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Welcome to the 2018 Power Responsive Annual Report.

Demand side flexibility (DSF) participation in GB electricity markets has continued to grow since the publication of the 2017 Annual Report. New opportunities are emerging as markets become more accessible to smaller flexibility providers. Extensive policy and regulatory developments are taking place, mostly to help enable a smarter and more flexible system for the future, but near-term uncertainty is making the business proposition for DSF more complex.

Through our Power Responsive engagement activities in 2018, we have heard how a number of industry developments are unlocking barriers to entry. We are also seeing great steps forward in creating more equal access for demand side participants in delivering the flexibility that the GB electricity system increasingly requires. Many of these have been shared and welcomed through our Power Responsive Flexibility Forums, Summer Reception, website and distribution list. You have also told us that near-term uncertainty and complexity arise from other industry changes and contributes to a challenging environment for investment in DSF.

The potential benefits from accessible and competitive flexibility opportunities, in which all technology types can participate, are clear. Demand side flexibility improves system efficiency, helping to integrate low-carbon technologies, reduce peak demand, lower operating costs, and avoid or defer network investments. We are already seeing the impact of increased competition in markets from demand side providers, leading to competitive prices, to the benefit of customers.

Decarbonisation, digitisation and decentralisation are transforming the electricity system. Wider uptake of technologies such as solar PV and wind, electricity storage, electric vehicles and heat pumps have the potential to radically change electricity demand profiles, including increased volatility on the networks. The electricity system of the future will need to be flexible and dynamic, and so DSF should play a central role.

BEIS and Ofgem suggest that a more flexible energy system could save the UK £17–40 billion to 2050. They continue work to implement the Smart Systems and Flexibility Plan. The critical role for DSF has been recognised by National Grid Electricity System Operator (ESO) in its Forward Plan, and Distribution Network Operators (DNOs) through the Open Networks Project.

The 2018 Power Responsive Annual Report reflects on policy, regulatory and market developments over the past 12 months, as well as trends in demand side flexibility participation over the past two years. The report is intended to help stakeholders better navigate industry change and complexity, and support the continued development of demand side participation in flexibility markets.

I would like to extend my warm thanks to those who have engaged with and contributed to the Power Responsive programme this year, and I look forward to our continued collaboration.

For more information on Power Responsive, visit www.powerresponsive.com.

The 2018 Power Responsive Annual Report has been written on behalf of the Power Responsive Steering Group by National Grid Electricity System Operator and the environmental charity Sustainability First.
1.0 Introduction – Purpose of the Power Responsive Annual Report 2018 and headline findings

The Power Responsive Annual Report is designed for an audience with some knowledge of demand side flexibility (DSF), including electricity market actors, policymakers and demand side providers. The aim is to reflect on progress and developments in 2018 and highlight upcoming activity in 2019 and remaining challenges. The report also presents metrics for DSF participation in flexibility services.

The content covers:

• The Power Responsive programme – achievements over 2018 and engagement activity for the coming year;
• Highlights of recent policy, regulatory and industry-led initiatives supporting or impacting DSF, with perspectives of demand side providers;
• Metrics on demand side participation in Balancing Services and the Capacity Market, creating a benchmark against which to assess development; and
• Future outlook for DSF.

Headlines from 2018

• Continued growth in DSF participation – Demand side flexibility participation in contracted markets has continued to grow since the publication of the 2017 Annual Report. This in part links to greater awareness of opportunities and challenges.
• More liquid markets mean lower costs to consumers – Greater participation in Balancing Service tenders means increased liquidity and competitive prices, which is a positive development for end consumers.
• Policy and regulatory change are causing uncertainty – A number of changes are causing an uncertain near-term outlook for DSF providers. This includes reform of charging arrangements, particularly impacting distributed generators whose business models depend on embedded benefits, and those customers who currently actively respond to Triad signals. The implementation of the Medium Combustion Plant Directive (MCPD) is deterring some parties from DSF participation. A recent European Court of Justice (ECJ) ruling on the Capacity Market has added further uncertainty.

• New market opportunities – Steps are being taken by National Grid ESO to widen access to different Balancing Services and the Balancing Mechanism, and DNOs are procuring DSF to address local constraints. This is particularly important considering increased market liquidity. Through the Energy Network Association’s Open Networks Project, National Grid ESO, the DNOs and wider stakeholders are taking a whole energy system approach to designing solutions for the future electricity system. To give DSF providers greater confidence, the Association for Decentralised Energy (ADE) has launched a code of conduct for demand side aggregators.
2.0 Power Responsive programme overview

This section provides an insight into the objectives of the Power Responsive programme, activities and achievements during 2018, the priorities for 2019, and a summary of engagement channels.

About the Power Responsive programme
Power Responsive is a stakeholder-led programme, facilitated by National Grid ESO, to stimulate increased participation in different forms of flexible technology such as demand side response (DSR), small-scale generation and storage. We class these solutions as demand side flexibility (DSF).

The programme brings industry and energy users together, to work in a co-ordinated way. A key priority is to grow participation in DSF, making it easier for industrial and commercial businesses to get involved and realise the financial and carbon-cutting benefits. Increasingly, we are looking at the potential flexibility from aggregation, for example at city scale, of smaller-scale assets, such as electric vehicles and domestic properties.

Power Responsive is overseen by a high-level steering group, which meets quarterly with representatives of relevant DSF stakeholder groups. The steering group sets the strategic direction, objectives and priorities of the programme. We also host Power Responsive Flexibility Forums to encourage industry collaboration across all DSF technologies, raise awareness of relevant industry developments, and provide the opportunity for delegates to speak with subject matter experts. A metrics sub-group met over the autumn to inform DSF metrics for this report.

Over the last few years, the programme has promoted the target of achieving 30–50% of tender submissions for National Grid ESO’s Balancing Services being obtained from demand side providers. At our Power Responsive Summer Reception in June 2018, we shared that, over the last year, more than 30% of tender submissions received for Balancing Services were from demand side providers on an on-going basis. Some months this exceeded 50%. As National Grid ESO has taken on its new role as a legally separate entity, this target will be reviewed in the context of growing participation of demand side providers and the future ambition for the industry.
The Power Responsive programme is raising awareness, building confidence, and evolving markets to increase the demand side opportunity.

Activities in 2018

The table below summarises the achievements and activities from 2018 across the programme’s three objectives:

**Wider awareness-raising**
- Power Responsive Flexibility Forums (January and October 2018), bringing together delegates, speakers and exhibitors across demand side flexibility to discuss the relevant industry developments.
- Local Authorities workshop in September 2018 with over 40 delegates from 11 councils, covering an overview of routes to market for demand side flexibility and Local Authority case studies.
- Supporting stakeholder events, such as:
  - Tertiary Education Committee (TEC) workshops on DSF with universities
  - Participation in the Major User Energy Council’s (MEUC) Spring ‘Big Bash’ and Autumn Roadshow
  - The launch events for The Energyst’s DSR and Storage Reports 2018
- Registration on the Power Responsive mailing list increased by over 500 new members over 2018, and now consists of a community of over 2,500 demand side stakeholders.

**Building confidence in flexibility opportunities**
- Power Responsive Annual Report 2017
- Power Responsive Summer Reception
- Supporting the release of the ADE’s Code of Conduct for aggregators
- Sponsoring The Energyst’s DSR and Storage Reports 2018
- Hosting the Flexible Power Zone at the Energy Management Association’s Energy Management Exhibition (EMEX)

**Future evolution of flexibility markets**
- Vehicle-to-grid projects
- Centrica Cornwall LEM
- Electron Distributed Asset Register
Engagement activity for the coming year
The table below summarises the upcoming activities and actions from the Power Responsive programme and wider initiatives for 2019:

| Wider awareness raising                  | Updated and improved Power Responsive education material |
|                                         | Sector-specific engagement within Power Responsive       |
| Building confidence in flexibility opportunities | Power Responsive Summer Reception 2019 |
|                                         | Power Responsive Annual Report 2019                      |
|                                         | ESO addressing exclusivity clauses within contracts      |
| Future evolution of flexibility markets  | National Grid ESO’s continued reform of Balancing Services, including the implementation of the frequency response weekly auction trial and other commitments from the frequency response and reserve, restoration and reactive power roadmaps. |
|                                         | Consultation on BEIS and Ofgem’s Smart System and Flexibility Plan, and progression towards completing actions set out in the Plan. |
|                                         | Supporting the development of DSO flexibility products with the ENA’s Open Networks Project. Also ESO/DSO coordination and efficient access to flexibility across the transmission and distribution interface. |
|                                         | Project TERRE – aggregator participation in the Balancing Mechanism. |
3.0 Demand side flexibility – insights, opportunities and challenges

This section discusses opportunities and challenges for demand side providers and summarises policy, regulatory and market changes over the past and upcoming year.

3.1 Demand side provider insights

Increasingly, aggregators, suppliers and industrial & commercial customers are actively participating in markets for demand side flexibility. At the Power Responsive Summer Reception 2018, we showcased success stories of innovative DSF projects including:

**Plessey battery energy storage system (KiWi Power)** – at this site, a 2–2.4 MW Tesla battery system is providing high-speed (250 millisecond) response to National Grid ESO and delivering local services to the distribution network with Western Power Distribution.

**South Mimms Motorway Services battery storage and electric vehicle charging (Open Energi)** – the Tesla supercharging station is connected to a 500 kWh / 250 kW battery to provide frequency response, peak price avoidance and distribution constraint management.

**World’s first hybrid battery and demand network (GridBeyond)** – this hybrid system of battery, embedded generation and flexible load is delivering dynamic frequency response.

**Capturing value from industrial and commercial demand (Lineage Logistics and REstore)** – of this cold storage provider’s 2.3 MW peak load, 87% is flexible.

**Energy storage and control (Powervault)** – UK Power Networks and Imperial College London are working to combine home energy storage with solar panels. By storing solar power during the day, aggregating loads like a virtual power station, it was possible to reduce evening peaks by approximately 60%.

**Flexibility platform using artificial intelligence (Aggregate Industries and Open Energi)** – a dynamic demand platform is being used to stack value streams across different flexibility services and price signals, with plans to roll out the technology to all 48 sites (150 bitumen tanks). This would provide 4.5 MW flexibility to the grid, resulting in a 10–15% reduction in the operating costs of those assets.
Headlines from The Energyst DSR Survey 2018

In September 2018, The Energyst launched their fourth Demand Side Response Report: Aligning Risk and Reward, offering a perspective from end users and service providers. Of 134 responses, 75 were used for the survey (removing responses from aggregators, suppliers and consultants), making it a smaller sample than previous years. Findings from the survey include:

- **Most** of those participating in DSR are motivated by money and most remain broadly satisfied with the outcome.
- For those not participating in DSR, lack of knowledge, perception of risk, insufficient rewards and/or lack of revenue certainly remain barriers.
- Most (83%) of those that do not participate in DSR would be interested in doing so if it did not affect their operations (77% in 2017 survey).
- Of those not providing DSR, 42% said return on investment was not high enough.

At the Power Responsive Steering Group meeting on 3 October 2018, demand customers and market actors outlined some of the remaining challenges for DSF, including:

- **Knowledge and lack of resources** – a lack of awareness and detailed understanding presents a barrier to DSF. There is a need for improved data gathering and market information to help overcome this. There is often a lack of time or dedicated resource within non-energy industry organisations to research opportunities and to progress projects.
- **Finance** – the cost-benefit proposition, the challenge of stacking multiple revenue streams and the investment required, for example, to comply with the Medium Combustion Plant Directive (MCPD) are all factors deterring stakeholders from pursuing DSF.
- **Market and contractual arrangements** – complexity of services, supplier contracts and industry code governance, as well as the potential for multiple DNO services, were highlighted as challenges for engaging smaller providers.

Similar themes were captured in The Energyst DSR Survey 2018.
3.2 Policy, regulatory and market developments

This section signposts relevant policy, regulatory and market developments since the publication of the 2017 Annual Report.

The context for DSF has changed considerably over the past year. The diagram and table below summarise key developments, publications and activities, and what these mean for DSF.

**HM Government**
- Smart System and Flexibility Plan (with Ofgem)
- Industrial Strategy and Innovation funding
- Road to Zero
- Costs of Energy Review
- Energy Bill 2019

**Ofgem**
- Targeted Charging Review and Significant Code Review
- RIIO2 Framework (for distribution, transmission and ESO price controls)
- Electricity Settlement Reform
- Capacity Market rule changes

**European Union**
- Brexit
- Widen access to the Balancing Mechanism/ProjectTERRE
- Medium Combustion Plant Directive (MCPD)
- ECJ ruling on fossil fuel bias in the Capacity Market

**Networks & Market Actors**

**Electricity System Operator**
- ESO Forward Plan
- Balancing Services Future
- Outlook/System Needs and Products Strategy
- System Operability Framework
- Legal separation within National Grid group April 2019

**Transmission and Distribution Networks**
- RIIO 2 Business Plans and Customer Challenge Groups
- DNO to DSO transition
- Future Worlds Consultation

**Suppliers and aggregators**
- Flex Assure – ADE code of conduct for aggregators

**End Users**
- Industrial
- Commercial
- Residential
  - Smart Meters
  - Half Hourly Settlement
  - Smart Appliance Standards

**Assets**
- Microgeneration
  - Feed in Tariff not available from 2021
  - New Smart Export Guarantee
- Distributed Generation & CHP
  - Loss of embedded benefits
  - MCPD requirements
- Demand Response
- Energy Storage
  - Confirmed as Generation
- Electric Vehicles
  - Flexibility enabled Charging Stations
Overarching Policy Framework

Smart Systems and Flexibility Plan
BEIS and Ofgem outlined steps to: remove barriers to smart technologies (including storage); enable smart homes and businesses (through smart meter rollout, half-hourly settlement and smart appliances); and make markets work for flexibility. The Smart Systems Forum discusses progress on the plan. A progress update was issued in October 2018, indicating that 15 of the 29 actions set out in the plan have been implemented, with a commitment to deliver the remaining 14 by 2022.

The plan clarified the treatment of storage as generation in legislation and for licensing; confirming that DNOs cannot operate storage without Ofgem’s consent; giving guidance on co-location of storage with renewable technologies; and enabling deployment of storage through the planning regime, network charging and connections.

It is anticipated that the Energy Bill 2019 will enact certain measures in the Smart Systems and Flexibility Plan. The Government also launched a Clean Growth Buildings Mission to at least halve the energy use of new buildings by 2030; and a new Energy Data Taskforce to consider data access, management; identify gaps and encourage standardisation. Cyber security remains a priority, including network and information systems, and technologies that are secure by design.

Industrial Strategy & innovation initiatives
Smart and clean energy technologies were included as an important focus in the Government’s wider Industrial Strategy. This included innovation funding: the Industrial Strategy Challenge Fund to promote world-leading research; the Faraday Challenge that will support the design, development and manufacture of batteries through £246 million of investment; and the Prospering from the Energy Revolution challenge will invest £102.5 million in new, local and integrated energy systems, covering business and domestic DSF. BEIS recently announced £20 million for large-scale energy storage (4 hr duration); and £4 million competition fund for flexibility exchange trials.

Ofgem has an Innovation Link to enable businesses with new ideas and approaches to talk with them. This includes a ‘regulatory sandbox’ to allow innovators to trial innovative business propositions that will benefit consumers without incurring all of the usual regulatory requirements. Ofgem has recently announced the Electricity Network Innovation Competition (NIC) awards for 2019, which include dynamic response, distributed generation and electric vehicle projects.

The Road to Zero
The Government has set an ambition to ensure that at least half of new cars are ultra low emission by 2030. It will be critical to ensure that the potential impacts and benefits of electric vehicles (EVs) for flexibility, demand response and storage are realised through this process. The Automated and Electric Vehicles Act 2018 requires that all new EV charge points have smart functionality. The government has established an EV Energy Taskforce and put out a call for evidence on potential barriers to the electrification of fleets.
Targeted Charging Review

Ofgem’s Targeted Charging Review (TCR) and Significant Code Review (SCR) are considering reform of residual network charges for transmission and distribution, for both generation and demand, to ensure that charging methodologies meet the interests of consumers, both now and in the future.

The Charging Delivery Body coordinates the programme and stakeholders are engaged through the Charging Futures Forum (CFF). The CFF focuses on forward-looking network charges (signalling how costs will increase or decrease with network usage), residual transmission charges (recovering the remainder of the costs), and Network Access Rights (when users can import/export electricity and how much, and how these rights are allocated).

The TCR minded-to-decision was released in November 2018, following a consultation on access arrangements in July 2018, and consults on two changes:

- Whether to set transmission and distribution residual charges based on a ‘fixed charge’ or ‘agreed capacity charge’, with Ofgem’s preference for fixed.
- Removal of remaining embedded benefits for smaller generators, including those in relation to Balancing Service charges and the Small Generator Discount, to take effect from 2020/21.

The changes are intended to ensure a level playing field on which different types of energy service providers can compete – avoiding differential treatment based on the size of a provider, which voltage they are connected to, their location and their type (e.g. directly-connected generator, co-located with demand or an alternative DSR technology).

Although, in the long run, this potentially benefits consumers overall, the changes mean some customers will pay more and some less for their power. Some businesses that have benefited from reduced contributions to network charges because of investing in onsite generation will pay more than those who have not taken such action.

Ofgem plans to publish working papers (summer 2019), minded-to-decision and draft impact assessment (spring 2020), public decision and final impact assessment (autumn 2020), implementing any quick wins in advance.
From April 2019, National Grid ESO will be a legally separate entity within the National Grid Group. National Grid ESO has developed a Forward Plan with a focus on incentive arrangements and metrics for: managing system balancing and operability; facilitating competitive markets; facilitating whole system outcomes; and supporting competition in networks.

Power Responsive will continue to provide a voice for demand side stakeholders as National Grid ESO takes on its new role.

Ofgem is calling for input on the 2019-21 ESO regulatory and incentives framework. This includes adjustments to the ESO roles and principles, the Forward Plan, reporting and evaluation processes.

The System Needs and Product Strategy (SNaPS), published in June 2017, outlined National Grid ESO’s system balancing needs and set out how these products could likely develop over time – with product roadmaps for Frequency Response and Reserve; Reactive Power; and Restoration (black start). Changes have been made to simplify products and increase access, such as reducing the MW threshold for participation in certain services. National Grid ESO has also been developing the EPEX (European Power Exchange) platform with full delivery in June/July 2019 for standardised products in a week-ahead auction.

BEIS, Ofgem and National Grid ESO are looking to widen access to the Balancing Mechanism. This is being delivered through GB’s participation in Project TERRE (Trans-European Replacement Reserves Exchange), through BSC Modification P344 ‘Project TERRE implementation into GB market arrangements’ and Grid Code Modification GC0097 ‘Grid Code Processes Supporting TERRE’.

Ofgem sets the price controls for the companies that operate the gas and electricity networks through the RIIO framework, which involves setting Revenue using Incentives to deliver Innovation and Outputs. The 8-year RIIO period to 2023 covered £90bn of network investment.

Ofgem published its draft RIIO2 Sector Specific Methodology consultation in December 2018, following the RIIO 2 Framework Decision, published in July 2018. These documents provide more detail on applying the framework in each sector, with their next price control starting in 2021 (including companies that operate the gas distribution, gas transmission, electricity transmission networks and the electricity system operator).

The consumer voice is being strengthened through consumer challenge and engagement groups.
Ofgem has consulted on changes to future Supply Market Arrangements. Initial findings suggest that the ‘Supplier Hub’ model is not fit-for-purpose over the long term and Ofgem is considering fundamental reforms, including steps to address barriers to innovation, improve data accessibility and ensure appropriate consumer protection. Ofgem is currently consulting on a Supplier Licence Review to raise standards in relation to financial resilience and customer service, including for customers in vulnerable circumstances.

Ofgem is also leading work on moving to market-wide half-hourly settlement of domestic and smaller non-domestic consumers. Settlement reform would expose suppliers to the true half-hourly cost of supplying their consumers, so incentivising suppliers to promote more active demand side engagement and shifting consumption away from peak or high-priced times. Ofgem is considering the distributional impact of this approach and will consult on the consumer impact of settlement reform in early 2019.

The Association for Decentralised Energy (ADE) has developed and published Flex Assure, a voluntary industry-led Code of Conduct for aggregators, which addresses five areas of customer concern: sales and marketing; technical due diligence and site visits; proposals and pre-contractual information; customer contracts and complaints.

The FiT pays individuals and businesses for creating their own clean electricity via a generation tariff with extra payments available when they generate more than they use (known as the ‘export tariff’). In July 2018, BEIS consulted on plans to close both the generation and export tariff to new applicants from 1 April 2019. They have also proposed the introduction of a Smart Export Guarantee where larger electricity suppliers would be obliged to offer small-scale generators (up to 5KW capacity) a price per KWH for the electricity they export to the grid, with smaller suppliers voluntarily being able to opt in.
### Whole Electricity System Approaches and Distribution Network Operators

#### Transition to Distribution System Operators (DSOs)
Distribution Network Operators (DNOs) have committed to opening up network requirements to markets and competition on a business-as-usual basis. Several DNOs have already launched multiple location tenders for flexible solutions to network issues.

#### Open Networks Project and Future Worlds consultation
The Energy Networks Association (ENA) Open Networks Project continues to develop a forward-looking vision for networks. It recently undertook a substantial stakeholder engagement process to develop five potential ‘future worlds’ capable of supporting the smart decentralised energy industry. Stakeholder views on these scenarios will be presented as evidence to BEIS and Ofgem.

### Europe

#### Britain’s exit from the EU
The biggest political issue is the exit package negotiated between Britain and the EU. This will have implications for the nature of Britain’s involvement in EU-wide electricity market initiatives, regulations and codes.

#### Medium Combustion Plant Directive (MCPD)
The Specified Generator regulations are a way of improving air quality by controlling emissions from plant equipment of a certain size (less than 50 MWth) and came into force at the same time as the MCPD. The MCPD fills the unregulated gap that currently exists at EU level between smaller appliances (1 MWth) and large combustion plants (over 50 MWth). England and Wales’ implementation of the Specified Generator regulations is intended to address short-term local air quality issues from capacity and balancing generating plant, and is likely to impact on fossil fuel generators offering flexibility services.

Diesel generators <50 MWth that have new contracts (post 31 October 2017) and do not have suitable emissions control equipment cannot participate as commercial operators in the CM or in balancing. This is likely to apply to many small distributed generators, who currently provide balancing and some capacity services. Gas generators are likely to be able to operate without abatement but will still need a permit.

Tranche B generators must have demonstrated their compliance with NOx Emissions Limit Values (ELV) or obtained a permit by 1 January 2019. Tranche A generators above 5 MW must be permitted by 1 October 2019, equal to or below 5 MW by 1 Jan 2030. A generator ceases to be a Tranche A generator if it is the subject of a capacity agreement, or an agreement for provision of Balancing Services entered into after 31 October 2017 and remains in force after 31 December 2018.
Metrics illustrating participation in demand side flexibility

This section provides an overview of demand side flexibility participation in different markets – including Balancing Services, the capacity market and self-dispatch activity (Triad avoidance). The intention is to provide a view of current DSF participation as a benchmark against which to assess development in future years.

Continued progress has been made to establish metrics for DSF participation, building on the Power Responsive Annual Report 2017, with improved granularity and standardisation of our information across different services so that they can be more easily compared. This is in part due to introducing a standard categorisation for technology type (listed on page 3.) at the point of submitting a tender for frequency response and reserve services, and also due to a concerted effort to improve transparency of information as part of the ESO Forward Plan commitments.

Where possible, we have included data for the period January 2017 – December 2018 to consider trends over a 2-year period. We refer to Balancing Mechanism (BM) participants as traditional providers and smaller-scale participants not participating in the BM as DSF providers. The report focuses on Balancing Services and also discusses the Capacity Market and Triad management. In future, we would like to include information on other markets such as local markets and DNO activities.

As highlighted in Section 3.2, National Grid ESO is reforming its Balancing Services to improve accessibility and increase competition. This will result in changes to the way metrics are presented over the coming years as services take different forms. In addition, widening of the Balancing Mechanism to DSF providers means BM participation will no longer be a suitable ‘proxy’ for comparing traditional versus DSF provision for future reports.
4.1 Overall participation in demand side flexibility
Demand side flexibility participation in Balancing Services grew across 2017 as tenders from new units continued to be offered into Ancillary Service markets. On average, 5 new units per month were received from April 2017 – December 2017. We saw an increase of 100% of new units in 2018, with an average of 10 new units per month entering the Ancillary Service markets. This was supported significantly by 39 new tenders in January 2018 and 35 in July 2018. New unit registrations spiked ahead of long-term Firm Frequency Response tenders – taking place every three months, having commenced in July 2018.

4.2 Balancing Services
Of all Balancing Services, the highest participation in tenders by volume from demand side flexibility was seen for the Short Term Operating Reserve, with 3314 unique MW of capacity tendered and 305 unique units tendered.

a. Short Term Operating Reserve (STOR)
Short Term Operating Reserve (STOR) is a service that provides additional active power from either generation or demand reduction. National Grid ESO procures STOR via a competitive tender process with three tender rounds per year. Tenders are assessed and either accepted or rejected; if accepted, the tender becomes binding on both parties. Tenders can be for one or more STOR seasons, up to a total contracted period of 2 years.

The STOR year runs from April to April and each year is divided into six seasons, each of differing length, as driven by operational requirements. STOR Year 12 covers April 2018 to April 2019 and the seasons can be seen below:

| Season 12.1 | 1 April 2018 – 30 April 2018 |
| Season 12.2 | 30 April 2018 – 20 August 2018 |
| Season 12.3 | 20 August 2018 – 24 September 2018 |
| Season 12.4 | 24 September 2018 – 29 October 2018 |
| Season 12.5 | 29 October 2018 – 28 January 2019 |
| Season 12.6 | 28 January 2019 – 1 April 2019 |

In order to participate in STOR, providers must be able to meet the following technical requirements:

| Minimum threshold | A STOR provider must be able to offer a minimum of 3 MW of generation or steady demand reduction. This can be aggregated from more than one site. |
| Response time | Providers should be able to respond to an instruction within a maximum of 240 minutes, although response times within 20 minutes are preferable |
| Ability to sustain | A STOR provider must be able to sustain the response for a minimum of 2 hours and have a recovery period of not more than 1200 minutes |
Chart 1: STOR – Accepted and rejected tender submissions from DSF providers by technology type

Capacity (MW) is shown in the outer circle and the number of units in the inner circle, with the technology breakdown for Tender Rounds 35 (May 2018) and 36 (August 2018).

Dist. Gen (for export)  
Dist. Gen (for onsite)  
Multiple Fuel Type  
Load Response  
Storage (for export)

Presenting rejected tender submissions alongside the accepted ones gives a fuller picture of the technology types participating in STOR; for example, whether the tenders accepted or rejected are disproportionate for a given technology type. The charts also present tender submissions by both MW capacity and the number of units to give an indication of the size of units within each technology type.

Distributed generation for export (for example, a purpose-built generator) accounts for the greatest proportion of both accepted and rejected tender submissions, indicating a significant presence in the STOR service. However, participation is open to all technology types capable of meeting the service requirements. It is possible that these distributed generation providers, and those offering the service through onsite generation, could face a more challenging commercial environment in 2019 due to the implications of the Capacity Market suspension, the implementation of the MCPD and proposed changes to embedded benefits. As a result, we may see more diversification of technologies in the STOR market.

There were no storage-only accepted tender submissions in distribution connected STOR. However, storage could feature as part of portfolios with multiple fuel types.

In the 2017 Annual Report, we reported on tendered and accepted STOR tender submissions by a different classification of technology. Whilst this means that a direct comparison with this year’s annual report is not possible, the move to new technology categorisation allows for a comparison across all Balancing Services within the 2018 Annual Report, and is another step forwards in building a baseline against which to assess progress.

Increased demand side participation in flexibility markets is enabling greater renewable generation on our networks.
Chart 2: STOR – Accepted and rejected tendered capacity from traditional and DSF providers
Showing capacity (MW), by unique units, from October 2016 to December 2018.

From June 2017 (Tender Round 32, TR32) onwards, more tender submissions were accepted from DSF providers than traditional providers, largely due to increased participation in flexible STOR, which is unavailable to traditional parties. Tender submissions are accessed using assessment criteria and awarded based on which submissions are most economic compared to alternative actions, as can be seen in Chart 3. Over this time period, DSR providers trend towards lower availability and utilisation prices, compared with traditional providers.

Providers often submit multiple tenders per unit (although they may only submit for tender per unit per STOR season). In order to remove double counting of submitted capacity, only the highest tendered volume per unit has been included for each tender round.
This chart shows the price of accepted tender submissions for STOR providers of differing sizes against the providers’ approach in balancing availability and utilisation prices. This indicates what a competitive and cost-reflective offer might look like. It suggests that successful approaches to STOR bidding varies between traditional and DSF providers. It may also reflect greater liquidity in flexible STOR due to increased participation.

Chart 3 shows a greater range in the prices offered from DSF providers in comparison to traditional parties. As competition in the STOR service has grown, there has been an increasing trend in providers offering lower availability prices in order to compete, and this is clearly shown in the chart. However, over the 21 months captured in the chart, a number of STOR providers have been successful in securing relatively high availability and utilisation prices. This could be reflective of particular requirements in a particular tender round (for example, winter peaks command a premium), and/or the strength of rival submissions with a tender round (for example, low liquidity may result in higher accepted prices).

There is a clear distinction between the volumes tendered in by traditional parties and those tendered in by DSF providers, with strong indication that larger volumes may be required in order to achieve more lucrative prices across both availability and utilisation.

Table 1: STOR – Average availability and utilisation prices, and average size of accepted DSF providers

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Availability (£/MW/h)</td>
<td>£2.14</td>
<td>£1.04</td>
</tr>
<tr>
<td>Average Utilisation (£/MWh)</td>
<td>£87.91</td>
<td>£76.00</td>
</tr>
<tr>
<td>Average Unit Size (MW)</td>
<td>13.85</td>
<td>13.45</td>
</tr>
</tbody>
</table>

There has been a substantial decrease in both the average availability prices accepted and the average utilisation price accepted through STOR tenders from 2017 to 2018. Increased participation in the service has resulted in increasingly competitive prices submitted by providers in order to be successful during tender rounds, whilst the average size of capacity accepted has remained relatively consistent.
Chart 4: STOR – Average utilisation (MWh) per unit, categorised by unit size (MW)

Taking into account unit size, the chart below shows average utilisation per unit between January 2017 and December 2018.

Chart 5: STOR – Utilised volume 2017 and 2018 for both traditional and DSF providers

Total MWh utilised by month for STOR (traditional and non-traditional) from January 2017 to December 2018.

There was a peak in STOR utilisation for March 2018 as a result of the ‘Beast from the East’ and accompanying weather conditions. Overall, utilisation of STOR increased by 49% in 2018 compared to 2017.

The significant rise in utilisation is a reflection of cheaper accepted prices in the service, therefore STOR became more economical to utilise against alternative actions.

Short Term Operating Reserve snapshot

Upcoming changes:

In summer 2019, National Grid ESO will start to transition non-BM STOR providers to a new IT system to enable more efficient dispatch of service providers through the national control room. This will involve the Platform for Ancillary Services (PAS) project transferring providers to the Ancillary Services Dispatch Platform (ASDP).
b. Fast Reserve

Fast Reserve provides rapid and reliable delivery of active power through increasing output from generation or reducing consumption from demand sources. It is procured through monthly tenders. In order to participate in Fast Reserve, providers must be able to meet the following technical requirements:

<table>
<thead>
<tr>
<th>Minimum threshold</th>
<th>Active power delivery must start within two minutes of the dispatch instruction.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time</td>
<td>The delivery rate must be in excess of 25 MW/minute.</td>
</tr>
<tr>
<td>Ability to sustain</td>
<td>The reserve energy should be sustainable for a minimum of 15 minutes and must be able to deliver a minimum of 25 MW.</td>
</tr>
</tbody>
</table>

Chart 6: Fast Reserve – Accepted and rejected tendered volumes from traditional and DSF providers

Showing capacity (MW), by unique units, from January 2017 to December 2018.

In 2018, the capacity entered into Fast Reserve tenders was significantly higher than the requirements for the service, given the proportion of accepted to rejected capacity. There is little to differentiate the split between capacity accepted from traditional and DSF providers. Typically, there is little DSF participation due to the 50 MW threshold.

The tender round in August 2018 appears to be an anomaly, with a significantly greater volume tendered in and accepted. It was reported in the Fast Reserve Market Information Report prior to this tender round that National Grid ESO would be additionally procuring 180 MW of Fast Reserve volume for 13 to 30 September 2018 after the volume originally procured for this time period had become unavailable.

There are only a small number of providers (4 traditional and 3 DSF) actively participating in Fast Reserve due to the 50 MW threshold to participate. The introduction of the third DSF unit in the August 2018 tender therefore represents a significant milestone as the first battery provider to be offering Fast Reserve.
Charts 7 and 8 together suggest there is little distinction between accepted utilisation prices (£/MWh) for traditional and for DSF providers. However, there is a slight trend towards lower accepted availability prices (£/MW/h) for DSF providers, reflecting the fact that no DSF providers have submitted a positional element to their availability, which is in direct contrast to traditional providers, whereby all but one accepted bid submitted a positional element to their bid. There was a downward trend in the prices accepted between 2017 and 2018.

Whilst only 1 new provider entered the Fast Reserve market in 2018, the number of unique units tendering doubled from 11 to 22, although this appears to have had only a minimal effect on prices.
There’s a clear correlation that reflects the greatest requirement for Fast Reserve takes place during the winter months. Utilisation increased in the summer months of 2018 in comparison to 2017. Overall, there was a 25% increase in total utilisation from 2017 to 2018.

Fast Reserve snapshot

Recent developments:
In 2018, National Grid ESO delivered a number of new IT systems for dispatching smaller-scale (non BM) Fast Reserve providers. This involved implementing the Ancillary Services Dispatch Platform (ASDP) to enable more efficient dispatch of providers.

Upcoming changes:
Following a consultation on proposed changes to the Standard Contract Terms for Fast Reserve, a decision has been made to reduce the entry level from 50 MW to 25 MW from 25 March 2019. This is a positive step in making the service more accessible to smaller scale providers.
c. Demand Turn Up

Demand Turn Up was developed in 2016 to encourage large energy users and generators to either increase demand or reduce generation at times of high renewable output and low national demand. This typically occurs overnight and during weekend afternoons in the summer.

Minimum MW size

- The entry threshold for participation is 1 MW. This can be aggregated from sites at least 0.1 MW. Fractions of megawatts are acceptable, providing that they meet the entry threshold.

Average response time and duration

- The average notice period for an instruction in 2017 was 6 hours 40 minutes.
- In 2017, the average length of delivery was 3 hours 34 minutes.
- We will ask how long you are capable of providing DTU for in a single instruction and we won’t exceed this when issuing instructions.

Equipment

- Providing you have minute by minute or half hourly metering on your site(s), a mobile phone / landline and access to Microsoft Outlook, there is no additional equipment that needs to be installed.

Service dispatch

- Instructions will be issued via email with a supporting SMS. We will send an email containing the details of the MW response and the timeframes during which it is required. Providers will need to confirm receipt of an email instruction within 30 minutes of it being issued. The Platform for Ancillary Services (PAS) system is not available for DTU in 2018.

Chart 10: Demand Turn Up – Accepted and rejected tender submissions from DSF providers by technology type for 2018 DTU season

Capacity (MW) is shown in the outer circle and the number of units in the inner circle, showing the technology breakdown for 2018 DTU season.

![Chart showing Demand Turn Up data](chart.png)
Charts 10 and 11 show that all load response participating in the 2018 DTU tender was accepted. As in 2017, no storage participated in the DTU service. This is perhaps due to the relatively low price paid for delivering the service when compared to services more suited to the technical characteristics of electricity storage, such as frequency response. Overall, participation in the service in 2018 was lower than during 2017. Nearly half the capacity tendered into the 2017 DTU market was tendered in 2018; however, a similar capacity was ultimately contracted (138.6 MW in 2017 and 114.7 MW in 2018). 2018 saw the second annual tender for the DTU service.

Table 2: Demand Turn Up – Average availability and utilisation prices, and average size of accepted DSF providers

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Availability (£/MW/h)</td>
<td>£1.51</td>
<td>£1.48</td>
</tr>
<tr>
<td>Average Utilisation (£/MWh)</td>
<td>£68.44</td>
<td>£65.33</td>
</tr>
<tr>
<td>Average Unit Size (MW)</td>
<td>6.9</td>
<td>7.7</td>
</tr>
</tbody>
</table>

Between 2017 and 2018 there was a slight reduction in the average availability and utilisation prices tendered and accepted for DTU, and a slight rise in the average size of the units participating.

There has been a slight decrease in accepted availability and utilisation prices from 2017 to 2018. However, this is a less significant shift than has been recognised in other Balancing Services, with the average availability price decreasing by just £0.03, and the average utilisation price decreasing by £3.11. In contrast, the average accepted MW size per unit increased by approximately 0.7 MW. The relatively static nature of the service (when compared to other Balancing Services) could reflect the infancy of the DTU service and the fact that there is currently just one annual tender for the fixed service, hence little opportunity for price discovery.
The DTU service was far less utilised in 2018 compared to 2017. In 2017, 6429 MWh were instructed (162 instructions), compared to only 1465 MWh (41 instructions) in 2018. This could reflect the availability of more economic actions to the ESO, or the high summer temperatures and weather conditions experienced in 2018.

Demand Turn Up snapshot

Upcoming changes:
This service was designed to enable demand increase/generation reduction from demand side providers in the near-term. It is not viewed as an enduring solution for ‘negative’ reserve – unlike STOR and Fast Reserve, which are ‘positive’ reserve services. The design of both positive and negative reserve services will reviewed in 2019 as part of National Grid ESO’s work to reform Balancing Services.
d. Firm Frequency Response (FFR)
National Grid ESO has a statutory obligation to maintain the frequency of the National Electricity Transmission System within ±1% of 50Hz (49.5 to 50.5Hz). The control room normally controls frequency within a tighter operational limit of 49.8 to 50.2Hz.

System frequency is continuously changing: it is determined and controlled by the balance between demand and generation. If demand is greater than generation, frequency falls. If generation is greater than demand, frequency rises. National Grid ESO must therefore ensure that sufficient generation and/or demand is held in readiness to respond to frequency variations.

Response represents the ability to modify generation or demand to compensate for changes in system frequency within 2–30 seconds, depending on FFR service type. The FFR service is split into two physical products: static (non-dynamic) and dynamic frequency response.

• Static frequency response is triggered at a defined frequency deviation that is specified in the provider’s Framework Agreement, which must be in place before tendering. No response is required within the operating range.

• Dynamic frequency response is continuously provided and is used to manage second-by-second frequency variations. Dynamic response is automatically delivered for all frequency variations outside of the 50Hz ±0.015Hz – which is referred to as the ‘deadband’.

The service is procured through monthly tenders and, in order to participate in FFR, providers must be able to meet the following technical requirements:

<table>
<thead>
<tr>
<th>Minimum size</th>
<th>Minimum response is 1 MW. This can be from a single unit or aggregated from several smaller units.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency sensitive mode</td>
<td>Providers must have the capability to operate (when instructed) in a frequency sensitive mode for Dynamic response, or change their MW level via automatic relay for Non-Dynamic response.</td>
</tr>
<tr>
<td>Dispatch</td>
<td>There must be a single point of dispatch or a method in which the total output of the combined loads can be monitored to demonstrate to National Grid that the service is available.</td>
</tr>
</tbody>
</table>

**Chart 13: FFR – Accepted and rejected tendered capacity from traditional and DSF providers**
*Showing capacity (MW) by unique units, from January 2017 to December 2018.*
Similar to the STOR market, there has been a move towards a greater capacity accepted in FFR from DSF providers compared to traditional parties. In only one tender round (October 2018), since May 2018, has any capacity been accepted from traditional providers. This may be as a result of increased market participation and liquidity, but may also indicate that non-traditional providers find efficiencies in their business models that enable them to submit more competitive tenders, or that traditional parties are focusing on the intraday mandatory frequency response market as delivering better returns.

Greater DSF was offered into the FFR market in 2018 compared to 2017: 124 unique providers offered 2341 MW in 2018, compared to 58 unique providers offering 773 MW in 2017.

During 2018, National Grid ESO introduced tenders for long-term FFR contracts. These tender rounds have resulted in the increased number of tenders received and in the capacity accepted, as shown in June, September and December 2018. Tender rounds for longer-term contracts occur every three months, and reflect how National Grid ESO has responded to stakeholder requirements for short and long-term contracts.

Introducing standardised timeframes to FFR has resulted in an increased number of tenders received and capacity accepted.

Chart 14a: FFR – Accepted prices from traditional and DSF providers, and Chart 14b: FFR – Accepted prices from DSF providers only

Availability prices (£/h) against maximum unit volume (MW) from January 2017 – December 2018.

Accepted prices from smaller providers are clustered on the lower end of the scale. Chart 14b shows a more granular view of the spread of accepted availability prices across units of different sizes, particularly for smaller DSF providers.

However, there are still a large number of non-traditional parties willing to offer low prices, despite holding large volumes of capacity. It is possible that these providers may be new to the market, and exploring pricing strategies with short-term contracts, or possibly a reflection of specific requirements within a particular tender round.
For dynamic FFR, there is a clear distinction between the higher prices accepted from traditional parties, and those accepted from non-traditional providers. This is likely to reflect the greater capacity offered by traditional providers, which means they received a higher payment on a £/h basis. Similarly to static FFR, average dynamic FFR prices have decreased significantly from 2017 to 2018. In 2017, the average price of an accepted dynamic FFR contract was £305.97/hour compared with £110.18/hour in 2018. In 2017, 392 MW of dynamic capacity was accepted from DSF providers; this increased to 2720 MW in 2018. The average non-traditional unit size has also increased in 2018 (by 3.32 MW, 43%) from 7.69 MW to 11.01 MW.

There has been a steady downward trend in prices accepted for static FFR over the past two years, with the average price for static FFR decreasing from £46.18/hour in 2017 to £32.46/hour in 2018. Outliers suggest that providers continue to submit speculative bids to aid price discovery, although price ranges are less distributed throughout 2018 than in 2017. All static FFR providers over this time period were DSF providers, and the size of the contracted unit is indicated by the size of the data point.

Chart 15: FFR – Accepted prices for static FFR from January 2017 – December 2018
Availability prices (£/h) accepted for static FFR across January 2017 – December 2018 (only DSF providers participated).

Chart 16: FFR – Accepted prices for dynamic FFR from January 2017 – December 2018
Availability prices (£/h) accepted for dynamic FFR across January 2017 – December 2018 (traditional and DSF providers).
4.3 Triad avoidance

Triad events are the three half-hours of highest demand on the GB electricity transmission system between November and February each year, separated by at least ten days. National Grid ESO uses the Triad as a mechanism to help manage peak demand on the network and to determine Transmission Network Use of System (TNUoS) charges for end-customers with half-hour metering.

There is little data held on self-dispatch activity, as no formal instructions are sent to dispatch providers to initiate a change in energy usage or production. Triad avoidance has become a well-understood signal to end-customers, with many energy users choosing to participate in DSF activities initially with this opportunity, before venturing into contracted services with more complex requirements and explicit instructions.

Over winter 2017–18, National Grid ESO witnessed up to 2GW of non-dispatched load during each Triad event as a result of Triad avoidance activity. Whilst Triad avoidance is often seen as an accessible opportunity for end-customers, the increasing level of participation means that Triad events are becoming ever more challenging to predict. This is reflected in the number of observed Triad days, shown in the table below – there has been a steady increase in the number of observed Triad days since 2009/10.

That said, 2017/18 was an anomaly. Generally, it is easier to predict which days are likely to be the indicative Triad demands during colder winters, compared with mild winters. The cold weather over winter 2017/18 is reflected in the dip in the number of observed Triad days, compared with the milder winter the previous year.

Table 3: Triad avoidance activity across 2009/10 – 2017/18

Number of occurrences, i.e. the days on which Triad warnings were issued, and the maximum observed Triad avoidance for the winter, i.e. observed demand reduction (GW).

<table>
<thead>
<tr>
<th>Winter</th>
<th>Number of occurrences (days)</th>
<th>Maximum Triad avoidance (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009/10</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>2010/11</td>
<td>15</td>
<td>1.2</td>
</tr>
<tr>
<td>2011/12</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>2012/13</td>
<td>15</td>
<td>1.2</td>
</tr>
<tr>
<td>2013/14</td>
<td>23</td>
<td>1.8</td>
</tr>
<tr>
<td>2014/15</td>
<td>25</td>
<td>1.2</td>
</tr>
<tr>
<td>2015/16</td>
<td>37</td>
<td>2</td>
</tr>
<tr>
<td>2016/17</td>
<td>49</td>
<td>2</td>
</tr>
<tr>
<td>2017/18</td>
<td>34</td>
<td>2</td>
</tr>
</tbody>
</table>
4.4 Capacity Market

As the delivery body for Electricity Market Reform, National Grid ESO runs the main T-4 annual auction, buying capacity for four years ahead of delivery. The annual T-1 auction runs one year ahead of delivery as a top-up to secure volume. The first auction, described as the ‘Early Auction’ (EA), was held on 31 January 2017, for delivery in winter 2017/18. The DSR Transitional Arrangements (TA) auction offered targeted support to DSR to encourage enterprise and increase levels of participation in the intervening years 2016–2018.

It can be challenging for DSR participants to give a view of volume available four years ahead of the delivery year. As a result, an increase in demand side capacity bid and acceptance in the T-1 auctions can be seen in Chart 17.

In the T-4 2017 auction, 1160 MW of unproven DSR and 46 MW of proven DSR were contracted for £8.40 per kW/year for delivery in 2020/21 – a record low clearing price. This compares with 1367 MW of unproven DSR and 44 MW for £22.50 per kW/year during the T-4 2016 auction.

The T-1 2017 auction also delivered a record low clearing price of £6 per kW, contracting 521 MW of unproven DSR and 93 MW of proven DSR.

Market commentators question whether record low prices will create a difficult environment for new, purpose-built demand side assets.

Chart 17: Capacity Market – Auctioned and accepted DSR and non DSR units by delivery year

In the T-4 2017 auction, 1160 MW of unproven DSR and 46 MW of proven DSR were contracted for £8.40 per kW/year for delivery in 2020/21 – a record low clearing price. This compares with 1367 MW of unproven DSR and 44 MW for £22.50 per kW/year during the T-4 2016 auction.

The T-1 2017 auction also delivered a record low clearing price of £6 per kW, contracting 521 MW of unproven DSR and 93 MW of proven DSR.

Market commentators question whether record low prices will create a difficult environment for new, purpose-built demand side assets.

Capacity Market snapshot

Recent developments:
A recent European Court of Justice (ECJ) ruling on the Capacity Market has added further uncertainty.

Upcoming changes:
Ofgem has since consulted on Capacity Market Rule Change Proposals and the Five Year Review of Capacity Market Rules, so interested parties should await the outcomes of this activity.
**Future developments in demand side flexibility opportunities**

<table>
<thead>
<tr>
<th>Ancillary Services</th>
<th>National Grid ESO aim is to create balancing services markets that meet our changing system needs, and in which all technology types can compete on a level playing field.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reserve and Response</strong></td>
<td>A published product roadmaps set out the actions to be taken forward for frequency response and reserve markets and details the principles that will govern the way that balancing services are procured in future. The roadmap also outlines broader improvements to how the SO shares information with the market to enhance transparency of decision making, including:</td>
</tr>
<tr>
<td><strong>Frequency Response Auction Trial</strong></td>
<td>developing a trial of a weekly cleared price auction for a defined volume of frequency response requirement. This trial will look at testing a number of improvements and new areas of functionality, which will increase market transparency and lower barriers to entry for new providers.</td>
</tr>
<tr>
<td><strong>Consultation on Exclusivity Clauses</strong></td>
<td>a commitment to publish and consult industry on revised exclusivity clauses within balancing services contracts. These clauses place restrictions on what other commercial services, such as those to DNOs, can be provided by parties who are contracted to provide balancing services to the ESO.</td>
</tr>
<tr>
<td><strong>Performance Monitoring Policy</strong></td>
<td>a commitment to review policy for testing and performance monitoring of balancing services.</td>
</tr>
<tr>
<td><strong>Transmission thermal constraints information</strong></td>
<td>an ESO information note provides detail on how thermal constraints are managed on the electricity transmission system currently, and how the ESO plan to manage these constraints in future.</td>
</tr>
<tr>
<td><strong>Reactive Power and Restoration</strong></td>
<td>National Grid ESO are exploring market based approaches to procuring Reactive Power and Restoration Services in light of the changing generation mix.</td>
</tr>
<tr>
<td><strong>Wider access to the Balancing Mechanism and Project TERRE</strong></td>
<td>Wider Access to the Balancing Mechanism and Project TERRE - the ESO roadmap sets out the commitments and actions to improve existing BM entry routes and create a new route to market.</td>
</tr>
<tr>
<td><strong>Changes to network charging arrangements.</strong></td>
<td>The SCR was launched to address Ofgem’s concern that the current framework for residual and cost-recovery charging may result in inefficient use of the networks and unfair outcomes for consumers. The Targeted Charging Review is looking at how electricity network residual charges should be set in future, for both transmission and distribution. The principles Ofgem are proposing to use to assess potential changes are:</td>
</tr>
</tbody>
</table>

1. reducing distortions
2. fairness
3. proportionality and practical considerations.
The ENA Open Networks project brings together the main UK electricity network owners and operators to collaborate and develop the transition to DSO. The ESO plays an active role in the project and has recently led the delivery of its latest milestone, the ‘Future Worlds’ consultation - a substantial stakeholder engagement process to map and describe a number of potential system architectures (“Future Worlds”) capable of supporting the smart decentralised energy industry that the UK is transitioning towards.

<table>
<thead>
<tr>
<th>Technological innovations and trials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Transition</strong> (with SSE Networks) – to trial a platform to live-test outputs from ENA Open Networks project and demonstrate the concept of neutral market facilitator in several locations.</td>
</tr>
<tr>
<td><strong>Project FUSION</strong> (with SPEN) – to demonstrate a smart electricity market framework for distribution-connected flexibility to resolve network constraints in East Fife.</td>
</tr>
<tr>
<td><strong>Energy Flexibility and Forecasting System (EFFS)</strong> (with WPD) – to develop an IT platform to forecast network capacity and identify opportunities to trade flexible network services.</td>
</tr>
<tr>
<td><strong>Cornwall Local Energy Market</strong> (with Centrica &amp; WPD) – to demonstrate a local market for coordinated procurement of flexibility between multiple flexibility markets.</td>
</tr>
<tr>
<td><strong>Power Potential</strong> (with UKPN) – to demonstrate whether distributed energy resources can provide key services to the transmission network, such as dynamic voltage control.</td>
</tr>
<tr>
<td><strong>Blockchain flexibility trading platform</strong> (with Electron, UKPN, &amp; ScottishPower) – to test whether collaborative trading of flexibility will reduce or increase liquidity and reduce overall costs. Developing a blockchain register of flexibility assets.</td>
</tr>
<tr>
<td><strong>Frequency Auction Platform trial</strong> (with EpexSpot) – a weekly cleared price auction platform to test that closer to real time procurement will lower overall costs and enable new providers.</td>
</tr>
<tr>
<td><strong>Enhanced Frequency Control Capability</strong> (with multiple partners) - to demonstrate rapid response services from new technologies across the Whole System (e.g. solar, wind, DSR)</td>
</tr>
</tbody>
</table>

Thank you
With thanks to Sustainability First for their continued contribution to the publication of this report, and to the Power Responsive programme.

**Sustainability first**

Disclaimer: This report should not be taken as investment advice in demand side markets on the part of National Grid Electricity System Operator or Sustainability First.
## Annex A – Power Responsive Steering Group members 2018

<table>
<thead>
<tr>
<th>Sector</th>
<th>Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy</td>
<td>Department for Business, Energy &amp; Industrial Strategy</td>
</tr>
<tr>
<td>Regulation</td>
<td>Ofgem</td>
</tr>
<tr>
<td>System Operator</td>
<td>National Grid ESO</td>
</tr>
<tr>
<td>Distribution Network Operator</td>
<td>Northern Powergrid</td>
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<td></td>
<td>Western Power Distribution</td>
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<td>Suppliers</td>
<td>Centrica</td>
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<td>Aggregators</td>
<td>KiWi Power</td>
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<td></td>
<td>Flexitricity</td>
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<tr>
<td>Market Commentator</td>
<td>EnergyBridge</td>
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<td></td>
<td>Cornwall</td>
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<tr>
<td>Market Trading</td>
<td>ELEXON</td>
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<tr>
<td>Technology Provider</td>
<td>BEAMA</td>
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<td>End Users</td>
<td>United Utilities</td>
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<td></td>
<td>Crown Commercial Service</td>
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<td></td>
<td>MEUC</td>
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<td></td>
<td>TFL</td>
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<tr>
<td>Storage</td>
<td>DNV GL</td>
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<td></td>
<td>Fluence</td>
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<tr>
<td>Secretariat</td>
<td>Sustainability First</td>
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<td></td>
<td>National Grid ESO</td>
</tr>
</tbody>
</table>
## Annex B – Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregator</td>
<td>Aggregates loads and participates in contracted markets or responds to price signals on behalf of customers.</td>
</tr>
<tr>
<td>Capacity Market (CM)</td>
<td>Designed to provide incentives for investment in the overall level of reliable capacity (supply and demand side) and secure supply of electricity.</td>
</tr>
<tr>
<td>Charging Futures Forum (CFF)</td>
<td>A stakeholder forum to consider electricity network charging reviews led by Ofgem and industry.</td>
</tr>
<tr>
<td>Demand Side Flexibility (DSF)</td>
<td>Electricity demand is changed (increased, reduced or shifted) at a particular moment in time in response to an external signal (such as a change in price, or a message). DSF providers include industrial and commercial energy users and owners of small-scale generation and electricity storage, such as batteries.</td>
</tr>
<tr>
<td>Demand Side Providers</td>
<td>Demand side providers offer demand side flexibility services to markets and market actors, including aggregators, suppliers, customers and third-party intermediaries.</td>
</tr>
<tr>
<td>Demand Turn Up (DTU)</td>
<td>Increasing demand at times of high generation (e.g. from wind and solar) in response to a signal from the electricity system operator. Demand increase should be achieved through shifting demand, not the wasting of energy.</td>
</tr>
<tr>
<td>Distribution Network Operator (DNO)</td>
<td>Companies that build, maintain and operate distribution networks that transport electricity from high-voltage transmission networks to customers.</td>
</tr>
<tr>
<td>Distribution System Operator (DSO)</td>
<td>An emerging role for DNOs which involves more active management of supply, demand and constraints at a local level.</td>
</tr>
<tr>
<td>Electricity System Operator (ESO)</td>
<td>ESO balances electricity supply and demand in real time, acting as a legally separate company within the National Grid Group from April 2019.</td>
</tr>
<tr>
<td>Embedded Benefits</td>
<td>Benefits available to small-scale ‘embedded’ generation under industry arrangements.</td>
</tr>
<tr>
<td>Embedded Generation</td>
<td>Embedded generation is the production of electricity from generators that are directly connected to a distribution network.</td>
</tr>
<tr>
<td>Fast Reserve</td>
<td>A monthly tendered service designed to procure large blocks of reserve energy of 50 MW to respond within 2 minutes.</td>
</tr>
<tr>
<td>Firm Frequency Response</td>
<td>Procured via a monthly tender round. Participants can tender for contracts beginning the month ahead up to 2 years ahead. FFR dynamic is a continuously provided service used to manage the normal second-by-second changes on the system. FFR static is a discrete service triggered at a defined frequency deviation.</td>
</tr>
</tbody>
</table>
Frequency Response

System frequency is a continuously changing variable that is determined and controlled by the second-by-second balance between system demand and total generation. The ESO must maintain a frequency of +/-1% of 50Hz at all times, so procures frequency services in readiness to manage fluctuations in electricity demand or generation from forecast volumes or to withstand faults to the network or connected generation.

Half-Hourly Settlement

The electricity settlement process places incentives on suppliers to buy energy to meet their customers’ demand in each half hour of the day. With advanced meters, customers are increasingly able to have their electricity consumption settled on a half-hourly basis.

Industrial and Commercial (I&C) Customers

This refers to large business customers of electricity, including those manufacturing goods, those serving customers and public sector organisations.

Medium Combustion Plant (MCP) Directive

EU legislation restricting emissions of certain pollutants from combustion plants with a rated thermal input equal to or greater than 1 megawatt and less than 50 megawatts. This impacts diesel plant – resulting in limited running hours for commercial gain.

Reserve Services

In order to deal with unforeseen changes in demand or lack of generation, the ESO requires access to additional sources of power in the form of generation or demand reduction. The response time and duration are typically longer for reserve services than frequency.

Short Term Operating Reserve (STOR)

An important source of reserve energy for the ESO, which is procured via three tenders throughout each year and requires a response time of less than 20 minutes.

Significant Code Review (SCR)

A process which enables Ofgem, as energy regulator, to initiate wide-ranging and holistic changes and to implement reform to a code-based issue.

Targeted Charging Review (TCR)

An Ofgem review to consider reform of residual charging for transmission and distribution, for both generation and demand, to ensure that it meets the interests of consumers, both now and in the future.

Third Party Intermediaries (TPI)

Organisations or individuals that give energy-related advice aimed at helping customers to buy energy and/or manage their energy needs.

Transmission Network Owner (TNO)

Companies that build, maintain and operate transmission networks, transporting electricity at a high voltage across the country.

Triad Avoidance

Reducing consumption at periods where peak winter national demand is forecast, in order to proportionally reduce TNUoS (Transmission Network Use of System) changes.