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Take the first steps in demand side response

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Demand side response (DSR) and demand side management (DSM) are terms used by electric utilities to describe programmes developed to influence the electricity usage patterns of customers. This article will focus particularly on DSR but it is worthwhile to understand the difference between the two terms.

Demand Side Response is a term used for programmes designed to encourage end-users to make short-term reductions in energy demand in response to a price signal from the electricity hourly market, or a trigger initiated by the electricity grid operator.

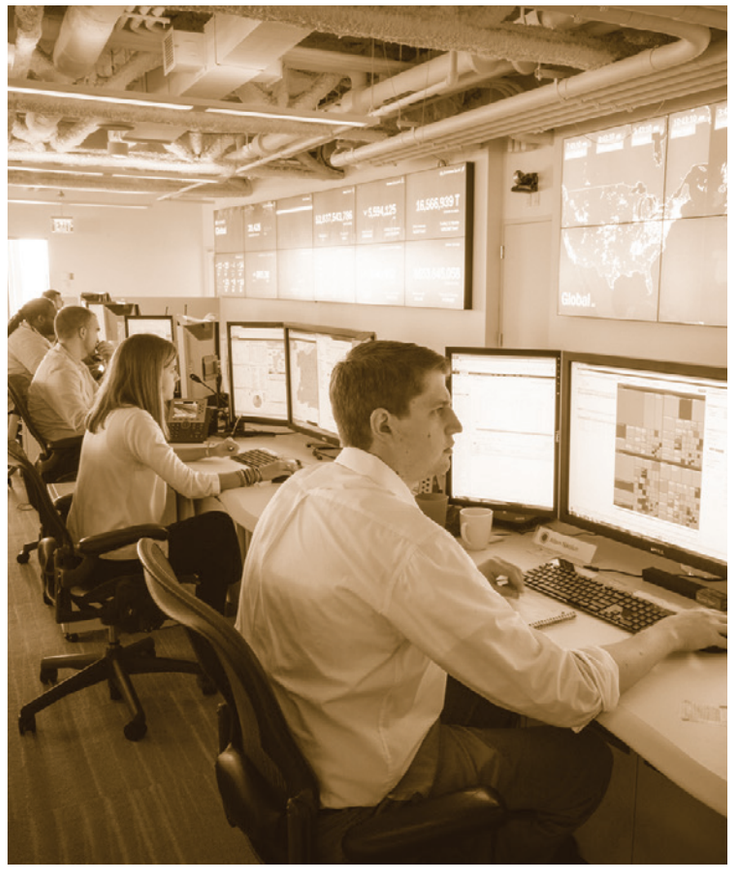
Typically, DSR actions would be in the range of 1 to 4 hours and include turning off or dimming banks of lighting, adjusting HVAC levels, or shutting down a portion of a manufacturing process.

Alternatively, onsite generation can be used to displace load drawn from the electricity power grid.

To provide an incentive for end-users to develop DSR capability, utilities and power regulators have developed suites of DSR programmes and benefits for involvement in these programmes.

Demand side response simply involves businesses increasing, decreasing, or shifting their electricity use to help balance Britain's electricity system. In return they receive strong financial incentives, lower their bills, reduce their carbon footprint and play an important role in the transition to a low-carbon energy system. Participating in DSR makes perfect sense for any business that is serious about being environmentally responsible.

Demand Side Management programmes encourage the end user to be more energy efficient. DSM measures can include lighting retrofits, building automation upgrades, re-commissioning, HVAC improvements, variable frequency drives, etc.



The ability of customers to shed power loads during periods of peak demand through demand response activities is beneficial to the electric system as a whole for two main reasons. First, under tight electricity supply and demand conditions demand response can significantly reduce peak prices and overall price volatility for all users. Second, by reducing system peaks, demand response may reduce the need for very expensive new generation, transmission, and distribution facilities to meet these peaks in demand.

DSR programmes are attractive since they require relatively little capital expenditure. They have a short payback cycle if automated control systems are already in place.

DSR programmes also offer a minimal price risk: when prices are low, there are no DSR opportunities but customers still benefit from a low electricity bill.

The short-term nature of DSR programmes means that they have little effect on the total amount of energy used in the building over a longer period of time.

Fig. 1 shows the effect of energy efficiency on a typical facility's electricity load. The effect is a load reduction for all hours of the day. Although the reduction does not always have the effect described, the philosophy is to establish a net reduction across all hours.

Demand Response, as shown in Fig. 2, is reducing electricity usage when prices are high. In hours 11, 14 and 17 the electricity prices spiked and the facility reacted by reducing its demand in those hours.

With more renewable generation, such as wind and solar, coming online we are seeing a requirement for increased system flexibility to balance the system, along with changes in where we can source flexibility and capacity.

Nation Grid believes that DSR and other forms of flexible technology, such as storage, can help to provide the capacity and flexibility needed to operate the electricity system in tomorrow's world. So, while this new reality creates challenges in operating the grid, it presents exciting opportunities for energy users. They aim to make sure there is a level playing field for both supply side and demand side solutions in Britain's energy markets – and to help businesses take full advantage of these opportunities.

In the UK, National Grid has insufficient available electrical power capacity to meet national electricity supply requirements during times of peak demand throughout each winter period.

DSR is all about intelligent energy use. 'Demand Side' covers services that enable businesses and consumers to turn up, turn down or shift demand in real-time. This is a really important tool to help ensure a secure, sustainable and affordable electricity system. It can help to soften peaks in demand and fill in the troughs, especially at times when power is more abundant, affordable and clean.

To protect against grid power 'black-outs' resulting in loss of electricity supply to customer sites, National Grid procures capacity supply contracts with purpose-built facility owners and customers who commit their on-site standby power generating assets via Demand Side Reserve and Demand Side Response (DSR) schemes respectively.

Pre-event dispatch

NG then send out a pre-event dispatch message for these collective supporting assets to be started, synchronised and operational over a pre-described time-period (usually up to four hours, with a four-hour advanced warning).

Fig. 1 – Effects of Energy Efficiency

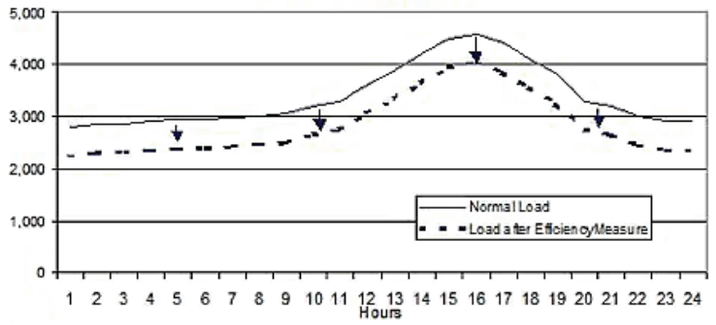
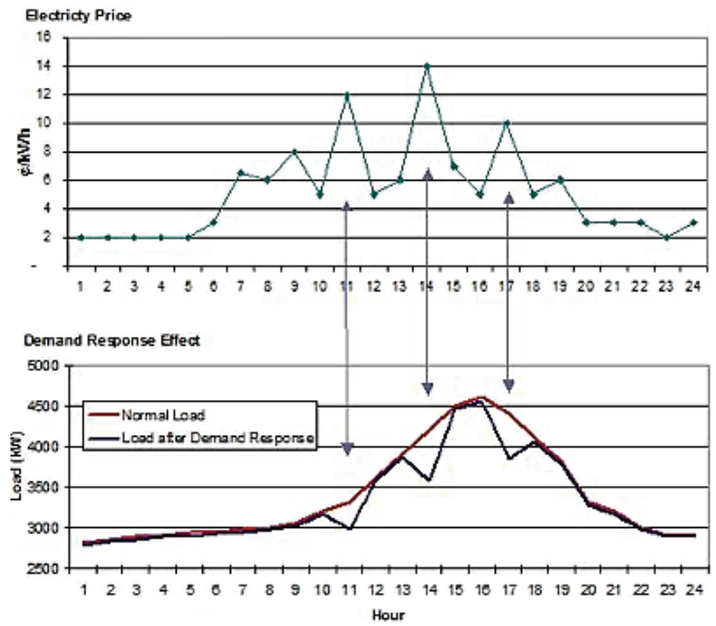


Fig. 2 – Effects of Demand Response



Current, new and developing DSR balancing services include:

- Firm Frequency Response (FFR) – a monthly electronically tendered service through which Nationl Grid procures energy that can respond within either ten or 30 seconds;
- Enhanced Frequency Response (EFR) – a new, faster frequency response product, which requires businesses to provide full response in less than a second.

Among the balancing services available are:

1) RESERVE

Short Term Operating Reserve (STOR) – an important source of reserve energy for National Grid. Procured via three tenders throughout each year, a response time of up to 240 minutes is required. However, a response time of less than 20 minutes is preferable.

STOR Runway – an alternative route in to the STOR market, via a growth contract; designed to help businesses get off the ground in demand side services.

Fast Reserve – a monthly tendered market designed to procure large blocks of reserve energy of 50MW to respond within 2 minutes.

Demand Turn Up – a service which will pay businesses to increase demand (by shifting demand or reducing onsite generation) when there's too much energy in the system, typically responding within several hours of a signal.

2) CAPACITY

Capacity Mechanism – the capacity mechanism is a catch-all term for the auctions for the Capacity Market that NG runs to guarantee capacity for any given year. The Capacity Market is one of the main building blocks in the UK Government's Electricity Market Reform (EMR) programme.

Transitional Arrangements – auctions that are in place to help demand side providers enter the Capacity Market; working in exactly the same way as the main Capacity Market auction, but for a much shorter term.

3) PEAK AVOIDANCE

Triad Avoidance – reducing consumption at periods where peak winter national demand is forecast, in order to proportionally reduce TNUoS (Transmission Network Use of System) charge.

Red Zone Management – shifting consumption to avoid periods of highest distribution network cost (DUoS; Distribution Use of System), often referred to as "red-zones". Other Opportunities

Trials – Distribution Network Operators are running bespoke local trials for demand response which offer opportunities for business users to get involved.

Portfolio Management/Renewables Balancing – some suppliers offer revenue opportunities for businesses via services to aid balancing of their portfolio.

4) ENHANCED FREQUENCY RESPONSE

Enhanced frequency response is defined by NG Electricity Transmission as being a service that achieves 100 per cent active power output at one second (or less) of registering a frequency deviation. This is in contrast with existing frequency response services of primary and high which have timescales of 10 seconds, and secondary which has timescales of 30 seconds. This is a new service that is being developed to improve management of the system frequency pre-fault, i.e. to maintain the system frequency closer to 50Hz under normal operation.

5) INCENTIVES

NG will pay premium rates for these strategic supply services, which are determined through advanced auctions for each upcoming winter (presently up to Winter 2020).

6) PROCESS OPTIONS

The services of an official NG

Aggregator organisation to administer schemes for a set fee, but additional options are available to self-administrate the scheme directly with NG or realise benefit additionality through partnership with Utility suppliers.

The DSR advantages of G59 installations are:

• NG electricity supply parameters are, although controlled within pre-set limits, subject to constant fluctuations depending on local and national demand profiles;

• G59 equipment enables a generator to start and run in parallel with the NG electricity supply for up to 30 seconds, either on mains failure or under on-load maintenance periodic testing. This ensures that the electricity to be supplied to the site by the generator automatically matches the parameters of the prevailing NG site supply at the exact moment that changeover takes place. This negates the risk of loss of 'Business As Usual' services due to the generator failing to start.

• The G59 also performs a similar function when the reverse changeover from generator to NG supply is performed.

Remote start and stop control

One of the advantages of using DSR in remote start/stop installations is that electrical power generators can be fitted with remote start and stop controls, which can be facilitated via existing site control systems to enable manual or automatic operation of one single, or multiple site-located generator sets simultaneously. This function enhances the operational cost and reliability of participation in revenue generating NG Demand Side Response (DSR) schemes.

The continuous increase in taxation and levies means the proportion of addressable/commodity spend is decreasing. Up to 70 per cent of energy unit cost can be attributed to electricity as a commodity, with the remaining 30 per cent attributed to taxes, levies and industry costs. By 2020 the split will reverse.

Future energy costs will be dictated by government policy (taxation) with options to mitigate this through revenue generation and cost avoidance schemes utilising on site standby generators.

To participate in NG scheme the generation assets must meet prescribed engineering standards (G59) which enables seamless transition from grid- to generator supply, and Remote Start capability.

To participate in Triad avoidance nominated sites/generators must have G59 certification by 30 June 2017. Any Generator sets not G59 enabled will be excluded from future participation from April 2018. Participation in any cost avoidance or revenue generation schemes requires G59 certification from 30 April 2020.

As demand response refers to the ability of consumers to respond to a supply shortage by curtailing demand, thereby improving economic efficiency, Demand Side Response is being used in electricity markets throughout the UK. Recent developments in the natural gas sector show that the time has come to also introduce demand response in that sector too.

Natural gas is a major fuel for power generation for a number of reasons, including environmental restrictions on the burning of coal and the establishment of renewable energy standards in many regions. In the past, natural gas demand was relatively stable and seasonal, being largely driven by the demand for gas as a space heating fuel. As more natural gas is used for power generation, more volatility can be expected in gas markets.

Electricity markets have begun incorporating increasing amounts of demand response in an effort to assure reliable power supply at a cost that is lower than the marginal cost of building additional generators. Because of the increasing interdependence of electricity and gas markets, the time is right to take advantage of the latent demand response potential on the natural gas side. This will enhance reliability in both gas and electricity markets at a lower cost than would be accomplished by focusing on either market in isolation.

Ofgem's Security of Supply (SoS) Significant Code Review (SCR) identified that, in the build-up to a Gas Deficit Emergency (GDE), there may be benefit in developing a mechanism to further encourage Gas Consumers, to signal their willingness to reduce their gas consumption, at times of system stress in return for a payment.

New gas industry service

Following a consultation on the draft licence obligation, Ofgem published their Gas SoS, SCR Conclusions in September 2014. This confirmed their decision to proceed with the development of a centralised GAS DSR Mechanism and to place the licence obligation on National Grid Gas to develop the Methodology.

GAS DSR is a new service that is being developed by gas industry representatives to encourage daily metered (DM) consumers to offer to reduce their gas demand during times of system stress. The aim is that by providing GAS DSR prior to entering a gas supply emergency, DM consumers have the potential to protect their critical loads by turning down other less critical loads and receive compensation for doing so. This has the potential to minimise the cost of demand interruptions and further reduce the likelihood of entering into an emergency.

In the future event of the UK gas system being unable to balance, with more gas leaving the gas pipeline system than entering the system due to a critical loss of supply, NG may declare a Network Gas Supply Emergency GDE. During the GDE, a National Executive Committee (NEC) delegated by National Grid will take steps to bring the UK gas system into balance. These steps will include maximising other gas supply sources. If these steps prove to be inadequate in bringing the gas system into balance then the NEC will ask industrial and commercial firm consumers to begin cessation of their gas consumption, a process known as "firm load shedding."

Gas DSR methodology seeks to provide an additional 'route to market' through which end users (via their shipper/supplier) can signal their willingness to make available additional gas DSR available i.e. gas DSR energy quantities which would not otherwise be offered through existing market mechanisms. Encouraging gas DSR to come forward, after a gas deficit warning (GDW), but prior to the end of GDE Stage 1, may in some circumstances, provide sufficient additional system balancing volumes to avoid the system entering a GDE Stage 2. This may enhance the security of supply to more critical load and help all affected parties avoid the high costs and risks associated with an escalation into the later stages of a GDE.

The GAS DSR service features two principle contractual arrangements:

• for reduction in gas quantity taken at the relevant site there can be a shipper/supplier to end user contractual arrangement. On behalf of the end user (in some cases through instruction by the supplier) the shipper will agree to place an offer onto the gas DSR mechanism which reflects the agreed gas DSR energy quantity and price in exchange for the end user's reduction in off-take from the NTS. In return, the end user commits to honouring and delivering on the agreed energy quantity reduction if called to do so by the shipper following acceptance of the offer by NG; and

• under prescribed parameters and criteria set out in the gas DSR framework and methodology, the shipper will offer to sell title to gas (associated to the gas DSR offer), to National Grid, in its role as residual balancer.

Further reading

www.energyadvantage.com
www2.nationalgrid.com
www.ofgem.gov.uk
www.gasgovernance.co.uk

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CPD SERIES 14 | MODULE 10 | APRIL 2017

ENTRY FORM

DEMAND SIDE RESPONSE

Please mark your answers on the sheet below by placing a cross in the box next to the correct answer. Only mark one box for each question. 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 in ink, return it to the address below. Photocopies are acceptable.

QUESTIONS

1. **What is the typical duration time range of a DSR action?**
   - ☐ 7 to 8 hours
   - ☐ 5 to 6 hours
   - ☐ 1 to 4 hours
   - ☐ 9 to 10 hours.

2. **Which of the following is not a measure for carrying out a DSR action?**
   - ☐ adjusting HVAC levels
   - ☐ shutting down a portion of a manufacturing process
   - ☐ use onsite generation to displace load drawn from the electricity power grid
   - ☐ operating at business as usual levels.

3. **How does demand side management differ from demand side response?**
   - ☐ it encourages the end user to be more energy efficient
   - ☐ it encourages temporary reduction of demand
   - ☐ it encourages the temporary use of on-site generating assets
   - ☐ it encourages the end user to be less energy efficient.

4. **What feature helps to reduce the payback time for a demand side response site or sites?**
   - ☐ asset financing
   - ☐ if automated control systems are already in place
   - ☐ hire Purchase
   - ☐ Green Loan.

5. **What is the required response time for Enhanced Frequency Response?**
   - ☐ 10 seconds
   - ☐ 30 seconds
   - ☐ 10 or 30 seconds
   - ☐ under 1 second.

6. **What are the block capacity (MW) and the response time required for the 'Fast Reserve' scheme?**
   - ☐ 500kW and 1 minute
   - ☐ 50MW and 1 minute
   - ☐ 10MW and 1 minute
   - ☐ 50MW and 2 minutes.

7. **TRIAD Avoidance is primarily used to proportionally reduce the impact of:**
   - ☐ Duos
   - ☐ CRC
   - ☐ TNUos
   - ☐ CCL?

8. **Shifting consumption to avoid periods of highest distribution network cost (DUoS; Distribution Use of System) is often referred to as?**
   - ☐ blue zones
   - ☐ red zones
   - ☐ green zones
   - ☐ black zones

9. **A G59 arrangement enables a generator to start and run in parallel with the NG electricity supply for up to?**
   - ☐ 30 seconds
   - ☐ 60 seconds
   - ☐ 10 seconds
   - ☐ 45 seconds.

10. **Which of the following are main principles contractual arrangements featured in the GAS DSR service?**
    - ☐ increase in gas quantity taken at a relevant site
    - ☐ offer to sell title to DSR associated gas to the National Grid
    - ☐ offer to sell title to DSR associated gas to the Residual Balancer
    - ☐ decrease in gas quantity taken at a relevant site.

Please complete your details below in block capitals

Name ..... (Mr. Mrs, Ms) .....

Business .....

Business Address .....

.....

.....

..... Post Code .....

email address .....

Tel No. .....

Completed answers should be mailed to:

The Education Department, Energy in Buildings & Industry, P.O. Box 825, GUILDFORD, GU4 8WQ

CPD fundamentals
THE CONTINUING PROFESSIONAL DEVELOPMENT PROGRAMME

How to obtain a CPD accreditation from the Energy Institute

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This is the tenth and last module in the fourteenth series and focuses on **Demand Side Response**. It is accompanied by a set of multiple-choice questions.

To qualify for a CPD certificate readers must submit at least eight of the ten sets of questions from this series of modules to EiBI for the Energy Institute to mark. Anyone achieving at least eight out of ten correct answers on eight separate articles qualifies for an Energy Institute CPD certificate. This can be obtained, on successful completion of the course and notification by the Energy Institute, **free of charge** for both Energy Institute members and non-members.

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