Gas Demand Side Response Auctions

Final Report

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Issued: 29 April 2013

Status: Final

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1. Introduction

1.1 Background

Since market liberalisation and privatisation, the relative abundance of North Sea gas combined with well functioning gas and electricity markets have ensured that sufficient gas has always been available to meet demand. To date, Great Britain (GB) has never suffered a Gas Deficit Emergency (GDE) and National Grid (NG) has never had to involuntarily load shed gas customers. The decline in UK continental production has inevitably resulted in increased reliance on international gas markets to deliver security of supply to gas customers and electricity generation. This exposes GB to a range of additional risks. As a result, Ofgem has been reviewing a range of measures to improve GB security of supply, including changes to GB gas cash-out arrangements.

Under current market arrangements, if a GDE occurred:

- National Grid could start to load shed Daily Metered (DM) customers, with the largest customers being load shed first[1]. Thus, the order in which customers would be interrupted does not necessarily reflect the opportunity cost of them being interrupted, i.e. their Value of Lost Load (VoLL); and
- The cash-out price that shippers pay for their imbalances would be frozen. This blunts the incentive on shippers to take mitigating action to ensure that they can meet peak demand, reducing the incentive to invest in security of supply.

Ofgem launched the Gas Significant Code Review (SCR) in January 2011. In November 2011 Ofgem published a draft policy decision to unfreeze the cash-out price in an emergency and allow it to rise to up £20 per therm, which is the level that Ofgem estimates to be the average VoLL for domestic consumers. Further, Ofgem stated that the cash-out arrangements would be changed so that any consumers who were involuntarily disconnected would be paid for this interruption at the level of £20 per therm. This policy was intended to provide an incentive for gas shippers to find means of reducing the risk of involuntary interruptions. It is likely that a cost effective means for shippers to do this would be to enter into interruptible contracts with daily metered consumers who have a VoLL below £20/therm, so that at times of system stress their demand could be taken off and the likelihood of a GDE significantly reduced. Following further consideration and analysis, Ofgem has suggested a revised figure of £14/therm for average domestic customer VoLL.

Industry stakeholders raised significant concerns regarding Ofgem's decision on the gas SCR. One concern centred on the administered estimate of VoLL acting as a target price for interruptible contract pricing. As an alternative to Ofgem's proposals, Centrica raised a UNC modification proposal (UNC 435) that proposed a Demand Side Response (DSR) auction or tender - they have subsequently expressed a preference for simple tender (i.e. single round sealed bid auction).

[1] Except where there were additional requirements to manage local constraints

Under UNC 435, DM customers would be invited to bid an exercise fee and an option fee in return for reducing their demand at times of system stress, so as to avoid involuntary gas interruptions. The rationale for including both an option fee and exercise fee is that the option fee would cover a customer's costs of investing in back up fuel, whilst the exercise fee would cover the customer's opportunity cost in the case of fuel switching (incremental cost of alternative fuel, or cost of lost production).

The initial industry proposals are for a budget/volume based approach, in which National Grid Gas would agree a budget with the relevant authority[2] (based on an assumed volume to meet a prescribed security of supply standard[3]) and then tender to procure the required level of DSR. When these tenders are exercised ahead of an emergency, they would be treated as balancing actions and so included in the calculation of cash-out prices. Some stakeholders consider it would be preferable for a market determined VoLL to be reflected in the cash-out price, rather than a VoLL administratively determined by Ofgem.

A DSR auction could provide benefits by:

- Be used to facilitate the revelation of actual market VoLLs for different customers and that reflecting market determined VoLLs in cash-out prices is preferable to using administratively determined VoLLs;
- Result in more economically efficient interruption arrangements that:
    - Reduce the potential for a Stage 2 emergency GDE by bringing forward more voluntary interruption, which NG can call upon ahead of an emergency, following a Gas Deficit Warning (GDW);
    - Ensure that customers are interrupted in an economically efficient order.

Ofgem has procured the advice of ESP Consulting on certain aspects of the potential design and feasibility of DSR auctions, including how they may be reflected in cash-out prices. Specifically, Ofgem sought views on:

1) The general design of DSR auctions, including:
    a) frequency;
    b) baselining methodology (i.e. the methodology for determining a baseline level of demand from which demand side reduction is measured);
    c) style of auction or tender; and
    d) whether the accepted bids should rationed on the basis of volume or price.
2) How best to encourage participation.

[2] It has been suggested by Centrica that the relevant policy authority, in regard to security of supply, is DECC

[3] The applicable security of supply standard may need to be higher than the minimum European standards to ensure that some DSR is procured, as GB currently meets the standards, and the budget would therefore be set at zero

3) How to incorporate exercise and options fees into any design (and whether it is appropriate to do so) and how those fees should be paid (pay-as-bid vs. pay-as-clear etc).

4) How to set auction reserve prices, or other approaches to ensuring the outcomes of the auction are economic and efficient.

5) Suggestions on how to use the outcomes of the auction in cash-out charges.

6) Suggestions on how to remunerate / charge unsuccessful bidders in the auction.

The remainder of this report sets out:

- Our recommendations and the rationale for these recommendations in Section 2;
- Any residual risk / unintended consequences in Section 3; and
- Remaining issues to be considered during implementation in Section 4.

2. Options Considered and Recommendations

2.1 Overview

Following discussions with Ofgem, ESP Consulting developed two “strawmen” options and discussed these “strawmen” options with the industry. Both options were based on a number of key design parameters for auctions, interruption arrangements and their impact on payments for DSR services and cash-out. These key design parameters are:

- Eligibility: who should be eligible to bid and provide voluntary DSR?
- Auction Bid parameters: what price parameters (i.e. option fees and exercise fees) should eligible customers bid on and be selected on? Should these price parameters have implications for how customers are paid for DSR provision?
- Product design:
    - High level: how long should the auctioned contract last?
    - Detailed: what should be the maximum duration of interruption, minimum bid tranches, and length of notice to interrupt?
- Auction format[4]: e.g. should the auction be a multiple round dynamic auction or a sealed bid tender?
- Timing and frequency: How frequently should the auction be conducted, and at what time of year?
- Reserve price: Does the auction need an explicit reserve price, or do limits on payments for DSR services create a de-facto reserve price?
- Acceptance and exercise of bids: On what basis does the auctioneer (presumed to be NG or an agent of NG) decide which bids to accept and how and when to exercise the bids?
- Payments for DSR services and failure to interrupt charges:
    - How are customers who are called to provide DSR paid, and how is failure to provide DSR on request disincentivised?
    - How are customers who are involuntarily load shed paid (or not paid), and does this depend on whether they were eligible to bid in the auction?
- Cash-out price treatment: how are auction outcomes reflected in the cash-out price?

[4] Note that in this document we use the term auction in the broadest sense, consistent with terminology used by auction practitioners, but not necessarily as commonly used by the industry. Under this terminology, tenders are a specific type of non-dynamic auction, where bidders do not get the chance to react based upon competitors’ bids. Therefore any reference to the term auction used in this document should be taken to include tenders unless specifically stated otherwise.

Following further discussion with Ofgem, we also developed a third option, which is a hybrid option.

The key differences between Option 1 (our recommended option), Option 2 (which was more in line the industry's preferred approach) and Option 3 (hybrid option) is whether the successful bidder should be paid an Option Fee in addition to an Exercise Fee, and how that the Option Fee should be determined:

- In Option 1, customers would bid and be selected only based on an Exercise Fee, i.e. a fee to be paid only if they are called to deliver DSR. Under these arrangements the cost of payments to DSR providers would be incurred only if and when DSR was required.
- In Option 2, bidders would be paid both an Option Fee and an Exercise Fee. Bidders would bid both parameters, so that both fees would be market determined outcomes. Under these arrangements, fees would be paid to some DSR "providers" even if no DSR was ever required.
- In Option 3, the Option Fee would be set administratively *ex ante* so that, whilst successful bidders would receive an Option Fee as per Option 2, bidders would bid only an Exercise Fee as per Option 1. Thus, under Option 3 the option fee would be administratively determined and the Exercise Fee would be market determined.

Whilst the key difference between Options 1, 2 and 3 primarily relates to the Auction Bid Parameters, the design of the Auction Bid Parameters has consequential implications for certain other design features such as: the contract duration; timing and frequency of auctions; Reserve Price (as regards option fees); acceptance of bids; and payments for DSR services and charges for failure to interrupt for option fees.

Other elements of the design features are independent of the choice between Options 1, 2 and 3. These include: eligibility; elements of product design; auction format; Reserve Price (as regards exercise fee); exercise of accepted bids based on Exercise Price; payments for DSR services and charges for failure to interrupt for Exercise; and reflection of auction outcomes in cash-out prices.

We summarise the design parameters of Options 1, 2 and 3 in Table 2.1 below. In the remainder of this section we set out for each design parameter (where relevant and not self-evident):

- The key choices with regard to each design parameter;
- Why we have specified the design parameter in the chosen way for Options 1, 2 and3;
- Why the design leads us to prefer Option 1 over Options 2 and 3; and
- Issues that require more detailed work at a later stage in the implementation of the project.

Table 2.1- Summary of Options considered

Design parameter	Option 1	Option 2	Option 3
Eligibility to bid (Eligible Customers)	• All DM customers, or a subset of larger DM customers, if too many smaller DM customers for NG to manage in an emergency • Exclude gas generators • Exclude gas producers	As Option 1	As Option 1and 2
Bid parameters	Exercise price only. Allow bidding in tranches, and bidding of partial load DSR.	As Option 1, but with Option Fee	As Option 1, Option Fee sets ex ante, not a bid parameter
Product design	Single product of one Gas Year duration, detailed design to be consulted on further with industry	Single product, for 3-5 year duration. Detailed design to be consulted on further with industry	As Option 2
Auction format	Sealed bid tender	As Option 1	As Option 1 and 2
Timing and frequency	Annually, close to start of Gas Year (e.g. August)	Annually, up to two years before contract start	As Option 2
Reserve Price / volume limit	Price effectively capped at average domestic VoLL, since no bids exercised or paid above average domestic VoLL[5]	As Option 1, but with budget on Option Fees	As Option 2
Acceptance and exercise of bids	• All bids below average domestic VoLL form supply curve • On the day, bids accepted in Exercise Price order, except for constraint management	First based on Option Fees. Accepted bids then ranked based on Exercise Price	As Option 2
Payments for DSR services	• All DSR bids accepted through auction paid-as-clear • No payment to involuntarily load shed eligible customers	• Option fees to all accepted bids • Other payments for voluntary and involuntary load shedding as Option 1	As Option 2
Cash-out price	Highest priced Exercise Bid accepted on the day reflected in cash-out price	As Option 1	As Option 1and 2

5 Based on the rationale that it is not economic to exercise bid above average domestic VoLL and to give strong incentive to bid. However, there is a possibility that time lags in restoring isolated NDM customers could mean it is economic to load shed higher VoLL DM customers first.

2.2 Eligibility

Our key recommendations are that:

- NDM customers should not be eligible to participate;
- Gas generators and gas producers, who already have a "route-to-market", should not be eligible to participate; and
- All other DM customers (both NTS and GDN connected), should be eligible to bid, unless this results in a large number of smaller DM customers which NG cannot manage in operational timescales.

Additionally, Ofgem has questioned whether there is a role for aggregators in the market. We see little value add from aggregators, who should not and would not be in a position to repackage prices offerings and risk. There is also a risk that allowing aggregators to play a role would also increase the likelihood of collusion amongst bidders to push up the bid prices. However, it should be noted that if those aggregators are also suppliers, it would be contrary to their interests to facilitate collusion and in doing so, push up prices.

These recommendations apply equally to Options 1, 2 and 3.

NDM customer should not be eligible to bid

The case for excluding NDM customer is clear. Aside from the impracticality of asking NG or the GDN to isolate and load shed lots of small NDM customers in price (merit) order during an emergency situation, it is not possible (cost effectively) to monitor compliance with DSR requests in the absence of daily metering.

Gas generators and gas producers (Supply side) should not be eligible to bid

On balance, we propose that neither gas generators nor gas producers (including storage capacity rights owners) should be eligible to bid. A key rationale for the DSR auctions is that there is a market failure that we are trying to address. Large customers, with a few exceptions, do not have the capability to react to market prices, by curtailing their own demand at times of high prices and selling gas back to the Day Ahead or On-the-day Commodity Market (OCM). It may not be cost effective for them to build up the internal skills, information sources or market access[6] to react to market prices on the occasion of a few peak days when prices exceed their VoLL. Moreover, in order to manage their price risk, they may have negotiated fixed price tariffs with their suppliers, so that they are indifferent to spot prices.

By contrast, gas generators and gas producers are typically already active in wholesale markets, either directly or through agents who are contracted to trade on their behalf (i.e. they have "route to market") and do not need to participate in the DSR market.

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[6] e.g. exchange memberships or access to brokers and to have pre-arranged credit cover

It could be argued that a more economically efficient outcome can be achieved by allowing CCGTs to participate in either the OCM or the DSR and thus preventing market bifurcation, provided the arrangements are designed to ensure that they cannot get "double-dip" benefits[7]. If both markets worked fully competitively one might expect the prices in two markets equalise as NG took balancing actions via the cheapest market until prices equalised, and allowing CCGTs to participate in both markets could aid the smooth functioning of both markets. However, on balance we have a preference for excluding CCGTs from the DSR market because:

- We have concerns about the amount of market power that CCGTs may have, particularly in the DSR market;
- Few industry participants expect the OCM market prices to rise as high as DSR market prices (although in our view nobody has coherently articulated why), so CCGTs may hold back demand to participate in the DSR market to the detriment of the OCM, increasing the likelihood of DSR needing to be called.

In the case of gas generators, such as CCGTs, there is also significant uncertainty about how DSR obligations would interact with obligations under a future capacity payment mechanism, and whether an obligation to provide electricity generation capacity could conflict with obligation to provide DSR in the gas market.

All other DM customers should be eligible to bid, subject to NG operational constraints

Subject to NG's ability to manage the voluntary load shedding of a larger number of customers in operational timescales, we propose that all DM customers be allowed to bid.

In the event of NG invoking its right to call DSR, NG will need to instruct the customer to load shed, communicating either directly or indirectly via the GDN to which the site is connected. As illustrated in Tables 2.2 a, b and c, NG have estimated that 1134 DM customers are connected to GDN networks, and a further 15 to 20 large DM customers are connected directly to NG's National Transmission System (NTS).However, we understand that these numbers are subject to some dispute around the industry and cannot be regarded as definitive.

Moreover, it is expected that a significant number of existing NDM customers may switch to DM metering over the next few years, partly as a result of the Supply licence condition which requires all non domestic customers with an AQ>732k kWhs to switch to an "advanced meter" by April 2014. As and when smart metering is rolled out in the gas sector, the number of DM customers will clearly increase substantially.

NG has expressed a view that communicating with even a the current total of around 1150 GDN and NTS connected customers is impractical in an emergency. They have

[7] They may benefit from "double dip" payments if they are provided with provided a second route to market, being paid for the fair market value of their gas in the spot market and receiving additional payment based upon VoLL of the marginal customer interrupted in the DSR market.

further suggested that communicating with even 360 mandatory and mandatory-unique customers may be infeasible and noted that a large proportion of DM demand is concentrated amongst the largest 50 (or even 15) GDN connected customers and the 15 to 20 NTS connected customers. However, it should be noted that the contribution of the large GDN customers may inflated by a small number of GDN connected gas generators, who would not be eligible to bid. More commentary, provided by NG, on these numbers is set out in Appendix 2.

Tables 2.2a and 2.2b show two different splits of the distribution of the estimated 1134 GDN customers into different size categories.

Table 2.2a – GDN connected DM customers (split by NG category)

NG category	Known information about customer size	Number of sites	Aggregate peak volume (mcm / day)	Average daily mcm / customer
Voluntary	> DM threshold	774	13.64	0.02
Mandatory	approx >0.15 mcm/day	303	23.54	0.08
Mandatory (unique)	[awaiting information on definition from NG]	57	23.44	0.41
Total		1134	60.62	0.05

Table 2.2b – GDN connected DM customers (split by > and < SOQ of 0.46 mcm/day)

Category	Number of sites	Aggregate peak volume (mcm / day)	Average daily mcm / customer
SOQ < 0.46 mcm / day	1119	44.68	0.04
SOQ > 0.46 mcm /day	15	15.94	1.06
Total	1134	60.62	0.05

Table 2.2c- NTS connected industrial customers (excludes gas generators)

Category	Number of sites	Aggregate peak volume (mcm / day)	Average daily mcm / customer
Total	15 to 20	Approx 7	0.3 to 0.5

Source for Tables 2.2a, b and c: NG (provided to ESP by Ofgem)

Other industry participants have the challenged the view that operational management of a large number of bidders is infeasible. A number of people expressed the view that communicating with customers can and should be delegated to the GDNs, and so should not be too onerous on NG. NG has made the counter argument that they also need to monitor compliance by each site with DSR instructions in operational timescales. We also recognise that the complexity of operational management will increase if individual customers are allowed to bid in multiple tranches, so that a single customer may need to be contacted multiple times, as the load shedding requirement increases and NG moves up the DSR merit order.

At the moment, two key uncertainties make it undesirable to provide a firm recommendation on whether the bidding should be restricted to just a subset of larger DM customers. Firstly, NG have not yet been tasked with giving significant thought to how they intend to manage the process, and the implications of that operational requirement for how many customers / customer tranches they can feasibly manage.

Secondly, we do not know how many of the larger customers will bid at relatively low VoLLs, and would not want to set a size threshold too high, only to find there is limited response from larger DM customers below the average domestic VoLL. Our proposal (set out in Section 2.7), to ensure that any DM customer who is involuntarily load shed would not receive a payment, is likely to incentivise even those DM customers with a VoLL above average domestic VoLL to bid just below the average domestic VoLL to avoid unpaid involuntary load shedding. However, it is undesirable if high VoLL large DM customers are load shed in preference to low VoLL smaller DM customers because the smaller DM customers were not allowed to participate in the auction. Thus we recommend that Ofgem maintain the line that all DM customers will be eligible, and in the meantime challenge NG to:

- Define the process for managing voluntary load shedding; and
- To come up with a more definitive estimate of the number of customers, or customer tranches that can be managed.

At that point Ofgem can make a decision on whether to restrict bidding to a subset of larger DM customers, or to allow NG to disallow bids from DM customers below a certain threshold, in the event that they get a pre-defined response rate from DM customers above the threshold.

2.3 Bid Parameters

We see two key issues in the design of the bid parameters:

- One or Two-dimensional auction. Should auction bidders bid on a single price dimension (an Exercise Fee only, Option 1 and 3[8]) or on two price dimensions (both an Option Fee and an Exercise Fee, Option 2)?
- Tranche bidding. Should auction bidders be allowed to bid in DSR tranches, e.g. bid at different prices for the first x therms / day of load shedding, and at a higher price for the next increment of y therms per day of load shedding?

One or two dimensional auction

The two potential price dimensions under consideration are:

- Exercise Fees. Exercise Fees would be paid if and only if the customer is called to provide DSR, and is paid per occasion (day) that the DSR customer is instructed to provide DSR. The rationale for the Exercise Fee would be to allow the customer to recover any opportunity cost incurred when NG exercised its DSR right. The opportunity cost is likely to include the incremental cost of the back-up fuel over the cost of gas and/or the opportunity cost of lost industrial production; and
- Option Fees. Option Fees would be paid for the right to call the DSR, regardless of whether NG ever exercised the right to call the DSR. The rationale behind paying an Option Fee upfront is that it allows the customer to recover the cost of any investment required to enable it to provide DSR. This is assumed to be principally back-up fuel storage and burning capability, and this cost would be incurred regardless of whether NG ever exercised the right to call the DSR.

As stated above, we have defined three key options that are worthy of detailed consideration: Option 1, the single dimensional option; Option 2, the two dimensional option favoured by the industry and which is reflected within UNC 435; and Option 3, which whilst it would result in the payment of two fees, is still a single dimensional auction.

In principle, it would also be possible to have multi-dimensional auctions whereby NG takes decisions on which bids to accept based on factors other than price, such as how quickly DSR can be provided, the duration that the DSR can be provided for etc. In such a case different bidders are essentially providing different products. For DSR auctions we see benefits in keeping things simple and having a single product creating an unambiguous price signal to feed into the cash-out price. If there are multiple products based upon different response times or durations of DSR interruption, then it is not necessarily clear which product should set the cash-out price. The introduction of multiple products would also impose an extra burden on potential bidders in trying to work out which product to bid for, and would make the auction more difficult for NG to administer. Whilst neither the extra burden on bidders or NG are show-stoppers, these

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[8] Whilst under Option 3 successful bidders would receive an Option Fee and an Exercise Fee if called to deliver DSR they actually bid only one parameter, so Option 3 is a one-dimensional auction like Option 1.

two factors, combined with a desire to have a clear and unambiguous marginal price to feed into cash-out, leads us to recommend a single product auction. We discuss product design in Section 2.4.

The key pros and cons of Options 1, 2 and 3 are summarised in Figure 2.1 below.

Figure 2.1 – Pros and cons of Options 1 and 2

	Pros	Cons
Option 1: Exercise Fee only, auction determined	• Simple, quick, cheap to implement- no need for bespoke software. • No credit issues (since no upfront payments such as option fees) • Can facilitate bid updates between auctions	• Weakest investment incentives
Option 2: Option Fee and Exercise Fee auction determined	• Likely to provide strongest incentives to bid than Exercise Price only auction • Relatively simple to implement, especially if no "scoring rule"	• Commitment to option fees hard to justify when security standard already met, and hard to determine optimum investment in option fee • Some credit risk- if have been paying option fees, but bidder unable to deliver. Mitigate via monthly payment, loaded in winter months • More issues associated with re-bidding Exercise Price post auction • Overall greater complexity
Option 3: Option Fee set ex ante, Exercise Fee auction determined	• Relatively strong investment incentives, but risk of setting Option Fee to high / low • Simple, quick, cheap to implement- no need for bespoke software.	• Commitment to option fees hard to justify when security standard already met, and hard to determine optimum investment in option fee • Some credit risk- if have been paying option fees, but bidder unable to deliver. Mitigate via monthly payment, loaded in winter months • More issues associated with re-bidding Exercise Price post auction

In our view, a key advantage of Option 1 is that Payments to DSR providers will only be made, if and when DSR is called for[9]. Given that the 1 in 20 security standard is currently being met without DSR, it is anticipated that DSR will be required approximately once in twenty years[10], whereas under Option 2, payments would be made every year.

The industry has suggested that a budget of £10-20m[11] be set aside for Option Fee payments under UNC 435, which is a variant of Option 2. Certain elements of the industry have argued that it will be necessary to pay Option Fees in order to attract meaningful volumes of DSR bids. From a conceptual point of view, clearly it will be more attractive for customers to invest in back-up fuel if they are paid Option Fees. However,

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[9] Costs associated with holding the auction and subsequently changing NG's internal processes will be incurred once the decision is made to proceed with the DSR auction regime, regardless of whether NG ever exercises its right to call the DSR contracts. As discussed in Section 4 we think that the costs of holding the auction itself will be small. It is outside our scope to comment on the costs of changing regulations and of changing NG's internal processes.

[10] We recognise that the security standard relates to load shedding and that a GDW will be called before loadshedding occurs, nevertheless, we anticipate that the requirement to call for DSR would occur in very few years as things currently stand.

11 Centrica suggestion in the context of UNC435.

in our view, there is limited data to support the contention that meaningful volumes of DSR would be forthcoming only if Option Fees were paid. At a theoretical level, one would expect bids to be forthcoming from the following types of DM customer (subject to appropriate incentivisation):

- Customers with existing back-up fuel capability. Unfortunately there is a paucity of data on the numbers of DM customers that already have back-up fuel capability. During stakeholder consultation the representative of major energy users suggested that some major industrial customers already have back-up fuel capability, although this evidence was anecdotal and not backed by statistics;

- Industrial customers who find that their production becomes uneconomic at high gas spot prices, although if they are on fixed price tariffs or are otherwise hedged, their production economics may not be affected[12]; and

- Industrial customers who have a relatively low opportunity cost of gas if interrupted only for a short period, e.g. if they have substantial stock on hand, and weak demand for their product.

<u>In our view, any commitment to Option Fees of the magnitude of £10-20m is hard to justify at a time when GB meets prescribed security of supply standards[13]. We recommend that NG test the market first to ascertain what the market response is to an Exercise Fee only auction</u>.

We consider that Option 3, where the Option Fee is administratively determined, rather than market determined, has additional risks. It may be that the administratively determined fee will be set significantly higher than necessary, and this may not be discoverable, even after the auction.

In addition to the cost commitment associated with Option Fees under Options 2 and 3, we have a number of subsidiary reasons for recommending Option 1:

- Simplicity (compared to Option 2). Overall, an Exercise Fee only option is much easier to administer and it is easier to decide who has won the auction as there is no need to trade-off low Option Fee bids against high Exercise Fee bids and vice-versa. However, the greater complexity associated with an Option and Exercise Fee auction is far from insuperable and there are numerous examples of Option and Exercise Fee auctions/tenders in the sector, such as GDN interruptibility auctions and NG power ancillary service procurement.

- Reduced gaming risk (compared to Option 2). Scoring rules which are typically introduced to allow the auctioneer to choose between bids with low Option Fees and

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12 In theory, these customers could respond to spot price signals and selling back power to the Day Ahead and / or OCM, but the fact that they do not is part of the market failure that we are trying to address

13 We note that in theory it would be possible to justify investment in Option Fees, even if the 1 in 20 security standard is met. An expected Value of Lost Load (in £m) could be calculated associated with the "tail risk events" beyond the 1 in 20 security standard, and any investment in Option Fees could be justified if the reduction in the expected Value of Lost Load resulting from "tail risk events" was greater than the investment. However, the assessment of probabilities of tail risk events is notoriously unreliable.

high Exercise Fees and vice-versa (as would be the case under Option 2) have been shown in academic literature[14] to be gameable, particularly where a linear scoring rule is used to solve what is a non-linear problem, and more particularly where the scoring rule is disclosed to bidders before the auction. This problem is more than just a theoretical possibility, California Power Reserve auctions have been shown to have suffered from this problem. We note however that in the absence of reasonable competition to provide DSR, gaming is a residual concern under both Options 1 and 2. We discuss these residual concerns in Section 3.

- Lack of credit issues. There are no concerns with credit risk under Option 1, as Payments to DSR providers are made after the event. Under Options 2 and 3, there are some credit issues associated with making Option Fee payments upfront to DM customers who do not subsequently honour their DSR commitments (see Section 3.3).

Tranche bidding

Tranche bidding can in principle apply to both the Exercise Fee and the Option Fee[15], but in line with our recommendations above, we focus on the Exercise Fee.

Allowing bidding in tranches is desirable, subject to any practical constraints. Tranche bidding would enable bidders, whose VoLL is a function of the depth (i.e. therms /day) of their load shedding, to reflect their cost structure in their bids. For instance, if it is relatively costless for them to cut their demand by (say) 50%, but very costly for them to turn off completely, then allowing bidding of two tranches could enable NG to call the cheap first tranche but not the costly second tranche[16]. Feedback from the industry suggested that there was strong support for allowing bidding in tranches, as a number of large DM customers need to maintain a baseload of gas consumption, but could load shed some part of their demand at significantly lower cost than load shedding the entirety of their demand.

The practical constraints that need to be considered are:

- How is the partial demand reduction measured / monitored? This issue is a particular case of how DSR is measured in general (refer to Section 4 on Implementation Issues);
- Does scheduling DSR in tranches impose extra constraints on the number of DSR providers that NG can manage in operational timescales in an emergency? However, we do not see this issue as being a reason not to allow tranche bidding by the largest DM customers, rather it might place a tighter constraint on the threshold at which

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[14] See Chao and Wilson- Multi-Dimensional Procurement Auctions for Power Reserves: Incentive-Compatible Evaluation and Settlement Rules (1999)

[15] For instance, the rationale for having tranche bidding for an Option Fee might be because a bidder may choose not to have back-up fuel for any discretionary part of its consumption (and hence have zero investment cost) but need to invest in back-up fuel for a minimum baseload fuel consumption

[16] Typically where bidding in tranches is allowed, bidders are required to bid a monotonically increasing price function

DM customer become eligible to bid, and might impose limits on the minimum tranche size that can bid.

These issues will need to be resolved during implementation through discussion with NG and the rest of the industry.

2.4 Product Design

We recommend that, at least initially, Ofgem focuses on a single simple product which is easy to understand, for two key reasons:

- One key objective is to define a single market VoLL to reflect in the cash-out price, on any given day[17]. If multiple products with different terms and conditions and hence potentially different clearing prices are defined, it creates potential ambiguity in the VoLL to use in cash-out on any given day; and
- Another key objective is to maximise participation. There is already uncertainty about the appetite from DM customers to bid in any DSR auction, and whether they will be prepared to invest the time and effort to understand a product that supposedly has a less-than-1 in 20 chance of yielding any payback in any given year. Therefore, we recommend minimising that investment in time required by DM customers, by focusing on a single, easily understood, product, with clearly defined rights and obligations.

Option 1 product design

Under Option 1, which is not predicated on any investment by the DM customer, we would envisage that the contract auctioned would be for a single Gas Year, so any contract would span the entire period of the winter peak demand.

The product design will need to be discussed in more detail with NG and DM customers, in order to strike the right balance between offering an attractive product for DM customers whilst providing maximum flexibility and operational efficiency for NG in balancing the system. The detailed design features are likely to include some or all of the following specifications:

- The maximum number of days the DM customer can be required to provide DSR, including defining: the number of consecutive days; whether there should be limits on the number of aggregate days of interruption in a prescribed period; and the minimum period between DSR calls.
- How many advance hours / days advance notice will be given of the requirement to shed load.

We note that in reality the VoLL of a DM customer is unlikely to be a constant £/therm. For many customers the VoLL is likely to be a function of the duration of interruption and / or how much of their load they are required to shed.

[17] the market VoLL may vary from day to day of an event depending upon how much DSR is required

For some industrial customers, there is likely to be a much larger opportunity cost per therm if they are required to turn off for a longer period, such that the plant cools beyond maximum tolerance levels, or if they are not allowed to operate the plant at minimum baseload level. Facilitating a minimum baseload level of operation via bidding is discussed in Section 2.3, but optimum participation may depend on the duration of interruption, not just the depth of interruption in therms or mcm per day. Therefore, setting an appropriate maximum duration of interruption may be necessary to encourage DM customers to bid at a price that reflects the VoLL for a short period of interruption. Once this period of interruption is over, they will drop out of the merit order and the requirement to engage in voluntary load shedding will be passed on to someone else higher in the merit order.

Conceptually, it would be possible for DM customers to bid a VoLL that was function of the duration of interruption, and for NG to re-optimise against this function each day depending on the duration that each customer had already been interrupted for. However, the additional cost and complexity introduced does not appear proportionate for what is expected to be a rare event.

Unfortunately, different industrial processes / technologies may lead to VoLLs that vary quite differently as a function of time, and Ofgem will need to work with DM customers and NG to define an appropriate compromise.

Option 2 and 3 product design

The key difference between the product under Option 1 and Option 2/Option 3 is contract duration. Since Options 2 and 3 are predicated on the assumption that investment is required, we would expect contracts under Option 2 to have a longer duration than contracts under Option 1 (e.g. 3-5 years as opposed to 1 year). The representatives of major energy users stated that obviously their preference would be for a duration which would cover the life of the plant investment in back-up fuel. However, other participants recognised that a 10 to 20 year life of plant contract duration was unrealistic. Whilst such commitments may be the norm in electricity generation capacity mechanisms, it appears that there would be limited appetite to commit to such payments at a time when the security of supply standard is already met.

Any contract auctioned under Option 2 or 3 may also need to have long lead times between the auction and the start of DSR obligations, to allow time for the successful auction bidder to invest in back-up fuel capability – again an arrangement similar to that in electricity generation capacity auctions. The representative of the major energy users suggested that lead times between the auction and the start of the DSR obligation may not be necessary because a number of large DM customers already have back-up fuel capability. We note that this reinforces the view that it is not necessary to commit to option fees, and that paying option fees would lead to “deadweight” costs, merely helping customers to recoup the costs of investment they have already made or helping them fund replacement investment that they would make anyway.

In the event of an Option 2 or 3 type auction, we still recommend that Ofgem consult with the industry on the detailed features of the product design (i.e. maximum interruption durations, the ability to bid in tranches, notice periods). Even with the presumption that a high proportion of bidders have back-up fuel capability, their VoLL may still be a function of the duration of interruption, albeit a different function[18].

2.5 Auction Format

The industry has expressed a preference for a simple form of auction, i.e. a sealed bid tender, as opposed to a more sophisticated dynamic auction. We agree that a simple sealed bid tender format is preferable for the DSR auctions, rather than more complex dynamic auction forms. We explain the rationale for our conclusion below, before going on to describe how we envisage the tender and selection process would work under a simple sealed bid tender.

Rationale for supporting a simple sealed bid tender

The key features influencing the optimal format of this auction are:

- There is a single product being auctioned, not multiple substitutable products with bidders seeking to optimise their choice between different products. Hence, there is no need for a simultaneous auction, which is often facilitated by dynamic multiple round bidding;
- There are expected to be multiple winners, rather than a single winner;
- The auctioneer (NG) is trying to procure DSR at the minimum price (not extract the maximum price for the bidders); and
- The auctioneer does not know at the time of the auction how much DSR will be required (if at all), as this will depend upon supply and demand shocks of unknown magnitude. Therefore, the auctioneer is trying to obtain a "DSR supply curve" up to maximum volume or a reserve price.

Given there are potentially multiple winners, and that the auctioneer is trying to obtain a supply curve, a simple English auction where the price is bid up until one remaining bidder prevails is not applicable. Equally, a simple Dutch auction where the price is bid down until a single bidder "cracks" and puts in a winning bid is not applicable.

A simple sealed bid tender will clearly enable NG to construct a supply curve by simply ordering the bids, and we illustrate how we envisage that happening under the heading "recommended process".

The most applicable form of dynamic auction, which would also allow NG to construct a DSR supply curve, is a descending clock auction with multiple rounds. In a multiple round descending clock auction, the auctioneer determines a start-of-round price and an end-of-round price, and asks bidders to submit bid volumes between those prices. If aggregate supply exceeds aggregate demand, the auction moves on to the next round, decrementing the prices until aggregate supply is less than or equal to aggregate demand. In the case of DSR auctions, where we are trying to construct a full supply curve, this process would continue until the last bidder drops out. More detail on the

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18 driven by practical limits on replacing back up fuel stocks at times of peak demand when logistical chains are likely to be disrupted by transport interruptions

operation of descending/ascending clock auction and other auction formats is set out in Appendix 1.

Dynamic auctions are clearly more complex to administer and to participate in than simple tenders, particularly where there are a high number of potential bidders[19].

There are a number of potential advantages of dynamic auctions, which have led to their common adoption in the power and gas sales sector. These are as follows:

- Dynamic auction are typically used where a key objective is to promote price transparency, particularly where auctions are mandated as a competition remedy to combat the perceived market power and information asymmetries associated with a dominant incumbent. In this regard, dynamic auctions offer the greatest transparency and, by contrast, sealed-bid auctions are comparatively opaque;
- A descending / ascending-clock auction is a particularly simple and effective format for obtaining price discovery. Another frequent objective of power and gas auctions is to jumpstart the development of wholesale power or gas markets, the promotion of price discovery, which in turn facilitates wholesale transactions outside the auction, is another reason for the adoption of descending / ascending-clock auctions.
- It has been observed that bidders will be reluctant to reveal their valuations truthfully in an auction where the seller may have the opportunity subsequently to use the information against the bidders (e.g. a minor wholesale market player bidding to a dominant market player). By contrast, a dynamic auction avoids this problem, as it does not require the high-value bidders to reveal their true valuations if the bidding stops as soon as the aggregate demand becomes equal to supply; and
- The descending / ascending-clock auction format scales particularly well to a simultaneous auction of multiple products, which are frequently present in power and gas auctions. By contrast, independent sealed-bid auctions perform less well when substitutes (for example, base-load products of different durations) or complements (for example, base-load and peak-load products) are auctioned together.

However, whilst these factors explain the prevalence of dynamic auctions in power and gas markets, none of the factors apply in the case of the DSR auctions. The bidders are not wholesale market participants (a market failure we are trying to address), and we are not trying to level the informational playing field between a dominant wholesale market incumbent and would-be competitors, who fear that information gained by the "buyer" NG could subsequently be used against them in later trading activity. It is for the good of the market as whole that we want bidders to reveal their true costs, all the way along supply curve. Finally, we are only proposing to auction a single product, so the issues of substitutes and complements do not arise.

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[19] As discussed in Section 2.2, depending on eventual decision on eligibility criteria, there are likely to be 50, 100 or even over a thousand potential bidders. Whilst in principle, software can be designed to accommodate multiple round bidding, multiple round auctions are not typically employed in auctions with hundreds of bidders, and the high number of bidders is likely to require the development of more robust software and communication links for multiple bidding to be conducting within reasonable timescales e.g. within day

Therefore, since the more complex dynamic forms of the auction do not deliver benefits in relation to the objectives of the DSR auction, we recommend the adoption of the simple sealed bid format, not least given the relatively low level of sophistication of bidders.

Recommended process

Under Option 1 we envisage that the process would work as follows:

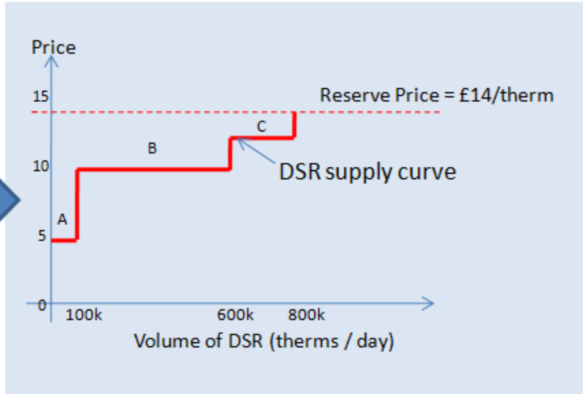
1. Prior to the auction, NG would agree a maximum Exercise Price at which bids would be considered, i.e. the Reserve Price (see discussion of the Reserve Price in Section 2.7);
2. This price would be notified to Eligible Customers, and Eligible Customers would be informed that any bids above the Reserve Price would not be considered. Moreover, Eligible Customers would be informed that any Eligible Customer who failed to submit a bid below the Reserve Price would not be paid in the event of involuntary load shedding, which provides the incentive to submit a bid;
3. Some Eligible Customers would then bid, and NG would construct a DSR supply curve out of those bids, as illustrated in Figure 2.2, rejecting bids above the Reserve Price.

Figure 2.2 – Creation of DSR supply curve

Assume 4 bids submitted, 3 below Reserve Price of £14/therm

DM Customer	Volume (therms / day of DSR)	Price (£/therm)	Status
A	100,000	5	Accepted
B	500,000	10	Accepted
C	200,000	12	Accepted
D	300,000	15	Rejected

NG rejects Bid D, and creates a DSR aggregate supply curve ready in case of a GDW



2.6 Auction Timing and Frequency

Under Option 1, we propose that the auction be held annually before the start of the Winter, the period when DSR is most likely to be required. In practice, DSR is most likely to be required during a few peak Winter months in December to February/early March, but since part of the purpose of DSR is to provide security cover against production outages as well demand spikes, the contract duration should be the entire year.

Ideally the auction should be held in close proximity to the time at which DSR is mostly likely to be required (i.e. close to the start of the Winter), when DM customer will have the most informed view of what their VoLL will be during the period when they are mostly to be required to provide DSR[20]. A logical timing would be for the auction take place just before the start of the Gas Year (1 October) for a contract to apply for the entirety of the Gas Year.

One way to mitigate the risk to bidders of the unpredictability of their forward VoLL for the entire year is to allow them to submit periodic updates (e.g. monthly) if they wish to do so.

Under Options 2 and 3, we would also propose that auctions are annual. However, the auctions might need to take place up to a year or two prior to the customer's commitment to provide DSR starting, if the objective of providing an Option Fee is to facilitate investment in plant to provide back-up fuel. Clearly the issue of uncertainty over the opportunity cost of DSR (in this case it is likely to be a function of the market price of back-up fuel) also applies under Options 2 and 3, but under Option 2 and 3 the issue of having certainty of funding for investment is likely to be paramount.

Since we have proposed contracts of 3-5 year duration, clearly annual auctions would result in overlapping contracts. We do not foresee any issues with overlapping contracts as such practice is common in long term capacity auctions, with the annual frequency of auctions allowing the auctioneer to fine tune its requirements year on year.

Under Option 1, we envisage that it would be possible to allow successful bidders to submit updated Exercise Fee bids on a periodic basis (e.g. monthly, to enable them to mitigate the risk that there are material changes to their VoLL). Such an approach of allowing monthly updates would be analogous to having a monthly auction and hence create a more dynamic DSR market, but with a much lower administration cost for those bidders who have no desire to update bids between annual auction rounds.

Under Options 2 and 3, where successful bidders also receive an Option Fee, we see significantly more risk of gaming associated with allowing bid updating. There is the potential for gaming if successful bidders are continuously receiving an Option Fee, but are then able to adjust up their Exercise Fee bids close to a point in time when they think that NG are most likely to call the exercise right, so that they have received Option Fees up to that with little intent of actually providing DSR.

[20] The difficulty in forecasting VoLL is not unique to Option 1, although the issues are slightly different, depending on whether the customer has backup fuel or not. If the customer has no backup fuel, then the uncertainty is more likely to relate to whether the company has sufficient stock to interrupt production with loss of sales and values may be quite binary. If the customer has back-up fuel, the uncertainty relates to the market value of replacement fuel at the time. Close to the time of DSR provision, companies will have a better informed view of back-up fuel replacement costs (which will are hard to hedge given the volume uncertainty) and / or how the available of stock relative to demand for their output will reflect the opportunity cost.

2.7 Reserve Price / Volume Limits

We have been asked us to address the issue of whether there should a Reserve Price set, or whether alternatively there should be a limit on the volume of DSR that NG procures.

Option 1 approach

Under Option 1, where no Option Fee is payable, there are the following potential approaches to reserve prices / volume limits:

- Option A: No reserve price or volume limit;
- Option B: Set a reserve price / de-facto reserve price equal to the average domestic VoLL; and
- Option C: Set a volume limit on the amount of DSR to be procured

Under Option A, bidders would be free to bid whatever price they choose, including a value above the average domestic VoLL. The rationale for allowing bids above average domestic VoLL is that operational constraints may lead to load-shedding of a DM customer with a VoLL greater than the average domestic VoLL, in preference to NDM customers. We understand that in practice, the only way to load shed NDM (whether domestic or small industrial and commercial) customers is to isolate a part of the distribution network. Once isolated, it may take several days (or possibly weeks) to restore service to all isolated customers. Thus supposing NG knew it would take 14 days to restore service to an isolated network, they may choose to call DSR from an Eligible Customer who had bid £195/therm, i.e. just less than 14 days x £14 = £196, if they knew that the Eligible Customer would only be required to provide DSR for one day.

However, we have significant concerns around Option A. We do not think that it is appropriate that a very high VoLL, such as £195/therm should feed into cash-out price. Whilst in theory it may be arguable that £195/therm is the genuine marginal cost of maintaining system security in this case, it would make the cash-out price massively volatile and impose excessive risks on market participants. Such a move can be expected to be resisted strongly by the industry, although that in itself should not be a reason to reject this option. Moreover, it would make the cash-out price very dependent on judgement calls taken by NG when acting under stressed conditions[21].

We recognise however that it would possible for any bids, which are in excess to be excluded to be from the cash-out price setting process, for instance they could be deemed to be "out-of-merit" order and hence not setting the marginal cash-out price.

[21] In theory, given these operational constraints, if NG had knowledge of the VoLL of the remaining DM customers, economically optimal outcomes would require NG to make a probabilistic assessment of how long the DSR requirement was likely to last and optimise a trade-off between load shedding high VoLL DM customers for a short period or lower VoLL NDM customers for a longer period. However, in practice we cannot see NG realistically being able to make such a trade-off in an informed way.

However, there is then the question of how DM customers who had bids above average domestic VoLL would be remunerated. If they were paid their bid price, we would have significant concerns about the potential for market power abuse. If they were not paid their bid price, we would have significant doubts about whether they would bid accurately. For instance, if the payment was capped at £14/therm, DM customers with VoLLs greater than £14/therm would merely bid a very high price to try and avoid being load shed. This would defeat the objective of not having a reserve price, i.e. to continue to get load shedding in an economic merit order amongst DM customers with VoLLs in excess of £14/therm.

Therefore our preferred option is Option B, to set a *de-facto* reserve price by capping accepted bids at the average domestic VoLL. Any Eligible Customers, who were "involuntarily" load shed, having bid a VoLL above the average domestic VoLL, should not be paid. This would give them a strong incentive to bid just below the average domestic VoLL to ensure that they do not involuntarily load shed without payment. The industry is concerned that this design will lead to clustering of DM customer bids just below £14/therm. We agree that it will lead to a clustering of bids from high VoLL DM customers at this level, but see no problem with this outcome, which merely reflects the reality of the order in which high VoLL DM and NDM customers will be load shed. We do not agree that DM customers with low VoLLs will necessarily bid up to the £14/therm *de-facto* reserve price- it depends upon the level of competition. We recognise that in the initial auction bidders may be bidding from a relatively uniformed point of view, but we would hope that over a period of repeated annual auctions bidders would come to see that the economically rational approach is for them to bid their true VoLL under option B.

An alternative approach that has been suggested is to set a volume cap, Option C. The proponents of this approach (who are predominantly interested in lower price outcomes) argue that by setting a maximum volume of accepted bids it may be possible to "scare" bidders into bidding a low price, because they think that not all bids below average DM VoLL would be accepted, and they run the risk of being involuntarily load shed without payment. However, such an approach runs the risk that the volume limit is set at an inappropriate level. For instance, if the authority responsible for setting the volume limit under-estimates the amount of low VoLL DM load, the limit will set too low, and there will be willing DSR that is not accepted- an inefficient outcome, which could materially limit the benefits of the auction and increase the probability of a GDE. This risk is enhanced by the fact that in advance of the fist auction, nobody really knows how much low VoLL DSR will be offered. Conversely, if the limit is set deliberately high to mitigate this risk, then if bidders know the limit will not bind, then Option C will become either Option A or Option B (depending on whether there is also a price cap).

<u>In summary, in our view the simplest and most effective approach would be to maintain a line that any eligible customers who did not submit a bid below the average domestic VoLL would not be remunerated if they were load shed, on the grounds that they are providing no new security of supply benefits. Such an approach sets a *de facto* Reserve Price.</u>

This approach gives Eligible Customers a stronger incentive to bid, which is desirable. We recognise that it is likely lead to a distortion in bidding behaviour amongst high VoLL Eligible Customers, causing them to cluster their bids just below the average domestic

VoLL to minimise their chances of being asked to provide DSR, whilst avoiding the possibility that they will be involuntarily load shed without payment. Whilst this may lead to a distortion in bidding activity, it is not likely to change the order in which they would have been load shed, since it is those larger customers who would have been load shed first anyway under involuntary load shedding.

Option 2 and Option 3 approach

The key difference with Option 2 is that there should be a limit to the commitment to pay Option Fees, which are committed to regardless of whether DSR contracts are eventually exercised. Two approaches can be considered: 1) setting a monetary budget for Option Fees; or 2) setting a volume limit. We recommend the former since we are trying to limit the £ spend and it does not make sense to curtail the volume of bids if the Option Fee is zero or very low.

Under this approach, NG would accept all bids in Option Fee rank order (subject to the Exercise Price also being below any Reserve Price) until the Option Fee budget had been exhausted (so clearly all those who bid a zero option fee would be accepted) and pay them on the basis of their Option Fee bid. These bids would then be ranked in order of Exercise Fee to form a DSR exercise merit order to be called in the event DSR was actually needed on any given day.

Under Option 3, where Option Fee is administratively determined, there is no meaningful distinction between specifying a monetary limit and a volumetric limit since they are directly related.

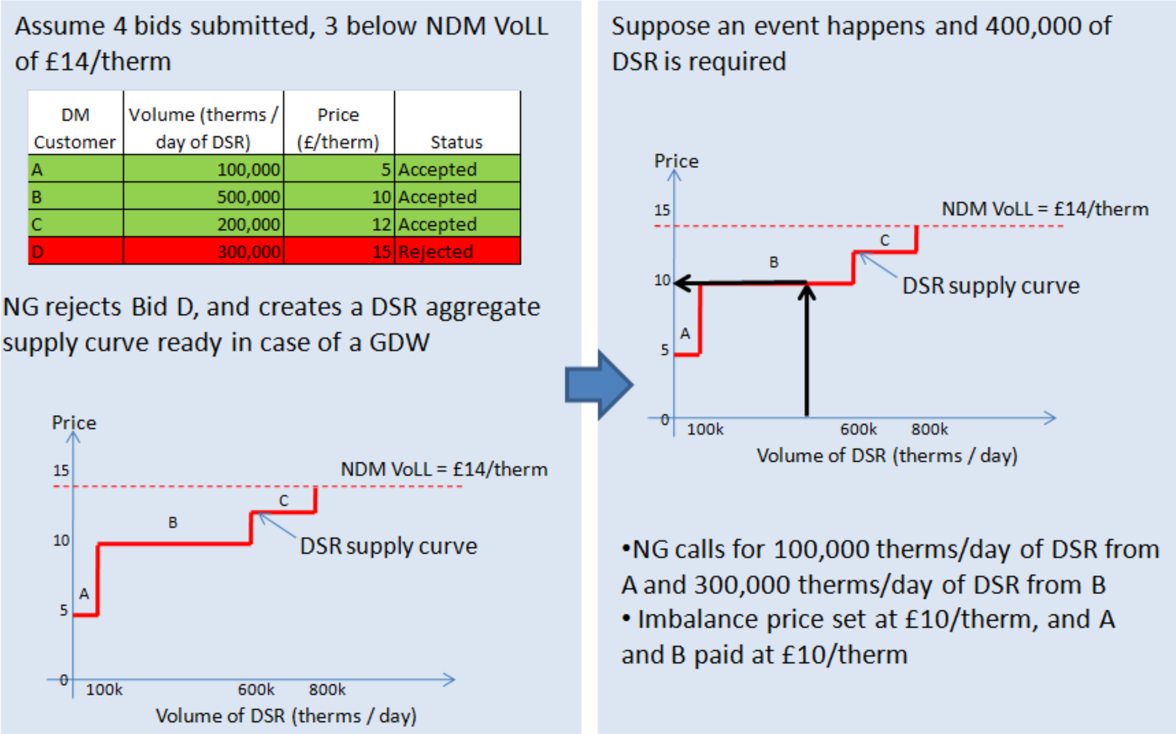
2.8 Exercise of Bids

Having used the auction results to generate a DSR supply curve, no further action is required by NG until an event occurs, other than periodic updating of bids, if updating is permitted.

If and when DSR is required:

- NG should instruct DSR contracted customers to load shed in merit order until sufficient DSR has been scheduled, except where transportation constraints dictate otherwise;
- As illustrated in Figure 2.3, the highest price DSR bid scheduled on the day, with the exception of those scheduled for transportation constraint management reasons, should be deemed to set the market clearing price; and
- If DSR is required on subsequent days (with either more or less DSR scheduled) then the market clearing price could potentially be different on the subsequent days.

Figure 2.3: Exercising bids and setting market clearing price



DM Customer	Volume (therms / day of DSR)	Price (£/therm)	Status
A	100,000	5	Accepted
B	500,000	10	Accepted
C	200,000	12	Accepted
D	300,000	15	Rejected

2.9 Payments for DSR Service and Failure to Interrupt Charges

We recommend the following principles be reflected in the Payments for DSR Service and Failure to Interrupt Charges under Option 1:

- Eligible Customers who provide DSR on any given day should be paid an Exercise Fee at the market clearing price for that day, i.e. pay-as-clear rather than pay-as-bid;
- Any Eligible Customer involuntarily interrupted who did not make a bid at a lower price than the reserve price will not be paid for being involuntarily interrupted (for rationale, see the discussion of Reserve Price in Section 2.7);
- There should be significant charges for failure deliver DSR when instructed to, high enough to incentivise non-delivery. Clearly failure to deliver DSR needs to be appropriately defined (see Section 4) so that actions which deliver system security benefits such as self-curtailment are not disincentivised.

In the case of Option 2, clearly winning bidders would receive an Option Fee in addition to the market clearing price. As a result, penalties for failing to deliver DSR if instructed need to be larger than Option 1 penalties. They need to be sufficient to discourage a customer bidding to receive Option Fees whilst having no intention of delivering against the DSR contract, gambling that they will never be called to deliver during the duration of the contract.

Pay-as-clear versus pay-as-bid

We note that during industry consultation we received a number of questions on why we proposed a pay-as-clear approach as opposed to a pay-as-bid approach and industry participants noted that the GB gas market balancing arrangements currently generally apply pay-as-bid rules. Whilst we are not strongly committed to a pay-as-clear approach for DSR provision, as opposed to pay-as-bid, we recommended the pay-as-clear approach because:

- It provides better incentives on Eligible Customers to bid their true cost, since the chances that their payment will be affected by what they bid is much reduced (it only matters if they are the marginal DSR bid scheduled that day) With pay-as-bid, a bidder's incentive is to guess the clearing price and bid that. With full information, this leads to the same outcome as pay-as-clear. However, where uncertainty is apt to be great, then poor guesses of the clearing price can lead to inefficiency. With pay-as-clear, the bidder can bid their true cost with greater confidence that they will not lose value as a result of under-estimating the market clearing price, since only the highest accepted bid affects the price received by all bidders. As a result, bidding is simplified and economic efficiency is improved;

- It provides the right dynamic incentives over a period of years to Eligible Customers to innovate to reduce the cost of DSR provision and yet still bid their true costs whilst retaining the benefits of their innovation. If an Eligible Customer innovates and thus reduces the opportunity cost of DSR provision, it can reflect this reduced cost in its bid (which promotes economic efficiency), and if the bids of other bidders have not changed, the market clearing price will not change. Thus the Eligible Customer benefits from the increased difference between the market clearing price and its cost of service provision, which provides the dynamic incentive to innovate; and

- It provides symmetry with our proposed approach of reflecting the marginal cost of DSR (i.e. the most expensive bid scheduled) into cash-out prices.

2.10 Cash-out price treatment

The market clearing price (the cost of the most expensive bid scheduled that day, other than for constraint management reasons) should be reflected in the cash-out price. That way the cash-out price reflects the marginal cost of actions taken by NG to balance the system, inclusive of DSR, which is the right economic signal. Alternatives such as reflecting the average price of bids scheduled, coupled with a pay-as-bid approach, do not send the right economic signals.

The cash-out price need not necessarily be equal to the DSR market clearing price (for instance, if OCM prices are higher), but most participants thought that it was unlikely that prices in the OCM market would rise as high as DSR bids.

3. Residual risks and unintended consequences

In this Section we review residual risks and potential unintended consequences associated with the proposed DSR auctions, assessing the risks and how they can be mitigated.

3.1 Level of engagement, participation and competition

Shippers / suppliers have expressed concerns that an explicitly published average domestic customer VoLL (e.g. £14/therm) will serve as a guide price for eligible customer bids, and that eligible customer bids will not bid their true VoLL. They have expressed a concern that even eligible customers with true VoLLs substantially lower than £14/therm would pitch their bids just below £14/therm rather than at their true VoLL.

However, this view must be reliant on a belief that levels of engagement, participation and competition amongst larger DM customers will be low. It is true that if eligible customers consider that the chances of DSR actually being required are very small they may:

- Not bother participating in an Exercise Fee only auction, considering that it is not worth the investment in their time estimating their VoLL and submitting a bid; or
- Participate in the process to the extent that they submit a minimally compliant bid to avoid the chance of unpaid involuntary load shedding without bothering to engage sufficiently to work out their true VoLL.

However, if the larger DM customers form a reasonable view of their VoLL and expect other larger DM customers to do the same, then it would be rational for them to bid close to their true VoLL[22] rather than around the £14/therm because:

- At the time of bidding, a DM customer will not know how much DSR will be needed in the event;
- Assuming there is sufficient DSR, any bidder who bids higher than VoLL runs the risk that the market clears below their bid, but above their VoLL due to competitive pressure, which means they lose value; and
- The pay-as-clear approach means that they are not likely to gain value by bidding an inflated price. In a pay-as-clear market you can only gain value if you are the marginal bidder, and only then by bidding up to the value submitted by the next highest bidder. This requires you to know the value of the next highest bid and by limiting price feedback during the auction that risk can be minimised.

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[22] We acknowledge that our proposed design may encourage larger DM customers with VoLLs higher than the £14/therm to bid below the £14/therm level to avoid unpaid involuntary load shedding (although we contend that this is less likely to distort actual load shedding patterns- see Section 2.7)

Whilst we cannot guarantee that large customers will participate in an Exercise Fee only auction (nobody can be sure unless the market is tested), we do not agree with the logic employed by some industry participants who argue that participation will be low.

Ultimately, one of the best ways to mitigate the risk of low participation, albeit at a cost, is to offer Option Fees, since with Option Fees successful bidders are guaranteed to extract some value. However, within the context of an Exercise Fee only auction there are a number of ways to mitigate risk of low participation / engagement including:

- Ensuring that the new regime and the incentives it imposes on eligible customers are appropriately communicated;
- Appropriate product design (see Figure 3.1 and refer back to Section 2.4); and
- Allowing customers to update bids between auctions (see Figure 3.1 and refer back to Section 2.6)

Figure 3.1 – Mitigating risk of low participation in an Exercise Fee only auction

Risk		Mitigation
Long / unlimited interruption period and increasing VoLL. Some customers may be able to disrupt at low opportunity cost for shorter periods, but customers without dual fuel may have high VoLL if disrupted for longer periods, and may choose not to bid as a result	→	**Mitigate risk via product design** (e.g. by setting maximum disruption period, after which customer is taken out of disruption stack). Ofgem should consult on product design
Uncertainty over forward VoLL. A DM customer may not know in August what its VoLL will be in February- e.g.: • what will its product demand / stockpile be in mid-Winter, and therefore what is the opportunity cost of turning down production? •what will be cost of replacement fuel, if dual fuel back up?	→	**Allow DM customers to mitigate the risk of committing to a VoLL by updating bids.** This is just a simple update of the supply curve- (high gaming potential in Option2, but lower in Option 1)

3.2 Risk of Collusion

In any auction where the auctioneer is seeking to procure a product at the cheapest price, there is a concern that the bidders will collude to drive up the market price. *Ceteris paribus,* the risks of effective collusion are:

- Reduced if there are a greater number of eligible customers, although it is likely to be reduced concentration of demand rather than increased absolute customer numbers that matter;
- Increased if bids are channelled via a smaller set of shipper/suppliers or other aggregators, rather than bid directly by a larger number of end customers. However,

in this case we note this risk is mitigated because it is not in the financial interest of shippers/suppliers to inflate cash-out prices, which would have the consequence of inflating their customers' bids.

3.3 Credit Risks

As discussed in Section 2.3, there is no material credit risk issue associated with an Exercise Fee only auction, but there are potential credit risks issues associated with the payment of Option Fees.

The risk arises where Option Fee payments are made upfront to DSR contracted customers who do not subsequently honour their DSR commitments, due to:

- Bankruptcy. There is an element of "right way" risk mitigation associated with bankruptcy, in that if the company is no longer operating it is not contributing to demand (i.e. it has already load shed itself). But there is still a risk that the assets are bought out of administration by a new company that chooses not to adopt the old DSR contract as part of its purchase. In that case Option Fees have been paid and the contract may no longer be honoured without charge;
- Simply reneging on their obligation when called to provide DSR. Arguably, this risk is more a question of non-compliance risk rather than credit risk, and this problem can be disincentivised through a charging regime, although collecting onerous charges relating to Option Fees already paid over a number of years may impose its own credit risk issues.

Option Fee credit risks can be partially mitigated by making payments monthly over the contract duration rather than entirely at the contract signature date, and by sculpting payments to peak demand periods when DSR is mostly likely to be required.

4. Implementation issues

Finally, in this Section we discuss implementation issues. We start by highlighting three issues which will need to be resolved as part of the implementation, before setting out our view of the implications of the auction design on the implementation timescales.

4.1 How do you measure the amount of DSR delivered?

To date, the industry debate about DSR auctions has proceeded on the assumption that it is possible to measure how much DSR a customer has delivered so that they can be rewarded for delivering the instructed quantity of DSR, or penalised for failing to deliver the instructed quantity. However, how the amount of DSR delivered will be measured has not been defined, and needs to be defined during implementation.

Presumably DSR will be defined as a reduction in metered demand against some baseline demand, but should that baseline be:

- Some contractual amount, and if so, what contractual amount?; or
- Actual consumption in a period prior to being instructed by NG to provide DSR, and if so, what period?

In specifying the baseline, Ofgem should ensure that it does not create inappropriate incentive on the DSR contracted customer in a period when the customer thinks that it is highly likely to be instructed to deliver DSR.

4.2 Product design

We have recommended that the auction should focus on a single product. Getting the product design right is a necessary but not sufficient condition for ensuring desired levels of engagement from Eligible Customers.

We recommend that Ofgem consults with the industry on the design of the product in order to achieve an appropriate balance between meeting NG's and Eligible Customers' requirements.

Assuming an Exercise Price only auction, the key elements of product design, which should be reviewed, are likely to include:

- Are there any practical constraints to allowing partial self interruption (or must a consumer fully self interrupt to be deemed to have delivered DSR), and if partial self-interruption is to be allowed, how small can tranches of self-interruption be?
- How much notice will the DSR contracted customer be given of the requirement to start providing DSR?
- What are the constraints on the maximum frequency and duration that a customer can be required to provide DSR for? How many consecutive days can the DSR provision last? If the answer is finite, is there any limit to the number of days within

any given month/year that a DSR contracted customer can be required to provide DSR across multiple events?

- What level should penalties for non-compliance be set at?

Additionally, if the auction is an Option Fee and Exercise Price auction, the following contractual issues should also be considered:

- What is the appropriate contract duration (we have suggested somewhere in the range 3-5 years)?; and
- How much time do Eligible Customer require from the completion of the auction to the start of the obligation to provide DSR (to allow time for investment)?

4.3 Threshold to be an Eligible Customer

Ideally, all DM customers would be Eligible Customers. NG have expressed doubt that it is feasible to manage merit order load shedding of hundreds of customers, and suggested that only a subset of larger DM customers should be eligible to bid. At this stage, certain facts are lacking to make an informed determination of the appropriate definition of an Eligible Customer:

- We do not have definitive estimates of the total number of DM customers, split by size;
- The process by which NG communicates with DSR contracted customers and monitors their compliance with requests to provide DSR has not been defined. It has been argued that the number of customers that can be managed will depend upon whether NG has to communicate directly with the DSR contracted customer, or via the GDN;
- What is the minimum tranche size that can be bid, assuming partial self-interruption is allowed? If Eligible Customers can bid in tranches it may be that fewer customers can be practically managed; and
- What proportion of customers will bid if eligible and how does this vary by customer size?

More research and analysis is required on each of these issues.

4.4 Implementation timescales

In our view the proposed design (Option 1) is relatively simple and the auction itself should be relatively quick and inexpensive to implement. Since auction is to take the form of a simple tender, there is no need to procure any bespoke software and no auction platform is necessary, and there is no need for any credit support.

As a result, implementing the DSR auction should not be on the “critical path” for implementation of the wider regulatory changes.

A.1. Appendix 1- Possible Auction Formats

For standard auctions of a single item, the following auction formats are typically considered:

- **First-price auction:** Bidders simultaneously submit sealed bids for the item. The highest bidder wins the item and pays the amount of its bid.
- **Second-price auction:** Bidders simultaneously submit sealed bids for the item. The highest bidder wins the item and pays the amount bid by the second highest bidder.
- **English auction:** Bidders dynamically submit successively higher bids for the item. The final bidder wins the item and pays the amount of its final bid.
- **Dutch auction:** The auctioneer starts at a high price and announces successively lower prices, until some bidder expresses its willingness to purchase the item by bidding. The first bidder to bid wins the item and pays the current price at the time it bids.

However, when there are multiple units of a homogeneous good to be sold, it is preferable to use an auction format that explicitly permits bidders to express quantities of units at various prices. The following multi-unit auction formats are typically considered:

- **Sealed-bid, multi-unit auction:** Bidders simultaneously submit sealed bids comprising their demand curves. The bids are then aggregated, and the clearing price at which demand equals supply is determined. Each bidder wins the quantity that it demanded at the clearing price. The winners' payments may be based solely upon the clearing price ("uniform price"), the amount of each winning bid ("pay as bid"), or opportunity cost ("Vickrey").
- **Ascending / descending clock auction:** The auctioneer announces prices to bidders, and bidders simultaneously submit bids indicating the quantities demanded at those prices. If aggregate demand exceeds supply, then the auction proceeds to a new round of bidding, in which the price "clock" has been increased / decreased. When a round occurs in which aggregate demand no longer exceeds supply, the auction concludes. Each bidder wins the quantity that it demanded at the final price. Payments may be based on uniform pricing or on other possible payment rules. More detail on the procedure typically followed in ascending / descending clock auctions is set out below.
- **Combinatorial auction:** Bidders simultaneously submit one or more "package" bids, which are all-or-nothing bids for a given quantity and a total payment. The auctioneer then solves the winner determination problem, which is the problem of determining the collection of feasible bids that maximises the sum of the bid values. Pricing of the winning packages may be pay-as-bid or various variations on second pricing.

The above are the principal options for auctioning a single product. To auction multiple products, any of the above formats could be used simultaneously, or in sequence.

In the dynamic ascending-clock auction with discrete rounds[23], the following basic procedure is typically used:

1. The auctioneer pre-announces the available supply[24] in the auction, which may be subject to a reserve price or an increasing supply curve, which is fixed for the duration of the auction;
2. The auctioneer announces to bidders an interval of prices effective for round;
3. Each bidder simultaneously and independently submits its demands for during the round [25];
4. Following the round, the auctioneer calculates the aggregate demand;
5. If the aggregate demand is greater than the available supply, then the aggregate demand is disclosed to the bidders and the auction progresses to round 2 and so on until an equilibrium is reached and clearing price can be calculated; or
6. If the aggregate demand is lower than the available supply, then the auction concludes at a clearing price of x, where x is typically selected to be the lowest bid.

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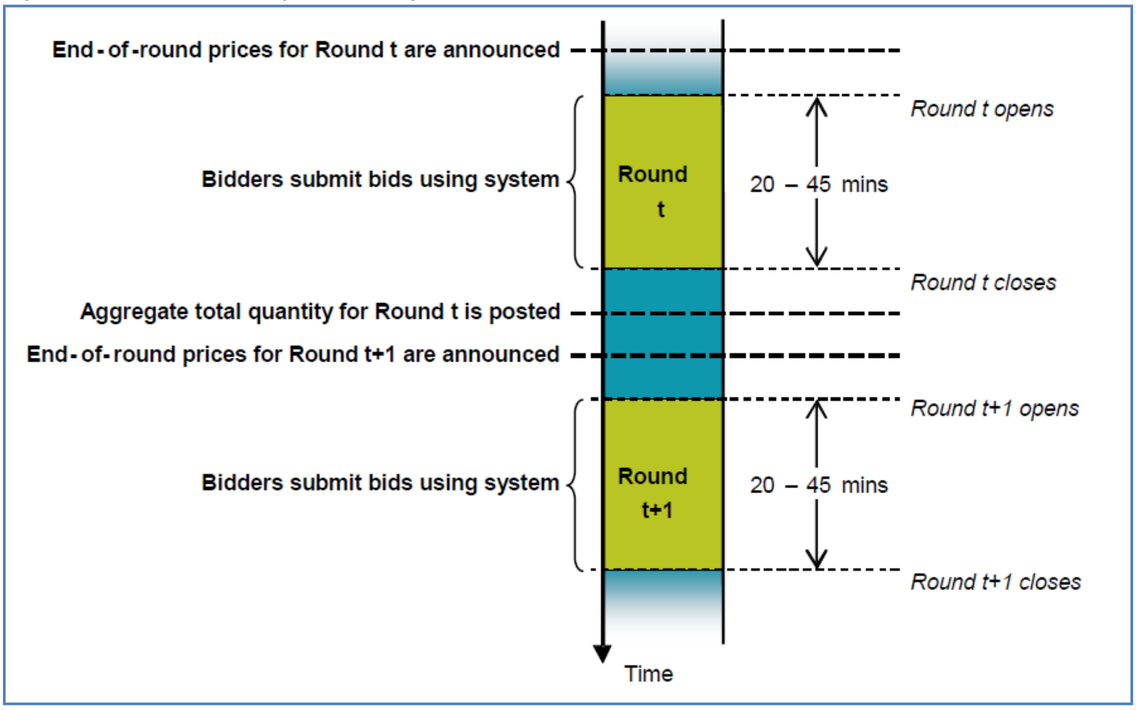
23 Although in theory one can imagine implementing an ascending-clock auction in continuous time, this is hardly ever done in practice in auctions of high-valued items. Power auctions inevitably use discrete rounds for at least three important reasons. First, communication is rarely so reliable that bidders would be willing to be exposed to a continuous clock. A bidder would find it unsatisfactory if the price clock swept past the bidder's willingness to pay because of a brief communication glitch. Discrete rounds are robust to communication problems. Discrete rounds have a bidding window of significant duration, rarely less than ten minutes and often a half-hour or longer. This window gives bidders time to correct any communication problems, to resort to back-up systems, or to contact the auctioneer and have the round extended. Second, bids need to be legally-binding commitments in order for an auction process to work as intended. This implies that bidders need to be given sufficient time to reflect upon, carefully enter, check and submit their bids, if bidders are going to be held to their bids. Third, a discrete-round auction also improves price discovery by giving the bidders an opportunity to reflect between rounds. Bidders need time to incorporate information from prior rounds into a revised bidding strategy. This updating is precisely one of the sources of price discovery and its associated benefits.

24 Available supply in the auction consists of the mandatory volume and any additional volume offered.

25 Proxy bids are also allowed at the start of Round 1 which removes the need to keep rebidding, e.g. x MW at £1,000/MWh, thus a proxy bid guarantees a volume at the clearing price to the buyer.

Figure A1.1- Overview of Ascending Clock Auction Process

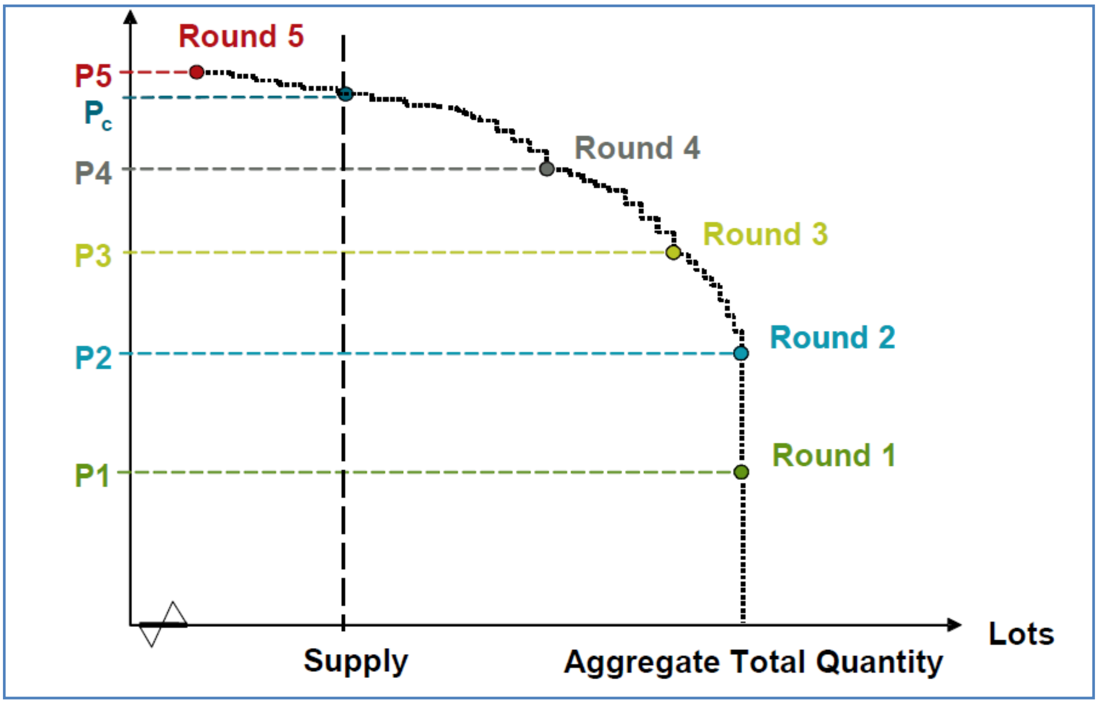


Source: DONG

When the ascending-clock auction involves multiple products, they are typically auctioned simultaneously. Products may be in the same product group or in distinct product groups. When products are in the same product group, it is possible for bidders to "switch" from one product to another as prices ascend; while when products are in distinct product groups, they are auctioned independently (but simultaneously). For example, in many of the auctions, base-load products of different durations have been assigned to the same product group, while peak-load and baseload products have been assigned to different product groups. The rationale for this grouping has been that base-load products of different durations are generally viewed as substitutes, while base-load and peak-load products are generally viewed as complements. As such, a bidder may wish to shift its demand among the different base-load products as prices evolve, but probably will not need to shift its demand between base-load and peak-load products.

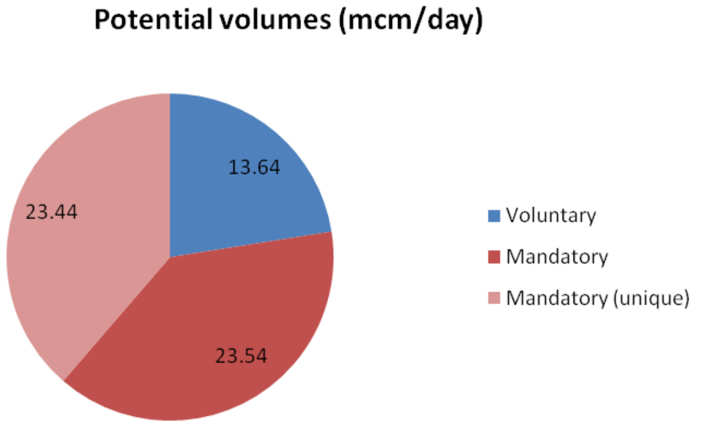
By contrast, in the standard sealed-bid auction, bidders have a single opportunity to submit demand curves that cover the entire possible range of prices. Often, in sealed-bid auctions, bidders are permitted to submit multiple bids, each for a given quantity of electricity and at a given price. They do not receive any feedback about the bids of other bidders until the auction has concluded. Based on the single round of sealed-bid submissions, the auctioneer determines the clearing price to be the lowest successful bid. Each bidder wins the quantity if the aggregate demand is less than the supply available, or a scaled-back volume if demand exceeds supply, and pays either the lowest successful bid per unit (uniform-price auction) or the amount of its winning bid (pay-as-bid auction), depending on the exact auction format.

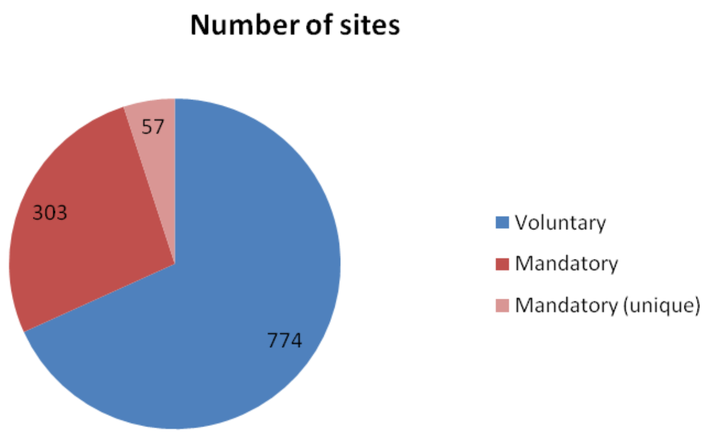
Figure A2.2- Determination of equilibrium Price (P_c) in an Ascending Clock Auction over multiple rounds



A.2. Appendix 2- NG provided data on DM customer numbers and volumes

The following data provided by NG shows a simple breakdown of GDN connected DM demand[26]. The data is based on peak demand from each site so it represents maximum potential DSR (see final chart for indication of average daily volumes). Mandatory sites are those with an annual consumption greater than 58 million KWh (approximately two million therms)[27]. Unique sites are a subset of mandatory sites and are generally very large users:



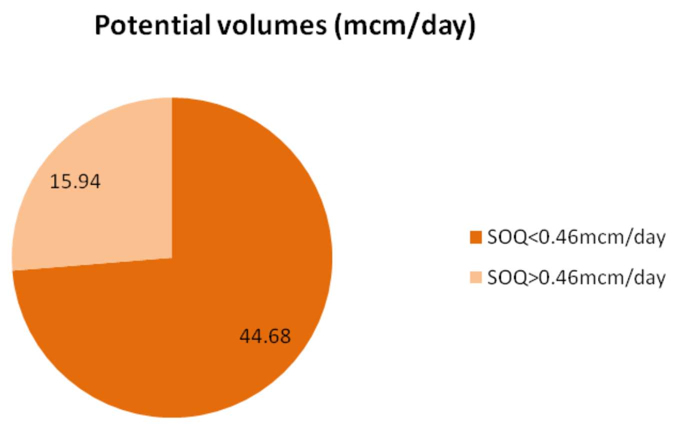


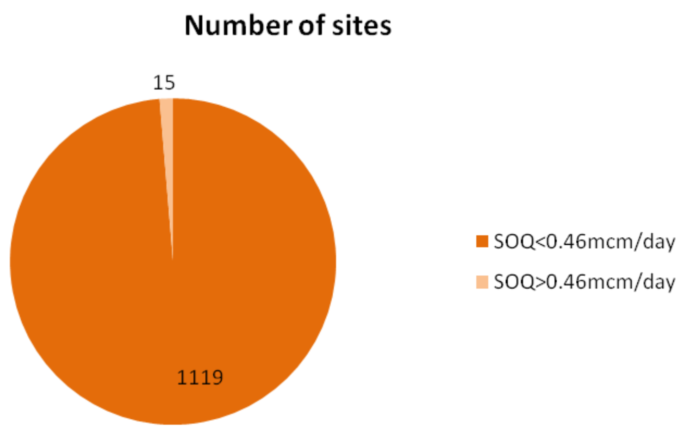
As can be seen from the charts above, one third of sites comprise almost four fifths of potential DSR. It is also notable that unique sites alone make up one third of potential DSR despite being comprised of just 57 sites (5% of the total number).

26 A very small number of NDM sites have been captured by this data. This has a negligible impact on volumes but it is not entirely clear how this might affect the number of sites count. Likely the effect is also negligible.

27 This is annual. DSR is likely more concerned with daily consumption.

It should be noted that mandatory sites are not exactly large: their daily consumption need only be above ~0.015mcm/day[28] for them to qualify and the average amount of DSR available from a Mandatory (non-unique) DM site, based on the above data, is below 0.1mcm/day. In light of this, the mandatory/voluntary split may still be too low to use as a threshold. Below is the division of volumes and sites at a 0.46mcm/day split[29]:





Again, a very small number of sites (15) make up a large proportion (25%) of potential DSR. On top of DM sites, there are also NTS sites to account for. Potential NTS Industrial demand is roughly 7mcm/day for 15 to 20 sites, giving an average amount of DSR available per site of 0.3-0.5mcm/day. It is important to point out that it remains to be seen what percentage of these DM and NTS sites would actually be willing to participate in the auction, or bid in at levels that could actually be accepted. Finally, the chart below highlights that the likely response on any given day (i.e. average consumption) is significantly lower than the peak potential given by the figures discussed above.

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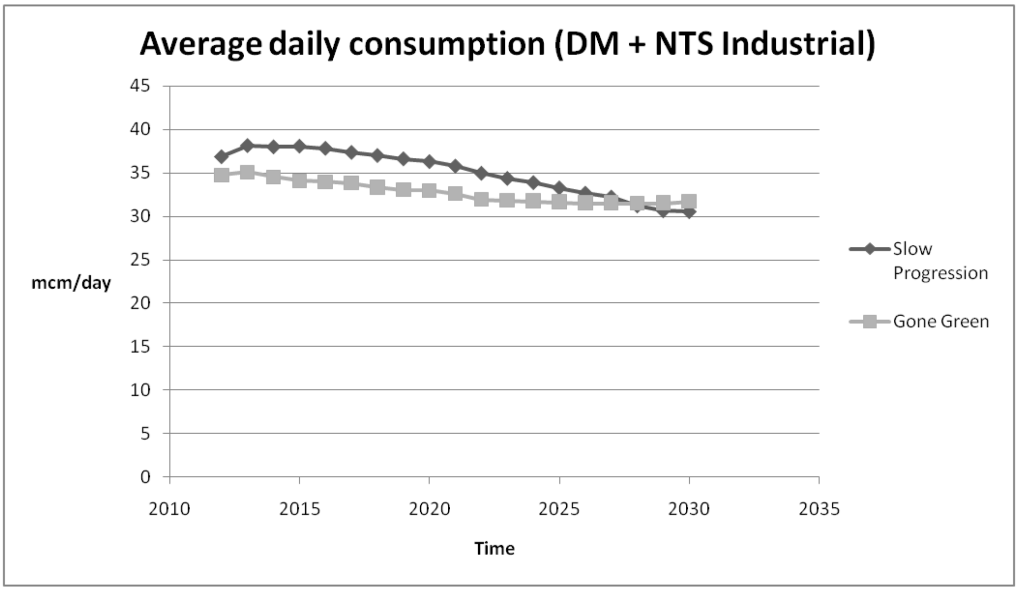
28 The minimum volume for a trade on the OCM is 4000 therms which equates to roughly 0.01mcm.

29 The 0.46mcm/day split shown is more for illustrative purposes rather than as a suggestion for a plausible threshold.


Average daily consumption (DM + NTS Industrial)
45
40
35
30
25
20
15
10
5
0
mcm/day
2010
2015
2020
2025
2030
2035
Time
Slow Progression
Gone Green