Capacity Market Gaming and Consistency Assessment

Final Report

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TABLE OF CONTENTS

1. INTRODUCTION

1. Charles River Associates ("CRA") was retained by the Department of Energy and Climate Change ("DECC") to provide a gaming and consistency assessment of its strawman capacity market ("CM") design for the GB market. CRA has worked with the DECC CM design team and staff from Ofgem and National Grid (which will conduct the CM auction) in developing its understanding of the current CM proposals and to highlight issues for further assessment and discussion.

2. DECC and other UK stakeholders have been working on the CM design and related issues for some time, and the CM proposals have been already been substantially developed and presented in some detail.[1] CRA has not focused its efforts on revisiting the design choices made but rather has sought to review the current CM design in its entirety with a view to developing specific recommendations for reducing the likelihood of unwanted gaming or unintended consequences with respect to CM implementation.

3. The overall objectives of this analysis have been to:

   - To provide quality assurance and validation of the internal coherence of the detailed policy proposals for the CM design, by identifying issues which might either open the market to anti-competitive behaviour or more generally work against the objectives of the market.
   - To identify specific gaming risks within the CM design and to assess the likelihood and impact of those risks. In particular, to identify potential behavioural risks in accrediting and testing for reliable capacity and demand response, manipulating the outcome of the auction, and the potential for anti-competitive behaviours subsequent operation of the market
   - To propose practical solutions to mitigate those risks identified - recognising the challenging time constraints involved in delivering the CM for a potential first auction in 2014.

4. Our summary assessment is that the proposed Capacity Market design is internally consistent. It is comparable to designs of other established Capacity Markets, and its design provides substantive mitigation against the principal gaming risks that can arise. However, no capacity procurement process is immune from such risk and inevitably there will be areas where problems could arise – for instance around the auction process for setting the capacity price and around the participation of Demand Side Response.

5. This report summarizes our analysis of the scope for such gaming in the proposed CM design and presents a significant number of specific recommendations, especially with regards to the auction implementation. Reflecting the practical experience with similar CM designs elsewhere, especially in the United States, we also highlight the need for monitoring and review as part of such a major market change.

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1 DECC, CM Strawman Document, Version 13, June 2013.

2. CONSISTENCY WITH POLICY OBJECTIVES

6. DECC has asked CRA to comment on the consistency of its proposed CM design with various stated elements of UK and EU policy. It should be recognized that these comments are offered as a preliminary economic commentary only and do not provide an assessment of the CM design against legal or regulatory requirements.

7. We have not considered, and do not discuss here, the need for a CM in the UK, which is now a settled element of government policy. We therefore do not repeat the extensive arguments that have been made for and against CM designs versus energy-only market designs, all of which are available elsewhere. Our focus is simply to comment on the CM proposals as they currently stand.

2.1. The CM and Market Concentration

8. As part of its consultation on capacity markets, the European Commission sets outs some potential detailed criteria as to assess how the market need affect competition issues:[2]

- The mechanism should not create market power or support exclusionary practices;
- The mechanism should not strengthen or maintain the market power of incumbent firms.
- The mechanism should not act to maintain inefficient market structures or undertakings, acting to deter new entry

9. The proposed CM design is neutral in respect of how competition among participants in the electricity market should develop. There are no restrictions on the amount of capacity a single firm may bring to the auction and there is no restriction on the amount of capacity that a single firm can win. Ultimately, a well-designed CM delivers additional capacity and prevents tight market conditions and therefore promote competition in the wholesale energy market. The proposed Capacity Market is also intended to encourage independent investment by offering investors a stable capacity payment. There is no guarantee, however, that the proposed CM design will deliver a less concentrated generation ownership pattern than exists at present.

10. A brief review of the National Grid TEC register shows a relatively diverse mix of potential new entrant plant (which has either been consented or is in scoping phase) and which would have the potential to participate in the first auction.[3] The table below summarises new capacity with an indicated completion date beyond 2014.

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2 European Commission, Consultation Paper on "Generation Adequacy, Capacity Mechanisms and the Internal Market in Electricity", November 2012.

3 We reviewed the TEC register as of 26th June, which is available from the National Grid website.

Table 1: New Capacity Planned in UK Electricity Market which could take part in Capacity Auction

Owning Interest	New Connection Capacity (TEC) 2014-2019[4]	%
Big Six (EDF, E.On, RWE, Scottish and Southern, Scottish Power, Centrica)	9,061 MW	52%
Others	8,391 MW	48%
Total	17,542 MW	

Source: National Grid

11. It is not possible here to determine the potential effect of the CM on new capacity completion, but this brief analysis suggests that the composition of such new capacity in the early auctions could potentially be more diverse than the current generation mix (in which the Big Six own approximately 71% of total capacity).[5] The impact on market concentration of implementing the CM auction thus may depend on the relative competitiveness of large versus small portfolio plant in the auction.[6]

2.2. Facilitating New Entry

12. The most obvious mitigation to market power in both the general energy market and also in the CM is to encourage broad participation of smaller companies. The CM could bring some substantial potential benefits to smaller companies. For example, the proposed CM offers new entrants the possibility of long-term contracts four years in advance, which should improve the chance of obtaining financing.

13. Our concerns on the proposed CM design with respect to new entry arise from outage risks and potential CM penalties. While DECC has not yet set the level of penalties or liability cap for providers that fail to perform, the CM design provides for high penalties for non-performance (based on actual metered supply relative to obligation) when a Capacity Market Warning ("CMW") is declared.

14. The proposed penalties for under-delivery and rewards for over-delivery serve an important purpose in the Capacity Market design, for instance in mitigating gaming risks around adverse selection (whereby unreliable providers receive unduly generous payments). However while penalties strengthen availability incentives, they also create very high unavailability risks, as there is no allowance for forced outages or planned

4 Note the figures here are connection capacity which will deviate from actual generating capacity.

5 Sheffield Energy Resources Information Services,, "Who owns the UK Electricity Generating Industry – and does it matter?", July 2012. Report draws from National Grid Seven Year Statement, 2011

6 Some CM designs have market concentration measures built in (especially for smaller, zonal markets) which impose bid controls in concentrated sub-regional markets which are not expected to be competitive. These however to our knowledge do not limit new entry by incumbents, and merely impose tighter controls on bids from large incumbents to control incumbent market power.

maintenance within the design. This risk is much higher for firms with few assets due to the more limited capacity for self-insurance.

15. This problem is in the first instance mitigated by various features of the CM design which reduce the potential at any point of under-delivery and so offset potential losses:

- Secondary trading (should an outage by foreseen and planned)
- Scaling of obligations at times of system stress to account for system demand at that time ('load following') which would reduce the scale of under-delivery for a single CMU
- Obligations are adjusted for performance in National Grid's Balancing Services.
- Delivery obligations are not binding unless preceded by a Capacity Market Warning and allow for a four hour warning period.
- No delivery obligations if the stress event is the result of a failure in the transmission system.
- Over-delivery payments exist for delivering more than the obligation level thus allowing for the potential of losses in one period at other times or later within the stress event.
- There is an annual cap on penalties applicable, which will bind faster for small portfolios than larger ones.

16. DECC envisages the development of a financial insurance market to cover the residual risk. The need for this insurance, however, will be asymmetric for a portfolio generator and a small firm with a single generating unit or a small number of assets.

- Portfolio generators will likely only require the insurance for periods when its obligation is close to maximum, and spare capacity is low and unable to cover for single capacity market unit ("CMU") outages. At this point the entire market is short and there is no natural counterparty for the risk, which can then only be pooled.
- For small generators the need for insurance is broader and more consistent as the ability to cover the loss of a CMU during a capacity market event will always be more constrained from within their own limited portfolios.
- The proposed CM design includes a cap on penalties. This has not yet been set by DECC but is potentially a large amount on an annual basis (though designed to be smaller for independents).

17. The availability and cost of insurance or the availability of outage hedging transactions will be an important consideration for generators as they develop their CM bids.

18. We understand that initial investigations by DECC have shown a potential willingness to provide this insurance service. The likely market sellers for such insurance would most probably include portfolio generators. Indeed, as the soft cap is less likely to bind for larger portfolios this may encourage such participants to engage in the hedging market. It would be difficult, however, to require them to provide the insurance.

19. Any inability of small firms to access outage insurance in the CM could imply that smaller bidders would have to increase the price of their bids in the auction to cover the risk or choose not to participate.

20. We considered whether small generators could be allowed to form synthetic portfolios after the auction to allow for the pooling of risk. This option would be difficult to design

without introducing competition concerns. Parties would need to find mechanisms to allocate risk, but to affect valuation these would need to be negotiated before the auction. This could require communication between bidders about bidding strategy before (and potentially during) the auction which is problematic.

21. We recommend, therefore, that DECC consult on the likelihood of such a penalty insurance market arising, the willingness of different companies to provide the insurance and the form in which it would be offered. We would also recommend that after CM implementation, the premiums and liquidity observed in this market should be reviewed to analyse its efficient operation and whether it is meeting the objectives set out for it.

2.3. Avoiding distortions to competition

22. There is no technological preference incorporated into the CM beyond the ability to be available with four hours on a CMW. Hence among qualifying assets, the CM design is technologically neutral and should not distort market competition. All CMUs will be paid the same CM price.

23. Firms can offer different kinds of resources into the CM auctions (subject to constraints external to the market such as planning regulations), and the bids should reflect not only the cost of construction and financing, but also the expected net revenues from the sale of energy and ancillary services. While the demand curve will be set against a reference cost of a single open-cycle gas turbine technology (see the discussion in Section 4.2 below), entry by other technologies is possible if these are economic. For example, a combined cycle ("CCGT") unit would have higher capital costs but lower variable costs, and hence higher energy margins. If these higher margins offset the higher capital costs then CCGT new entry is more efficient and will occur in preference to the reference OCGT technology.

24. In calculating energy margins, plant developers would naturally consider the expected cost of any plant emissions, so a low- or no-emissions project would have a cost advantage over its more-polluting counterpart, if emissions are correctly priced.

25. As with any market-based resource adequacy approach, the optimality of the outcome from a social policy perspective depends on the existence of accurate prices for the various benefits and costs produced by capacity resources. As in the current GB market structure, the ability of the CM to encourage (socially) efficient new entry depends on emission prices reflecting the external costs of carbon dioxide and other emissions.

2.4. Seams issues with the CFD/RO schemes

26. New low carbon projects will be supported through contracts for differences ("CFDs"), as well as generation units under the Renewables Obligation ("RO"), and are not eligible to participate in the CM auction. These resources do count towards capacity margin. Hence calculation of target demand for the auction depends indirectly on the CFD and RO mechanisms.

27. If there is a significant mismatch between the CFD allocation timeline and the capacity market timeline, then there may be opportunities to arbitrage the two systems, as an underestimate of CFD capacity by the System Operator ("SO") would increase demand in the CM. Significant timeline discrepancies might allow for misleading statements about intentions for new capacity (especially four years out). We expect the likelihood of manipulative behaviour in this respect to be very small. The CFD mechanism will incorporate a system of incentives for timely delivery through a "Target Commissioning

Window" and a "Long Stop Date" that make such statements difficult to execute without risk of lost revenue.[7]

7 See , "Electricity Market– Contract for Difference: for Difference: Contract and Allocation Overview", DECC August 2013, paragraphs 3.2 to 3.24

3. ECONOMIC FRAMEWORK FOR CM ASSESSMENT

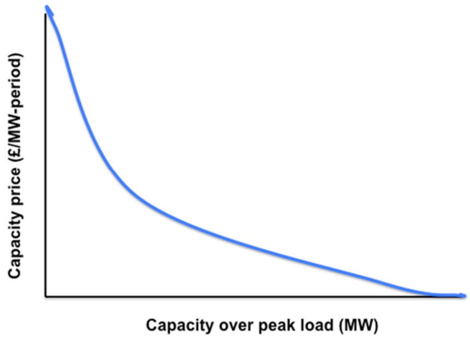
28. In this section we develop briefly an economic framework for the design and analysis of CM issues in power markets. These concepts will be useful later in this report in analysing specific aspects of the proposed CM design

3.1. Capacity and peak pricing

29. Capacity markets seek to deal with particular challenges in electricity market design. Capacity markets in most systems replace – fully or partially – the scarcity pricing inherent as the "quality of supply" term in the idealized spot pricing framework.[8] This scarcity pricing – a key component of ensuring that market prices can deliver sufficient investment against uncertain demand – is a translation of the standard theory of peak-load pricing from regulatory economics translated to a market-based framework.

30. Capacity pricing is inherently difficult in power systems as the value (and hence the price) of capacity varies non-linearly with the net capacity balance. Even assuming a constant value of lost load ("VoLL") or un-served energy, in a conventional stochastic planning framework for a power system the loss of load expectation ("LOLE") increases very quickly as surplus capacity after expected or realized demand is reached. This is illustrated in Figure 1 below.

Figure 1: Stylized capacity pricing curve



31. When capacity is tight – towards the left in Figure 1 – capacity prices should rise sharply, reflecting the true expectation of lost load and associated costs.

32. The problem for the market designer is a fundamental one of incentives. The blue line in Figure 1 reflects the marginal value or benefit of capacity near the capacity constraint and hence is the demand curve for capacity. A sharply declining demand curve is however very prone to the exercise of market power through economic or physical withholding which we discuss in the following paragraphs.

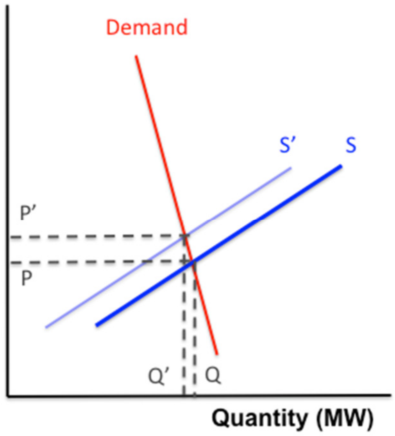
3.2. Withholding in Capacity Markets

33. Where the demand curve is (locally) steep, a supplier has a strong incentive to withhold capacity. In Figure 2, for example, even the small change in quantity supplied from Q to Q' moves the price upward from P to P'. For a single supplier, the effectiveness of this game – which may be evaluated in game-theoretic terms – is whether the opportunity cost of selling less quantity is more than offset by the raise in price from P to P' on the remaining capacity sold (we discuss this further below). In a CM design, such withholding

8 Schweppe, F, M. Caramanis, R. Tabors and R. Bohn, *Spot Pricing of Electricity*, Springer-Verlag, 1988.

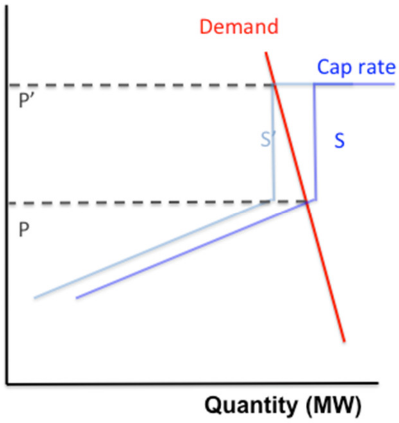
may be effectuated through economic withholding (offering some supply into the auction at a price well above cost so some quantity does not clear), physically withholding (not making capacity available at all) or market selection (shifting capacity from one market to another in order to raise the price in the first).

Figure 2: Withholding capacity against a demand curve



34. Similar problems arise near dislocations in the supply curve for capacity. Early US capacity mechanisms (New England, PJM, etc.) used a vertical demand curve combined with bidding of capacity up to the maximum level of each bidder. This led to the problem illustrated in Figure 3. When demand for capacity was close to the maximum available capacity, even a small change (from supplier withholding or uncertainty in demand) could create a sharp rise in price, up to the level of a pre-determined cap or penalty rate.

Figure 3: Supply withholding near a supply curve non-linearity



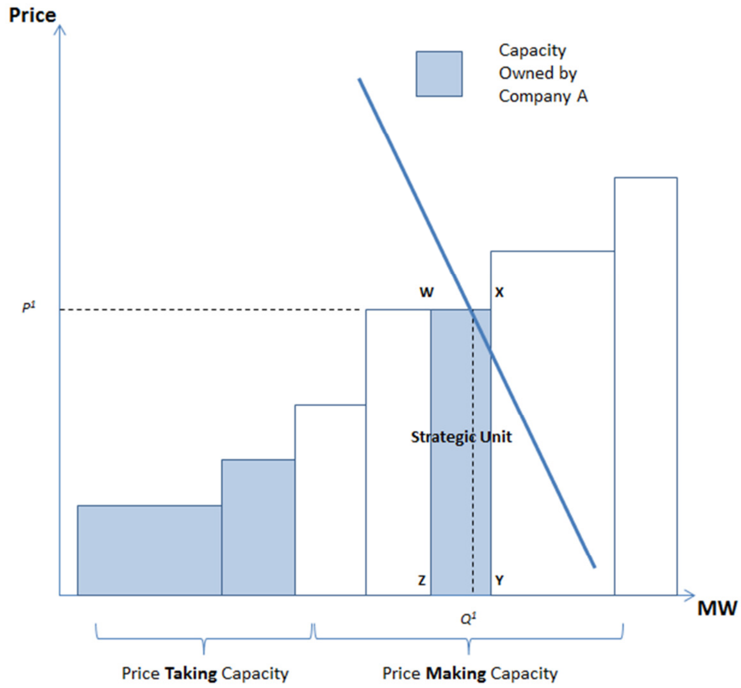
35. The resulting capacity prices were highly volatile, and provided little useful investment signal.

3.3. Generator portfolios and withholding incentives

36. Market participants with a portfolio of plants in the capacity or energy market may be able to benefit from withholding on a small part of their portfolio which can affect the price for their whole portfolio (such as would be the case in a uniform price auction). If this leverage effect is sufficiently large it may offset lost opportunity for revenue on the strategically bid assets.

37. In the example below, Company A is has three assets, one of which is a price-making unit, called here the "strategic unit".

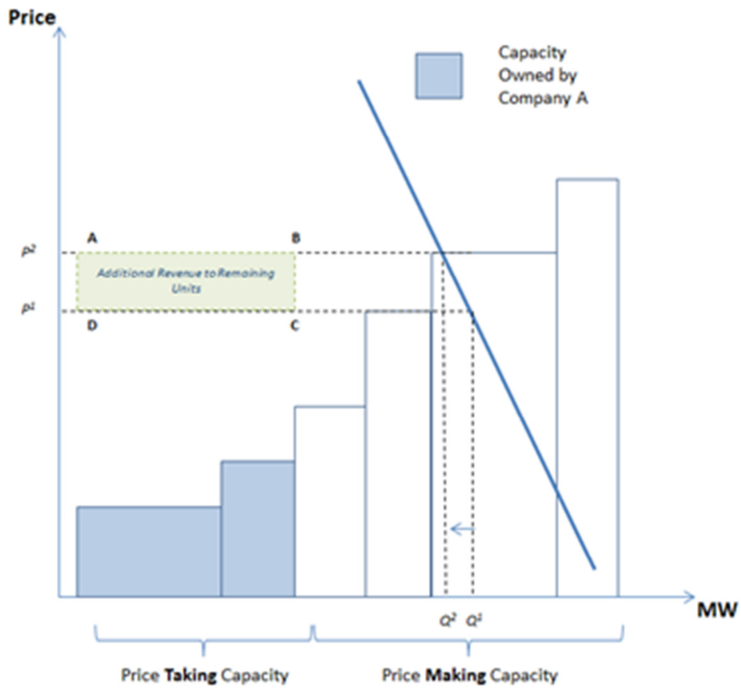
Figure 4: Strategic Bidding Example part 1



38. Now suppose that Company A withholds the strategic unit from the market; in the new equilibrium demand decreases from Q_1 to Q_2 but price increases from P_1 to P_2 as shown in Figure 5 below.

39. The profitability of the strategy to Company A depends on the relationship between lost revenue on the unit withheld and the additional revenue gained on remaining plants in the auction, as well as regulatory risks.

Figure 5: Strategic Bidding Example Part 2



40. By withholding in the market, Company A has lost the opportunity to earn the revenue implied by area WXYZ in Figure 4 but it has earned additional revenue shown in Figure 5 as shaded area ABCD.

41. This example leads us to a few general conclusions about risk of withholding:

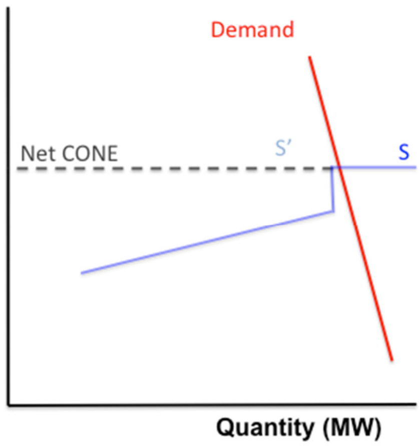
- The more atomistic the market is; the lower the risk of withholding as market players will have little or no leverage to benefit from;
- The flatter the aggregate supply curve in the price setting region, the lower the impact of withholding of incremental capacity and hence the benefit to withholding.
- The greater the uncertainty around the supply and demand in the market, the greater the risk for parties seeking to drive up prices by withholding

3.4. Contestability through facilitating new entry

42. The fundamental problem with the market design illustrated in Figure 3 is that no new supply could enter. For a seasonal or annual capacity product, no new supply was possible even if prices were high; the time scales were too short to allow new generation supply to enter the market and hence make it contestable.

43. The major advance in capacity market design came when the time horizon for procuring the product was shifted out several years to allow new entrants to enter the market and set the price in the auction. This is illustrated in Figure 6. Under this structure, existing capacity remains fixed, but there is a segment of (very elastic) of new entry supply represented by the horizontal segment of supply curve *S*. This new supply effectively caps the capacity price at the net cost of new entry ("Net CONE"), assuming cost-effective entry is possible.

Figure 6: Contestable capacity market



44. This contestable market structure is the basis for the current PJM and ISO New England market designs and underlies the current CM design. The choice to run the GB CM four years-ahead of first delivery and to provide entry of DSR is an implementation of this approach and serves generally to mitigate the impact of withholding by increasing the possibility for new entry to the market.

45. A review of the current TEC register, as discussed in Section 2.2, shows a predominance of CCGTs. While some capacity may not yet be declared and it is possible that this may change through time, the price-making portion of the supply curve could be relatively flat. DECC believe that after the first few years of the auction there will be a consistent need

for new capacity and hence price will be set by new competition among new entrants, i.e., in the most elastic portion of the supply curve. This would help mitigate against the probability of withholding in general and specifically within the auction, as parties expect the capacity price to equal the cost of new entry even without withholding.

4. SPECIFIC CM DESIGN ELEMENTS

46. In this section, we analyse some specific elements of the proposed DECC CM design, based on the economic framework established in Section 3.

4.1. Use of Demand Curves

47. As discussed in Section 3, the incentive for withholding is strong when the apparent demand is extremely inelastic, such as in the vertical demand curve used in some of the early US designs (which quickly proved unworkable). The proposed DECC CM incorporates a sloped demand curve for capacity. A sloped demand curve reduces some incentives for withholding, and is a key element of the proposed CM design. In this section we analyse the proposed elements of the demand curve.

48. We understand that the basic components of the demand curve proposed by DECC as it relates to the Auction are:

- The Government picks a target of how much capacity to contract which will be based on underlying calculations about the reliability standards for the UK electricity market.
- This target level is bought if the price is equal to Net CONE - an administrative estimate of the reasonable net cost of new entry. There will be a target range of ± 1.5 GW for the four year-ahead auction (which may differ for the one-year ahead auction). [9]
- The slope of the demand curve will be negative, i.e., more will be contracted at a lower price, less will be contracted at a higher price.

49. Economic theory strongly suggests that the demand curve for capacity should be downward sloping (as for the CM), and that this slope should become flatter as capacity increases relative to the target capacity level.

50. Demand should be downward sloping for two reasons:

- Adding extra capacity beyond the administratively determined target increases the reliability of the system and decreases the expected energy price, both of which have non-zero value to consumers.
- Conversely, falling one megawatt short of the target should not imply that consumers are willing to pay a very high price to cover that shortfall; that small shortage only increases the reliability risk by some small fraction.

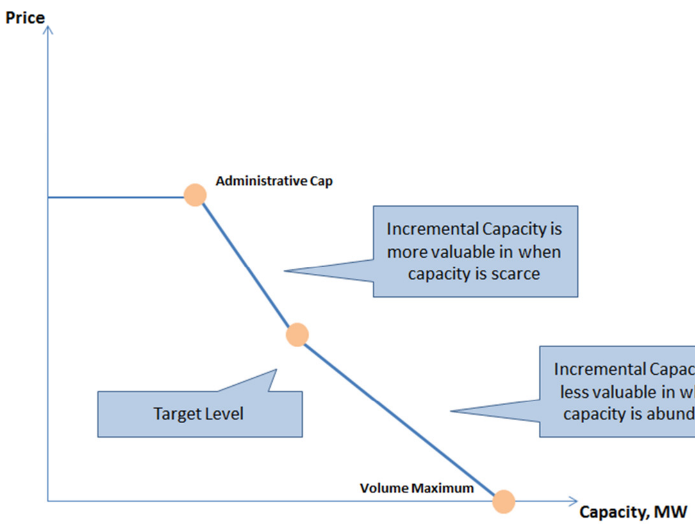
51. Thus, an alternative of using a vertical demand "curve" would not reflect the economic fundamentals of acquiring planning reserves.

52. Economics also indicates that the slope should decrease (become flatter) along the curve. With such a curve, at capacity levels below target capacity, the capacity price rises quickly to ensure that the market does not go too far short even if new capacity costs more than had been estimated—running short of capacity has serious economic consequences. Above the target capacity, the price tapers off more gradually, consistent with the idea that extra capacity has decreasing incremental value. There is also a

9 Capacity Market Strawman v11, page 9 available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209354/Capacity_Market_strawman_v11.pdf

maximum price to ensure that consumers are not unexpectedly exposed to prices outside of the range of reasonableness. This is shown in the Figure below:

Figure 7: Illustrative Demand Curve Proposed



53. The shape of the demand curve should also reflect other key elements of the market design; in particular, the forward planning period. If the goal of having slope to the demand curve is to mitigate strategic withholding the one also needs to consider the curvature of the supply curve. For example,

- With a short forward planning horizon for the CM, the supply curve is likely to be relatively more inelastic, and so the demand curve needs to have more slope to damp volatility and control for strategic withholding;
- By contrast, a multi-year forward planning horizon creates some extra slope in the supply curve by allowing timely entry and exit of resources; thus the demand curve can be relatively steeper than needed with a short forward commitment period.

54. By implication, it might be necessary to consider different slopes to the demand curve depending upon the expectations of supply curve elasticity in an auction. In particular, there may need for a different slope to the demand curve in the four-year-ahead auction relative to the one-year-ahead auction and may vary between iterations in the auction. We understand this to be part of the design for the capacity market.

4.2. Cost of New Entry

55. The key parameter of the CM demand curve is the Cost of New Entry ("CONE"), which is typically determined administratively. This determination must try to replicate the financial calculations of a generation developer and, therefore, assesses three elements: construction costs, financing costs, and expected future net cash flow including earnings in other markets (such as the energy market). The last element acts as an offset to the needed CM element of the CONE and reflects the difference between gross CONE and Net CONE (the cost of new entry after accounting or expected energy and other revenues minus fuel and other variable costs).

56. Of these, construction costs are arguably the least controversial to measure, and the three U.S. power markets examined all undertook this step by retaining an expert consultant to estimate engineering costs, benchmarking the results to recent observable installation costs. Financing costs are mechanically straightforward to compute, but doing

so requires agreement on cost of equity, debt financing structure and interest rates, residual value, and the method of levelization. Expected future net cash flows (from energy sales) are a highly contentious element of the estimate as they must be netted out of the final calculation.

57. Peaking units are frequently used as the benchmark to reduce the importance of this element in the estimate as this minimises the important of energy market revenues. This is the case for the GB CM. The cost of new entry of a marginal plant will be based on an open-cycle gas turbine ("OCGT") unit.[10] The Net CONE calculation embeds an assumption about how much energy market rent is attained by this kind of plant. The current proposal reduces Gross CONE of £47/kW-year by £18/kW-year (assuming cash-out reform and a reliability standard of 3 hours of load shedding at which the cash out price will be £6,000/MWh).

58. We have reviewed the calculation of CONE made by DECC and observe that the underlying CAPEX and OPEX cost parameters have been sourced from an engineering consultancy, Parsons Brinckerhoff.[11] These parameters are subsequently translated by DECC using annuity calculations into a £/kW-year gross capacity price. This translation embeds a number of financing and operating assumptions. All of these are subject to substantial risk (witness the change in OCGT costs based on change in the type of technology referenced between 2012 and 2013 reports).[12] We would expect that they would be naturally challenged as part of the consultation process, as is anticipated by DECC.

59. We recommend that this Net CONE calculation be an explicit part of the consultation. Given its importance to the market some form of explicit process may be needed to address industry concerns while balancing customer interests.

60. The choice of netting out three hours from the calculation is also a relatively strong assumption but is logical in the context of how gross CONE was calculated and DECC note the inherent uncertainty involved in making this assumption. The alternatives may be equally unpalatable.

61. In PJM, Net CONE is calculated using historical averages of the previous three years of energy and ancillary service revenue as an offset.[13] Using historical data for the energy and ancillary services ("E&AS") offset is also subject to error but is not necessarily biased. It can be very inaccurate if in the intervening period there is a substantial change in the underlying fuel costs. Interveners in the PJM RPM proceedings sought an offset based on the single most-recent year of data, a concept that the regulator rejected, noting that

10 Economic theory suggests that over time the various economic new entrant technologies will have similar Net CONE values, as the extra margin from lower variable cost, higher capital cost technologies will balance out the initial higher investment cost. Using the Net CONE value for a peaker is therefore a reasonable proxy for the Net CONE of any efficient technology (and more reliably estimated, since the most difficult portion to estimate—the future energy market earnings—is small relative to the capital costs.

11 Electricity Generation Cost Model - 2013 Update Of Nonrenewable Technologies, Parsons Brinckerhoff, April 2013

12 Electricity Generation Cost Model - 2012 Update of Non Renewable Technologies, Parsons Brinckerhoff, April 2012

13 An OCGT plant is also used as the reference technology in PJM.

"that the better predictor of prices in any one delivery year, three years forward, is likely to be a multiyear average price rather than the average price in any single year".[14]

62. In New England, high heat rate peaking units (also put forward by DECC as its reference technology) retain very little rent in the energy market as such revenues are recovered by the RTO under its Peak Energy Rent Rule.[15] Thus, in ISO-NE, CONE and Net CONE are the same and no offset calculation is needed. Since the GB market has no equivalent rent rule such a structure cannot be directly applied here.

63. We recommend, therefore, that DECC benchmark its proposed £18/kW-year E&AS deduction against historical performance of the reference technology.

64. Ultimately, the demand curve must include a substantial range around Net CONE; it will be impossible to eliminate uncertainty about the level of Net CONE and the likely variation among different parties in the market. The range chosen by DECC is similar to those in PJM and ISO-NE, but we would caution against referencing absolute ranges as the underlying CONE figures are quite different for those markets relative to the currently estimated value for the GB CM.

65. Under the current design, a 50% margin on top of Net CONE of the marginal plant is used to compensate for the risk that Net CONE might be set too low. It is important to remember, however, that £15/kW-year can be swamped by relatively small changes in energy market revenues, as illustrated in the following illustrative example.

66. For example, using Parsons Brinckerhoff's paper to DECC in 2012 as a reference,[16] if an OCGT operates at an average load factor of 7.5% or 658 hours, then £15/kW-year equates to approximately £23/MWh difference in prices on average in those hours. The table below shows the average system buy price for 2011 and 2012 for the top 7.5% of hours by price.

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14 PJM Interconnection, L.L.C., 117 FERC ¶ 61,331, at 118-119 (2006)

15 According to ISO-NE, "Peak Energy Rent is calculated at an hourly and monthly level for each Capacity Zone as determined by the Forward Capacity Auction. The Locational Marginal Price (LMP) is the Hub price for the Rest-of-Pool Capacity Zone and for all other Capacity Zones the LMP is the LMP of the Load Zone associated with the Capacity Zone(s). Hourly PER is calculated as the maximum of the difference between the LMP and a strike price or zero. The strike price is based on fuel cost (ultra low-sulfur No. 2 oil measured at New York Harbor or day-ahead gas measured at the Algonquin City Gate) and the heat rate of a proxy unit.", http://www.iso-ne.com/mkts_billing/mkt_descriptions/line_items/peak_energy_rent.html

16 Electricity Generation Cost Model – 2012, Update of Non Renewable Technologies, Parsons Brinckerhoff, August 2012

Table 2: Top 7.5% System Buy Prices, 2011 and 2012

Year	Average	Range	Standard Deviation
2011	£95.72/MWh	£77.88-179.72/MWh	£17.51/MWh
2012	£103.84/MWh	£80.44-264.12/MWh	£24.93/MWh

Source: Elexon BM Reports – System Buy Price for top 7.5% of hours ranked

67. Continuing this illustrative example, based on the reference OCGT in the Parsons Brinckerhoff paper[17], and an average of approximately 60 pence/therm for 2012 NBP gas prices, we estimate a strike price of about £75/MWh (fuel plus variable operating cost) [18]. This provides an approximate average rent of £29/MWh (or approximately £19/kW-yr) in those 7.5% of hours with a standard deviation of approximately £25/MWh (or approximately £16/kW-year).

68. Firstly, this shows that actual energy revenue and rent is variable and to set a fixed £18/kW deduction is somewhat arbitrary, albeit reasonably so. Secondly it shows the importance, therefore in setting a large range for acceptable prices. If Net CONE is £29-kWh then a one standard deviation difference in opinion about energy market rent would imply a range of 1.5 times the current Net CONE estimate. Normal variation in energy market prices can quickly overwhelm the price range in the CM implementation if that range is set too narrowly.

69. We recommend, therefore, that a reflection of volatility in energy market rent be considered at the time of setting the allowable range in the CM.

4.3. Duration of obligation

70. The proposed CM design allows potential capacity suppliers to receive capacity contracts of various durations. Existing CMUs will be offered a capacity contract of 1 year. Refurbished units will be allowed contracts between 1 and 3 years. New capacity will be allowed (as currently proposed) to select contracts up to 10 years in duration.

71. The CM Auction enforces indifference, from the buyer's perspective, between CM contracts as the CM auction will clear a single price irrespective of the balance between contract tenors delivered as a result of what capacity wins in the auction.

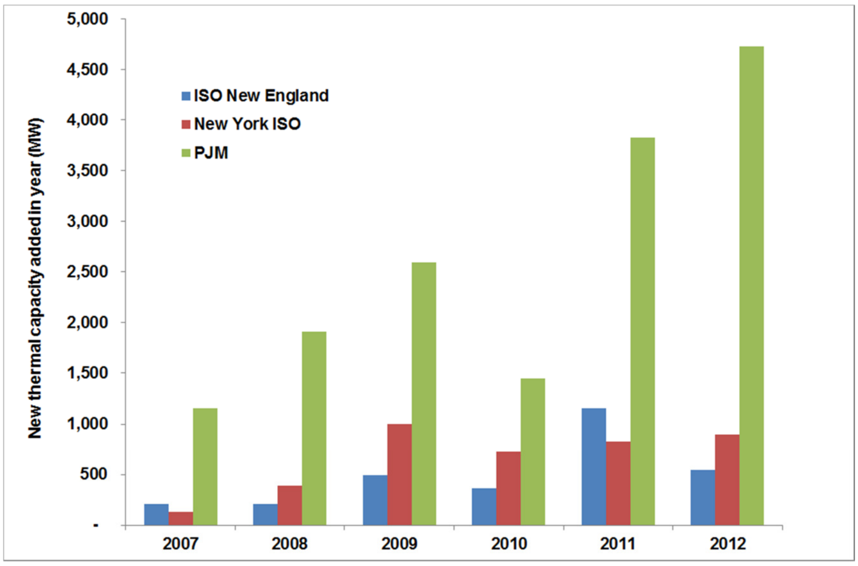
72. Market participants would not be indifferent between the contracts. We could imagine, for example, that new entrant capacity may prefer to sell with certainty a longer duration contract for capacity, whilst an existing plant may be happier with a shorter duration if it expects capacity prices to be rising over time. Although outside of this remit of this report we make some remarks about alternative designs which allow for bidding on tenor as a parameter in Section 11.

17 An OCGT with LHV efficiency of 39% LHV (~35% HHV), VOM of £26,774/MW-year, operating for 658 hours (per assumption of 7.5% load factor)

18 BP Statistical Review of World Energy 2013, Data Tables, $9.46/mmbtu for NBP in 2012 converted at 0.631 GBP to US Dollar (Source: Oanda.com)

73. The experience from the US is that the use of shorter term contracts (up to five years in some cases) has not prevented generally substantial new (thermal) plant construction, as shown in the table below.[19]

Figure 8: New Entrant Capacity in US Capacity Auctions



74. Of course, for any CM the credibility of the design and its implementation is critical. While there have been significant changes in some of the US CMs in general, investors appear confident that CM revenues will continue. In the GB context, however, the CM is viewed from a policy perspective as filling a transitional role, with stronger investment incentives over time coming through the energy market due to cash out reform and greater DSR. It will remain to seen whether investors will be as confident with shorter tenors as they are in the US.

4.4. Locational issues

75. The current design includes no locational component to the CM price, and a single GB-wide capacity product. This is a policy-level decision and the need for locational CM incentives has not been analysed by CRA.

76. The lack of locational pricing could theoretically raise incentive and gaming issues if there were locations where new capacity could be added cheaply yet where the additional capacity would have minimal or lesser reliability value than elsewhere on the grid. This issue has not been analysed further. We have also not analysed the potential for constrained-on or constrained-off plant to bid in the CM.

77. The use of a zonal CM auction – as is used in US CMs – would definitely increase the complexity of the CM design and implementation. The auction design itself would be substantially more complex. Implementing a zonal CM design implies the determination of how much capacity within each zone can be delivered from other zones, and how much can be exported from each zone to contiguous zones. These deliverability and transfer calculations are extremely complex.

19 Both PJM and ISO-NE forward capacity market designs allow certain suppliers of new capacity to "lock in" capacity prices for three to five years. In ISO-NE the supplier maintains the choice of tenor up to five years. In PJM only suppliers of certain new capacity in transmission constrained zones can lock in prices for up to three years. Otherwise generators are limited to one year tenors.

78. A zonal CM auction would also present greater challenges in terms of anti-competitive issues, as supply within a constrained zone or nested zone may potentially be more limited and hence present greater opportunity for strategic bidding amongst bidders critical to zonal constraints. The PJM RPM design, for example includes complex rules addressing bidding where there is a supplier within a zone with potential market power which include assessments of market concentration.

5. AUCTION WITHHOLDING STRATEGIES

79. Section 3 introduced a basic framework for withholding analysis of market power. As the proposed GB CM is a voluntary market with multiple auctions, there is scope for gaming behaviour through auction participation. In this section we analyse this scope from:

- Withholding capacity by opting some capacity out of the CM
- Plant retirements
- Pure withholding in the auction
- Withholding capacity in the initial auction to offer it in a later auction for the same delivery year.

5.1. Withholding Capacity by Opting Out of the CM

80. As part of the CM design a target quantity of capacity to be acquired in the CM must be determined. This in turn helps determine the demand curve used in the CM auction.

81. It is clear that the contribution of CFD/RO generation will be factored into the calculation (i.e. netted out of the demand calculations for the CM). It is not yet, to our understanding, fully determined how capacity which is available to the energy and balancing market but voluntarily not part of the CM will be factored into the calculation of demand.

82. There are two specific circumstances we have considered:

- Plant which intend to remain on-line but decide to opt out of the CM
- Plant which opt out of the CM as they are scheduled to retire before the CM delivery period

5.1.1. Plant Opting out of the CM but remaining online

83. A company with a number of existing plants applicable to the CM could benefit from withholding if it believes that it can increase prices in the auction (by increasing demand in the auction) and affect a larger revenue gain from its remaining assets in the CM than lost CM payments to the plant withheld.

84. This strategy is dependent upon the de-rating process for plant outside of the CM being different from that for those within the CM. We understand, from DECC and National Grid, that currently it is proposed that such plant be treated identically. The risk of this behaviour would thus be mitigated. We would recommend that this proposal be implemented and the CM participation rules be revisited if CM and non-CM capacity is treated differently in the final implementation.[20]

5.1.2. Plant Retirements

85. A large portfolio generator could – in theory – increase CM prices and its new revenues by retiring plants in order to raise capacity prices received for other portfolio plants. In the US markets, there have been specific regulatory concerns about plant retirements and

20 Theoretically, given the reward and penalty system in the CM it would seem unlikely that CM plant would, ceteris paribus, be less available than plant outside of the CM. The difficulty, however, in assigning a different rule for different plant is significant and as it would need to be done four years in advance could be quite arbitrary by nature. In view of the advantages to keeping the de-rating identical from a gaming perspective, we would recommend keeping the de-rating process the same for the CM demand calculation.

capacity prices but these concerns are greatly strengthened in zonal CM designs where the zonal price could be highly influenced by shutting of even one unit in some areas. There are two variations of behaviour worth considering:

- Premature retirements of plant;
- False retirement statements; and
- Plant opting out but stating intention to remain online but then retiring

Premature Retirements

86. A portfolio generator could prematurely retire existing units in order to raise CM prices (for other plants or new capacity being built by the same portfolio generator) in theory, but given the GB-wide nature of the CM price and the use of the demand curve this strategy does not appear to be credible. To the extent possible we recommend that DECC and Ofgem do not seek to manage generator retirement decisions and plant retirement decisions can be left to the market to the maximum extent possible. As the supply curve for new entry generation in the CM is likely to be quite flat it is also unlikely that a generator would see premature (e.g., otherwise uneconomic) retirements as a profitable strategy.

False Retirement Statements

87. A portfolio generator with a large number of units could also seek to influence the level of CM demand (and hence CM prices) by falsely stating that a number of its units will be retired or mothballed. This would then increase the amount of effective CM demand to be procured in the auction. If the plants were not actually retired these could be offered into later (incremental) auctions. Energy market revenue is not lost if subsequently the retirement decision is reversed after the auction.

88. The current design protects against the risk that false retirement statements are made to reduce supply (and hence increase prices) in the Auction. Such "retired" plants are not eligible for participation in the year-ahead auction for the same delivery year or auctions for the two subsequent years which could amount to a significant loss of revenue on the plant.

89. In addition, ordinary practice around retirements makes retirement choices relatively public and subject to scrutiny. Notifications are made of future plant availability up to five years ahead under the Grid Code (OC2 data). Whilst grid capacity retirement rules under the CUSC are such that a generator can seek to reduce its TEC at five days' notice, CUSC modification CMP192 implies that if very little notice is given by a generator there will be a liability to charges relating to "wider" and "attributable" transmission system works.[21]

90. We understand that plant retirements announced but not completed will be subject to regulatory investigation at the discretion of Ofgem (subject to its normal criteria of being proportionate and necessary to protect consumers). The four year time lapse, however, between the first auction and the delivery period is, in our view long enough that suppliers

21 The wider transmission works include general system reinforcement investments and attributable works are those that specifically took place to allow connection of your generator. The "wider" charges are higher the further north in the transmission system you go e.g. c£17,000/MW in the North of Scotland. To avoid these charges altogether a generator must give more than two years notice of TEC reduction. For physical disconnection from the transmission system six months' notice must be given to National Grid.

could find it relatively easy to justify change as a result of change in the market / economic / regulatory environment. If this was a single incidence from a company, this would make it may make it difficult to isolate anti-competitive behaviour sufficiently to be able to punish it.

91. We assume that if an investigation finds no evidence of abuse of market power that the CMU would be able to benefit from subsequent auctions. If the risk of being “found out” is low then this may become a reasonable strategy. This would, in our view, be easiest for units in which the mothball / retirement decision is marginal (i.e., the scale of change required in the market is sufficiently small – or likely – that a change of strategy would be more easily justified). This kind of plant, however, stands most to potentially benefit from capacity payments and hence the opportunity cost for the strategy is relatively high.

92. Consequently, we think incentives for this behaviour should be limited and given the relatively observable nature of the strategy this is of secondary concern.

Plant Opting out of the CM and then retiring

93. It is possible that the current incentive scheme encourages plants which are uncertain about their future operation to opt out rather than opt out and state retirement, even if they know that it is likely they will retire. This raises the risk that the CM will under-procure capacity if in reality these plants do retire. In our view, the risk of under-procurement is mitigated by the use of year-ahead auctions.

94. It is possible that bidders may communicate this that they will struggle to remain online even with the CM in order to encourage a tougher de-rating of opt-out capacity than CM capacity as a strategy to raise prices in the auction. This reinforces the need to de-rate CM and non-CM plant equally.

5.2. Pure economic withholding in the auction

95. As the clock auction progresses, the margin of supply and demand will be understood by all parties to be decreasing. There may come a point where a single company becomes pivotal to the auction. If it were to withdraw capacity it might close the auction early at a higher price than would have been expected had the capacity been bid at its true cost-based price level.

96. The incentives for this behaviour are the same as described above and are increased with the existence of portfolios of generators creating a leveraged effect. As this auction will be repeated, there is a risk that over the course of several auctions with similar participants and similar supply and demand conditions that participants will learn bidding behaviours that increase the probability of affecting prices in the auction

97. For example, if supply behaves in a consistent fashion as the auction reaches a close, then larger bidders may be able to exploit this information to understand the probability that the auction is likely to close shortly, and develop strategies for prematurely closing the auction by withdrawing capacity.

5.2.1. Mitigation from the Price Taker Threshold

98. In general, the impact of withholding is mitigated by the use of a demand curve (as described in Section 4.1). Within the auction, further mitigation is provided by the price-taking rule, in which existing CMUs must stay in the auction until a pre-determined level is set for each CMU and thus prevents

99. According to the Detailed Design Proposals, "Any existing plants wishing to set the price would have to provide sufficient information to justify that their bid reflects the price at which the unit needs a capacity agreement to remain operational (for example a board certificate and business plan presented to the provider's board) – which may be open to investigation / enforcement. The information will be submitted directly to Ofgem, and must be provided prior to the auction."[22]

100. To be effective this should be a robust evidence-based process. This is of course a form of direct price regulation and hence the going-forward costs for existing CMUs will be critical. To the extent that default price levels cannot be used for plants (e.g., for units undergoing refurbishment), DECC should expect a complex and protracted interaction with existing CMU owners. Having detailed protocols and monitoring for existing CMUs, as discussed in more detail in Section 238, will help ease the burden.

Interpretation of bids in relation to net-going forward costs

101. There is a question as to how to interpret bids in the auction in relation to previously submitted net going forward costs, particularly as for existing plants this will enable them to qualify as price makers rather than price takers.

- For example, if a generator estimates a net-going forward cost of £30/kW-yr in its qualification submissions, how is one to interpret the choice to stay in the auction until a price is reached below that?
- Conversely, if a generator estimates a net-going forward cost of £30/kW-yr in its qualification submissions, how is one to interpret the choice to exit the auction at an amount above that?

102. The current detailed design proposals state "Any existing providers that bid a price above the 'price maker' threshold and do not receive a capacity agreement in the auction, but continue to operate in the delivery year, are likely to be investigated by Ofgem, which may use information provided alongside the price setting auction bid."[23]

103. Bids that deviate from net-going forward costs do not imply necessarily some form of gaming behaviour. A major reason for running a descending clock auction is to allow for the fact that participants' valuation may in part be dependent upon the valuation of others. Bids may deviate on the basis of information gained from the auction (for example better understanding of the energy market revenue expectations of others). It would be counterproductive, therefore, to restrict bidding in such a way as changes in bids may simply reflect the learning the CM auction is designed to encourage.

104. Nonetheless, if there is sufficient concern that existing plants will use the latitude to deviate from bidding to net-going forward costs to artificially raise prices in the auction,

22 Electricity Market Reform: Capacity Market – Detailed Design Proposals, DECC June 2013, p.27

23 Electricity Market Reform: Capacity Market – Detailed Design Proposals, DECC June 2013, p.27

incentives could be strengthened by requiring plant to drop out of the auction at their stated net-going forward cost[24].

5.2.2. Further Recommendations

105. Beyond the critical price-taking rule, we believe that other rules and policies may be used to minimize the impacts of economic withholding in the auction itself.

Encourage participation in the market

106. The simplest (and best) mitigation for this is to make participation as attractive as possible to smaller bidders who can act as a competitive fringe in auctions. Without the same portfolio incentives to withdraw capacity, they increase the risk for portfolio players engaged in strategic bidding by making the supply curve more elastic.

Liquidity Rules

107. Under current proposals the four year-ahead auction may be postponed or cancelled if less than 1.5 GW above target of capacity qualifies for the auction or offers capacity in the Auction. A volume measure is quite normal in auctions. Volume measures are intended to mitigate the potential for market power amongst participants which would encourage withholding (as discussed above). This provides a minimum capacity in round 1 of the auction of 3 GW.

108. We would recommend a slightly more general volume-based rule, in which there must be some minimum margin over target demand in the auction that allows for flexibility from auction to auction.

109. We would also recommend that DECC also have the right (if not necessarily the obligation) to consider the number of participants qualified for an auction. For example, in an extreme circumstance, if one large player is pivotal but supply margin is greater than 50% then risk of anti-competitive bidding might be higher than with a supply margin of 10% but with many more atomistic participants.

110. The most likely circumstance in which this might arise is if new entrant capacity is likely to set the price in the auction but very little new capacity is qualified to bid in the auction and that capacity is concentrated within only a few bidders.

Information published before and during the auction

111. The risk of withholding behaviour in the auction is strongly correlated to the amount of information that individual bidders have about the extent of pricing power they have, or how pivotal they are to the continuation of the auction. For example, in the worst case scenario a pivotal bidder would know precisely when by withdrawing capacity it can end the auction.

112. We would not recommend making any specific statements about eligible supply before the auction beyond at the aggregate level. In particular, we would not recommend making

24 This could be implemented in a similar way to New England Forward Capacity market where "delist" bids commit to dropping out of the capacity market. See FCM manuals at www.iso-ne.com. Note that dropping out of the capacity market does not require necessarily closure of the plant or preclude future participation in capacity markets (Static delisting bids withdraw a resource from the capacity market for a specific delivery year (to be mothballed, for example) but allow the resource to re-enter the forward capacity auction in a subsequent year.

explicit information about eligibility of specific companies and their units if overall liquidity in the market is likely to be limited.

113. In order to increase uncertainty as a deterrent to strategic bidding we would recommend limiting the information during the auction about remaining supply:

- The amount of supply remaining in the auction in each round should be specified as a range again in proportion to the remaining margin between supply and demand. For example the auctioneer might say, “Excess supply in the auction is in the range of 100-500 MW”.
- The amount of information provided should reduce as the auction progresses and the supply/demand margin falls. While this reduces the learning benefit from the clock auction, it reduces the probability that a bidder is able to precisely calculate when it might be able to arbitrarily close the auction.
- Only winning prices and perhaps the names of winning bidders should be announced after the auction. No information about individual bids should be provided as this is a repeated game and cost structures and hence bidding strategies may not change greatly between auctions

5.3. Withholding capacity to offer in subsequent auctions

114. The auction design foresees several opportunities for capacity providers to sell capacity. Firstly there is the main CM auction, to be held four years in advance, secondly there is a “fine-tuning” auction to be held the year ahead of delivery, thirdly there is the opportunity for bilateral transfers of rights.

115. With multiple opportunities to sell the same capacity, the risk from not selling in any one auction is reduced. There is a possibility, therefore, that some generators could arbitrage entry into the CM between the four-year-ahead auction and the year-ahead auction or bilateral market. This is not gaming behaviour, per se, and in our view the advantage of incorporating new capacity not yet under construction should be substantial and so we would not recommend changing the basic structure of the auction.[25]

116. There is also the possibility that bidders who perceive limited risk to not winning capacity contracts, eventually – for example in the year-ahead auction, might be more inclined to experiment with bidding strategies in the four-year ahead auction. Again this is not gaming behaviour, but the possibility of a “second chance” does reduce risk to gaming behaviour within an auction.

117. We would recommend that while the commitment to running year-ahead auctions is firm that only non-binding estimates of capacity to be procured through the year-ahead auction be issued at the time of the four year ahead auction. This would increase the risk to bidders of engaging in gaming strategies. We believe this makes commercial sense as well since at the four year ahead stage the evolution of demand and supply is uncertain and the need for fine-tuning will be unclear and will avoid the situation where the system operator is required to over or under-procure capacity.

25 Concerns have also been raised that demand side participants can effectively conduct the same form of arbitrage over the four year-ahead and one year-ahead auctions.

118. CM bidders should also be made aware that overall strategy to allocate capacity between the four year auction and other auctions is subject to monitoring and potential regulatory investigation.

5.4. Potential for gaming by net-short participants

119. A major issue in US capacity markets has been that vertically-integrated utilities that are net short against their capacity obligation may have strong incentives to lower CM prices. State regulators in a zonal design, for example, might support over-investment in generation or CM bidding at below going-forward costs in a constrained region if this would lower the CM price and reduce aggregate customer costs. Concerns over this type of behaviour have led to the introduction of "Minimum Offer Price Rules" in some markets.

120. In these jurisdictions concerns have focused on utilities with large amounts of regulated or "franchise" load, and hence with the long-term incentive to reduce CM prices. Given the structure of the retail market in GB this issue appears to have much less relevance.

6. POTENTIAL COLLUSIVE AUCTION STRATEGIES

121. The CM auction strategies discussed so far have been unilateral strategies – actions by a single market participant to change prices to its benefit. There is also a risk that companies may collude to explicitly avoid bidding down prices in the Auction and the CM will clear at a price higher than would have been anticipated under competitive conditions.

122. Collusion to bid in a certain manner does not necessarily require some formal cartel-like arrangements which deal with joint bidding strategies and payments and risk-sharing amongst participants. It can occur through communication and incentives built into the auction mechanism. For example, Klemperer *et al* discuss how in telecoms spectrum auctions in Germany in the 1990s, the integer format of bids submitted were interpreted as bidding intentions by parties.[26] Multi-round auctions create scope for punishment of deviations through bidding in later rounds or in subsequent auctions.

123. As bids submitted in the CM auction will be private, this auction is not susceptible to such explicit collusive strategies and so some form of communication between bidders is required. There is always potential for such arrangements to occur if the probability of detection is low and the parties involved can be relatively sure of its efficiency (for example combinations of parties can be pivotal in a way that makes joint-withholding strategies similar to those discussed in Section 3 profitable).

6.1. Signalling and bidder communications

6.1.1. Prior to the Auction

124. Participants could make statements (in public or in private) about either their intended bidding behaviour or their view on the likely price levels in the auction in a fashion designed to encourage specific withholding strategies from other participants.

125. An example might be statements designed to discourage the participation of smaller participants. The current design proposals do not deal with communication about the capacity market or bidding behaviour. If statements can be made without sanction then the likelihood of this activity occurring could be relatively high.

6.1.2. During the auction

126. The probability of collusive joint bidding strategies is increased absent a contestable marketplace with active participation from "weaker" bidders who would make cartel-like strategies more difficult to implement and enforce.

127. We believe the risk of this is probably quite low given the number of likely participants and the risk inherent of falling foul of UK competition law.

128. As a general principle, bidders should not be able to communicate about their intentions to bid or the bids that they submit within the auction. To allow communication would open the design to the risk of explicit cartel bidding or more subtle signalling between participants.

26 Paul Klemperer, "What Really Matters in Auction Design", 2001. Working paper available from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=237114

6.2. Complications from portfolios and jointly owned assets

129. The current capacity market design establishes portfolios as a vehicle to assess performance and calculate penalties based on performance. The risk of penalties will factor into the valuation of the capacity product and so will affect bidding strategies in the auction.

130. Imagine an example of a company which owns two plants it is entering into the CM. One plant is very unreliable and one is very reliable. The bid in the capacity auction on the unreliable plant would logically to be correlated to the likelihood that the reliable plant is also available in the capacity market to offset the risk of non-performance. Some form of joint-bidding strategy would be logical for those plants. Within the context of a single company, this is presents no issues. This would not be the case if the joint-bidding strategy related to separate companies.

131. If the structure of portfolios will impact the rational bids in the capacity market then in order to avoid joint bidding strategies, it would be preferable to avoid portfolios with joint ownership amongst the assets that it comprises. In extremis, one would not welcome two large bidders combining to bid jointly on their portfolio as this would reduce competition in the marketplace.

132. We understand that a number of options are being considered for establishing CM portfolios:

- Asset ownership/ equity basis;
- Licence holders/party responsible for operational management of plant
- Lead party registered in respect of each Balancing Mechanism Unit (and for whom energy contract volumes are credited or debited from their Energy Account)
- Self-determination at pre-qualification stage

133. The second and third options above point to a complicating feature of the electricity market: the potential for joint ownership/control of generating assets (as well as the possibility of tolling arrangements). In both instances, it is quite commercially reasonable for parties involved to discuss the nature of bidding into the capacity auction. This becomes complicated if one or both the parties intend also to bid on other assets in the market as this raises issues of collusion on bids in the auction.

134. We believe it will be difficult to cover all potential portfolio issues arising from these options in advance.

135. We would recommend, however, that portfolios be defined on an asset ownership basis and that for the purposes of the auction a lead bidder is nominated for assets with joint ownership. A firewall should be put in place to prevent communication with other owners should they also be participating in the auction. The lead bidder should be the owner of the portfolio in which the plant will reside for the purposes of the CM. These arrangements should be declared in advance so that bidding arrangements/ agreements on these assets can be specifically reviewed and monitored if necessary. In PJM, for

example, declaration of joint bidding agreements has been required to the Auction Manager and the PJM Market Monitor in its auction processes.[27]

6.3. Communications Protocols

136. While we believe that competition law would be adequate for the punishment of proven collusion, we also believe it would be prudent to control the precursor – i.e., communication between bidders about the auction - as competition law sets a high burden of proof.

137. We would recommend that bidders be expressly forbidden from communicating publically or privately with other companies about their bids or bidding strategy before or during the CM auction. We would this recommend the use of a communications protocol (which would form part of an Auction Participation Agreement – see Section 7.5), that qualified bidders must adhere to as part of the rules of participation in the auction.

138. The protocol should limit the nature of public and private interactions with other CM participants about their participation and strategies in the auction. In particular that this protocol should limit communication about expected pricing outcomes for the auction and should forbid discussion of likely bidding behaviour. This prohibition is a frequently observed condition (even if difficult to monitor) and is included in UK spectrum auction conditions and most auctions we have conducted.[28]

139. The need for a protocol can be illustrated through a couple of examples.

- Large Company XYZ states before the auction, “The price resulting the auction will necessarily be around £20/kW-year as we know that should be enough for most participants”
- Company ABC tweets during a round of the auction, “We plan to drop all our capacity out of the auction if the price falls below £20/kW-year”.

140. The intent of the first example is unclear and would need to be judged in light of other communications. The second communication could be damaging to the chances of a competitive auction. It is difficult to draw a line between what is acceptable and not. Consequently we recommend that auction participants should be forbidden from communicating with each other about auction outcomes prior to and during the auction.

141. Breaches of the communications protocol should be considered seriously. Potential penalties resulting from a breach could include exclusion from the auction, fines, retention of pre-bid deposits (if existing) and at the very least should be incorporated into any ex-post review of the effectiveness of the auction.

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27 See for example, the auction agreement relating to the integration of ATSI utilities into PJM and the auctioning of capacity for its load zone, FERC Docket ER09-1589, found at http://www.pjm.com/~/media/markets-ops/rpm/rpm-auction-info/atsi-information/frr-integration-auction-rules.ashx

28 As an example from UK spectrum auctions for 800MHz and 2.6GHz Spectrum bands the communication rule is that “Disclosure of confidential information of relevance to the auction to anyone that is not a member of the applicant’s or bidder’s bidder group (with certain limited exceptions, such as disclosure to providers of finance for the purpose of raising finance for a bid) may mean that the applicant does not qualify to take part in the award, or if already qualified, may lose their deposit and may be excluded from the award.” See “Award of the 800MHz and 2.6GHz Spectrum bands Guidance to potential applicants and bidders in the auction” Ofcom, Nov 2012 found at http://stakeholders.ofcom.org.uk/binaries/spectrum/spectrum-awards/awards-in-progress/key-documents/Guidance.pdf

7. SPECIFIC AUCTION DESIGN RECOMMENDATIONS

7.1. Introduction

142. In our experience of designing and operating auctions in a wide range of different markets and commodities, there are a number of fairly basic conditions which generally positively contribute to the chances for success. The process and design of the auction should:

- Encourage active/motivated participation
- Encourage price discovery in a way which facilitates bidders' expressions of economic value and minimises the opportunities for anti-competitive behaviour
- Deliver an economically efficient result
- Be fair, transparent, and non-discriminatory in the allocation of products / rights

143. Accordingly, it is helpful if there is:

- A clear statement of objectives - this may be welfare maximisation, profit maximisation, cost minimisation or various hybrid alternatives but the objectives need to be clear in order to guide the auctioneer in its design and implementation choices
- A stable, predictable external institutional and regulatory framework within which to evaluate the product (and also the process)
- A comprehensive definition of product which participants are able to evaluate
- A comprehensive and credible design to the auction process which suits the objectives and reflects the nature of supply and demand for the product

144. In this section we describe some specific auction design and implementation recommendations responsive to requests made by DECC's CM team as they relate to the last of these points.

7.2. Auction Design

7.2.1. Impact of "Common Value"

145. In situations where bidders are uncertain about the true value of a product to them and where information about what other bidders believe would influence their own beliefs then a (well-designed) descending clock auction such as proposed is appropriate as it helps to avoid the problem of winner's curse and so encourages sincere bidding.

7.2.2. Descending auctions and "weaker" bidders

146. The pricing rules in the auction need to encourage competition or contestability in the market to discipline stronger bidders and reduce benefits to gaming behaviour. Absent mitigating factors, round by round bidding such as descending auctions can suffer from the problem that smaller and weaker bidders believe that they will eventually be priced out by the strongest bidders. This can discourage participation and also promote weaker bidding during the auction. This effect can be magnified in a repeated series of auctions as bidders will have the opportunity to demonstrate aggressive bidding. A low capacity price achieved by (a) dominant bidder(s) in one auction may deter potential rivals in future

auctions; making them less willing to participate, and/or likely to bid less aggressively if they do participate.[29] [30]

147. This problem is more prevalent in open bid-auctions where bidders observe each other's bids.[31] Stronger bidders can publically bid below any bid received by a weaker bidder. The weaker bidder will be aware of this – perhaps even before an auction – and may choose, therefore, not to participate at all. This can be mitigated by accepting some inefficiency through a closed-bid clock auction where bids become anonymous. Some information is lost to bidders but the ability of stronger bidders to signal is reduced. The repeated nature of the capacity auctions unwinds some of the benefit, however, as winning bidders and resultant prices will be observed from auction to auction.

148. Whilst mostly mitigated by closed bidding, the underlying influence remains and needs to be weighed in the choice of auction design. For example, a single shot sealed bid auction where everyone submits once their best offer in private would mitigate further.

149. A one-shot sealed-bid design for the CM would not be recommended as we believe there is sufficient common value in the product that the risk of winners curse is high and so learning benefit from the clock format is substantial.

150. There are hybrid designs which could be considered if one believes that there will be a significant imbalance in the nature of bidders in this auction and if DECC are worried about the participation of smaller bidders. For example, in some auctions there are two phases: a clock phase and a sealed bid phase. The clock phase ends when excess supply falls below a certain threshold and remaining bidders submit a last and best offer.

151. The exit rule proposed for the CM Auction, if implemented appropriately is an analogue to the option of an explicit sealed bid round and should deliver the same benefits.

7.3. Price Decrements

152. As part of the set-up for the auction, the auctioneer will need to have an approach set out (in private) as to how the price will be changed from round to round

153. There is a certain amount of lumpiness in the supply curve (as units must be bid in a binary, all or nothing, fashion. Between rounds, therefore, there is the natural potential for supply remaining in the auction to fall by a large amount – for example as the auction moves down the supply curve and transition from new entrant plant to refurbishing plant to existing capacity.

154. The auctioneer will wish to avoid having to settle a large amount of the capacity sold in the auction through a tie-breaker and particularly to avoid having to choose between a small volume at a high price and a high volume as a lower price on the basis of an arbitrary formula.

155. As a general rule of thumb, the size of price decrements (without any exit pricing rule) would decrease as the margin between supply and demand decreases. If the price

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29 While capacity market prices would be lower, this strategy would reduce ultimately competition in the energy market, allowing for higher prices to be achieved in a less competitive market.

30 By definition, a single shot sealed bid does not have these characteristics and thus is less prone to this problem

31 See P. Klemperer "What Really Matters in Auction Design", *Journal of Economic Perspectives*, 2002. for illustration of effect in various auction formats and Klemperer, "Auction Theory: A Guide to the Literature" Introductory chapter to *The Economic Theory of Auctions*, P. Klemperer (ed.), Edward Elgar (pub.), 2000.

decrement is set as a percentage of the previous round (as frequently done) then as the auction proceeds then the percentage decrement would decrease as the auction progresses (the auctioneer could set the decrement relative to something else – e.g., starting price but the principle remains the same).

156. The exit rule mitigates the need for this somewhat, for if at the end of round *N* supply is less than demand then the exit bids of those participants which withdrew capacity are considered.

157. The exit pricing rule reduces the need to decrease the size of the increment as the auction progresses and this mitigates the potential for a single bidder to close the auction prematurely as it increases the risk that it will lose out in a tie-breaker (as a larger decrement should ensure more capacity competing in the tie-breaker). It does not fully mitigate for this behaviour – as a the bidder has a chance to set a high exit price relative to the previous round's price to increase chances of still winning capacity (compared to a lottery division) potentially offsetting the benefit of having more capacity to compete with.

158. We would recommend ensuring that mechanical rules about price decrements during the auction and the size of ranges of ranges of information provided be changed between auctions or incorporate some small amount of "random noise" to reduce the effectiveness of formulaic bidding strategies developed or anticipated. This reduces the probability of tacit collusion as it adds noise to the signals around which strategies develop.

7.4. Bid Deposits

159. As part of the bidder qualification process, the applicants may be required to submit a pre-bid deposit that is refundable after the auction (assuming the bidder has not violated the auction rules. (Note that the pre-bid security is separate from the credit requirements of winning bidders.)

160. Pre-bid security generally serves the following purposes: (a) ensures only serious bidders participate, (b) provides a credible indication of level of interest and demand, and (c) provides some financial security that the auctioneer can keep if the bidder violates the auction rules. In the context of this CM, (c) is potentially the most useful purpose as the qualification process will address (a) and (b).

161. Normally when pre-bid deposits are required, the amount of the pre-bid deposit is proportional to the initial eligibility that the bidder desires – in this case the amount of capacity being bid upon. The most common forms of deposit either actual cash or letters of credit which can be drawn upon based on terms in any auction participation agreements.

162. It is difficult to recommend a specific formula for the magnitude of the pre-bid deposit (i.e., pounds per MW of initial eligibility). It should be punitive and noticeable but should not discourage participation. In the UK auction for 800 MHz and 2.6 GHz spectrum an initial deposit of £100,000 was required.

163. Given that communication is a precursor to collusion one of the most useful purposes for the pre-bid deposit is to deter communication between bidders during the Auction. This deposit could be retained in the event that the Auction Trustee believes with reasonable certainty that communication protocols or other auction rules have been breached.

7.5. Legal framework for participation

164. The current detailed design does not include a description of a legal framework for participation, beyond the existence of a capacity contract, in the auction (though we

understand that it will be prepared later). A legal framework needs to be established between the bidders and the Auctioneer, at the very least, to bind participants to the bids they make during the auction and govern the process and behaviour expected during the auction process by the bidders and the auctioneer.

165. Additionally, it allows for the establishment (if desired) of penalties/ sanctions, if so desired and enforceable, for certain behaviours not otherwise covered under law. For example we have discussed withholding pre-bid deposits in the event of breaches of the any Communications Protocol.

166. We do not address in this report how the legal framework should be implemented. There are a variety of different forms of which the documentation can be implemented and the choice should reflect the legal preferences of the Government's Counsel. It could for example come in the form of a stand-alone contract or it could form part of other operating agreements, regulations, or rules of the UK electricity market. The table below, however, summarises some potential components of the any framework that we would recommend is covered in the CM legal framework.

Table 3: Components of legal framework to support the auction

Component	Scope
Auction Participation Agreement Sets out the contractual framework for participation in the auction	• Definition, Rights, Roles and responsibilities of all parties in the auction: (Auctioneer (the buyer), Auction Manager (the person running the auction), the Auction Trustee (if any), the bidders • Description of the products • Auction process • Admission to the auction – e.g., qualification criteria, posting of pre-bid deposits • The de-rating process for the auction – e.g., who determines much capacity can be bid on – how is it done – e.g., credit requirements such as bank guarantees or minimum solvency terms • Terms of sale (i.e., capacity agreement) and process for execution of capacity agreements • Implications and linkages to any other contractual arrangements • Assurances that must be given by bidders to participate in the auction (e.g., that the persons nominated to bid on behalf of the bidder are legally entitled to do so • Disclaimers and liability arising out of the auction • Termination and disqualification and implications for any pre-bid deposits, application of penalties • Dispute handling • Treatment of data and information provided by all parties (e.g., who can see qualification data provided by bidders, what information will bidders be permitted to see before and during the auction) • Allowable communications between parties before, during,

	and after the auction • Process for execution of the subsequent capacity contracts
Detailed rules for the actual auction	• Definition of a round – what activity occurs in each round and the consequences of those activities on the status of bidders. • The frequency of rounds through the auction and the duration of gaps between rounds through the auction • How is a bid constituted, • What happens if a bid is not submitted, • How and when can bids be changed, • Submissions of default (by the auctioneer on behalf of bidders) and automatic bids (e.g., bid until price falls to X) • How prices are announced • High level information about how prices for each round will be determined by the Auctioneer (in private) • Whether there is a reserve price and what happens is the reserve price is not met • The closing rule for the auction • The definition of a winning bid • The process for splitting tied bids • How the clearing price is set • Information that will be reported to bidders during the auction about supply, demand, prices, round duration, breaks, questions asked by bidders during the auction • Information about winning bids that will be provided after the auction and who will receive it • Information / Data that will be seen by the auctioneer (and other third parties if relevant – e.g., regulator, market monitor) • Technology requirements for participating in the auction (assuming that the auction is run online) • Back-up bidding processes should the technology platform fail • Handling of *force majeure* type events • Possibilities for pausing the auction and for cancelling the auction (after the opening of the auction) – who has the right to pause an auction and what process would follow • Role of Auction Trustee (if used) • Auction Help Desk roles and responsibilities, contacts (if

	used)
Auction Protocols[32] Sets out private rules used by Auctioneer to run the auction in advance	• The reservation price to be used (if any) • Precise rules for size of range of remaining supply communicated to bidder • Precise rules for the size of pricing decrement • Communications between Auctioneer and Trustee (if used)
User Manuals	• Technical documentation for access and use of the software system

167. In order to encourage participation in the auction through as great as transparency as possible, DECC should plan to give potential participants an early opportunity to comment on the public documents (i.e., not the Auction Protocols described above).

7.5.1. The qualification process

168. In order to encourage sincere participation in the capacity auction, the qualification process needs to be as transparent and non-discriminatory as possible.

169. We understand that the pre-qualification process will be 6 months long and that the plan is to open pre-qualification in April each year.

- Participants will be invited to submit their pre-qualification applications at any time from this point. They will see the demand curve for the auction in July though, so may hold off finalising their pre-qualification bids until this point. The deadline for their pre-qualification submissions will be 2 weeks after the demand curve is published, likely in mid-August (4 months after the pre-qualification window opened).
- There is then another 4-6 week period for National Grid to process all applications received and determine the outcome of pre-qualification.
- There is an extra three month window for appeals afterwards

170. The key dependency is the publication of the demand curve and this could lead to a bottleneck at the end of the process which may require significant resource and decision-making time from all parties. Particularly for new-build and plants demonstrating refurbishment plans, the submission of necessary data may be a substantive task requiring multiple stakeholders in the organisation. More generally, the choice to participate in an auction such as this, in our experience, often requires sanction from boards of directors which may meet only periodically.

171. In general, as experience with the process grows, the time required to submit and analyse data will decrease. We would anticipate the first auction to require the longest duration to satisfactorily complete the qualification process.

32 A full set of auction rules has not been completed. Whilst the framework and key principles of the auction design are known and have been communicated, we would recommend that with due course, the final auction rules document should be reviewed for consistency and completeness. It is the details of the rules documents that usually ensure the effectiveness of the auction and its susceptibility to gaming.

172. Given the process described and our experience running qualification processes in other auctions; this time period should be sufficient but not generous.

173. There is a clear preference to make the qualification process as mechanical as possible and this is a good practice. We would recommend that DECC maintain a clear policy about deadlines. DECC needs to decide in advance what your policy in respect to late submission of documentation is. In general, we would recommend strict adherence to timelines and submission requirements as a matter of fairness to other parties in the auction and as a matter of avoiding the perception of discriminatory behaviour by the auctioneer.

7.5.2. Transaction costs from participation

174. In general, if the transaction cost of participating in an auction is too high then it may discourage some smaller/weaker and more marginal bidders from taking part.

175. Transaction costs can arise from staffing requirements during the qualification process, the use of external counsel, the cost of credit support, the posting of bid-bonds, and the use of advisors to support in valuations.

176. Given the nature of the activities underlying this auction, the costs of participation are likely to be small in relation to the potential value realisable and so we do not consider this to be a major concern for the CM.

7.5.3. Consistent communication about the process

177. The amount of information about the auction and the qualification process must be uniform among bidders. No bidder should be able to gain more advantaged information about the parameters of the auction than others as this may give undue advantage during the auction. In many instances, auctioneers will hold either an information event to which all interested parties are invited and may establish information websites which hold all relevant documents for participation and can include a “Frequently Asked Questions” (”FAQ”) section.

178. Generally any information about the process provided to a bidder by the auctioneer should be made available to all bidders (to the extent that confidentiality permits). A central source of information can be provided efficiently via an FAQ website.

179. During the auction, it might be necessary to run a supporting help desk for bidders. As questions arise which have general application to bidders then these need to be shared with all bidders. Many auction software packages include the capacity for the auctioneer to send messages to bidders during the auction.

8. ENERGY AND BALANCING MARKET INTERACTIONS

180. In this section, we address the interaction of the proposed CM with the energy and balancing markets. In particular we investigate the incentives created by the penalty mechanism and whether over-delivery payments create incentives for generators to change their schedules in light of the potential for a stress event, or to indeed increase the probability of a stress event.

8.1. Operating incentives under the CM

181. The current CM design envisages over-delivery payments in the four hours after a CMW is issued (if a stress event is already in place). Such payments apply to CMUs that increase their generation available relative to the initial and final physical notifications ("IPNs and FPNs") in place with the SO at the time the CMW is issued if there is a stress event within the initial four hours. These payments will be made at the negative of the penalty rate (and hence will be substantial).

182. After four hours, the point at which the adjusted load following obligation for CMUs takes effect, over-delivery payments are also available at the negative of the penalty rate, though they are then measured relative to the load following obligation and are dependent upon SO despatch decisions (rather than unilateral changes made by the generator in the Balancing Market).

183. Again, absent perverse incentives, the existence of such premia for over-delivery should, in our view, increase the likelihood of generators being available to the SO. This should in fact reduce the probability of the stress event occurring or will make the stress event shorter-lived.

8.2. Incentives to withhold in order to capture over-delivery payments

184. As over-delivery payments are significant, there is the possibility that generators might try to adjust their schedules before a CMW in order to capture these payments, raising the possibility that CM units are paid to be on at a time they would already have been on. We believe, however, that this risk is relatively small.

185. We would normally expect that as a stress event approached, energy and BM prices would be rising sharply.[33] Our understanding is that a CMW is likely to occur after a Notice of Insufficient Margins and this means energy market prices should (to some extent) reflect the probability of a stress event occurring.

186. While that price rise may be insufficient to solve the "missing money" problem completely – which would obviate the need for a CM at all – in general stress events should be correlated with higher prices. In this case, most units should already be scheduled. This raises the opportunity cost for a generator seeking to take advantage of over-delivery payments by withholding plant. For a generator which has already contracted its generation, the cost of buying its way out of its position will also be high, for the same reason.

187. Furthermore, if energy market signals are efficient rising prices should reduce the likelihood of a stress event which increases the opportunity cost.

33 Generators already have options for selling power in spot or forward markets or in the BM, so arbitrage between spot energy and BM prices already occurs.

188. Finally, it is not clear that this is undesirable from a CM point of view. To unwind the forward energy position would require bringing a new generator to the market which was not selling planning to operate. Given the incentives for over-delivery the generator buying out the position would likely be outside of the CM since CMU's will be similarly incentivised to capture over-delivery payments.

189. CMU's which are not forward contracted, very expensive peaking units for example, do not have the same problem of unwinding forward positions but face a choice that is also not different from today between revenues achievable in the short-term and real-time market. As they operate for only a few hours they need to capture the high prices when they occur. Therefore, if the probability of a stress event is high, energy market prices will be high and it is likely that the plants will already be available. The choice between holding back FPNs and submitting BM offers which are likely to be selected (so as to claim over-delivery payments) and taking short-term energy market revenue will be made based on the risk preferences of the generator. As this will be a known possibility, the value from this arbitrage opportunity should be largely factored into the bids of such peaking units.

190. Some potential advantage could arise if a generator is able to unwind its forward position in a market in which it has asymmetric information. If it has better information about the probability of a stress event, for example if it has private information about plant availability, then it could secure additional revenues from over-delivery payments. In our view, this could contravene REMIT provisions[34] and hence this behaviour should be covered under existing regulatory control.

8.3. Could generators create stress events to capture over-delivery payments?

8.3.1. Plant Scheduling and Statements of Availability

191. The need for a CMW will be determined, in part, based on levels of capacity which the SO believes to be available to meet demand. The precise calculation is, we understand, not yet determined, but capacity will likely be assessed on:

- "2 to 14 days Output Useable by Fuel Type" reports published on the BM Reports website. This forms part of the output useable forecast provided by the SO as required by the Grid Code; and
- Maximum Export Limit ("MEL") data submitted to the Balancing Mechanism and equivalent data from non-BM capacity market participants to inform a warning to be published four hours ahead of real time when delivery against CM obligations is expected.

192. The importance of MEL data to the calculation raises the possibility as to whether plant could manipulate their MEL submissions so as to increase the probability of a stress event. As MEL can be changed with ease, there is the possibility that (subject to the same caveats above about the dampening effect of forward contracting) that a generator

34 Article 3 of Regulation (EU) No 1227/2011, prohibits trading which benefits from Inside Information (though does not apply to trading in relation to physical loss from unplanned outages). Article 4 places an obligation on market participants to publish inside information in an effective and timely manner. The regulation places investigatory powers with ACER and Ofgem to enforce this regulation.

could artificially reduce its MEL to increase the probability of a stress event, changing it back a later point to capture energy or CM revenues.

193. In our view, the likelihood of this behaviour is small as MEL is observable by other market parties, the SO, and the regulator. It will be possible, for example, to observe typical MELs in relation to MELs running up to the Stress Event. We believe that this behaviour could be easily deterred by a commitment to review statements about MEL by market participants in the run up to a CMW.

8.3.2. Plant Outages

194. A large unit tripping off system at time of low demand could trigger a stress event. The normal expectation is that such events would be triggered by purely operational/technical drivers. An extreme case of abuse (which builds from the example above) could be that a portfolio player makes the decision to trip an opted-out unit that does have a problem, but a problem that could have been run on with and shutdown in a controlled manner over several hours. Following such a trip the portfolio player could pick up their CM plant with a double benefit - avoid/minimise portfolio imbalance charges from the tripped unit and receive CM over-delivery payments.

195. This strategy would appear to be an outlier. It would require a period of relatively low demand (summer), a portfolio player with opted out plant (fully loaded) and a running CM plant (partly loaded). However, it is also possible that these circumstances could occur accidentally. It would also appear, at best, a one-off or rare strategy.

196. We would recommend a review of plant behaviour in the period running up to a CMW. Ofgem, in the case of an investigation, would already have sufficient access to plant operating information (including operations and maintenance logs) to observe and challenge this behaviour. While it can be difficult to determine whether an outage is necessary or whether it could have been deferred is hard, the threat of investigation should mitigate somewhat and a commitment to review and would likely fall under the provisions of REMIT anyway to investigate market abuse

8.4. Conclusions

197. We have highlighted some methods in which generators might be able to take advantage of the complex potential interactions between the CM, energy and balancing markets. We have noted that natural market forces should tend to blunt the effectiveness of such strategies and increase energy prices leading up to stress events. This is consistent with normal scarcity prices.

198. We also note that CMW and stress events are expected to be infrequent, and hence that generator and trader behaviour in and around such events will be highly observable.. We recommend, therefore, that any CMW trigger a routine review of market behaviour before and during the stress event. This would fit in with the general scope of monitoring we discuss in Section 10 and would be useful for understanding and improving the efficiency of the mechanism in practice.

9. DEMAND SIDE RESPONSE

199. In our experience, demand side response ("DSR") participation (comprising both specific load reduction measures and also embedded generation) in CMs has proven to be one of the largest single sources of gaming and compliance issues with respect to CM implementation – in numbers of issues arising if not in total financial impact. In this section, we review the recent GB proposal, provide an initial economic and practical critique, and make some preliminary recommendations on further DSR rule development.

9.1. DSR in the Proposed Design

200. We have developed an initial understanding of the DECC DSR proposal from a review of the Strawman and other documents, and discussions with DECC staff.[35] We have also reviewed National Grid's proposed Demand Side Balancing Reserve ("DSBR") proposals as presented in the 27 June 2013 consultation document.[36] Our understanding is that the current thinking regarding implementation of DSR in the CM is encompassed in the DECC DSR Instructions document recently provided to us.[37]

201. The DSR arrangements and proposals continue to evolve but the following discussion, which focuses on general gaming aspects of DSR implementation, should remain broadly applicable.

202. DECC has described a phased implementation of DSR in the CM. Stage 1 would last until the first delivery year of CM (2018). In this phase, a pre-determined amount of DSR would be acquired (based on analysis by the SO) in annual auctions. DSR capacity contracted in the main CM auction would be excluded from participation in the Stage I transitional auctions.

203. DSR providers in Stage 1 will be able to offer one of two products. The first and primary product will be a general load following ("load drop") obligation callable by the SO structured as in the main CM. The second is a time-banded DSR product tied to specific periods on winter weekdays. The general load following obligation will be acquired first to maximize supply of this product over the time-banded product.

204. Stage 2 implementation of DSR will closely follow the final implementation of DSR in the CM Strawman design, but with lower risk penalties (either a lower penalty or penalty cap).

205. It is envisioned that the exact implementation of Stage 2 will reflect the results of a review of Stage 1 results by Ofgem and the SO. This review should also reflect the potential for interactions between Stage 1 and 2 DSR, DBSR as implemented by the SO, and other policy measures, which are potentially complex and not fully specified at this point.

9.2. Baseline gaming Issues associated with DSR

206. The participation of DSR in capacity markets in general raises a number of economic issues associated with gaming and compliance. The primary issue reflects the

35 DECC, "Capacity Market: The Participation of Demand Side Response (DSR)", working document, 2013

36 National Grid: "Demand Side Balancing Reserve and Supplemental Balancing Reserve", Informal consultation paper, 27 June 2013. Available from http://www.nationalgrid.com/NR/rdonlyres/432E936B-ABDF-48A0-9021-9B34455918C2/61220/130627BalancingServicesConsultationfinal.pdf

37 DECC, "DSR Instructions (v3)", working document.

incompatibility of incentives between the DSR provider and a welfare-maximizing system SO. From the SO's perspective, DSR participation is efficient when this represents:

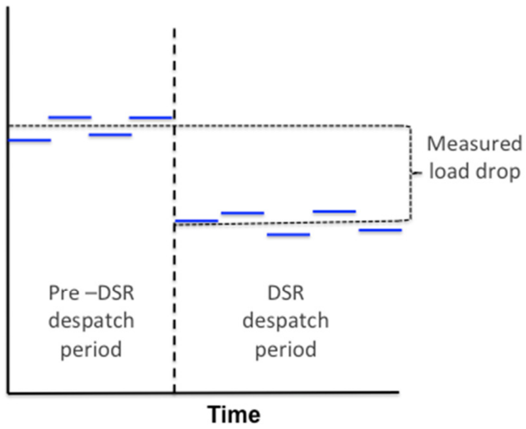
- load that would otherwise have to be served and planned for (with an adequate capacity margin to protect reliability);
- load whose value is greater than the avoided energy price (otherwise there is no need for DSR payments); and
- load on the system that would have existed without the effect of DSR (capacity or energy) payments.

207. The difficulty in procuring and paying for DSR (in either the DECC or National Grid formulations) is the familiar "baseline" problem – how to pay someone *not* to do something requires knowing not only what they have done but also establishing what they would have done absent the payment.

9.3. DSR Measurement Issues

208. Under the DECC proposals DSR providers will be paid for reducing or shifting load in a defined period when directed by the SO (a "load drop" after a load following obligation signal). This could be a CMW (after its implementation) or another SO-determined DSR despatch instruction.

Figure 9: Stylized measurement of load drop from interval settlement data



209. Given sufficient interval meter data – measuring the immediate load drop itself is relatively simple (as long as the correct pre-DSR despatch load can be determined). This is illustrated in Figure 9.

210. If the timing of DSR calls can be reasonably anticipated (by DSR bidders anxious to receive a high utilisation payment) the DSR payment can be easily manipulated by increasing load (even uneconomic load) in the run-up to the DSR call. For this reason, the DECC proposal rightfully does not establish the baseline consumption using data from immediately before the DSR is called off. At this stage, given reasonably available public information, doing so would make it too easy for DSR providers to anticipate DSR despatch and inflate their baseline consumption.

211. Instead, the DECC proposal relies on an assessment of baseline consumption on a number of peak days – the "X of Y" approach. The baseline consumption for example would be calculated on loads in settlement periods ("SPs") in 5 of the 10 previous days.

212. The DECC document describes a complex weighting of SP loads, reflecting SP load from the previous 6 weeks, demand in the corresponding SP one week before and after the DSR despatch, and demand in the same SP for 10 of the previous 14 days.

213. This system decouples the measurement from the immediate period before the DSR call (which may be easily anticipated), and therefore should help alleviate some gaming concerns.

214. A DSR provider will responsible for alerting the Settlement Agent if overall average load drops by more than 20%. As the baseline system is backward-looking this helps prevent a DSR provider from being paid for a load which is dropping in general (for some other reason than DSR despatch). More detailed rules may be needed to define a precise protocol for ensuring that DSR providers have a specific and detailed obligation to report declining general consumption to prevent over-payment for declining loads.

9.4. CHP and other small general Implementation

215. The DECC team has indicated that in the early years at least it is expected that much DSR bidding will come from CHP and other small embedded generation resources. Under the proposed DECC definitions, this would include non-licensed generation (up to 50 MW), connected to the distribution network, and metered through a consumption meter (not as a separate generation meter).

216. As an initial point, we note that in the US experience CHP-DSR implementation has raised specific gaming issues and that specific baseline issues arise when including CHP in DSR schemes.

217. With embedded generation, the baseline issue is twofold – the level of demand and the level of embedded generation, changing the net load on the system. Under advance contracted DSR proposals, embedded generation bidders have a strong incentive to understate expected generation, which in effect provides an almost free option to reduce metered net load when DSR is called. In theory, such a bidder could get paid for providing DSR at zero economic cost since its load need not be affected at all – only the effective assumed level of generation output. Current proposals under development include separate metering of embedded generation to both allow such generation to demonstrate its contribution during a stress event and for it to be verified.

218. Such concerns are not solely theoretical, but have created significant regulatory action in US capacity markets. For example, in July 2012 the Federal Energy Regulatory Commission (FERC) initiated a proceeding against Rumford Paper Company (a large paper producer with significant "behind the fence" CHP capacity) after an investigation of manipulation of its baseline amount to fraudulently obtain higher DSR payments in the ISO New England market.[38] Rumford had an average load of approximately 95 MW and a 110 MW CHP unit that normally provided almost all of its requirements. The ISO New England market monitor identified that during the baseline period Rumford (on the recommendation of a DSR aggregator) had artificially reduced its generation output in order to increase its apparent load for establishing the DSR baseline.

38 Federal Energy Regulatory Commission, Order to Show Cause and Notice of Proposed Penalty, Docket IN12-11-000, July 17, 2012.

219. Rumford agreed to pay a $10 million penalty and disgorgement of $2.8 million in profits from the scheme in March 2013, after itself entering into a Chapter 11 bankruptcy proceeding.[39]

220. In the DECC proposals, embedded generation will participate on significantly the same terms as other DSR resources. This creates the need for potentially some additional rules regarding baselines. The DECC proposal does not for example discuss any additional rules regarding embedded generation availability and operation during DSR test periods or for notification to the Settlement Agent that potential generation output was lower in the past (analogous to the change in average load rule for DSR providers discussed above).

221. We suggest that embedded generation DSR providers be required to inform the Settlement Agent of unavailability or inoperability of such resources during any test-period, and also if such generation output changes over time materially. If an embedded generator were to have low availability in the past, but output was now generally higher, this would lead to overpayment under the weighted SP methodology. Any DSR provider providing embedded generation-based DSR resources should therefore be required to inform the Settlement Agent regarding material changes in availability and output.

9.5. Metering and Verification

222. The DECC proposals aim to use the existing metering and data collection infrastructure to minimize upfront costs and give strong incentives for participation.

223. Implementation of DSR requires significant attention to metering and data verification issues. DECC appears to recognise this well as and discusses metering and data issues in some detail in its DSR Instructions document.

224. All DSR providers should be required to sign an undertaking that they have the right to control load at customer’s premises. This is also consistent with the DBSR proposal.

225. Under the DECC proposals DSR providers must provide a set of Meter Point Administrative Numbers (“MPANs”) for customers for which demand reductions can be made. These lists can then be used to make a basic check to ensure that no MPANs are duplicated across DSR providers, for example.

226. We also fully support the necessity of access enough meter data to ensure that the demand reductions are consistent with maximum demand of the relevant MPANs.

227. As we have noted on previous calls, many larger customers will have multiple meters on site and many industrial customers may be able to relatively easily switch their consumption from one meter “feed” to another. It is therefore critical that Grid (and the market monitor) be authorized to see all meter data from a site (including MPANs not included in any DSR bid) to ensure that load is not simply being shifted from one meter to another. All participants signing up for DSR (directly or through a third-party) should be required to authorise the disclosure of all such data to prevent any oversight from being stymied through data protection regulations.

228. We have not reviewed (but assume) that data integrity issues do not pose a problem as these are the same half-hourly meter data used for energy settlement.

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39 Federal Energy Regulatory Commission, Order Approving Stipulation and Consent Agreement, Docket IN12-11-000, March 22, 2013

9.6. DSR pre-qualification testing and penalties

229. Currently, in Stage 1 DSR providers will face a penalty for providing a lower measured load drop when despatched. The penalty factor in Stage 1 however will be lower and the total penalty will be capped at the annual DSR capacity payment in the auction.

230. Having a penalty regime lowers the possibility of asymmetric risks faced by the SO ("heads I win, tails you lose"). The penalty/payment rate for under and over-performance by DSR providers should be the same to ensure incentive problems are minimised.

231. The DECC proposals now also include a more complete testing regime for DSR providers. When no capacity stress events occur DSR providers will be tested at periods designated by the DSR provider. These are designed to prove the existence and operational effectiveness of the DSR capacity during pre-qualification, after the auction and during the delivery year (if an insufficient number of capacity stress events occur).

232. The testing regime is not described in detail and we assume that additional testing protocols will be required. We would generally recommend the use of unscheduled DSR tests (after pre-qualification) during the delivery year as well to ensure that DSR providers are actually able to respond to SO emergency requirements. We understand that the current plan is to use unscheduled tests if a provider fails to meet an obligation to undertake sufficient scheduled testing. This is in line with our recommendation.

233. We are pleased to see the addition of more detailed pre-qualification requirements, including credit requirements. The use of bonds for DSR suppliers is useful as entry is relatively easy into DSR and the SO should require some indication of serious intent to deliver and comply with the rules. The requirement for providing a business plan and/or associated meter numbers is also laudable; some more detailed protocol may be needed for the evaluation of these submissions.

9.7. DSR Recommendations

234. CRA recognizes that DECC's CM DSR proposals are still under development and that further refinement is likely. However, given the inherent incentive issues associated with DSR gaming is always a possibility.

235. Active and detailed market monitoring (discussed in more detail in Section 238) is a critical deterrent to gaming of DSR in CMs. We do not believe that all gaming issues associated with DSR can be identified *ex ante* and the strongest protection for customer interests is assurance that DSR provider behaviour will be scrutinised and investigated when necessary. Market monitoring can be implemented in numerous ways and under varying institutional structures but is critical for DSR implementation in general.

236. We fully support the ability of the Settlement Agent (or any other DSR administrator or monitor) to access sufficient meter data to ensure that demand reductions are real. This will include the need to access all meter data from a site (even where there are meters whose MPANs are not included in any DSR bid).

237. We also support the implementation of pre-qualification and credit requirements, plus the use of bonds by DSR bidders to assist in insuring only serious DSR bids are submitted to the auction(s).

238. The DSR proposal works for embedded generation only to the extent that the despatch of such generation naturally follows peak consumption. This requires further investigation but to the extent that CHP plant was not running on test days (or was withheld) CHP customers could be over-compensated.

10. CM MONITORING AND COMPLIANCE FRAMEWORK

10.1. Regulatory deterrence

239. No energy or capacity market design is immune from gaming or manipulation. Getting the rules sets right is only half the battle. The other half requires an expectation among market participants that the likelihood of detection of unwanted manipulative schemes is sufficiently high, followed by the deterrent effect of penalties. Despite the extensive effort to tweak CM rules in PJM, ISO New England and other US capacity markets, there have been concerns raised by regulators regarding specific instances of market behaviour.

240. The implementation of new CM designs has often proved difficult and controversial, and rules implications and market behaviour have sometimes differed sharply from expectations. In whatever institution construct, some form of monitoring can assist in deterring gaming, identify rules problems quickly and assist in making the market credible to both customers and investors.

241. From our discussions with DECC, Ofgem and others we understand that the GB market does not rely on market monitoring in the same degree as the US regional transmission organizations ("RTOs"). The GB market is also used to a different form of regulation than that employed by the US Federal Energy Regulatory Commission ("FERC"). We also understand that legislation which proposes the CM does not foresee regulatory powers beyond those invested in current institutions. However, given the possibility of problems arising – not all of which can be anticipated by any market designer - we would recommend the development of a limited CM monitoring programme, done within the construct of current institutional powers.

10.2. Role of market monitors in US RTOs

242. US RTOs are required by FERC to have independent market monitoring in place – a provision that was strengthened in the Energy Policy Act of 2005. In brief, market monitors are designed to act as the "eyes and ears" of the RTOs to identify problematic market behaviour and rules problems as they arise.

243. Market monitor units ("MMUs") generally report directly to the board of directors of the RTO but also typically have the ability and responsibility to work with FERC directly to identify market flaws. These US Market monitors can make a recommendation for further regulatory investigation and can even intervene in certain regulatory proceedings and investigations.[40]

244. Each RTO has a market monitoring plan, which defines the objectives of its market monitor. This will usually include:

- Monitoring market participant behaviour with the rules, standards and practices of the RTO markets (including energy, capacity, ancillary services, transmission access, etc;)
- Look for the ability of participants to exercise undue market power;
- Identify structural flaws in market rules and how these may be exacerbated by participant behaviour; and

40 A summary of a market monitoring unit's basic objectives can be found in FERC's Policy Statement on Market Monitoring Units, Docket PL05-1-000, May 27 2005.

- Assessing market outcomes to ensure consistency with robust competitive outcomes and policy objectives and report on how well the market is functioning.

RTO market monitors conduct a number of activities to implement these requirements. These include:

- Gathering data from RTO and other systems on market prices, offer curves, quantities and other market variables;
- Development and calculation of market metrics for assessing market behaviour and market outcomes;
- Monitoring market rules and identifying potential flaws in market rules or potential gaming of those rules;
- Analysing market performance and behaviour in short-term markets and identify potential exercise of undue market power or gaming;
- Alerting regulatory staff (FERC) when serious market issues are identified for further investigation.

It should be noted that market monitoring units do not have the ability to levy sanctions, directly force changes in market behaviour of change market rules. These powers are strictly retained by FERC. And in this respect, this is not different to the situation in which a GB market monitor might find itself, with Ofgem remaining in control of market oversight.

10.3. Specific PJM capacity market monitoring functions

245. RTO MMUs cover all of the RTO markets – for energy, capacity, ancillary services and transmission. As such, their remit is much broader than considered for the GB CM monitor recommended here.

246. With respect to the PJM RPM capacity market design, the PJM market monitor is responsible for:

- Ensuring CMU bidders follow market rules and overseeing he single-shot auction used in PJM (in this sense the market monitor also incorporates the role of an Auction Monitor in DECC's strawman design).
- Developing the default bids for existing CMUs and developing a protocol and process for interacting with generators setting each existing unit's default bid.
- Implementing the previously-developed protocol for assessing applications by existing generators wanting to use different values for existing units. This could include, for example, units facing large avoidable capital expenditure to meet environmental requirements.
- Assessing the legitimacy of outages (important in the RPM design) during system peaks
- Using actual energy and ancillary services ("E&AS") data to calculate the E&AS offset for CMUs on a unit specific basis.
- Assessing CM bids and behaviour for attempts to exercise market power or gaming
- Evaluating CM outcomes and report on market efficiency and effectiveness as part of the general market monitoring reporting function.

- Assessing DSR activities and effectiveness and monitor for attempts to game DSR rules.
- Providing expert support to RTO management on the almost continuously evolving rule sets in RTOs.

10.4. Resource requirements for capacity market monitoring in PJM

247. We were asked to provide a rough indication of the level of resourcing required for the extensive monitoring mechanisms found in the US.

248. The total on-going cost of PJM's external market monitoring function is approximately $10 million per year (~£6.5 million per annum). This market monitoring group however covers all aspects of the PJM market, including the LMP energy market, the ancillary services market and financial transmission rights markets. The monitoring cost of the PJM RPM capacity market is much less – roughly estimated at approximately $3 million (£2 million per annum).

249. The PJM market is a much larger market than the GB market. To give some perspective almost 170 GW of capacity cleared in the most recent RPM auction and the PJM footprint includes over 1000 major generating units across 13 states. Proportionately, GB might expect fewer monitoring manpower resources would be required. Unlike PJM, DECC has also not proposed a more complex multi-regional market.

250. PJM notes that a successful market monitoring function does require an IT infrastructure – especially if the market monitor will be required to interact with existing CMUs regarding default bids, etc. (this will have to be done anyway in the DECC strawman design). A GB CM monitoring function will also require some means of acquiring BM and meter data for reviewing generator and DSR behaviour before and during CMW events.

251. We have not estimated the costs of implementing such an IT infrastructure but note that the market monitoring function in general does not require access to real-time meter, BM or similar data. As such, if appropriate protocols were devised we expect that data could be provided cost effectively from National Grid, the meter data repository or Elexon as appropriate.

10.5. Recommendations for the GB Capacity Market

252. In this Section we set out a number of monitoring and compliance activities that would act as deterrence to gaming behaviour. We have drawn from the function set of the US market monitors, but this is not intended to suggest any specific institutional requirement; rather the activities themselves are of interest.

10.5.1. General Principles

253. Monitoring should be carried out within the legislative framework that exists which establishes the regulatory institutions and their powers of investigation and enforcement. Monitoring, therefore, must therefore fit into the process for subsequent investigation of market abuse (if it had occurred). It would be difficult to establish a monitoring and compliance mechanism separate to that of the other parts of the market.

254. Those parties which engage in reviews of the market should not be in conflict with their interests in the market. Reviews should be conducted by independent parties to those engaged in the activities being reviewed.

255. Market monitoring can be an *ex post* rather than a real-time activity, which would require many more staffing resources, and would raise many challenges in interference with real time operations of the CM.

10.5.2. Monitoring Activities Recommended

256. We foresee the need to a review to be carried out in a number of different areas of the CM process.

257. There is a need for a general periodic review which examines the competitiveness and efficiency of the CM and participant behaviour in it. This would include analysis of everything from issues arising in pre-qualification of CM bidders to evaluation of how CMUs and DSR providers performed during CM stress events. We understand this is currently planned.

258. This periodic review needs, however, to be supplemented with event-driven monitoring:

- ***Pre-qualification***: review qualification process, including decisions to opt-out, opt-out and retire, application of price-maker / price taker decisions, evidence of gaming behaviour
- ***Auction:***
  - Review the activities of the auctioneer (in this case National Grid) during the auction for fair application of the rules of the auction and any procedures agreed outside of those rules (including the operation of any real-time help desk)
  - Review bidding behaviour of auction participants, evidence of gaming behaviour
  - Audit the outputs of the auction software and report on the results of the auction.[41]
- ***CM Operation***:
  - Review of CMU behaviour before and during stress events
  - Review of efficiency of financial insurance product markets arising from CM obligations
  - Evaluate specific and general DSR performance.

10.6. Implementation Considerations

259. As stated above, we believe this many of the tasks outlined could be easily and cost effectively conducted by an independent firm under contract to either DECC and/or Ofgem or done by teams within those organisations. Much of the monitoring would require legal access to data, including CM offers in the auction, settlement data from CMU units (before and after a CMW), DSR bids, baseline data, half-hourly load data by meter (for all meters owned by a DSR provider).

260. It is very difficult to do any of these monitoring tasks with the goal to make real-time decisions based on findings. The monitoring activity needs to be consistent with due legal process so as not to harm any subsequent investigation (should one be necessary).

41 For example, in the recent 4G spectrum, the Smith Institute worked with Ofcom to test auction systems and produced an independent verification of results. This was a limited variant of the trustee role, in part because other parties provided other assurances, which maintained Ofcom in its role as Regulator and guarantor of the auction. In other auctions for Ofcom, Peter Cramton has provided expert review of spectrum auction outcomes

Thus we recommend that the monitoring activities be a trigger for a formal investigation rather than a formal investigation (with findings) in its own right. This is consistent with the current proposal for at least an annual review of CM performance, the recommendations of which would be considered by DECC and Ofgem; who would subsequently take action if needed.

261. In some auctions we have observed have employed an "Auction Trustee" with specific responsibility for monitoring the live auction. Such a Trustee could:

- Monitor the activities of the auctioneer during the auction for compliance with the rules of the auction
- Monitor bidding behaviour of participants in the auction
- Possibly, certify the results of the auction software
- Resolve disputes or problems, if desired, between participants and the auctioneer, should they arise during the course of the Auction

262. All but the last of these tasks can be reported on ex-post but would require real-time presence at the Auction for effective review.

263. As part of its responsibilities, the Auction Trustee could be responsible to recommending that further investigation of parties be undertaken in respect to gaming behaviour. This could take place ex-post or if it is observed during the auction. Given the envisaged legal structure, we would imagine that this would need to be a non-binding recommendation.

264. Finally, to the extent that to that gaming behaviour is apparent, clear procedures for consequences should be in place before the auction. In particular:

- Should after the auction it become clear that gaming behaviour has occurred and that such behaviour needs to be investigated and/or prosecuted, who will make the decision to investigate? We assume that even if an Auction Trustee is employed that their recommendations would be non-binding. Decision-making authority, therefore, needs to be allocated.
- In the event that after an auction, gaming behaviour is successfully prosecuted what implications are there for any capacity contracts that were won by the offending party and what implications for the auction results (in their entirety) if it is concluded that the behaviour had a material effect on prices. For example, should the auction results stand or be cancelled and the auction re-run?
- If the event that there is a strong suspicion that gaming is occurring and this arises during the auction, what process will be applied? Should the auction be stopped? Who should make that decision? Should suspect participants be excluded immediately for the auction? What implications are there for the determinations made by the Secretary of State after the auction? In our view, the likelihood of being in a position to be definite during the auction is very small but a plan is needed for extreme circumstances so as to avoid unnecessary confusion amongst all bidders as to the status of their bids.

11. ANNEX: NOTE ON MULTIPLE CONTRACT TENOR AUCTIONS

Introduction

265. The current design of the CM enforces parity of pricing (where the choice is allowed to bidders) between tenors of capacity contract secured through the CM auction. Although, not a focus for this report, we have been asked make some selected comments on the reasonableness of a multi-product design and how it might be implemented as well as its impact upon possible gaming behaviour.

Implications of the Current Design

266. Existing plant which cannot justify net going forward costs beyond a set threshold are limited to one year tenor contracts. Plants which qualify as Refurbishments can choose between one and three year contracts. Plants which qualify as new entrants can choose between one, three, and ten year contracts. A bidder, who is afforded a choice in respect to the contract tenor, is not given, however, the opportunity to express a preference in terms of difference in value between those tenors. The price (£/kW) resulting from the auction applies equally to one, three, and ten year contracts.

267. DECC has a stated a preference for shorter duration contracts but accepts that for some capacity, contracts of longer duration may be required.

268. It is not, however, immediately evident for all potential prices for the contracts that bidders would consider them indifferently. This can be shown from two different angles:

- A new entrant plant may, for example, value a long term contract more than a short term contract. This might be a function of its risk preferences, in terms of cash flow or practically in terms of ability to secure financing for development. It would, therefore, require a higher price for the one-year contract relative to the ten-year contract. Thus given a uniform price for all contract tenors we would expect new entrants to choose their longest feasible duration tenor (taking into account their risk adjusted expectations of being able to secure a higher priced contract in a later auction);

and

- Some existing plant would be willing to remain in the auction for longer (once the price is below the price-taker threshold) if offered the option of a longer term contract. This might occur for plant considering retirement - where a longer term commitment in capacity price might be valued more.

269. It is difficult to say, without precise knowledge of the supply and demand curves, how prices will be set in the auction. However, we can make some general remarks.

- It seems logical to allow new entrant capacity to have a choice of contract tenor, if indeed the need to incentivize capacity through the CM is likely to be long lasting. If new entrants would accept a lower price for a longer term contract than a one-year contract then they will remain in the auction for longer than if they were only offered a one-year tenor. To the extent that new entrant capacity will set the price then this should be a downward influence on prices.

- It is difficult to suggest an appropriate maximum tenor as this might depend of the manner in which new plant is financed and the extent to which such financing must be aligned with capacity market revenue. This, of course, will vary depending on the extent to which external project finance is required in addition to equity investments. We understand that DECC, appropriately, intends to consult on this issues. Aligning the product to market requirements should increase the probability of participation.
- The case for allowing choice for existing plant is less obvious. In PJM and New England, existing plant are similarly restricted to one-year contracts. To the extent that the CM persists (i.e., there is a positive value to capacity systematically not being recovered in the energy market), annual contracts will be available. To the extent that existing plant set the price in the CM, allowing choice of contract length might allow for lower prices. However, even in these circumstances, given the uniform price design, all but the marginal plant in the auction are receiving some form of infra-marginal rent in excess of their net going forward costs and so it becomes harder to justify the need to also lengthen tenor of the contract.
- In practice, however, we understand that new capacity is likely to be required (and hence will influence price) beyond the first couple of years of the CM. Absent severe risk aversion or very strong preferences to retire (associated with low expectations of energy prices - based on factors outside of the control of the CM design) in existing units, we would not consider the current restriction on tenors to be likely influential on participation choices.

270. In summary, while in theory it could be argued that there is difference in valuation of contract tenors, we do not consider the implications to be significant from a design point to cause inefficient pricing outcomes from the current CM auction.

Comments on practicality of multi-tenor design

271. Some form of clock auction would continue to be the best option as common value remains a characteristic of the products.

272. One could choose to run separate descending clock auctions for each contract tenor. However, as the value of each of the contract tenors is related and could be viewed in some form as substitutes by bidders, it will improve price discovery and efficiency in bidding by running bids simultaneously in the same auction. Furthermore if one splits the auction and divides participants between specific contracts, liquidity will by default be reduced thus the risk that a single participant is able to affect the outcome of the auction unilaterally is increased. We would not recommend, therefore, split auctions for the CM.

273. If a multi-product auction is run, it will be necessary to decide how to intervene in the market to allow bidders to express preferences. There are two basic options:

i. Set the volumes of the contract tenors which you wish to purchase and allow the market to establish the prices at which they will clear; or

ii. Set the pricing relationship between the contract tenors and allow the market to determine how much of each tenor is cleared.

274. The current design is a version of (ii). In both options, however, to move away from the current design would require DECC to determine an acceptable relationship between either volumes or prices. This would be a non-trivial task. The extent to which this preference is not known then the current design is appropriate.

275. Then depending on which option chosen above:

i. In this option, at the start of the auction the auctioneer would set the volume of each contract tenor it wishes to procure. In each round the auctioneer would announce a price for each contract tenor and solicit bids. The price of each product would fall until each products supply is less than or equal to demand.

ii. In this option, at the start of the auction the auctioneer sets the volume across all contracts that it wishes to purchase. It also (privately) establishes its preferences for each tenor which you would translate into a pricing relationship for each of the products (e.g. the value of a ten year contract is 90% of the value of a fifteen year contract). In each round of the auction the auctioneer would use those preferences to set the price for each of the tenors. Prices decrease until aggregate demand target is reached - the market, however, establishes the volumes sold in each contract.

In both of these formats DECC would need to determine a set of rules for eligibility to bid on contract tenors for each participant. You would need to do this in advance. For example, an existing generator might be permitted to bid only on one and three year tenors, whilst a new entrant could bid on one, three, and ten year tenors. "Activity" rules would be required to govern how participants might switch between bids on different tenors during the auction. For example, if a participant bids all of its capacity on the one year contract in the first round of the auction, under what circumstances would it be permitted for a bidder to switch its offer to a different contract in a subsequent round of the auction?

276. This is more complex from a design and software implementation perspective. Both of the formats, suggested above, have been run successfully run before in the electricity market (See EDF, Electrabel, Elsam, RWE auctions)[42]. Some of the activity rules in the Auction design can become quite complex as the auction designer must determine how bids are submitted and how bidders change their preferences for tenors as prices change in the auction. In our view most bidders in this auction will, however, likely be sufficiently sophisticated to be able to understand the rules and participate effectively. The common practice of running mock auctions before the final auction would also mitigate risk.

Comments on gaming issues

277. The same basic potential for gaming exists for multiple product auctions as for a single product auction. There are some particular areas in which the risk is more difficult to manage:

42 See “Virtual Power Plant Auctions” by Ausabel and Cramton, 2010 for a useful summary of European power plant auction design. Available at http://www.cramton.umd.edu/papers2005-2009/ausubel-cramton-virtual-power-plant-auctions.pdf

- During the course of a descending clock auction, it is usual to enforce the rule that the supply curve is strictly upward sloping. In a single product auction this would manifest itself in the following basic rule: Bidders may not increase their offer of supply in response to a decrease in price. Thus as the rounds progress and prices decrease, the remaining supply offered of any bidder should either remain the same or reduce. This rule prevents bidders from "hiding" their position (as one purpose of a clock auction is to provide information about other bidders preferences). The same basic rule is required in a multi-product auction but also because you need to prevent bidders from "parking" their offers in one product to mislead others about their intentions to bid on another product. There are various activity rules about switching which can manage this but, of course, they make the auction a more complicated. For example, you might say that you can only switch out of a product if that product if the price of that product has decreased from the previous round (i.e., is still in conditions of excess supply).
- The rules for disclosure about remaining supply in the auction must also be different. For example, consider an auction round in which demand for the one year contract is 500 MW and demand for the ten year contract is 500 MW. If supply bid for the one year contract in that round was 510 MW and supply bid for the 10-year contract was 600 MW, what information should be presented to bidders at the end of the round? Aggregate supply is 1110 MW against aggregate demand of 1000 MW. If bidders can choose to switch between contracts in the auction then it is only appropriate to report aggregate demand and supply.