frontier economics

Bulletin

Water
→ Energy
→ Environment
Retailing
Transport
Financial services
Healthcare
Telecoms
Media
Post
Competition policy
→ Policy analysis and design
→ Regulation
Strategy
Contract design and evaluation
Dispute support services
Market design and auctions

MARCH 2016

Demanding times

MANAGING BRITAIN'S DEMAND FOR ELECTRICITY

Regulators, policymakers and network operators all agree that Demand Side Response (DSR) will play an increasingly important role across the electricity system. The National Infrastructure Commission's (NIC's) recently published "Smart Power" report found that flexible demand, together with greater use of storage and interconnection, could save UK consumers up to £8bn a year by 2030. However, "DSR" covers a wide range of tools and techniques, and the division between demand and generation is not always clear. Frontier's recent report for DECC, which the NIC study draws upon, unpicks some of the complexities in this area.

Traditionally, most of the work to balance the electricity system has taken place on the supply side, with large power plants adjusting their output second-by-second to meet the demands of consumers. However, a more flexible demand side will be needed to solve a variety of challenges in the future, whether

increasingly tight capacity margins or the issues that networks will face from greater use of renewables and the electrification of heat and transport.

DSR is therefore moving rapidly up the policymakers' agenda,[1] and so the Department for Energy and Climate Change (DECC) commissioned Frontier Economics (with support from Lane Clark & Peacock and Sustainability First) to review its potential over the next 20 years. Our report[2] concluded that both demand for and supply of DSR can be expected to increase. However, this significant potential may be hampered by large **uncertainties**, not least because of the limitations of the data currently available on the availability of DSR.

In addition, there are **interactions** between different forms of DSR that need to be taken into account and are not yet well understood. For example, some forms of DSR are intrinsically (or more cost-effectively) local; some vary in terms of the notice period needed to initiate them; some are more useful (or cost-effective) for very short periods. These technologies can be put to a wide variety of uses – managing capacity, reducing wholesale costs, or reducing reinforcement costs for the Distribution and Transmission Network Operators. Earlier work done by Frontier for ELEXON indicated some of the ways in which these different demands for DSR could either compete with or complement each other.[3]

This makes it important to **model the use of different forms of DSR holistically**, and to integrate the results into DECC's modelling work. Frontier's report is intended to be used as a "reference guide" by DECC and others, and has also fed into updated models for use within DECC. The results will also be relevant when thinking about the development about market rules – for example, whether or not to give local networks priority access to DSR.

KEEP IT BROAD?

A tricky question for policymakers and researchers alike is how to define DSR. For our report, we were asked to use a broad definition, including distributed generation (both stand-alone units and back-up generators), on the grounds that these too help to reduce demand from the transmission system at a particular moment in time. **Figure 1** indicates the range of tools considered in the report.

Currently, most "DSR" capacity (on this broad definition) is provided by generation, and the flexibility it provides is likely to continue to be greater than any individual form of load-shifting. However, market rules may restrict what some forms of "DSR" can be used for. DECC is proposing to exclude

---

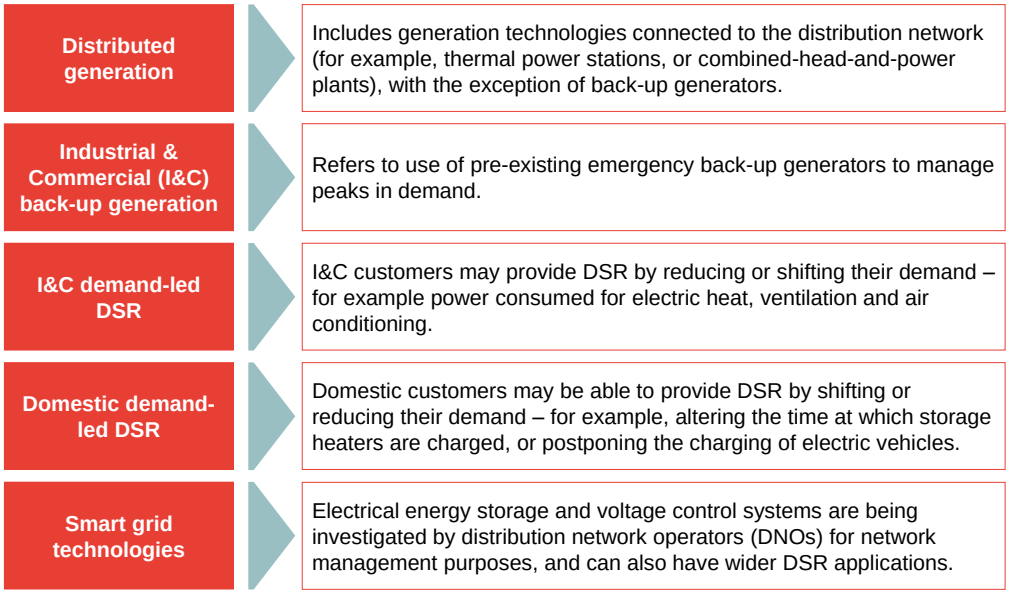
1 See for example National Infrastructure Commission (2016), *Smart Power*, which draws on the work carried out by Frontier

2 Frontier Economics, LCP and Sustainability first (2015), *Future Potential for DSR in Great Britain*

3 Summarised in ELEXON (2015), *Maximising the value from Demand Side Response*

generation from the 2017 Transitional Arrangement auctions on the grounds that such assets (unlike demand-led DSR) are already competitive in the Capacity Market. The "embedded benefits" that generators obtain by avoiding transmission network charges are currently under review by Ofgem, and a recent Frontier bulletin explained the distortions that these may cause.[4]

Figure 1. The many faces of "DSR"



Source: Frontier Economics

Industrial load-shifting may come to play a more important role in the near term. It is here that the poverty of the data frustrates analysis: there is an extremely large amount of industrial demand lumped unexplained under the heading of "other industrial processes" (perhaps about 10 GW), making it hard to estimate the potential for demand-shifting. There is an important role for parties such as aggregators to help identify, and access, this potential.

The ability to elicit DSR from domestic customers may remain more limited in the near term. But new technologies hold promise for the future. Most current domestic DSR comes from storage heaters working off time-of-use tariffs. However, the adoption of smart technologies such as meters and apps that enable households to monitor and control their energy usage in real time mean that there is potential for forms of DSR, which can be called at short notice. The extent to which this can be exploited is untested and depends on customer acceptance and the costs of setting up the necessary arrangements.

4 Frontier and LCP (2015), *Review of the second GB capacity auction*

While trials have shown that customers may be willing to adjust their use of appliances such as washing machines and dishwashers (many of which are already fitted with delay devices) in line with time-of-use signals, getting them to respond over time may prove challenging. Other frequently-quoted examples of possible domestic responses, such as temporary disconnection of fridges and freezers, obviously have limited duration on a relatively low load and will therefore be of limited value. Because of this, such ideas may be less likely to prove as cost-effective as other forms of DSR.

This is not the end of the domestic story. The greatest opportunities to elicit domestic DSR will come if and when evolving technologies such as electric vehicles, heat pumps and domestic energy storage become mainstream (some of these will also increase the pressure on networks that DSR can mitigate). However, projections of the take-up of these technologies vary widely

A somewhat neglected area of potential – possibly because it does not fit neatly into the "generation" or "demand" category – comes from "smart grid" technologies currently being considered by DNOs. Both grid-level energy storage and enhanced automated voltage control might offer significant possibilities, for load-shifting and load reduction respectively. The costs and capabilities of these systems merit further investigation, with the results of trials incorporated into DECC's modelling as they become available.

However broad our definition, it excludes at least one important area of potential: permanent reduction of demand through greater energy efficiency in the design of appliances (and buildings). But that, of course, takes us into a much wider set of policy issues and challenges.

CONCLUSION

Our report for DECC demonstrates that both the demand for, and supply of, DSR are likely to increase; and its potential not just to keep the lights on but also to improve the cost-effectiveness and lower the carbon intensity of electricity generation is clear. Critically, the interactions between different forms of DSR mean that it is important to paint a broad canvas: so we looked at a wide range of techniques on both the energy demand and supply side, with the limiting definition only that they should reduce demand on the transmission system. These interactions needed to be incorporated into DECC's modelling to determine the most effective mix of incentives and market rules for the future. But our analysis has also illustrated the limitations of the data currently available on the scope for demand shifting. Some modest investments in richer data – in particular on industrial load shifting – may pay dividends in helping target larger investments where they can be most effective.

CONTACT	**Sarah Deasley** sarah.deasley@frontier-economics.com
	Dan Roberts dan.roberts@frontier-economics.com
	Frontier Economics Ltd
	FRONTIER ECONOMICS EUROPE BRUSSELS | COLOGNE | DUBLIN | LONDON | MADRID
	www.frontier-economics.com