



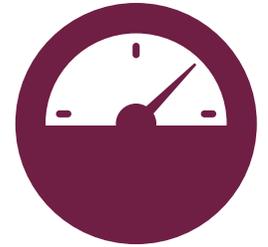
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MARK THROWER MANAGING EDITOR



SERIES 17 | MODULE 04 | DEMANDSIDE RESPONSE

Introduction to Demand Side Response



Paul Bennett of BSSEC looks at how organisations can use demand side response programmes for their own benefit and for the good of the UK electricity network

Demand side response (DSR) is the ability for businesses to increase, decrease or shift electricity consumption in response to a signal. This signal could be price, time or system related. For example, changes in the balance between electricity supply and demand on the grid or shifting consumption out of peak periods of demand when electricity is more expensive.

Organisations can earn revenue or reduce electricity costs by participating in DSR programmes and in the process they are helping to create a smarter, more flexible energy system that can support the UK's transition to a net zero carbon future.

The UK electricity network constantly needs to maintain the balance of supply and demand that it experiences and this is complex owing to balancing the various generation methods to its customers. Indeed, the modern 'smart grid' is now seeing 'coal-free weeks' and renewables and low carbon technologies meeting 70 per cent of electricity demands on peak summer days, coupled with the minimum energy demands now being in the day as opposed to overnight. The fact that wind and solar energy is unpredictable makes balancing the system difficult.

National Grid ESO is the sole system operator in Great Britain and has a statutory mandate to keep power generated balanced between 49.5Hz to 50.5Hz. If demand exceeds supply the frequency will fall and if the supply exceeds demand the frequency will rise.

It can be seen that it is a fine balance. Demand side response is a series of initiatives to encourage consumers and



generators to act flexibly at times of high and low demands to support and stabilise the grid.

Two main benefits of DSR

From a commercial perspective the incentives are high, this can be better visualised when it is understood that in a single 24-hour period the wholesale electricity power prices can fluctuate from £25/MWh (at around 11am) to as high as £75/MWh (around 6pm). Therefore energy avoidance and generation at the right time has real currency

At its most basic, DSR offers two main benefits: cost avoidance and revenue production. The estimates vary but British energy users could save between £2.9bn and £8.1bn a year by 2030 through DSR.

Quite simply put when national or regional demands are high energy is

switched down by flexible users and they receive a payment. Additionally, when the grid needs more energy, flexible organisations that have generating or energy storage capabilities are paid to generate and export energy onto the grid.

There is also the wider societal benefit as we need more of our energy to be low carbon, but the production of renewable, non-dispatchable energy increases the level of fluctuation in grid supply energy consumers, generators and energy storage providers can all help to balance the grid.

In theory any public or private organisation with assets that consume, generate or store electrical energy can take part in Demand Side Response. However, the most common organisations include:

- utilities (renewable and traditional);
- energy storage companies;

Demand side response option	Details of how the scheme operates
Frequency response	Real-time service used by the National Grid to balance electricity supply and demand and maintain system frequency at 50 Hertz. Demand Side Response providers are paid for being available and may be asked to increase or decrease demand for up to 30 minutes.
Capacity Market	Government scheme designed to secure sufficient capacity on the network as part of the Electricity Market Reform. Demand Side Response participants are notified 4 hours in advance of a possible event, and then 15 minutes ahead of required response (either to turn-down assets or run generation). They are paid for being available. Since the Capacity Market was introduced in 2016 no events have occurred, but they are expected to last up to 4 hours.
STOR	Short-Term Operating Reserve is the National Grid's core capacity reserve scheme. Its requirements vary slightly across the year, but Demand Side Response providers are paid an availability and utilisation fee and are required to reduce demand within ten minutes for up to a maximum of two hours.
Peak price avoidance	Shifting electricity demand away from peak periods of the day (usually 4-7pm) to avoid Triad charges and reduce network and capacity charges e.g. DUoS (Distribution Use of System) charges and the Capacity Market Levy.
Constraint management	Distribution System Operators have started to tender for flexibility services to help them manage constraints on the local network.
Energy trading	Increased volatility in wholesale energy markets and market access reforms are making it possible for businesses to benefit from pricing opportunities to optimise their electricity consumption against prices.

- industrial and manufacturing companies;
- hospitals;
- universities;
- hotels;
- retail; and
- offices.

The types of 'assets' that are most commonly controlled include:

- energy storage;
- energy generation (CHP, generators);
- industrial process;
- large motors (air handling units, pumps, heat pumps);
- air conditioning and freezers;
- electric heating;
- electric vehicle charging; and
- lighting (in some cases)

In the early years of demand side response there was something of a 'wild west' market in which unrealistic revenue streams were being promised. The market has now responded and produced a code of conduct to assure organisations of the standard of service they should receive.

The ADE (Association for Decentralised Energy) operates a code of conduct which is a voluntary compliance scheme and is called Flex Assure (www.flexassure.org.uk) for Demand Side Response aggregators. Launched in May 2019 it helps to give customers assurance that they will

receive good quality service from registered scheme members. The compliance scheme covers issues ranging from sales and marketing to operations and processes.

Organisations that wish to use their on-site generating plant for the purposes of Demand Side Response must comply with the Medium Combustion Plant Directive (MCPD) and Specified Generator Regulations. This is new legislation introduced to improve air quality and tackle pollution. These place strict controls on emissions from plant - including back-up generators, CHPs and boilers - with a thermal input between 1 and 50MW. Businesses wishing to bid these assets into DSR programmes need to ensure they comply with the legislation and have the appropriate permits in place.

Demand side response is the

umbrella term for the many different ways in which energy flexibility can be monetised or exploited to reduce expenditure. Demand Side Response can be perceived as complex and sometimes have a confusing range of products and services. In the most basic terms Demand Side Response can be viewed as services termed Frequency Response, Capacity Market, STOR (Short Term Operating Reserve), Peak Price Avoidance, Constraint Management and Energy Trading.

Understand the opportunity

There are five steps to implement a demand side response programme. The first is to understand the opportunity. Almost every building or asset has an amount of flexibility in the way they consume energy. The conditions are ideal for energy sharing, so that building operators can take

advantage of this flexibility. From a building operator's perspective, there are certain functions that the building has to perform and strict parameters to meet in order to keep occupants comfortable and processes running. An example would be working out whether the sizable air conditioning unit which keeps the main atrium cool can be turned off for 30 minutes at times of peak energy demand, without affecting the temperature of the atrium or the performance of the AC unit.

The next step would be to develop a business case based on the energy savings and payments available from the scheme. In order to do this an organisation will need to work with specialists. Following this would be the development of a specification and terms that can be tendered and procured. Organisations are free to contract directly with the National

Fig. 1 The five steps to successful demand side response



Grid ESO or through a demand side provider (also known as an aggregator or a supplier).

On award of the contract, the DSR scheme provider will set up automated controls systems to monetise the flexibility, adjusting demand or supply. From a practical perspective, the building operator has access to a portal that visualises the behaviour of each of their assets, displays the asset availability schedule and helps them decide (automatically or manually) if each asset can be indeed switched on or off.

The final step is to manage and review the system. The scheme is set up so that the organisation remains in control of their assets and their day-to-day operations and processes are unaffected. A system of requests, permissions and agreements are made before any final action to switch on or off is made between the parties. Contract reviews should be planned with the performance of both parties reviewed.

Maintaining full control

When done properly, there are no real risks. The building operator always maintains full control and has the ability to stop any demand side response activities at any point. When implemented well, the building's operational guidelines and policies are the foundation of the demand side response scheme and the programme will be designed to honour these. The core job of the building whether that is manufacturing a certain product or keeping occupants comfortable will always be maintained.

However, the specific risks to be considered and managed include:

- continuity of building operations - requiring a detailed and in-depth analysis to any non-obvious impacts;
- health and safety particularly with maintenance and operations staff;
- system and scheme provider reliability and quality - requiring due diligence checks on all parties; and
- cyber-attack and data protection - requiring a review of the scheme software and protection.

Historically, the National Grid has been the main buyer of demand side response services in the UK, but the market is changing rapidly. Distribution system operators, who manage the local electricity networks, are introducing DSR programmes of their own to help manage constraints on



their networks and support increasing levels of local generation (e.g. solar and biogas) and an anticipated growth in electric vehicle charging.

At the same time, market reforms are opening up access to new markets that have traditionally been the preserve of electricity suppliers and large fossil-fuelled power generators.

The National Grid uses the Balancing Mechanism (BM) to balance electricity supply and demand in the hour before

it is consumed. The market is worth around £350m a year but is expected to grow substantially as energy markets become more decentralised. Currently, a supply licence is required to access the BM but this is set to change later in 2019, opening the market up to aggregators for the first time.

Project Terre is a Europe-wide initiative to enable cross-border balancing between countries. The project is also due to go live in late

2019 and all parties - including smaller generators and aggregators - will have access to equal footing.

Credits for Contributions

EDF Energy - Miranda Murphy-Merrydew, Senior Business Content Exec B2B Market & Insight and Vincent de Rul Energy Solutions Sales Director

Kiwi Energy - Jonathan Ainley, Head of Public Affairs and UK Programme Manager

Useful Links

- National Grid ESO - <https://www.nationalgrideso.com/>
- Major Energy Users Council www.meuc.co.uk
- The Association for Decentralised Energy <https://www.theade.co.uk/>
- Case studies <http://powerresponsive.com/case-studies/>
- Case studies <https://www.kiwipowered.com/clients-partners/>
- Case studies and white paper <https://www.edfenergy.com/large-business/energy-solutions>

Further Reading

- Profiting from Demand Side Flexibility and Storage, The Major Energy Users Council in association with National Grid ESO, Reprinted 2019.
- Power response - a short guide to how your business can profit from Demand Side Response, National Grid ESO, March 2018.
- Industrial flexibility and competitiveness in a low carbon world, ADE & Renewable UK, June 2018



DEMAND SIDE RESPONSE

Please mark your answers below by placing a cross in the box. Don't forget that some questions might have more than one correct answer. You may find it helpful to mark the answers in pencil first before filling in the final answers in ink. Once you have completed the answer sheet, return it to the address below. Photocopies are acceptable.

QUESTIONS

1. What is DSR and how would you best explain what it means?

- Decreased Stringent Response (DSR) is the ability for commercial businesses to halt electricity consumption in response to marketable signals.
- Demand Side Response (DSR) is the ability for businesses to increase, decrease or shift electricity consumption in response to a signal.
- Decentralised Safe Restrictions (DSR) is the ability businesses hold to fluctuate electricity supplies from different suppliers based on climate change legislation.
- Dexterous Synergy Response (DSR) is the ability for businesses to increase or decrease their electric and gas consumption in response to government legislation.

2. What percentage of the modern 'smart grid' is now seeing renewables and low carbon technologies are meeting electricity demands on peak summer days?

- 20% 40% 70% 80%

3. What is the statutory mandate for the National Grid ESO to keep power generated balanced

- 49.5Hz to 50.5Hz 50.5Hz to 60.5Hz
 59.5Hz to 70.5Hz 69.5 Hz to 80.5 Hz

4. What can wholesale electricity power prices fluctuate between in a single 24 - hour period

- From £5/MWh (at around 11am) to as high as £55/MWh (around 6pm).
- From £15/MWh (at around 11am) to as high as £85/MWh (around 6pm).
- From £25/MWh (at around 11am) to as high as £95/MWh (around 6pm).
- From £25/MWh (at around 11am) to as high as £75/MWh (around 6pm).

5. At its most basic, DSR offers two main benefits: cost avoidance and revenue production. The estimates vary but what could British energy users save a year by 2030 through DSR?

- between £1.9bn and £7.1bn

- between £2.9bn and £8.1bn
- between £3.9bn and £9.1bn
- between £4.9bn and £10.1bn

6. What is the voluntary compliance scheme that the Association for Decentralised Energy operates for Demand Side Response aggregators called and when was it launched?

- Satiability Assurances - June 2019
- Arch Assure - May 2019
- Flex Assure - May 2019
- Energy Assure - March 2019

7. The Medium Combustion Plant Directive (MCPD) and Specified Generator Controls Regulations place strict controls on emissions from plant - including back-up generators, CHPs and boilers. At what thermal input bands do plants fall into this legislation?

- between 0.5 and 25MW
- between 5 and 10MW
- between 25 and 500MW
- between 1 and 50MW

8. National Grid uses the Balancing Mechanism (BM) to balance electricity supply and demand in the hour before it is consumed. How much is this market worth per year?

- £150m a year £250m a year
 £350m a year £450m a year

9. What is Frequency Response?

- Real-time service used by National Grid to balance electricity supply and demand and maintain system frequency at 50Hz
- Pre-planned service used by National Grid to balance electricity supply and demand and maintain system frequency at 50Hz
- Self-administered service used by local councils to balance electricity supply and demand and maintain system frequency at 50Hz
- Real-time service used by regional businesses to balance electricity supply and demand and maintain system frequency at 48.5 Hertz

10. What project is due to take place in late 2019 across Europe to enable cross-border balancing between countries?

- Project Mondre Project Terre
- Project Synergy Project Tarre

Please complete your details below in block capitals

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- 1 BEMS
- 2 Refrigeration
- 3 LED Technology
- 4 District Heating
- 5 Air Conditioning
- 6 Behaviour Change
- 7 Thermal Imaging
- 8 Solar Thermal
- 9 Smart Buildings
- 10 Biomass Boilers

SERIES 17

MAY 2019 - APR 2020

- 1 Batteries & Storage
- 2 Energy as a Service
- 3 Water Management
- 4 Demand Side Response
- 5 Drives & Motors*
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