contribution that honours both constraints, they shall be relaxed:
 - In line with guidance from the SEM Committee at that time;
 - With the aim of returning socialisation to a position where it can operate within those constraints as soon as is reasonably practicable.
- **I-SEM launch:** The contribution rate for the introduction of the fund (immediately following go-live) will be set such that, the fund can achieve the first of the above objectives (confidence level of sufficiency) within 4 years.

8.3.9 We propose the Suppliers "contribution rate" will be calculated and proposed by SEMO, based upon a set of principles, being consulted upon above. This proposed contribution rate would be subject to the Regulatory Authorities annual review and approval before coming into effect.

Backstop Against Annual Socialisation

8.3.10 While we aim to reduce the likelihood of any shortfall in difference payments by proposing a 90% confidence level in setting the contribution rate. We also have to consider the possibility that there may come a point where the Contribution Rate is insufficient to cover any shortfall in difference payments (for whatever reason they occur). In general, any shortfall can be covered through borrowing. However, there will come a point at which the costs of borrowing rise to a level such that this is not efficient. Socialisation needs to be designed in a way that it can cope with this event.

8.3.11 The following two options are being considered by the SEM Committee and we would appreciate consultation feedback regarding these options. They are:

- **Suspend and accrue:** Should a residual difference payment shortfall still remain we propose to suspend and accrue socialisation. Any existing funds are allocated to Suppliers pro-rata to the difference payments that they are owed. When the fund is exhausted, payments would be suspended until there are sufficient funds from ongoing contributions to cover liabilities. Once there are sufficient socialisation funds, following

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credit facility repayments and the fund reaching a minimum level, these are first used to cover the historic shortfalls accrued, and then new liabilities; and

- **Immediate additional charge:** Any shortfall remaining after surplus difference payments have been exhausted would be funded by an immediate additional charge to all Suppliers pro-rated to their (MWh) market share at the time of the shortfall. This money would be immediately used to cover the outstanding difference payments.

8.3.12 The two options will eventually deliver the same payments to Suppliers for outstanding difference payments, but the timing of the cashflows is different. In the Suspend and Accrue option, those Suppliers may have to wait a year or more to get their accrued liabilities funded. In the Immediate Additional Charge option they are funded immediately.

8.3.13 The cashflow impact of the two options is illustrated with a worked example. Consider the case, where there are Suppliers, A, B and C. The scarcity price is assumed to be €10,000, the Reliability Option Strike price is €500 and there is €20,000 left in the socialisation fund. Then a scarcity hour happens. Assume that the DAM price for this hour was less than €500, but that the BM price rises to €10,000. Supplier A has a consumption of 60MWh in that hour, all of which was bought in the DAM. Supplier B has a consumption of 38MWh, of which 8MWh was bought in the BM. Supplier C's entire 2 MWh was bought in the BM. Therefore 10MWh were bought in the BM, and €95,000⁷⁹ of difference payments are owed. This situation is depicted in Table 7 below:

Table 7: Socialisation worked example

Supplier	A	B	C	Total
Consumption in scarcity period	60 MWh	38 MWh	2 MWh	100 MWh
Amount bought per-scarcity (DAM)	60 MWh	30 MWh	0 MWh	90 MWh
Amount exposed to scarcity (BM)	0 MWh	8 MWh	2 MWh	10 MWh
Difference payments due	€ 0	€ 76,000	€ 19,000	€ 95,000

8.3.14 However, only €20,000 sits in the fund. This remaining €20,000 is paid out 8/10ths to Supplier B and 2/10ths to Supplier C.

8.3.15 Supplier B has €60,000 of difference payments which are not met and Supplier C has €15,000 of difference payments unmet.

8.3.16 In the Suspend and Accrue option the difference payment which remains unpaid would be managed by SEMO up to a specified credit limit. At that point any residual difference payment remaining would be suspended and accrued. This option provides for Supplier B and Supplier C recovering their difference payment at a later stage once the credit facility is repaid and the fund is replenished to a level which allows historical shortfalls to be paid in the first instance.

⁷⁹ (€10,000/MWh BM price – €500/MWh Strike Price) x 10MWh

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8.3.17 In the Immediate Additional Charge model, this shortfall is immediately funded by an additional charge to all suppliers. Supplier A has to pay 60% of the shortfall into the fund (€45,000), Supplier B pays 38% and Supplier C pays 2%. This is then used to make good the shortfall in difference payments immediately.

This worked example of both options continues in Table 8 below:

Table 8: Socialisation worked example of both options

Supplier	A	B	C	Total
Consumption in scarcity period	60 MWh	38 MWh	2 MWh	100 MWh
Amount bought per-scarcity (DAM)	60 MWh	30 MWh	0 MWh	90 MWh
Amount exposed to scarcity (BM)	0 MWh	8 MWh	2 MWh	10 MWh
Difference payments due	€ 0	€ 76,000	€ 19,000	€ 95,000
Surplus fund used on a pro-rata basis	€ 0	-€ 16,000	-€ 4,000	-€ 20,000
Difference payments not paid	€ 0	€ 60,000	€ 15,000	€ 75,000
Option 1: SEMO manage up to a credit limit at which any remaining balance is suspended and accrued		€ 60,000	€ 15,000	€ 75,000
Option 2: Immediate Additional Charge				
Recover shortfall from all Supplier pro-rata basis	€ 45,000	€ 28,500	€ 1,500	€ 75,000
Pay remaining difference payment	€ 0	-€ 60,000	-€ 15,000	-€ 75,000
Total	€ 45,000	-€ 31,500	-€ 13,500	€ 0

8.3.18 The main benefit (assessed against the key criteria) of the Immediate Additional Charge option is that it better promotes competition in Supply by managing the cashflow risk faced by Suppliers, which will provide greater assistance to small Suppliers with weak balance sheets.

8.3.19 The main benefit of the Suspend and Accrue option is that it provides stability in charges, with no risk of additional charges to Suppliers who have accurately hedged their demand before scarcity occurred.

Summary Questions

The SEM Committee welcomes views on all aspects of this section, including:

- A) Do you agree with the proposed approach for setting the Supplier's contribution rate? If not, please explain.
- B) Do you have a preference as to which option (Suspend and Accrue or Immediate Additional Charge) should be applied to socialisation of any shortfall in Reliability Option difference payments? If not, please explain.

9. NEXT STEPS

- 9.1.1 Interested parties are invited to respond to the consultation, presenting views on the options set out in this paper and where applicable any minded to positions that have been expressed proposals and discussion in this paper.
- 9.1.2 The SEM Committee intends to make a decision in July 2016 on the various aspects of the detailed design of the CRM covered in this consultation paper. In reaching this decision we will take into account comments received from respondents to this paper as well as feedback obtained at the public workshops.
- 9.1.3 A public workshop presenting an overview of this consultation will be held on 16 March 2016 in the Crowne Plaza Hotel, Dundalk. Further information on this event will be published on the All-Island project website.
- 9.1.4 Responses to the consultation paper should be sent to Karen Shiels (Karen.Shiels@uregni.gov.uk) and Thomas Quinn (tquinn@cer.ie) by 17:00 on Wednesday 27 April 2016.
- 9.1.5 Please note that we intend to publish all responses unless marked confidential. While respondents may wish to identify some aspects of their responses as confidential, we request that non-confidential versions are also provided, or that the confidential information is provided in a separate annex. Please note that both Regulatory Authorities are subject to Freedom of Information legislation.

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10. ACRONYMS

ACER	Agency for the Co-operation of Energy Regulators
ACPS	Annual Capacity Payment Sum
AER	Alternative Energy Requirement
ALFCO	Adjusted Load Following Capacity Obligation
BCoP	Bidding Code of Practice
BM	Balancing Market
BNE	Best New Entrant
CACM	Capacity Allocation and Congestion Management
CCGT	Combined Cycle Gas Turbine
CfD	Contracts for Difference
CMU	Capacity Market Unit
CRM	Capacity Remuneration Mechanism
DAM	Day Ahead Market
DCENR	Department of Communications, Energy and Natural Resources
DECC	Department of Energy and Climate Change
DSR	Demand Side Response
DSU	Demand Side Unit
EC	European Commission
EEAG	The Environmental and Energy State Aid Guidelines
ENTSO-E	European Network of Transmission System Operators – Electricity
ETA	Energy Trading Arrangements
EU	European Union
FiT	Feed in Tariff
FOR	Forced Outage Rate
FTR	Financial Transmission Right
GB	Great Britain
GB CM	Great Britain Capacity Market
GDP	Gross Domestic Product
GTUoS	Generator Transmission Use of System
GUA	Generating Unit Agreement
HLD	High Level Design
ICE	Intercontinental Exchange
IDM	Intra-Day Market
IED	Industrial Emissions Directive
I-SEM	Integrated Single Electricity Market
ISO NE	Independent System Operator New England
LoLE	Loss of Load Expectation
LOLP	Loss of Load Probability
MB	Balancing Market (Italy)
MGP	Day Ahead Market (Italy)
MRP	Market Reference Price
MSD	Ancillary Services Market (Italy)

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MW	Megawatt
MWh	Megawatt hour
NG	National Grid
OCGT	Open Cycle Gas Turbine
ODR	Over Delivery Rate
PER	Peak Energy Rents
PFP	Pay-for-Performance
PJM	Pennsylvania Jersey Maryland
PPA	Power Purchase Agreement
PPB	Power Procurement Business
PSO	Public Service Obligation
ROC	Renewables Obligation Certificate
RP	Reference Price
SEM	Single Electricity Market
SO	System Operator
SoLR	Supplier of Last Resort
SP	Strike Price
SRMC	Short Run Marginal Cost
TLAF	Transmission Loss Adjustment Factor
TSC	Trading and Settlement Code
TSO	Transmission System Operator
US	United States
VoLL	Value of Lost Load

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APPENDIX A : KEY LEGAL TERMS AND CONDITIONS IN QUALIFICATION AND AUCTION (NOT INCLUDING OPERATIONAL PHASE)

	<i>General provisions:</i>	
	Definition of terms	
	Roles of all parties	CRM Delivery Body, Bidder (seller); Capacity Providers; Auction Monitor (part overseeing the auction conduct)
	Setting the auction date	Initial notice period and notice period if to advance or postpone the auction date
	Right to terminate or postpone	Who can decide and what are allowable reasons
	Changes to auction rules / late changes	Ordinary changes to auction rules and product and late/urgent changes
	Link to product contract	Make clear what product is bought (depends on legal arrangements)
	Information disclosure	Before/during/after auction event
	Allowable communication	Before/during/after auction event
	Rules governed by / auction takes place	Governing Law to apply to Capacity Market Code (Ireland or Northern Ireland)
	Force Majeure	In relation to auction conduct
	Limitation of liability	In relation to auction conduct
	<i>Qualification process:</i>	
	Requirements to enter Q process	Set out what the bidders must have already signed [X, Y & Z]- may vary by participant type, e.g. generator, aggregator, DSU
	Right to opt-out of capacity auction	Declarations to be made / consequences for future participation
	Restrictions on participation	Only one entity/related party per group of companies to ensure each bidder acts independently
	Dispute resolution/appeals	Process for resolution of disputes and or appeals
	Details of capacity offered	Different forms for existing/refurbishing/new/DSR
	Representations and warranties	Single list to tie bidder to legal framework and ensure company is acting in good faith and of good standing
	Contact details	Often handy to have a principal point of contact
	Guarantee/deposit	Set out the required form
	Bidder limits	Related to value of guarantee and/or an overall limit
	Timeline for qualification	When to submit / respond
	Results of evaluation	Accept/conditional/reject
	Notification of all material changes	Obligation to inform
	Right to withdraw	Treated as opt-out or differently, e.g. regarding guarantee
	Right to revoke	Set out valid reasons to revoke a qualification already granted
	User Guide / UN&PW distribution	Tie in as a condition for participation
	Ways and means of communication	Use of letters, email and recorded telephones

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	<i>Auction Process:</i>	
	Announcing the demand curve	Preliminary / Final / Rights to revise
	Reserve prices	Private or public
	Access to bid data	During and after auction
	Communication	Bidder to/from auctioneer
	Alternative means of bid submission	Fax or recorded phone
	Announcements prior to a round	Schedule, prices and round duration
	Activity rule	Only if multi-round (typically monotonicity requirement)
	Non-submission of bid	Deemed "zero" bid or instead require only "exit" bids
	Different treatment of capacity classes	Price-taker / price-maker with a published threshold or offer cap
	Valid bid parameters	
	Price	unit, no of decimal places, range
	Quantity	unit, no of decimal places, range
	Duration	Length of contract period subject to a maximum
	any other parameter	flexibility/location
	Bid constraints	
	Monotonicity	To ensure price discovery and maintain activity
	price bids	E.g. price-taker only if below Price-taker Offer Cap
	duration	When a bidder may change duration and direction, e.g. reduce only
	Intermediate pricing	[if used] incl. meaning if flexibility included in bid
	Treatment of tied bids	Simple tie-breakers (bid size, total bids from same entity, random number) or computational (minimize over-/undershoot)
	Bid submission if fax/phone	Same strict time interpretation
	Bid removal / amendment	Allowed within round
	Closing condition	e.g. $S < \text{or} = D$ (and below reserve price if one is set)
	Announcement of round result	Define information given to each bidder (unique and general information)
	Announcement of prices for next round	
	Calculation of closing price and quantity	Possibly including "flexibility"
	Auction outcome	Automatically entering into contract "consented to contract only to be signed for confirmation"
	Announcement of final results	Timeline (preliminary if requiring review by Auction Monitor, followed by final results)
	Limitation of liability re auction site	
	Technology requirements	Alternatively, kept in User Guide
	Any helpdesk facility	Alternatively, kept in User Guide
	<i>Post auction procedure:</i>	
	Dealing with auction guarantee if winner / if not	
	Timeline for signing documents	

APPENDIX B GB AUCTION CASE STUDY

Overview

GB has so far held two T-4 capacity auctions in December 2014 and December 2015, and a T-1 auction in January 2016. Key points to note about these auctions are:

- Renewable generation supported by renewables regimes were not allowed to participate, unlike in the I-SEM CRM auctions;
- The auctions took the form of a multiple round descending clock auction:
 - In the 2014 T-4 auction there were 12 rounds and the auction lasted 3 full business days
 - In the 2015 T-4 auction there were also 12 rounds over 3 days;
 - In the 2016 T-1 auction there were 5 rounds.
- The T-4 auction employed an Auction Price Cap (at $1.5 \times \text{Net CONE}$) and a Price-taker Threshold at $0.5 \times \text{Net CONE}$. New capacity was allowed to bid an exit price equal to the Auction Price Cap, but existing capacity was not allowed to exit the auction above the Price-taker Threshold. The auction Net CONE was based on a CCGT rather than an OCGT as it was perceived that no new OCGT would be built (none was planned);
- A sloping demand curve was employed in both T-4 and T-1 Auctions. In the T-4 auctions, at the Auction Price Cap, the auctioneer was allowed to purchase up to 1.5GW less than the capacity requirement, and at very low prices, the auctioneer was allowed to purchase up to 1.5GW more than the capacity requirement;
- The GB auctions used a net welfare algorithm to decide whether or not to accept the marginal bid;
- GB employed an independent Auction Monitor, who provided an assurance report, including validating the auction results;

Auction format

All GB auctions have taken the form of multiple round descending clock. The results are shown below.

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2014 T-1 auction

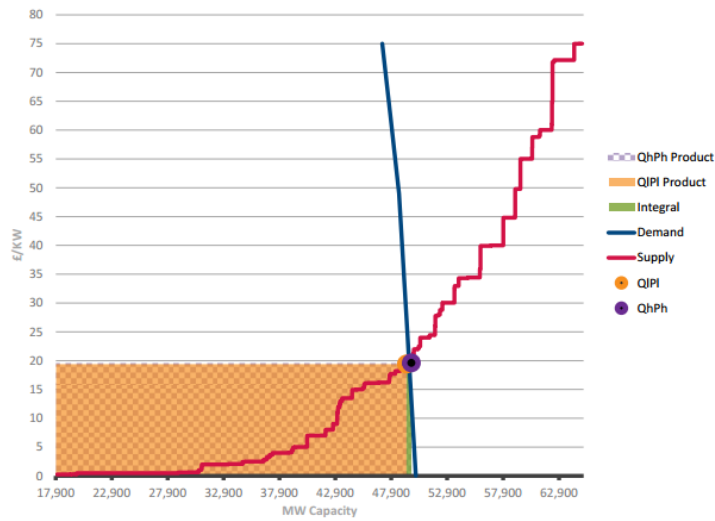
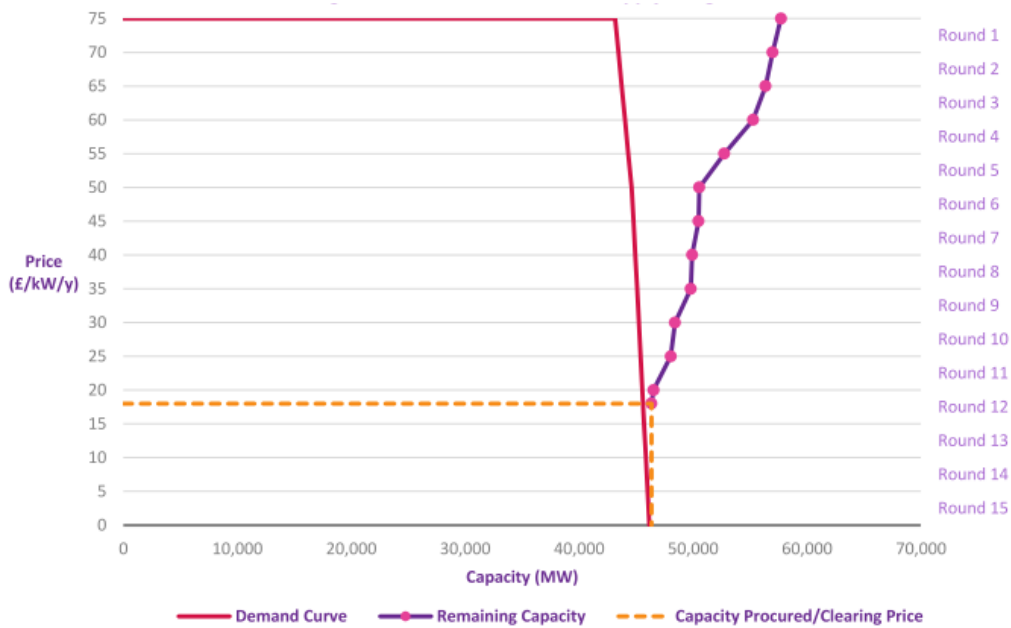


Figure 1: The Supply Curve

The Points (Qh, Ph) and (Ql, Pl) are marked on Figures 1 and 2. These are the two possible quantity-price pairs which are evaluated by the Net Welfare Algorithm. The 'high' pair (subscript 'h') includes the capacity of the marginal CMU while the low case (subscript 'l') excludes this capacity.

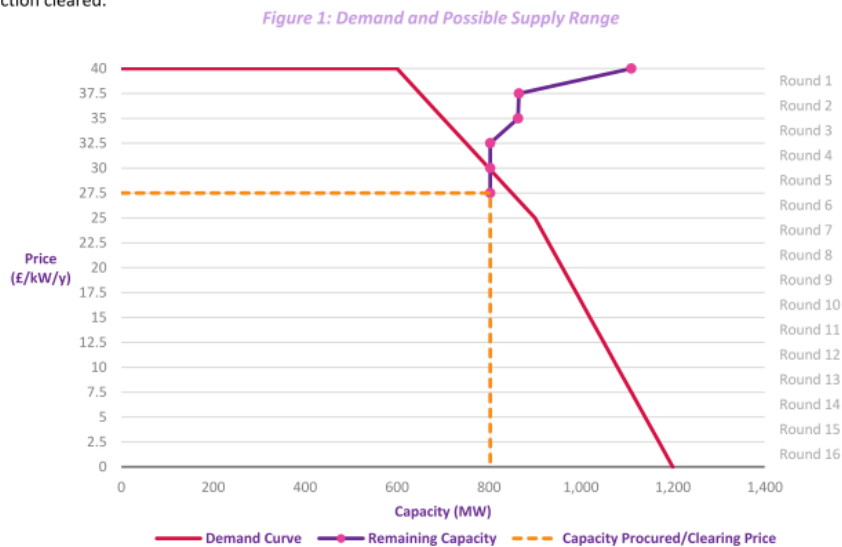
2015 T-4 auction



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2016 T-1 auction

Figure 1 shows the Demand Curve and the supply curve. The supply curve is found by cumulatively adding the Bidding Capacities of CMUs, according to their Exit Ranking. The dotted orange line shows the price and quantity where the auction cleared.



Structure of bids

In the GB auctions, a qualified capacity provider remains in the auction by default until it submits an exit bid. When it submits an exit bid, it withdraws all the capacity on that Capacity Market Unit. It cannot partially withdraw that unit. However, there is provision for a bidder to turn a refurbishment bid (for a three year contract) into a standard bid for a one year contract at a price point.

Market power controls

The following price controls are applied:

- Existing capacity was required to bid its full de-rated capacity;
- An Auction Price Cap set at £79/kW/year set on the basis that it is 1.5 x NET CONE. New investor could not submit "Exit bids" above the Auction Price Cap (which was also the starting price in the first round of the auction)
- A Price-taker Threshold set at 0.5 Net CONE. Existing capacity was not allowed to submit an "Exit bid" at a price above the Price-taker Threshold

Sloping demand curve / volume tolerances

GB implemented a sloping demand curve in all auctions, as illustrated in the figures depicting the auction results above.

Following a consultation process, in June 2014, the UK Department of Energy and Climate Change, stated that the following approach will be used to set the demand curve for the GB auction..

"A capacity demand curve will be determined annually by the Government, in advance of capacity auctions. The demand curve will:

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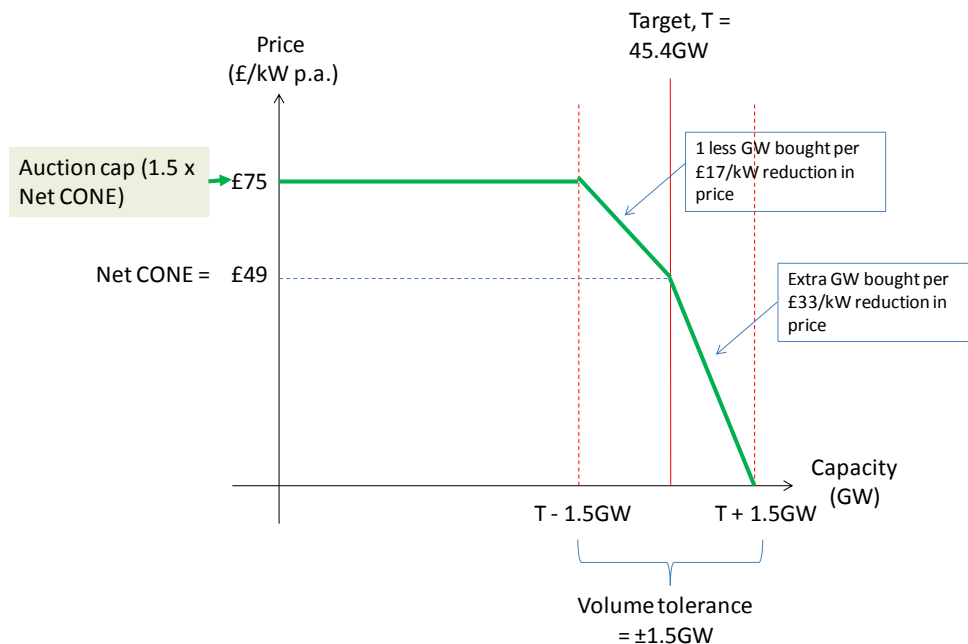
- *Set a target level of capacity to auction;*
- *Enable the trade-off between cost and reliability to be automatically determined at auction;*
and
- *Set a cap on the maximum price that can be set at auction”.*⁸⁰

In practice, as illustrated in the Figure below, the slope of the demand curve in the 2014 and 2015 T-4 auction was determined by a number of other auction parameters:

- The government sets the target (i.e. capacity requirement) and specified that National Grid must procure within $\pm 1.5\text{GW}$ of that target. The rationale for using a 1.5GW tolerance, is that 1.5GW approximately represents the de-rated capacity of two large CCGT plants, and:
 - The GB net CONE is set based on a reference CCGT plant
 - Allowing the amount of capacity contracted in the auction to vary by this amount either side of the target should ensure that no single plant can significantly influence the auction clearing price, i.e. for competition related reasons.
- The demand curve passes through the target at net CONE (estimated at $\text{£}49/\text{kW p.a.}$)
- The minimum amount of the target + 1.5GW is bought at the auction cap, which is set at $1.5 \times \text{CONE}$ ($\text{£}75/\text{kW p.a.}$), with the demand curve set as a straight line function between net CONE and the target cap;
- The maximum amount of target + 1.5GW is bought at a zero price, with the demand curve set as a straight line function between net CONE and the maximum.

The resulting demand curve is shown in the Figure below as the green line.

GB December 2015 T-4 auction demand curve



⁸⁰ See page 67, Electricity Market Reform: Consultation on proposals for implementation Government Response, June 2014

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In practice, the December 2015 auction cleared at £18.00/kW p.a., i.e. at only 37% of net CONE, with an extra 954MW, 63% of the 1.5GW maximum, extra volume in excess of target bought.

There are a number of reasons why precisely the GB calibration may not be directly applicable to the I-SEM:

- Clearly a volume tolerance based on plus or minus two CCGTs either side of the target is much too large for a market the size of the all-island market, which is roughly one-tenth the size of the GB market;
- We are likely to decide that the appropriate reference plant should be an OCGT. There is precedent in the SEM of using an OCGT, as the reference plant for capacity purposes. For instance, the current Best New Entrant plant used in the SEM is the Alstom GT13E2, has a nameplate capacity of approximately 200MW⁸¹;
- Whilst using a volume tolerance level of plus or minus 400MW (i.e. two OCGTs) is more feasible in the I-SEM context, it is still significantly higher in proportion to the I-SEM capacity requirement than the GB volume tolerance bands are in relation to the GB capacity requirement of 45.4GW.
- If we choose a different reference plant, we can expect net CONE to be different. Therefore there is no guarantee that scaling the GB approach to the I-SEM system will generate the right trade-off between increased cost of capacity and increased reliability.

Dealing with discrete capacity bids

The GB auction closes when a unit submits an Exit Bid which causes the remaining volume of bidders to be less than or equal to the demand curve at that price, i.e. when supply is less than or equal to demand.

Given that a CMU is a discrete number of MW, it is likely that if the last Exit Bid is awarded a contract, the volume of accepted bids will exceed the demand curve, and if the last Exit Bid is not awarded a contract, then the volume of accepted contracts will be less than the demand curve. As illustrated in Figure 11, in GB, the net welfare function is specified as the difference between the incremental:

- Consumer utility of the marginal unit, measured as the area under the demand curve in the range covered by the marginal bid; and
- Cost to consumers if the marginal bid is accepted.

Roles and responsibilities

The TSO (National Grid) is the Capacity Delivery Body. GB employs an independent Auction Monitor/Auditor (the same organisation monitors the auctions and provides assurance reports). The role of the auction monitor/auditor is set out in Rules 5.14 of the GB Capacity Market Rules.

⁸¹ SEM-15-032a quotes an average lifetime MW output of 195.7MW when burning distillate and 203.9MW on dual fuel

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5.14 Auction Monitor and **Audit** of Capacity Auctions

5.14.1 Appointment of Auction Monitor

- (a) The Delivery Body must appoint a third party to monitor the conduct of each Capacity Auction (an "**Auction Monitor**").
- (b) The duration of the appointment of the Auction Monitor must be determined by the Delivery Body and the cost of such appointment must be for the Delivery Body's account.
- (c) All Capacity Auctions falling within the duration of the appointment of an Auction Monitor must be monitored by that Auction Monitor.

5.14.2 Monitoring during a Capacity Auction

- (a) The Auction Monitor must have full read-only access to the electronic platform provided by the Auctioneer for the purpose of the Capacity Auction including the ability to view all Bids as they occur and all communication during the Capacity Auction between the Auctioneer and the Bidders.
- (b) Each of the Delivery Body and the Auction Monitor must notify the other if it becomes aware of a potential breach or suspected breach of the Regulations or the Rules by the Delivery Body or the Auctioneer or any other potential irregularity or suspected irregularity in the conduct of a Capacity Auction by the Delivery Body or the Auctioneer.
- (c) The Delivery Body may request that the Auction Monitor give its view, and the Auction Monitor must do so if requested, as to the most appropriate course of action regarding any potential breach of the Regulations or the Rules or other potential irregularity with respect to the conduct of a Capacity Auction.

5.14.3 Reporting by the Auction Monitor following a Capacity Auction

- (a) Within two Working Days after the Delivery Body has notified Bidders of the provisional results of a Capacity Auction pursuant to Rule 5.10.1, the Auction Monitor must provide a report to the Secretary of State (with a copy to the Authority) that:
 - (i) confirms the list of Bidders that have been awarded a Capacity Agreement;
 - (ii) sets out whether or not the Auction Monitor considers that the Delivery Body and/or the Auctioneer conducted the Capacity Auction in accordance with the Regulations and the Rules; and
 - (iii) where applicable, identifies any actual or potential breach of the Regulations or the Rules or other actual or potential irregularity in the conduct of the Capacity Auction by the Delivery Body and/or the Auctioneer together with an audit of the calculations made and the Auction Monitor's assessment as to the likely consequences of such actual or potential breach or irregularity.
- (b) The Auction Monitor must, upon request by the Delivery Body, or the Secretary of State, report from time to time on any specific issue related to the functioning of any Capacity Auction process.

APPENDIX C ISO NE AUCTION CASE STUDY

Overview

ISO New England is regulated by the Federal Energy Regulatory Commission (FERC). The Forward Capacity Market (FCM) is a forward procurement, auction-based, locational capacity market; it provides a long-term commitment to Supply and Demand Resources to encourage investment. The FCA is conducted approximately 3 years in advance before the commitment period, with resources required to qualify to participate (with qualification starting approximately 4 years before commitment period).

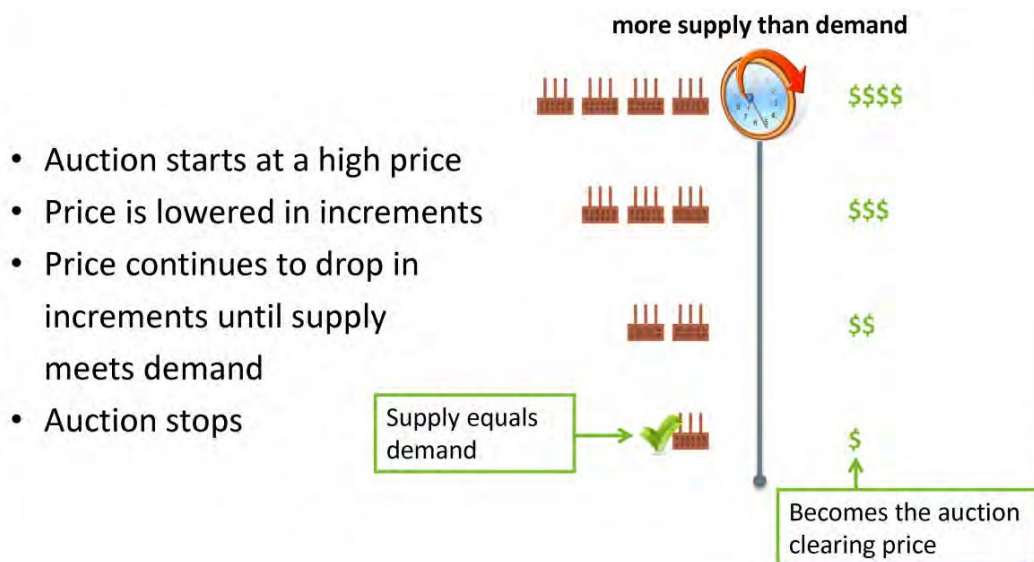
There are 3 Annual Reconfiguration Auctions (ARA) conducted between the FCA and the commitment period. This allows capacity suppliers swap obligations, and allow the system operator adjust the amount of capacity purchased. During each FCA, existing capacity providers are limited to a service period of one capacity commitment period (1 year), while new resources may commit to as many as seven such periods at the FCA price. This changed from five to seven periods on May 30, 2014.

Auction format

The FCA in ISO New England is a descending-clock auction with capacity resources procured three years in advance of the delivery period. The descending Clock Auction includes both Demand and Supply Resources. The descending-clock auction, run by an auctioneer, consists of multiple rounds. With successive price reductions continuing until supply equals demand. The auction price starts at twice the cost of new entry (CONE), if more resources bid than are required, the price is lowered. Before the beginning of each round, the auctioneer announces to all participants the start-of-round and end-of-round prices. Participants choose to exit the market when the price offered by the market operator falls below the resource's approved de-list bid.

Each Forward Capacity Auction is conducted in two stages; a descending-clock auction followed by an auction clearing process. All the capacity resources remaining in the auction at the end of round six pass through to the second stage of the FCA. In this stage, the market-clearing auction software is run to determine the minimal capacity payment and to calculate final capacity-zone clearing prices. This step also includes a post-processing procedure that determines the final payment rate for each resource and its capacity supply obligation for the capacity commitment period.

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(taken from Introduction to ISO New England: ISO 101)

Table 1 shows the hypothetical result of a descending-clock FCA with a starting price of \$15.00/kW-month. Additional assumptions built into this example are that the NICR equals 30,000 MW; 23,000 MW of existing capacity will be participating, thus 7,000 MW of new resources will be needed to meet the NICR; and 15,000 MW of new capacity will be participating.

Table 1: Sample Results from a Descending-Clock Forward Capacity Auction Round

Round Number	Start-of-Round Price (\$/kW-mo)	End-of-Round Price (\$/kW-mo)	End-of-Round Resource (MW)	Excess Capacity (MW)
1	\$15.00	\$9.50	38,000	8,000
2	\$9.49	\$9.00	32,500	2,500
3	\$8.99	\$8.00	32,000	2,000
4	\$7.99	\$7.50	31,000	1,000
5	\$7.49	\$7.00	30,750	750
6	\$6.99	\$6.00	29,800	-200

(taken from Introduction to ISO New England: ISO 101)

All the capacity resources remaining in the auction at the end of round six pass through to the second stage of the FCA. In this stage, the market-clearing auction software is run to determine the minimal capacity payment and to calculate final capacity-zone clearing prices. This step also includes a post-processing procedure that determines the final payment rate for each resource and its capacity supply obligation for the capacity commitment period. Thus, using the example shown in Table 1, after the sixth round, the market-clearing auction software would be run to determine the resources and the price that would minimize the cost at a purchase amount of 30,000 MW. The final capacity-zone clearing price in this example would equal some value between the round six start-of-round price and end-of-round price.

Structure of bids, market power control and monitoring

In ISO-NE, existing capacity resources that have cleared in a previous capacity auction and do not wish to participate in a subsequent auction are required to submit a specific bid to withdraw, called a de-list bid. These de-list bids can be submitted either for a specific capacity auction (and associated delivery

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year), to permanently leave the capacity market, or to retire. There are different types of de-list bids, these include:

- Static delist bids: These are submitted for a resource before the existing capacity qualification deadline, which occurs approximately eight months before an FCA. These delist bids are for resources opting to remove all or part of their total capacity from the market for a single commitment period at a price greater than or equal to \$1.00/kW-month.
- Dynamic delist bids: These are submitted by participants during an auction. Unlike other types of delist bids, dynamic delist bids are only offered below \$1.00/kW-month, and the Internal Market Monitor does not oversee these bids (these are presumed to be competitive).
- Permanent delist bids: These represent a binding request to remove the resource's capacity from the capacity market permanently at a certain price.
- Non-price retirement requests: These are irrevocable requests to retire all or a portion of a resource, supersede any other delist bids submitted.
- Export-delist bids: These are bids to exit the New England capacity market and sell capacity to a neighbouring area.
- Administrative export delist bids: These are submitted for capacity exports associated with multiyear contracts and are initiated using the same requirements as for export delist bids.

Internal Market Monitor (IMM)

To address market power concerns, during the qualification process, the IMM reviews certain delist bids to determine whether bid prices are consistent with a resource's net risk-adjusted going-forward costs and opportunity costs as specified in the rules. All delist bids, except dynamic delist bids, must include sufficient documentation for the Internal Market Monitor to make these determinations; the Internal Market Monitor may reject delist bids that have insufficient supporting documentation for the delist price. The IMM also does not review dynamic delist bids submitted during the auction at prices below 1.00/kW-month (these are presumed to be competitive).

Sloping demand curve

ISO-NE is proposing to eliminate administrative pricing rules for zones (with vertical demand curves) concurrent with the introduction of zonal demand curves, this follows the decision to eliminate administrative prices at the system level with the introduction of a system demand curve in FCA9 (completed in Spring 2014). This decision is based on the numerous undesirable properties and design challenges associated with the existing administrative pricing rules whereas other mechanisms can more effectively, comprehensively, and directly address market power concerns.

The introduction of sloped zonal demand curves that replace the existing fixed requirements reduces the effective slope of the curve. This change reduces the potential financial gains and price impact associated with withholding capacity or offering it above its competitive price. As a result, the introduction of sloped zonal demand curves will reduce capacity providers' incentives to exercise market power.

Administrative Pricing Rules

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The administrative pricing rules (Inadequate Supply (IS) and Insufficient Competition (IC) provisions) were applied to the FCM with the intention of protecting consumers from uncompetitive auction outcomes. Without adequate competition, suppliers could increase clearing prices by withholding capacity or submitting supply offers at inflated prices. These administrative pricing rules aim to address this concern by identifying instances where an auction could fail to produce a competitive outcome and, in these instances, reducing the price paid to existing capacity, and approximating the price that would be paid in a competitive auction.

Absent the IS and IC rules, a participant's financial gain from withholding capacity is largely dependent on the resulting price impact: the gains from withholding increase as the administrative demand curve steepens. The need for the IS and IC rules historically has been based on the use of vertical demand curves at both the system and zonal levels, where small changes in capacity offers can have dramatic impacts on the clearing price.

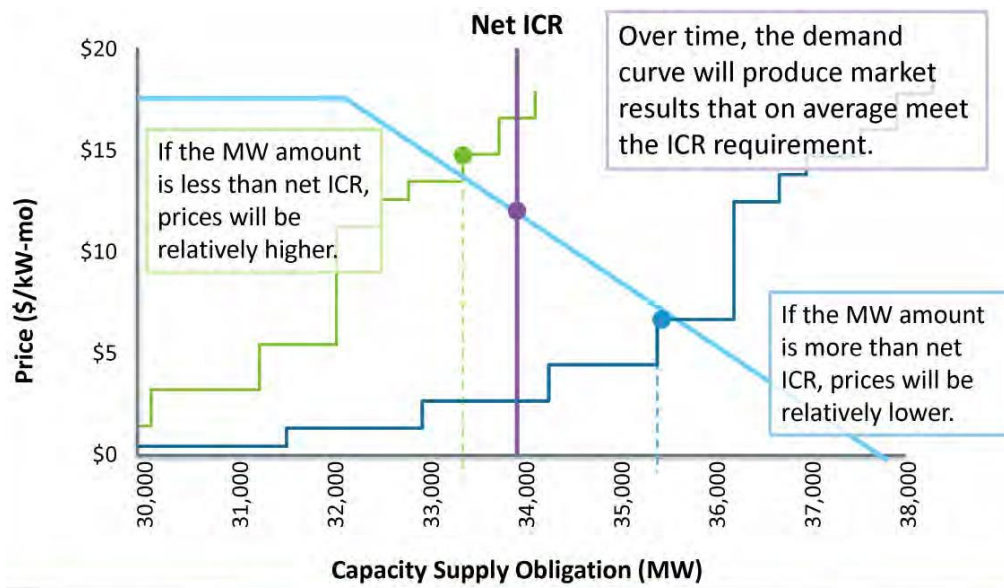
These administrative rules such as Inadequate Supply (IS) and Insufficient Competition (IC) provisions may help protect consumers against short-run price spikes due to uncompetitive conditions, but have several undesirable properties. These are:

- Price discrimination, paying existing capacity a lower price than new entrants when both provide the same capacity product
- These two-tiered pricing schemes introduce various gaming opportunities and perverse incentives for capacity suppliers
- They increase the risk for existing resources because when triggered, the resource will be paid the administrative price in the auction. However, if the resource must shed its obligation in a reconfiguration auction, it will have to 'buy out' of the obligation at the market clearing price, which is likely to be higher.
- Require the setting of subjective trigger conditions (when to price discriminate) and pricing schedules (what prices each type of capacity should be paid). These criteria are difficult to determine and justify using sound market design principles because they lead to wasteful spending and inefficient outcomes.

The capacity market applied the IS and IC provisions at both the system and zonal levels. In January 24, 2014, the FERC issued an Order directing the ISO to file sloped demand curves as such a design would obviate the need for administrative pricing rules (IS and IC provisions). Due to tight timelines the ISO opted to introduce sloped demand curves into the capacity market in two stages. In the first stage, which was completed in the spring of 2014, the ISO filed a system demand curve for FCA9 that eliminated administrative prices at the system level.

The proposed demand curve framework for the zonal level differs dramatically from the methodology used to derive the system-wide demand curve. The continuation of the existing administrative pricing rules does not work well in the context of the new demand curve system. The clearing price paid for a MW in each zone is directly proportional to its marginal reliability benefit, in dollar terms. In other words, if an additional unit of capacity in both zones A and B improve reliability equally, the prices should be equivalent in each zone. The existing administrative pricing rules contradict this core principle because, when they are triggered, existing resources would no longer get paid proportional to the marginal reliability value their capacity provides.

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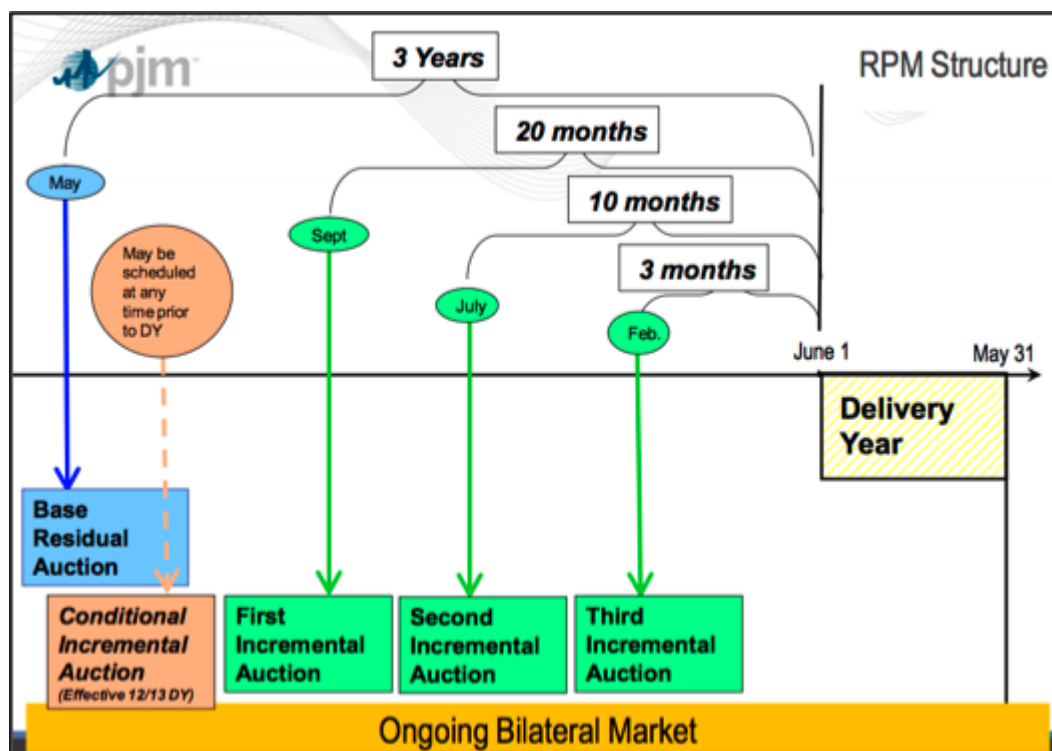
ICR = Installed Capacity Requirement

APPENDIX D PJM AUCTION CASE STUDY

Overview

The Reliability Pricing Model (RPM) is the PJM resource adequacy framework that ensures sufficient capacity resources to meet reliability requirements. The RPM in PJM is a centralized market for procuring capacity on behalf of all load, with most capacity procured through Base Residual Auctions (BRAs) conducted three years prior to delivery, and a remaining 2.5% procured through shorter-term Incremental Auctions (IAs). The main auction is called the Base Residual Auction (BRA), it happens every May three years in advance of the delivery year. There are then at least three Incremental Auctions per Delivery Year.

The costs of these capacity procurements are allocated to load serving entities (LSE) throughout the actual delivery year. The PJM capacity auction allocates the cost of these commitments through a Locational Reliability Charge, with the possibility for locational price separation to reflect locational differences in supply and demand conditions. Prices in the transmission constrained eastern parts of the PJM have generally exceeded prices in the western part of PJM. The Bilateral Market allows Load Serving Entities (LSEs) to cover shortages or monetize surpluses and also to hedge against Locational Reliability Charges that could be levied against them via the capacity auctions.



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Auction format

In PJM generators offer the amount of capacity they are willing to sell and the price at which they will sell that capacity. Typically, these offers can be one price/quantity pair or multiple price/quantity pairs that show an increasing cost. They employ a simple sealed bid format.

These offers, when stacked from least to greatest cost, define the supply curve. The Reliability Pricing Model (RPM) is a multi-auction structure designed to procure resource commitments to satisfy the region's unforced capacity obligation through the following market mechanisms: a Base Residual Auction, Incremental Auctions and a Bilateral Market.

The Base Residual Auction clearing software is an optimization algorithm. This algorithm has the objective of minimizing capacity procurement costs given the supply offers, Variable Resource Requirement Curve(s), Locational Constraints and other data. The clearing of the Incremental Auctions is determined by the intersection of the supply curve and the demand curve. If no intersections occur as a result of the supply curve extension or the demand curve extension, no capacity will be cleared in the Incremental Auction. The Incremental Auction clearing prices for each Buy Bid or Sell Offer cleared is determined by the same optimization algorithm used in the Base Residual Auction clearing.

The Reliability Pricing Model (RPM) is a multi-auction structure designed to procure resource commitments to satisfy the region's unforced capacity obligation through the following market mechanisms: a Base Residual Auction, Incremental Auctions and a Bilateral Market.

Out of the auction (Base Residual Auction) successful participants receive a uniform clearing price.

Structure of bids

Generation suppliers offer the amount of capacity they are willing to sell and the price at which they will sell that capacity. These offers can be one price/quantity pair or multiple price/quantity pairs that show an increasing cost. These offers, when stacked from least to greatest cost, define the supply curve.

Auction Price Cap and Minimum Offer Price Rule

The Minimum Offer Price Rule (MOPR) is intended to prevent the exercise of buyer-side market power. MOPR ensures all new resources are offered into RPM Auctions on a competitive basis. MOPR imposes a minimum offer screening process to determine whether an offer from a new resource is competitive and prevents market participants from submitting uncompetitive, low new entry offers in RPM Auctions to artificially depress auction clearing prices. Unless a MOPR exception or exemption is requested and approved, the MOPR Floor Offer Price for any auction shall be set equal to 100% of the applicable Net Asset Class CONE.

Sloping demand curve / volume tolerances

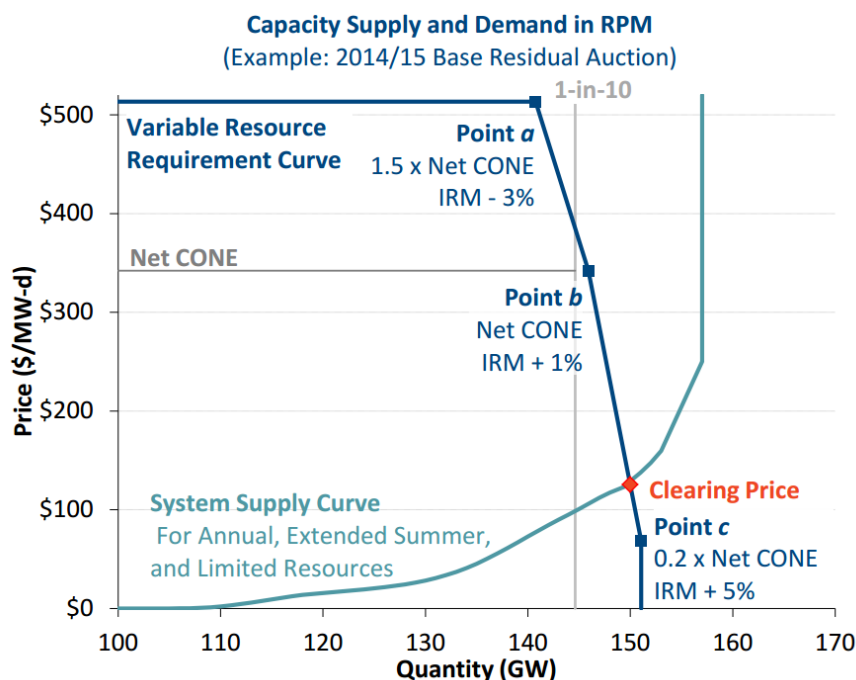
All three major eastern US Independent System Operators (ISOs) ISO-NE, NYISO and PJM initially employed capacity market designs that secured a fixed amount of capacity equal to the planning reserve margin, and imposed deficiency charges on load serving entities who failed to meet their share of the planning reserve margin. In practice, this resulted in a vertical demand curve. Concerns were raised in some regions that the prices resulting from the use of a vertical demand curve were too

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volatile, with prices at or near the deficiency charge when supply was not sufficient to meet the planning reserve margin, and prices near or at zero once the planning reserve margin was met. In response, NYISO and PJM adopted downward sloping demand curves, while ISO-NE is just about to move to a sloped demand curve.

Demand in PJM's auctions is described by the Variable Resource Requirement Curve(s) (VRR), a segmented downward-sloping curve that is designed to procure enough capacity to meet resource adequacy objectives while avoiding the extreme price volatility that a vertical curve might produce. Recognizing transmission constraints, each of several Locational Deliverability Areas (LDAs) has its own VRR curve that may set higher prices locally if transmission constraints bind in the auction.

The VRR curve is designed to yield auction clearing prices higher than Net CONE when the amount of cleared capacity falls below the target reserve margin and below Net CONE when cleared capacity exceeds the target. The prices and quantities of the VRR curve are premised on the assumption that, in a long-term economic equilibrium, new entrants will set average capacity market prices at Net CONE. The highest price part of the demand curve is flat from the y or price axis at a price equal to 1.5 times the net cost of new entry, or the gross cost of new entry if that is higher. PJM has been utilizing a frame-type combustion turbine plant as its reference technology for the purpose of defining Net CONE for the VRR curve.



Other market power mitigation measures

Participation is mandatory for all existing resources, with all Load Serving Entities (LSE's) that serve load in PJM required to participate in the capacity auctions (except those who opt for the FRR Alternative). They must offer at least their minimum available installed capacity position (i.e. Minimum Available ICAP position). Participation is voluntary for external and planned generation resources, existing and planned demand resources, energy efficiency resources, and qualifying transmission upgrades.

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PJM has a number of very large generation owners who are individually pivotal. The locational markets also exhibit structural market power. Due to these issues market power mitigation rules are required to ensure that capacity market outcomes are competitive. A pivotal generation supplier must offer existing capacity at a price equal to the marginal cost of capacity if their offer absent mitigation would increase the clearing price. Although planned new generation is usually presumed to be competitive, but if it is pivotal it is subject to maximum offers linked to the cost of new entry.

Prior to the 2017/2018 Delivery Year, the marginal value of system capacity is the clearing price for Limited Demand Response (DR) in the unconstrained area of the PJM region. For the 2017/2018 Delivery Year, the marginal value of system capacity is the clearing price for Annual Resources in the unconstrained area of the PJM region. Effective with the 2018/2019 Delivery Year, the marginal value of system capacity is the clearing price for Capacity Performance Resources in the unconstrained area of the PJM region. In the event that the Sell Offers forming the supply curve do not result in an intersection with the Variable Resource Requirement Curve, the marginal value of system capacity will be set along the Variable Resource Requirement Curve by extending the supply curve vertically from its end point until it intersects the Variable Resource Requirement Curve.

Dealing with discrete capacity bids

A capacity supplier is willing to accept the clearing of any amount equal to or greater than the Min MW amount specified in the segment and equal to or less than the Max MW amount specified in the segment. If the Min MW amount specified in the segment is greater than 0 MW and less than or equal to the Max MW amount specified in the segment, the segment is considered inflexible and may not clear in the RPM Auction due to the Min MW amount specified in the offer segment, even if the segment offer price is less than or equal to the auction's relevant resource clearing price as it may be more cost effective to clear a higher priced but flexible resource.

APPENDIX E MISO AUCTION CASE STUDY

Overview

The Midcontinent Independent System Operator (MISO) serves 11 U.S. states and the Canadian province of Manitoba. MISO manages one of the world's largest energy markets, with \$18.4 billion in gross annual market charges. MISO is a non-profit organization governed by an independent Board of Directors and is headquartered in Carmel, Indiana, with operations centres in Carmel and St. Paul, Minnesota. Membership is voluntary.

The MISO Resource Adequacy (RA) construct began with the 2013–2014 auction period. Previously, MISO conducted a voluntary capacity market with significantly low capacity prices and no incentives for localization. In the Midcontinent Independent System Operator's (MISO) region, load-serving entities (LSEs), with oversight by the States (as applicable by jurisdiction,) are responsible for their resource adequacy. MISO is divided into nine local resource zones (LRZs).

MISO's resource adequacy construct provides compensation for resources not under a fixed resource adequacy plan (FRAP) for the value of having available energy in a particular geographic location. This construct aims to improve the reliability of the MISO electricity grid, especially during peak times when supply can be scarce.

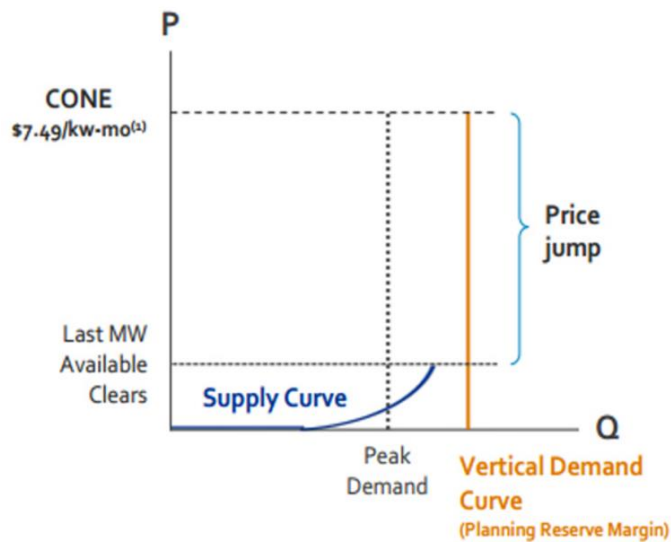
Load serving entities (LSEs) and utilities must meet two reserve requirements in the RA auctions: the planning reserve margin requirement (PRMR) and the local clearing requirement (LCR). The LCR is the amount of capacity a zone must procure internally in order to meet its own peak demand requirements. The PRMR is the amount of capacity a zone must procure, which can include imports, to fulfil its obligation to meet MISO's peak demand reliability requirements.

The capacity auction is prompt rather than forward looking meaning that capacity for the June–May annual planning period is procured in April of that same year. Participants bid into the auction for zonal resource credits (ZRCs) that are equivalent to one MW of capacity. ZRCs are for one-year obligations.

Auction format and demand curve

The bids are cleared through a single, sealed-bid clearing price auction against a vertical demand curve.

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Source: Dynegy

Roles and responsibilities

The Midwest ISO is the administrator and overseer.

Other issues

Capacity committing to PJM: With MISO's low capacity prices, power plants operators have an increasing incentive to interconnect to PJM. This incentive was seen in MISO when Covert, a 1.1 GW combined cycle unit in Zone 7, began the process of interconnecting to PJM and cleared in PJM's 2016–2017 and 2017–2018 auctions. This trend also has been seen in other regions with low capacity prices as well. For example, Roseton, a plant located in New York Independent System Operator, cleared in ISO-NE's higher-priced 2018–2019 auction.

APPENDIX F NYISO CASE STUDY

Auction format

NYISO, suppliers offer the amount of capacity they are willing to sell and the price at which they will sell that capacity. Typically, these offers can be one price/quantity pair or multiple price/quantity pairs that show an increasing cost. They employ a simple sealed bid format.

Market power mitigation measures

NYISO uses a pivotal supplier test. Any entity, in combination with its affiliates, controlling 500 MW or more of unforced capacity necessary to meet New York City's capacity requirement is deemed a pivotal supplier and is therefore subject to mitigation. Mitigated resources offering into NYISO's spot-market are mitigated to the higher of the projected clearing price for the capacity suppliers into New York City or the going forward costs of the capacity supplier, calculated by NYISO based on cost data submitted by the supplier. NYISO does not apply this supply-side mitigation outside of New York City.

APPENDIX G COLOMBIA CASE STUDY

Overview

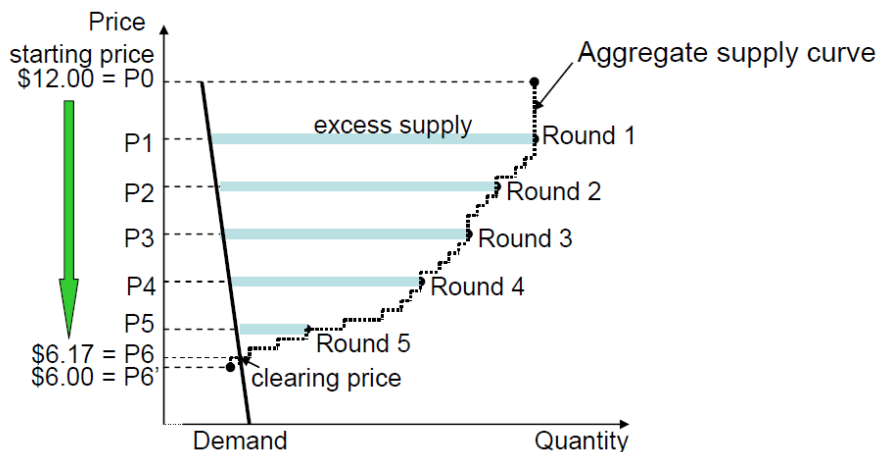
In 2006 the Colombian Comisión de Regulación de Energía y Gas (CREG) introduced a new regulatory scheme to ensure the reliability of the long-term supply of electric energy in Colombia. The scheme allocates Firm Energy Obligations (OEFs) to new and existing generating plant in order to guarantee a sufficient long-run supply of firm energy at prices determined in competitive auctions. The Colombian electricity market is hydro dominated with roughly 80% of Colombia's energy being produced from hydro resources, and with around two-thirds of its capacity being hydro. The first OEF auctions were held in May and June 2008 and allocated OEFs for periods of up to twenty years beginning in December 2012.

Auction format

The Colombian Commission for the Regulation of Energy and Gas (CREG) runs capacity auctions using the descending clock auction format. The auction uses a dynamic auction design intended to promote price discovery. The price starts at a high price (two times CONE) and suppliers bid the quantity they are willing to supply at that price. If there is excess supply, the price is reduced and again suppliers respond with their willingness to supply. This process continues until supply and demand balance, which determines the quantity won by each supplier and the clearing price paid to all suppliers during the commitment period.

The 2008 auction ended at the first point when a large bidder saw that it had become pivotal and withdrew one of its offers to set a high capacity price. Subsequently in 2011 the CREG attempted to counter this strategy by reducing the amount of information released to bidders on demand and supply during the auction. This auction was abandoned after the initial two rounds and a sealed-bid auction was held in its place. The CREG subsequently recommended changing the auction format to a combinatorial clock auction followed by a sealed-bid stage to reduce the risk of this being repeated in the future.

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Structure of bids

The clock auction includes a simple activity rule: as the price declines suppliers can maintain or reduce quantities; quantities cannot increase. Thus, a supplier's offers must be consistent with an upward sloping supply curve. In addition, there is a rule that prevents existing suppliers from exercising market power. Existing resources can opt out of the market, but this choice does not impact the firm energy price paid to existing resources.

The 6 May 2008 OEF auction was a descending clock auction for new resources, and effectively a sealed-bid auction for existing resources. New power plants were able to submit supply bids during each round of the auction and withdraw supply at whatever prices they chose. The market power mitigation rules effectively meant that the auction was a sealed-bid auction for 87% of the energy offered.

Since the auction ended at the first point at which any active bidder became pivotal, and on the basis of bids which were evidently finely-tuned to achieve a particular outcome. Certain information reported to bidders during the auction may have increased their ability to manipulate the auction outcome. In particular, reporting aggregate excess supply, along with precise information about the auction demand curve, allows bidders on new resources to see exactly when their capacity becomes pivotal, and thus endows them with an ability to end the auction at prices which do not reflect actual energy costs.

Auction Price Cap and Price-taker Threshold

New firm energy bids are not mitigated in any way. A critical assumption is that the market for new resources is competitive. An opt-out bid is used by a capacity supplier to opt out of a single commitment year. If the price falls below the supplier's opt-out bid, the capacity supplier will not have any obligation during the commitment year. The capacity supplier can still participate in the energy spot market, but it will not receive any firm energy payment. Opt-out bids are not revealed during the auction.

A retirement bid is a permanent opt out of the firm energy market. Retirement bids are submitted four weeks before the start of the auction. Accepted retirements are excluded from any future firm

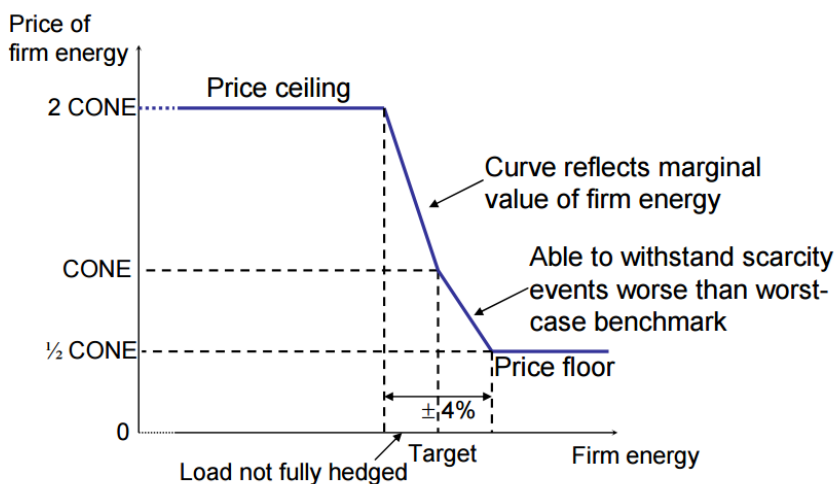
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energy payments. Retirements are replaced with new resources in the auction. They are represented as a shift to the right in the demand curve for all prices below the retirement bid.

With this approach to market power, new capacity resources almost always set the price. The demand curve sets the price in surplus years in which new entry is not needed. Retirements occasionally set the price. Other than retirements, existing resources never impact the price.

Sloping demand curve / volume tolerances

The demand curve specifies how the purchased quantity of firm energy depends upon price. At CONE, load purchases its firm energy target (100% of estimated firm energy demand). At higher prices, load purchases slightly less than the target quantity; at lower prices load purchases slightly more than the target quantity. The firm energy price has a ceiling of two times CONE and a floor of one-half times CONE.



Initially, CONE is estimated by the regulator. Subsequently, CONE is adjusted based on competitive auction results.

Other market power mitigation measures

There is an activity rule designed to promote price discovery, this limits what a bidder can do later in the auction based on what it did earlier in the auction. In particular, the activity rule requires that the bidders bid in a way consistent with an upward sloping supply curve: suppliers can only maintain or reduce quantity as the price falls.

Dealing with discrete capacity bids

The auction respects the fact that projects are lumpy. Generating units come in discrete lumps; the bidder's supply curve is interpreted as discrete quantities. In this way, the capacity supplier need not fear partial acceptance. However, the lumps bid by the supplier must correspond to the supplier's discrete physical generating units.

APPENDIX H AUCTION EXAMPLE AND BID STRUCTURE

Worked example of descending clock auction

A worked example of a descending clock auction format is provided below:

Multiple round descending clock auction

Sealed bid and multiple round descending clock auctions operate in a similar way in many respects. Both result in the development of an aggregate supply curve during the course of the auctions, and the auction clears at a price at which aggregate supply reduces to the level of aggregate demand.

The key difference between a sealed bid auction and a multiple round descending clock auction is that a multiple round descending clock auction provides bidders with information between bidding rounds which they can use to inform their bids in subsequent rounds. By contrast, a simple sealed bid auction has only one round, so by definition cannot provide bidders with information between rounds.

Providing feedback to bidders on prices bid by other bidders and on excess supply/demand (i.e. on market depth) is often deemed to be a good thing. It promotes price discovery and allows bidders to discover other bidder's view of the value of the product. The argument is that bidders face significant "common value" uncertainty concerning the value of the product being auctioned (i.e. the Reliability Option). This uncertainty will lead them to bid conservatively, i.e. by demanding a higher price for new capacity, to avoid falling victim to the "winner's curse", whereby the winners are the bidders who have mis-judged the value of the product and end up over-bidding as a result.

Price discovery is particularly valuable in auctions where the:

- Product lacks price transparency, as will be the case in the new I-SEM capacity product, at least initially;
- Value of the product is not well understood, which is arguably the case with the new Reliability Options, whose value is in part a function of unpredictable difference payments. In this respect the "common value" argument is arguably stronger for the I-SEM Reliability Option than in other auctions where the value of price discovery has been questioned in academic literature (see Harbordy and Pagnozzi (2014)⁸²); and/or
- Where there is a strong asymmetry in price information between an auctioneer which is also an incumbent market participant, and new entrants with limited access to price information. In such auctions, whereby the incumbent seller has more information than the other bidders on pricing in its home market, providing other bidders with price and market depth information between rounds aids competition.

However, the disadvantage of providing bidders with price and market depth information in between rounds is that it may increase their ability to game the auction / exercise market power (see Harbordy

⁸² Britain's Electricity Capacity Auctions: Lessons from Colombia and New England, David Harbordy and Marco Pagnozzi, 10 April 2014

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and Pagnozzi, 2014). In particular, market power concerns led the Colombian Regulator to abandon the multiple round descending clock format.

In each round of the multiple round descending clock auction format, the auctioneer announces a *start-of-round price* and an *end-of-round price*. In the first round of the auction, the *start-of-round price* is the maximum price which the auctioneer is prepared to pay, a form of reserve price⁸³.

Let us assume that instead of running a sealed bid auction, as above, the auctioneer runs a multiple round descending clock process, with the same five bidders, A to E. Let us assume that the auctioneer declared during the qualification process that the maximum price it was prepared to pay was €50/kW/year, and that A to E qualified with the same overall volumes as set out in Table 3**Error! eference source not found.**, i.e. an aggregate of 49 MWs. Assume that A to E have the same cost characteristics and bidding intentions as in the simple sealed bid example above.

The auctioneer announces that the start of round price for the first round is €50/kW/year (the maximum amount that it is prepared to pay), and that the end-of-round price for the first round is €45//kW/year, and the time the round starts and finishes (i.e. the window during which bidders could submit their bids relating to volumes between a price of €50/kW/year and €45/kW/year).

As with the sealed bid auction above, it would be possible to allow bidders to bid a “supply curve” between the start-of round and end-of-round price, or to bid a single price at which it wishes to exit the auction (if it wishes to exit the auction before or at the end of round price)⁸⁴.

To illustrate this approach, we shall assume that our multiple round descending clock auction is based on submitting a single exit bid price for all qualified volume for that capacity unit.

Now in our example, none of A to E would have submitted an exit bid in the first round, seeing as all of them would want to remain in the auction at a price of €45/kW/year. After the completion of the first round, the auctioneer calculates the aggregate demand at the end-of-round price. In our example, there would be a surplus of supply over demand of 24 MWs (49 MWs offered, 25 MWs demanded). Since the excess supply (i.e. the aggregate supply less the aggregate demand) at the end-of-round price is positive, the auction moves on to a next round. Auction rounds continue descending until excess demand is less than or equal to zero, at which point the auctioneer determines the lowest price at which the excess demand became less than or equal to zero (the clearing price) and identifies the winners and the auction ends.

In our example, at the end of the first round the auctioneer would announce that there was still excess supply at the end of round, and depending on the auction information policy may announce how much excess supply there was. In the case of the GB capacity auctions, at the end of each round, in the T-4 auction the auctioneer announces the amount of excess supply over demand rounded to the nearest 1GW, and in the T-1 auction the auctioneer announces the excess rounded to the nearest

⁸³ For instance, the GB 2014 and 2015 capacity auctions were in the multiple round descending clock format, with the price at the start of the first round set equal to 1.5 x CONE (Cost of New Entry), the maximum price that the auctioneer would pay

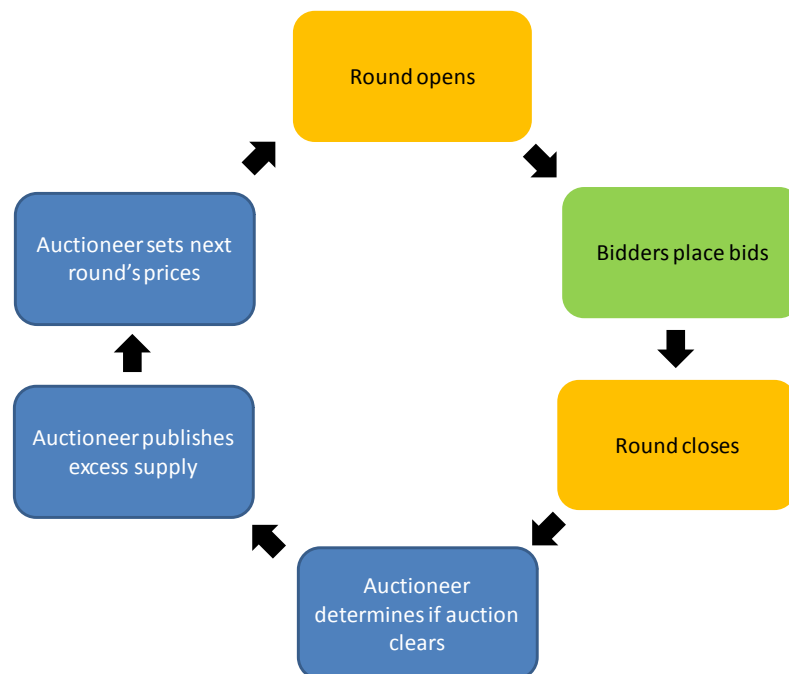
⁸⁴ In the GB 2014 and 2015 T-4 auctions, and the January 2016 T-1 auctions capacity providers submitted only at exit price, rather than a supply curve. In this example, a capacity unit remained in the auction until it bid an exit price, so that its bid was all of its qualified capacity above the exit price, none of its exit capacity below the exit bid price. This approach is analogous to only allowing bidders to submit a single PQ pair in a sealed bid auction.

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100MW. The bidders can then use this information to inform their bids in the next and subsequent rounds.

The start-of-round price for each round is the end-of-round price from the previous round, so in our example the start of second round price is €45/kW/year. Let us assume that the auctioneer announces the end of second round price is €40/kW/year. In this case, Bidder B submits an exit bid at precisely €40/kW/year, and at the end of the round, the supply has fallen to 39 MWs. Therefore the auctioneer notifies bidders of the level of excess supply at the end of Round 2, in accordance with the information policy, and the auction continues to Round 3. The end of Round 3 price is announced as €35/kW/year, and Bidder D submits an exit bid for its 15 MWs at €35/kW/year, at which point supply ceases to exceed demand and the auction closes. The clearing price for this auction is €35/kW/year⁸⁵, just as in the sealed bid example (assuming, as in the sealed bid example, Bidder D is willing to supply 1 MW, rather than either 15 MW or zero).

Figure 16: Multiple round descending clock auction format



In the above example, Bidder D was informed at the end of Round 2 (when the price was €40/kW/year) that the excess of supply over demand is 14 MW. Bidder D chose not to exploit that information to game the auction. Instead, knowing that 15 of its MWs were still in the auction, D could have made its exit bid at €39.99/kW/year rather than the €35.00/kW/year exit price bid it actually made. It would still have had only 1 MW, but at a clearing price of €39.99/kW/year rather than €35.00/kW/year.

This example illustrates that a key difference between the sealed bid auction and the multiple round descending clock auction is that D received feedback between the rounds, which gave it more information that it had market power within a certain price range. So, a multiple round descending

⁸⁵ Or €35.01/kW/year, depending on the precise formulation of the clearing rule

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clock format gives a bidder more information to be able to exploit market power, if the bidder has market power in the first place. On the other hand, it is also argued a multiple round descending clock format will assist information-weak bidders, leading to more aggressive bidding and hence quite possibly a lower price for the procured capacity.

Structure of bids

Multiple round descending clock format (Auction format 2)

There are multiple approaches to the structure of bids under a multiple round descending clock format

- Approach 1. Bidders remain in the auction until it submits an Exit Bid. A bidder remains in at its qualified volume by default (i.e. is deemed to have submitted a continuation bid), until it submits an Exit Bid. If it does not submit a bid during the round then by default it is still bidding the same volume at the end of round price as it was at the start of round price. If it submits an Exit Bid, it must exit that unit from the auction entirely, it cannot reduce its offered volume to a lower non-zero MW. This “Exit Bid” approach was employed in the GB, where a bidders choice was largely binary⁸⁶, be in at the qualified volume, or exit. This approach has the same effect as Option 1 under the Simple Sealed Bid format.
- Approach 2. Bidders bids remain unchanged until they submit an alternative bid, but their choice is not entirely binary (in at the qualified volume or zero). Suppose that the start of round price is €20/MWh and Bidder A is still in at its qualified volume of 400MW. During the course of the next round Bidder A can choose to reduce its offered volume to 380 at €19/MWh and to 360MW at €18/MWh. Under such an approach there is typically a limit to the number of times that a bidder can reduce its bid volume during the course of a round. This approach could be further simplified for those bidders who did not want to take advantage of any price discovery that may occur during the course of the auction, and wanted to submit a “sealed bid” at the start of the auction.
- Approach 3. A bidder must submit a bid during each round, it cannot “do nothing” and be deemed to have bid in that round by default (i.e. still be bidding the same volume at the end of round price as the start of round price if it does not submit a bid). We would envisage that under this approach, that a bidder would be able to reduce its offered volume in steps during the course of a round. We note that where a bidder is still bound by a Price-taker Threshold at the end of round price, if it failed to submit a bid during that round, it would need to be deemed to have submitted a continuation bid by default.

We envisage that bidders should be allowed to bid their quantity as a function of price, subject to the controls imposed by the Auction Price Cap and the Price-taker Threshold, therefore we do not envisage adopting Approach 1. In particular, we envisage that intermittent generators (who did not participate in the GB auction), Capacity Aggregators and Demand Side Units may find this extra flexibility useful, and that it would promote environmental objectives, efficiency and competition.

⁸⁶ In the GB auction, the bidder with existing capacity was allowed to specify a point at price at which its bid changed from a refurbishment bid with a higher MW to a bid based on existing capacity with a lower MW. In GB there was no scope for new capacity to bid, say 400MW at a price of £20/MWh, 380MW at £19/MWh and 360MW at £18/MWh.

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Approach 2 has the advantage that it may be simpler, particularly for smaller unsophisticated bidders or who did not want to be tied up participating in a multiple round auction for several hours, or possibly a couple of days.

Approach 3 has the advantage that each bidder has to make a clear unambiguous commitment by submitting a bid in each round, but could involve bidders being tied up to a couple of days.

Additionally, where a bidder who is bound by a Price-taker Threshold failed to submit a bid, it would need to be deemed to have submitted a continuation bid anyway (i.e. Approach 2 would be applied in these circumstances anyway).

Under Approach 3, bidders would submit bids according to the following process and format:

- For each round t , the auctioneer announces to bidders an interval of prices, consisting of a start of round price and an end of round price effective for round t . The starting price in round 1 is the Auction Price Cap, and the end of round price is a lower price.
- Each bidder i simultaneously and independently submits its supply function $Q_i(P)$ for prices between the start of round price and the end of round price where $Q_i(P)$ is constrained to be a weakly-decreasing step function;
- Following round t , the auctioneer calculates the aggregate supply offer by bidders, at the end of round price;
- If the aggregate supply becomes equal to or less than the demand curve at any price during the round, the auction close and contracts are awarded according to the winner and price determination processes. If aggregate supply exceeds the demand curve at the end of round price, the auction progresses to round $t+1$, and the auctioneer announces the end of round price for round $t+1$ (the start of round price is the end of round t price);

Under Approach 2, the only difference is that the bidders do not need to submit a bid in every round. Their end of round volume is deemed to be the same as their start of round volume unless they submit a bid.

Combinatorial action (Auction format 3)

In a combinatorial auction format, for T-4 or a T-1 auction, the bidder can submit up to mutual exclusive price quantity pairs $P_{i,n}$, $Q_{i,n}$ per Capacity Market unit i , for that Capacity Delivery year t . The auctioneer typically has to limit the number of pairs allowed since the number of potential combination of bids that the software has to evaluate grows exponentially with n .

In a single product format (such as the T-4 or T-1 auctions), this bid structure offers the bidder some extra flexibility over and above bidding a supply function because the auctioneer does not typically impose the requirement Q_i is a monotonically increasing function of P_i . However, it is doubtful that this has much value to a bidder in a single product auction.

This bid format has more additional value to a bidder in a multi-product auction. For instance, in the transitional auction Option 2 (Auction as block), there are four “products”, 2017/18 capacity, 2018/19 capacity, 2019/20 capacity and 2020/21. As set out in SEM-15-014, under this Option we have required a bidder to bid the same price for all four Capacity Delivery Years. However, bidders could, for instance submit the following mutually exclusive bids:

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- €20/kW/year to mothball for 2017/18 and 2018/19 and then come back at 100MW capacity in 2019/20 and 2020/2021;
- €20/kW/year to operate at 100MW capacity for 2017/18 and 2018/19 and then close;
- €30/kW/year to operate at 100MW for all four years.

The key advantage in multi-product auction is that it allows bidders to link their offerings across the four years. Thus for instance, if it is in the interests of the bidder and the auctioneer to mothball in 2017/18 and 2018/19 then it can bid that outcome as a package. If the capacity in each year was auctioned separately⁸⁷, a sub-optimal outcome could result, if the bidder is not able to express this contingent bid format.

⁸⁷ under multiple sealed bid or multiple simultaneous descending clock auctions

APPENDIX I SLOPED DEMAND CURVE

Sloped demand curve case studies

All three major eastern US Independent System Operators (ISOs) ISO-NE, NYISO and PJM initially employed capacity market designs that secured a fixed amount of capacity equal to the planning reserve margin, and resulted in a vertical demand curve. Concerns were raised in some regions that the prices resulting from the use of a vertical demand curve were too volatile, with prices at or near the deficiency charge when supply was not sufficient to meet the planning reserve margin, and prices near or at zero once the planning reserve margin was met. In response, NYISO and PJM adopted downward sloping demand curves. While ISO-NE continued to use a vertical demand curve within the context of a descending clock auction, it is now proposing to move to a sloping demand curve.

The demand curve in PJM's auctions is called the Variable Resource Requirement Curve(s) (VRR), a segmented downward-sloping curve that is designed to procure enough capacity to meet resource adequacy objectives while avoiding the extreme price volatility that a vertical curve might produce.

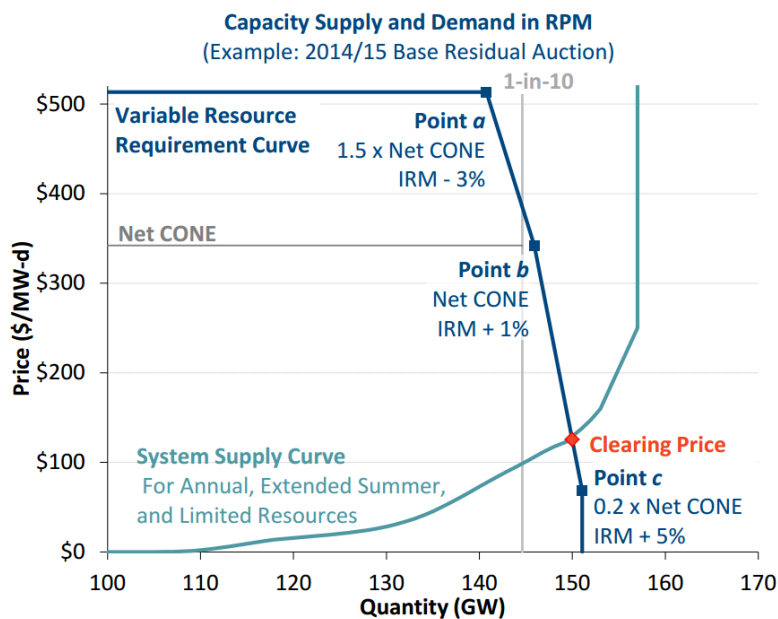
The VRR curve is a downward sloping demand curve illustrated in Figure 16 below that is anchored at point "b" at a price of Net CONE and quantity at one percentage point above the installed reserve margin needed to satisfy the system-wide Reliability Requirement⁸⁸.

The VRR curve is designed to yield auction clearing prices higher than Net CONE when the amount of cleared capacity falls below the target reserve margin and below Net CONE when cleared capacity exceeds the target. The prices and quantities of the VRR curve are premised on the assumption that, in a long-term economic equilibrium, new entrants will set average capacity market prices at Net CONE. The highest price part of the demand curve is flat from the y or price axis at a price equal to 1.5 times the net cost of new entry, or the gross cost of new entry if that is higher.

⁸⁸ The Reliability Requirement is the quantity needed to meet the 1 event in 10 years, or 1-in-10, loss of load event standard.

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Figure 17: Example demand curve from 2014/15 PJM auction



GB also implemented a sloping demand curve in the GB 2014 capacity auctions (for delivery in 2018/19), and did so again in the December 2015 auction for delivery in 2019/20⁸⁹ and in the January 2016 T-1 auction. More details of the GB example are included in Appendix [].

In setting the slope of the demand curve there are a number of parameters to be defined, which can be described by the price and quantity values of points A, B and C in the above diagram:

- A is the point at which the curve becomes horizontal, i.e. the Auction Price Cap. The Auction Price Cap is discussed in Section 6.3 below.
- B would normally pass through the point where the price is equal to Net CONE and the quantity is equal to the Capacity Requirement (defined by the capacity standard, in our case an 8 hour LOLE). However, during the first years of the transitional arrangement we may consider increasing the quantity value at point b, in order to ensure capacity which is required in 2020/21 does not close in 2017/18.
- C is the maximum capacity that we are prepared for, even at a zero price. The curve could slope continuously down to a price of zero (as in GB) or become vertical at a price above zero as in the PJM picture illustrated above.

Bid limits

The GB capacity auctions are multiple round descending clock auctions. In the context of a multiple round auction, they employed a Price-taker Threshold (the equivalent of what we are calling a Price-

⁸⁹ Following a consultation process, in June 2014, the UK Department of Energy and Climate Change, stated that the following approach will be used to set the demand curve for the GB auction...“A capacity demand curve will be determined annually by the Government, in advance of capacity auctions. The demand curve will: Set a target level of capacity to auction; enable the trade-off between cost and reliability to be automatically determined at auction; and set a cap on the maximum price that can be set at auction” See page 67, Electricity Market Reform: Consultation on proposals for implementation Government Response, June 2014

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taker Offer Cap) which means that the bidder has to keep submitting⁹⁰ its qualified MW until the price descends to the Price-taker Threshold. The Price-taker Threshold was not applied to new entrants, who are only limited in what they can bid by the Auction Price Cap. In GB, the Price-taker Threshold was set at 0.5 x Net CONE.

In the GB capacity auction price-takers can ask to have their price-taker restriction removed by seeking declaration to be a price maker. This is achieved by the submission of a memorandum under seal to Ofgem. The memorandum must make clear why the plant needs to be released from the price taker status and at what price level they will withdraw their unit from the auction, essentially a declaration in advance of their net going forward costs.

In PJM, locational markets market power mitigation rules are required to ensure capacity market outcomes are competitive. A pivotal generator must offer existing capacity at a price equal to the marginal cost of capacity. If new planned generation is deemed pivotal then its maximum offers are linked to the cost of new entry. Effective from the 2018/19 delivery year, the marginal value of system capacity is the clearing price for capacity resources in the unconstrained area of the PJM region.

In PJM the marginal cost of capacity includes the full costs of any incremental investments required to maintain the ability of an existing generating unit to be a capacity resource. So the annualised fixed costs of an investment in new environmental/more efficient technology can be added to the offer cap. This facility to add the fixed costs associated with necessary capital additions to offer prices allows a market test of the need for the investment.

In ISO-NE administrative pricing rules were applied to the capacity auction to protect consumers from uncompetitive auction outcomes. These worked by identifying instances where an auction could fail to produce a competitive outcome and approximating the price that would be paid in a competitive auction. This meant that existing capacity could be paid a lower price than new entrants, potentially creating undesirable side-effects. These administrative pricing rules are being potentially replaced by a proposed zonal demand curve framework. In ISO-NE plants opting out of bidding in capacity auction could have their de-list bids reviewed. De-list bids are reviewed by the Internal market Monitor (IMM) to determine whether bid prices are consistent with a resources net risk adjusted going forward costs and opportunity costs. These de-list bids must include sufficient documentation for IMM to make their determination or may otherwise be rejected

In NYISO a pivotal supplier test is used, with any entity in combination with its affiliates, controlling 500 MW or more of unforced capacity necessary to meet New York City's capacity requirement is deemed a pivotal supplier and is therefore subject to mitigation. Mitigated resources offering into NYISO's spot-market are mitigated to the higher of the projected clearing price for the capacity suppliers into New York City or the going forward costs of the capacity supplier, calculated by NYISO based on cost data submitted by the supplier. NYISO does not apply this supply-side mitigation outside of New York City.

The level of bid price controls employed in recent GB auction are shown in the table below, along with with Net CONE values. The table also shows that the GB auctions have cleared below the Price-taker

⁹⁰ In the GB auction, the bidder did not need to actually submit a bid. It remained in the auction by default until it submitted an Exit Bid. In some other multiple round descending clock auctions, bidders need to actually submit a continuation bid each round

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Threshold of 0.5 x Net CONE. So both existing capacity and some new capacity has been prepared to bid below this level. The GB Net CONE of £49/kW/year is similar to the 2016 SEM BME Net Cone of €66/kW/year, given the range of exchange rate fluctuations⁹¹.

Table 9: Summary of auction price caps and clearing prices

Market	Year/proposal	Net CONE (£ or €/kW/year)	Auction Price Cap	Auction Clearing Price
SEM Capacity Mechanism	2015 (for capacity delivery 2016)	€65.60	n.a.	n.a.
GB T-4 auctions	2014 T-4 actual auction	£49.00 (in 2014/15 money ⁹²)	£75/kW/yr	€ 19.40/kW/yr (£/kW/yr)
	2015 T-4 actual auction	£49.00 (in 2014/15 money ⁹³)	€ /kW/yr (£75/kW/yr)	(£18/kW/yr) in 2014/15 prices
GB T-1 auction	2016 T-1 auction		€ /kW/yr (£40/kW/yr)	(£27.50/kW/yr) in 2014/15 prices

Potential further considerations of design aspects of sloped demand curve

Design aspects of Sloping Demand Curve

There are a number of design aspects of a sloping demand curve which influence the price and quantity outcomes in an auction, these include:

- **Slope and shape of demand curve:** A flatter demand curve would result in a tight distribution of price outcomes but with broader more uncertain quantity outcomes. In contrast a steeper demand curve will produce greater price volatility but will minimise quantity uncertainty.
- **Positioning of the demand curve:** This refers to the amount of excess capacity the auction is designed to procure. Positioning means that a demand curve with defined slope and shape can be moved left or right (the same price associates with less or more capacity). A demand curve positioned to procure more excess capacity will have a higher level of reliability and a higher cost.

Slope and shape of demand curve

There are a number of different demand curve shapes as shown in the figure below, these include:

- **Steep Linear Curve:** In a small market like I-SEM this option could lead to highly volatile prices. This curve results in prices relatively reflective of the marginal economic value provided by capacity at the relevant level of excess.

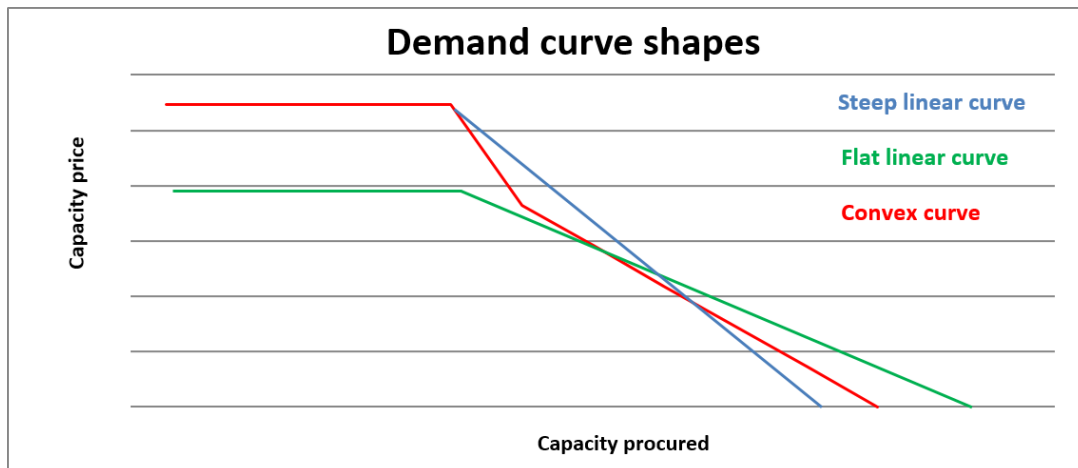
⁹¹ They are the same at an exchange rate of 1.346. The exchange rate fluctuated between 1.27 and 1.44 in 2015

⁹² Average index October 2014 to April 2015 inclusive; CPI All Items

⁹³ Average index October 2014 to April 2015 inclusive; CPI All Items

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- **Flat Linear Curve:** This option could result in prices that are above the marginal value of capacity at levels of excess capacity. This flatter curve will result in less volatile prices.
- **Convex Curve:** This option most accurately reflects the marginal value of capacity. This curve can keep prices from falling too low following entry of capacity but can also let prices rise towards the cap as the marginal value of capacity increases. At excess capacity it provides a relatively stable price outcome.



Assessment of options

These options can be assessed under the following areas:

- Expected cost
- Price reflective of fundamentals
- Price volatility

Expected cost: The A steep linear curve due to its narrowly distributed reliability outcomes and ability for average reliability to be closer to target reliability outcomes results in a low overall cost relative to less steep curves. In contrast to flat linear curve results in relatively higher overall costs due to the widely distributed reliability outcomes and average reliability being further from the target capacity volume. The convex curve has costs in-between the costs of the steep and flat linear curves.

Price reflective of fundamentals: A steep curve results in prices relatively reflective of the marginal economic value provided by capacity at the relevant level of excess. A flatter demand curve results in prices above marginal economic value provided by capacity at the relevant level of excess, the use of a convex curve may more accurately reflects the marginal value of capacity.

Price volatility: A key benefit of a sloping demand curve is that it can depending on the shape of the slope smooth out volatility in auction prices from year to year, which might otherwise yield significant swings in prices with high prices in years with new entry and lower prices in years where no new entry is required to meet the capacity requirement. A steep linear curve leads to high volatility in price outcomes. A flat linear curve produces much more stable price outcomes, making it less susceptible to the exercise of market power.. The convex curve will produce volatile price outcomes when the supply position is at or below the targeted capacity volume, however at larger levels of excess capacity it will produce stable price outcomes.

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Positioning of the demand curve

The positioning of the demand curve represents a trade-off between reliability and cost. The demand curve can be positioned to ensure the auction is designed to under procure no more than some target level.

Zero crossing point

The zero crossing price is the level of excess capacity at which the auction can clear at a zero price. This can be set at varying levels of excess capacity affecting the amount of excess capacity bought in the auction. There are a number of reasons for keeping this parameter higher, these include:

- It leads to a wider, flatter demand curve which helps mitigate against price volatility, and susceptibility to market power abuse.
- It limits the downside to capacity provider participants helping to attract investment at a target capacity requirement level without having to set the rest of the curve at a high price.

Zero crossing points that exist in smaller markets tend to have larger percentage values compared to those used in larger markets. For example in NYISO its New York City zone uses an 18% zero crossing point, while larger ISO-NE and PJM capacity auctions use zero crossing points of less than half this value (in % terms).

Inflection point

The sloping demand curve is anchored at the point of the price of Net CONE and the target capacity quantity (plus potentially some percentage margin) this is the inflection point in the demand curve (shown in figure 13).

The placement of an inflection point is based on different considerations such as:

- The desire to limit the steepness of the slope
- Consistency with the shape of the marginal economic value curve
- The level of uncertainty in long run marginal cost

The Net CONE is typically defined as the estimated fixed costs of a Best New Entrant (BNE) Peaking Plant, minus revenues from infra-marginal rent in the energy market and ancillary services. The BNE plant should be a peaking plant, since it is a peaking plant which runs least and therefore needs the capacity payment to cover “missing money” in the energy market. The choice of peaking plant should also reflect a reasonable, low capital cost investment.

In practice Net CONE is calculated as:

- Gross CONE, which has two key elements:
 - Investment costs, including depreciation, interest financing and return on capital on investment; and

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- Fixed operating and maintenance (O&M) cost;
- Net of infra-marginal rent earned by the reference new entry plant from energy income and ancillary service income.

The use of Net CONE based upon a reference BNE cost is well established as a methodology for setting the Annual Capacity Payment Sum in the SEM. Generally, the SEM Committee has adopted the principle of not changing methodologies that do not need to be changed when moving from the SEM to the I-SEM.

APPENDIX J GB AUCTION GOVERNANCE CASE STUDY

In GB, the requirement on the Capacity Delivery Body to publish Auction Guidelines and the Auction Rules are specified within the Capacity Market Rules document. The Capacity Market Rules, which are pursuant to the Energy Act 2014.

The Auction Guidelines chapter of the Capacity Market Rules sets out, *inter alia*, the following auction related requirements:

- The requirement on the Capacity Delivery Body to develop auction guidelines; and
- The auction timetable.

The Capacity Auction chapter of the Capacity Market Rules sets out, *inter alia* the:

- Role of the Auctioneer;
- Rules for qualification to bid in the capacity auction;
- Rules for disqualification from future bid submission;
- Capacity auction format;
- Format of bids in the capacity auction;
- Capacity auction clearing and pricing rules;
- Publication of capacity auction results;
- Rules governing the capacity auction suspension or cancellation;
- Prohibition on market manipulation;
- Prohibition on other unreasonable business methods; and
- Role of the Auction Monitor and audit of capacity auctions.

APPENDIX K MODIFICATION PROCESS FOR SEM TSC AND GB CRM RULES

The current SEM Trading and Settlement Code Modification Procedure and the Ofgem Guidance for the Change Process for the Capacity Market Rules are summarised below.

Trading & Settlement Code (T&SC)

Like the proposed approach for the CMC, the T&SC is a multi-lateral contract with a Framework Agreement to which all Parties accede. The T&SC is now, and will continue to be a commercial agreement dealing predominately with matters of financial settlement between generators and suppliers. This characteristic is often contrasted with the Grid Code, which is accepted as largely a technical document concerned with conditions relating to connection to the transmission system.

Because of the commercial attribute of the T&SC, the Modification Process is designed with a high degree of participant involvement. Indeed the Regulatory Authorities (Regulatory Authorities) have no direct role in the process (other than to attend Modification Committee meetings where such a Modification Proposal is discussed) until the Modifications Committee makes its recommendation about a proposed modification to the SEM Committee. The only exception to this RA exclusion is that the Regulatory Authorities have the right to make a Modification Proposal (which usually involves a consultation element to the process and which Modification Proposal is usually treated exactly the same as a Modification Proposal raised by any other person). It should also be noted that anyone person may make a Modification Proposal.

The T&SC contains a Modifications Committee of elected people representing generators or suppliers, together with representatives of the TSOs, the Market Operator, the Regulatory Authorities, Meter Data Providers, Demand Side Participants and Interconnector Users. Once raised, a Modification Proposal is under the control of the Modifications Committee, which is responsible for developing the proposal into a final proposal for change specifying precise changes to the legal drafting of the T&SC and recommending (or otherwise) that proposal to the SEM Committee, together with a fully developed justification to support the finding of the Modifications Committee. The SEM Committee has the power to accept or reject a proposal or to accept an amended proposal or to require the Modifications Committee to carry out additional work on the proposal. The only limitation on the Modifications Committee is one of timing in that a decision must be reached on a Modification Proposal (usually) within 8 months of its being raised. In the alternative, RA consent for an extension to consider the Proposal is required if the Modifications Committee believe it cannot complete its work within the original 8 months. It should be noted, that if no recommendation is forthcoming from the Modifications Committee within 8 months of the proposal being raised, the Regulatory Authorities may make a decision without having received a recommendation from the Modifications Committee.

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The process allows for two different specific types of Modification Proposal: an Urgent proposal and an RA Proposal. Both are quite limited in their application. An Urgent proposal must imminently threaten or prejudice safety, security or reliability of supply or unduly interfere with disrupt or threaten the operation of the SEM. An RA proposal is one where the Regulatory Authorities have already consulted upon and made a decision in relation to the topic of the proposal and in this case the 8 month timescale is reduced to 6 month.

All of this means that RA control of the T&SC Modification Process is very limited, although the SEM Committee power to direct changes at the end is extensive, and the regulatory control of timescales is limited and would not be fit for purpose to affect changes to the CMC given the tight timescales involved in running auctions on an annual basis.

Change Process of the GB Capacity Market Rules

This process is designed around the annual qualification and auction process(es). There are also limitation on those who can raise a proposal. These are:

- The Secretary of State;
- The Delivery Body (National Grid);
- A Supply licence holder;
- A capacity provider or someone who wishes to be a capacity provider; and
- A person that Ofgem believes has a sufficient interest in the capacity market.

Although proposals may be submitted at any time, there is a deadline each year for submission if the proposal is to be considered in the current year. That deadline is after the publication of the auction results and normally the annual change will be effected before the start of pre-qualification in the following year. The steps in the process, which is operated by Ofgem, are:

1. After pre-qualification but before the auction Ofgem hold a workshop to discuss the current proposals;
2. A second workshop is held after the auction but before the annual deadline
3. Ofgem publishes a letter setting out their expected priorities for the proposals and seeking views;
4. After the auction and the annual deadline, Ofgem prepare rule changes to come into effect before the next pre-qualification and consult on that;
5. Ofgem reach a decision based upon that consultation and publish the new rules and all comments and proposals not taken forward with explanation of that;
6. New rules come into effect before the next pre-qualification period.

This process has two important elements for consideration. Firstly, it is tightly controlled to timescale. There is only one point in the year when changes are directed, which is shortly before the start of the annual qualification and auction process. Secondly, it appears to be controlled (and resourced) by the regulator throughout.