

power  
responsive

A short guide to how your business can profit  
from Demand Side Response





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from Demand Side Response

Produced by Power Responsive – a programme within National Grid



national**grid**

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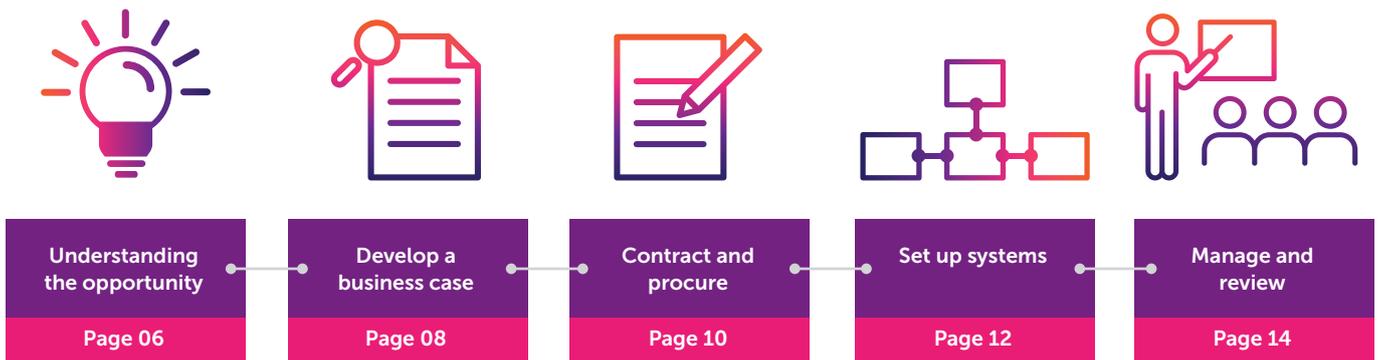
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# Introduction

**Our electricity system is changing. A rise in intermittent renewable energy along with rapid advances in technology is transforming the landscape. We're moving away from a world where electricity once flowed one-way along networks from a generator to homes and businesses, to one where it is now often produced locally and flows in multiple directions. This means the system needs to be managed differently and more responsively.**

Businesses are helping to deliver this change, saving money and earning revenue by using their power more intelligently, without impacting on their normal day-to-day operations.

This guide sets out five steps for business customers to get involved:



Power Responsive is a collaborative programme of work, facilitated by National Grid. It sees the System Operator working with business customers and the energy market to increase participation in various forms of demand side response. For more information visit [www.powerresponsive.com](http://www.powerresponsive.com).

This short guide has been written by the environmental charity Sustainability First for Power Responsive. It draws upon a more in-depth Major Energy Users' Council (MEUC) training booklet, 'Profiting from demand side response'. It should not be taken as investment advice in demand side markets on the part of National Grid or Sustainability First.

## Step 1: Understand the opportunity

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### What is demand side response?

It's where levels of electricity demand are changed at a particular moment in time in response to a signal – such as higher peak-time tariffs, a notification from National Grid or an automatic response to a change in frequency. Customers can opt not to react. They can also override these signals. Demand side response can mean increasing, reducing or shifting electricity demand in areas such as onsite generation, heating and cooling systems, business operations and appliances, and battery storage.

### How can demand side response benefit my business?

Most businesses participate because they can reduce their electricity costs and generate new revenue streams. But there can be other gains, such as improving the resilience of existing systems by being paid to regularly test back-up generators, improved energy management through real-time monitoring and new systems, and supporting environmental ambitions.

### What information should I gather about my business?

To find out what demand side response could offer your business, you need to understand both your power use and business operations. You should gather information on your business's: operational and safety requirements; electricity consumption; existing Building Management System (BMS); potentially suitable assets and who manages them; and – if you are intending to use generation for export – the type of generation connection agreement you have with your local Distribution Network Operator (DNO).

### Why does the electricity system and market value your demand side response?

Demand side response can deliver significant cost savings to the electricity system as a whole by supporting efficient balancing. It can be valuable to: the system operator for balancing; network operators to manage local or national constraints and to avoid reinforcement; and suppliers to manage market risk. In this guide, we will refer to those helping customers to participate in demand side response – such as electricity suppliers, aggregators and Third Party Intermediaries as 'demand side providers'.

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### Who can help me get started?

Demand side providers can make it easier for you to take part. You can have a no obligation discussion and they can perform onsite surveys. You could also talk to someone with a similar business already providing demand side response and look at relevant case studies, including those on the Power Responsive website.

#### Checklist

- Compile information on your business operating requirements, assets and electricity consumption
- Meet with an expert



## Step 2: Develop a business case

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To make the case internally and drive your project forward it is helpful to have a senior sponsor and an internal champion for demand side response. It is also important to meet early with people across the organisation who might need to be involved, such as energy management, operations, finance, procurement and estates/building services. Identify who manages which parts of the energy chain in your business, and their existing relationships with the market. Treat demand side response as you would any other cross-departmental project with a project manager, team and plan.

Make contact with electricity industry experts, such as your electricity supplier, DNO, National Grid and demand side providers. This will help you establish whether you are able to contract directly or whether you may need an aggregator. Demand side providers can help you access services with technical or commercial requirements that you may not be able to meet directly.

Assess different schemes to work out which will give you the greatest cost savings or, perhaps, new revenues. **Annex A** shows how you can save money by adopting a tariff that rewards customers who are able to avoid peak-load periods. **Annex B** provides details of the current demand side response schemes that are available.

When pitching your project internally, consider how demand side response fits with wider business objectives. For example, it can support sustainability and carbon reduction objectives, existing energy efficiency and energy management schemes (e.g. the Energy Saving Opportunities Scheme) and Corporate Social Responsibility (CSR).

Perhaps start with a site survey to fully understand your electrical equipment, its operational demand and which assets are suitable. This can be done with an industry expert. There are potential risks to participation. Set out what your business is willing to be flexible on at various times of the day and what is non-negotiable – for safety and comfort – such as lighting levels, temperatures and uninterruptible processes. Be aware of new environmental rules, including emissions, which may impact on running times for a back-up plant.

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Calculate the financial benefits, including potential revenues, payback and set up costs (e.g. data gathering, feasibility, design, implementation and commissioning).

### Checklist

- Identify an internal sponsor/champion, project manager and stakeholders
- Contact your electricity supplier and local network provider
- Establish whether to contract directly or via a demand side provider
- Undertake or arrange a site survey
- Assess financial returns and wider benefits

### Why work with a demand side provider?

Demand side providers can help make it simpler for businesses to participate in demand side response schemes via their:

- Access to different schemes – e.g. meeting minimum volume requirements
- Knowledge and support
- Established relationships with market actors
- Economies of scale
- Innovative technology
- Risk management

## Step 3: Contract and procure



**Demand side schemes usually require a contract, either directly with the procurer – such as National Grid – or through a demand side provider. There is a process for assessing your suitability to take part, after which contracts are awarded either bilaterally or through a competitive process. The amount paid varies depending on the scheme, and contracts vary in length from monthly to seasonally or annually.**

For money-saving schemes, such as peak avoidance, a separate contract is not usually necessary. Most electricity suppliers offer a 'pass-through' contract as part of their retail tariff so that your business gets the benefit of its avoidance activity for both transmission and distribution.

If you are likely to export electricity from a generator you will need to have a Power Purchase Agreement (PPA) in place in order to receive payment. These vary in type and value, and are obtained from an electricity supplier.

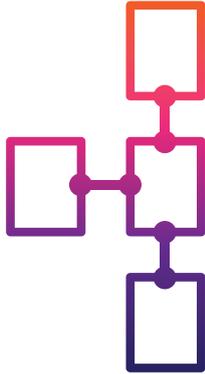
If you are unsure who to partner with, it may help to meet an independent expert, or a few different demand side providers – asking them questions about their track record and how they will ensure your core business will be protected physically and commercially.

### Checklist

- Establish all capital and ongoing costs for participation
- Understand revenue projections, risks, contract terms and conditions
- Directly contract/tender for schemes; or contract with a demand side provider



## Step 4: Set up systems



Your business will need to make sure it has the right equipment in place – such as suitable meters, monitoring and control systems. Some demand side providers offer enabling equipment at no upfront cost, although this is likely to be recovered through your earnings. For customers with BMS it may be possible, with new and developing technology, to participate by adapting existing systems.

It is important to: hold regular meetings with your project team and demand side provider to assess progress; develop a schedule for the project delivery; test the systems; make sure staff understand the programme and do not inadvertently disrupt the equipment or signals; and consider operational and maintenance impacts, such as maintaining a minimum fuel reserve if using back-up generation.

### The basic equipment required:

- Smart/advanced meters or secondary devices for monitoring electricity consumption and to verify that the demand side action took place
- Two-way communications

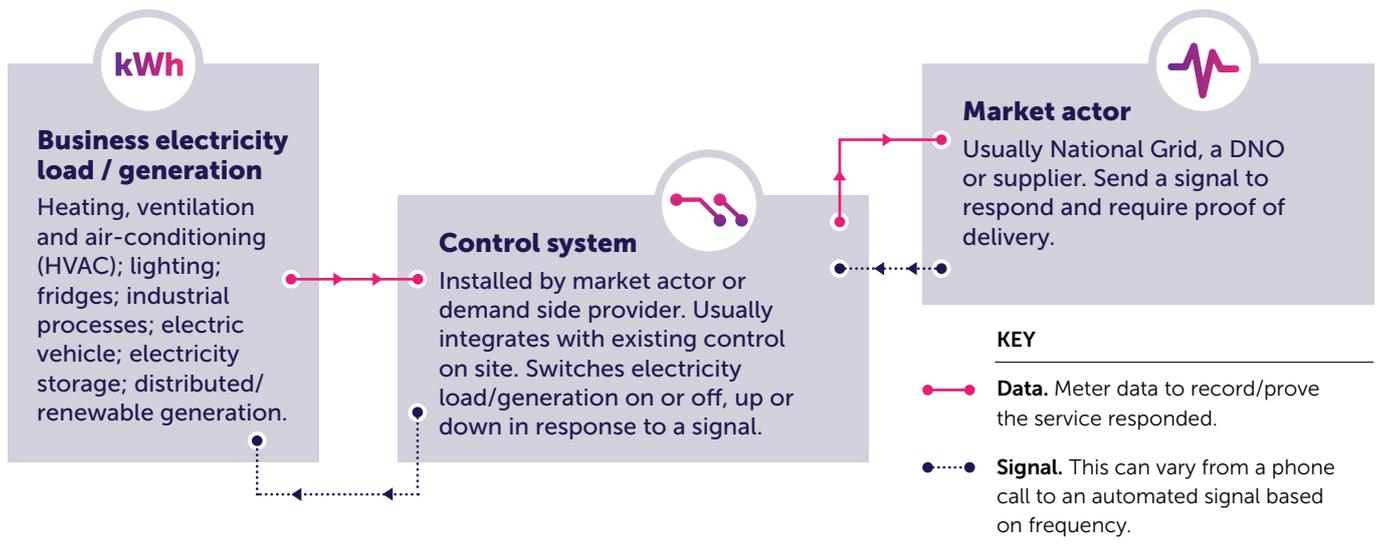
### For flexible demand:

- Monitoring equipment (e.g. temperature and humidity) to ensure comfort levels and business operating requirements are maintained
- Interfaces/switches directly connected to site control systems

### For generation and storage:

- Connection agreements (e.g. G59 rules) and safety relays for generation

The diagram below shows how control equipment links your business to the market actor – such as National Grid, a DNO or supplier – that is procuring demand side response.



### Will demand side response impact my business operations?

Demand side response need not have any discernible impact on your day-to-day operations. Business customers can decide the extent to which they are willing and able to change their practices to participate in demand side response. Some customers are able to shift their electricity use themselves and respond to signals.

Others may have limited ability to change their practices or have smaller loads, so they can work with demand side providers and bring in the technology they need to participate. Demand side providers can also help you identify what equipment can respond and when - and set specific parameters to ensure comfort and safety levels are maintained.

#### Checklist

- Set up enabling equipment
- Test system response to signal
- Meet regularly with internal project team & external market actors
- Develop a schedule for project delivery
- Consider operation and maintenance

## Step 5: Manage and review

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For demand side response schemes (as in **Appendix B**), the market actor who procures your service will require you to monitor, report and verify its delivery. Demand side providers can do all of this on your behalf. You will typically invoice for payment. For money-saving schemes (as in **Appendix A**) these steps are not necessary.



Businesses should undertake a regular review of the project, including its financial benefits, variations to expected payments and a financial audit. It is also advisable to meet with market experts and assess any new partnership arrangements with demand side providers.

Retaining an internal project champion will help to maintain momentum. Communicating project progress to internal stakeholders is also important, and it is helpful to share successes, challenges and lessons learned with other businesses through case studies.

### Checklist

- Monitor, report and verify demand side participation (if applicable)
- Raise invoices (if applicable)
- Audit finances
- Quarterly review of progress
- Periodic review of partnership with demand side provider
- Communicate progress internally and externally



## Annex A: Saving money – avoiding peak network charges

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Electricity prices fluctuate, reflecting seasonal changes and daily demand. There is a pronounced evening peak every day from around 5-8pm (which is steeper in winter and flatter in summer), a morning rise, and lower night-time consumption.

Customers can save money by regularly reviewing the best retail deals. Fixed contracts give long-term confidence but may include a premium. Customers opting for a variable contract can save by reducing their power consumption at peak times. This can also reduce costly network charges.

Network charges come from two sources: National Grid (for transmission) and DNOs.

### Transmission charges

Transmission Network Use of System (TNUoS) charges totaling £2.3 billion per year are placed on suppliers for the operation, maintenance, and building of transmission networks. Suppliers then pass these costs through to their customers energy bill.

Transmission charges vary based on zonal locations, with higher charges for consumption in the South and South West of England and lower charges in Scotland. Charges have increased by as much as 45% a year and are as high as £50,000 per MW in some parts of the UK for 2016-17.

Annual transmission charges payable by suppliers and some large customers are calculated based on their demand during the three half-hour periods with the highest system demand between November and February. These 'Triad' periods are determined after the event and separated by at least ten clear days. These peaks typically occur between 5:30-6pm.

For customers with half-hourly settlement it is possible to opt to pay transmission charges directly and potentially reduce annual TNUoS charges by curbing demand during the three annual Triad periods. Demand side providers can assist in predicting and notifying businesses when Triad half hours are expected, as well as providing the response. Many businesses find Triad avoidance a good starting point for demand side response as it requires no contract. However, the supply contract does need to be correctly structured so that the business gets the benefit of its avoidance activity.

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### Distribution charges

Distribution Use of System (DUoS) charges cover the costs to run and maintain a safe and reliable distribution system. The charges account for about £5.5 billion a year and typically make up approximately 16% of a business customer's electricity bill.

There are 14 distribution zones and DUoS charges vary by zone and time band over the day. Depending on the network, charges are banded as: red (peak), amber (day) and green (off-peak/night) for half-hourly metered customers connected at low voltage (LV) or high voltage (HV); and green and super-red for customers connected at extra-high voltage (EHV). Therefore, businesses with half-hourly settlement and/or tariffs which reflect distribution costs can use these predictable price signals to modify their use and help avoid peak tariffs by shifting their loads.

### Businesses benefiting from demand side response

- Bath NHS Foundation Trust uses its existing two 800kW standby generators to participate in Short Term Operating Reserve (STOR) and Triad management, combining essential testing of the generators with overall benefits of £40,000/MW for 2015-16
- Bernard Matthews found that by shifting the lighting for their livestock by one hour to avoid peak times, they saved £40,000 whilst maintaining comfort levels

## Annex B:

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# Making money – participating in demand side response schemes

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### Balancing Services

As the System Operator, National Grid balances the Electricity Transmission System in real-time. To do this it has developed a number of different balancing products for frequency and reserve services.

### Frequency services

System frequency is a continuously changing variable that is determined and controlled second-by-second by balancing electricity demand and generation. National Grid must maintain a frequency of +/- 1% of 50Hz at all times, so procures frequency services in readiness to manage fluctuations that occur in forecasted volumes or to withstand faults on the network or generation connections.

### Reserve services

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



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### Demand Turn Up

National Grid has been trialling a service, in collaboration with Western Power Distribution, to increase demand when there is excess generation from wind and solar and/or to manage a network constraint. This can be achieved through the reduction of any on-site generation or by shifting power consumption, particularly on processes such as heating, cooling and pumping. These are typically at periods of low demand, for example during the night or weekends and holidays.

### Capacity Market

The Capacity Market aims to ensure there is sufficient capacity of electricity to meet projected levels of future demand and ensure security of supply. It offers payments to generators and demand side providers to guarantee they'll provide the additional capacity when it's needed.

### Businesses benefiting from demand side response

- London Underground is London's biggest power consumer, with the largest private power network in the country. It has achieved significant savings and revenue of £3 million through demand side response, using its' power station in Greenwich.
- Water companies are major power users. United Utilities is involved in winter peak avoidance, Short Term Operating Reserve (STOR) and Frequency Response, using flexibility from its' water/wastewater pumping and waste water aeration processes. Over the next five years it intends to offer up to 50 MW of demand side response.
- Sainsbury's sends a warning to all stores during Triads to reduce electricity use, with automatic turn down of air handling units via onsite Building Management Systems. The business also offers dynamic frequency response through heating ventilation and air conditioning (HVAC) systems and fridges.

# Summary table of National Grid’s balancing services

Below is a summary table of National Grid balancing services for frequency and reserve with their requirements, relative value and contracting arrangements. Please note that suppliers and DNOs also offer opportunities to provide demand side response services, but these are not included in the table.

Scheme	Minimum size*	Notice period	Duration	Regularity**	Value***	Contract	
FREQUENCY RESPONSE SERVICES	<b>Static Firm Frequency Response (FFR)</b>	10 MW	30 sec	Max 30 min Typically 5 min	10-30	££	Monthly electronic tender
	<b>Dynamic FFR</b>	10 MW	2 sec	Max 30 min Typically 3-4 min	Daily	£££	Monthly electronic tender
	<b>FFR Bridging</b>	< 10 MW	30 sec	30 min	10-30	££	Bilateral contract of 12-24 months to transition in to the FFR market (either Static or Dynamic).
	<b>Frequency Control by Demand Management (FCDM)</b>	3 MW	2 sec	30 min	~10	££	Bilateral contracts for 1-2 yrs. Week ahead notification of daily load able to shed
	<b>Enhanced Frequency Response (EFR)</b>	1 - 50 MW	1 sec Dynamic	Max 15 min Typically 3-4 min		£££	New product – trial tender
RESERVE SERVICES	<b>Short Term Operating Reserve (STOR)</b>	3 MW	20 min	2-4 hrs Typically <20 min	Able to deliver 3x per week	£	3 tenders p.a. 'Committed' or 'Flexible' service
	<b>STOR Runway</b>	< 3 MW	20 min	2-4 hrs Typically <20 min	Able to deliver 3x per week	£	Bilateral contract
	<b>Fast Reserve</b>	50 MW	2 min, reaching 50MW in 4 min	15 min		£	Monthly tender
	<b>Demand Turn Up</b>	1 MW	10 min, sometimes requested day-ahead	Min 30 min		£	New product – trial tender

\* to contract directly with NG (smaller loads via demand side providers)

\*\* Average number of times called on per year, based on recent data.

Source: National Grid.

\*\*\* Relative value to participant

£ the greater number of '£' signs indicates a greater value to the demand side participant

# Suitability of assets for demand side response services

Demand side providers can help businesses to assess the suitability of a scheme based on the assets of the business and its operational requirements. But some customers want to assess the options themselves. Below we give a rough guide to the assets of a business and compatibility with schemes, based on experience of schemes to date.

	Dynamic / Firm Frequency Response	Frequency Control by Demand Management	Enhanced Frequency Response	Short Term Operating Reserve	Fast Reserve	Demand Turn Up	Triad management	Red Zone management	Capacity Mechanism
Heating, cooling, air-conditioning & ventilation systems	Y					Y	Y	Y	Y
Fridges, freezers & chillers	Y		Y				Y		
Electrical appliances							Y		
Lighting							Y		
Cooking									
Wet appliances									
Hot water, electric heating/storage heaters	Y		Y						
Electric heat pumps							Y	Y	
Electric vehicles	Y								
Back-up / distributed generation				Y	Y		Y	Y	Y
Renewable generation / CHP	Y			Y		Y	Y	Y	Y
Battery / electricity storage	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pumps / motors / compressors	Y	Y		Y		Y	Y	Y	Y
Industrial & manufacturing processes	Y	Y		Y		Y	Y	Y	Y

Source: feedback from demand side providers.

This table does not currently include opportunities for balancing from supplier or DNO schemes such as constraint-managed zones.

# Who to contact

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## Working with National Grid

National Grid provides a specific point of contact for each of the demand side services it buys. Up to date details can be found on National Grid's website<sup>1</sup>.

## Working with demand side providers

There is a list of demand side providers on page 57 of the full MEUC training booklet available on the Power Responsive website<sup>2</sup>. This list is not exhaustive and National Grid does not provide advice on which to choose. The most important considerations for businesses making this choice are: whether the provider understands the business and ensures there will be no negative impact on operations; what the financial offer is; and whether the provider has a good track record and is recommended by others.

## Working with DNOs

DNOs are now entering the market for demand side schemes. These will vary between DNOs depending on the geographical take up of low carbon technologies and local constraints. It is best to contact your local DNO to find out about their schemes.

1. <http://www2.nationalgrid.com/uk/services/balancing-services>
2. <http://www.powerresponsive.com/dsr-guide>

## For more information:

Visit our website: [www.powerresponsive.com](http://www.powerresponsive.com), where you can also register to receive updates by email.

Join the discussion in our LinkedIn '**Power Responsive**' group.

Email: [powerresponsive@nationalgrid.com](mailto:powerresponsive@nationalgrid.com)

## Disclaimer

This short guide has been pulled together by Sustainability First. It draws upon the Year 1 Power Responsive work programme, including a more in-depth MEUC training booklet 'Profiting from demand side response'. Our short guide should not be taken as advice or guidance on the part of National Grid or Sustainability First about involvement or investment in GB demand side markets.



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