OFGEM

Aggregators - Barriers and External Impacts

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EXECUTIVE SUMMARY

Purpose

The purpose of this report is to review the position of independent Aggregators[1] in the provision of Demand Side Response (DSR)[2] services in the GB electricity market. It considers any barriers to their ability to provide these services, the materiality of these barriers and hence potential consumer detriment; and the nature of any policy intervention if required to address these barriers. This is a short timescale qualitative review to inform high level consideration of the area, and as such considers a relatively short-term time horizon. The report is intentionally limited to the consideration of independent Aggregators and does not consider Suppliers who also act as Aggregators. Hereon, 'Aggregators' is used as short-hand for 'independent Aggregators'.

This report was commissioned as part of Ofgem's programme of work to ensure regulation supports an efficient, flexible energy system, which delivers benefits to consumers. The report represents the views of PA Consulting and not necessarily those of Ofgem.

The Evolution of DSR

The involvement of end consumers in DSR, both in the GB market and internationally, has been relatively limited with flexibility being mainly procured from fossil-fuelled generation. However, increased levels of intermittent renewable generation could increase the potential value that DSR could bring to consumers and to security of supply. The increased participation of DSR in the provision of flexibility has been recognised by National Grid, the System Operator (SO). Through its Power Responsive Initiative, the SO has ambitions to procure by 2020 30-50% of its Balancing Services through demand-side measures, a significant increase from the current level of less than 6%[3]. The National Infrastructure Commission (NIC) has recently noted the opportunities for DSR, in its report *Smart Power*[4].

DSR is also being actively supported by the European Commission and ACER.[5] The EC's consultation on the new Energy Market Design for instance sought evidence on barriers to DSR and aggregation.[6] ACER has proposed new regulations, such as Article 31 of the draft Network Balancing Code[7], to

[1] Aggregators are defined as third party intermediaries specialising in coordinating or aggregating demand response from individual consumers to better meet industry parties' technical requirements for specific routes to market. Aggregators send signals to their consumers to modify their demand as a response to the System Operator requirements and/or market price signal

[2] The ability of consumers to change their pattern of demand in response to a price signal is termed Demand Side Response (DSR), and is a form of flexibility. The change in the pattern of demand can be due to changes in the use of electricity or the use of on-site generation.

[3] http://www.powerresponsive.com/

[4] https://www.gov.uk/government/news/a-smart-power-revolution-could-save-consumers-8-billion-a-year-adonis

[5] ACER is the Agency for the Cooperation of Energy Regulators

[6] https://ec.europa.eu/energy/en/consultations/public-consultation-new-energy-market-design

[7] http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/ANNEXES_TO_RECOMMENDATION_032015/Annex%20II%20-%20Proposed%20amendments%20to%20the%20Network%20Code.pdf

reduce the potential barriers facing Aggregators in deploying DSR, though it is uncertain whether this article as drafted will go forward for approval.

Where consumers have participated in DSR, activity has typically been by large scale industrial and commercial (I&C) companies. The introduction of smart metering and broader medium term movements of the industry towards 'smarter energy markets' may increase both awareness of DSR opportunities and the appetite to participate across a broader range of consumers. However, the direct engagement between small to medium sized consumers and the procurers of flexibility, such as the SO, remains unlikely as the costs of direct engagement are high compared with the volume of flexibility tendered. Therefore, Aggregators are expected to continue to have a role in bridging that gap, and they may also assist consumers in the transition, including large consumers, by offering value through scale, portfolio effects and simplification.

To fulfil this role, Aggregators will require access to appropriate markets and market instruments. The ability of Aggregators to access markets varies across Europe. For example, in Germany, Aggregators require agreement with the Supplier before they can access the flexibility of the consumer, though this may be changing. In GB, Aggregators can access certain specific markets only through the Supplier. The remaining markets they can access directly. In France, on the other hand, pre-determined arrangements allow Aggregators to access all markets without negotiating first with a Supplier.

The Value and Delivery of DSR

DSR can deliver value to the GB energy system in a range of ways. Each of these can potentially create consumer benefit. The table below sets these out and how Aggregators can access each opportunity.

Value to GB Energy	**Description/Benefit**	**Aggregator route to market**
Operational balancing of the Extra High Voltage (EHV) and HV network	DSR may allow demand to be turned up or down and hence help balance the network. This helps avoid outages which may occur when the network is over stressed. The most economic provision of these services ultimately reduces cost to consumers.	Balancing Services Balancing Mechanism (through a party that has signed the Balancing & Settlement Code (BSC) such as a Supplier)
Provision of capacity	DSR can lower demand at times of system stress, which frees up capacity for other areas of the network This helps the SO provide system security. The most economic provision of these services ultimately reduces cost to consumers.	Capacity Market
Benefits to networks	Appropriate DSR can help manage load peaks and avoid the need for reinforcement of the network. It can support cheaper and more timely connections, better manage issues on the network, and be used to manage losses. Where DSR is a lower price than capital costs, it can contribute to avoided investment, which can lead to reduced costs for consumers.	Direct DNO contracts

Supplier/Consumer usage reduction at high prices	DSR allows demand to be reduced at times of high prices. DSR enables consumer to receive lower bill.	Direct consumer contract Contract via Supplier

Consumer detriment will arise if the above benefits cannot be realised in the most efficient and effective manner.

Approach and Key Findings

The study has been conducted by an assessment of appropriate literature and tested through stakeholder workshops with Aggregators, Supplier Aggregators, Elexon, the SO and Ofgem. Given the potential for change, the study also considered whether there may be a need for Aggregators to be regulated.

The table over-leaf sets out the key findings in terms of route to market, barriers, materiality and potential policy options.

Table 1: Key Findings

Route to Market/Area	Barrier	Materiality	Potential Policy Options	Scale of Change
Balancing Services	Information may be diverse, incomplete, or not clear Large number of services and varied structure Structures can be unsuitable for DSR (e.g. availability window timings) Services are often perceived to be only transitory	Evidence of an active market, but well below SO desired scale Barriers may impede new entrants, the identification of optimum service provision and the evolution of the market	Improve transparency and reporting Rationalise suite of balancing services Consider more flexibility in service requirements	Low Low/Medium Low
Balancing Mechanism and Wholesale Market	Aggregator currently needs to register as a trading party or partner with a Supplier Wholesale prices do not exhibit sufficient volatility	There are no Suppliers or independent Aggregators offering DSR services in the BM In addition to the BM, there are other market opportunities for DSR, including Balancing Services and benefiting from the terms of the Retail contracts negotiated with Suppliers	Reform the BSC[8] to recognise the role of an independent Aggregator and create a regulatory framework for the Aggregator to register a Balancing Mechanism Unit (BMU) and compensate the Supplier (this is effectively the ACER proposal)	Medium / High
Capacity Market	Though all capacity, including aggregated DSR, can access 1 year contracts agreements, refurbished build have access to up to 3 year contracts and new build generators have access to up to 15 year	Aggregators are active in the Capacity Market, but primarily in the Transitional Arrangements which is ending in 2017	Allow DSR to be awarded contracts longer than 1 year (This is not possible under current arrangements – as it would require change to State Aid approval)	High

[8] The Balancing and Settlement Code (BSC) is an industry code that sets out how Balancing is undertaken in the Balancing Mechanism (BM), and how parties are settled for their contractual imbalances.

	contracts, in recognition of the up-front capex required	Aggregators see length of contract as major barrier, but differences in contract length may be appropriate		
DNO	Lack of customer engagement DNOs slow to move away from traditional asset reinforcement Interaction with other DSR market opportunities	Some load-related capex has been offset by DSR, but it is too early to assess materiality	RIIO-ED1[9] and RIIO-ED2 already include incentives. Strengthening of these incentives could be considered	Low
Licensing of Aggregators	Aggregators are not currently licensed. Thus Ofgem has limited direct enforcement powers over Aggregator activities	In its discussions with stakeholders, Ofgem has not received significant evidence of inappropriate behaviour Regulation may be appropriate if their role expands	Monitor the accreditation process being proposed by the Association for Decentralised Energy, and the development of competition Introduce licence or other authorisation framework	No change Medium

[9] RIIO stands for Revenue = Incentives + Innovation + Outputs model for network regulation. RIIO is designed to drive benefits for consumers. ED1 and ED2 are the specific price control schemes which are relevant to DNOs.

Conclusion

There are a range of different mechanisms to provide flexibility. These are complex and there are strong inter-relationships between the wholesale market, the Capacity Market, the Balancing Mechanism, the provision of Balancing Services and implicit drivers of revenue such as Triad payments that may limit the use of explicit DSR.

While there is evidence that Supplier-Aggregators and independent Aggregators are active and can be successful in the market, the current level of DSR deployment is substantially below the SO's 2020 target and the level of uptake implies that growth may not be achieved without some further intervention, such as the Power Responsive initiative currently being undertaken by the SO.

The strongest current opportunity for independent Aggregators to deploy DSR services is via Balancing Services to the SO. This is a reasonably active market, but one which also offers the greatest opportunity for change. Ofgem can consider mechanisms to rationalise the suite of balancing services; improve transparency and reporting, in a manner similar to the Capacity Market, for all activities. These aspects have been recognised by the Power Responsive campaign, which offers a platform to work with stakeholders on this.[10]

The Capacity Market (CM) has been successful in attracting Aggregators, however much of this has been through the temporary Transitional Arrangements auction, the second and final of which is taking place in 2017. This has provided a springboard for DSR. Recently-confirmed changes to the CM may encourage the successful participation of peak shifting DSR in the CM [11]. In particular, by increasing the total volume of capacity purchased, the changes could bring forward more DSR opportunities in general. In addition by placing restrictions on participation by certain parties competing with peak-shift DSR in the second Transitional Auction[12], they may bring forward more peak-shifting DSR and drive wider changes in the composition of DSR.

To revise the BSC to incorporate independent Aggregators in the Balancing Mechanism would require significant change and take perhaps 1-2 years to implement. Some of the changes to BSC which may be required are complex[13]. Previous Elexon analysis suggests it may entail significant implementation costs[14]. Finally, the benefits of the solution will depend on the extent to which retail competition is already encouraging Suppliers to realise and share the value of flexible demand through retail contracts with customers. The greater the effectiveness of retail competition, the lower the potential benefit of a revision to the BSC to incorporate independent Aggregators would be.

This review does not have sufficient evidence to conclude on the balance between cost and benefit on the question of direct Balancing Mechanism access. We recommend Ofgem seeks further evidence through its Call for Evidence on the potential benefits and costs of Aggregators being able to offer

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[10] The PR Campaign has worked with stakeholders to identify four themes. These are: 1) a co-ordinated approach across the industry, 2) reaching out to customers through clear information and transparency 3) developing customer led products, and 4) certainty and stability over the market opportunity.

[11] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/521301/Govt_response_to_March_2016_consultation_FINAL.pdf. The key elements of the recent changes are a) holding an early auction to bring forward delivery to 2017/18, b) tightening delivery incentives, and c) buying more capacity, and buying it earlier.

[12] Restrictions on participation include taking generation-based DSR out of the TA.

[13] Changes would likely need to introduce a regulatory framework to correct cross-party impacts, potentially including an agreed compensation price methodology, and real-time provision of information to affected Suppliers in order to prevent them from taking actions that undermine system efficiency.

[14] https://www.elexon.co.uk/wp-content/uploads/2015/03/Maximising-the-value-from-DSR_March2015.pdf. This report considers potential compensation mechanisms to neutralise imbalance effects from DSR. Although it may be possible to conceive of other approaches to facilitate independent aggregation, the finding regarding the scale of implementation costs is likely to be of relevance for those as well.

DSR flexibility in the BM independently of the Supplier. Further assessment of cost could be facilitated through a detailed modification and would require further assistance of Elexon[15].

The market for consumers to sell services to DNOs is currently immature, and is in the early stages of development. Looking forward there is likely to be a stronger case for DNOs to procure more DSR through Aggregators, and we recommend Ofgem monitors progress in use of DSR under RIIO-ED1 incentives.

We believe there is no compelling need to regulate Aggregators at this point as Ofgem has not received significant evidence of inappropriate behaviour. However regulation may be appropriate if their role expands and Ofgem should monitor progress of the proposed industry trade accreditation scheme.

[15] Elexon's preliminary view is that any modification would be relatively substantial compared with historic BSC modifications.

Recommendations

We recommend that Ofgem, with the SO as appropriate, consider the following actions, set out in the table below.

Area/Number	Description/Benefit
Balancing Services	
1.	Consider the opportunities and optimum delivery mechanism to improve transparency and reporting
2.	Gather evidence on whether the range of services is a barrier or advantage to effective market operation
Capacity Market	
3.	Monitor activity in the CM, especially once the transitional arrangement auctions are complete with the conclusion of the Transitional Auction in 2017
Balancing Mechanism and Wholesale Market	
4.	Engage with ACER and other European regulators to monitor proposals, Consider providing routes for non-BSC party independent aggregators to bring forward modification proposals (which will be subject to BSC Cost Benefit Analysis) through the BSC process Seek evidence of the level of implicit DSR participation undertaken by Suppliers and consumers
DNO	
5.	Monitor progress in use of DSR under RIIO-ED1 incentives

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1 INTRODUCTION

1.1 Overview of the Report

1.1.1 Purpose and Background

The purpose of this report is to review the position of independent Aggregators in the provision of Demand Side Response (DSR) services in the GB electricity market. It considers: any barriers to their ability to provide these services; the materiality of these barriers and hence potential consumer detriment; and the need for, and nature of, any policy intervention to address them. This is a short timescale qualitative review to inform high-level consideration of the area. The report is intentionally limited to the consideration of independent Aggregators and does not consider Suppliers who also act as Aggregators.

The involvement of end consumers, either directly or indirectly, both in the GB market and internationally, has been relatively limited with flexibility being mainly procured from generators. However, increased levels of intermittent renewable generation and the tightening capacity margins with the closure of ageing nuclear and coal-fired generation will encourage a greater role for DSR and hence Aggregators.

The importance of more active engagement by consumers in DSR, either directly in the market or through Aggregators, has long been recognised by Ofgem and the Department of Energy and Climate Change (DECC). Ofgem is keen to better understand the issues and barriers to the increased use of Aggregators, and has held a series of discussions with stakeholders to better understand their concerns about the current market arrangements and regulations. Drawing upon such stakeholder discussions, this report seeks to support the policy development currently being undertaken by Ofgem[16] by considering the following areas:

1. Barriers - The cultural, regulatory, commercial and structural barriers which prevent more deployment of DSR aggregation services
2. External Impacts - The impacts of potential issues affecting independent aggregation including:
    - External effects of aggregation (imbalance impacts as well as impacts on the Supplier's ability to recoup costs of generation procurement)
    - Absence of consumer protection for those customers entering into a service with an aggregator
3. Consumer detriment - Analysis of the value potentially offered by Aggregators that may be impeded by these barriers, taking into account likely dynamic effects and broader considerations
4. Policy options - Potential oversight procedures and intervention options which would overcome the obstacles to DSR aggregation, including draft EU policy and regulations relating to DSR aggregation as discussed by the EC ACER and CEER (the Council of European Energy Regulators).

This report forms part of Ofgem's programme of work to ensure regulation supports an efficient, flexible energy system, which delivers benefits to consumers and it should be read in conjunction with parallel reports.

[16] And contribute to the debate underway in the European Agency for the Cooperation of Energy Regulators (ACER) and the European Commission (EC).

1.1.2 Definitions

Demand Side Response (DSR) is the change in demand from a consumer in response to a price signal. DSR can be provided in two forms:

- Demand Turn-Down – This involves the suppression of demand by turning down or turning off appliances, or the increased running of Back-Up / Stand-By Generation which is located on a consumer's premise.
- Demand Turn-Up – This involves turning on additional appliances or processes or reducing generation from Back-Up / Stand-By Generation which is located on a consumer's premise, thus increasing the consumption of electricity from the grid.

In practice, virtually all current DSR is demand turn down and appears to be often provided by Back-Up/standby generation, though it is noted that the SO is in the process of procuring up to 625 MW of demand-turn up services for this summer[17].

Aggregators act as third party intermediaries between the providers of flexibility and the network operators who rely on the service to manage loads and flows on their systems. Suppliers can also use the services of Aggregators to help them balance their contractual position. Aggregators specialise in coordinating or aggregating demand response from individual consumers. Aggregators typically form contractual relationships with individual consumers, predominantly commercial and industrial, relaying the signals given by the flexibility procurers to these providers. There is a range of business models adopted, with some parties choosing to become licensed Suppliers. We term such parties Supplier-Aggregators to distinguish them from those parties, who we term simply Aggregators, who chose not to become Suppliers.

1.1.3 Structure of the Report

This report has 6 main sections:

- Section 1 – this section provides an introduction and the context behind the report. It also provides a brief guide to the market arrangements and the role of the various parties, including aggregators
- Sections 2 – 5 assess four market opportunities for independent Aggregators. For each market opportunity it considers the nature of the market; how Aggregators can add value in that market; potential barriers; potential customer detriment and policy options to address any market deficiencies. The four markets considered are:
    - Section 2: Balancing Services
    - Section 3: Balancing Mechanism
    - Section 4: Capacity Market
    - Section 5: Services to Distribution Network Operators (DNOs)
- Section 6 considers two additional discrete issues: the nature of price signals in the market and whether Aggregators should be licenced.
- Appendix A provides a more detailed description and evaluation of the ACER proposals. Finally
- Appendix B provides a detailed bibliography of article and reports consulted during the writing of this report.

[17] http://www.powerresponsive.com/media/1107/dtu-slides.pdf

1.2 Market Opportunities - How DSR Adds Value

1.2.1 How DSR Adds Value

There are a range of ways in which DSR can deliver value to the GB energy system. Each of these can potentially create consumer benefit. The table below sets these out and the route to market. These markets are then briefly described.

Table 1: How DSR adds value

Value to GB Energy	Description/Benefit	Route to market
Operational balancing of the Extra High Voltage (EHV) and HV network	DSR may allow demand to be turned up or down and hence help balance the network This helps avoid outages as it reduces stress on systems at times of peak load The most economic provision of these services ultimately reduces cost to consumers	Balancing Services Balancing Mechanism
Provision of capacity	DSR can lower demand at times of system stress This helps the SO provide system security The most economic provision of these services ultimately reduces cost to consumers	Capacity Market
Benefits to networks	Appropriate DSR can help manage load peaks and avoid the need for reinforcement of the network It can support cheaper and more timely connections, better manage issues on the network, and be used to manage losses Where DSR is a lower price than capital costs, it can contribute to avoided investment, which can lead to reduced costs for consumers Avoided investment ultimately reduces cost to consumers	Direct DNO contracts
Supplier/Consumer usage reduction at high prices	DSR allows demand to be reduced at times of high prices DSR enables consumers to receive lower bills	Direct consumer contract Contract via Supplier

Consumer detriment will arise if the above benefits cannot be realised in the most efficient and effective manner.

1.2.2 The Market Opportunities

Balancing Services

The SO procures Balancing Services (BS) in order to ensure security of supply and maintain the electricity grid's frequency and voltage, as set out by Security and Quality of Supply Standard

(SQSS)[18]. The term Balancing Services is very broad and includes all actions undertaken and all services procured by the SO. The focus in this section is on Balancing Services contracted by the SO, that may be of potential interest to Aggregators. The value of the service increases with the technical requirements of the service such as notice time, call duration and frequency of triggering.

Balancing Mechanism

The SO constantly manages the balance of generation and demand on the transmission system. As the levels of demand and generation rise and fall, it is necessary to maintain the overall balance on the system on a second by second basis. If balancing activities were not carried out, changes in demand or generation could lead to the system frequency moving outside the required tolerances, or voltage instability. These could damage equipment on the system or within customers' premises, or even lead to blackouts. The Balancing Mechanism (BM) provides a way for the SO to buy or sell additional energy close to real-time to maintain energy balance. The BM is a short-term market for physical energy where suppliers or generators can make offers to sell, or bids to buy, energy at a price of their choosing at specific locations on the network.

Capacity Market

The Capacity Market (CM) is one of the main building blocks of Electricity Market Reform and its goal is to put in place a means to achieve an adequate capacity margin to ensure security of supply over medium and longer timeframes.

The CM is open to all capacity providers including new and existing power stations, electricity storage plant, capacity provided by DSR and interconnectors. It offers a steady, predictable revenue stream on which providers can base their future investments. In return for Capacity Payments, providers must deliver energy at times of system stress[19], or face loss of revenue or bid bonds. Potential providers secure the right to receive capacity revenues by participating in a competitive auction process which will set the level of Capacity Payments.

Distribution Network Operators

In addition to incentivising some customers to alter their demand profile through the use of Distribution Use of System (DUoS) charges [20], DNOs contract with parties to alter their generation or consumption levels. DNOs can use these services for a number of purposes: to defer or avoid investment, support cheaper and more timely connections, to better manage issues on networks, and to manage losses.

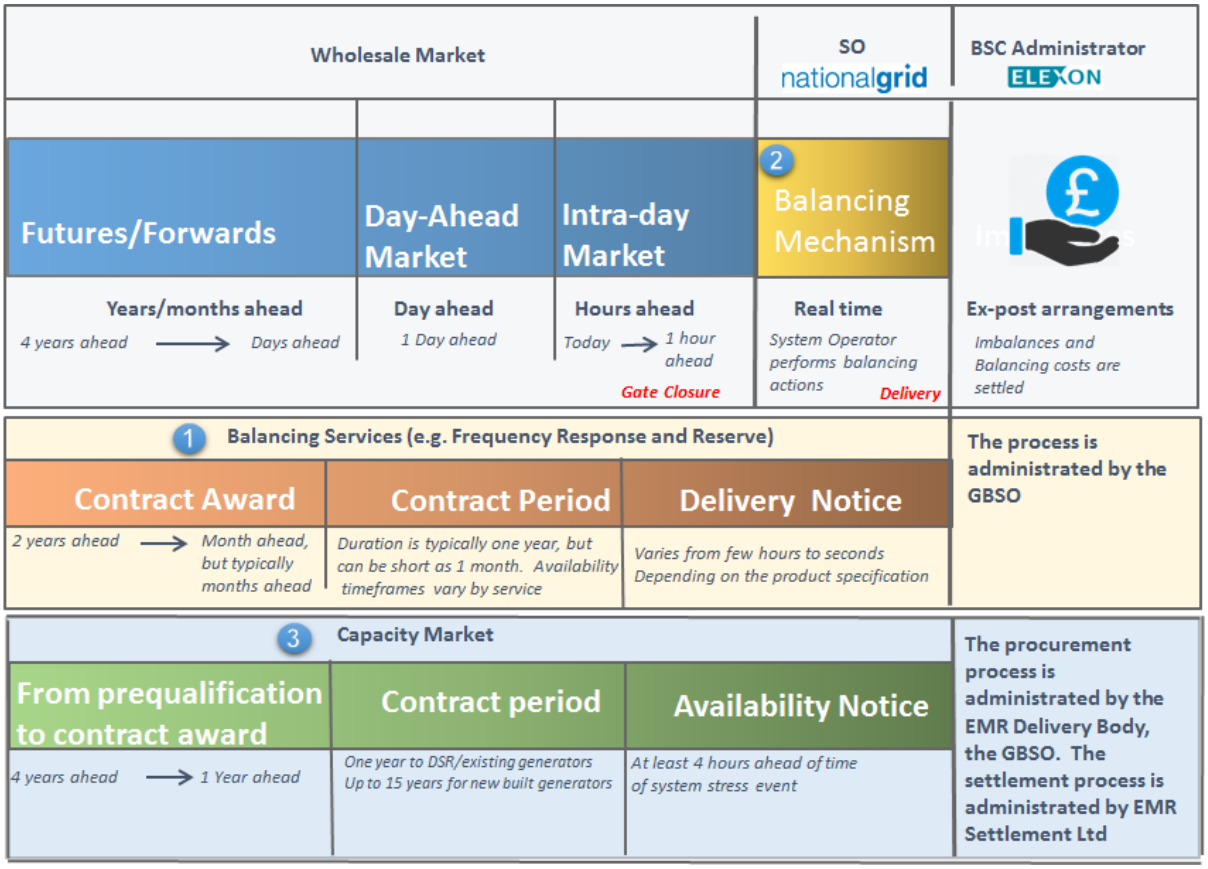
[18] http://www2.nationalgrid.com/uk/industry-information/electricity-codes/sqss/the-sqss/

[19] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/340046/capacity_market_rules.pdf

[20] For large consumers, DUoS charges vary by Time of Use (i.e.by season and by time of the day), and by voltage level. However, residential consumers are typically exposed to a more limited range of TOU tariffs, with most residential consumers paying only a fixed unit charge for the use of the distribution network.

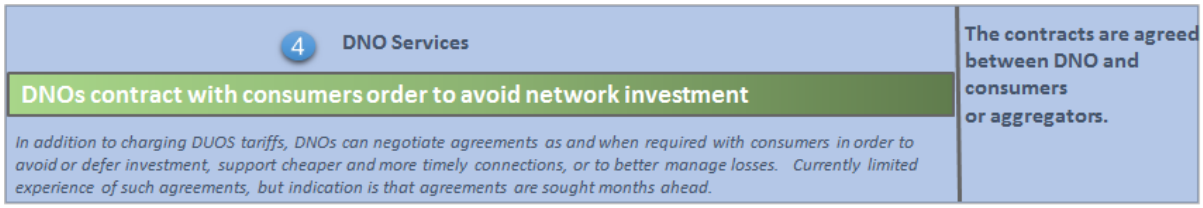
The timelines in which parties can participate in the various markets are illustrated in Figure 1.

Figure 1: GB electricity markets timelines, a PA Consulting illustration



The timelines in which parties can earn value by selling services to DNOs are illustrated in Figure 2.

Figure 2: Timeline for Services to DNOs market



1.3 Market Roles

This sub-section sets out the key roles in the market.

1.3.1 Suppliers

A Supplier buys and sells energy in order to supply electricity to a consumer, either residential, commercial or industrial. Suppliers extract value from the price differential between the retail price and the cost of supplying energy, which includes the cost of wholesale energy, network charges and environmental levies. Any party “supplying” electricity to a third-party consumer is required to be licensed by Ofgem. The licence then places obligations on parties to accede to the relevant industry codes, such as the Balancing and Settlement Code (BSC).

Some retail tariffs incorporate implicit incentives for consumers to engage in DSR through the pricing of the tariffs, with higher prices at times of peak demand and corresponding lower prices during other

time periods. By inference, the higher the tariff imposed by the Supplier, the greater the incentive for the consumer to reduce their demand (assuming their demand is aligned with conventional economic theory on elasticity). This type of consumer response related to price signals is often referred to as implicit DSR.

Retail tariffs that are agreed between customers and their suppliers do not typically perfectly reflect the spot wholesale price of energy, which fluctuates on a half-hourly basis. There are two main reasons for this. The first is that the retail price is typically fixed up front, rather than dynamically responding to movements in the wholesale price. Wholesale prices vary over time to reflect prevailing market conditions and therefore they may be significantly different between the time that a contract (or contracts) is struck, and the time when the electricity is consumed by the customer. The second is that the retail price represents an average price for the time periods covered by the customer tariff rather than a particular half-hour. In this respect, a flat-rate domestic tariff will reflect the average cost of wholesale energy for a domestic consumer across the relevant year, rather than the spot price of wholesale energy for a particular half-hour on a particular day.

1.3.2 Aggregators

Aggregators specialise in coordinating or aggregating demand response from individual consumers. They act as third party intermediaries between the providers of flexibility, either directly or via Suppliers, and those who procure flexibility, such as the SO and DNOs. Though aggregators form contractual relationships with individual customers, relaying the signals given by the procurers of flexibility to these providers of flexibility, the relationship does not involve the Supply of electricity as defined above.

There are a range of business models adopted by Aggregators, with some focusing exclusively on engaging with consumers, some focusing on engaging with embedded generators[21] and some engaging with a range of clients. Of the 19 companies currently listed by the SO as providing aggregation services[22], only 1 company appears to focus exclusively on providing DSR services, whilst 11 companies offer services to both consumers and small generators. As detailed in Table 2 below, the remaining 7 parties are licensed Suppliers. In addition to aggregators offering services to the SO, a small number of Suppliers focus on installing smart equipment in homes and businesses to automatically shift customer usage away from expensive times and into periods when prices are lower.

Table 2: Aggregator sector mapping[23]

Both DSR & Generation based Aggregation	11
Exclusively DSR based Aggregation	1
Supplier Aggregator	7
Total	19

Aggregators who participated in stakeholder engagement with Ofgem indicated that their markets currently consist only of I&C consumers. This is due to the current high costs of reaching and

[21] Embedded generators are those generators with a capacity below 100 MW and connected to distribution network, rather than the transmission network.

[22] http://www2.nationalgrid.com/UK/Services/Balancing-services/Demand-Side-Response/

[23] Based upon PA's analysis

contracting with residential consumers who on an individual basis have a limited volume of DSR capability. There is limited evidence of Aggregators at the residential level even in markets where DSR is fairly well-developed such as in the PJM market[24] on the eastern seaboard of the USA, or in less mature markets such as France.

Few Aggregators thought that there was significant potential in the near future for provision of DSR services to residential customers. This is further supported by the current scope of the SO Power Responsive initiative[25] which is focused on non-residential customers. However, the growth in electric vehicles, the increase in the use of wind and other inflexible technologies may suggest that the need for flexibility will increase. This, coupled with some key enablers such as the roll-out of smart metering, smart devices and the introduction of half-hourly settlement across the remainder of electricity customers, may spur exploitation of as yet untapped I&C flexibility, and encourage more active engagement with smaller non-domestic and residential consumers.

1.4 Levels of DSR

1.4.1 Current Levels of DSR

Though progress is being made by the SO and DECC in understanding the volumes of DSR capacity and embedded-generation, there remains an incomplete picture. In terms of capacity, there are no official figures specifying the total volume of DSR currently achieved. The SO publishes several figures but the reporting is dispersed and can exclude valuable information, such as the proportion of demand reduction that is achieved by the actual reduction in the use of electricity, rather than the use of on-site generation.

Demand Turn-Down Flexibility

Consumers who have the flexibility to turn-down demand have access to a range of Balancing Services contracts procured by the SO. The SO seeks to maintain a very high level of confidence that it can balance the system in real time, and contracts for reserve, in particular Demand Side Balancing Reserve (DSBR) and Short Term Operating Reserve (STOR), both of which consumers are able to provide. The SO also procures frequency response services, such as Firm Frequency Response (FFR) from consumers, directly or via Aggregators, as detailed in Table 3, but the volume currently provided by consumers is low.

The SO[26] also estimates that of the 16 GW of demand from large, over 1 MW consumers, 1.2 GW is turned down at times of System Peak in response to Transmission Network Use of System (TNUoS) charges (also referred to as Triad charges)[27]. This reduction in demand is known as “Triad Avoidance”.

The SO procures both committed STOR and flexible STOR services. We do not have access to a full breakdown of DSR figures procured by SO. However, we have made some estimates on the basis of data available as in Table 3. Hence, the total volume of DSR achieved in 2015/16 is in the range of 1.3-1.6 GW. The high volume of Triad avoidance delivered, 1.2 GW, relative to STOR and DSBR, 0.5 GW, reflects the high value of Triad charges compared with the relative low market price of STOR, both Committed and Flexible STOR, and the fact that Triad value can be achieved across a relatively

[24] PJM is a regional transmission organisation (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 US states and the District of Columbia. Its span includes Pennsylvania (P), New Jersey (J) and Maryland (M). Further details can be found at www.pjm.com.

[25] http://www.powerresponsive.com/

[26] National Grid Winter Outlook Report, http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/FES/Winter-Outlook/

[27] This is due to the TNUoS methodology, which generates customer charges according to the average customer demand within three half-hourly periods of particularly high transmission system demand. The process of turning down to avoid these charges is referred to as “Triad avoidance”.

few occasions of the year[28]. The SO does not publish a full breakdown of the contractual prices for committed STOR or flexible STOR services. The value of Triad avoidance is around 4 times that of DSBR. A flexible consumer is more likely to undertake Triad Avoidance in the winter and offer flexible STOR services to the SO at other times, rather than offering a DSBR service to the SO.

Table 3: Levels of Contracted DSR, MW [29]

	2015/16
Triad Avoidance	1,200
Committed STOR	27
Flexible STOR	210
DSBR	133
Firm Frequency Response	25
Total inc.flexible STOR and DSBR	1,595
Total exc. DSBR & flexible STOR	1,252

DSR provided by aggregators

The SO publishes figures relating to the services provided by the broad group of what it terms aggregators, but does not distinguish between Aggregators and Supplier-Aggregators. Of the 237 MW of DSR contracted as STOR, Aggregators and Supplier-Aggregators provide 195 MW, and customers directly provide 42 MW. Aggregators and Supplier-Aggregators provide 511 MW of STOR capacity via the use of embedded generators. Of the 133 MW of DSR contracted as DSBR, Aggregators and Supplier-Aggregators provide 129 MW, and consumers directly provide 4 MW.

Table 4: Levels of Contracted STOR and DSBR provided by Aggregators, MW, 2015/16 [30]

	DSR	Generation	Total	DSR as % of total
STOR - Total contracted	237	3,207	3,444	7%
STOR provided by Aggregators and Supplier-Aggregators	195	511	706	28%
STOR not supplied by Aggregators	42	2,696	2,738	2%
DSBR - Total contracted	133	180	313	42%
DSBR supplied by Aggregators and Supplier-Aggregators	129	0	129	100%
DSBR not supplied by Aggregators	4	180	184	2%

DSR has successfully participated in the CM as detailed below in Table 5. The earliest year when a contracted service can be provided is 2016/17. Future projections of DSR are discussed further below. Capacity contracted via the CM is not excluded from playing in any other market.[31]

[28] Though Triad TNUoS charges are based on the 3 winter days with peak demand, separated by 10 days, the actual incidence of these peak demand is not known until after the end of the winter. However, there is a high degree of confidence in forecasting the incidence of Triad periods, and consumers who at the moment lower their demand on 15-20 days a year have a high confidence of achieving the full value of Triad Avoidance.

[29] http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=37710 and www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=43382

[30] Source – PA analysis, based upon figures published by the SO

[31] Though holders of CM contracts are not excluded from other markets, holders of long-term STOR contracts, signed before the establishment of the CM, are not allowed to participate in the CM.

Table 5: Levels of DSR contracted in the CM, MW [32]

	Aggregators	Vertically integrated utilities	Suppliers	Direct consumers	Total
2014 T-4	171			4	174
2015 T-4	413	43			456
2016 TA	363	63	20	29	475
Total	946	107	20	33	1,105

1.4.2 Future levels of DSR

Forecasts of DSR potential and participation levels vary from party to party and are strongly related to the assumptions used in the projections and the different assessment and modelling methods. Future levels of DSR could be influenced by the following developments:

- **Transmission Network Use of System ("Triad") Charges** – The SO's latest projection sees Triad TNUoS charges rising by around 90% in nominal terms from 2015/16 to 2020/21[33]. Ofgem is currently reviewing TNUoS charges as part of its review of embedded benefits[34].
- **Capacity Market (CM):** the degree of competition in the CM.
- **Balancing Services (BS) and the Balancing Mechanism:** There will be an increasing requirement for flexibility by the SO and the market generally due to the increasing volume of intermittent generation[35]. Through its Power Responsive initiative, the SO is actively seeking ways for DSR to play a bigger role in providing BS, though the long-term existence of the DSBR service remains uncertain[36]. However, it is plausible to assume that there will be an increase in demand for such services given future projections for the penetration of intermittent generation. Further competition by other providers of flexibility, in particular from embedded generators and potentially storage, could dampen the prices for BS, and hence the level of actual participation of DSR in future remains unknown but could be estimated through scenario modelling, as undertaken by the SO and discussed further below.
- **DNO Constraint Contracts** – In common with the transmission system the distribution networks are likely to see additional penetration of embedded generation such as wind and solar. As part of their RIIO EDI business plans, a number of DNOs have shown an increase in the use of DSR and storage to provide additional services on the network to avoid or defer the need for costly investment. DNOs, such as SSE and Western Power Distribution, are developing constraint management services, to provide flexibility to alleviate network constraints and deploying them as

[32] Source – PA analysis, based upon figures published by the SO

[33] http://www2.nationalgrid.com/UK/Industry-information/System-charges/Electricity-transmission/Approval-conditions/Condition-5/

[34] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/504217/March_2016_Consultation_Document.pdf

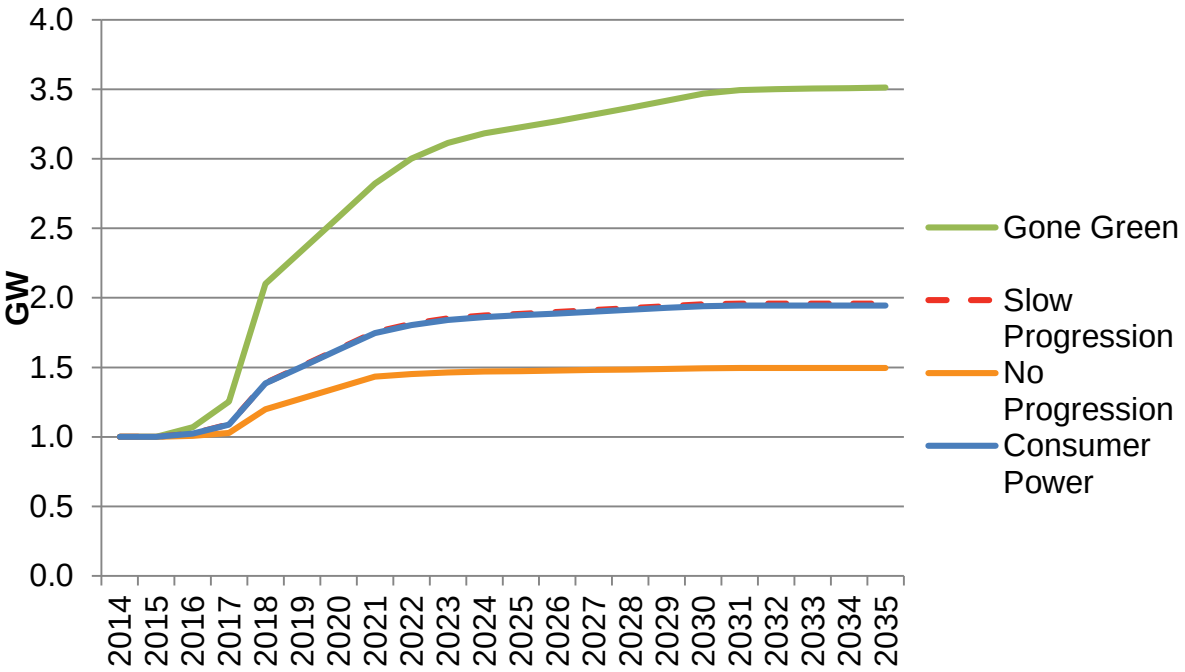
[35] http://www.nationalgrid.com/NR/rdonlyres/DF928C19-9210-4629-AB78-BBAA7AD8B89D/47178/Operatingin2020_finalversion0806_final.pdf

[36] Note Ofgem stated in its open Letter (1 March 2016) on the future of SBR and DSBR that "We would expect a 2017/18 CM auction to procure enough capacity to meet the government's reliability standard. Therefore, SBR and DSBR services would not be needed for that year".

an alternative to traditional network reinforcement[37]. The provision of services to the DNOs may develop further and provide aggregators and other providers of DSR with an important revenue stream.

The SO forecasts different paths for the evolution of non-residential DSR to 2035. In its 2015 Future Energy Scenarios (FES), the SO estimated that potential DSR peak reduction by 2020 will range between 1.4 GW in the No Progression scenario to 2.6 GW in the Gone Green scenario. Maximum non-residential DSR potential in the Slow Progression and Consumer Power scenarios is capped at a level of 2 GW by 2030 and as in Figure 3 below:

Figure 3: Non-residential DSR[38]



In this Future Energy Scenario report, the SO forecasts that DSR will be encouraged by BS, Triad Avoidance, CM and Time of Use (ToU) tariffs and contracts with DNOs. However it does not foresee any DSR participation in the BM in the future.

As a result of the BSC Modification P272, from 2017/18 half-hourly settlement will be mandatory for those consumers who have installed half-hourly meters and who fit within Profile Classes 5-8[39]. The SO forecasts that there will be an additional 3 GW of customers with half-hourly metering in 2017/18 on the basis of the current roll-out forecasts. On the assumption that they are exposed to more cost-reflective tariffs and that their demand is elastic it is plausible to assume there may be additional DSR available, though the extent to which the SO forecasts an associated increase in DSR is unknown[40].

[37] http://news.ssepd.co.uk/news/all-articles/2015/06/constrained-managed-zone/ and http://www.westernpowerinnovation.co.uk/Projects/Sunshine-Tariff.aspx

[38] Source: Future Energy Scenarios (FES) 2015, http://fes.nationalgrid.com/fes-document/

[39] https://www.elexon.co.uk/mod-proposal/p272-mandatory-half-hourly-settlement-for-profile-classes-5-8/

[40] TNUoS 5 year forecast, February 2016, http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=45336

In Frontier's report for DECC[41] they assess roughly 10 GW of potential non-residential DSR capacity in the near term, but they consider in reality only a fraction would be delivered. Element Energy in its report to Ofgem estimates that non-residential DSR potential is between 1.2 GW to 4.5 GW with 2.5 GW in their base scenario[42]. However, these reports do not provide information on their assumed routes to market.

In summary, conservative scenarios project achieved levels of DSR at around 1.5 GW in comparison to more optimistic models which project between 4 GW and 10 GW of DSR potential.

[41] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/467024/rpt-frontier-DECC_DSR_phase_2_report-rev3-PDF-021015.pdf

[42] http://www.element-energy.co.uk/wordpress/wp-content/uploads/2012/07/Demand-Side-Response-in-the-non-domestic-sector.pdf

2 THE BALANCING SERVICES MARKET

2.1 Introduction to Balancing Services

The SO procures Balancing Services (BS) in order to ensure security of supply and maintain the electricity grid's frequency and voltage, as set out by Security and Quality of Supply Standard (SQSS)[43] .The term BS is very broad and includes all actions undertaken and all services procured by the SO. The focus in this section is on BS contracted by the SO, of potential interest to consumers and Aggregators. The selling of services to the SO via the BM is discussed in a later section.

The BS procured by the SO vary with respect to response times, duration and capacity sizes. The SO currently actively manages the supply and demand balance on the system, equivalent to around the last 2-3%. In 2014/5 the SO spent £850m on contracted Balancing Services and actions in the BM[44].

The BS procured by the SO can be grouped into 5 broad themes:

- Reserve Services
- Frequency Response Services
- Negative Reserve Services
- Constraint Management Services
- Reactive Power and Black Start Services.

2.1.1 Reserve Services

To help it ensure that it can meet demand in full, the SO procures a range of reserve services from generators and consumers, directly or via Aggregators. For generators, reserve services involve the ability to increase generation, whilst for consumers reserve services involve the ability to reduce demand. There is a range of reserve services, which vary by technical requirements of each service, such as:

- Notification time - the time between receipt of an instruction from the SO and the increase in generation or decrease in demand
- Call duration - the length of time that generation is required to be higher, or demand is required to be lower
- Frequency of triggering - the number of times per year that the generator or consumer is willing to increase generation or lower demand.

2.1.2 Frequency Response Services

The SO is required to maintain the frequency of the electricity grid within a certain range, and contracts with generators and consumers for frequency response services, by which they automatically change the level of generation or demand in response to changes in the system frequency. Historically, generators have been the dominant provider of frequency response services.

[43] http://www2.nationalgrid.com/uk/industry-information/electricity-codes/sqss/the-sqss/

[44] http://www.powerresponsive.com/media/1112/future-balancing-services-strategy-131015.pdf

2.1.3 Negative Reserve Services

In addition to maintaining an overall energy balance, the SO is required to maintain a certain level of "Footroom" or "Downward Regulation" on the system to allow it to decrease generation quickly to cover situations such as the sudden loss of demand. The SO can choose between increasing the demand of consumers and reducing the generation of "must-run" generation.

2.1.4 Constraint Management Services

The transmission network has a limited amount of infrastructure and capacity. A high volume of generation in a local area/zone, compared with a low volume of demand, could lead to a constraint on the system, and consequently there is a requirement for the SO to lower generation, increase demand or do a combination of both. Historically, the procured services tend to involve lowering generation, but on occasion parties have agreed to increase demand. The SO has found DSR attractive when the network constraint is driven by high volume of low-cost renewable generation which is unwilling or unable to reduce generation, due to the loss of subsidies.

2.1.5 Reactive Power and Black Start

The SO procures Reactive Power services from generators to help it maintain voltage levels across the network. To help the restoration of the wider electricity system following a disruption, the SO contracts for Black Start services from generators who are able to provide energy independently onto the system.

2.1.6 Payment and procurement structure

BS typically involve two revenue streams:

- Availability Fees - BS providers receive payments on a £ per MW per hour basis for the provision of a particular BS
- Utilisation payments - When the SO instructs a provider to decrease/increase generation or demand, the provider receives an additional payment.

The SO's procurement process varies according by type of service. For reserve and frequency response services, a formal tendering process is typically used, and often the SO has a series of tender rounds, with parties who were initially unsuccessful able to participate in further rounds. For other schemes, such as constraint management services, the procurement process is often less formal and bilateral negotiations are often used.

2.2 How Consumers and Aggregators Can Access the Market

The SO procures services from generators and consumers, directly or via Aggregators. The SO has minimum volume thresholds for each service, but allows parties, be they Aggregators or Suppliers, to aggregate a portfolio of consumers in order to meet this threshold.

Aggregators do not require the consent of the consumer's Supplier when they offer BS to the SO. Further, Aggregators are not required to be party to the BSC to offer Balancing Services to the SO. The SO procures Balancing Services via a series of formal and informal markets, which are accessible to Aggregators, provided their clients' flexibility meets the technical requirements of the BS as set by the SO.

Reflecting the technical requirements of the services, consumers and Aggregators have tended to focus on providing reserve services and frequency response services. In the past, large consumers, such as aluminium smelters, have been able to offer Fast Reserve or Frequency Control by Demand

Management (FCDM) services, but the closure of these smelters has reduced the participation of demand-side in these services.

There is evidence of consumers providing only limited constraint management services or Negative Reserve services. Currently, the potential value to be gained by the consumer's ability to turn-up demand is relatively low as the frequency of such situations is low and the SO tends to manage constraints and Footroom issues through taking actions in the BM, rather than through BS[45]. However, future developments will change this. The SO is developing a new service, Demand-Turn-Up[46], to encourage greater participation of demand-side in helping to balance the system at times of high generation and low demand.

The table below presents the main Balancing Services schemes in which DSR aggregators actively participate:

Table 6: Balancing Services with potential DSR participation[47]

Scheme	Total Capacity (MW)	Estimated DSR Capacity (MW)	Notification time	Minimum Capacity (MW)	Procurement method
Short Term Operating Reserve (STOR)	3,444	237	between 4 hours to 20 minutes	3[48]	Tendering
Firm Frequency Response (FFR)	600	25	30 seconds	10	Tendering
Frequency Control by Demand Management (FCDM)	No data	No data	2 seconds	3	Bilateral contracts
Demand Side Balancing Reserve (DSBR)	313	133[49]	2 hours	1	Tendering
Fast Reserve (FR)	180	No data	2 minutes	50	Tendering

Each service has its own technical requirements, which have evolved over time in response to the requirements of the SO and the desire of the SO to encourage competition between providers. Over time, the SO has introduced more services, such as DSBR, STOR Runway and FFR Bridging. These services are not included in the table above, and the contracted volumes are understood to be low. The DSBR service has a less onerous notification time requirement and a reduced minimum volume requirement than the existing STOR service. Recognising that not all providers initially can fully meet the minimum volume requirement of existing services such as STOR and FFR, the STOR Runway service and the FFR Bridging services were developed and provide opportunities for Demand Side

[45] The SO provides a monthly report detailing how it procures services: http://www2.nationalgrid.com/UK/Industry-information/Electricity-transmission-operational-data/Report-explorer/Services-Reports/

[46] http://www.powerresponsive.com/media/1130/power-responsive-dsr-product-map-glossary-161215.pdf

[47] http://www2.nationalgrid.com/uk/services/balancing-services/. Note there are also introductory arrangements for STOR and FFR that aim to support parties in reaching the minimum MW capacity thresholds.

[48] The SO introduced STOR Bridging and Runaway schemes which have more relaxed requirement on minimum capacity

[49] The difference of 180 MW is referred by the SO as 'other generating assets' which export electricity to the network

Providers to secure a contract for an envelope of volume which will then be grown in their portfolio within an agreed timeframe[50].

Consumers, directly or via Aggregators, have the choice of which services to offer to the SO but they cannot "double-sell" their flexibility for the same time-period to the SO – e.g. they cannot provide both STOR and DSBR for the same time period. This is to prevent double-payment and inefficiency.

2.3 Evidence of Successful Aggregator Operation

The SO publishes figures relating to the services provided by the broad group of what it terms aggregators, but does not distinguish between Aggregators and Supplier-Aggregators. Of the 237 MW of DSR contracted as STOR, Aggregators and Supplier-Aggregators provide 195 MW, and customers directly provide 42 MW. Aggregators and Supplier-Aggregators provide 511 MW of STOR capacity via the use of embedded generators. In the DSBR market, Aggregators and Supplier-Aggregators provide 129 MW, and consumers directly provide 4 MW, as detailed in the table below.

Table 7: STOR and DSBR, provided by Aggregators and Supplier-Aggregators, MW, 2015/16 **51**

	DSR	Generation	Total	DSR as % of total
STOR - Total contracted	237	3,207	3,444	7%
STOR provided by Aggregators and Supplier-Aggregators	195	511	706	28%
STOR not supplied by Aggregators	42	2,696	2,738	2%
DSBR - Total contracted	133	180	313	42%
DSBR supplied by Aggregators and Supplier-Aggregators	129	0	129	100%
DSBR not supplied by Aggregators	4	180	184	2%

In addition to the successful DSR providers, there are those providers who were unable to secure contracts; this indicates there is additional potential available in the market[52]. STOR tender information from the SO for the year 2014/5[53] shows that within the tender rounds many of the tenders from potential providers were not accepted. Overall, nearly a third of the providers that participated in auctions relating to 2014/15 STOR did not secure a contract.

2.4 Potential Barriers to Successful Operation

Many Aggregators throughout the stakeholder engagement process indicated that Balancing Services is where they see most of their revenue potential. Aggregators mainly provide STOR and DSBR, as it better suits their response times of their clients. A few Aggregators are capable of providing FFR from consumers, and participate in the FFR market.

However, in 2015/16 DSR represents only 6.7% of contracted STOR, and less than 5% of FFR. In launching the Power Responsive initiative, the SO acknowledges that there is scope for an increase in the extent to which consumers, directly or via Aggregators, provide BS. Based upon stakeholder

[50] http://www2.nationalgrid.com/UK/Services/Balancing-services/Reserve-services/Short-Term-Operating-Reserve/STOR-Runway/ and http://www2.nationalgrid.com/UK/Services/Balancing-services/Frequency-response/Firm-Frequency-Response/FFR-Bridging/

[51] Source – PA analysis, based upon figures published by the SO.

[52] http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=44492 (STOR Annual Report 2014-15)

[53] http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589934618 (STOR TR28 MIR)

feedback and our analysis of how the SO procures services, there are two potential areas for improvement in relation to BS:

- limited transparency and disclosure
- complexity and service specification.

2.4.1 Limited transparency and disclosure

The SO publishes monthly data regarding the procured services, including a breakdown of expenditure on availability fees and utilisation payments. However, it is difficult for participants to gain a complete picture and to compare the different revenues which they can achieve in the different services. Even when the information is available it is not easy to navigate through the SO's website, and information for a certain service is located in different sections of the website. The level of transparency is not as high as in the BM, the CM, or other international markets such as PJM.

2.4.2 Complexity and service specification

According to the National Audit Office (NAO)[54], the SO procured 22 different Balancing Services, with different specifications such as response times, duration of actions, and availability period. On one hand, a large variety of products may make it difficult for Aggregators, especially potential new entrants, to fully understand the different services requirements and to understand where they can best extract value. It might allow characteristics to be unbundled (for instance turn up from turn down) so that requirements do not unnecessarily impede some technologies e.g. DSR. On the other hand, the wide variety of services might assist Aggregators in finding the product which best suits the capabilities of their clients. Though striking the right balance between complexity and flexibility is difficult, it might still be worth considering streamlining the variety of products.

A limited number of the services have requirements which Aggregators struggle to meet. For example Fast Reserve requires a minimum capacity of 50MW and FFR has a minimum capacity of 10 MW. The two hours minimum run duration for STOR may also be difficult for consumers to satisfy. Similarly, response times may arbitrarily impede some technologies. For instance, finding that more than 85% of contracted capacity in 2012 had response times between five and ten minutes, Torriti et al argue that "rapid response times may preclude demand reduction measures that may involve preparatory action"[55]. Product specification / design has been identified as a barrier to DSR deployment in a study of balancing services markets in the USA[56].

2.5 Consumer Detriment

The degree of competition in the BS Market is currently high, as it is a market abundant with transmission connected generators, and small generators. There is currently an over-supply within the STOR market, with many of the tenders from potential providers not accepted[57]. Overall, nearly a third of the units that participated in auctions relating to 2014/15 STOR did not secure a contract. An increase in the participation of consumers, directly or via Aggregators, may have a low impact upon the costs incurred by the SO in procuring Balancing Services.

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[54] https://www.nao.org.uk/wp-content/uploads/2014/05/Electricity-Balancing-Services.pdf

[55] "Peak Energy Demand and Demand Side Response", Jacopo Torriti, Routledge, 2016

[56] "An assessment of market and policy barriers from demand response providing ancillary services in U.S. electricity markets", Peter Cappers et al, Energy Policy 62 (2013)

[57] http://www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=8589934618 (STOR TR28 MIR)

Although more transparency and less complexity might increase the uptake of DSR, the high degree of competition at present might suggest that the effect on the BS tenders and contracts may not be very high in the short term, noting of course that this may change over time as the need for flexibility increases.

2.6 Potential Options to Address Barriers

2.6.1 Improvements to the level of transparency and disclosure

The market reporting arrangements of the Capacity Market shows that high levels of disclosure are possible as detailed and relatively easy to understand auction registrar and summary reports are produced. PJM's disclosure standards may also be something to examine further which include detailed reports on DSR in all the markets it participates in. The SO has kicked off a review of transparency as part of its Power Responsive initiative.

Pros	Cons
Lower transaction costs for consumers	IT system costs
Better understanding of the value to be gained	SO procurement costs may increase
New entrants encouraged by reduced complexity	

2.6.2 Review the range of services procured and their service specification

There is a case for a review of the range of BS procured by the SO, to confirm that the technical specifications of each BS are reflective of the requirements of the SO, and not unnecessarily onerous or complex from a participants' perspective. ACER, the European Energy Regulator, seeks, via the European Balancing Network Code, to introduce a level of standardisation of services across Europe in order to reduce fragmentation of products and markets[58].

Pros	Cons
Encourage competition by reducing complexity	A reduced range of services may reduce the ability of consumers to participate
Better reveal to consumers the value of DSR	Reforms to the technical requirements of the services may increase costs to the SO
Changes to technical requirements may allow more consumers to participate	

[58] http://www.acer.europa.eu/official_documents/acts_of_the_agency/opinions/opinions/acer%20opinion%2007-2014.pdf Paragraph 2.2.5

2.7 Conclusion

The SO acknowledges that there is scope for an increase in the extent to which consumers, directly or via Aggregators, provide BS, and has a target of 30-50% contribution of BS from DSR, directly from consumers or via Aggregators, by 2020[59]. Stakeholders have claimed there is a need for greater market transparency and clarity relating to how much DSR can earn by providing BS to the SO. Though there is a lot of information provided by the SO, at times it is dispersed and it is not always clear. Information is not as structured or transparent as in other markets, such as the CM. Further, the relatively high number of services might deter participants as potential providers are confused by the range of options and may find it difficult to determine the market value of their flexibility. However it is noted that the current arrangements may involve lower administration costs for the SO, and allow it to procure a portfolio of services that overall better suits its technical requirements.

We welcome the actions being taken by the SO to actively encourage greater participation by the demand-side generally in the provision of BS. In undertaking its Power Responsive initiative, we recommend that Ofgem provides oversight as the SO (through its Power Responsive campaign) considers with stakeholders the following:

- improvements to the level of transparency and reporting of BS
- a review of the current suite of BS, including whether their technical requirements are unnecessarily onerous.

[59] http://www.powerresponsive.com/media/1120/power-responsive-steering-group-meeting-191015.pdf

3 FLEXIBLE DEMAND AND BALANCING OUTSIDE AND IN THE BALANCING MECHANISM

3.1 Overview of the Wholesale Market and Balancing Mechanism

The New Electricity Trading arrangements (NETA) that were introduced in 2001 set out the arrangements under which electricity is traded in the UK wholesale electricity market. The previous trading arrangements required all electricity to be bought or sold via the Electricity Pool. NETA was designed to encourage the development of a more flexible set of trading arrangements whilst maintaining the operation of a secure and reliable electricity system by the establishment of close to real time balancing arrangements.

National Grid, in its capacity as SO, constantly manages the balance of generation and demand on the transmission system. As the levels of demand and generation rise and fall, it is necessary to maintain the overall balance on the system on a second by second basis. If balancing activities were not carried out, changes in demand or generation could lead to the system frequency moving outside the required tolerances, or voltage instability. These could damage equipment on the system or within customers' premises, or even lead to blackouts.

One of the key objectives of the NETA arrangements was to create strong incentives on participants to balance their positions, ensuring that their contracted purchases and sales of energy matched as closely as possible. Under the previous Electricity Pool, imbalance costs arising from the necessary balancing activities were largely socialised across all participants. As a result, individual participants did not face effective incentives to manage their individual positions, leading to higher overall balancing costs for each.

The physical generation of electricity and the supply of electricity to premises must be undertaken by holders of the relevant licences issued by Ofgem[60]. However, trading of electricity ahead of physical delivery or consumption is not a licenced activity and any party interested in trading - including someone acting as an Independent Aggregator - is able to do so.

Within the NETA arrangements, the Balancing and Settlement Code (BSC) contains the governance arrangements for electricity balancing and settlement. In addition to licenced generators and suppliers, other parties wishing to trade electricity can also join the BSC. All participants have energy accounts that record the balance between electricity produced and consumed.

Individual participants are incentivised by the BSC to balance their energy accounts at the point of Gate Closure. Gate Closure occurs one hour ahead of each half-hourly trading period. Up until that time participants can actively manage the net position in their energy accounts via their preferred combination of purchases or sales. So for a Supplier, if they expected the aggregate demand of their retail customers to exceed their previous contracted purchases, they could opt to increase purchases or encourage their customers to reduce their demand. A trading party that is neither a generator nor a supplier has the choice whether to close out their trading position by making further contractual purchases or sales, or accept an exposure to the Imbalance Price on its net position.

The Balancing Mechanism (BM) provides a way for the SO to buy or sell additional energy close to real-time to maintain energy balance. The BM is a short-term market for physical energy where suppliers or generators can (if they wish to do so) make offers to sell, or bids to buy, energy at a price of their choosing.

[60] For completeness, there are some small exemptions to this rule.

These offers and bids can be submitted in respect of each unit of generation or consumption, known as a Balancing Mechanism Unit (BMU), belonging to each BSC Party. The SO accepts Offers and Bids as necessary to balance the system, and seeks to do so at least cost by taking the lowest-priced Offers and accepting the highest-priced Bids, consistent with factors such as transmission system constraints and the BSC Party's ability to deliver within the timescales necessary. The price of the most expensive action helps set the imbalance price, the unit price applied to the imbalance position that is observed during the relevant half-hour trading period[61].

3.2 Flexible Demand and Balancing

Consumers who have demand that is capable of being flexible can potentially make use of this capability both ahead of, and after Gate Closure.

- As part of their retail supply contract, they could reach agreement with their Supplier to provide this flexibility when asked to do so by the Supplier. For example, they might agree to switch off or reduce demand by a certain amount a number of times in a particular period in return for a lower overall unit energy price. This could take place as part of the Supplier's portfolio balancing activities ahead of gate closure (and so outside of the BM).
- They could participate explicitly in the BM itself via their Supplier, agreeing: a) to reduce demand when the bids/offers submitted by the Supplier are accepted; and b) how the resulting payment would be shared between the consumer and the Supplier.
- In the latter scenario, in principle it might appear that the consumer could offer their flexible demand via any BM participant including traders. However, if the participant is not also their Supplier, this would mean that the actions of one BM participant were impacting on the measured imbalance position of another participant, undermining the requirement for individual balancing on which the BSC is based. The BSC only permits the Supplier to submit such bids.
- In order to make such a scenario of independent aggregator participation in the BM function, the question as to how the reduction in demand impacts on the Supplier – its balance position in the BM and its ability to recoup wholesale energy procurement costs – would need to be addressed..

3.3 Evidence of Flexible Demand Participation in Balancing

There does not currently appear to be substantial active participation of flexible demand in the BM. The SO is required to treat demand-side BMUs and generation BMUs equally. However, currently virtually all of the participants in the BM are individual generators. There is no experience of demand BMUs playing a role in the BM. It is our understanding from talking to Elexon that no party has registered a single site or a number of customer sites as a single BMU and offered their customers' flexibility into the BM in this way.

Under the first scenario identified in Section 3.2, flexible demand can be participating in balancing but it is doing so implicitly rather than explicitly in the BM. This implicit participation is not directly observable to other parties since it is part of the Supplier's portfolio balancing rather than any visibly traded product.

We recommend that any call for evidence around the effective participation of flexible demand and the role of Independent Aggregators seeks evidence on the current extent of this implicit participation from consumers and Suppliers. This will be important to understand the potential additional value that could be gained by taking steps to facilitate increased explicit participation in the BM.

[61] https://www.elexon.co.uk/wp-content/uploads/2016/02/Imbalance_Pricing_v9.0.pdf

3.4 How Aggregators Could Operate in the Balancing Mechanism

We understand that in conversations with Ofgem, several aggregators have expressed an interest in accessing the BM. The potential to earn value in the BM is uncertain as the real-time balancing requirements on the system can be volatile and it is also unclear how much flexible demand is already participating implicitly rather than explicitly. However, a number of aggregators consider the BM to represent an opportunity to extract value from DSR flexibility in the future.

To offer DSR flexibility into the BM, the consumer's demand or a portfolio of consumers' demand must be registered at a BMU. The current BSC rules require that the registration of the BMU is undertaken by the consumer's Supplier, and hence that the consent of the Supplier is required before BMUs can be registered.

So to be able to offer its clients' flexibility into the BM, an Aggregator would need to either:

- Participate via agreement with the relevant Supplier - Establish a commercial agreement outside of the BSC with a Supplier that would then participate in the BM on behalf of the Aggregator. This option may be possible without any changes to the BSC.
- Directly participate - Become a relevant Trading Party under the BSC itself and directly offer DSR flexibility in the BM by registering a portfolio of flexible demand as a single BMU. Changes to the BSC would be required and the registration of the BMU would require the Supplier's consent or new rules to hold the Supplier harmless within the BM.
- Indirectly participate via another Trading Party – The Aggregator could reach agreement outside the BSC with any Trading Party that would then participate in the BM on behalf of the Aggregator. However, the consent of the consumer's Supplier would still be required to register the BMU.

3.5 Current Barriers to Successful Aggregator Operation

3.5.1 Current BSC rules prevent direct participation

The BSC does not make any provision for the role of an aggregator. There are specific rules set out in the BSC as to who can register BMUs and the characteristics that a BMU must satisfy. Current BSC rules mean that a "third party" Aggregator (i.e. a party which is not directly responsible for the relevant exports or imports under the terms of the BSC) could not participate directly in the BM.

3.5.2 Contractual arrangements needed for participation via a Supplier

Although in principle, the aggregator could reach agreement to provide a service to any Supplier, this may not be straightforward. There is no framework requiring a Supplier to submit prices into the BM on behalf of an Aggregator. It is unclear how any value realised would be split between the consumer providing the flexible demand, the aggregator and the Supplier. There may also be a risk that the Supplier would seek to dis-intermediate the Aggregator, re-shaping the retail supply contract to exclude any role for the Aggregator. Finally, unless the aggregator activity was limited to the customers of a single trading party, separate agreements would be needed with each Trading Party.

3.5.3 Other barriers to BM participation

In addition to the rule or contract based issues, the potential opportunities for Aggregators to provide DSR services in the BM may also be constrained by a number of additional factors:

- Consumers can benefit from flexible demand being used in other markets - The BM as a route to market for flexible demand itself faces "competition" from contracted STOR and other Balancing Services, accessible to the SO. Flexible demand also has opportunities to participate implicitly via its Supplier as part of retail supply contracts.

- Strong competition within the BM - The BM is already competitive, with a wide range of flexible generators offering their services
- Unproven usability of aggregated demand-side BMUs - An Aggregator would need to demonstrate to the SO that it could provide an effective balancing capability – i.e. that the aggregated demand side response would be sufficiently large, flexible and controllable to be useful and cost effective in balancing the transmission system via the BM. This challenge also exists in the BS arena, and so existing techniques employed in BS could be applied here.
- Technical metering and communication requirements - There are technical and communication requirements associated with BMU registration[62], though these are understood to be similar to the existing requirements for Balancing Services participation.
- Commercial attractiveness of the BM payment structure - There is no payment for availability in the BM, with value earned only when services are utilised. The evidence from STOR is for low utilisation rates overall, and especially so for DSR which has an average utilisation rate of only one hour per year in 2014/2015. As detailed in the table below, the experience of DSR in France and PJM paints a similar picture of low utilisation in the real time balancing markets. While utilisation rates in the BM may differ and will depend on the price submitted, the experience of DSR STOR being dispatched infrequently does not paint an encouraging picture on likely utilisation and hence current commercial attractiveness.

Table 8: DSR Utilisation in PJM, France and GB markets, 2014/2015[63]

Market	Revenue stream	GW	utilisation (GWh)	utilisation (hours pa)	equivalent annual load factor
PJM	Balancing Services	3.5	633.0	180.9	2.1%
	Real Time Market	11.6	87.4	7.5	0.1%
France	Balancing Services	0.8	24.0	30.0	0.3%
	Real Time Market	0.8	0.3	0.4	0.0%
GB	**STOR (DSR)**	**0.2**	**0.2**	**0.9**	**0.0%**

3.6 Consumer Detriment

Although the current rules prevent direct participation by Aggregators in the BM, flexible demand can participate in a number of other ways. Combined with the current experience of low utilisation rates for DSR in other markets noted above, this suggests that consumer detriment arising from the impact of the current rules for the BM is currently low.

[62] Further details of the requirements relating to Electronic Dispatch Logging (EDL) and Electronic Date Transfer (EDT) can be found at https://www.elexon.co.uk/wp-content/uploads/2015/06/bscp15_v23.0.pdf

[63] http://www.pjm.com/~/media/markets-ops/dsr/2015-demand-response-activity-report.ashx (Figure 20), and http://www.smartenergydemand.eu/wp-content/uploads/2015/09/Mapping-Demand-Response-in-Europe-Today-2015.pdf (p.69) and www2.nationalgrid.com/WorkArea/DownloadAsset.aspx?id=40981

Longer-term, there is a general expectation that the requirements for flexibility to support balancing will increase in the future due to the expected increase in the volumes of intermittent generation from wind and solar PV capacity. However it is extremely difficult to predict how this increasing requirement will translate into additional value for flexibility, as well as how this additional value might be split between demand or generation sources of flexibility and between BS and the BM. Even forecasts derived from a detailed modelling exercise covering the likely patterns of generation and consumer behaviours (not in the scope of this work) would be subject to substantial uncertainty.

3.7 Potential Future Changes to Address Barriers

3.7.1 Direct participation in the BM

To facilitate direct participation by third party Aggregators, it would be necessary to make changes to the current trading arrangements. At a high level, these would likely need to address two principal areas:

- changes to allow BMUs to be registered by Aggregators; and
- arrangements to compensate the Supplier for the indirect effects of any DSR activated via the BM (including arrangements for the resulting financial flows).

One potential model for Supplier compensation is the ACER proposal for Article 31[64] of the European Balancing Network Code, discussed in Appendix A. Note however that practical concerns about this model have been raised by NordREG, the Nordic energy regulator, in relation to the Nordic arrangements[65].

In discussions with Elexon around this report, they expressed their view that it is feasible to consider modifications to the BSC in order to allow BMUs to be registered by Aggregators, independent of the Supplier. However, their preliminary view is that such a modification would be relatively substantial compared with historic BSC modifications. As part of their 2015 paper on issues related to maximising the value from DSR, Elexon also suggested that changes to the BSC to compensate Suppliers for additional imbalance costs due to DSR would be somewhat complex and costly[66].

3.7.2 Participation in the BM via Suppliers

As noted in Section 3.4, it is already possible for Independent Aggregators to participate if they are able to reach agreement with the Suppliers of the consumers who are providing the flexible demand. However, as Section 3.5 also recognises, reaching such agreements may not be straightforward. So as an alternative to making alterations to the BSC to allow direct participation, there could be merit in considering an alternative approach to encourage Suppliers to reach such agreements.

In principle, it would be possible to make modifications to the BSC, or to put in place another industry code, in order to require Suppliers to submit prices for DSR flexibility into the BM on behalf of the independent Aggregator. In this situation, it is possible that the Aggregator may not be required to be a party to the BSC, as the Supplier would be acting as its agent. However, the key question as to whether this requires the Supplier's consent would remain.

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[64] http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/ANNEXES_TO_RECOMMENDATION_032015/Annex%20II%20-%20Proposed%20amendments%20to%20the%20Network%20Code.pdf

[65] http://www.nordicenergyregulators.org/wp-content/uploads/2016/02/NordREG-Discussion-of-different-arrangements-for-aggregation-of-demand-response-in-the-Nordic-market.pdf

[66] https://www.elexon.co.uk/wp-content/uploads/2015/03/Maximising-the-value-from-DSR_March2015.pdf

As detailed in Appendix A, it is still likely that arrangements would need to be put in place to compensate the Supplier for the indirect effects of any DSR activated via the BM, and for the Supplier to transfer payments related to the utilisation of DSR in the BM to the Aggregator. Such frameworks would likely add some complexity to the existing arrangements, and may also require supporting IT infrastructure. So although worth some consideration, it is by no means certain that this would be easier or less costly to implement than direct participation.

3.8 Aggregators participation in the Wholesale Market

In addition to expressing a desire to participate directly in the BM, some aggregators have also expressed interest in participating within the Wholesale Market. As noted in Section 3.1, it is already possible for parties other than generators or suppliers to participate. However in practical terms, the current ability for an Independent Aggregator to trade is likely to be limited by the BSC balancing arrangements. Were the changes contemplated in Section 3.7 to be made, these would allow both participation in the BM and could be extended to facilitate participation in the Wholesale Market.

The current extent of the untapped potential DSR that could be realised by these modifications is unknown. A number of large I&C consumers are already able to access value in the wholesale market through the terms of their retail contract. Consumers with flexible demand can also provide BS or respond to the incentives provided by their retail contracts. However, future developments in technology, smart metering, and half-hourly settlement may encourage greater DSR flexibility. To the extent that this potential were unable to find sufficient value via their retail contracts with their Supplier, through the BS or the BM, additional wholesale market opportunities may offer additional value.

3.9 Conclusion

This report has insufficient evidence to establish the balance of benefits and costs of a regulatory intervention to facilitate direct participation of Aggregators in the BM. In particular, potential options to address existing barriers to participation in the BM would require detailed scoping and development from Elexon and industry.

In terms of cost, preliminary high-level indications are that such changes would be more complex and costly than many previous BSC modifications. In addition while there is potential for increased participation by flexible demand to add value, since there are already other opportunities for DSR to earn value either via implicit participation under retail supply contracts or the provision of BS to the SO, the impact of the specific constraints on Aggregator operation within the BM is likely to be low. Retail competition tends to be most intense for large I&C customers with the most commercially viable DSR; this provides an incentive for Suppliers to tap this flexibility, including through offering aggregation services themselves, either in-house or in partnership with a Supplier-Aggregator. We therefore consider that the value to be gained by additional facilitation of Aggregator participation in the BM is likely to be low in the short term.

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4 THE CAPACITY MARKET

4.1 Introduction to the Capacity Market

The Capacity Market (CM) is one of the main building blocks of Electricity Market Reform and the CM's goal is to put in place a means to achieve an adequate capacity margin to ensure security of supply. DECC has issued its response to the consultation on further reforms to the CM[67], recognising that UK energy market conditions have changed considerably since 2014, when the original CM was designed. The proposed reforms will increase the volume of capacity procured, and in the Transitional Auction make it more difficult for small embedded generators, be they stand-alone or on a consumer's site, to participate. Generally the proposed reforms may increase the scope for DSR to play a bigger role in the CM – though it is hard to judge given potentially opposing effects (discussed later). However, the following discussion is based upon the existing rules and regulations.

The CM is open to all capacity providers including new and existing power stations, electricity storage plant, capacity provided by consumers lowering demand (i.e. DSR), and interconnectors. It offers a steady, predictable revenue stream on which providers can base their future investments. In return for Capacity Payments, providers must deliver capacity at times of system stress, or incur loss of revenues or bonds. Potential providers secure the right to receive capacity revenues by participating in a competitive auction process which will set the level of Capacity Payments.

Presently there are 3 main types of Capacity Auctions, as outlined in Table 9:

- T-4 Auction – Four Year Ahead Auction: Though all parties can participate in this auction, its main aim is to promote investment in new capacity and get the best out of existing assets to safeguard against the possibility of future black-outs. The length of contract varies by type of capacity. New build capacity can be awarded up to 15 year contracts. Refurbished capacity can earn up to 3 year contracts. Existing power stations and DSR gain 1 year contracts. In the first T-4 Auction held, 64% of capacity was awarded 1 year contracts, and in the second T-4 Auction 96% was awarded 1 year contracts.
- T-1 Auction – Year-ahead Auction: All parties can participate in this auction, but only 1 year contracts can be awarded.
- Transitional Arrangements (TA): The Transitional Arrangements auctions offer targeted support to DSR, to encourage increased levels of participation in the two years preceding full Capacity Market delivery in 2018/19. Though the TA is focused on DSR providers, small distribution level generators can also participate in this auction. DECC has restricted the ability of generating units participating in the TA. Only 1 year contracts can be awarded, and the last TA is due to be held in March 2017.

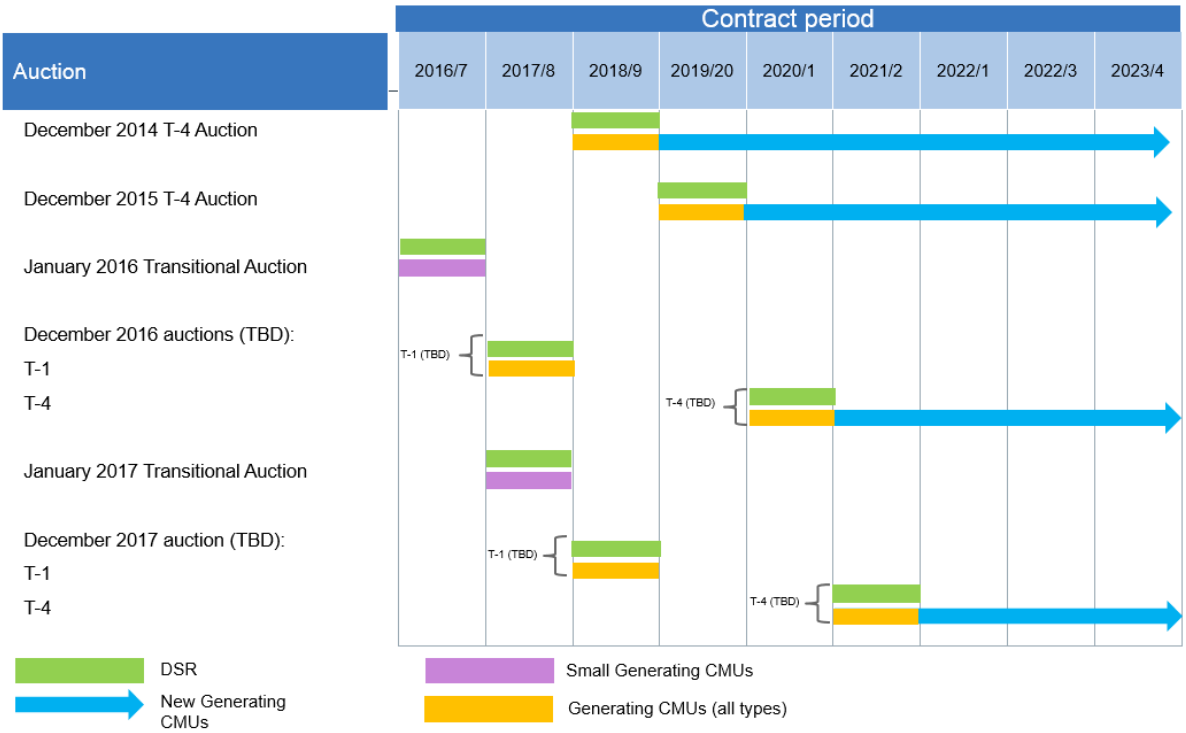
67 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/521301/Govt_response_to_March_2016_consultation_FINAL.pdf

Table 9: Capacity Market Auctions – maximum length of contracts, in years

	T-4	T-1	TA
New Capacity	15	1	1
Refurbished Capacity	3	1	1
Existing Capacity	1	1	1
Interconnectors	1	1	
DSR	1	1	1

The first Capacity Auction took place in December 2014, for delivery obligations commencing in October 2018. Subsequently two further auctions have taken place, one in December 2015 for delivery obligations beginning in October 2019, and a Transitional Capacity Auction in January 2016 for delivery obligations commencing October 2016. The timetable for auctions is provided below in Figure 4.

Figure 4: Capacity Markets timeline



4.2 How DSR and Aggregators Can Operate in the CM

DSR can participate in all the CM auctions. As per other established capacity markets, such as PJM, there is a formal methodology for establishing the baseline volume, which is based upon the observed demand pattern of the consumer[68]. DSR capacity is calculated as the difference between the agreed Baseline Volume and the actual metered demand at times of system stress.

[68] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/340046/capacity_market_rules.pdf

In the T-1 and T-4 auctions, DSR is required to be available at all times of the year, the same as other capacity providers. However, in the TA, participants are able to choose either a time banded product (09.00-11.00 and 16.00-20.00 on working days in winter) or a non-time banded product. If parties opt to choose the time banded product, their capacity payment is reduced by 30% of the auction clearing price.

Currently, there is a minimum capacity size of 2 MW in the CM. Aggregators can participate in the CM by aggregating the demand of a portfolio of consumers, such that the aggregate DSR capacity is above this size. Aggregators can also act as agents, participating in the CM on behalf of large consumers.

4.3 Evidence of Successful Aggregator Operation

4.3.1 DSR in the Capacity Market auctions

DSR has successfully participated in the 3 auctions held so far. However, cleared DSR capacity represents a fraction of the awarded capacity with 174 MW (0.3%) in the 2014 T-4 auction and 456 MW (1%) in 2015 T-4 auction, as detailed in the Table 10 below.

Table 10: Capacity Market – Awarded Contracts by type of Capacity, GW

	2014 (T-4)[69]	2015 (T-4)[70]	2016 TA (T-1)[71]
Existing Generation Capacity	31.45	42.01	0.31
Refurbished Capacity	15.02	0.09	
New Build Generating Capacity	2.62	1.94	0.01
DSR	0.17	0.46	0.47
Existing interconnectors		1.86	
Total	49.26	46.35	0.80

The success rate among prequalified DSR Capacity Providers in the 2015 T-4 auction was 67% which is significantly higher than the 39% clearing rate of new generating and refurbished Capacity Providers.

In the two completed T-4 auctions the clearing prices were set between £18 to £19.4 per kW per year, substantially lower than the Net Cost of New entry of £49 per kW per year as set by DECC, as detailed in Figure 5.

The purpose of the TA was to promote DSR. The first TA took place in January 2016 for the delivery year 2016/7 and the second and final TA is due to take place in March 2017 for the delivery year

[69] https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/T-4%202014%20Final%20Auction%20Results%20Report.pdf

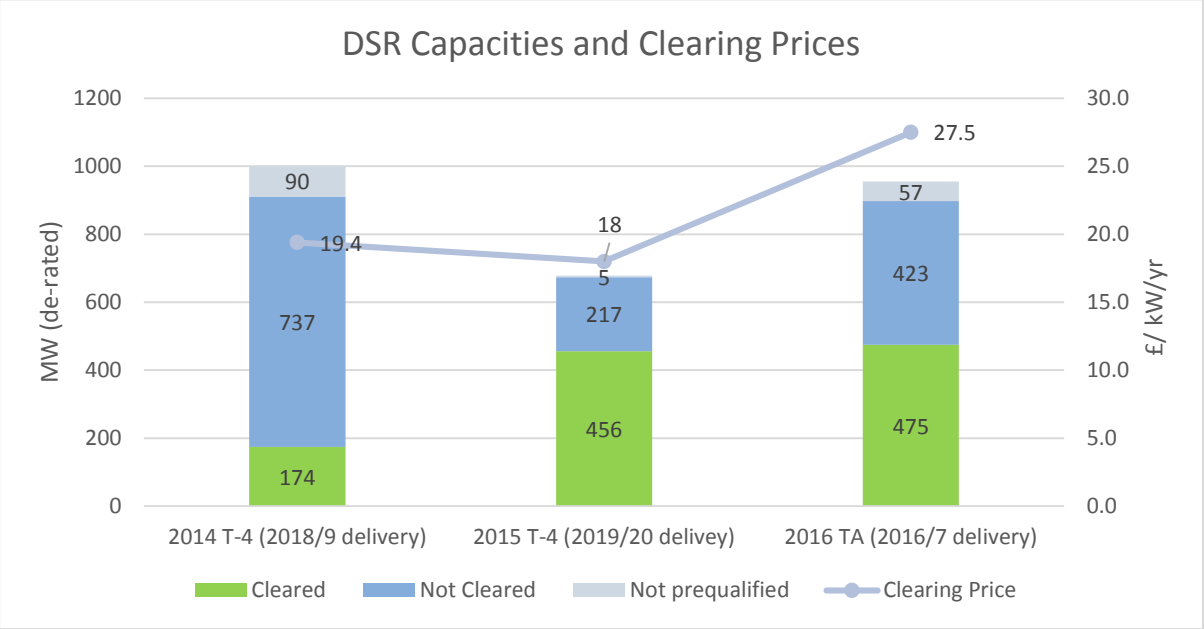
[70] https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/2015%20T-4%20Capacity%20Market%20Provisional%20Results.pdf

[71] https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/Transitional%20Auction%202016%20-%20Final%20Results.pdf

2017/8. The 2016 TA targeted a capacity between 600 MW to 1200 MW depending on the clearing price. Although the auction is mainly targeted towards DSR, small generating units connected to the distribution network with capacity below 50 MW can also participate. As a result, small scale generators, such as OCGTs, reciprocating engines and oil fired steam generators, participated in the TA together with DSR providers.

In the January 2016 TA Auction 803 MW of capacity cleared of which 475 MW was DSR and the rest was embedded generators. The clearing price was £27.5 per kW per year which is 53% higher in comparison to the 2015 T-4 auction although the volume of successful DSR capacity was similar across the two auctions. The auction results demonstrate that DSR, directly or via aggregators, is able to compete with small generators in the year ahead TA auction as well as in the T-4 auction.

Figure 5: DSR Capacities and Clearing Prices



Aggregators play a significant role in the CM, as summarised in Figure 6. The dominant form of DSR participation in the CM is via Aggregators with a limited role for Suppliers and directly by consumers. DECC believes that the DSR currently contracted in the CM is mainly provided by Back-Up on-site generation[72].

Figure 6: DSR Capacity in the CM, MW[73]

	Aggregators	Vertically integrated utilities	Suppliers	Direct consumers	Total
2014 T-4	171			4	174
2015 T-4	413	43			456
2016 TA	363	63	20	29	475
Total	946	107	20	33	1,105

[72] https://www.gov.uk/government/consultations/consultation-on-reforms-to-the-capacity-market-march-2016

[73] PA analysis based upon published figures

4.4 Current Potential Barriers to Successful Aggregator Operation

At discussions between Aggregators and Ofgem the following issues were raised by stakeholders as potential barriers which might limit the ability of DSR to compete in the CM:

- **Lack of long-term contracts for DSR:** DSR is allowed to participate in the CM under similar terms as generators but with a significant exception: In the T-4 Auctions, DSR can bid for only 1 year contracts, unlike refurbished generators who can bid for 3 year contracts, and new generators who can bid for 15 years contracts. A major aggregator indicated that the ideal contract length for aggregators would be between 3 to 5 years, as this would reduce the risk associated with a series of short-term contracts and reduce the difficulty of obtaining finance.
- **In the T-4 auction, there is un-even competition between parties:** DSR competes in the same auctions with new generators which can achieve 15 years capacity agreements. DSR might be outpriced due to the lower risk premium sought by new generators, which are able to earn 15 year contracts, though it is recognised that the capital investment required for new generation capacity is typically considerably higher than that required to facilitate DSR.
- **Unrestricted availability timeframe:** Reflecting the fact that a stress event[74] could occur at any time of the year, the T-1 and T-4 auctions require constant availability, including outside of peak times for all capacity, which exposes DSR to penalties due to the inability of some types of DSR to shift/reduce their load at times when their baseline demand is very low[75]. This issue is addressed in the TA where parties can opt for time framed contracts, though no TA participants appear to have taken up this option. The TA is temporary and after its termination, the inability of a DSR participant to enter into a "time framed" contracts could potentially expose DSR parties to penalties which they are less able to mitigate. An example of a more flexible CM can be found in PJM where aggregators have the options to choose between 3 capacity markets with different availability conditions. Though a few aggregators expressed a view that the unrestricted availability represented a barrier, the materiality of this barrier appears low, as under the TA no parties have taken up the option of time-framed contracts. Further it should be stressed that under the current CM structure, penalties are capped to the amount of annual capacity payments and therefore limits the financial risk faced by parties. Secondly the probability of system stress occurring outside of the traditional peak hours may be relatively low.
- **CM rewards capacity rather than reliability**: A limited number of stakeholders expressed a view that the CM rewards Capacity, but does not sufficiently reward reliability, as the penalties for non-delivery are capped. This concern is cross-cutting in nature – rather than Aggregator / DSR specific.

Overall, the main barrier to DSR in the CM appears to be the contract length which might undermine DSR's competitiveness.

4.5 Consumer Detriment

Though it is difficult to know how high the perceived barriers are, the limited experience of the CM auctions held so far may provide some insight into how the CM is operating.

Looking at the total capacity in the first T-4 Auction in 2014, where participants had no previous CM experience to draw upon, the total DSR capacity which prequalified in the CM was close to 1 GW, and of this 0.2 GW was successful, and gained 1-year contacts. In the second T-4 Auction, 0.7 GW of

[74] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/340046/capacity_market_rules.pdf:

[75] Note that aggregation of DSR may assist delivery on load following obligations through portfolio effects.

DSR Capacity participated, and 0.5 GW was successful in gaining a 1-year contract. It is possible that by facilitating better conditions for DSR we are likely to see up to 1 GW of DSR securing CM contracts in the short-term.

The degree of competition in the CM is currently high, with a significant over-supply of potential supply in the T-4 auctions held so far. Though under the current rules an increase in the participation of consumers, directly or via Aggregators, may have a low impact upon the clearing price in the CM, it is noted that the recently announced DECC proposals may significantly influence the degree of future competition in the CM.

4.6 Potential Policy Options

A differently-designed CM might in theory enhance opportunities for Aggregators to extract value and to participate. Features could include:

- Different auctions for different contract lengths - The CM auctions could be separated by contract lengths, with one auction for 1 year contracts and another auction for 15 year contracts. This would allow DSR to compete on a more level playing with other technologies. However, this would require a significant reform to the present CM rules and regulations as well as a new notification to the European Commission.
- Allow DSR to be awarded contracts longer than 1 year - To reduce the risk faced by DSR providers and Aggregators and to make it easier to raise finance, the contract length can be extended, perhaps to 3 years, as per refurbished capacity. This would require a significant reform to the present CM rules and regulations as well as a new notification to the European Commission.
- Relax the Capacity Market requirement for DSR to be available 24/7- Limiting the availability windows of DSR will expose Aggregators to a lower risk that they will lose revenue for not delivering capacity. In the TA, participants could opt for a time banded product (09.00-11.00 and 16.00-20.00 on working days in winter) in return to a 30% loss of CM revenue, though there appears to be no evidence that participants have taken up this option. This option is not currently available in the T-1 and T-4 auctions. In the PJM Capacity market, aggregators can choose to participate in 3 different auctions which have different availability time frames in terms of hours and days.

4.7 Conclusion

Stakeholders have expressed concerns with the current CM arrangements, claiming that the rules and regulations appear to favour generators, rather than DSR. DECC has consulted on proposed changes to the CM Rules and Regulations, recognising that UK energy market conditions have changed considerably since 2014, when the original CM was designed. The changes recently announced by DECC may create a more level playing field, by excluding parties in receipt of tax reliefs (Enterprise Investment Schemes, and Venture Capital Trusts), and may encourage peak shifting DSR in particular to play a bigger role, by excluding generation from playing in the TA. While the decision to procure more capacity in general could bring forward more DSR, the decision to procure it earlier (i.e. in the T-4 auction) may, as suggested by some Aggregators be more difficult for them to obtain contracts with their clients so far ahead – thus making it hard to judge the likely net impact. Note, Ofgem has recently published its minded-to decisions on changes to the CM rules, some of which address barriers identified by Aggregators.[76] At this stage in the development of the CM and the wider market arrangements, it is difficult to judge with confidence the significance of the current perceived barriers.

[76] Statutory consultation on changes to the Capacity Market Rules, Ofgem, April 2016 Rules, https://www.ofgem.gov.uk/system/files/docs/2016/04/statutory_consultation_on_changes_to_the_capacity_market_rules_april_2016.pdf

5 DNO SERVICES MARKET

This section briefly discusses the current state and potential barriers to DSR aggregation services which are procured by DNOs.

5.1 Introduction to the Market

The use of DSR by DNOs can benefit DNOs and consumers in various ways:

- By using DSR, DNOs can avoid or defer networks reinforcements in areas where the distribution network is short of capacity.
- DSR can enable better network management during fault conditions on the distribution network and can manage load losses.
- DSR can be used to support cheaper and more timely connections, thereby directly benefiting consumers.

The market for consumers to sell services to DNOs is currently immature, and is in its early stage of development.

5.2 Role of Aggregators in the Market

Rather than directly contracting with consumers, DNOs can use the services of an Aggregator to identify and approach consumers, who are willing to provide DSR. However, it is likely that DSR will be required in a specific location to support system capacity constraints. Aggregators can also enable consumers to provide DSR through the provision of advice and the installation of devices to control the consumer's demand and locations where there are particular stresses.

5.3 Evidence of Successful Aggregator Operation

Innovation projects have deployed demand side response as a technical and commercial smart grid intervention to address distribution network constraints relating to limited network capacity and power quality issues. Some contracts for demand response services have been established directly with I&C customers and via aggregators.

Ofgem and EA technology's recent report[77] on Low Carbon Network Fund learning identified that all DNOs are building on the learning of LCNF projects to include DSR as part of their approach to network investment. The precise form that this DSR takes varies form one DNO to another.

SSE is developing its "Constraint Managed Zone" service to provide flexibility to alleviate network constraints and deploying them as an alternative to traditional network reinforcement[78].Through the NINES project in Shetland SSE Distribution[79] is also introducing new methods and engaging with a range of stakeholders to manage the electricity distribution network more effectively. However, this project appears to be relatively unique and is driven by both a desire to run and invest in the distribution network more efficiently and the desire to avoid investment in expensive generation capacity.

[77] https://www.ofgem.gov.uk/publications-and-updates/ea-technology-s-summary-low-carbon-network-fund-learning

[78] http://news.ssepd.co.uk/news/all-articles/2015/06/constrained-managed-zone/

[79] https://www.ssepd.co.uk/NINES/

Western Power Distribution has established the Sunshine Tariff project, which seeks to develop and trial the feasibility of an 'offset connection agreement'[80]. These agreements will enable additional generation customers to connect to the grid on the basis that the local energy demand on the network changes to offset the power generated. If the generation can be absorbed locally then it will have no net effect on network constraints at higher voltage levels. The proposed method for controlling load is to engage approximately 240 homes, supplied from Wadebridge primary substation, offering a reduced tariff between 10am and 4pm during summer months. The project is due to run between April and September 2016 and is being supported by Wadebridge Renewable Energy Network (WREN), Regen SW and Tempus Energy.

A few trials of DNOs engagement with Aggregators have taken place as part of the Low Carbon Network Fund (LCNF)[81]. Most notable examples include the Falcon project[82] carried out by Western Power Distribution, Consumer Led Network Revolution[83] (CLNR) led by Northern Power Grid and Low Carbon London led by UKPN[84]. In these trials DNOs used their allocated funds from LCNF to contract with Aggregators for the supply of flexibility by both using availability and capacity payments. A number of potential DSR schemes have also been identified as part of DNO RIIO submissions.

Whilst DSR is in use by DNOs, PA's analysis has suggested that business models remain predominantly based on network reinforcement, and DSR offers greater potential than is currently being realised.

5.4 Potential Barriers to Successful Operation

Presently, there is no regulatory restriction on DNOs contracting with consumers or Aggregators in transactions which do not involve the trading of energy. However, three key barriers have been identified from the 3 LCNF trials mentioned above:

- **Lack of customer engagement / insufficient DSR resources**: consumers were unwilling to offer the level of DSR response required by DNOs because of the calls duration and frequency of response required as they appeared in the contracts[85]. Northern Power Grid engaged with 251 industrial and commercial customers as part of CLNR trials, of which only 36 were interested in engaging with Aggregators[86]. Greater transparency of the DNOs' requirements at specific locations and the increased use of the services of aggregators may help to improve the level of customer engagement.
- **Uncertainty of DSR performance:** DSR performance reliability proved to be between 77% and 95% in the different trials. In comparison, network reinforcements are perceived to give a higher degree of reliability. The planning standards may require the DNOs to over procure DSR in order to prevent system faults with a high degree of certainty.

[80] http://www.westernpowerinnovation.co.uk/Projects/Sunshine-Tariff.aspx

[81] RIIO-ED1 price control Ofgem created the Low Carbon Network Fund. The LCN Fund allows up to £500m to support projects sponsored by the DNOs to trial new technology, operating and commercial arrangements. The aim of the fund is to help all DNOs understand how they can provide security of supply for value for money as Britain moves to a low carbon economy.

[82] http://www.westernpowerinnovation.co.uk/Document-library/2014/FALCON-Commercial-Trials-Season-1-Winter-2013-14-v.aspx

[83] http://www.networkrevolution.co.uk/wp-content/uploads/2014/12/CLNR-I-and-C-Demand-Side-Response-Trials-2014-v0.92.pdf

[84] http://innovation.ukpowernetworks.co.uk/innovation/en/Projects/tier-2-projects/Low-Carbon-London-(LCL)/Project-Documents/LCL%20Learning%20Report%20-%20A7%20-%20Distributed%20Generation%20and%20Demand%20Side%20Response%20services%20for%20smart%20Distribution%20Networks.pdf

[85] Northern Power Grid required 4 hours call duration cap

[86] http://www.networkrevolution.co.uk/wp-content/uploads/2014/10/IC-DSR-presentation-WS6-161014.pdf

- **Interaction with other DSR schemes:** in the absence of a clear sharing services framework with BS such as STOR, Aggregators and consumers are only willing to sign contracts with DNOs if the benefit they get is higher than other revenue streams such as STOR.

5.5 Potential Future Change

RIIO-ED1 and ED2 price controls already incentivise DNOs to seek cheaper alternatives to capital investments in networks. The current order of magnitude of DNO triggered DSR is understood to be relatively low. Looking forward, it seems that there might be a stronger case for DNOs to procure more DSR through Aggregators, particularly as DNOs transition to distribution system operator (DSO) roles. The value of DSR contracted by Aggregators for DNOs is likely to increase in the future with the increase in decentralised renewable generation and the higher uptake of electric vehicles and heat pumps.

5.6 Consumer Detriment

Currently DNOs see limited need to contract for DSR, either directly or indirectly via Aggregators. Where barriers prevent DNOs from using efficient levels of DSR to manage their networks, there will be associated customer detriment in the form of higher costs. The materiality of this is hard to quantify at this stage.

5.7 Conclusion

There is limited experience of engagement between DNOs and Aggregators as the DNOs' business models are predominantly based on network reinforcements whenever they face network constraints. There is evidence of DNO use of DSR in trials and in business as usual practices. In common with the transmission system, the distribution networks are likely to see additional penetration of embedded generation such as wind and solar. As part of their RIIO EDI business plans a number of DNOs have shown an increase in the use of DSR and storage to provide additional services on the network to avoid the need for costly investment. However, business models remain predominantly based on network reinforcements. Several potential barriers have been identified via the LCNF Trials, but further experience of DNO-consumer or DNO-Aggregator engagement is needed to better understand the materiality of these barriers. The provision of services to the DNOs may develop further, particularly in the context of the DSO transition, and supply aggregators and other providers of DSR with an important revenue stream, and an opportunity to consider whether reforms are required to better facilitate the provisions of services by the consumer to the DNO.

6 ISSUES ASSOCIATED WITH THE CURRENT ROLE OF AGGREGATORS

6.1 Introduction

The main focus of this report has been to assess potential barriers facing non-supplier Aggregators across the different services and markets in which flexible demand can contribute. In addition, Ofgem also requested consideration of two specific additional questions:

- Whether the current absence of any formal regulation of aggregator activities raises consumer protection issues[87]?
- Whether utilisation of Balancing Services at the same time as the operation of the Balancing Mechanism creates issues of concern? More specifically, is there potential for impacts on supplier imbalance positions within the BM that will undermine the effectiveness of the BM, or lead to potential inefficient dispatch of DSR Balancing Services?

Sections 6.2 and 6.3 consider these additional questions in turn.

6.2 Absence of Formal Regulation of Aggregator Activities

Currently, Aggregators are not required to obtain a Supply licence (or other licence) in order to engage with consumers. In contrast, suppliers are obliged to obtain a Supply licence or Licence Lite from Ofgem. Non-supplier aggregators currently engage with large consumers and embedded generators.

Ofgem has held discussions with large consumers and their representatives, but no evidenced concerns of consumer abuse by Aggregators have been raised[88]. However, there was recognition that future developments, such as entry by new players and the potential engagement of Aggregators with residential and smaller business consumers, may lead to circumstances in which the potential for inappropriate conduct by Aggregators would become more of a concern.

6.2.1 Consumer Detriment

Given both the relatively low levels of DSR usage observed in the areas considered in the previous sections, and the feedback from Ofgem's discussions with large consumers[89], there is as yet little evidence that the absence of formal regulation leads to consumer detriment.

Nevertheless, in light of studies suggesting in the longer run the technical potential of DSR – potentially aggregated – from residential and smaller non-domestics[90], and the possibility that

[87] Whilst Ofgem does not formally licence Aggregators, the Capacity Market Rules, which are overseen by Ofgem, have provisions relating to aggregators

[88] In this respect, note at Ofgem's stakeholder roundtable on Aggregation in December 2015, one consumer body representative has expressed concerns that an absence of regulation of aggregators may lead to poor standards of conduct by some Aggregators. At the same event, Citizens Advice noted that aggregation has not been a focus of consumer concern to date.

[89] Ofgem organised a series of round table and bilateral discussions with a wide range of stakeholders, including large consumers and their representatives.

[90] Baringa estimate potential for peak reduction in 2030 could be up to 2.5 GW in the domestic sector and up to 2 GW for SMEs, from Baringa Redpoint / Element Energy (Aug 2012) Electricity System Analysis – future system benefits from selected DSR scenarios – Final report pack, as quoted in 'Towards a smart energy system', DECC, December 2015

innovations may allow this to be tapped, we suggest Ofgem monitor this. Potential facilitators of such engagement may include ambitions to enable elective half hourly settlement for domestic and smaller non-domestic consumers,[91] the impact of innovation programmes, such as those run by Innovate UK[92], Nesta, and DECC's Energy Entrepreneurs Fund[93], and the reduction in cost of additional automation technologies[94].

6.2.2 Potential options to address and future issues

Industry Accreditation scheme

Aggregators, via their trade organisation, the Association for Decentralised Energy, have announced their intention to establish an accreditation scheme, to operate in in a similar manner to the Heat Trust scheme, a GB-wide customer protection scheme for residential and micro-business customers served by communal and district heating networks.[95] The proposals appear to be for a voluntary scheme since non-accredited Aggregators could still continue to operate, engage with consumers and sell services to the SO.

Formal Licensing of Aggregators by Ofgem

In principle, licensing would create stronger incentives on aggregators by setting out specific licence conditions with which they must comply. However, the creation of a licencing framework would require specific vires to be provided to Ofgem, and then consideration of the specific licence conditions that an Aggregator must meet. This would require both additional articulation of the role of the aggregator, and the duties that they should have.

At this stage in the development of the aggregation services market, we do not see a strong case for formal licensing as it may constrain the development of the market and there is currently no evidence of consumer detriment. If evidence of potential consumer detriment does begin to emerge, either the industry-led accreditation scheme or an alternative form of regulation may offer a flexible and rapid response to these.

Alternative forms of regulation

Ofgem could also make use of other regulatory mechanisms in order to exercise influence over the conduct of regulators and the development of the market. These could include options such as a voluntary code of practice or some form of general authorisation/accreditation scheme, perhaps supported by requirements in supply licences to co-operate with independent aggregators or require that only accredited independent aggregators are used.

It is difficult to draw any clear conclusions about the respective merits of an industry accreditation scheme or alternative forms of regulation implemented by Ofgem at this point, without seeing the detail of specific proposals. Either approach can be made to work, but requires significant attention to both the substance of the detailed provisions in the schemes, as well as robust implementation, monitoring and enforcement.

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[91] https://www.ofgem.gov.uk/sites/default/files/docs/final_open_letter_on_hhs.pdf

[92] https://www.gov.uk/government/organisations/innovate-uk

[93] Which are assisting the piloting of schemes to assist residential consumer engagement with DSR, such as Upside Energy

[94] The importance of automation in driving consumer response is stressed in reports such as Frontier Economics & Sustainability First, 'Demand Side Response in the domestic sector- a literature review of major trials – final report' 2012, and Element Energy & De MontFort University, 'DSR in the non-domestic sector, Final report for Ofgem', July 2012

[95] http://www.theade.co.uk/demand-side-response-code-of-conduct-planned_4012.html?Parent=697

6.3 Differences in Results When Flexible Demand is Utilised via Balancing Services Rather than the BM

As noted in Section 2, the term BS covers a broad range of specific service types. Not all are suitable for DSR participation, and the details of those that are supplied by DSR differ. However, the key feature of DSR BS is that their usage is not linked to the operation of the BM. This leads to potential concerns about differences in results when flexible demand is utilised via BS rather than via the BM.

6.3.1 Impact of DSR activity in the BM

When flexible demand participates in the BM and its Offer is accepted, the Supplier will receive the price at which the accepted Offer was submitted. In the relevant trading periods, the volume of each Offer accepted is applied to the Supplier's notified contract position. So providing the flexibility service is delivered as instructed by the acceptance of the Offer, the imbalance position of the Supplier is unaffected. As a result, the wholesale energy purchase cost faced by the Supplier will not reduce because of the reduction in demand by its customer (i.e. the Supplier will not receive an imbalance windfall). The Supplier will receive less retail revenue from its customer in the trading period, but this may be offset by the income it receives from the BM and the increased retail revenue in a future period.

For the customer there are likely to be two impacts. Firstly, the customer may incur some form of inconvenience cost arising from alterations to its expected production schedule, for example if non-energy costs cannot be fully adjusted in the time available. Secondly, although its cost of energy will reduce in the trading period concerned, where the production foregone is replaced by increased production at a later point, the cost of replacement energy may offset this. If the retail price of its energy in the future period is lower, there will still be an element of net benefit.

So overall, the Offer price submitted by the Supplier will have to provide sufficient revenue to: a) compensate the customer for the inconvenience cost; b) offset the loss of retail revenue in the trading period adjusted for expected future retail margin on replacement energy; and c) to offset the additional costs incurred by the Supplier and provide some element of overall surplus. The customer's willingness to provide flexibility will depend on the benefits from doing so being sufficient to outweigh the inconvenience costs.

As noted in Section 3, the precise way in which the size, timing and price of the Offer is determined is a matter for the retail contracts between the Supplier and those of its customers who are interested in providing demand flexibility. For example, retail contracts may provide for a dialogue between the Supplier and customer to agree the specific prices to be submitted. Alternatively, the contracts could give the Supplier the option to instruct a customer to reduce its demand in certain circumstances in return for a lower overall unit price.

6.3.2 Impact of DSR activity via Balancing Services

For the customer providing the flexible demand, the situation is similar to that in the BM, but with a few differences. The first key difference between flexible demand provided via a BS is that in most cases there is no recognition of the impact on imbalance volumes within the BM. So when a consumer reduces demand to deliver a BS, the Supplier with which that consumer is contracted will have a surplus (or smaller deficit) in the BM. The Supplier will lose retail revenue in the trading period, but will receive an imbalance payment. Note that this imbalance payment will arise irrespective of whether the BS is purchased from the Supplier, or from an Independent Aggregator. The imbalance payments to the Supplier are also recovered from all BM parties, who in effect pay for the long position of the

Supplier. The cost is recovered by the BSC Residual Cashflow Reallocation Charge (RCRC) charge[96].

The second important difference that could arise occurs when the BS is provided via an Independent Aggregator rather than the Supplier. Where a Supplier considers a BS, they are likely to take account of the loss of retail revenue in pricing the offer to provide the service. However an Independent Aggregator is not exposed to any loss of retail revenue and so in principle, could price the BS only to cover the inconvenience cost for the customer providing the flexible demand, and its own costs and margin.

6.3.3 Impact of differences in results between BM and BS

The preceding sub-sections explain the nature of the differences that arise when flexible demand is utilised via the BM or BS. The delivery of the BS impacts on the imbalance position of the relevant Supplier, resulting in an imbalance payment which is recovered from all BM parties. It is also possible that an Independent Aggregator could price the service more cheaply since there is no exposure to lost retail revenue, and this in principle could result in a larger quantity of the BS being dispatched. This issue has been explored in the context of electricity markets in the USA by in an article published in the Electricity Journal, which concluded that the utilisation price of DSR ought to take account of the avoided retail energy cost[97].

While it is clear that the results will be different, the materiality of the differences is unlikely to be substantial in the current market environment. This reflects both the relatively low volumes of demand side utilisation in BS noted in Sections 2 and 3, and also the observed price differentials. At times of high-energy prices, the imbalance payment effect is likely to be significantly higher than the lost retail revenue, and the Supplier therefore tends to benefit from the imbalance exposure as a result of the delivery of the demand turn-down BS. However, in many trading periods, the imbalance price tends to be a similar order of magnitude to the Wholesale Market element of the Retail price. Therefore the net overall financial effect on the Supplier is likely to be relatively small. However, as the effect will be enhanced by the Electricity Balancing Significant Code Reforms (EBSCR), which will introduce fully marginal imbalance prices and an administrative Value of Lost Load (VoLL) of £6,000/MWh in 2018, and the SO and Ofgem may wish to monitor this.[98]

Even with the concern that some BS may be priced in such a way that does not recognise the impact on a Supplier's retail revenue, the quantities of demand side participation dispatched via BS have been small. Further, a low utilisation price for BS has the effect of lowering the SO's costs of balancing the system, and hence reduces the costs the SO needs to recover from users via Balancing Services Use of Service (BSUoS) charges. To a large degree, these two effects are likely to offset each other, and the net cost to all consumers is therefore likely to be very low.

So in summary, the fact that delivery of Balancing Services is not recognised within the BSC does create some degree of misalignment. However, since neither the volume nor the price differentials involved are typically large, the impact of the inefficiency is currently not great. Given the importance of BS for system stability, the small misalignments have not been a source of any particular concern to date.

6.3.4 Potential options to address issue

As noted previously, there is a general expectation that the need for flexibility is likely to increase over time as a result of changes in the generation fleet and in the prospective level and volatility of demand.

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[96] https://www.elexon.co.uk/reference/credit-pricing/trading-charges/

[97] Areas of Congruence", Electricity Journal 2012 Volume 25, Issue 1

[98] https://www.elexon.co.uk/mod-proposal/p305/

So over time, it is possible that the interplay between BS and the BM may become an area of greater concern. In the event that it were decided to introduce remedial steps to remove or mitigate this issue, the ACER proposal to facilitate independent aggregation in relation to the prospective Article 31 of the draft Electricity Balancing Network Code of[99], may become relevant. The prospective Article 60 of the draft Electricity Balancing Network Code is a partial solution to the issue, as it proposes to adjust the Imbalance position of Suppliers to reflect SO utilisation of BS. However it does not consider the issue of compensation paid by the Aggregator to the Supplier. Appendix A provides a summary of the ACER proposed Article 31.

[99] http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/ANNEXES_TO_RECOMMENDATION_032015/Annex%20II%20-%20Proposed%20amendments%20to%20the%20Network%20Code.pdf

A ACER PROPOSED FRAMEWORK TO FACILITATE DSR BY INDEPENDENT AGGREGATORS - "ARTICLE 31"

A.1 Potential Regulated Framework / Industry Code for Aggregator to Compensate Supplier

The ability of Aggregators to access markets varies across Europe. In Germany, Aggregators need the agreement of the Supplier before they can access the flexibility of the consumer, whilst in GB independent Aggregators can access certain markets without the involvement of the Supplier.

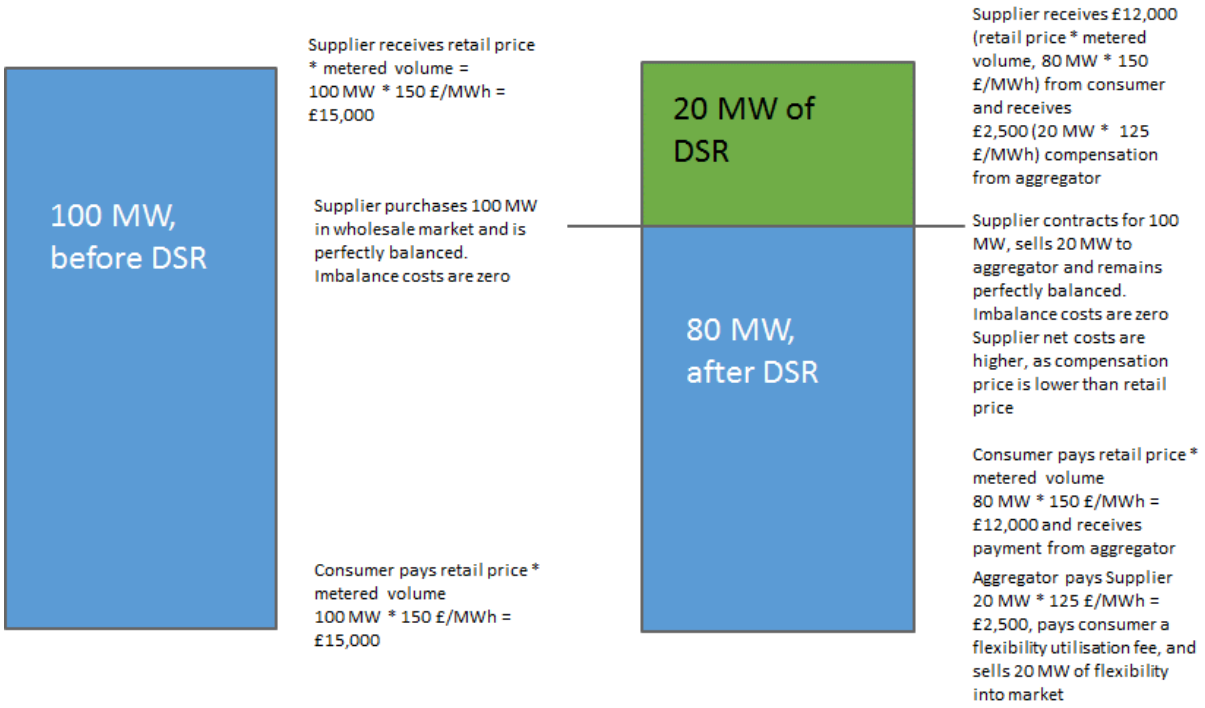
Article 31 of the Draft Electricity Balancing Network Code ("Article 31"), as drafted in March 2015, proposes a framework allowing independent Aggregators to access a range of markets, without the consent of the Supplier. In the GB context, it appears only relevant to accessing the BM and trading in the Wholesale Market, as currently the provision of Balancing Services by an Aggregator does not require the consent of the Supplier.

The draft Article 31[100] allows for an Aggregator to purchase DSR from a consumer, without the consent of the Supplier. In the proposal, the Aggregator would buy energy from the Supplier at "the average sourcing costs of the energy supplied by the energy supplier to the Demand facility". The Supplier is effectively held harmless by the combination of the trade and the lower demand. The Supplier's contractual imbalance position remains as it would have been assuming DSR had not happened, and the Supplier receives a payment from the Aggregator, which compensates them for the loss of retail revenue. Under the ACER proposal, the Aggregator would sell the consumer's flexibility into the "market", be that directly as an energy trade in the Wholesale Market, in the Balancing Mechanism, or as a Balancing Service.

The "trade" between the Supplier and the Aggregator does need not require an explicit contract between the parties, and may be facilitated/administrated by Elexon, or indeed any other third party. Figure 7 provides an illustration of 20 MW of DSR being provided from a 100 MW consumer.

100 http://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/ANNEXES_TO_RECOMMENDATION_032015/Annex%20II%20-%20Proposed%20amendments%20to%20the%20Network%20Code.pdf

Figure 7: Illustration of ACER proposal[101]



A.2 Issues with Proposal

There are several issues, some of them very significant, associated with the current ACER draft proposal. The issues can be grouped into 4 broad areas:

- Compensation price
- Settlement volume
- Transparency
- Consistency with BSC

Similar concerns about the ACER proposal have been raised by NordREG, the Nordic energy regulator, in relation to the Nordic arrangements[102] .

A.2.1 Compensation Price

The compensation price paid to the Supplier by the Aggregator is difficult to establish, but needs to be established before the DSR actually occurs to allow the Aggregator to know what costs it would be exposed to. The ACER proposal refers to "average sourcing costs", but does not precisely define what is meant by this. There are 5 broad options for determining the compensation price:

- **Energy element of Supplier's Retail Price** - To hold the Supplier harmless for the loss of retail revenue, arguably the Supplier should be compensated at the wholesale energy component of its retail price. However, the retail price to the end consumer tends to be less transparent, though the Supplier will have the detail of the constituent elements of the final price such as DUoS, TNUoS,

[101] This is an illustration, based upon PA's understanding of the ACER proposal. The numbers are given are for illustration only.

[102] http://www.nordicenergyregulators.org/wp-content/uploads/2016/02/NordREG-Discussion-of-different-arrangements-for-aggregation-of-demand-response-in-the-Nordic-market.pdf

BSUoS and other levies. Reaching agreement between the Supplier and the Aggregator on the pure energy costs will be difficult as there are many ways in which the Supplier could have obtained the energy.

- **Imbalance Price** – For each half hour trading period or 'Settlement Period', there is a single 'cash-out price' or 'energy imbalance price'. When the system is "short", i.e. the SO is taking actions to increase generation or lower demand, the Imbalance Price is calculated based on accepted BM Offers. When the system is "long", i.e. the SO is taking actions to decrease generation or increase demand, the Imbalance Price is calculated based on accepted BM Bids. BSC Parties that are "short" i.e. have negative imbalances pay the Imbalance Price, whilst parties that are "long" i.e. have positive imbalances receive the Imbalance Price. Currently, the Supplier is cashed out and receives Imbalance Price when its demand is lower than the volume of electricity it has purchased or generated. Settlement at Imbalance Price is transparent but could over/under compensate the Supplier compared to its lost retail revenue.
- **Wholesale Price, as set by the Market, varying from the spot (very close to real time) to the Day-ahead** – you could argue that the cost to the Supplier of the foregone demand is the price the Supplier could have achieved in the Wholesale Market, if it had known that its consumer's demand would be low. Settlement at some market index price is transparent but the choice of which wholesale price (e.g. prompt, Day-ahead, and Week-ahead) is arbitrary. It could over/under compensate the Supplier compared to its lost retail revenue.
- **Some form of sourcing cost based upon the Supplier's own purchasing costs** – this is similar in concept to the energy cost component of the Retail price. It is virtually impossible to establish and allocate on a half-hourly basis. It would also need to be established before the DSR actually occurs to allow the Aggregator to know what costs it would be exposed to.
- **Negotiated price between Supplier and Aggregator** – In principle this would appear attractive as it would be a bilateral agreement, and would not require any administrated mechanism. However, there would need to be a default price, from one of the options above, in the event that the parties fail to agree terms.

Furthermore, dependent upon the exact nature of the transfer of volumes between the Supplier and the Aggregator, it is possible that there would be a metered volume allocated to an Aggregator, especially in situations of demand "turn-up". Unlike a non-physical trader, in these situations an Aggregator would be subject to a series of charges related to their physical "through-put" on the system. The allocation of these charges between the Aggregator and the Supplier would need to be known prior to the provision of any DSR flexibility in the BM.

The Aggregator may attempt to reflect the compensation paid by the Aggregator to the Supplier by increasing the utilisation price of the Balancing Services it tenders to the SO. It is possible that a higher utilisation price may lead to less DSR being procured by the SO, and/or less utilisation of DSR by the SO.

A.2.2 Settlement volume

Establishing a settlement volume could be difficult as the expected demand profile will need to be established and agreed in advance and then compared to an actual meter reading. This "volume" risk is an inherent risk faced by Suppliers already. There are several options to establish the DSR settlement volume:

- **Baseline** – The actual consumption of the consumer could be compared with the forecast/baseline based upon their recent consumption patterns. This would be a difficult process but there are examples of this process in PJM, and the GB Capacity Market. However, not all of the change in demand may be due to DSR, as instructed and paid for by the Aggregator. Some of the fluctuations in the consumer's demand may be the result of the inherent volatility of consumer's demand, the risk of which is currently borne by the Supplier.

- **As nominated by Aggregator/Third party** – A simpler option is to allow the Aggregator to nominate the volume. The volume settled between the Supplier and the Aggregator should be the same as the volume settled between the Aggregator and the consumer. However, as discussed above, the demand of a consumer is inevitably volatile and the Supplier may have different views on the extent of DSR purchased by the Aggregator.
- **As determined by the SO** – There are existing processes in place to determine the volume of DSR provided in situations when the purchaser of the DSR is the SO. This settlement process would work in situations where the Aggregator sells the consumer's flexibility to the SO via a BS or in the BM, but would not work well in situations in which the SO is not involved, such as when the Aggregator sells the flexibility into the Wholesale Market.

The Aggregator would be responsible for the imbalance settlement associated with the acquired volume of DSR flexibility. Dependent upon how the settlement volumes are determined, the Aggregator could have an imbalance position, and be exposed to Imbalance price.

A.2.3 Transparency

To enable it to better understand its risks, the Supplier would tend to argue for full disclosure of an Aggregator's actions at the level of each consumer, whilst the Aggregator would argue that such a level of disclosure is unnecessary and may threaten its competitive position and could seek corresponding cost transparency. Several of the pricing options involve the commercial pricing data being revealed by the Supplier, and Suppliers may be very reluctant to inform the Aggregator of its own purchase costs or the retail prices charged to its customers.

A.2.4 Consistency with BSC

It is our understanding that the ACER proposal, as currently drafted, would require modifications to the BSC, as explained further in Section 3. The BSC does not currently permit third parties to register consumers' demand as a BMU, and hence Aggregators cannot directly participate in the BM on behalf of their consumers. Secondly Aggregators wanting to participate directly in the BM would be required to be a party to the BSC. The ability of Aggregators to be a party to the BSC would need to be clarified by Elexon.

To allow Aggregators to indirectly participate in the BM via the Supplier would require changes to the BSC or the establishment of another industry code / regulation, which set out the rights of Aggregators to influence how Suppliers offer their consumers' flexibility in the BM. Dependent upon the exact details of how the BSC is modified to allow a role for independent aggregators, there may be significant IT systems implications.

A.3 Policy Evaluation of ACER proposal

A.3.1 Pros

Aggregators will be able to offer consumer's real-time flexibility into the BM, and will not be restricted to providing BS under contract to the SO. It offers a solution to correct the issue of inefficient dispatch and inefficient price signals, as discussed in Section 6.

A.3.2 Cons

There are several issues relating to the ACER proposal that require further consideration. Firstly, it is understood that the ACER proposal would not work under the current terms of the BSC and so changes to the BSC would be required. The BSC states that the Supplier is responsible for submission of Bid and Offers into the BM. How the Regulated Framework and the BSC would interact and be made consistent would need careful attention. Secondly there are several issues relating to the detail of the Regulation itself, especially in relation to

- the Compensation Price to be paid by the Aggregator, including how this would be calculated in practice
- the correction of imbalance volumes including estimates of rebound effects (this may be introduced by the prospective Article 60 of the draft Electricity Balancing Network Code), and
- real-time provision of accurate information to affected Suppliers in order to prevent them from taking actions that undermine system efficiency.

Suppliers currently have the ability to offer the DSR flexibility of their consumers into the BM, yet none appears to have done so.

We recommend that Ofgem seeks further evidence on the potential benefits of Aggregators being able to offer DSR flexibility in the BM independently of the Suppler, and the implications for the BSC and the supporting IT systems.

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