MAKING SENSE OF MARKET TRENDS
– an ELEXON perspective

Maximising the value from Demand Side Response

The value, and therefore use, of Demand Side Response (DSR) in the electricity market is expected to grow over the period to 2030. New market models, that coordinate and optimise its use, are needed to ensure customers get the full benefits.

DSR has a value to multiple parties across the electricity value chain. By using DSR:

- Suppliers help minimise their wholesale costs and fine tune their imbalance position on a daily basis.
- Network companies avoid investment to manage infrequent faults on their network.
- System Operator (SO) helps minimise imbalance costs.

Individual parties may get great benefit from the use of DSR. However, if they act in their own self-interest, their actions can affect other parties. This can change over time depending on system conditions.

Here we explore the two main types of cross-party impacts and potential options for mitigating them.

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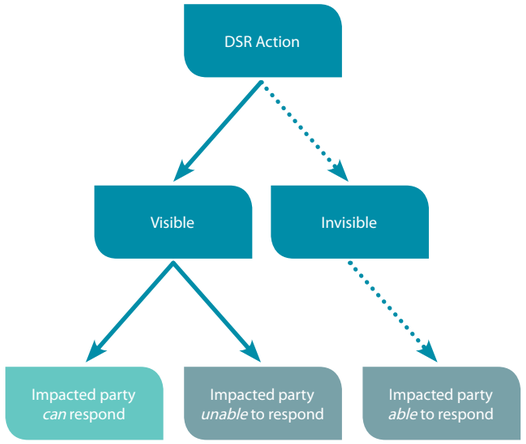
Understanding cross-party impacts

1. Information problems

DSR that is unforeseen has greater potential to cause problems.

FIGURE 1. CATEGORISING THE IMPACT OF DSR ACTIONS ON OTHER PARTIES



Actions that are *visible* to other participants provide an opportunity for impacted parties to respond, although this may not be without cost. However, if the action is *invisible* then the impacted party has no knowledge that the action has taken place and therefore limited ability to respond.
A dynamic DSR contract enables behaviour change much closer to real-time and is therefore less visible to other market participants. For example, a direct load control contract allows the purchaser of DSR to control the load directly by turning off equipment remotely.

Suppliers in particular might be concerned if their imbalance volumes are affected by the dynamic DSR action of another party after gate closure, ie the point at which they can no longer respond. For example, if a distribution network owner (DNO) activated demand reduction from the customer of a supplier in response to a fault on their network.

2. Inefficient use of DSR

Given the interconnected nature of the electricity market, a DSR action by any one party may impact on the costs of other parties in a positive, negative or neutral way. This can result in the inefficient use of DSR. Below are three examples of this.

- Positive spillover effects. Where conditions (eg national and local peaks) are aligned, DSR called by one party may benefit others. For example, DNOs are likely to benefit in terms of reduced network investment if DSR use by suppliers reduces peak demand. But, if there is no way of aggregating the value of the DSR from multiple parties, the level of DSR will be lower as a result, and the customers providing the DSR would be paid less for it than its value.
- Negative spillover effects. Where conditions are not aligned, actions by one party may impose costs on others. By 2030 there may be increased potential for suppliers to create new peaks on networks as they try to align demand with very low market prices, increasing investment costs for DNOs. If these are not taken into account by the supplier, their DSR use could be greater as a result and the costs on the system will be higher than they need to be.
- Contractual inefficiencies. Traditionally, DSR contracts tend to be exclusive and struck for a period of time (upwards of a few months to a number of years). The expectation may be that a call for DSR on each contract may be an infrequent occurrence, eg in the case of DNOs. This risks tying up a resource that could be used by other parties. It also prevents parties from sharing the fixed costs of setting up DSR contracts.

What are the implications for the electricity industry?

Before deciding on whether future change to industry arrangements is required, it will be important to understand how prevalent the problems could be: if cross party impacts are low, there is not a case for expensive industry change.

To support this analysis ELEXON commissioned Frontier Economics to develop a half-hourly DSR dispatch model to simulate the effects of DSR use by different parties in the period up to 2030. The model provides an initial quantification of the broad trends and key drivers related to cross-party impacts.
The findings from this work are summarised below.

The scale of the problem

Market participants have the potential to gain significant value

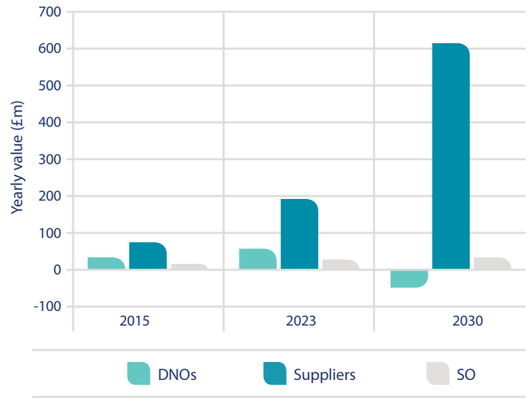
from using dynamic DSR, as shown in Figure 2.
This value is heavily concentrated with suppliers who are able to make annual savings of £0.6bn from their wholesale purchases by 2030.

The benefit to suppliers increases significantly in the late 2020s. There is more flexible demand available (through heat pumps and electric vehicles, and industrial and commercial load, including heat pumps) and greater opportunities for gains from increasingly volatile wholesale prices.

To a lesser extent in absolute terms, DNOs and the System Operator (SO) also benefit. The SO makes savings on Short Term Operating Reserve (STOR) costs and DNOs are able to use DSR to defer investment.

FIGURE 2. DISTRIBUTION OF VALUE FROM FUTURE INCREASES IN DYNAMIC DSR USE

The modelling from Frontier provides insights as to the potential for cross-party impacts and their likely importance. The first interesting result is that, while unseen DSR actions by others can harm suppliers by increasing exposure to



Source: Frontier Economics

imbalance risk, under most reasonable assumptions these are unlikely to be
material in the period to 2030.
There are two main reasons for this.

- Given the nature of imbalance pricing, now and as they change in future, the impact on supplier imbalance costs may be positive as well as negative, depending on the market conditions at the time. A low net impact therefore results (and is robust to scenarios with higher imbalance charges).
- The activation of DSR by DNOs only accounts for small volumes of shifted demand. Based on DNO estimates of expected usage, at any one time only 1% of feeders is likely to be at fault and they only cause a binding constraint requiring DSR on the highest winter peak days. Similarly, the SO will on average only dispatch a small proportion of its STOR DSR capacity in any given half-hour.

Instead, effort is almost certainly going to be best focussed on addressing the potential inefficiencies in the use of DSR as this is where the value is.

- There are positive spillover effects – 70% of the benefit that DNOs gain by 2023 can be explained by reduced investment due to supplier DSR.
- There is also the potential for negative spillover effects – supplier DSR could potentially create new network peaks and increase investment costs. This effect begins to dominate by 2030.

Looking forward post-2020, the value will be to improve the efficiency with which dynamic DSR is used.

Potential future market models

There are a range of potential market models that could improve the efficiency with which DSR is used, three of which are set out below. The first two focus on DSR use in the wholesale or balancing markets, with the third combining them into one central platform.

1. Supplier to supplier trading

Significant DSR value rests with suppliers as a means of managing their wholesale and balancing costs. While suppliers may be able to access this value from their own customer base, there could be efficiency improvements if they were also able to trade DSR with other suppliers. This may be particularly beneficial for smaller suppliers. However, this type of trade can be facilitated by existing arrangements in the market and the Balancing and Settlement Code (BSC). No further change is required.

2. DNO–SO sharing

Given that DNO activation of DSR is likely to be rare, there will be spare capacity in any bilateral contract model that can be shared to increase its efficiency. This type of arrangement could bring potential additional benefits (relative to those in

Figure 2) to DNOs and the SO in the region of £75m.

This type of model could be:

- DNO-led, where the DNO procures DSR contracts to defer network investment and then creates a pool of resource from which it can provide a guaranteed service to the SO or
- SO-led, where the SO would contract for its balancing services but makes these available to a DNO when its valuation of the resource is higher than the SO or
- Aggregator-led, where a third party pools resources and makes them available to both.

3. Central market platform

While there are material benefits to increasing DSR efficiency between DNOs and the SO, the biggest benefits come when sharing is optimised between all parties.

A central market platform combines all the potential actors with interests in selling or purchasing DSR into one market place. It therefore brings together the wholesale market (supplier-to-supplier DSR trading) and the balancing services market (DNO–SO sharing). This option is likely to be a costly and complex intervention, although the benefits are potentially large. A central market can help resolve conflicts in the use of DSR and allocate DSR to those parties who value it most at each point in time ie maximising the benefits from 'sharing'. However, the value of such a platform hinges on both there being a large pool of flexible DSR available and a failure to allocate this efficiently through a bilateral contracting model.

What needs to be done?

One of the clearest results is that most value from DSR sits with suppliers. The BSC can already facilitate the trading of DSR between suppliers should this be taken up in future. While there are potential changes that could be made to the BSC to compensate suppliers for additional imbalance costs due to DSR, their complexity and implementation costs are likely to outstrip any benefits, at least through the period up to 2030.

Instead, the focus should be on developing market models to enable efficient sharing of DSR resource between all parties. There are still many uncertainties and challenges associated with the design of the new market models discussed but there is potential that makes them worth further investigation. Important questions remain which future work should seek to answer.

- What commercial and contractual structures are most appropriate to realise the potential benefits demonstrated by this work?
- What are the potential challenges from combining national wholesale and local balancing markets for DSR onto one central platform?
- In the absence of a central market how can the efficiency of DSR allocation be improved?

ELEXON is keen to develop thinking on these issues and support the evolution of market arrangements. If you would like a copy of the full report by Frontier Economics, or would like to discuss this work further please contact ELEXON at market.operations@elexon.co.uk.