

FREQUENCY RESPONSE



SUPPORTING PARTNER:

Flexitricity

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FREQUENCY RESPONSE

What is frequency response?

Frequency response is how electricity loads, small generators, batteries and large power stations work with National Grid to keep the electricity system stable.

Frequency response ensures that the 'heartbeat' of electricity supply – the UK grid operating frequency – stays constant. If this frequency goes too far from its normal value of 50Hz, blackouts or equipment damage can result. National Grid buys frequency response services to make sure this doesn't happen.

The more firms that get involved with frequency response, the more quickly the UK can transition to lower carbon energy sources, and the more sustainable our energy supplies and businesses will become. ▶



How does frequency response work?

Frequency response works by flexible energy users generating additional electricity or reducing load on the grid whenever frequency falls too far. Conversely, if frequency goes too high, users generate less or consume more.

Commercially, this means signing up to one of a wide variety of frequency response schemes run by National Grid. Different schemes are suitable for different types of electricity user or small generator owner. All of them are designed to financially incentivise companies to vary how and when they use electricity, so as to help manage the load on the grid.

How do frequency response and demand response relate to one another?

For the end-user or small generator, frequency response is a form of demand response. In general, demand response is about paying businesses to vary how and when they use electricity in order to help keep the grid, and UK power supplies, stable and reliable.

Frequency response is simply the fastest type of demand response – it is suitable for sites that can act in seconds. However, frequency response sites don't have to deliver for very long on each occasion.

Most of the solutions we need to help keep our grid balanced can be provided either by demand response, or by large power stations. However, large power stations are less efficient when they provide balancing services, so it is better if demand response picks up as much of this work as possible, leaving the power stations to run steadily at their most efficient output.

What is frequency response particularly useful for, and why is it growing in significance?

The need for frequency response and other kinds of demand response is constantly changing as the generation mix on the grid changes.

When a large power station – like the huge nuclear power plant under construction at Hinkley Point – is running, National Grid must make sure it has enough frequency response capacity so that the power system won't collapse if the large generator fails. This is called 'largest loss' and it changes from time to time depending on what's generating. However, this part of the response market isn't about to grow dramatically: after Hinkley C is finished, it will be some time before anyone builds anything bigger.

On the other hand, when a large volume of renewable energy is being generated, the grid tends to be 'light'. This makes mains frequency change more quickly, making it more likely to go out of range. The challenge is that renewable generators don't provide 'system inertia' which gas and coal stations otherwise would. Frequency response is the primary way of dealing with this, and the need for the faster varieties of frequency response is growing as the penetration of renewables increases.

Which organisations are most suited to frequency response?

Frequency response is currently provided by an eclectic mix of firms. The need for frequency response, and hence the business opportunities, are growing. The majority of early commercial adopters of frequency response are large power users, including medium-to-large manufacturing businesses and datacentres. To work with frequency response, scale certainly helps. But, more importantly, a firm needs to be able to alter its electricity demand or generation quickly and reliably. The location of an end-user business is, for the most part, not a factor in suitability for frequency response. ▶

TOP TIP:

MARKET GROWTH = MORE OPPORTUNITIES

The need for frequency response, and the frequency response market itself, are both on the up. This means there is money to be made by those companies willing to get to grips with the complexities of frequency response.



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CHANGES TO THE FREQUENCY RESPONSE MARKET: FLEXITRICITY'S VIEW...

Some fundamental changes to National Grid's frequency response procurement, contracts and services are expected to come into play in 2018. Frequency response prices can be very difficult to understand. This is partly because of the wide array of variations of frequency response that providers can offer. This is why National Grid's System Needs and Product Strategy (SNaPS) review is so important.

SNaPS is still ongoing, but we know quite a lot about the outcome already. Here, Flexitricity's founder and chief strategy officer Dr Alastair Martin lists three key points to note about the upcoming changes to the frequency response market:

1) National Grid only needs so much. The power stations that can fail, causing frequency to go off, are only so big. There is a lot of competition to provide for this consistent requirement. You can get a firm income stream, but it won't be big.

2) The need for frequency response changes every hour. It takes more response to keep the lights on when the sun is up and the wind is blowing. Conversely, pulling out of frequency response when there is a shortage – like during triad peaks – is not the way to get best value. Providers who can follow the market are in the best shape here. And National Grid's tender strategy will change to reflect that, with on-the-day auctions a real possibility.

3) Fundamentals matter; names don't. Today, we talk about dynamic, static, high, low, firm, mandatory, primary, secondary and enhanced. SNaPS introduces terms like 'pre-fault' and 'post-fault'. Europe has its own clunky terminology. But the fundamentals don't change. When frequency is falling, it has to be slowed down, then caught before it hits blackout level, then picked back up. Personally, I'd prefer parachute, trampoline and ladder. Whatever it is called, you have to understand what it is to assess the value of it.

How do I determine if frequency response is the right approach for my business?

Frequency response can be complicated and consulting a third-party expert is recommended in the first instance. Third-parties can bring unique expertise, and should be able to ask you targeted questions that can identify quickly which of your organisation's sites are most suitable for frequency response and which are less suitable. There is, of course, some subtlety in this; some sites may appear suitable for frequency response on the face of it but, on closer inspection, may not be good frequency response candidates for a number of reasons (however, it may still be possible that some of those sites can monetise energy flexibility in other ways).

In an effort to incentivise more firms to work with frequency response, National Grid is planning a number of changes to frequency response procurement, contracts and services in 2018. It is hoped that these changes will simplify and widen the playing field for the frequency response market.

What are the overarching business benefits of frequency response?

Participation in frequency response offers businesses a valuable new revenue stream. As long as core business needs and the fundamental limitations of a site's operational processes are properly understood, frequency response revenue can be earned without any disruption to the organisation. There can also be unexpected additional wins from frequency response participation. For example, if a business works with frequency response by using its emergency power supply, an additional benefit is increased reliability: frequency response works by providing occasional on-load tests of emergency systems. ▶

TOP TIP:

KNOW THE MARKET BEFORE ENTERING IT

One crucial first step every firm should take is to fully understand the frequency response market and be fully aware of the changes that are happening. Opportunities are increasing all the time, but the market is complex, and rushing to participate without proper understanding is risky.



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What do all the different frequency response services mean?

There are several types of frequency response in the UK market, including mandatory frequency response, firm frequency response, frequency control by demand management, smart frequency control (or enhanced frequency control capability), and enhanced frequency response.

This can therefore be a very complex market for firms to navigate, but it is important to understand that all of these types of frequency response are simply procurement methods (or contract forms) – and all are currently under review.

Therefore, most of those contract names are likely to disappear during 2018 and be replaced by a simpler set of frequency response services. The principals of frequency response will remain the same, however. An organisation should identify which frequency response service(s) it is suitable for, then implement the most lucrative one(s).

Dynamic/non-dynamic frequency response; what are the differences?

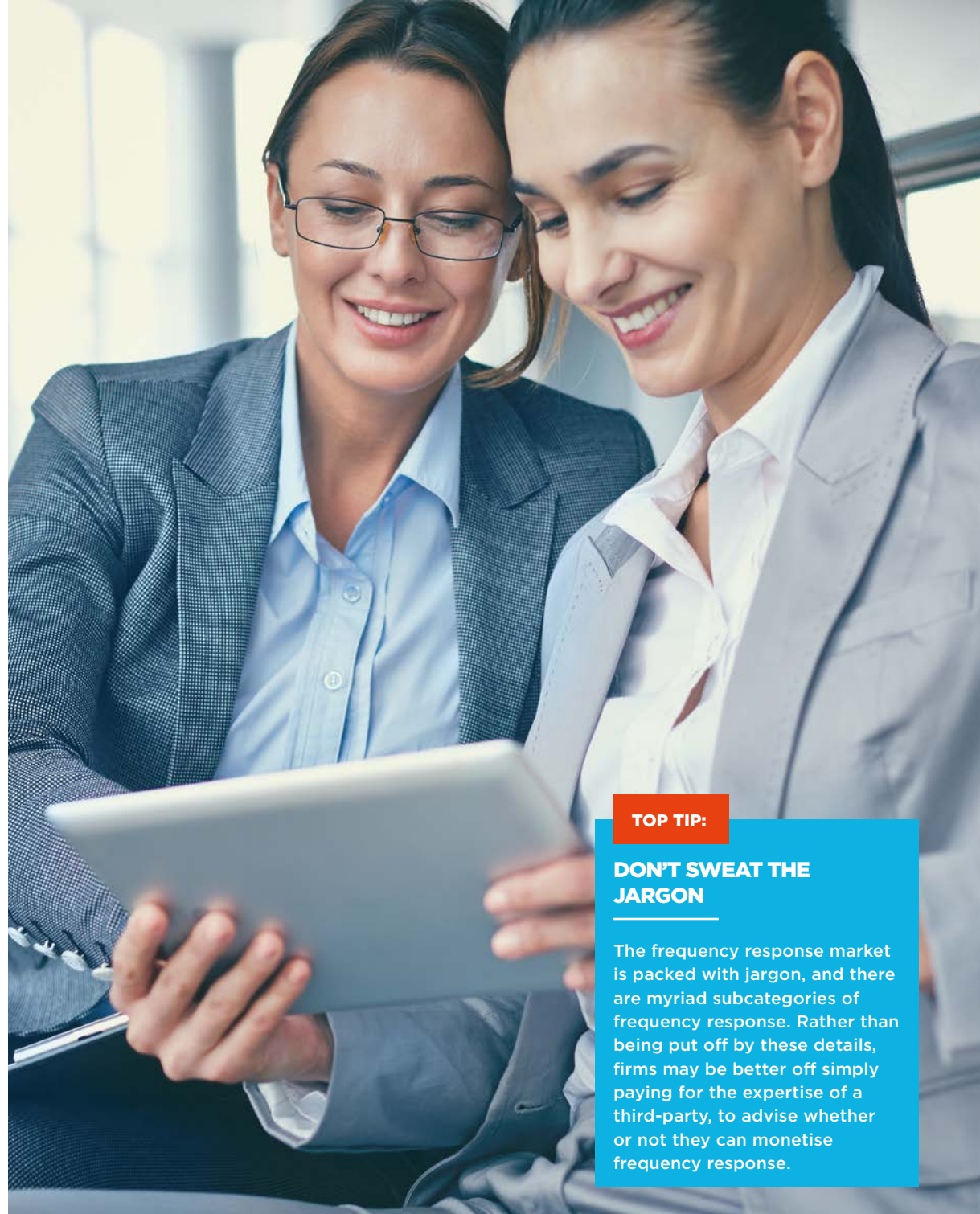
Dynamic frequency response follows frequency continuously by consuming a little less power or generating a little more as frequency falls, and – depending on the site – doing the opposite as it rises.

Non-dynamic frequency response involves either dropping electricity demand or increasing generation very quickly when the grid hits a crisis, which is shown by a fall in frequency to an unusually low level. ▶

TOP TIP:

THERE IS SERIOUS MONEY TO BE MADE FROM FREQUENCY RESPONSE

In August 2016, National Grid announced its enhanced frequency response tender. It said that this new ability to control variations in frequency almost immediately would result in reduced costs of approximately £200m. This is a big business opportunity with serious money involved.



TOP TIP:

DON'T SWEAT THE JARGON

The frequency response market is packed with jargon, and there are myriad subcategories of frequency response. Rather than being put off by these details, firms may be better off simply paying for the expertise of a third-party, to advise whether or not they can monetise frequency response.

Should I use a third-party/ aggregator, or work directly with National Grid on delivering frequency response?

The use of a third-party expert offers a number of immediate benefits. This route is particularly suitable for firms with a limited understanding of frequency response, firms which are time-short, or firms which are seeking an additional revenue stream but lack the internal resources to manage complex contracts. Use of third parties will of course attract fees, but these could be offset by the new frequency response revenue stream the third party brings in. Firms that are comfortable with the major complexities and impacts of frequency response, and for whom the additional burdens of managing frequency response internally are acceptable, may consider working directly with National Grid. Ultimately, each individual business case will be different, and it is up to the business to seek out the opportunities and consider which route to frequency response is the most appropriate one to take.

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Which systems and technology does a business need in place to implement frequency response?

The systems and technologies required will vary depending on the type of frequency response service being deployed, but there are a few common requirements. It is essential that the end-user business can alter the consumption or generation of the site quickly, automatically and without disruption to core business. Frequency response is always quick: the slowest form requires full delivery within thirty seconds, while the fastest expects full power inside half a second. Some types of frequency response require the change in consumption or generation to be sustained for up to half an hour on occasion. Other types need delivery for only thirty seconds. Hence, the type of frequency response individual firms pick should match their existing systems, technology and production/plant. ■



TOP TIP:

YOU CAN OPT OUT IF NEEDS BE

Remember that any site which faces any risk from frequency response can, and should, opt out; core business should always come first. Many third-parties offer their clients the ability to do this – automatically, manually or both – but it is important to check this before reaching an agreement.

FREQUENCY RESPONSE Q&A: DR ALASTAIR MARTIN, FOUNDER AND CHIEF STRATEGY OFFICER, FLEXITRICITY



“There are many flavours of frequency response, so to get the best money, you have to do the sort that is most valuable – or in shortest supply.”

Q. How much does frequency response pay?

Alastair: At the top of the market, the most advanced versions of frequency response were paying around £19 per megawatt per hour of service delivery. So, over a year, a megawatt which did nothing else could gross over £160,000. If you've seen a proposal with that kind of number on it, that's where it's coming from.

That's for two-sided dynamic primary and secondary response – which means a resource that follows frequency all the time, both up and down, delivering within 10 seconds and, in major events, sustaining the delivery for at least half an hour. And 'nothing else' means just that – no triads, no red rates, no renewable balancing.

At the same time, less sophisticated resources were chasing prices below one-fifth of that. If you have an engine farm, secondary static response is your only real choice. This means waiting for something big to happen, like a power station failure, and then going to full power within thirty seconds.

The value of this is typically below £30,000 per megawatt, again for a resource that does nothing else.

Q. How do I guarantee price reliability with frequency response?

Alastair: So, the caveats are at least as important as the headline numbers. If you want to manage triads or red rates, you make your frequency response a lot less valuable to National Grid.

There are many flavours of frequency response, so to get the best money, you have to do the sort that is most valuable – or in shortest supply.

The market got a shock when National Grid's battery-friendly Enhanced Frequency Response tender cleared at prices around half those in the main market. In addressing the emerging problem of falling inertia (a 'light' electricity system, associated with high renewable penetration, is less stable than the fossil-led 'heavy' one of the past), investors gifted National Grid 200MW of loss leader capacity.

Q. How important is it to take the right frequency response approach from the offset?

Alastair: Frequency response is the last line of defence against blackouts. There's no messing about here. This is one reason why the apparent increased competition in the market hasn't actually crashed prices – only the assets that can actually deliver compete. There are more battery projects

at the planning stage than could ever get a response contract – but it's the ones already on the ground that matter.

Then there's validation. Currently, National Grid relies on commissioning tests. Done properly, a commissioning test is quite onerous; it takes experience and high-grade equipment to ensure a pass. But a one-off test guarantees nothing about future performance – it takes continuous monitoring to keep the quality acceptable. Frequency response is too important for a 'fit-and-forget' approach.

Is my frequency response payment guaranteed?

Alastair: Realistic understanding of the capabilities of each resource, thorough engineering and testing, and a 24-hour fully-staffed control room with continuous live updates from every resource, ensure that we keep our promises and get our customers paid. This is Flexitricity's approach.

Added to that, our new energy supply offering means that we can follow the money, taking customers into the Balancing Mechanism when that's the best alternative for their assets. Frequency response will continue to be a valuable market, for the right resources at the right times. It's just as important to know when it's time to hunt somewhere else. And that can change every day. ■