

Barriers to Independent Aggregators in Europe

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EPG Working Paper: EPG1901

Abstract: Various studies and consultations have been undertaken in recent years which examine the benefits that independent aggregators can bring to the European electricity markets. Independent aggregators can provide an important route to market for demand side response providers and small-scale generators, by bringing together providers who would be too small to participate in the markets individually. In addition, aggregators have detailed knowledge of these markets which many small providers might lack. Aggregation can also increase the reliability of DSR by bringing together resources from across different industries and geographies.

However, at present there is no coordinated approach across Europe for the inclusion of independent aggregators into these markets. There is therefore a united view in industry bodies that further development and a coordinated approach to the aggregator role is necessary to enable their full inclusion.

Keywords: aggregation, policy, markets, suppliers, BRPs, compensation, DNO, ESO, flexibility, DSR

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Date: 09/01/2019



European Union

European Regional
Development Fund

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The Cornwall Local Energy Market is part-funded by the European Regional Development Fund under the European Structural and Investment Funds Programme 2014-2020

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Foreword

The authors are currently researching the Cornwall Local Energy Market (LEM) project, which is a three-year trial from 2017 to 2020, jointly funded through the European Regional Development Fund and Centrica. The project is led by Centrica in association with project partners Western Power Distribution, National Grid, the University of Exeter and Imperial College London.

The Cornwall LEM creates a local marketplace, via an online platform, which can draw together a community of renewable energy and low carbon generators, storage and demand side response (DSR) providers at both the domestic and non-domestic level. The platform allows participants in the local market to trade their flexible generation and demand in both traditional and new markets, either as a collective or individually.

The LEM caters for sellers across the spectrum, from residential participants, to SMEs and I&C customers, to front of meter assets, to aggregators. That is, the LEM aims to provide an important route to market for DSR providers and small-scale generators, by bringing together providers who would be too small to participate in the established electricity markets individually. Independent aggregators already provide an essential role in bringing these resources into existing GB marketplaces (where their access is allowed) but the LEM can now provide these actors with a further avenue for trading customers' flexibility, which should be beneficial to both parties – access to additional revenue streams for aggregators; whilst providing the LEM with increased local assets.

Aggregators can therefore play an important role in selling flexibility in an independent LEM. Barriers faced by aggregators therefore can also affect the LEM – either directly in that in several circumstances they face the same barriers (mostly surrounding access to existing and new markets¹), or indirectly, in that barriers which undermine the financial potential of aggregators could undermine their availability to transact with the LEM.

There has been renewed interest in energy flexibility and DSR globally as a result of climate change and energy security issues coming to the forefront of the political agenda (Warren, 2014) and thus an interest in the role of the independent aggregator, as a new facilitator entering the retail energy markets.

In the US, where demand response was pioneered, the role of independent aggregators is well understood (Engerati, 2017), and these actors are highly active, with market rules in New York (NYPDS, 2014) and California (California ISO, 2015) for example, designed to ensure that aggregators flourish.

However, the role of aggregators in Europe is less well understood and in most European countries the aggregator role doesn't formally exist (Engerati, 2017). Whilst Article 17.3 of the EU 'Winter Package' (European Commission, 2016) requires member states to define frameworks for independent aggregators to enable full participation in retail markets, their ability to access those markets currently varies widely across Europe, with many European markets still closed to the independent aggregator.

Meanwhile in GB, BEIS & Ofgem have identified some of the barriers facing aggregators in the 'Smart Systems and Flexibility Plan' (BEIS and Ofgem, 2017) and have put in place a range of solutions to unlocking those barriers, such as proposed changes to the Balancing and Settlement Code (BSC) and the ability to stack revenues across certain markets to increase viability (see Section 3.1).

¹ For full details on regulatory and market barriers see our overarching report (Bray, Woodman and Connor, 2018)

1. What is Aggregation?

The act of aggregation can be defined as the grouping of different customers within the power system (i.e. consumers, producers, prosumers) to act as a single entity when engaging in electricity markets or when selling services to system operators such as the electricity system operator (ESO) or the distribution network operators (DNOs) (Burger *et al.*, 2017). Through aggregation the value of flexibility (DSR, storage and embedded generation²) can be enhanced by bringing together providers who would be too small to participate in the markets individually due to specified load sizes.

Additionally, aggregation can also increase the reliability of flexibility by bringing together resources from across different industries and geographies within a single portfolio (CRA, 2017). This is known as the 'diversity effect' (Garcia-Rundstadler, 2018) as by mutualising between multiple technologies across different locations, aggregation can cushion the forecasting risk of intermittent technologies such as wind and solar.

To date in GB, system flexibility requirements have been mainly procured by National Grid (the ESO), from large generators connected to the transmission network. However, with increased levels of smaller-scale intermittent generation, much of it connected at the distribution level; combined with decarbonisation targets and the emergence of new technologies, this potentially encourages an increased role for the aggregation of small-scale resources. And therefore, a role for aggregators who are skilled at bringing these resources to market.

At present, aggregators do not need a licence to operate within the GB power system. Whilst some aggregators also hold a supply licence (supplier-aggregators) others do not and are termed as 'independent aggregators'. This report focuses on independent aggregators and the barriers which they face in fulfilling their role – barriers which may be in the form of regulatory procedures, financial penalties or from competition with other actors operating within the energy system.

Various studies and consultations have been undertaken in recent years which examine the benefits that independent aggregators can bring to the GB electricity markets (as discussed in Section 3.1). All of these studies agreed that independent aggregators provide an important route to market for flexibility providers, with one survey highlighting that 74% of respondents who provided demand side response (DSR) did so through an independent aggregator³ (PA Consulting Group, 2016). Fundamentally, independent aggregators have detailed knowledge of navigating the various energy markets, which individual flexibility providers might lack (CRA, 2017).

Aggregators also have an in-depth knowledge of their customer assets and requirements. This enables them to make decisions on behalf of their clients as to which markets they will be best placed to trade into; taking into account potential profit, length of contract, notification time, dispatch delivery time and duration of delivery. They also make decisions on which resources / clients to aggregate together to fulfil those obligations. The role of aggregators is therefore an active and involved role on their clients' behalf.

² Embedded generators are those with a capacity below 100MW and connected to the distribution network

³ This % is likely to have decreased recently with independent aggregators such as Flexitricity taking up supply licences in order to be able to trade across all markets (see Section 3.1).

Most of the literature on independent aggregators focuses on their ability to initiate DSR across their portfolio of sites. DSR itself can be split into two categories – *implicit* and *explicit* DSR. Implicit DSR refers to an event initiated in response to a price signal (i.e. reducing demand when prices are high); whilst explicit DSR refers to the selling of DSR into recognised electricity balancing markets.

One reason why explicit DSR captures the main focus of literature attention is because this, rather than generation, is deemed to be where the most financial benefits can be made. This is because the value of DSR flexibility is greater outside of the market (in helping to reduce imbalance penalties) than the value of generation assets within the market (Garcia-Rundstadler, 2018) as demonstrated in Section 3.2.3. However, aggregators can also play an important role in bringing small-scale renewable generation and battery storage into the market place, by pooling and therefore reducing costs of participation.

In European markets aggregators deal mainly with large scale industrial and commercial entities, with limited examples of aggregators engaging with smaller non-domestic and domestic customers (BEUC, 2018). This is true even in France where the domestic DSR market has been open since 2007 (PA Consulting Group, 2016). This is also true for GB; where a recent survey by Ofgem revealed that all aggregators who responded (including supplier-aggregators) worked only with I&C customers (Ofgem, 2016a). However, with the introduction of smart metering and half hourly settlement; alongside advances in digital technologies; it is perceived by BEIS and Ofgem that flexibility aggregation will become more accessible to smaller non-domestic and domestic customers within the next few years (BEIS and Ofgem, 2016).

Whilst the system and cost benefits of aggregation have been widely acknowledged (see Section 3.1), the actual role of aggregators themselves has been heavily debated across Europe. The European Commission have been supportive in their recent Electricity Directive (European Commission, 2017), yet anomalies persist throughout Member States regarding issues such as aggregators access to wholesale and retail markets and payment of compensation to Balancing Responsible Parties⁴ (BRPs) / suppliers.

One of the key debates is the impact that aggregators might have on suppliers, particularly in relation to a supplier's demand position in the market (De Heer, 2015). In GB aggregators are currently independent of the supplier of the customer providing the flexibility and as such are not responsible for the customer's metered supply; leading to demands from suppliers for compensation for loss of revenue (Baker, 2016) (see also Section 2.3).

To enable independent aggregators to enter the market at scale, it is critical therefore that their role and responsibilities are clarified. In particular, it is important that the relationships between suppliers, BRPs, and independent aggregators are clear, fair, and allow for fair competition (SEDC, 2017). However, despite the evidence collated there is still, as yet, no legally defined role for independent aggregators in GB and their access to some markets is still uncertain. Whilst Article 17.3 of the EU Electricity Directive (European Commission, 2016) (outlined in Section 2.2), requires Member States to define frameworks for independent aggregators along principles that enable full participation in the market, currently in GB, independent aggregators can only access some markets directly (i.e. the

⁴ A balancing responsible party is a market role in power systems that is specifically defined to settle differences between the scheduled and actual values of consumption, generation and trade.

ancillary services market and the Capacity Market); whilst other markets can currently only be accessed through suppliers (i.e. the Wholesale Market and the Balancing Market).

Independent aggregators' relationship with consumers has also been debated in GB, with some calling for the relationship to be formalised either through a mandatory Code of Practice or through an aggregators licence (BEIS and Ofgem, 2016) (see Section 3.1).

This briefing paper will look at barriers and opportunities for aggregators in GB, working within the current market structure, but it will also look at the wider European context of participation. The Cornwall LEM is supportive of aggregators as they can play an important role in selling flexibility in an independent LEM. Therefore, barriers faced by aggregators can also affect the performance of a LEM – either directly in that in several circumstances they face the same barriers (mostly surrounding access to existing and new markets⁵), or indirectly, in that barriers which undermine the financial potential of aggregators could undermine their availability to transact with a LEM.

⁵ For full details on regulatory and market barriers see our overarching report (Bray, Woodman and Connor, 2018)

2. European Context

2.1 European Markets

The ability of aggregators to access markets varies across Europe. For example, in Germany, Finland and Belgium aggregators currently require contractual agreement with the supplier before they can commence any agreement with the consumer. Whilst in France, on the other hand, regulation enables aggregators to access all markets without negotiating first with a supplier (PA Consulting Group, 2016).

A 2017 study of explicit DSR in Europe conducted by the Smart Energy Demand Coalition (SEDC, 2017), highlights the range of regulatory procedures currently in operation regarding the access of aggregators to European DSR markets⁶. Figure 1 gives an overview of the development of European DSR as of 2017 according to SEDC's analysis.

Figure 1: Demand Response in Europe



Source: (SEDC, 2017)

Note: SEDC note that they ranked the EU Member States in relation to each other, and that even where countries are shown as green on the map, further improvements are both possible and necessary.

Six Member States were identified as 'green' in Figure 1, based on the survey findings and a criteria tally. Of these six, France achieved the highest score in the survey overall, with a total score of 18 out of 20. Industrial customers in France have been able to participate in the balancing mechanism since 2003 and from 2007 aggregated residential load has also been able to participate (*ibid*). France introduced

⁶ Note this particular study only looks at DSR and no other forms of flexibility

the NEBEF mechanism in December 2013 which allows curtailed load to bid directly into the Day Ahead market, and as of 2017, the Intraday market also. The NEBEF mechanism also regulated and standardised the relationship between aggregators and suppliers through an administrative approach to compensation (Baker, 2016). France’s Capacity Mechanism (which commenced in 2017) is also open to DSR providers (BEUC, 2018).

We have looked in more detail at the six Member States which SEDC identified as the highest scoring i.e. those Member States which were in the green category, with scores ranging from 14 out of 20 upwards; along with two from the ‘yellow’ category – Germany and Denmark; which whilst they have well established energy trading markets have very limited access for independent aggregators to compete within these markets. Table 1 below outlines the BRP / aggregator relationship in each country; the markets which are open to flexibility, along with any identified market barriers. We have ranked the countries in descending order of how we perceive the ease with which independent aggregators can operate in these countries and the ease by which they can access individual markets. However, it should be noted that although France and Switzerland are presently leading the table, all of the remaining countries are currently undertaking improvements which should ease access in the longer term. These improvements are either in the form of new regulations, and / or the development of industry trials.

Table 1: Access and Barriers to European Markets

Country	BRP / aggregator relationship	Access to markets	Barriers to markets	Relevant Legislation
France	Aggregators do not need prior agreement from BRPs. However the BRP - aggregator adjustment mechanism sets compensation amounts which aggregators must pay to BRPs.	WM, BM, CM and ancillary services are all open to aggregated DSR.	DSOs are not able to contract flexibility for constraint management, although there are 18 demonstration projects in progress / concluded.	The NEBEF mechanism, 2013.
Switzerland	There is no BRP/ aggregator contract in the balancing markets – aggregators’ contract directly with the TSO and neither the BRP nor the aggregator pay imbalance fees. However the aggregator has to pay the BRP compensation for the difference in consumed energy.	DSR is active in the balancing and ancillary services markets (since 2013 when regulatory changes removed barriers).	No access to the WM; and Switzerland doesn’t have a CM. Currently there are only pilot projects at the DSO level looking at congestion management.	Swiss Energy Strategy 2050
Ireland	Aggregators don’t need the BRPs permission prior to load management. Neither the BRP nor the aggregator is charged for imbalances caused by load	The ancillary market opened to DSR in 2016 under Interim Arrangements leading up to the launch of I-SEM.	Difficult and expensive prequalification procedures act as barriers to consumer participation. Aggregators aren’t able to cushion consumers from these	After several delays, I-SEM launched on 1 Oct 2018

	management as imbalances are covered by the TSO.	Demand side participation should increase significantly through I-SEM due to a more diverse product range.	procedures as each consumer is treated as if they were a large generation unit.	
GB ⁷	The BRP / aggregator issue is not as yet resolved. Ofgem consider that aggregators shouldn't need to gain prior consent from suppliers (Ofgem, 2017a). However at present aggregators can only access some markets without agreement from the supplier, whilst other markets are closed to participation except via a supplier.	Aggregators can participate in the CM (although DSR is not on a level footing with generation). They can also access most ancillary services.	There is no access for independent aggregators to the WM or the BM – they would currently need a supply licence or a bilateral agreement with the supplier– and then can only bid in generation, not DSR to the WM. Most DNOs are trialling flexibility procurement.	Modification P344 to the Balancing and Settlement Code has recently been adopted and should be implemented in early 2019 which will alleviate access to the BM.
Belgium	Aggregators to date have needed the prior agreement of the customers BRP to contract with the customer. However Belgium's 'Energy Pact' 2018 removes this obligation. The new framework will allow aggregators to sign contracts for ancillary services with the TSO after passing a prequalification process.	Aggregated DSR can access ancillary services markets.	No access to the WM for DSR. Domestic customers cannot participate in DSR either individually or through an aggregator. DSOs do not contract flexibility but cooperate with the TSO to allow network consumers to participate in DSR - although the DSO reserves the right to block any flexibility event without notice if there is a capacity issue.	Energy Pact – approved by ministers 2018 but not as yet implemented
Finland	Independent aggregators can only access markets in agreement with the customers BRP (apart from one ancillary service FCR-D). There is no specific framework governing the aggregator / BRP relationship.	DSR and aggregation are legally possible in all markets but technical and operational limitations exist. However, FINGRID are running pilot	Limitations include the large scale of load requirements in some markets and BRP requirements. No DSO procurement of flexibility; and the DSO	National Energy and Climate Strategy 2030 (published 2016)

⁷ For overview only as GB situation discussed in detail in Section 3

	BRPs don't have to pay for imbalance as this is settled by the TSO.	projects from 2018 to develop a new model to enable independent aggregators to access the balancing markets (FINGRID, 2018)	role in controlling flexibility is as yet unclear. Network tariff is a flat day / night rate which disincentives day-time DSR.	
Germany	There is no standardised role for independent aggregators in Germany – requiring several contractual relationships to be negotiated – with the consumer; the TSO; the DSO and the consumers BRP.	Balancing market and ancillary services are open to demand response. Minimum bids for all balancing programmes were downsized in 2011 & 2012. Draft CM rules allow response participation in principle, but aggregation of resources is not allowed and minimum bid size is 10MW and opportunity costs are paid for generation – not demand. WM – demand response is only allowed via the BRP; independent aggregators cannot enter.	A number of markets are closed to demand response. No market-based programmes at the DSO level – partly due to DSOs incentive regulation favouring CAPEX over OPEX, hence financially better for a DSO to expand / reinforce the network rather than procure flexibility. Network fees incentivise a flat consumption rate; thereby penalising those that provide flexibility.	Energiewende 2010 (Energy Concept) Energy Package 2011 (supplements to the Energiewende)
Denmark	Independent aggregators must bilaterally contract with the consumers BRP and retailer through a prior agreement – however, there are no independent aggregators in Denmark; only retailers / BRPs currently provide aggregation services.	In theory demand response can enter the WM and ancillary services markets - but this is very limited due to little demand from the TSOs and DSOs. Approx. 85% of Danish electricity is traded on the Nord Pool Spot market.	Payments in WM are too low to make a good business case. Tertiary reserve market has a high volume demand of 10MW. Some markets require online measurement and 24-hour service. In 2015 published Markedsmodel 2.0 with	Danish Energy Agreement for 2012-2020 Denmark's Energy and Climate Outlook 2017

			proposed market reform to enable greater flexibility. It included 24 recommendations – leading to Denmark modelling several scenarios for the integration of aggregators (Arentsen <i>et al.</i> , 2017).	
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Sources: (SEDC, 2017) (FINGRID, 2018) (Ministry of Economic Affairs and Employment of Finland, 2017) (Elia, 2017) (Elexon, 2017b) (Elexon, 2017a) (Ofgem, 2017a) (SEMO, 2018) (Swiss Federal Office of Energy, 2018) (RTE, 2013) (IEA, 2013) (IEA, 2017) (Danish Energy Agency, 2017)

2.2 European Policy Position

Whilst there is at present no coordinated approach across Europe for the inclusion of independent aggregators in the energy markets, there is a united view in industry bodies that there is a need for further development and that a coordinated approach is necessary, led by the European Commission (Engerati, 2016).

The European Commission appointed the Smart Grids Task Force to provide regulatory recommendations for the deployment of flexibility in 2014; which assessed the role of aggregators within its remit. Their concluding document in 2015 recommends that:

“In order to avoid barriers to entry, an aggregator should never be obliged to negotiate its portfolio with the BRP or supplier of a consumer (SGTF, 2015).”

The European Commission further sought to ratify the role of aggregators across Europe through their 2016 proposed revision of the Electricity Directive. Their proposal states that: -

“Member States shall ensure that their regulatory framework encourages the participation of aggregators in the retail market and that it contains at least the following elements: (a) the right for each aggregator to enter the market without consent from other market participants.....(d) aggregators shall not be required to pay compensation to suppliers or generators.

Member States shall ensure access to and foster participation of demand response, including through independent aggregators in all organised markets” (European Commission, 2017).

However on 18 Dec 2017 the European Parliament made amendments to the proposal (European Parliament, 2017). The first amendment is positive in that it adds the words '**wholesale and retail markets**' to the first sentence above. At present, aggregators' ability to access wholesale markets differs across the Member States (as highlighted in Table 1 previously), with several countries currently denying independent aggregators access to their wholesale markets, including GB. Therefore, the additional wording adds emphasis.

However, the remainder of the amendments regarding aggregators effectively dilute the original statements. The original criterion (a) above still stands, but with added new criterion below this; whilst criterion (d) regarding compensation has been reversed, so that instead of stating that compensation would *not be required* it now states that suppliers can be compensated for the amount of electricity they provide, but which isn't consumed by their customer during a DSR event:

(d) transparent rules and procedures to ensure that market participants are remunerated for the energy they actually feed into the system during the demand response period. Where the conditions of remuneration are not agreed by market participants, they shall be subject to approval by the national regulatory authorities and monitored by the Agency (ibid).

The issue of compensation is currently the key barrier to be overcome in setting a common framework for independent aggregators in Europe. By removing the original wording on compensation, the European Parliament have now effectively allowed the argument to continue at the State regulatory level for more years to come. Indeed, Member States are finding this the most difficult aspect to reconcile as discussed below.

2.3 The Issue of Compensation for DSR events

The issue of supplier compensation provides the main source of discord in trying to develop a standardised framework for the roles and responsibilities of independent aggregators in relation to customers suppliers and the BRP.

When a customer modifies their energy consumption in response to a call from an aggregator, the customer or aggregator is effectively “selling-on” energy in the form of demand response, energy that has been purchased in advance by the supplier in anticipation of the customer’s consumption. As the retailer cannot bill the customer for energy that is not directly consumed, the supplier can therefore face a loss of revenue. This has resulted in demands for suppliers to be compensated for the loss of revenue, with compensation being agreed either via negotiation between the supplier and the customer / aggregator, or determined via an administered arrangement as happens currently in France (Baker, 2016).

To add clarity:

- The independent aggregator activates a DSR event within their customer base which changes the consumption of electricity in real-time (either more or less electricity is used by the customer than has been expected by their supplier).
- This event is not initiated by the supplier, who has already purchased a set amount of generation based on forecast requirements.
- This renders the forecast incorrect and results in an imbalance between the volumes purchased by the supplier and the electricity consumed by its customers.
- This creates 2 problems - the actual cost of the energy purchased by the supplier which cannot now be sold on (if less electricity was consumed than forecast). This additional amount of electricity is known as an ‘open energy position’. Plus, an imbalance position for the supplier (potentially leading to imbalance fees).

The two main issues to be addressed therefore are:

1. the open energy position⁸ of the Supplier due to a DSR (turn-down⁸) activation in the energy market (the Supplier has purchased energy it now can’t sell) and

⁸ Conversely if the DSR is ‘turn-up’ the Supplier will be able to sell additional energy during the event.

2. the need to avoid imbalance penalties for the BRP / Supplier of participating consumers during a DSR event triggered by an independent aggregator.

Solutions addressing these two issues need to be found if independent aggregators are to fully emerge in European markets. To date no standardised solution has been found; and there are several arguments surrounding what should happen in the meantime.

Eurelectric⁹ claim that currently independent aggregators are 'free riders' in the system whereby they re-sell electricity bought by a supplier after curtailing customer load, thus distorting price and market competition. They recommend that either the aggregator or the consumer should therefore compensate the supplier for the avoided consumption (Edwards, 2017; Eurelectric, 2017).

The international energy think-tank RAP, however, disagree that compensation should be paid, claiming that compensation payments could crush the commercial viability of DSR in the EU. In their 2016 Policy Brief (Baker, 2016) RAP claim that supplier compensation will severely restrict customer participation; thereby reducing the environmental and financial benefits which aggregation could provide to the whole energy system. RAP argue that as DSR is of benefit to the whole energy system that it should therefore be incentivised rather than penalised.

RAP continue this line of thinking in their 2017 Policy Brief (Baker, 2017b) which claims that when downward demand response (turn-down) is initiated this in fact reduces wholesale prices, meaning that suppliers have access to cheaper electricity, allowing them considerable savings when purchasing energy for their customers.

RAP outline that demands for direct compensation should be rejected on two counts (Baker, 2017b). Firstly, in that it poses a significant threat to incentivised demand response and the associated system and financial benefits to be gained by this. Secondly, they propose that there is a simpler solution, by allowing suppliers to retain a percentage of the wholesale savings made during a demand response event. RAP claim that as everyone benefits from these reduced wholesale prices it is fairer for all to share in the benefits, rather than penalising aggregators for instigating the situation (Baker, 2016).

RAP conducted analysis on the French, German-Austrian, and Nordic spot markets over the years 2013/14, 2014/15, and 2015/16 using actual day-ahead price data for the three markets. Their analysis identified that:

"By reducing demand during periods when capacity is scarce and wholesale prices are high, demand response reduces overall market costs thereby benefiting all consumers in the form of lower electricity bills, not just those who participate. Analysis suggests that even a modest application of demand response could generate savings of up to €1.6 billion annually across the German/Austrian, Nordic, and French electricity markets alone, with greater savings expected across Europe as a whole" (Baker, 2017a).

⁹ Eurelectric are a sector association which represents the interests of the electricity industry at pan-European level

The Smart Energy Demand Coalition (SEDC) however, claim that RAP's model would not be a practical or legitimate European solution¹⁰. They state that there is however an urgent need to create an EU-wide aggregator model, but a model based on the principles that:

- The open energy position is settled between the independent aggregator and the BRP/Supplier, i.e. the aggregator will buy the sourced but not consumed energy from the BRP/Supplier in case of demand curtailment (turn-down) or will sell the consumed but not sourced energy in case of demand enhancement (turn-up) to the BRP.
- This will:
 - Provide fair payment to the BRP for the open energy position and
 - Correct the balance position of the BRP avoiding any imbalance penalties due to the DSR event independently of the imbalance settlement rules in place
- The adjustment mechanism should be applicable and symmetric for both demand curtailment (turn-down) and demand enhancement (turn-up).
- The adjustment mechanism should be centrally facilitated and not require the independent aggregator to contract directly with the BRP, which creates a conflict of interest between parties. Without a central facilitation, dedicated aggregation services are not possible, because if the Supplier/BRP does not agree to the fair terms of the contract no services can be provided.
- Any communication of information between the BRP and independent aggregator should be centralized in order to avoid confidentiality and competition issues (SEDC, 2015).

This would appear to provide a pragmatic solution to the issues raised. On the one hand aggregators would need to pay suppliers the open energy cost; however, on the other hand, they could gain easier and quicker access to the energy markets. By removing the requirement for aggregators to hold prior contracts with suppliers; and by removing the communication / competition issues between aggregators and suppliers; this effectively gives aggregators the legitimate platform they need to establish a robust business proposition.

However, it is difficult to assess the exact open energy cost as individual suppliers will adopt different hedging strategies and purchase energy in different timescales. This means that negotiating compensation between the supplier and the customer or aggregator will be difficult as this "information gap" places the retailer in a very dominant negotiating position.

¹⁰ No argument is provided by SEDC as to why they conclude this

2.4 European Aggregator Models

Ongoing work has been undertaken in an attempt to create an EU-wide aggregator model. In this respect, USEF¹¹ developed an Aggregator Workstream in 2016 (USEF, 2018) to investigate ways to standardise the roles of aggregators across Europe; with an aim of increasing their participation across all relevant markets. The Workstream consisted of Transmission System Operators (TSOs), DSOs, suppliers, aggregators and BRPs from across Europe, with an initial focus on four differing European markets – Belgium, Denmark, Germany and The Netherlands.

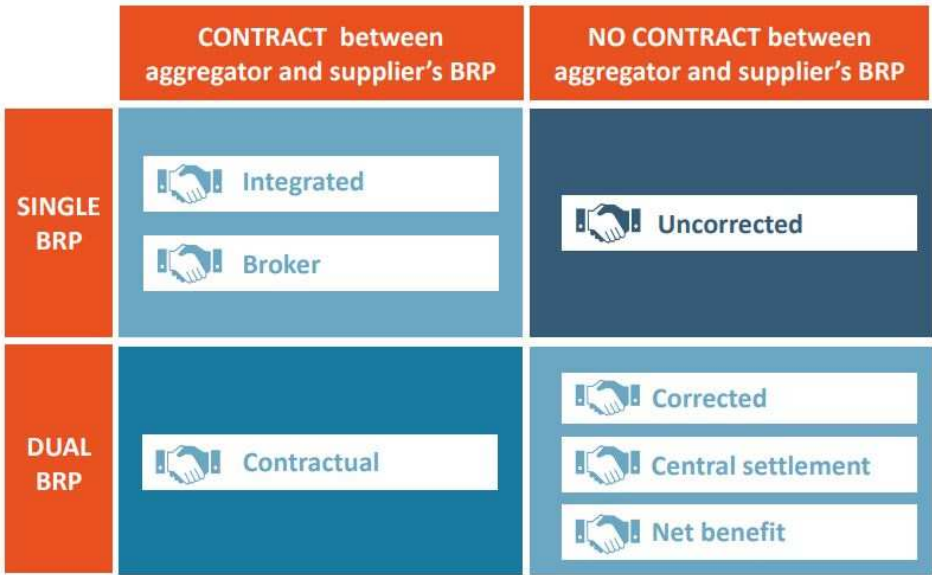
The workstream analysed the different topics related to the aggregator role with particular focus on the relationship between the aggregator and the BRP/Supplier. This resulted in a list of 'complexities' that the Aggregator Workstream determined need to be resolved:

- *Measurement and validation* - ensuring correct and trustworthy data.
- *Baseline methodology* – how to define appropriate baseline methodologies, roles and responsibilities?
- *Information exchange and confidentiality* - finding a balance between transparency and confidentiality.
- *Transfer of energy price methodology* - how to compensate the position of the Prosumer's supplier and its BRP?
- *Relationship between implicit and explicit demand response* - how to separate both impacts unambiguously.
- *Rebound effect* - can the BRP or Supplier be negatively impacted and if so, how can this be compensated?
- *Portfolio conditions* - how to participate in TSO/DSO/BRP products through a portfolio?

Emerging from those complexities the Aggregator Workstream developed a set of seven different aggregator models which could be implemented across any of the European Member States (see Figure 2), but the Foundation claim that there is no 'best single model' and that the model selected by Member States should be based on what works best for their individual market (Engerati, 2016) thus delegating responsibility back to national authorities to deliver regulatory frameworks for aggregators. The seven models show nuances of the arguments introduced in the previous section (RAP – Net Benefit model; Eurelectric - Broker model and Contractual model; SEDC – Central Settlement model); proving the ongoing complexity that has been created by trying to retrospectively fit the aggregator role within existing market structures.

¹¹ The Universal Smart Energy Framework (USEF) is an independent Dutch organisation which provides non-association regulatory recommendations to the European Commission via the Smart Grids Task Force. www.usef.energy

Figure 2: USEF's 7 models for aggregators in Europe



Name	Description
Integrated model	In the integrated model the roles of supplier and aggregator are combined in one market party. Compensation for imbalances and the open supply position are not necessary.
Broker model	In the broker model, the aggregator transfers the balance responsibility to the BRP _{sup} ¹ . Compensation for the open supply position and the caused imbalance is settled bilaterally based on contractual arrangements.
Contractual model	In the contractual model, the aggregator associates with his own BRP. Balancing parameters are corrected through a hub-deal (ex-post) between BRP _{agr} and BRP _{sup} , transfer prices are based on contractual arrangements.
Uncorrected model	In the uncorrected model, no perimeter correction is performed and no volume transfers occur between the BRP _{agr} and BRP _{sup} . The activated volume is settled through the regular balancing mechanism.
Corrected model	In the corrected model, the Prosumer's meter readings are modified, based on the amount of flexibility that has been activated by the aggregator. The transfer of energy takes place through the Prosumer, based on retail prices. The aggregator associates with his own BRP.
Central settlement model	In the central settlement model, the aggregator associates with his own BRP. A central entity (e.g. TSO) corrects the balancing perimeters following a DR activation. Compensation for the open supply position is also settled by this central entity, based on a pre-defined price formula.
Net benefit model	The net benefit model is similar to the central settlement model, yet the cost of neutralizing the BRP _{sup} is not born by the aggregator but socialized. Socialization may be limited to situations where DR brings energy savings.



¹ BRP_{sup} denotes the BRP of the Supplier; BRP_{agr} denotes the BRP of the Aggregator

Source: (USEF, 2016)

3. GB Context

3.1 GB Overview

There are currently nineteen Commercial Aggregation companies listed on National Grid's website¹², of which six companies hold a supply licence (supplier-aggregators) whilst four other companies work in partnership with a licenced supplier; leaving nine stand-alone aggregation service companies.

BEIS and Ofgem commissioned and published several reports in recent years which examine the benefits which independent aggregators can bring to the GB electricity markets; both financially and in terms of system-wide benefit (BEIS and Ofgem, 2016, 2017; PA Consulting Group, 2016; CRA, 2017).

All of these studies agreed that independent aggregators provide an important route to market for DSR and flexibility providers, with the report from the PA Consulting Group highlighting that 74% of their survey respondents who provided DSR did so through an independent aggregator¹³. Further, CRA's economic assessment estimated that the value of DSR participation in the Balancing Market could be in the region of £110mn to £400mn by 2020 (CRA, 2017) if entry was enabled.

However, despite the acknowledgement of the role which independent aggregators can play, several previously independent aggregators in GB have taken the decision to become licensed suppliers due to the barriers in place in accessing several GB markets. Erik Nygard, CEO of the supplier-aggregator Limejump believes that aggregators without a supply licence will struggle to survive (Coyne, 2017c); whilst Alastair Martin of Flexitricity, states that Flexitricity came to the decision to apply for a supply licence in 2017 due to the long delays anticipated in finalising and implementing amendments to the Balancing and Settlement Code which would ease access to the markets (Flexitricity, 2018) (see Section 3.2.3).

The CRA economic assessment also highlights a number of other concerns raised by independent aggregators. These include Capacity Market regulations, the organisation of energy markets and a general lack of customer understanding combined with a reticence to risk compromising core business activities through load interruptions (CRA, 2017). Indeed a previous survey conducted by Ofgem noted that 71% of companies in the industrial, commercial and public sectors don't participate in DSR due to a lack of customer understanding and difficulty in navigating separate markets (Ofgem, 2016b).

The ESO (National Grid) are facilitating the 'Power Responsive' programme (National Grid, 2017a) to stimulate increased participation in DSR by 2020. One of the outcomes for the programme will be to ensure that DSR has equal opportunity with supply in contributing to balancing the system. To date Power Responsive has been focused on I&C customers only, but it will also involve the smaller non-domestic and domestic sector in the near future.

BEIS & Ofgem further acknowledged some of the barriers facing aggregators in their 'Call for Evidence' and the subsequent 'Smart Systems and Flexibility Plan' (BEIS and Ofgem, 2017). Additionally, Ofgem added further detail in their Open Letter (Ofgem, 2017a) published alongside the Smart Systems and Flexibility Plan. This included the consideration that "*market arrangements should enable aggregators,*

¹² <https://www.nationalgrideso.com/balancing-services/demand-side-response-dsr>

¹³ This % is likely to have decreased with independent aggregators such as Flexitricity taking up supply licences in order to be able to trade across all markets

including independent aggregators, to access additional energy markets where they can be accommodated efficiently.” This is welcomed as a policy intent but it still raises questions over what is considered ‘efficient’ as there is no clarification given on how this will be assessed.

In addition, Paul Troughton of Enernoc (now known as Enel X), expressed concerns over Ofgem’s statement that “*payments for sold on energy may be most efficiently agreed in the retail contract terms between the supplier and the consumer” (ibid).* Troughton stated that “*we would be much happier with a rule that avoided the possibility of the supplier using such terms (or other retail contract clauses) to deter their customers from working with independent aggregators...For example, Ofgem could simply provide guidance that the transfer price of any demand response energy should be the retail price less any levies and network tariffs” (Coyne, 2017a).*

Ofgem’s proposal differs to the EU-wide target model proposed by SEDC (Section 2.4 above) which promotes a centralised system for handling adjustments and communication in order to preserve confidentiality and increase competition between market actors.

Independent aggregators’ relationship with consumers has also been debated in GB, with some calling for the relationship to be formalised either through a mandatory Code of Practice or through an aggregators licence (BEIS and Ofgem, 2016).

To aid with clarification, the Association for Decentralised Energy (ADE) launched a consultation into the development of a ‘DSR Code of Conduct’ in July 2017 (ADE, 2017) with the intent to provide assurance to market participants by setting standards which aggregators can (voluntarily) agree to. The Code of Conduct was published in November 2018 for launch in early 2019 (ADE, 2018a) when aggregators will be able to sign-up to it under a scheme membership agreement called ‘Flex Assure’. Flex Assure seeks to establish a common set of minimum standards by which customers can compare aggregators; focussing on five specific areas of concern – sales and marketing; technical due diligence (cybercrime and data protection); pre-contractual information; contracts and complaints procedures.

The Code of Conduct is intended to initially apply to non-domestic DSR customers only, but it will be revisited in due course to assess whether it can be extended to the domestic level also. BEIS & Ofgem have stated that they will monitor the code of conduct before deciding whether further measures are necessary (BEIS and Ofgem, 2017; Ofgem, 2017a).

GB aggregators appear to welcome the introduction of the Code of Conduct; indeed many have been involved in its design and content (ADE, 2018b). Signing up to Flex Assure enables them to uphold their claims of integrity and transparency in undertaking DSR on clients’ behalf; and gives them professional recognition. However, barriers to their participation in certain GB markets still persist as discussed in Section 3.2.

3.2 GB National Markets

3.2.1 Ancillary Services

The ancillary services markets currently provide the strongest opportunity in GB for independent aggregators to participate (PA Consulting Group, 2016). Aggregators are active in enabling the participation of small, individual loads which individually wouldn't meet the larger bid sizes, thereby increasing the level of participation by small generators. Aggregators don't need prior permission from suppliers to enter these markets and they can aggregate small loads from across the country (SEDC, 2017) providing reliability benefits through diversity.

In 2016 the ESO only procured 6% of its ancillary services through demand side measures (PA Consulting Group, 2016) although National Grid have an ambition to increase this to 30-50% by 2020 (BEIS and Ofgem, 2016).

In an attempt to remedy this situation National Grid launched their 'Product Roadmap for Frequency Response and Reserve' in December 2017 (National Grid, 2017b) in response to consultation with stakeholders in early 2017 (National Grid, 2017d). The consultation highlighted that the vast range of ancillary services products, each with differing technical specifications and timelines for procurement, had acted as a deterrent to flexibility providers (BEIS and Ofgem, 2016).

The Roadmap therefore sets out National Grid's first steps towards rationalising and simplifying their products, with an aim of making services easier for flexibility providers to access. To this end, tenders for short-term requirements will now be held on a monthly basis, with longer-term requirements held on a quarterly basis. In addition, trial auctions will also commence in June 2019 (National Grid, 2018a) and exclusivity clauses will be reviewed (National Grid, 2018b). Exclusivity clauses previously dampened the market by not allowing providers to stack revenue from multiple products and services; thus reducing revenue capacity.

National Grid further announced in June 2018 that they had achieved over 50% of their ancillary services by demand side measures in the preceding month (Coyle, 2018a). If this trend continues it may be the case therefore that National Grid have achieved their target two years in advance, which will mean significant progress for aggregators who participate in these markets.

3.2.2 Capacity Market

The participation of aggregators in the Capacity Market (CM) has been important in enabling the participation of individual DSR and storage providers who would not meet the minimum capacity requirement on their own¹⁴ and indeed most of the awarded DSR CM contracts have been negotiated via aggregators (Business Green, 2018).

The 2016/17 T-4 auction was the first time that battery storage had agreements awarded (around 500MW at a clearance price of £22.50 per kW) and although DSR saw significant growth; storage and DSR still accounted for only 6.11% and 2.69% respectively (National Grid, 2017c).

¹⁴ The minimum capacity required to participate in the main CM auctions is 2 MW and for the TA auctions it was 500kW (CRA, 2017).

However in the 2017/18 T-4 auction, only 153MW of battery storage capacity was contracted, due to developers unwilling or unable to accept contracts at the extremely low clearance price of £8.40 per kW; whilst DSR contracts stayed relatively stable at 1.2GW (Business Green, 2018).

The individual auction results are provided in Table 2 below:

Table 2: CM Auction Results

Auction	Delivery Year	DSR		All Storage (incl. battery)		Clearing price per kW per year
		MW	%	MW	%	
2014/15 T4	2018/ 19	174 MW	0.35%	2699 MW	5.48%	£19.40
2015 / 16 T4	2019/ 20	476 MW	1.03%	2617 MW	5.65%	£18.00
2016/ 17 T4	2020/ 21	1410 MW	2.69%	3201 MW	6.11%	£22.50
2017/ 18 T4	2021/ 22	1207 MW	2.39%	2680 MW	5.32%	£8.40
2015/16 TA	2016/17	803 MW	N/A	N/A	N/A	£27.50
2016/17 TA	2017/18	312 MW	N/A	N/A	N/A	£45.00
2017/18 T1	2018/19	443 MW	7.65%	104 MW	1.8%	£6.00

Source: EMR Delivery Body, collated from respective Final Auction Results Documents

Despite the addition of the two Transitional Arrangements (TA) auctions in 2015/16 and 2016/17 which were designed specifically to support DSR involvement, several issues have been identified with participation (CRA, 2017). Most of these are in relation to perceived discrimination when comparing DSR with generation.

Firstly, DSR providers are currently only awarded one-year contracts in the CM (as opposed to the 3-year and 15-year contracts available for refurbished generation and new-build generation respectively). This has been seen as a principal concern of aggregators as it can affect their access to finance (CRA, 2017). Until the present day, there have been no provisions to amend the Capacity Market Rules in order to extend contract periods as this would necessitate changes to State Aid (PA Consulting Group, 2016). The Tempus Ruling (see below) however, could now change this.

Secondly, CM Rules didn't originally allow for the stacking of contracts between the CM and the ancillary services products. This potentially reduced the profitability of DER as stacking enables access to several different revenue streams simultaneously. However, BEIS and Ofgem responded positively to this barrier in the 2017 'Smart Systems and Flexibility Plan' by stating that they would allow stacking to occur in future (BEIS and Ofgem, 2017). Ofgem have also committed to make changes to allow DSR providers to reallocate their assets in the CM ahead of pre-qualification as of 2019 (BEIS and Ofgem, 2018).

Thirdly, CM payments are based on availability (capacity) payments and also on activation (generation) payments. However, DSR does not receive an activation payment as its role within the CM is to reduce demand rather than to supply additional generation. Therefore, it is claimed that:

“Independently-aggregated DSR is the only resource in the CM which does not receive an energy payment. This increases the minimum capacity price at which it can viably be offered – as it must cover all its energy costs from its capacity revenue – putting it at a unique

disadvantage when bidding in auctions, and leading to less DSR clearing than would be economically optimal.” (SEDC, 2017)

Additionally, DSR providers were not able to participate in both the TA auction and the T-4 auction for the same year, leaving providers having to guess which one to enter to achieve the best price.

Tempus Energy Ruling

In December 2014, the demand-side company Tempus Energy took out a legal challenge to the General Court of the European Union stating that the CM design was unlawful under State Aid rules because of its treatment of DSR (Lockwood, 2017). Tempus’ claim included that:

- the Commission failed to properly assess the potential role of DSR in the UK capacity market;
- the restrictions on the duration of DSR contracts under the capacity market (1 year) violate the principles of legitimate expectation and non-discrimination;
- the requirement for DSR operators to choose between transitional and enduring market auctions violates the principles of legitimate expectation and non-discrimination;
- the capacity market’s cost recovery methodology violates the principles of non-discrimination, legitimate expectation and proportionality;
- the use of open-ended capacity events rather than time-bound ones in the enduring auctions of the capacity market is contrary to the principles of non-discrimination and legitimate expectation;
- the capacity market’s bid bond requirement to obtain access to the auctions violates the principles of non-discrimination and legitimate expectation; and
- the capacity market’s failure to provide for additional remuneration for savings in transmission and distribution losses from DSR violates the principles of non-discrimination and legitimate expectation (EUR-Lex, 2014).

The Case was heard in July 2017 and on 15 November 2018 the European Court of Justice found in favour of Tempus and removed its State Aid approval, ruling that the European Commission had not properly considered the role of DSR when it granted approval in 2014 (European Court of Justice, 2018).

The decision led to BEIS immediately suspending the CM and withholding payments to agreement holders, causing share prices in all participating companies to fall rapidly (Reed, 2018). Unfortunately, the ruling will cause short-term financial difficulty to all participants (including DSR participants) and some suggest it could cause further uncertainty across energy flexibility markets until a resolution has been achieved (Coynes, 2018b).

Longer-term however, the resolution should force BEIS to redesign the CM to allow an equal footing between generation and DSR, which aggregators have long argued for. It is hoped that this will afford BEIS and Ofgem the opportunity to finally resolve all outstanding issues with the treatment of DSR in the CM, but it is too early to tell how far-reaching any new proposals will be.

3.2.3 Wholesale Market and Balancing Market

Independent aggregators currently do not have direct access to the Wholesale Market (WM) and the Balancing Mechanism (Ofgem, 2017a) which is placing small embedded generators at a disadvantage to larger generation assets.

There are currently two routes of entry for small generators to the WM: -

- Central Volume Allocation (CVA) agreements which allows generators to access the market **directly**, and
- Supplier Volume Allocation (SVA) agreements which involve partnering with a licensed supplier, via a Power Purchase Agreement (PPA) i.e. **indirectly**.

The CVA route is particularly difficult for small generators to enter directly due to the volumes required by the ESO, administrative costs (including running a 24-hour trading desk) and compliance with electricity licensing codes. Costs include:

- Accession Form
- £500 Accession Fee
- Accession Agreement
- Authorized signatories (BSCP38/5.1 and Director's letter)
- Order Communications Line Request
- CVA Testing
- Funds Accession Form BSCP301/04a
- Credit Contacts
- Party Registration (BSCP65/01)
- Party Agent Registration (BSCP71/05)
- BM Unit Registration (BSCP15/4.1)
- £250 per month BSC membership fee
- £100 per month BMU registration fee

Source: Elexon 2017 (prices correct as of Dec 2017)

The SVA route is therefore much easier for small generators to access but partnering currently has to be through a *licensed supplier* in order to be able to access the WM and the Balancing Mechanism. This is one of the reasons why several independent aggregators have had to take the decision to become licensed suppliers.

If independent aggregators were able to access the WM this would ease both costs and risks for the smaller generators, due to the fact that aggregators could pool the costs across their portfolio of generators whilst also being responsible for operating a trading desk.

However, the greatest financial asset of aggregation in the WM could be realised through minimizing the risk of facing imbalance fees (should the generator not be able to fulfil its traded volume at gate closure) or the cost of buying any additional generation volume from a third party (in order to fulfil the requirement at gate closure). This is a particular challenge for intermittent technologies such as solar and wind.

Aggregation could therefore help to cushion forecasting errors by these generators, as aggregators could mutualise between multiple generators across different locations. This is known as the 'diversity

effect'; essentially meaning that forecasting errors for different areas are likely to compensate for each other; thereby lowering uncertainties and risk (Garcia-Rundstadler, 2018).

Smaller generators are also disadvantaged in the Balancing Mechanism. The ESO has operational issues with despatching smaller plants (Elexon, 2017c) thereby lessening the opportunities for them to participate. However, under current regulations, smaller generators are unable to aggregate generation from multiple sites into a single Balancing Mechanism Unit (BMU), making it difficult for them to compete with larger power stations in the Balancing Market (BM).

Additionally, there is no provision in the design of the BM for explicit DSR. In practice it can only be provided by the *supplier* of the DSR-provider. This is because there is no mechanism for making bids and offers for a customer's potential demand, since there is no baselining of a customer's demand against which such bids/offers may be assessed in order to monitor delivery. This means that independent aggregators are not currently able to register BMUs and thereby participate (CRA, 2017). As a result, DSR is limited to provision by suppliers that may activate DSR in their customers or via aggregators who sell to suppliers.

However, European balancing project TERRE has indirectly eased access to the BM for smaller generators and DSR providers, by requiring modifications to the Balancing and Settlement Code (BSC) in order for GB to comply with Project TERRE requirements.

Project TERRE (Trans European Replacement Reserves Exchange) is a pilot initiative set up by the European Network of Transmission System Operators (ENTSO-E) to tackle issues regarding the procurement, exchange and settlement of balancing energy across a large area of Western Europe (including GB).

TERRE will establish and operate a multi-TSO platform that can gather all bids for Replacement Reserves (RR) and can optimise the allocation of RR across the systems of the different TSOs.

TERRE requirements state that "*DSR must be allowed to compete on a level playing field with traditional flexibility providers*" and the TERRE concept should allow smaller generators access to the BM.

Modification P344 seeks to align the BSC with Project TERRE requirements to allow the implementation of the project at national level and be compliant with the first tranche of obligations in the European Network Codes.

Source: (AAMHE *et al.*, 2016).

Modification P344 (Elexon, 2017a) to the BSC seeks to align the BSC with TERRE requirements in order for TERRE to be implemented in December 2019 (after initial slippage from 2018). P344 introduces the concept of a Virtual Lead Party (VLP) which can register Secondary BM Units and hold a Virtual Balancing Account. As the VLP wouldn't need to be a BRP, this role can be fulfilled by independent aggregators once the Modification is implemented in 2019.

This Modification is welcomed by industry (Coynes, 2017c) but Erik Nygard, CEO of the supplier-aggregator Limejump believes that aggregators without a supply licence will struggle to survive in the meantime (*ibid*) whilst Alastair Martin, the Chief Strategy Officer of Flexitricity, states that although the introduction of P344 should eventually alleviate access problems; due to the long delay anticipated

in finalisation and implementation, Flexitricity came to the decision to apply for a supply licence in 2017 (Flexitricity, 2018).

Now that Flexitricity have changed their position from being an independent aggregator to be a supplier-aggregator they are now seeking to bid their customers DSR into the BM as of October 2018 as this is where the most profit can be made. Alastair Martin points out that prices in the BM can reach £2,500 per MWh, compared to around £50 per MWh in wholesale markets. He also believes that with the development of the 'Western bootstrap'⁴⁵ which will relieve congestion from Scottish wind generation, that this will lead to additional balancing being required by the ESO in the near future in order to be able to manage the additional peaks and troughs that could arise (*ibid*).

Meanwhile Limejump recently became the first company to trade an aggregated unit in the BM, and the first to trade batteries in the market. Its 168 MW virtual power plant (VPP) was the first BMU to be aggregated across multiple grid supply points (GSP). The VPP was able to enter the BM after Ofgem granted a derogation from certain Grid Code requirements, enabling BMU data to be aggregated at the GSP group level. This derogation is specific to Limejump, however Ofgem recently approved Grid Code modification GCoog7, which will allow other suppliers to do the same (Porter, 2018).

There is therefore much positive movement happening in the BM which will eventually greatly ease access for independent aggregators. However, they are currently missing out on these lucrative revenue streams until P344 is implemented.

⁴⁵ The Western Link or 'Bootstrap' is a 239-mile subsea cable from Ayrshire to the Wirral to export surplus wind generation from Scotland

3.3 Local Flexibility Markets

3.3.1 DNO Flexibility Markets

The changing role of the DNOs can be seen as one of the most critical factors determining whether, and how, small generators and DER providers are able to access new revenue streams and localised markets.

Until recently the DNOs have been seen as largely 'passive' in their operations – facilitating the one-way flow of electricity from the transmission network to the consumer. However, the amount of generation in GB that is connected at the distribution level (rather than the transmission level) has doubled over the last five years (Ofgem, 2017b) and now represents around 30% of total GB installed capacity, at 30,838 MW as of December 2017 (ONS, 2018).

However, distribution networks were not originally designed to accommodate generation and resulting bi-directional power flows, and therefore this increase in distributed generation has impacted on the DNOs in several ways, creating challenges in network management, with local networks experiencing severe strain at peak times (Ramos *et al.*, 2016; WPD, 2017a).

To meet the needs of this more decentralised future energy system, the GB DNOs are beginning to commence a transition to becoming DSOs – distribution **system** operators. The rationale for this transition is that with the increasing amount of generation connected at the network level, rather than at the transmission level; and with the further emergence of new technologies, heat pumps and EVs at the domestic level; the DNO will increasingly have a greater need to forecast and actively manage energy flows across the network. This could lead to the DSO replicating at the distribution level the system balancing functions which the TSO currently undertakes at the transmission level (Nolan, 2015).

It seems likely that a DSO will be expected to match generation and supply locally, and to facilitate competitive local trading markets as part of enabling this (ENA, 2017; WPD, 2017b) which would open up new revenue streams for aggregators to trade in. However, the balance between what the DSOs will operate themselves and what they will procure from the market is still to be determined. The Energy Networks Association (ENA) is leading on the 'Open Networks Project' which is advising on DNO to DSO transitions, as well as the future coordination scheme for the TSO and the DSOs in the procurement and dispatch of DER. The coordination scheme which is eventually chosen will not only determine the responsibilities of the system operators towards each other but will also determine their responsibilities towards third parties (e.g. aggregators, LEMs, DER providers etc.) (Hancher and Winters, 2017).

The ENA issued a consultation document in July 2018 entitled 'Future Worlds' (ENA, 2018) which gives an overview of five different scenarios which might be used for the procurement and dispatch of DER services as shown in Table 3. The ENA point out that they don't expect any one of the Future Worlds to be chosen as the final option, but they have set out what each 'world' would look like so that consultees are able to choose the characteristics which they feel should apply in any eventual model and also to be able to assess any barriers across the different models.

Table 3 ENA’s Five Future World Models

Future Worlds	Description	Analysis
World A DSO Coordinates	The DSO acts as the neutral facilitator for all DER and provides services on a locational basis to the ESO.	<p>This model would entail the DSOs managing the entire GB network, which they currently have no visibility of. Systems would need to be put in place to ensure smooth transactions between the DSOs and the ESO, but the DSOs should be in a better position to understand their own areas needs and constraints and this model would achieve granularity at the local level. However, this model runs the risk of DSOs becoming 'regional aggregators' and of conflict in DER being able to access ESO markets such as the BM.</p> <p>Worryingly, all the Future Worlds show DSOs owning and operating flexibility resources; which is a clear conflict of interest in neutral market facilitation; as well as being in conflict with the Smart Systems and Flexibility Plan which states that DSOs shouldn't own and operate storage.</p>
World B Coordinated DSO-ESO	The DSO and ESO work together to efficiently manage networks through coordinated procurement and dispatch of flexibility resources.	Although complex, this could be the most effective model longer term once the operating platform between the DSO and ESO is established as it should best enable local assets to access multiple markets – locally and nationally. There needs to be transparency in decision-making though as there will inevitably be conflicts of prioritisation between the DSO and the ESO.
World C Price-Driven Flexibility	Changes developed through Ofgem’s reform of electricity access and forward-looking charges have improved access arrangements and forward-looking signals for customers.	<p><i>This isn't a stand-alone world but can be overlaid across any of the other 4 worlds. This was added at Ofgem's request.</i></p> <p>The EPG is not in agreement with Ofgem’s proposals for reforming electricity access and forward-looking charges as we think it financially penalises DER providers and risks network flight as per our consultation response.¹⁶</p>
World D ESO Coordinates	The ESO is the counterparty for DER with DSOs informing the ESO of their requirements.	This may be the most conventional model and easiest to implement in the short term due to the ESO’s existing procurement, call-off and settlement processes already being in place. It also means that one organisation is procuring / dispatching on a nationwide basis, rather than 6 DSOs procuring separately for their own needs. However, it is a top down approach and may not include the granularity anticipated for full DER market availability. It is the opposite of World A and so therefore has the opposite issue – DER could be restricted in accessing DSO markets.

¹⁶ <http://projects.exeter.ac.uk/igov/submission-ofgem-electricity-network-access-and-charging/>

World E Flexibility Coordinators	A new national (or potentially regional) third-party acts as the neutral facilitator for DER providing efficient services to the ESO and / or DSO as required.	This is the least conventional model, requiring a new market actor or actors to coordinate between the ESO and the DSOs. There are issues to be addressed around whether the Flexibility Co-ordinator (FC) would become a monopoly decision maker, and therefore a very powerful new market actor. Therefore, to be a neutral actor the FC should not control assets in the same way that the ESO and DSOs should not. However, it is unclear whether the FC would fulfil an arbitrator role in managing conflicts; or whether it would be a rule-based software platform with defined processes.
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Source: (ENA, 2018) Analysis includes insights from (Centrica, 2018; Elexon, 2018; Piclo, 2018)

The Future Worlds consultation closed in September 2018 and at the present time the ENA are progressing independent impact assessments on the Future Worlds through Baringa.

In anticipation of a much wider remit in the procurement of flexibility (whichever World is eventually implemented) many of the DNOs are currently undertaking trial flexibility projects, funded through the Network Innovation Allowance (NIA) or the Network Innovation Competition (NIC) implemented through RIIO. For instance WPD are conducting 'Flexible Power' to bid DSR into the ancillary services market, as well as using capacity to manage local constraints (Coyne, 2017d). As of January 2018, WPD had contracted 70 MW of power from across 50 sites in the East Midlands¹⁷. Meanwhile Electricity North West are running 'Project CLASS' which provides demand turn-down through voltage control and UK Power Networks have tendered for an estimated 37.6 MW of flexibility in 2018/19, rising to 40.2 MW in 2019/2020 (UKPN, 2017).

Whilst these DNO projects could open up new opportunities for aggregators to trade in, there is also scope for them to undermine the role which aggregators perform in the market. There is already a perceived threat by some aggregators that by DNOs procuring flexibility themselves - either to use for constraint management, or to bid into National Grid services – that there is potential to squeeze the aggregator position out of the market by misuse of DNOs monopoly powers, as highlighted in World A above.

Several aggregators voiced their concerns in an interview with The Energyst in September 2017, claiming that DNO involvement in flexibility trials was anticompetitive. For instance UK Power Reserve's Ian Tanner suggested that "*some of the DNOs are almost trying to create 'nationalised' aggregators within their regions*" potentially locking out commercial aggregators (Coyne, 2017b).

The DNOs are quick to affirm that these trials are just that – trials to find out how flexibility markets will work in practice with an aim of adding more value into the markets (Coyne, 2017b). Currently under monopoly licence conditions DNOs need derogations from Ofgem to undertake these trials. In addition, they are only able to earn up to 1% of revenue from de minimis reward services so there are caveats in place to protect abuse of power. However, arguments remain that the concept of DNO involvement undermines market competition and raises many questions on the extent and control of DNOs in the marketplace (*ibid*).

¹⁷ Interview with WPD 16/01/18

3.3.2 Flexibility Platforms

One emerging approach to bringing more flexibility into the marketplace is through the development of commercial online platforms; which act as a third-party in bringing together DER providers and market opportunities (likened by Georgiopoulos of UKPN as 'online dating for DSOs and DERs') (Pratt, 2018).

The online platform approach to flexibility procurement could be utilised whichever Future World is determined, although the scope of opportunities could differ under each World i.e. World A could offer more local opportunities; whereas World D could offer more national opportunities. It is unclear whether such a platform could become a Flexibility Coordinator under World E; and indeed, the current remit of these platforms isn't to control assets or act as a BRP; but rather to act as a gateway which local DER assets can use for signalling availability, responding to flexibility tenders and coordinating dispatch.

However, will flexibility platforms further squeeze the role of aggregators out of the marketplace, or will they provide new opportunities for aggregators to trade in? Current thoughts are that flexibility platforms and aggregators are mutually beneficial as in the case of the Cornwall LEM.

The Cornwall LEM

The Cornwall LEM flexibility platform, launched in June 2018, offers a varied suite of market opportunities for flexibility and generation assets with an aim of enabling a more efficient market for local assets that gives them access to local and national flexibility markets. WPD are a partner in the project and are assisting in the design, testing and trial of the platform.

WPD signal their flexibility requirements on the platform, which local assets can then bid for. The platform is also used for the arming and dispatching of services and supporting the processes for validation of service delivery and settlement. The information on the platform can also be used for notifications between parties to reduce any negative impact that one party's use of flexibility services may have on another (WPD, 2018).

The LEM platform also enables access to ESO level opportunities as well as local opportunities. As part of the Cornwall LEM trial, Centrica is also trialling blockchain-based P2P trading with its partner LO3 Energy.

The ultimate aim of the Cornwall LEM is to release network capacity as a result of more intelligent management of demand, generation and storage; particularly in constrained areas of the grid. It incentivises participants to turn up, down, export or import to help optimise local capacity and to (hopefully) enable further renewable resources to connect to the grid in areas that were previously considered to be constrained.

Independent aggregators can also play an important role within the Cornwall LEM, by submitting local generation and flexibility assets to the LEM platform to help with this coordination of local congestion management. The LEM platform in return provides aggregators with more opportunities to participate and a clear overview of what flexibility is required in a given area:

"Being able to see clearly what the network companies need means that when we go to customers, we know that what we're inviting them into is something they can benefit from. We can figure out what the customers can do, how, when and at what cost."¹⁸

Piclo Flex

The remaining five GB DNOs are currently using, or will shortly be using¹⁹, the Piclo Flex online platform (developed by Open Utility) to announce their flexibility tenders.

The Piclo Flex platform currently only deals with flexibility, not generation per se. Whilst the scope of the platform may evolve over time to include generation, the current remit is to enable DNOs to signpost their future flexibility requirements, and for providers to register on the platform in order to notify the DNO of their availability – by technology type; location on the network and price. The platform therefore acts as the market place for signalling these tender opportunities and for providers, including aggregators, to submit offers.

Open Utility undertook a Flexibility Marketplace consultation with providers (including independent aggregators) in November 2017 to assess their appetite for this type of market-place. Overall respondents were positive about the market opportunities and access to additional revenue streams that the platform could provide, with most respondents interested in the extra revenue potential which could be achieved through gaining a DNO contract (Open Utility, 2017).

One of the recurring themes in the consultation was the need for transparency in DNO service requirements: where they would be needed, and what types of services they would be procuring i.e. turn up/ down, signal following or frequency response. Whilst several foresaw problems with DNOs resistance to changing their current practices and evolving into market service providers. Perceived barriers included:

"Resistance from DNOs to support the transition from their old models based on creating and maintaining significant over-capacity in distribution networks to allow for peak demand and peak generation events, to a smarter system enabled by locally managed flexibility and real-time data processing (ibid)."

There was also scepticism from some around the current policy and regulatory landscape and whether barriers to accessing markets would be relieved or persist:

"Flexibility procurement is currently so complex that outdated market mechanisms persist (e.g. in balancing services) or it is just abandoned in favour of other less efficient practices (DNOs upgrading networks) (ibid)."

¹⁸ Email correspondence with an aggregator June 2018

¹⁹ To date all the DNOs in GB have announced that they will partner with Piclo Flex, apart from WPD.

4. Conclusion

The role of aggregators is to act as an intermediary between multiple players and a market-place (Garcia-Rundstadler, 2018). The scope of that market-place could include Wholesale Markets, Balancing Markets, Capacity Markets and other market services such as ancillary services, flexibility platforms and local energy markets. However, at present, independent aggregators are limited in which of these markets they can currently access due to different policy and regulatory procedures that are in place across Europe.

Whilst there is need for a standardised approach across Europe to enable independent aggregators to participate in the energy markets, to date this has been seen as problematical due to different market approaches in individual Member States. USEF's Aggregator Workstream have therefore designed seven different models which they claim could be utilised Europe-wide. However, arguments still exist regarding independent aggregators position in relation to suppliers and BRPs, with most arguments relating to the issue of whether compensation should be paid to suppliers and whether prior contracts need to be arranged with customers suppliers before trading can take place. This stifles competition and effectively squeezes the independent aggregator out of many market places - even where they do technically have access to trade.

In GB the Smart Systems and Flexibility Plan acknowledges market access barriers to independent aggregators. Of greatest significance is access to the BSC which should be alleviated under Modification P344 to be implemented in February 2019; in advance of Project TERRE in December 2019. In the meantime, several previously independent aggregators in GB have taken the route of becoming licensed suppliers in order to circumnavigate restrictions. This is an expensive process which not every small aggregator will be able to afford, nor should they have to. However, by becoming suppliers this has enabled access to the more lucrative Balancing Market ahead of the anticipated changes to the BSC for those whom have followed this route.

Currently in GB aggregators don't need prior permission from suppliers to trade, which differs from the situation in many other EU Member States. However, in Ofgem's Open Letter which was published alongside the Smart Systems and Flexibility Plan, there are concerning undertones in the claim that Ofgem believe that compensation may be agreed in the retail contract between the supplier and the consumer. This is in contrast to the aggregator model proposed by SEDC which promotes a centralised system for handling adjustments and communication in order to preserve confidentiality and increase competition; and which could deter customers from engaging in aggregation services. A combination of these SEDC principles and USEF model 6 and 7 (Central Settlement and Net Benefit) could be implemented in GB, rather than relying on pre-arranged contracts.

Additionally, aggregation should be about bringing small-scale generation into the marketplace. All current literature on aggregation assumes a DSR-role for these aggregators; however, this is missing the point on the wider advantages that could be achieved by bundling DER resources into supply and demand markets. Given BEIS's recent announcement to close the Feed-in-Tariff from 1 April 2019 (BEIS, 2018) this could also give rise to new markets for the aggregation of small-scale commercial and domestic generation in the future which aggregators should capitalise on.

Given the acknowledged benefits which independent aggregators can provide to the energy system – benefits which will inevitably increase as European markets become more reliant on intermittent generation – it is concerning how difficult it is for independent aggregators to be able to participate.

Whilst energy policy and regulation abounds with phrases such as 'technology neutral' and 'level-playing field' when you consider the significant difficulties which are imposed on one market sector you can see how GB energy policy and regulation (and the wider EU) is still entrenched in incumbency thinking. Indeed, competition is fierce and incumbent market actors will want to underpin their own business models for as long as possible; whilst also attempting to gain a stronghold on emergent practices. GB has however recognised this fact and is actively attempting to remove barriers.

Business Secretary Greg Clark announced in a speech on 15 November 2018 that:

"Incumbents have often been able to put their interests ahead of those [of] entrants or consumers. We need to find a solution that harnesses industry knowledge of the system without handing over the keys to insiders (Clark, 2018)".

Clark promised a full review into industry codes and code governance, to enable innovators to enter the markets, claiming that "energy regulation must be agile and responsive if it is to reap the great opportunities of the smart, digital economy (*ibid*)".

This is potentially good news for aggregators in GB. Although change has been a long time coming; it is actually now being delivered; with 2019 set to be a pivotal year for the inclusion of aggregated resources in the Balancing Market. However, independent aggregators will still need to secure foot room in an industry which is iteratively changing around them; or face being further squeezed by new products and services entering the market-place. Aggregators must be enabled to navigate across all emergent market opportunities in order to bring DER into the energy system at scale; and for both providers and consumers to realise the benefits of a smarter, more flexible energy system.

Recommendations

Based on the barriers identified in this Working Paper we propose the following recommendations for change in order to increase the remit of independent aggregators in European electricity markets:

1. **ROLE** – the European Commission should continue to ratify the role of aggregators across Europe. A standard framework approach needs to be agreed which will enable the participation of independent aggregators in all wholesale and retail markets. This should include the ability for aggregators to contract with customers without needing prior permission from the customers supplier. We support the Code of Conduct implemented in GB which will provide assurance to market participants on industry standards that aggregators should comply with. A similar Code should be applied across Europe as it not only reassures potential customers; it also gives aggregators professional recognition as legitimate market actors.
2. **COMPENSATION** – this has proven to be the most difficult issue to reconcile across Europe. USEF's 7 Models for aggregators (Figure 2 earlier) is useful for contextualizing the differences between different market structures and recognizing the difficulties in retrospectively adjusting the existing market mechanisms. However, Member States should adopt the model which best incentivises independent aggregators into their wholesale and retail markets. In most cases this is likely to be through not requiring prior contractual arrangements between suppliers and customers or aggregators.
3. **DSO MARKETS** – In line with European regulation DSOs should not own or operate their own flexibility resources such as storage as this is anti-competitive. Neither should they be undermining market competition by acting as regional aggregators themselves. Instead DSOs should be procuring market services from a wide range of local providers, creating a new marketplace for

aggregators and DER providers to help optimise local capacity and relieve network constraints. DSOs should also allow value stacking across markets in order for DER providers to realise the maximum economic potential of their assets.

4. **AGGREGATED GENERATION** – more emphasis should be given to the system benefits which can be provided through the aggregation of small-scale generation; including domestic generation. Aggregation of these small-scale generation resources at the distribution level could give rise to new markets, such as local energy markets, which aggregators should capitalise on.
5. **CAPACITY MARKET (GB)** – BEIS should consider the full inclusion of DSR when reviewing the Capacity Market Rules, allowing DSR an equal footing with generation. This should include reviewing the length of contracts awarded as well as the minimum capacity size.

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6. Glossary

BEIS	Department for Business, Energy and Industrial Strategy
BM	Balancing Market
BMU	balancing mechanism unit
BRP	balancing responsible party
BSC	Balancing and Settlement Code
CAPEX	capital expenditure
CM	Capacity Market
CVA	central volume allocation
DER	distributed energy resources
DR	demand response
DSR	demand side response
DNO	Distribution Network Operator
DSO	Distribution System Operator
ENA	Energy Networks Association
EPG	Energy Policy Group (at the University of Exeter)
ESO	Electricity System Operator (National Grid)
GSP	grid supply point
LEM	local energy market
NIA	network innovation allowance
NIC	network innovation competition
OPEX	operational expenditure
P2P	Peer to Peer trading
PPA	power purchase agreement
RAP	Regulatory Assistance Project
RES	renewable energy sources
RIIO	Regulation = Incentives + Innovation + Outputs
SEDC	Smart Energy Demand Coalition
SVA	supplier volume allocation

TA Transitional Arrangements (Capacity Market)
TERRE Trans European Replacement Reserves Exchange
TSO Transmission System Operator
UKPN UK Power Networks (DNO)
VLP virtual lead party
VPP virtual power plant
WM Wholesale Market
WPD Western Power Distribution (DNO)