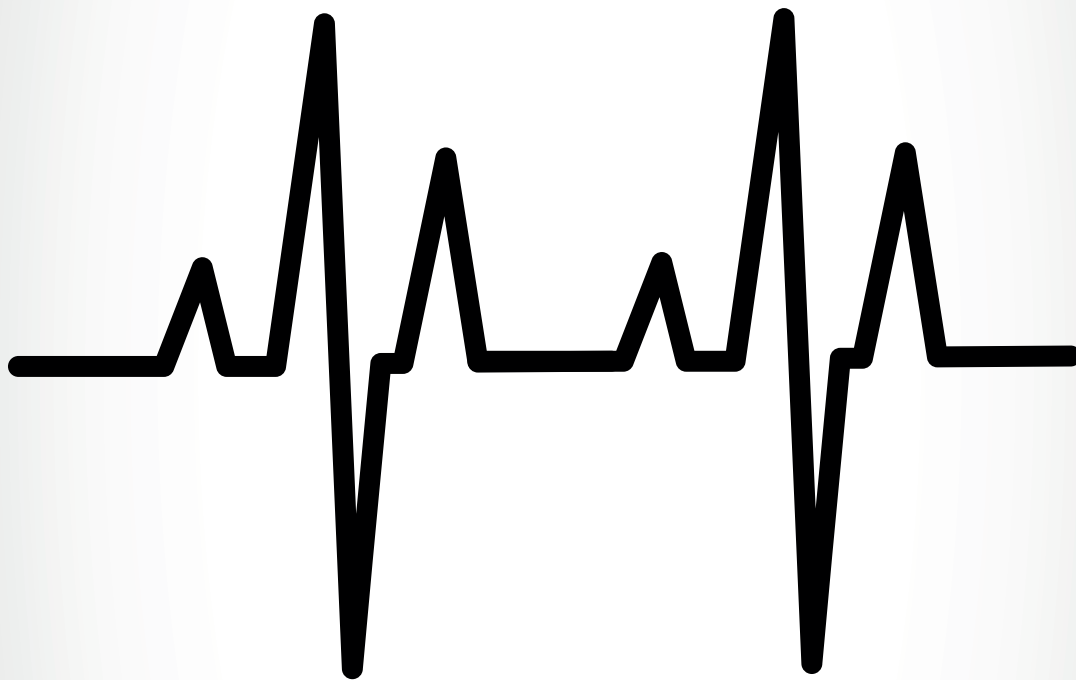


Demand Side Response

Shifting the balance of power

2017 Report



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A year in response

By **Tim McManan-Smith**, editor, *the energyst*

The landscape for demand-side response has changed over the last 12 months.

Some rule changes have been negatively received. But if the raft of proposals mooted in recent months by government and regulator are successfully implemented, they may, in the medium term, unlock higher value for firms that provide grid balancing services.

In June, regulator Ofgem confirmed its plans to cut a significant revenue stream for generators that export during Triad periods. Those rule changes may have a significant bearing on future capacity markets.

Last September, the regulator also agreed a change (called DCP228) that in effect will flatten network charges. From April 2018, some business cases partially predicated on avoiding higher red band charges may therefore require revisiting.

Meanwhile in August, Ofgem launched a sweeping review of network charging. While the outcome of that review cannot be predicted, wholesale changes to charging rules would impact DSR business plans and revenues.

This summer, government and regulator jointly published a Smart Systems and Flexibility Plan. The document, which set out plans to make flexibility markets more accessible, simplify metering requirements and remove regulatory barriers for storage, has been well received. But more concrete delivery timetables and details would also be welcomed by industry.

Meanwhile, National Grid published plans to materially change the way

it procures services to help balance the grid. Grid's consultation has been warmly received by market participants, and it is hoped that the outcome will be more open, transparent and liquid markets that enable demand-side participants to fill the gaps left by the loss of thermal plant.

WHAT'S THE IMPACT?

Until Ofgem's Significant Code Review is complete, nobody knows how this will affect, positively or negatively, revenue streams for DSR, behind the meter generation and potentially, storage.

Equally, any moves to simplify metering requirements may remove a significant cost and hassle factor for DSR providers. But the detail is yet to emerge.

Plans to allow aggregators to access the balancing market and wholesale market – revenue streams that are becoming increasingly valuable – have also been welcomed. But those regulations too may take some time to implement.

Next year, however, some rule changes made this year will start to bite.

Triad avoidance, which for many businesses represents the first step into DSR, will remain valuable.

But Triad export payments will drop by a third, falling away almost entirely over three years. This will hit forms of generation such as CHP and hydro as well as diesel (see p21). Meanwhile, flattening of distribution network charges will remove a significant price signal and cost avoidance mechanism for some businesses.



The Triad change may also have a material bearing on the Capacity Market, an important source of revenue for DSR providers (see p29).

Meanwhile, incoming legislation around running hours and emissions limits for back-up generation is another consideration for those participating in the Capacity Market and DSR services more broadly.

Over the next 12 months, despite a market in flux, and inherent risk of change, there are rewards for firms looking to monetise flexible consumption - and the DSR sector is definitely one of growth.

But if market changes can tip the balance further toward reward, while giving participants as much stability as possible, this survey suggests significant appetite from businesses to deliver a smarter, more flexible power system.



Author's note

Thanks to all who took part in the survey for this report. Thanks also to market participants for sharing their views on barriers and solutions. I hope you find the report useful and would welcome feedback, ideas and alternative viewpoints via www.theenergyst.com.

Brendan Coyne, report author

Key survey findings

Risk versus reward, complexity and market knowledge are key themes in this year's end-user survey. However, most organisations that already provide DSR are satisfied with the outcome, and most that do not would do so if it did not affect core business. Respondents also expressed significant interest in battery storage, with most predicting returns in under seven years

This year's survey confirms key findings of the research we conducted in 2015 and 2016: The majority (78%) of those that participate in DSR are satisfied. Meanwhile most (77%) of those that do not provide DSR would be interested in doing so if it did not affect core business.

These are broadly similar findings to previous surveys, despite little overlap in samples (~15% of 2016 sample took 2017 survey).

Of 180 survey participants this year, most (65%) do not participate in DSR. Those that do tend to be larger companies with higher consumption and peak demand. Their main motivations are generating income from assets and avoiding cost, broadly similar findings to 2016 and 2015 surveys.

SMES KEEN BUT LIMITED ROUTE TO MARKET

This year, of the 119 respondents that do not provide DSR, many are small or medium-sized companies, with relatively low consumption and peak demand.

While some have generation assets that can participate in balancing services, the flexibility potential of many of these firms is likely below the threshold of

commercial viability for aggregators, which largely prefer to work with hundreds of kilowatts of flexibility per site, if not megawatts.

That underlines the need to bring down costs of aggregation and associated DSR technology if the small and mid markets are to be brought into play, and potentially a need for price signals to be significantly sharpened.

COMPLEXITY, RISK AND REWARD

Key barriers to DSR participation remain similar to previous surveys – lack of awareness, knowledge and understanding, combined with a perception that equipment and processes are not suitable and that rewards may not be worth the effort.

Despite an element of self-selection and potential sample bias (around a third of the survey came via National Grid's Power Responsive user group) the survey also underlines that DSR is not a top priority for most.

Of those that do provide DSR, almost half say they could provide significantly more flexibility without affecting operations. Most of these are large firms with significant consumption, suggesting an opportunity is being missed.

POSITIVE OUTLOOK FOR STORAGE

Overall, this year's survey suggests strong interest and potential appetite for battery storage. Awareness of storage opportunities is perhaps underlined by the fact that enhanced frequency response (EFR) was the most 'heard of' product cited by DSR providers, despite being the newest of all contracted products and very few firms actually providing it.

More than half of respondents (54%) are considering investment in storage – across all sizes of companies and consumption profiles.

There is an even split between small, medium and large projects: 33% are mulling sub 250kW projects; 36% are considering 250kW-1MW projects and; 31% are exploring projects of 1MW+.

Around half are investigating behind the meter projects, just under a quarter standalone projects and just over a quarter considering renewables collocated projects.

The majority (66%) believe their projects will pay back in under seven years (33% say 3-5 years, 33% say 5-7 years), despite challenges around finance and predictability of revenue.

Demographics, caveats, sample bias and anomalies

180 people took the survey, which after demographic and consumption data, split into one set of questions for those that provide DSR and another set of questions for those that do not. The same battery storage questions were asked of all respondents.

While most respondents completed every relevant question, some did not, so we have provided sample numbers for each answer. Some answers come from a relatively small sample (39 for some questions asked of DSR participants).

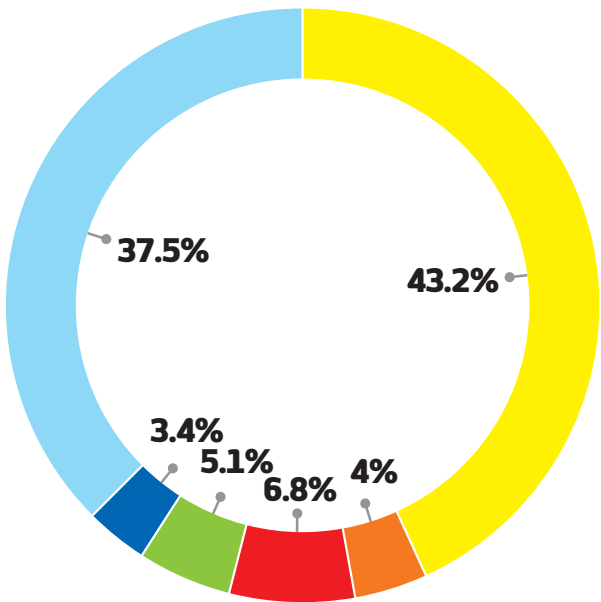
Around a third of the sample came via National Grid's Power Responsive mailing list.

This may explain one of the main differences in this year's survey versus the prior two years: A higher percentage of 'load' DSR versus use of generation. While there has been some growth in consumption-based DSR since Transitional Arrangement Capacity Market auctions, generation remains the source of the vast majority of DSR, according to aggregators. Engie, for example, has a portfolio of around 500MW of flexibility, of which 90MW is turn down or 'load' DSR, roughly an 80:20 split.

The survey was conducted online in June and July.

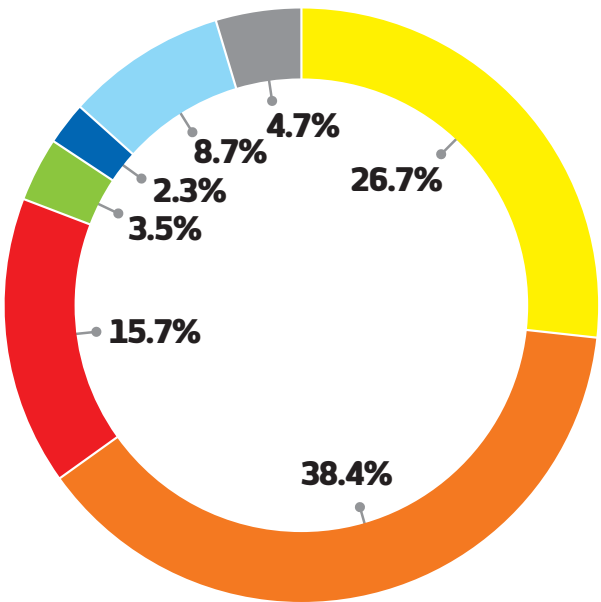
Survey respondents' demographic breakdown

Number of employees



- 0 - 49
- 50 - 99
- 100 - 249
- 250 - 499
- 500 - 999
- 1000+

Industry sector



- Industrial
- Commercial
- Public Sector
- Finance
- Food / Drink
- Manufacturing
- Retail

Job title



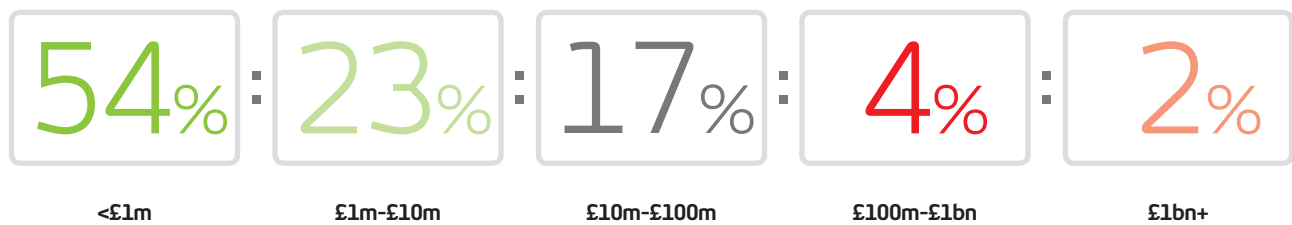
What is your organisation's energy consumption?

Some 54% of survey respondents fit the definition of an SME (under 249 employees). 54% also spend less than £1m on energy annually, the vast majority of whom fit the SME definition. There were eight SMEs that spend £1-£10m annually, and two that spend over £10m.

Around 40% of the sample spend between £1m and £100m per annum on energy. Of these around 70% were industrial and commercial companies, with around 30% in the public sector.

Ten respondents spend more than £100m annum on energy. These were mostly utilities and telcos, some of which are multinationals.

(169 answers in total)

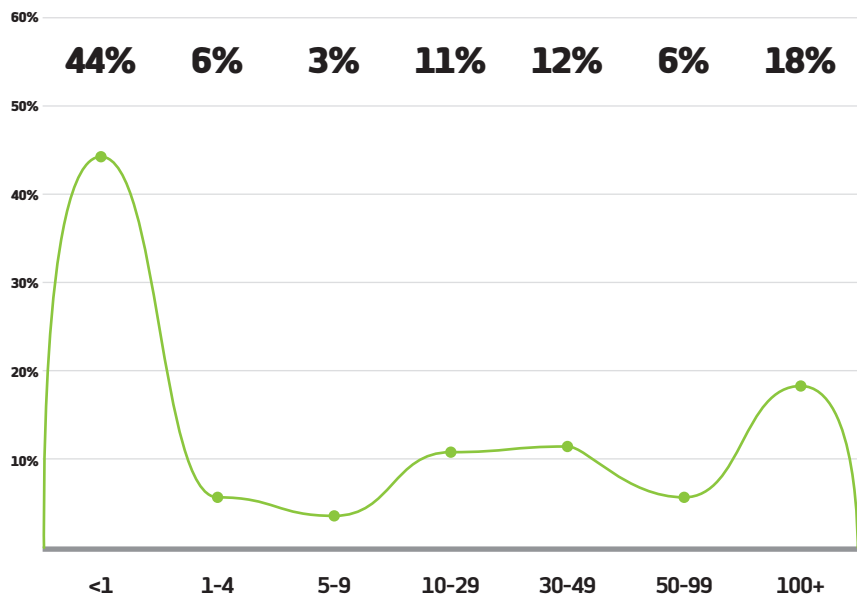


If you know your energy consumption in GWh, please choose from the following:

Roughly half (47%) of respondents consume at least 10GWh per annum. Some 44% consume less than a gigawatt hour, with 9% consuming 1-9GWh.

Of those consuming at least 10GWh, some 73% were in the I&C sector, with the remainder in the public sector and the majority (77%) have at least 1,000 employees).

(119 answers in total)

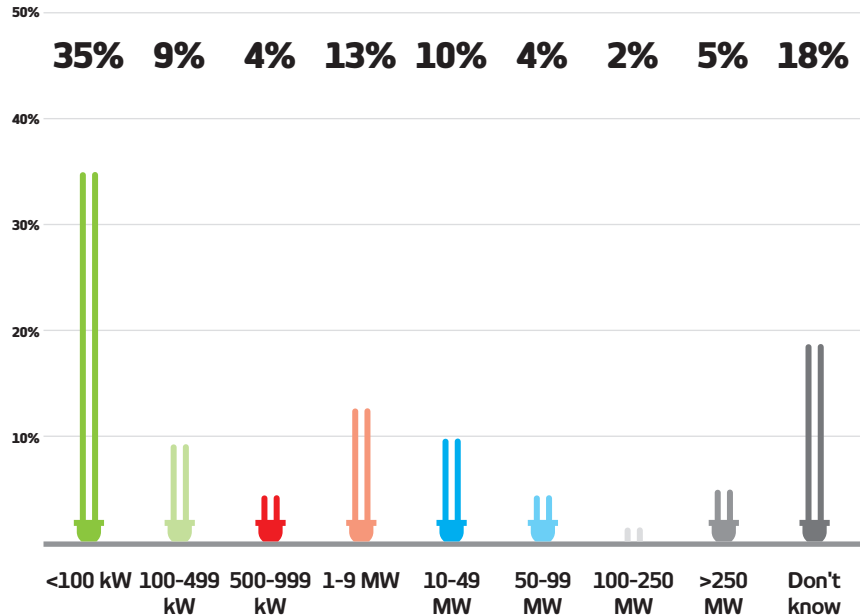


What is your approximate peak (maximum) demand ?

Discounting those that do not know peak consumption, the majority (59%) have a peak consumption of less than 1MW and 88% of these were SMEs.

Some 41% have a peak consumption of least 1MW. Those with peaks in excess of 50MW include large retailers, heavy industrial firms, utilities and telcos.

Those with peak consumption between 1MW and 49MW include universities, local authorities, NHS Trusts, utility companies, manufacturers and retailers. Around seven in ten of those that did not know peak consumption were from very large companies. (142 answers in total)

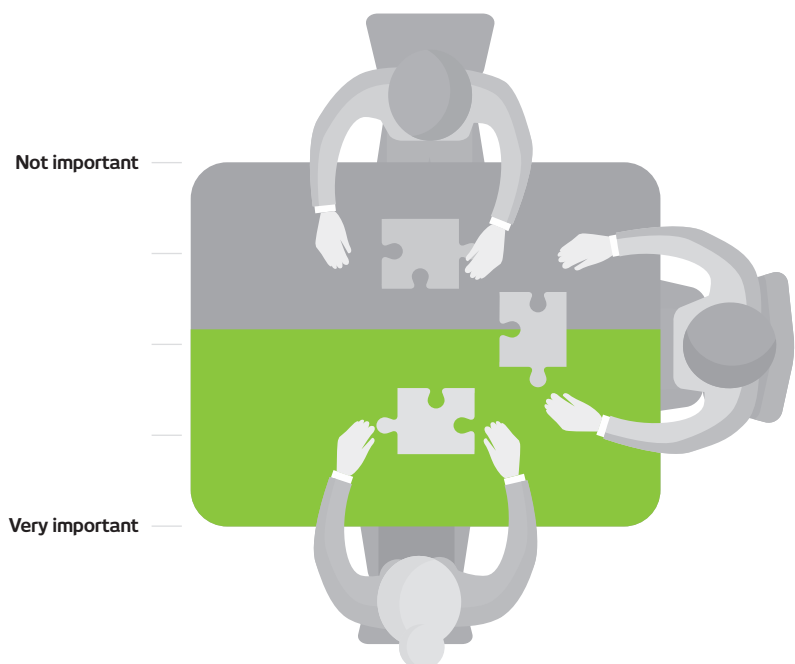


How important is DSR to your energy strategy in terms of priority? (1 being most important)

Across the sample, DSR is middling in terms of its importance to respondents. For those that participate in DSR, its importance marginally increases to a weighted average of 2.73. Those that rate it as important (1 or 2 out of 5) included utilities, hospitals, universities, consultants and others involved in balancing services.

DSR's importance for those that do not provide it was not hugely different overall, with a weighted average of 3.21.

(169 answers in total)

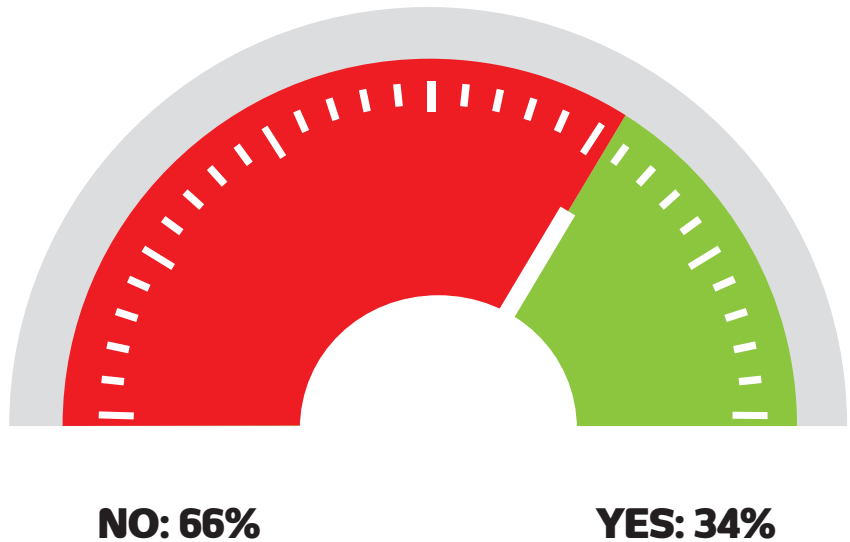


Does your organisation participate in DSR?

Two thirds of the sample do not participate in DSR. Of non-participants, two thirds are SMEs, the vast majority of whom (95%) spend of less than £1m on energy per annum and the majority of whom (68%) have a peak demand of less than 100kW.

Of those that do participate in DSR, six in ten are very large companies (1000+ employees). Overall, 66% of DSR participants consume at least 10GWh per annum. Ten respondents with peak consumption of less than 100kW said they participate in DSR, but these were largely companies involved in DSR service provision.

(179 answers in total)



The following answers are from the respondents that implement DSR within their organisation

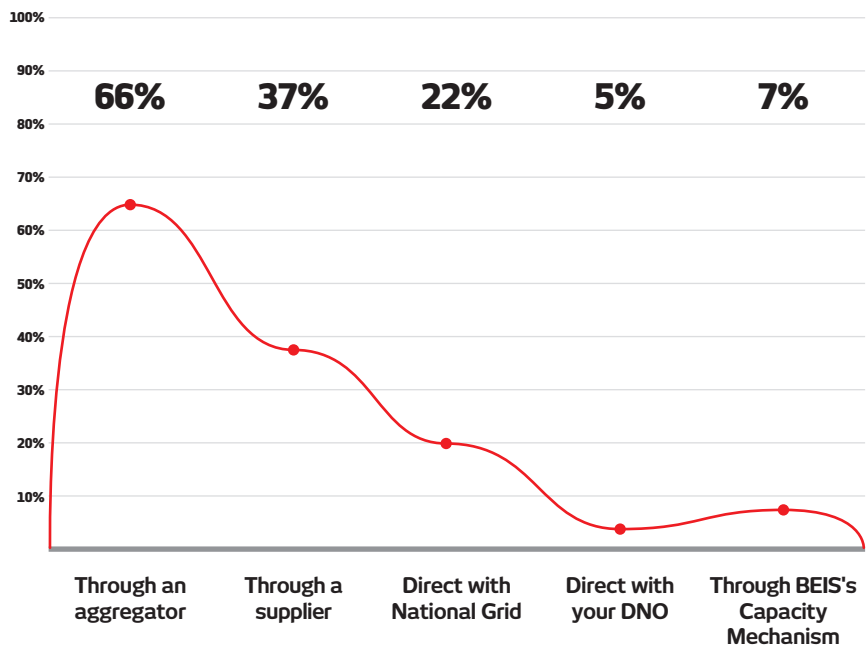
How is your DSR contracted?

Aggregators remain the most popular route to market for providers.

37% said they contract DSR via a supplier. Those that contract directly with National Grid or via a DNO include utility companies and some large industrials.

A number of respondents contract both via suppliers and aggregators, or via a combination of aggregators/suppliers and National Grid/DNOs.

(41 answers in total)

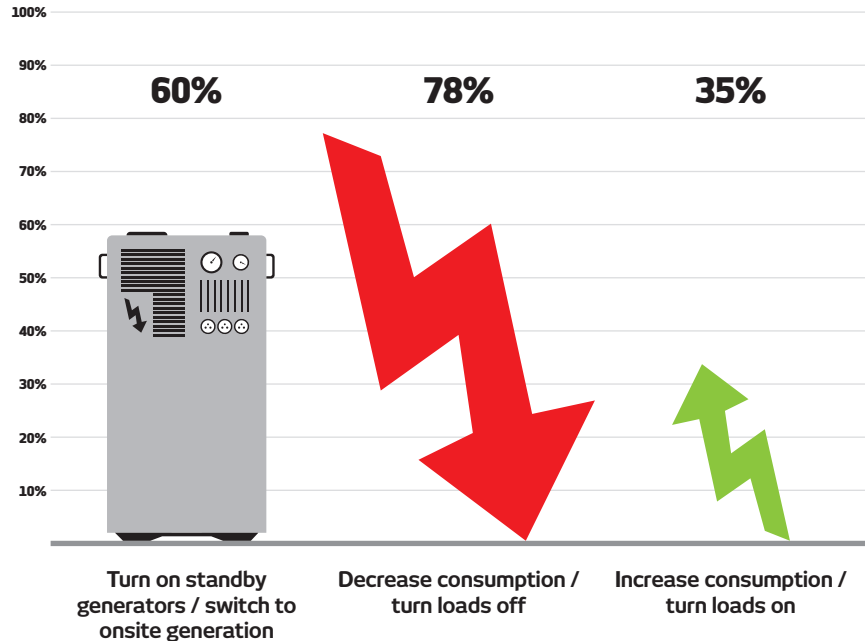


How do you participate in DSR?

60% of DSR participants use back-up or onsite generation. However, around three quarters say they decrease consumption. A third say they increase consumption or turn loads on. Some participants combine all three types of response.

The generation versus load finding is almost the exact opposite of last year's survey (76% via generation, 59% decrease consumption).

However, only around 15% of last year's respondents also took this year's survey so the data does not provide a like-for-like comparison.
(40 answers in total)



As a percentage of your total consumption how much flexibility do you harness for DSR?

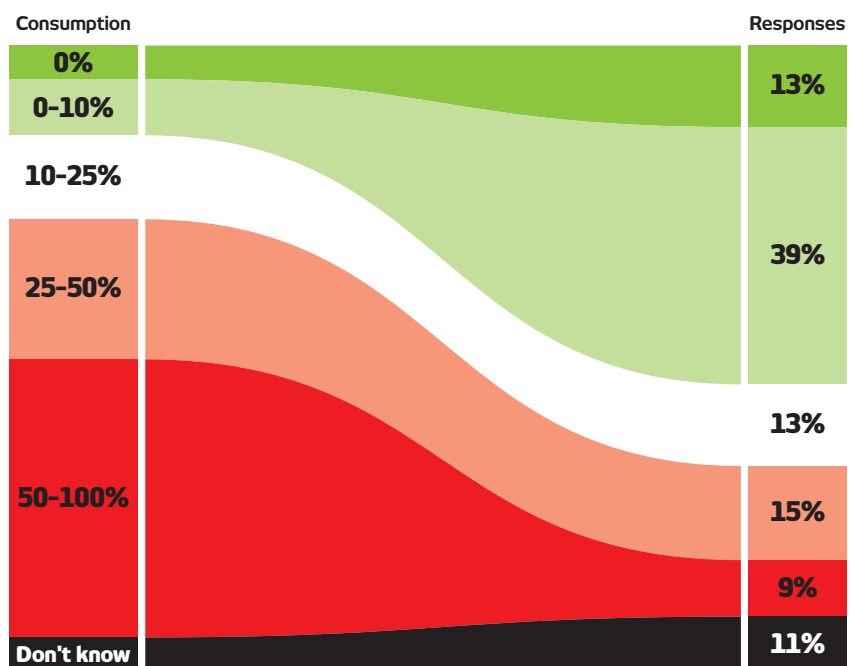
This answer combines flexibility in both directions. As some DSR providers do not provide flexibility in both directions, there is a zero percentage value.

Respondents typically use a minority of total consumption for DSR.

Those that use a majority of consumption include water companies, for whom energy is major operating cost.

An example of such is provided on p21

(52 answers in total from 40 respondents)



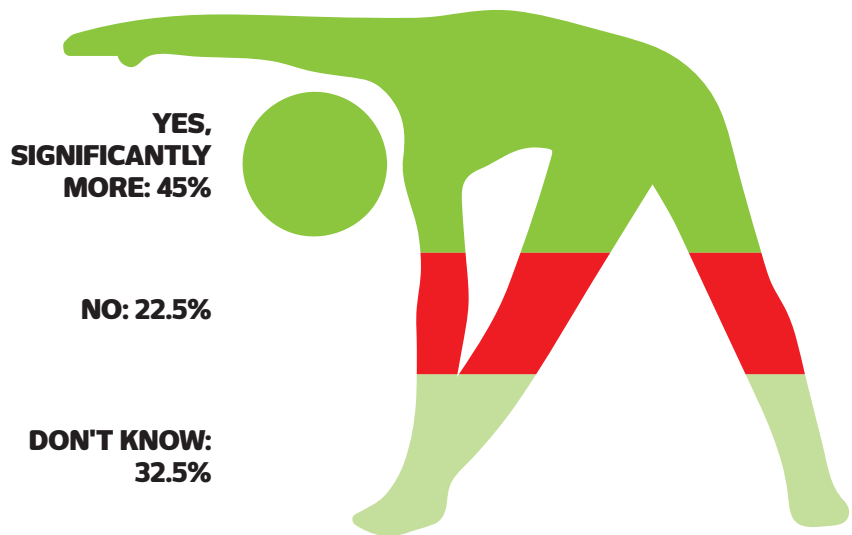
Could you potentially offer more flexibility without affecting your business?

Less than a quarter of DSR providers definitely cannot offer more flexibility without affecting their core business. Almost half could offer significantly more with the remainder uncertain.

Of those that could offer significantly more flexibility for DSR, three quarters are very large organisations (1000+ employees) that spend at least £10m per annum on energy.

This suggests an opportunity for aggregators and suppliers, provided they can convince those companies it is worth their while.

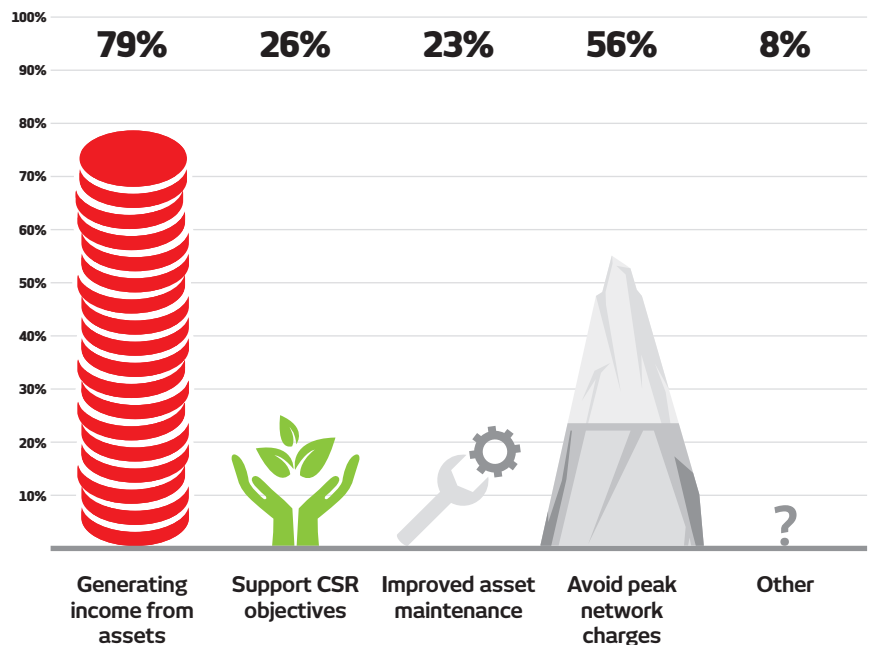
(Total responses 40)



What was your main motivation for participating in DSR?

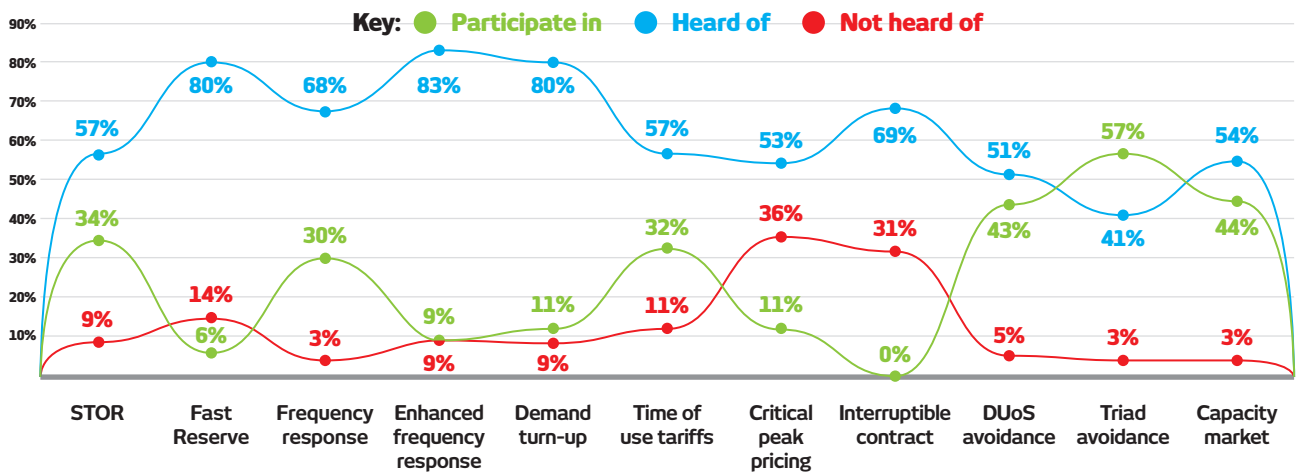
The vast majority of those providing DSR do so to generate revenue, while almost six in ten do so to avoid peak network charges. Improved maintenance and corporate social responsibility factors play a part, but overall revenue and cost avoidance remain king for most firms.

(Total responses 39)



Which of the following DSR programmes are you utilising or heard of?

Triad avoidance is the most common denominator amongst DSR providers, with 57% taking action to reduce transmission costs. 43% say they avoid peak distribution costs (DUoS red bands) and a similar percentage (44%) participate in the capacity market. Of National Grid's other services, around a third (34%) participate in STOR, while 30% participate in frequency response. Interestingly, while very few respondents participate in Enhanced Frequency Response (EFR), awareness of the programme, a route to market for batteries, was higher than any other scheme. (Total responses 39)



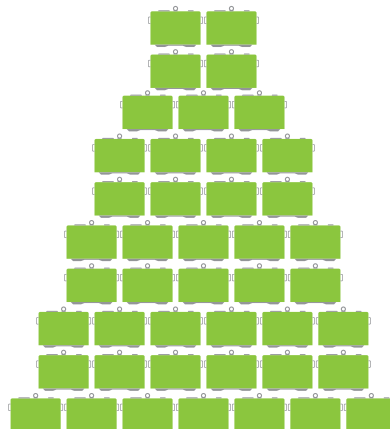
Do you use diesel back-up to provide DSR/avoid peak charges?

Just under half of DSR providers say they use diesel back-up for at least part of their provision. Of those that use diesel for DSR, half were water and energy companies, with the remainder including telcos, retailers, FM companies, a steelmaker and a hospital. Some 61% participate in the capacity market; 78% do Triad avoidance; 51% DUoS avoidance; 65% provide STOR.

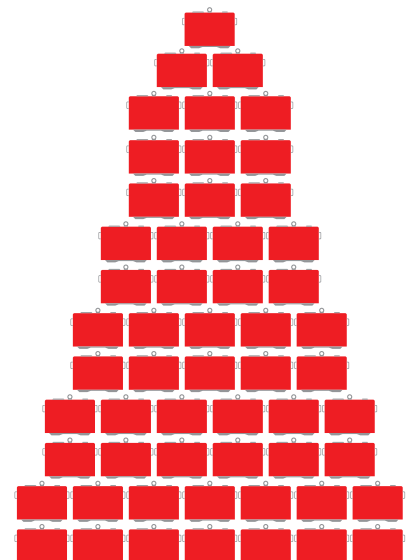
Of those that do not use diesel, 27% say they participate in the capacity market; while 35% do Triad avoidance and 35% do DUoS avoidance. Only 5% provide STOR.

(39 responses in total)

YES: 44%



NO: 56%



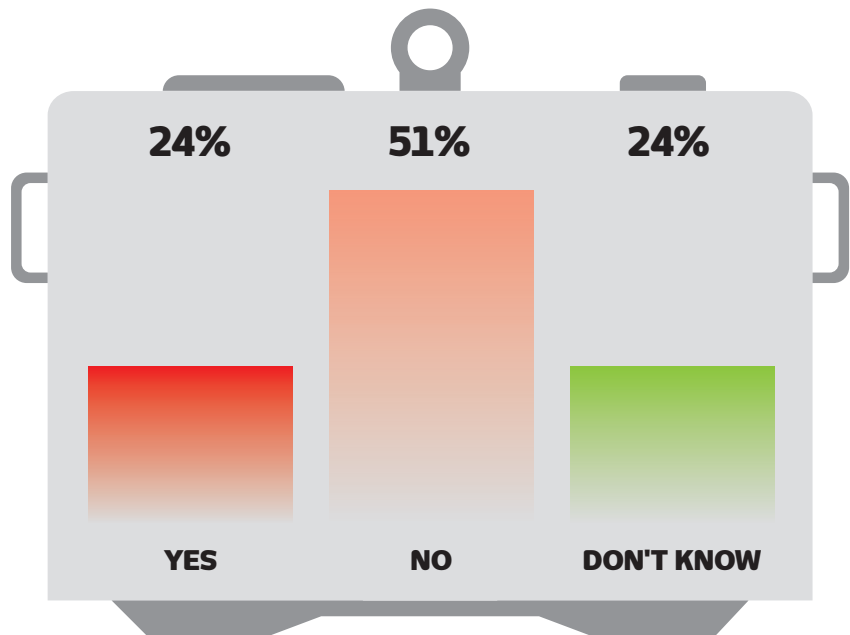
Will changes to Triad export payments reduce your use of diesel back-up?

Half of respondents say cuts to Triad export payments will not affect their use of back-up diesel.

Of those that say it will affect use of back-up, around three quarters take part in the capacity market and do Triad avoidance (although this is from low sample).

Of those that say Triad export payment cuts will not affect use of back-up diesel, around half do Triad avoidance, but only a minority partake in the capacity market.

(41 responses in total)

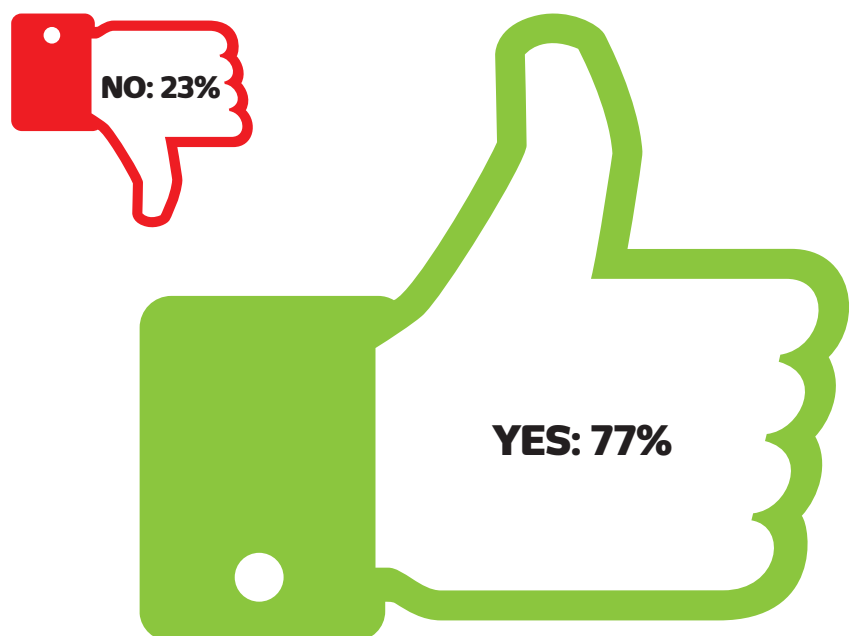


In terms of DSR experience overall, have you been satisfied with the outcome?

Around eight in ten DSR providers are satisfied with the outcome.

Those left unsatisfied were almost all large organisations with significant energy consumption and included large industrials, telcos and a university. Most of them said they could provide significantly more DSR without affecting operations, but the importance of DSR to their business was noticeably lower (weighted average of 3.7 out of 5) than the survey average for DSR participants (2.7).

(47 responses in total)



The following answers are from respondents that do not implement DSR within their organisation

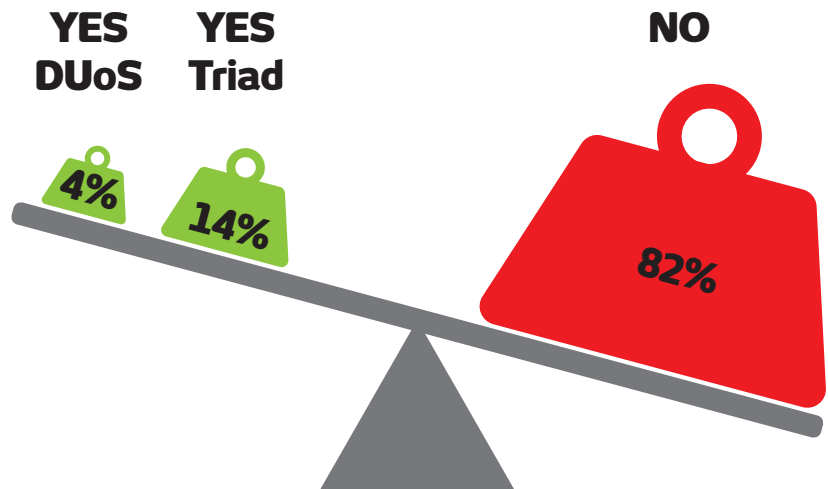
Do you shift loads to avoid peak network charges (Triad/DUoS)?

Most (82%) respondents that do not provide DSR do not take any form of peak network charge avoidance. Some 14% do Triad avoidance while just 4% said they avoid peak distribution charges.

Of non-DSR providers, 52% are small companies with fewer than 51 employees, 26% are large organisations with 1000+ employees, with the remainder somewhere in between.

Two thirds of non-providers spend less than £1m on energy per annum and 43% of non-DSR providers say their peak consumption is less than 100kW.

(119 responses in total)



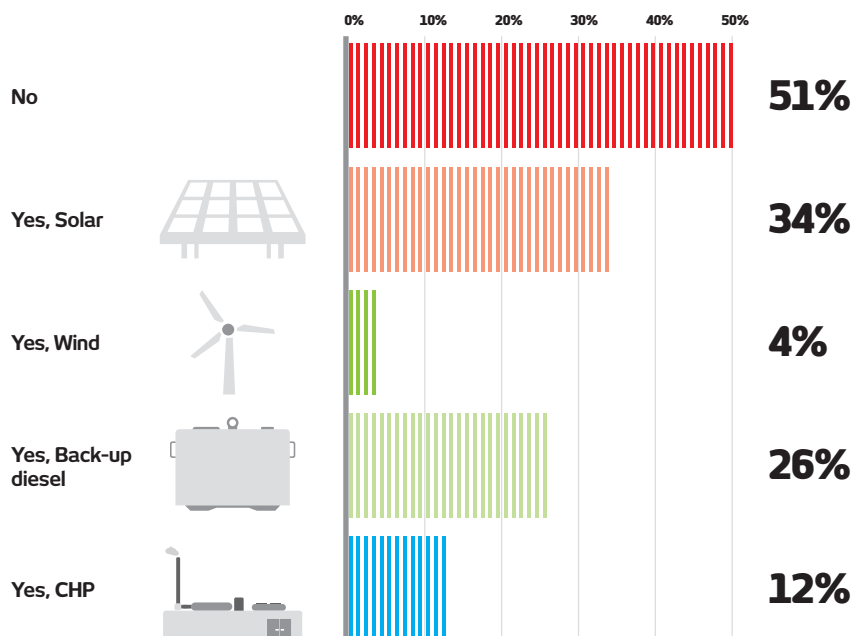
Do you have any form of onsite generation?

Half of non-DSR providers have some form of onsite generation.

Of those with onsite generation, solar PV is the dominant technology, followed by back-up diesel.

Answers exceed 100% as some respondents have more than one technology.

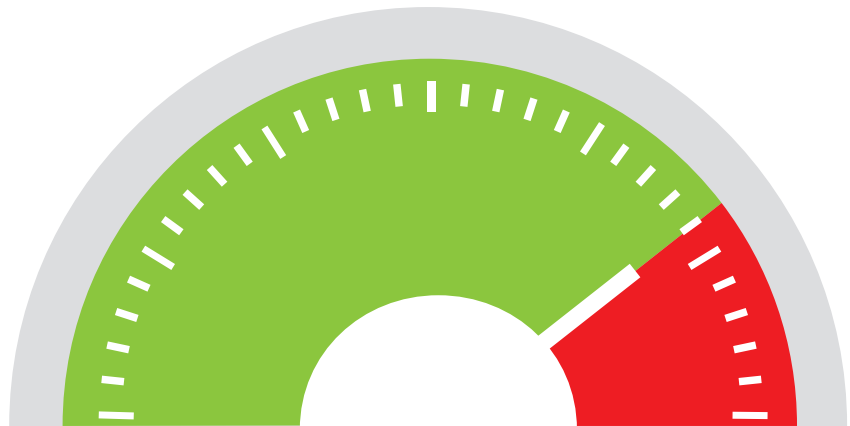
(97 responses in total)



Would you be interested in earning money through DSR if this did not affect your operation?

Almost eight in ten non-DSR providers would be interested in doing so if it did not affect their operation. That suggests an opportunity for suppliers and aggregators. However, given most non-providers are smaller businesses with low peak consumption, it may be that their flexibility is below the viable threshold for current commercial service providers. Nevertheless, 48% of non-DSR providers which expressed interest if it did not disrupt operations have energy spend of at least £1m, suggesting some potential.

(96 responses in total)



YES: 77%

NO: 23%

Why are you not providing DSR?

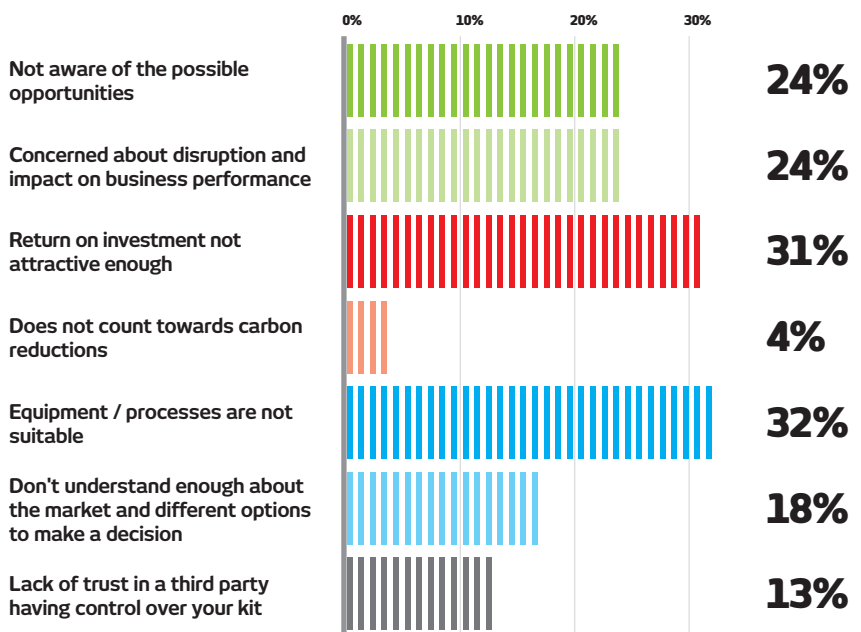
At face value, unsuitable equipment and processes (32%) and insufficient revenues (31%) are the biggest barriers.

However, lack of awareness and understanding are arguably two sides of the same coin and combined stand at 42%.

Concerns around impact on business performance remain a barrier, although trust in ceding control to third parties does not appear to be a major issue.

Multiple choice so total exceeds 100%.

(78 responses in total)

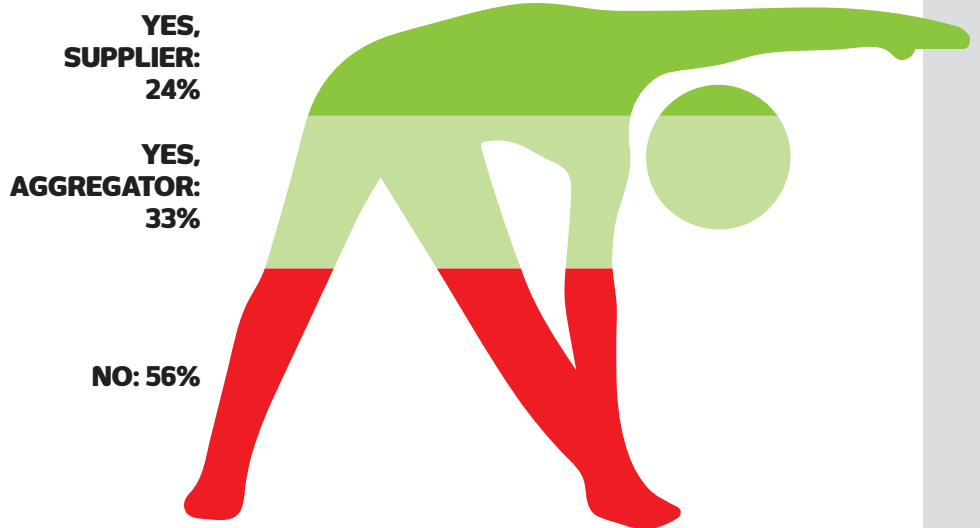


Has your electricity supplier or an aggregator spoken to you about the advantages of flexibility in your energy consumption?

More than half of respondents have not been contacted by suppliers or aggregators about DSR provision. Of those, two thirds are small firms, two thirds use less than 1GWh per annum and only 13% have peak consumption of more than 1MW, suggesting commercial aggregators and suppliers may not see them as attractive propositions.

Percentage does not total 100 as some respondents have been contacted by both suppliers and aggregators.

(94 responses in total)



Battery storage findings

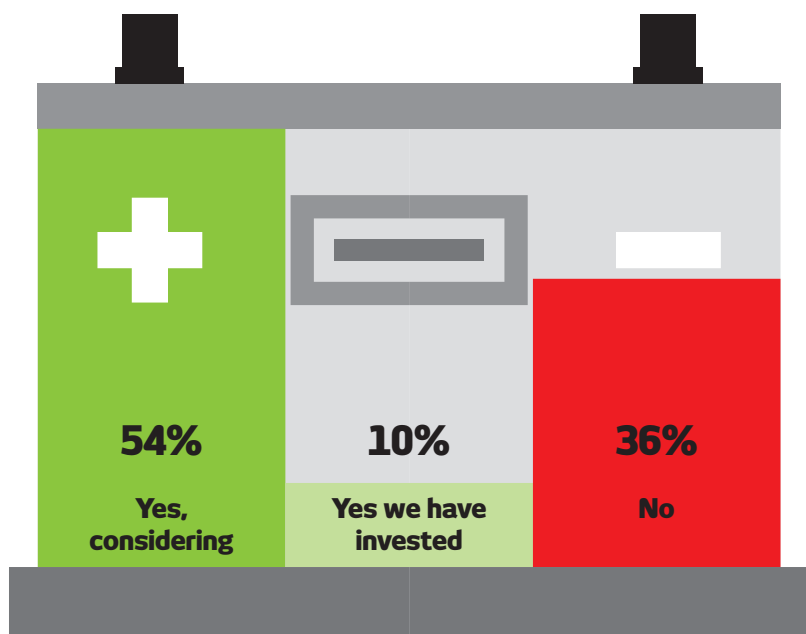
Are you considering investment in battery storage?

More than half of respondents are mulling investment in battery storage. While that does not mean they will actually invest, this is a significantly higher proportion of respondents than those that provide DSR.

Of those that have invested in battery storage, all bar one (a local council) are either utilities or involved in energy services and/or technology provision.

Of the 54% considering storage, around 40% are SMEs while almost 60% are large firms. The vast majority, roughly 80%, are in the I&C sector.

(136 responses in total)

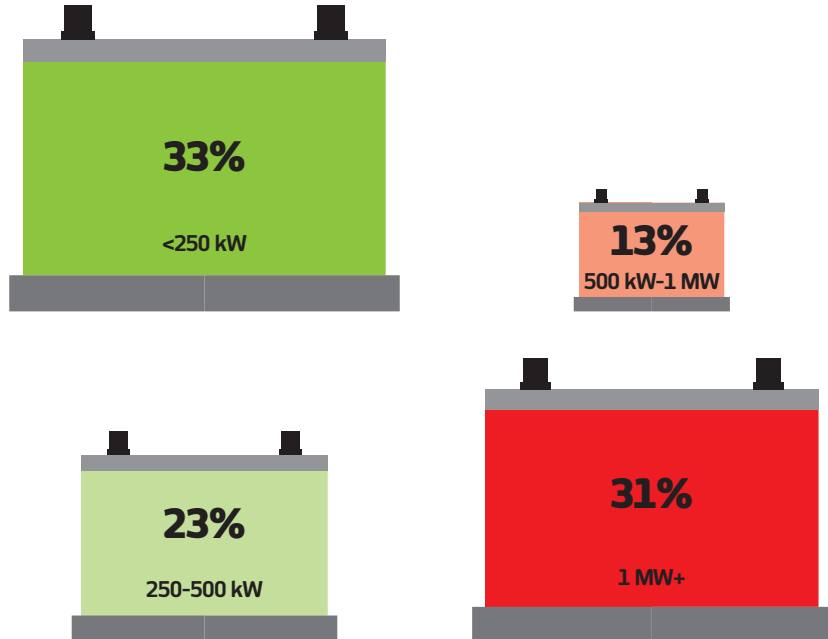


What size of battery have you invested in or considering?

Many sub 250kW projects are being considered by consultants or energy services/technology companies, although some universities and a local council were among this group, alongside a large retailer.

The medium-sized projects (250kW-1MW) are being considered by a broader range of organisations, the majority of whom are large firms.

1MW+ projects had greater representation from utilities (around 40%), with large industrials and telcos among that sample, alongside some smaller I&C firms and one local authority. (76 responses in total)

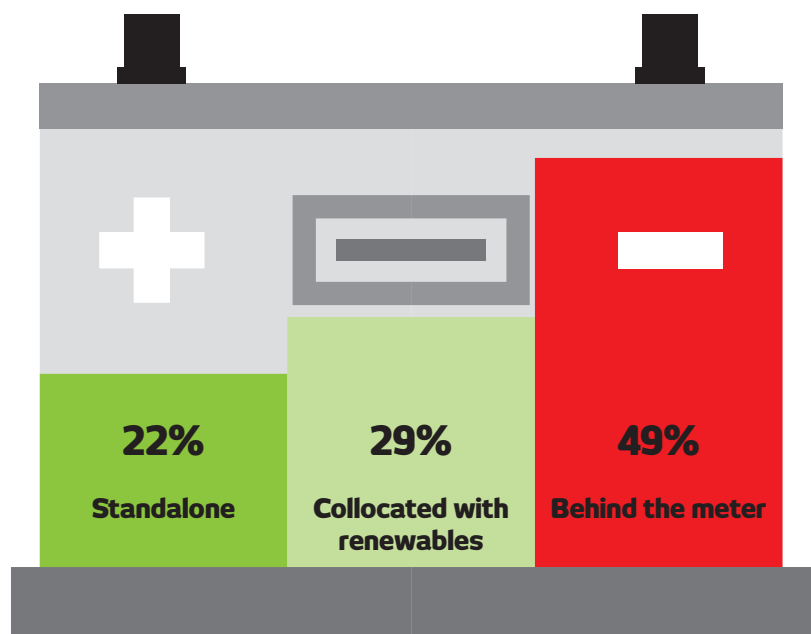


How would your battery be used/located?

Of those considering behind the meter projects, 44% participate in DSR, versus 56% that do not. Of these, 31% are sub 250kW, 44% are 250kW-1MW and 25% are 1MW+

Of standalone planned or live projects, 76% of respondents do not participate in DSR. 18% are sub 250kW, 35% are 250kW to 500kW (none are planned between 500kW-1MW) and 47% are 1MW+

Of those considering renewables collocated projects, 73% do not participate in DSR. 52% are sub 250kW; 24% are 1MW+ and 24% are 250kW-1MW. (76 responses in total)

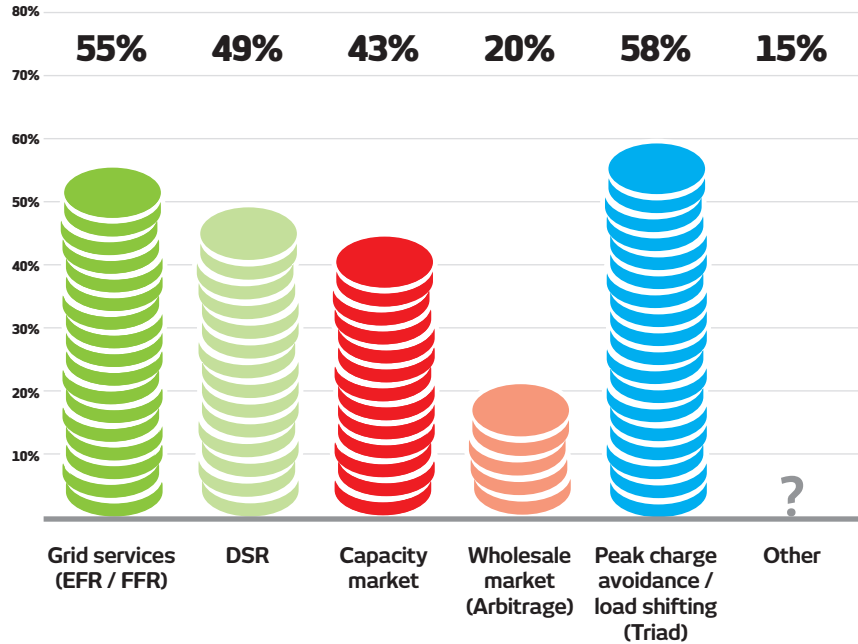


How do you plan to monetise the asset?

Respondents plan to stack multiple revenue streams.

Peak charge avoidance and frequency response services are the most commonly cited, although some firms interviewed for the report suggested flattening of network charges had impacted their business case.

Using the survey's comments facility, some respondents admitted revenue streams were undecided. Commentators interviewed for this report said revenue streams and business models for storage remain emergent.
(74 responses in total)



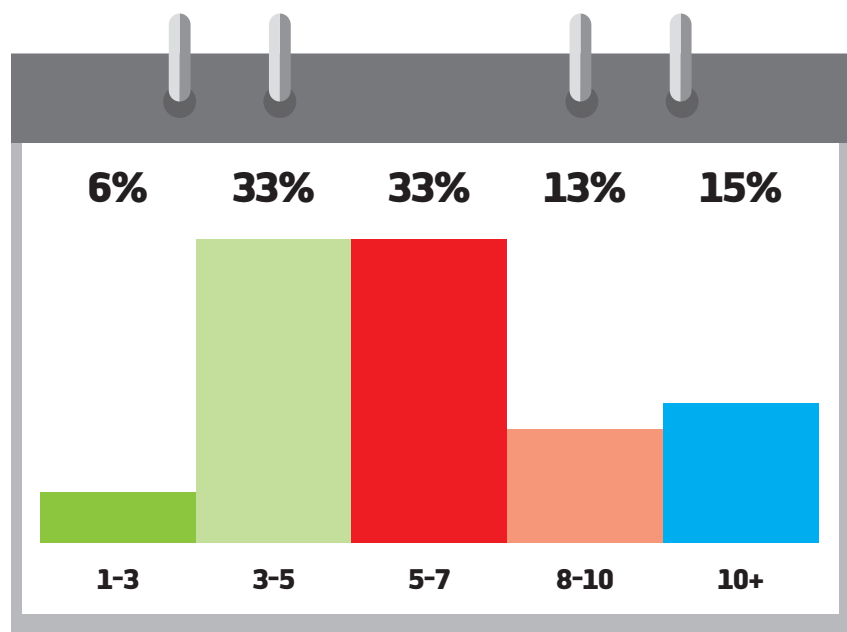
What is the projected payback period (years)?

Batteries are relatively high cost assets, while revenue streams are not perceived as certain.

However, two thirds of respondents believe their battery would payback in under seven years, with a significant percentage believing their potential project would achieve payback in under five years.

There was no real correlation between project size or location and projected payback period.

(73 responses in total)



DSR challenges: Customer perspectives

This year's survey confirms significant appetite to monetise flexibility. Almost eight in ten survey participants not currently providing DSR would consider it if operations were unaffected.

But revenue, both amount and certainty, lack of knowledge and fear of disruption, remain key customer barriers to scaling DSR.

There are also significant cost and hassle factors to be solved if businesses are to replace the inertia provided by massive power stations.

Even if headaches and costs could be alleviated and revenues increased, convincing people to do something different is fundamental.

HOSPITAL PASS

The NHS should in theory be a major player in demand-side response. Many sites have significant generation assets and it is financially stressed. But for now its participation is limited.

Kathryn Dapré, head of Engineering, Energy & Sustainability, NHS National Services Scotland, says that is not for lack of trying.

"The main barrier is cost. You are often told there is no cost [of entry]. But there is a cost associated with updating equipment, particularly switchgear, and also significant costs associated with G59 grid connections," she says.

An aggregator's survey of its main estate suggests a seven figure annual revenue sum could be realised via DSR participation. But only one new site (of 40 large acute trusts) is going ahead with the



Kathryn Dapré, NHS National Services Scotland

Security risk

Convincing finance departments and engineering departments to look at DSR is one challenge. But data and IT departments are also significant elements of the equation, says Yodaly Sierra-Rubio, EMEA finance & business development manager at CBRE.

The firm has frequency project experience with data centre clients. But Sierra-Rubio says while such revenue streams are attractive, ultimately "it will not be about the revenue, it will be about the security and the data ... and the moment that you have to engage with their assets and go outside of the building, it becomes more difficult".

Sierra-Rubio says aggregators and suppliers must have answers to security and data questions before they arise. She says moves by the Crown Commercial Service, whose framework agreement specifies that DSR providers must have strong cyber security credentials, are positive steps.

"But not all of the stakeholders will be aware of those parameters and will be very sceptical about it," she says. "[Aggregators] need to market those credentials more powerfully."

aggregator's full recommendations.

Another site is 'unofficially' doing DSR, by changing maintenance schedules to match red network charge periods. "The cost reductions from peak lopping have been significant," says Dapré. "But the next step would require necessary switchgear upgrades."

SCEPTICAL ENGINEERS

Expense can be compounded by inertia and fear of technical risk. Some sites are "categorically not interested", says Dapré. "The reasoning is that 'the equipment is too old and it won't cope' or, 'we are not prepared to change our maintenance schedules. We don't want that dictated to us.'"

That suggests engineers are king. "Yes [they are]," says Dapré. "We are under more financial pressure – all NHS Boards and Trusts are – but the engineers generally will make the decision [on technical issues]."

However, if something is deemed to be detrimental to patient care (such as noise from running generators more frequently) or infection controls, "it will not go ahead", says Dapré.

"It doesn't matter how much energy or money it might be saving: we will not compromise on those aspects."

Typically though, she says, "we are not getting to the clinical decision. It is still happening at a local engineering level where they are saying 'we know

this kit, it is not capable of functioning at this level and we are not doing it'. They would need to be told to do it."

Which would require mandate from government?

"Yes, it would have to be a mandate from government to say 'you must do this on every site or you must give documented evidence that you have considered it.'"

CHEQUES AND BALANCING

Even if that mandate materialised, cost would remain an issue, given genset and switchgear upgrades can be significant items, particularly at older sites, where costs would "run into six figures", says Dapré.

Energy Performance Contracts (EPCs) could help solve cost and risk issues. Dapré is a fan, having seen "massive savings" from them. But funding is a problem.

"We have two EPCs at the moment, one is up and running and one is about to reach practical completion, with a third going through tender," says Dapré.

"I would like to do more, because the EPCs we are doing are fantastic and are leading to improved equipment and massive savings – and allow us to explore opportunities such as DSR much more. But right now we are hamstrung by accountancy rules."

She says changes to accountancy rules, ESA10 and IFRS16, "mean

Look beyond DSR to build business cases

Unite Students provides accommodation for about 45,000 students in 24 cities. Across some 140 buildings, its utility spend totals some £21m, with electricity the lion's share at £14m. In terms of beds and room numbers, it is akin to a large hotel chain, somewhere between Travelodge and Premier Inn.

HOT WATER BATTERIES

About 80% of buildings use direct electric heating and hot water, so the group is examining how to use hot water tanks as batteries.

It is currently trialling about 120kW of those tanks for firm frequency response (FFR) via 20 flats in Bristol.

That trial is about six months old. Energy efficiency manager Gareth Chaplin says, should it deliver expected results, the group may roll out FFR more broadly across the estate.

But it is not without challenge, with occupants free to change controls at whim and strict safety standards around bacterial control.

THINK BEYOND DSR

On the basis of the FFR and other trials, Chaplin and colleagues are building a business case to network controls at room level. "That's an expensive thing to do," he says, and doing it for DSR in isolation doesn't stack up. So Chaplin is liaising with different departments to make the business case.

Better controls can reduce wastage, e.g. rooms aren't heated when nobody is using them. They also feed into customer service, as networked controls can improve comfort levels, so rooms are not cold in the middle of the night. Better energy monitoring can also signal maintenance issues. Plus, given these are student halls, Unite may also install noise monitoring equipment to reduce complaints.

"We are not looking to build a business case purely around DSR, but a multifaceted business case," says Chaplin. "We are looking to solve as many problems as we can when doing it."

"Strictly speaking, it is out of an energy manager's remit, but that is why we work with colleagues in estates and customer experience to add value," he says.

"It is crucial to combine different benefits. DSM/DSR by itself just doesn't stack up for us because of the nature of our estate. But if you start to package up multiple elements, it makes an attractive case financially, but also because we are ultimately a customer service business."

we cannot undertake further EPCs unless we fund them ourselves".

As things stand, when IFRS16, comes into effect in 2019, "all leases come on balance sheet" in Scotland at least, says Dapré. "And that is going to have a massive impact on the public sector."

FORCING THE ISSUE

The Crown Commercial Service has much responsibility for public sector procurement. This summer it appointed six DSR providers to its framework agreement. It has also drawn up a standardised template to try and simplify DSR procurement.

Dapré welcomes such moves. But she thinks Trust leaders – and policymakers – could take a stronger role in driving change.

However, as non-commodity costs continue to rise, "financial reasoning" is starting to kick in.

"Whereas a few years ago, we

couldn't see much of a financial benefit [from DSR], now we can actually see it much more. Now we can say, 'in a few years time we will have £90/MWh hitting us at peak times, we need to do something'."

TURNING TIDE?

While engaging the NHS in DSR appears akin to turning the Titanic, Dapré takes the long view.

"I think it is changing, because the kind of figures coming out of the capacity market mean it is no longer something that people can ignore and put in the 'too difficult' box."

"And I think when one or two sites implement DSR, then the others will follow suit. Nobody likes to be the first. So the more case studies we can have, the better."

"So the positive is that while we are not doing much, we are starting to do something – and if those things pay off, more will follow," says Dapré.

Connections a key 'blocker' for DSR

"We have found the G59 process [and its complexity] to be one of the key 'blockers', especially for the SME market," says Annalisa Bell, sales and origination manager at Eon's Virtual Power Plant & Flexibility Unit. The company has therefore created a dedicated team to handle G59 applications.

"It can otherwise be quite time consuming and challenging for customers," she says, but is a crucial aspect of business case building, as the cost of connections and upgrades has a material significant bearing on payback periods.

"We just have to keep raising awareness."

COST VERSUS OPPORTUNITY

Upgrade costs are a limiting factor for many potential DSR providers. Gareth Chaplin, energy efficiency manager at Unite Group, looked at putting the organisation's 12 CHP units into the capacity market – but was put off by the stringent metering requirements.

"When I was talking to the aggregator my eyes lit up. But then the quote for the metering came in. For 12 sites, it was well into six figures. That was sobering," says Chaplin.

"If you had that in your pocket, would you spend it [on metering]? It's a good opportunity but it wouldn't be the first place I would spend it."

CONNECTIONS CHALLENGE

Ensuring assets can export to the grid is another major challenge. Distribution network operators (DNOs) have to ensure the integrity of their networks and must carefully manage constraints. But their standard processes, such as the required G59 agreement, are difficult to navigate for those trying to provide DSR.

"If you don't tick every box correctly, the DNO will send you to the back of the queue and stop the clock on your application," says Mark Thomas, director of G59 Professional Services. "For a lot of people, because they are unfamiliar with the process, there is a risk that the clock times out, they have to reapply and they just give up."

Fellow director Steven Cook agrees. "If you are not an engineer, you will have real difficulty."

Chase top dollar or bank solid revenue?

Headline FFR revenues grab clients' attention, says Yodaly Sierra-Rubio, EMEA finance & business development manager at CBRE. But the high value schemes may not always return the most money.

"FFR definitely works to attract the client. But if you operate in a critical environment and participation is limited, actually it might be better to go with STOR and the capacity market and [promise] those revenues in the first place."

Otherwise, she says, trust can be eroded.

"The client doesn't want to know the name of the programme, they just want to know what they have to turn on and off, and how much revenue that will generate," says Sierra-Rubio.

"If you promise £1m a year from FFR, but then you give them half a million, they will ask what changed. They will not want to hear that 'the programme changed' and that is when you damage trust."



Mark Thomas, G59 Professional Services

He says just knowing where to start and who to contact is not straightforward, and that the DNO 'gatekeepers' are not always helpful.

"So if you are not technically minded and don't know the process, you can spend the first few months just working out what you have to do. You might be looking at 12 months before you know whether you can even go ahead."

The DNO cost "can make or break" a DSR business case, says Cook. "So that is key, for the DNO to come back as quickly as possible [with the connection/export offer] and make



Steve Cook, G59 Professional Services

that process as simple as possible."

While Western Power Distribution has recently created an online map showing where connections are more viable than others, Cook and Thomas believe a nationwide picture would be hugely beneficial.

SEEK PROFESSIONAL HELP

Maria Spyrou, energy efficiency manager at Marks & Spencer, says the retailer experienced the G59 challenge first hand.

The company began DSR trials three years ago, connecting back-up generators to the grid.

"We upgraded our first site and then realised we couldn't actually connect with the DNO because we hadn't applied for a G59 export licence. So we did the works and then went back to them to go through that process." M&S had appointed an aggregation service provider via tender, then tendered again for specialist help with the connections process.

"Working with the consultants was very beneficial," she says. "It would have taken a lot longer to figure it out ourselves." Such is the complexity of the process, says Spyrou, even



Maria Spyrou, Marks & Spencer

DSR's three known unknowns

Sam Scuille, regional director, European sales at aggregator Enernoc says uncertainty is a key barrier to bringing more businesses into DSR.

"At the end of the day none of this is core business to customers. What do they want? They want three things: 'Muchness', 'sureness' and 'soonest'."

"How much am I going to get; how sure am I that I am going to get it; and how soon can you deliver it to me? We don't have answers to all of those things because of the uncertainty in the marketplace."

some of the firms tendering for the G59 work "didn't actually know how to do it".

With hindsight, she adds, securing the export connection before upgrading sites would be the optimal approach.

RISK VERSUS REWARD

Spyrou says Marks & Spencer's investment is starting to pay off. This year, its electricity consumption was 10% lower than the previous year. While that resulted from a number of factors, DSR played its part, she says. The company is now working through the connections process at a number of other sites for phase two of its DSR programme, which Spyrou hopes will deliver greater savings next year.

M&S's story is largely positive. But as this year's survey suggests, many feel that the revenue from DSR is insufficient to justify the effort – and is subject to too many variables.

Lee Stokes, head of demand management at Mitie, says that is a key challenge for clients.

"For the last couple of years the DSR market has been fairly stable in terms of the money you can make from it. But the elements within that market are changing all over the place," he says.

"Static FFR has dropped down in price, DUoS bands have been flattened and Triad has just taken a significant hit."

Meanwhile, although STOR has "stabilised and performed reasonably in terms of price", he says the Capacity Market "has not produced the sort of prices that everyone thought it might".

Stokes says while smarter service



providers will “blend” programmes and revenue streams to insulate clients from risk, there is no escaping the damage done to DSR business cases.

“Many people will have pegged their business case at one price. But then policy has changed, price has changed and their business case will therefore no longer be viable,” he says. “But they have probably burnt all their capex so they are now stuck with it.”

So flattening of DUoS and Triad export cuts have wiped out business cases?

“One hundred percent,” says Stokes. “If you haven’t put your business case in yet, that’s one problem. But a worse problem is if you have put your business case in. Because the level of saving is no longer there and it is now not going to pay back.”

SMALL BEER

Stokes says instability in policy and regulation is a fact of life in the energy market. He believes innovative companies can find ways to make compelling returns for customers, but even outlining concrete revenue streams to clients is not always sufficient incentive.

“The big challenge in the DSR market is getting people to sign up. In the industrial and commercial market, people are looking for news ways to create revenue and cut costs, so there is now an appetite for DSR,” he says.

“The problem is when you have a DSR proposal on the ground. For example, if you get a good static frequency response contract at £45k/MW and the site has 300kW flexibility, that is less than £15,000 per site, per year,” says Stokes.

“That is a small amount of money if you are pitching to a global bank, a large industrial client or a telecoms company. It is not worth them getting out of bed for, taking on the business risk that comes with DSR.”

While National Grid’s Power

The law of unintended consequences

After labour, energy is Welsh Water’s highest cost. That provides strong incentive to maximise the value of flexibility.

The firm’s primary DSR activity at present is Triad and peak tariff avoidance.

“For Triad avoidance we reduce our demand by about 50% without the use of any diesel generators in parallel with the grid,” says Andrew Heygate-Brown, senior energy innovation analyst at Welsh Water.

The company has managed to reduce peak demand from 40MW to “about 17-18MW net after export benefit, a massive saving,” says Heygate-Brown.



TRIADS AND TRIBULATIONS

However, removal of Triad export payments will reduce those savings. The company is dismayed that renewable technology will feel the consequences of policy intended to curb diesel.

“We have 15.6MW of renewable hydro assets that can maximise exports during Triad periods to reduce our net Triad costs. We are going to be hit massively by the reduction in export benefit,” says Heygate-Brown

FAST ACTING ASSETS

Welsh Water is now planning a major firm frequency response (FFR) rollout – and is looking beyond frequency to broader markets.

Heygate-Brown believes Welsh Water can use the same equipment “not just for dynamic FFR, but also Triad avoidance, tariff avoidance, some supplier schemes (reducing imbalance charges where we receive a revenue share), STOR and/or Project TERRE,” he says. “We could also explore arrangements with DNOs to help with balancing services.”

POWER SHIFT?

The company would prefer to go direct to buyers of flexibility rather than through a middleman. But technology is a barrier.

“We are not aware of affordable technology being available to participate directly in [FFR] markets with National Grid.”

Dealing with middlemen reduces the benefit to Welsh Water and its customers, says Heygate-Brown.

“The power has sort of shifted to the aggregators. They can really charge what they like - and the amount that we get paid is a lot less than it used to be,” he says. “That is an area of concern because the amount that National Grid is paying some aggregators is still the same - or even higher.

“If we owned the technology ourselves, we could participate in the most suitable schemes at the most suitable times while meeting compliance and keeping customer bills down as much as possible.”

Will Welsh Water take that route?

“We are trying to go direct wherever possible, but right now for FFR, it is just not possible.”

Responsive campaign “has done a really good job of raising awareness,” says Stokes, “the numbers aren’t overly compelling”, especially without Triad.

CONVERGENCE

Stokes thinks that makes it imperative for DSR to be part of an integrated energy package, so that value can be maximised. He believes an Esco-type model - one that bundles energy procurement, management and flexibility - can deliver better returns and will bring more businesses into balancing.

“Procurement manages price risk – buy the commodity element as cheaply as possible. An energy performance contract will use as little as possible overall, and then DSR manages that non-commodity element as best it can,” says Stokes. “That is the real opportunity.”

Energy suppliers pushing harder into the DSR market take a similar view, as do some of the aggregators: Those with the ability and agility to access the broadest number of revenue streams will be able to maximise returns for customers.

FEAR OF FAILURE

However, that presumes aggregators and suppliers can convince clients to do something different and assuage fear of technical risk.

Triad, for example, incentivises some 2GW of response over winter, suggesting many large firms are comfortable with the scheme.

The capacity market may ultimately deliver higher volumes of DSR.

Customers engaged in those relatively basic, manual schemes could potentially unlock much greater value, says Restore's Louis Burford.

"If businesses are willing to make those changes for savings of £40-£45K/MW (via Triad), they could earn that kind of rate for the rest of the year. But I think perception of risk prevents them," he says.

LOSS OF CONTROL?

"Triad is a manual thing. But when it comes to automating DSR, which is necessary for higher value services such as frequency response, people become nervous."

Burford says the key is convincing firms that they set the parameters.

"Yes it is automated, but it is automated within the industrial

Louis Burford, Restore



boundaries that those consumers would operate within if they were doing it manually. You are only available if you are available. That is the reality."

Burford points out that some businesses may be turning off equipment for 30 hours a year to be sure of avoiding a Triad period.

"For frequency response, granted some of the technical specifications are different, but you are looking at perhaps a five minute activation 20-30 times a year," he says. "So the number of hours you are actually impacted is considerably less for the

same amount if not much greater value."

TRUTH BEGETS BELIEF

Even if businesses are comfortable with technical risk and revenues are sufficient to proceed with DSR, there is scepticism whether what is promised will materialise. In some cases for good reason.

While The Association for Decentralised Energy (ADE) is developing a voluntary code of conduct for aggregators (see opposite), it remains an unregulated market. Many firms have been burnt by bad deals and less than expected value, while some believe aggregators effectively hold all the cards when it comes to rates (see box, p21)

This year's survey suggests trust is not a primary concern when it comes to ceding control of kit to third parties. But if businesses are not confident they will receive what they are promised, it may feed into the perception that revenues offered by DSR are insufficient, cited as a key barrier by survey respondents.

Engie's Mark Cavill and Eon's Annalisa Bell point out that DSR is just a fraction of their broader utility businesses, and that they cannot risk customer relationships by over promising and under delivering.

Restore's Burford says any market participant that under delivers will struggle to survive in an increasingly competitive market. Nevertheless, he advises businesses considering DSR to do their homework before inviting firms to tender. All aggregators are not equal, he suggests.

"There is a lot of confusion when you have different offers from competing aggregators. My advice is: Look at track records. Look at the public auctions to see what price aggregators are achieving - and hold them to it."



Mark Cavill, Engie

Choose your partners carefully

Partner Logistics operates two main cold stores in the UK. The sites have a combined maximum peak demand of around 2.3MW. Compressors, which run the freezers, are responsible for the lion's share of load, of which around 500kW is flexible.

The firm started Triad avoidance eight years ago, shutting compressors from 4-6pm in the winter. When it learned that a sister site in Belgium was providing DSR, UK technical manager, Ian Harvey decided to find out how the UK operation might benefit. As a result, Partner Logistics trialled placing flexibility into various programmes, starting with STOR, as part of aggregator Restore's portfolio.

The company is now mulling whether to invest in the aggregators' software platform in conjunction with its broker, CUB, which buys Partner's power from Dong Energy. Harvey says he has to make a decision on the cost benefit analysis and feasibility of that investment in conjunction with the broker.

Either way, 12-month returns from the current programme total £40,000, he says.

While "not huge ... when you have [an energy] bill of £80,000 a month for one site", the revenue will pay for an enhanced metering programme.

"That will give us a better view of what assets are consuming and the variables that affect consumption," says Harvey.

"We would otherwise have faced capital expenditure [for that programme] and I think because of that, and the DSR programmes we are running, we will start to see more noticeable savings."

Harvey's advice to other firms mulling DSR?

"Choose suppliers to compare carefully. Don't go for the one offering the highest returns ... because more often than not, they do not," he says.

"Find a supplier with a programme you can if not fully understand, get to grips with - and with whom you feel confident enough to draw a line and say 'no'."

Major changes to balancing services

Market participants believe National Grid's push closer towards real-time procurement of flexibility will boost DSR uptake

National Grid has outlined plans to "radically reform and simplify" its suite of balancing services via its System Needs and Product Strategy (SNAPS) consultation.

The System Operator provides an overview of its aims on p24 of this report, but in essence it will move closer to real time procurement, which should mean a more liquid market. Some of the redesigned products will be launched next year and DSR market participants believe they will be a major driver in scaling demand-side response.

ALL CHANGE

"The SNAPS review will potentially present a big change to the industry," says UK Power Reserve's Ian Tanner.

"National Grid has been quite clear it wants more liquidity which can only be a good thing for flexibility. It enables people to join the market with much less of a barrier to entry."

National Grid's move closer to real-time procurement could mean weekly or even day-ahead tendering for DSR contracts. Tanner says that would be "fantastic" for DSR providers.

"You can literally sign up customers and have them providing the service the day after. That is perfect from an aggregation standpoint," he says.

"There is nothing worse than a customer saying they want to do something the day after Capacity Market prequalification closes. There is only one opportunity a year – if you

miss it, you must wait for the next one."

DSR BOOST

Eon's Annalisa Bell agrees such moves would boost the DSR sector.

"Our Virtual Power Plant team in Germany has experience of that type of market, where there are similar products to STOR with daily and weekly auctions. That enables them to be more agile in monitoring and reacting to the markets and ensure optimal value," she says.

"So we definitely view that kind of restructuring by National Grid as a benefit for demand-side response."

CERTAINTY REQUIRED

Will increased liquidity, and the reference prices that emerge from liquid markets, help address customer concerns around predictable revenue?

"More liquid and predictable markets will certainly be beneficial," says Bell. "But we also need more certainty in the market to help people plan and forecast."

From an end-user's perspective, Welsh Water's Andrew Heygate-Brown seconds that view.

"We are quite keen on being able to respond in seconds to price signals. But at the same time, we need to have some certainty of our rates. We don't want to speculate, that is not what we are about. But at the same time we would like to unlock some



of the additional revenue sources arising as the market changes."

He hopes National Grid considers a market-based approach to mitigate the risk of non-delivery of its balancing products.

"If one party can't deliver, maybe it could go to a secondary market system. Or potentially, they could have reserve bidders instead."

That approach would open up markets to businesses that do not have long-term visibility of flexibility.

"Because of the critical nature of our business we can't commit upfront to demand response," says Heygate-Brown. "But if we are available, then we will participate at shorter notice."

CLEAN UP

As well as aligning contracted products closer to market-based opportunities, Engie's Mark Cavill believes a move closer to real-time procurement will improve transparency of the DSR market.

It may also help address trust issues that have dogged the sector, particularly where customers have been locked into long-term contracts that have failed to deliver value.

"I think the market has historically been immature in some of the tactics applied [by participants] which hopefully National Grid is looking to address via the recent SNAPS consultation – potentially licensing procedures and arrangements for aggregators."

Hopefully, he says, that "will start to drive the transparency that is needed to ensure the DSR market is viewed in a more positive light than perhaps it has been in recent years".

Honest aggregators will grow market

The Association for Decentralised Energy (ADE) is developing a Demand-Side Response Code of Conduct.

The aim is to improve market trust by setting out a clear rules around how DSR aggregators and suppliers engage with potential customers.

The code covers sales and marketing, technical due diligence, customer service, complaints, contractual arrangements and security.

The hope is that by choosing to work with an aggregator or supplier that signs up to the voluntary code, customers can be sure of a fair deal.

The code is open for consultation until 15 September. It can be found at <http://bit.ly/2vtc1n3>

Levelling the playing field with simpler balancing services

System Operator National Grid is streamlining and enhancing its range of balancing services to help more providers and technologies get in on the balancing act. Rhiannon Marsh, the company's Power Responsive Manager, explains how the business is going about reshaping balancing markets as the needs of the system evolve

As the System Operator for Great Britain, we're responsible for operating the nation's high-voltage electricity transmission network in a safe, secure, reliable and cost-effective way.

It's our job to make sure the balance between supply and demand is maintained continuously. We need to make sure the system is operated within a number of defined limits and that we have the right services in place to manage any changes in supply or demand; this could be due to events we predict are likely to happen or unforeseen circumstances.

We do this by accessing flexible generation close to real time in the Balancing Mechanism (BM) and by contracting for balancing services ahead of time. Many of these allow businesses of all shapes and sizes to support the needs of the system by using their energy more flexibly. Those that participate can benefit from new revenue streams, a reduced carbon footprint and increased resilience from their energy assets.

THE NEEDS OF THE SYSTEM ARE CHANGING

While the current system has long been fit for purpose, the needs of the system are changing. As larger, conventional power plants close and intermittent renewable generation



Rhiannon Marsh, National Grid

grows, the system is becoming less predictable and more volatile. This makes managing it more sophisticated and complex than ever.

To meet these challenges, we need to evolve the way we manage the system. Balancing markets need to be simple, easy to navigate and transparent, so that everyone in the industry – regardless of their size or the technologies they use – can access them.

We're working on a four-step plan to make this happen. First, we're improving the information we share to make it easier for the industry to see, and meet, future system needs. The first example of this was the publication of our System Needs and Product Strategy consultation, which we published back in June.

Secondly, we're radically reforming and simplifying our suite of balancing services. This will allow us to meet our changing system needs – and give all businesses and technologies the opportunity to compete on a level playing field.

Third, we're removing barriers so that we can make better use of distributed energy sources. And finally, we're working to improve other market mechanisms, such as reviewing access to the BM.

Now let's shine a spotlight more closely on exactly how the system is changing and explore where new opportunities could exist for providers as we transition to a smarter, more flexible energy system.

1. SYSTEM INERTIA AND RATE OF CHANGE OF FREQUENCY (ROCOF)

Inertia helps stabilise the system by reducing the time it takes for frequency to rise and fall (known as the Rate of Change of Frequency – or RoCoF). As traditional power plants close and levels of wind, solar and interconnection rise, inertia on the system is falling. In turn, this causes

a rise in RoCoF. This requires more action from us – and providers – to manage it. Another issue is that many generators on the network have RoCoF protection relays, so they automatically shut down at times of high RoCoF. In the worst-case scenario, this could mean large amounts of generation would be lost at one time.

How will we address the need and where are the opportunities for providers?

We're implementing programmes to desensitise RoCoF protection relays, so they continue to run at lower levels of inertia. We're also working to offer products that help keep RoCoF below these relay trigger points where possible. Our RoCoF relay programme began in 2016 for those providing greater than 5MW of generation. A second phase is now being designed to address smaller generation. Further improved RoCoF response products will be available in March 2018.

2. FREQUENCY RESPONSE

We're seeing an increased need for fast-acting sources of frequency response; the need for frequency response is highest when system inertia is low, and fast-acting response can reduce the overall level of response needed. As a result, we need a market structure that allows us to buy fast-acting response and access flexibility from providers much closer to real time.

How will we address the need and where are the opportunities for providers?

A new response product is being designed that will require providers to deliver sub-second response. Until its launch, we'll continue to contract through Firm Frequency Response (which offers contracts from up to one month ahead) and access real-time flexibility through Mandatory Frequency Response. Our new



response product will be designed and launched by March 2018.

3. RESERVE

Reserve services allow us to manage imbalances in the system that arise from forecasting errors or unexpected losses of generation or demand. These are manually instructed after automatic frequency response services have been delivered. Reserve can either be upward (an increase in generation or a decrease in demand) or downward (a decrease in generation or an increase in demand). Needs in this area are becoming less predictable due to renewable and small scale generation. We're seeing an increasing need for downward reserve when transmission demand is low, as well as a greater need for close to real-time flexibility.

How will we address the need and where are the opportunities for providers?

Currently there are several different reserve products with overlapping timescales and different technical requirements. We believe this is an obstacle for new providers and technologies, so we're working to standardise and simplify our products. A new reserve service is also being designed to allow us to buy flexibility much closer to real time. The standardisation of reserve products is set to be completed in summer 2017, with the new reserve product launched in 2018/19.

4. REACTIVE POWER

Generation, demand and network equipment can either generate or absorb reactive power and this needs to be kept in balance to keep voltage at the right level. We're seeing a trend for a greater need for reactive power absorption, which is driven by lower transmission demand and a rise in reactive power contribution from distribution networks. We expect this need to continue to grow.

How will we address the need and where are the opportunities for providers?

A new reactive power market will be designed and implemented by the end of 2018/19. Through a project called Power Potential, with UK Power Networks, we're investigating routes into the reactive market for Distributed Energy Resources (DER) and the trial for the project will go live in January 2019.

5. BLACK START

In the unlikely event that a large section of the network were to shut down, black start services would be required to restore it. Our current restoration strategy was designed to suit traditional synchronous generation. As less of this becomes available, there is a growing need for new providers to enter the market.

How will we address the need and where are the opportunities for providers?

There will be opportunities for new providers to deliver up to 18

services across six regions in the UK, with details soon to be confirmed. Providers will be able to enter contracts to deliver these from 2018. We're also working to create opportunities for new alternative technology providers, including storage.

As we continue to simplify our portfolio of products, we'll also be looking at the structure of contracts, reviewing our testing and compliance requirements, and trialling new methods of procurement. Our aspiration is that all of this will translate into a better experience for providers of balancing services.

As the landscape continues to evolve, it's our goal to provide ever more opportunities for businesses to contribute to a flexible future energy system - one that makes the best use of all available resources, and meets the needs of energy users in an economic and efficient way.

- Join our mailing list to receive email updates on the Future of Balancing Services. www2.nationalgrid.com/UK/Services/Balancing-services/Future-of-balancing-services/
- Visit our Power Responsive website to find out more about the opportunities that exist by using energy or generation assets more flexibly – as well as stories from businesses that are taking part and enjoying the rewards of balancing markets right now. Go to powerresponsive.com

Market perspectives: Challenges and opportunities

Ability to access all available value pools should increase revenues for flexibility providers. Doing so may well define successful DSR businesses and ultimately, the size of the overall market

Eamonn Boland, senior manager at consultancy Baringa Partners, believes opportunities for flexible assets are expanding beyond contracted revenues, balancing services procured by National Grid for example, toward more merchant, market-based revenues.

Accessing these merchant market-based revenues will require significant resource, expertise, management and in some cases a portfolio of both flexible and inflexible assets.

"Historically these sorts of distribution connected peaking assets, DSR engines or storage, had quite a lot of their contracted revenues with National Grid or [via]



Eamonn Boland, Baringa Partners



High price spikes set to continue

Reforms to imbalance market arrangements in 2015 make higher price spikes more likely. As a result of those rule changes, which make it much more expensive if parties do not properly manage trading positions, imbalance market prices have since topped £1,000/MWh.

Cashout prices hit £1,500/MWh last November and reached a similar level in May, when the BritNed Interconnector was undergoing maintenance, unplanned outages at two nuclear power stations took 1GW off the system and renewable generation was unexpectedly low.

The impact of high imbalance prices spill out onto intra-day wholesale markets. While that creates challenges for power generators and suppliers, it also creates opportunity for firms with the flexibility and agility to quickly react.

Baringa Partner's Eamonn Boland believes that opportunity will exist for the foreseeable future, given relatively thin capacity margins.

"We have already seen how little it takes to push the system to periods of high volatility in the wholesale prices and balancing mechanism cashout prices," he says.

"In our modeling going forward ... we continue to see similar, if not the exact same levels, of volatility in the wholesale market and the balancing mechanism."

Aggregators like BM Lite, but how long will it take?

Alongside the Smart Systems Plan published in July, Ofgem issued a short letter outlining its intentions to facilitate Balancing Mechanism and wholesale market access to independent aggregators. This would enable them to find greater value for their customers' flexibility.

Paul Troughton, senior director of regulatory affairs at Enernoc (pictured), said the regulator "seemed to have most of the important principles right" around permissions, baseline methodologies, information flows and balancing costs and delivery risks.

However, other than how long the proposals may take to implement, Troughton expressed concern over "the assumption that the supply market is so competitive that suppliers won't be able to erect barriers to deter customers from dealing with independent aggregators".

While Ofgem states that, "payments for sold on energy may be most efficiently agreed in the retail contract terms between the supplier and the consumer," Troughton disagrees with that approach.

"We would be much happier with a rule that avoided the possibility of the supplier using such terms (or other retail contract clauses) to deter their customers from working with independent aggregators. Other jurisdictions (e.g. Singapore, Germany, many US markets) have rules in place or under development to prevent this," he says.

"For example, Ofgem could simply provide guidance that the transfer price of any demand response energy should be the retail price less any levies and network tariffs."



Annalisa Bell, Eon

Triad, so didn't require much trading or active management," says Boland.

"But those contracted revenues are being competed down in value or are not that deep a market: There are small volumes of frequency response, fast reserve and STOR to be procured, relative to interest in these markets and the depth of the more merchant wholesale and balancing markets," he says.

"We see emerging opportunities for DSR and engines in more merchant-type revenue streams. That is, participation in the wholesale market, the balancing mechanism, avoiding imbalance costs."

As a headline number, these activities present attractive revenue streams, says Boland.

"But the merchant risk that underpins them is materially different to what the market has historically been accustomed to with contracted revenues."

TRADE BALANCE

To turn those risks into rewards, aggregation businesses will need to be fully engaged in market trading.

For an industrial or commercial business providing DSR, their offtaker (aggregator, supplier, whoever monetises value for them) would therefore need "quite intelligent platforms and tools to extract the maximum value out of the traded markets", says Boland.

"Historically it has been quite easy for the offtaker to simply contract forward, not to have somebody sitting on a trading desk actively trading these assets 24 hours a day."

Building that kind of set up "is not an inconsiderable investment for aggregators", says Boland. But those that can access and actively trade on the markets "will be at a considerable advantage to those without that capability".

COMPETITIVE ADVANTAGE

Currently, aggregators cannot directly access the wholesale markets and Balancing Mechanism (BM) unless they hold a supply licence – and most do not.

Ofgem is working on plans to facilitate access to the BM – a move that has been welcomed by aggregators (see box above).

But it may take some time to finalise a 'BM Lite' solution, giving those that can access traded revenue streams a significant competitive advantage.

Suppliers aim to capitalise on their strengths.

"A benefit of having the synergy between supply and flexibility is that we are able to take a holistic approach to help customers optimise across the different markets and benefit from the wholesale energy markets, as well as National Grid schemes," says Eon's Annalisa Bell.

"We see the value of flexibility in traded markets increasing, as there is going to be an increasing need for flexibility in the future," she adds.

"I see the same trend with balancing services, but across the different markets there will be shifts in where that value lies. So having the ability to be agile and flexible amongst the flexibility markets is really important."

CONTRACTUAL OBLIGATIONS

Nevertheless, National Grid's contracted services remain a significant source of DSR revenue. Prices may fluctuate over time, in accordance with supply and demand, but the System Operator's products provide a degree of certainty for businesses.

As National Grid works on overhauling procurement, Restore's Louis Burford hopes the System Operator will create a system that maximises the value of flexibility.

"We are starting to see a bit of conflict between the ability to monetise assets in more than one 'market'," says Burford.



Louis Burford, Restore



Ian Tanner, UK Power Reserve

"For example, if you are participating in National Grid's frequency response programme, there are periods of time where a portfolio has more flexibility than what is contracted. You may have 10MW contracted, but at any given moment in time, because of the nature of a portfolio, you may have 15MW available. So what can you do with the other 5MW?"

At present, aggregators are not permitted to 'double dip'. Burford hopes that will change where possible and says the firm is in discussions with National Grid around solutions.

"You cannot put an amount of power into two markets, but, where additional flexibility exists during certain times, you should be able to monetise that," he says.

"I think as long as you have availability for your contracted position with National Grid, you should be able to use some of those assets elsewhere."

Burford believes that would create better value, potentially bringing more flexibility to market.

CAPACITY CHALLENGE

The Capacity Market is another major source of revenue for DSR providers, though predicting what price will emerge is a challenge.

The Transitional Arrangement (TA) Capacity Auction has delivered the highest outturn to date. Specifically for turn-down DSR, the TA auction in February 2017 cleared at £45/kW for 'load' DSR to be delivered winter 2017/18. Contracts were awarded for a total derated capacity of 312MW.

Almost 90% of that capacity is new or 'unproven'. If all of it comes forward, it will represent significant growth in turn-down DSR. However, there is some debate whether aggregators will be able to deliver.

Given the penalties for non-

Risk of declining frequency revenues?

While prices for static frequency response have declined, the requirement for faster, dynamic frequency may well increase. The question then becomes how many fast acting frequency assets come to market. The penetration of batteries will figure in the equation.

"Our modeling shows storage has a major role to play - and if battery costs keep coming down then you are going to have an oversupply of frequency response services," says Restore's Louis Burford. "But National Grid's challenge remains - inertia is continuing to come off the system - and the challenge around rate of change of frequency (RoCoF) will increase as that happens," he says.

"So the demand for frequency response will increase, but [prices] will depend on the volumes of assets able to quickly help control frequency."

However, Burford believes there will have to be a floor price for frequency response. "Otherwise you would start to see the mandatory frequency response providers, large power stations, finding it is not commercially viable for them."

Engie's head of demand response services, Mark Cavill, agrees. He says the fact Engie is reinvesting in pumped storage assets illustrates its belief that frequency response offers a long-term revenue stream.

"Due to RoCoF, or a lack of inertia in the system, frequency response is inherently required by the market to manage events. So I think frequency response will [continue to] be a high value service," says Cavill.

"What will become more important to Grid is the dynamic nature of that response and also the closeness to real time in terms of managing system frequency."

Cavill therefore thinks static frequency prices will continue to erode as the premium passes to faster responding dynamic frequency.

However, Baringa Partner's Eamonn Boland suggests the price drop for even the most technically capable frequency response could be significant.

"There is a material drop in frequency response revenues in our projections. A public reference point is last summer's Enhanced Frequency Response prices clearing at an average of £8/MWh for a response within one second and that compares to the similar provision in the commercial market of £18-£22/MWh."

Boland points out that STOR revenues have settled at around a quarter of their peak rates seven years ago.

"We forecast in our modeling a similar downward pressure on frequency response pricing."

delivery are only a tenth of the Capacity Market proper (£500/MW versus £5,000/MW), some of those bidding may have felt any risk was outweighed by the reward on offer.

"I would be surprised if all of it turned up," says UK Power Reserve's Ian Tanner. The company took 10MW in the TA auction, load that it also plans to use in products such as frequency response and STOR outside of the Capacity Market winter requirements.

"With the TA's high clearing prices versus the low termination risk, I would imagine that quite a few aggregators took quite large commitments with very little idea that customers would turn up.

"So I think there is quite a high risk that a lot of it will terminate. I could be wrong though," he says, "the DSR sector is one of strong growth, so there is plenty of scope for success."

Enernoc took 87MW, over a quarter of the contracts awarded. The company is "very confident," of delivering "all of it", according to Sam Sculli, head of European sales. "We have to test this summer and then deliver through the winter - and we feel good about that."



Sam Sculli, Enernoc

Scuilli says the high clearing price has turned the heads of potential customers: "We had way more interest than we had space to fill this year."

However, the challenge then becomes what to offer customers after that one-year revenue stream disappears.

"So a big part of what we are doing right now is to find the right stacks for customers so that they can increase the revenue to fill the gap left by the [TA] Capacity Market price," says Scuilli.

Moves to simplify metering requirements (see box) and to improve 'stackability' of revenues, as proposed in Beis and Ofgem's Smart Systems and Flexibility Plan, may help bring more DSR into the Capacity Market.

TESTING TIMES

However, there are some concerns over plans to bring forward the deadline for DSR testing within the Capacity Market.

Currently, tests must be completed the autumn prior to winter delivery. Under new government proposals, intended to mitigate the risk of non-delivery, they will have to ready be a year earlier. That way, any capacity that does not materialise can be replaced in the T-1 year ahead auction.

Alastair Martin, founder and chief strategy officer at aggregator Flexitricity, says he "understands that line of reasoning". But he believes that compressing the testing timetable will "reduce the rate at which capacity comes forward". Smaller aggregators or businesses aiming to enter single sites into the CM will likely find it more difficult, he suggests.

Martin thinks the proposals may be related to the Transitional Auction, where participants have to complete tests in under a year.

"We keep an eye on the TA register, and we are not seeing lots of people passing their DSR tests," says Martin.

"Perhaps government concludes that the system will be left short – and that is the argument that is presented in favour of change."

However, Martin welcomes any moves to simplify metering requirements, which to clients, he says, are "disruptive to the extent that they go far beyond the gain that is made by the system in terms of accuracy".

More interest, but uncertainty hurting DSR

Campaigns like Power Response appear to have taken effect over the last 12 months.

"What's changed since last year's DSR report? Well, we have had a lot of inbound calls," says Enernoc's Sam Scuilli. "That suggests end users are becoming a lot more engaged and that is a real positive. The message appears to be getting out there."

What hasn't changed, he says, is pricing uncertainty.

"Nobody knows where the T-1 auction is going to clear next year for the capacity market. Nobody knows where the frequency market is going to end up," he says.

"Without longer-term price signals it will remain hard for customers to make long-term commitments. I think for anybody in the market, that is the number one concern."

UK Power Reserve's Ian Tanner agrees.

"National Grid pushing the Power Responsive programme is very positive. But to a certain extent, the media and the political support for flexibility hasn't been backed up with the financial support for it," he says.

"Although there is an idea that we will need to be more flexible and that will be rewarded, that actual commitment in terms of finance just hasn't happened."

Market uncertainty compounds the issue, Tanner believes.

"With all the changes that Ofgem and National Grid are throwing out at the moment, it is quite difficult to sell any confidence in these products being around for the long term. Pretty much everything in the industry is under review at the moment."

Government recognises metering challenge

Beis and Ofgem's Smart Systems and Flexibility Plan states: "The Government will simplify metering requirements for those offering DSR, enable asset reallocation by DSR providers, and allow the stacking of revenues between the Capacity Market and ancillary services."

Stringent metering requirements for the Capacity Market have added cost to those involved. For example, providers of similar services, such as Short Term Operating Reserve (STOR), have had to invest in new, expensive metering for the capacity market. That metering also has to be extensively tested, adding further cost and time to the process.

Network charging changes raise questions

Ofgem has decided that Triad export rates, currently around £45/kWh, will reduce by a third each year from 2018-2020. Meanwhile, from 2018, distribution network (DUoS) charges have been flattened so that the price differentials between peak and off peak periods are greatly reduced.

The decision to cut Triad payments was criticised by embedded generators with T-4 capacity market contracts awarded in 2014 and 2015. They will now receive much less money than anticipated.

Analysis published in April by Aurora Energy Research suggests up to half of small generators with those capacity market contracts for delivery in winter 2018/19 and 2019/20 could give them up and potentially bid their assets back in to year ahead T-1 auctions in the hope of a better deal. Whether or not that occurs will start to become apparent in February 2018, following the T-1 auction for 6GW of capacity starting 30 January.

On flattening of DUoS bands, Upside Energy founder Graham Oakes says it seems "crazy to be taking away that price signal at a time when we are trying to raise awareness around time of use tariffs".

Those costs are "reflective of the actual costs of running the network, so there is a real question as to why they are flattening those prices so much", he suggests.

Emerging markets: DSOs and Project Terre

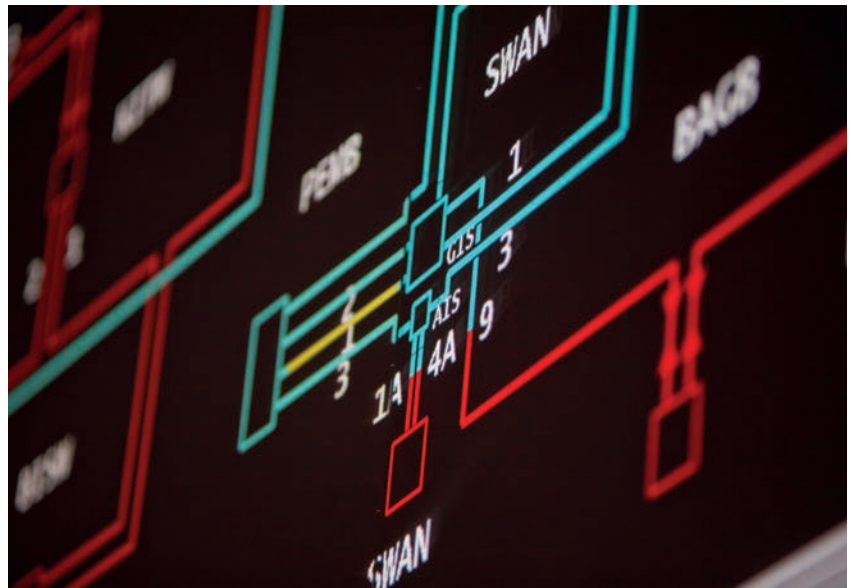
Distribution networks and European markets are emerging sources of revenue for businesses that can provide flexibility

Some distribution network operators (DNOs) are gearing up to procure balancing services to manage network constraints. Their intention is to become distribution system operators (DSOs), akin to smaller scale versions of National Grid, balancing their networks through demand management. By also feeding through to the national system so that regional actions do not create conflict, it is hoped that a more efficient, smarter power grid can be created.

The alternative is to remain with a patchwork of relatively 'dumb' networks. Dumb networks risk a lack of national visibility and, if decentralisation of generation continues, along with anticipated growth in electric vehicles, would require vastly more generation and network capacity.

Industry consensus is that smarter networks will be cheaper and more efficient to deliver - and the shift to the DSO model provides another route to market for DSR.

UK Power Networks and Western Power Distribution recently outlined plans to transition to DSOs, with the former's CEO Basil Scarsella



suggesting the DSO switch would be "a change as significant for electricity as the advent of broadband was for telecommunications."

While that represents an opportunity for DSR, it also poses challenges around market interfaces and interactions.

As Restore's Louis Burford asks, if the DSO model creates multiple markets, "how do you manage

bidding in to more than one without upsetting the purchasers of that flexibility - whether National Grid or the DSO?"

That challenge is something the DNOs and National Grid are working to address.

REGIONAL AND NATIONAL
Speaking at National Grid's Power Responsive conference in June,

Should aggregators fear the rise of the DSO?

While DSO markets represent an opportunity, some aggregators believe they may also represent a competitive threat.

UK Power Reserve's Ian Tanner worries that "some of the DNOs are almost trying to create 'nationalised' aggregators within their regions" potentially locking out commercial aggregators.

Tanner says that development would "damage competition in the market and potentially the end consumer, because they would have no option but to go through the DNO. Which would be quite detrimental to the prices they can secure".

Given much DSO transition work is being advanced via Ofgem's innovation allowances, Tanner suggests the regulator "arguably does not understand the risks [to competition] that they are funding".

Eamonn Boland, of Baringa Partners suggests that may be a valid fear.

"I think generators, I&C consumers, the people who own flexibility, will in the future potentially contract directly with DNOs and/or the system operator," he says.

If that happens, it would lead to a shift in role for commercial aggregators.

Rather than acting as a route to market for frequency response or voltage control, they would instead seek to "add incremental value to an individual asset by looking at it across a portfolio, or looking across other revenue streams", he suggests.

"I definitely think there is a movement towards the providers of flexibility contracting directly with the DNO and the System Operator," says Boland. "That means the generic, green field asset, going forward, will not have as much value as one that is strategically located."



Sotiris Georgiopoulos, head of smart grid development at UKPN, said the company was starting to focus in earnest on recruitment of companies for its Power Potential project in the South East, focused primarily on Kent and Sussex.

The aim is to create a market for flexibility that UKPN will manage and package up for National Grid while managing its own network constraints. It wants to prove that approach can deliver lower whole system balancing costs while maximising capacity on UKPN's network, reducing overall customer costs – and enabling it to connect

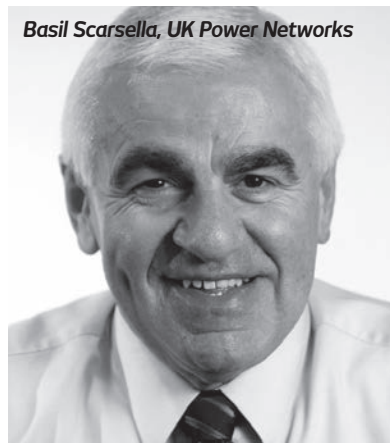


Sotiris Georgiopoulos, UKPN

distributed generation more cheaply.

UKPN, along with project partner National Grid, aims to create a market for both fast and slow reactive power on the network for voltage stability, and also active power and constraint management.

That market will give participants prices for taking actions to help balance the system and UKPN is now stepping up engagement with aggregators and I&C firms, developing framework agreements in readiness for service tendering or auctioning in 2018. The service is scheduled for initial delivery in January 2019.



Basil Scarsella, UK Power Networks

LOCATIONAL DSR

UKPN is also launching a tender for 35MW of flexibility in the East and South East as part of a separate project. The network operator will invite firms to tender early October for delivery in January 2018.

UK Power Networks seeks assets that can increase exports (generate) or reduce imports (consume less) at times of high electricity demand. It will award both availability and utilisation payments and has specific volume requirements in 10 specific locations.

The minimum clip size for providers is 500kW of flexibility, which can be aggregated across multiple sites, in order to manage constraint issues in Suffolk, London and the South East. However, the firm said it will “consider contracting directly with smaller sized resources depending on the characteristics of flexibility in each area”.

Delivery is required for between two hours and five hours to manage evening peaks in some locations, and morning and evening peaks in others.

STACKING AND SIMPLICITY

Western Power Distribution has launched a DSR trial in the East Midlands, whereby it is “trying to

understand how we can make DSR commercially viable for DNOs," according to Matt Watson, Innovation and Low Carbon Networks Engineer at WPD.

Also speaking at the Power Responsive conference, Watson said the company was focusing on minimising hassle and maximising the revenue streams flexibility providers can stack. Otherwise, "you can have a commercially viable service, but if nobody signs up, it is of no use to anyone", he said.

DSR is not primary business for most companies, so simplification is key, said Watson.

"They don't want myriad products, they want simple stuff. So we are looking at services that can stack revenues from different paths, how to engage effectively with customers and trying to create processes that are low on admin and which put the burden of complexity onto us."

SIGNALS AND CERTAINTY

Constraint management is the key rationale, said Watson, and the company aims to notify participants to reduce power or increase generation with signals a week ahead of time.

"At that point, we will pay people an 'arming fee' which assures them of profit," Watson explained. "Closer to the day, we reserve the right to call or not call them. But they will still get that fee – which is where most of the profit element for them sits. If they are called, they also receive a utilisation fee."

Some aggregators have expressed concern that WPD's approach could put them in direct competition, should its current Flexible Power project go beyond an innovation trial (see box p30).

But Watson said that kind of "simple, prompt service" was something aggregators could "use and add to," with "lots of interesting conversations" between WPD and aggregators now taking place.

PROJECT TERRE

The emergence of the DSO model throws up opportunities and challenges. But Project TERRE, an EU project to create a pan-European flexibility market, may ultimately have greater market impact.

TERRE's ultimate goal is to create a central platform that enables close to real-time exchange of balancing products between

Distribution networks could be 'main gig in town' for battery storage



While National Grid is currently the main game in town for battery storage, distribution networks could provide a significant chunk of revenues in the longer term.

"For batteries there is the immediate visible opportunity providing transmission level services, i.e. frequency response," says Baringa Partners' Eamonn Boland. "But there are similar levels of grid service requirements on the distribution network ... That is a difficult market to size if you are a developer. But we see it as being a very attractive space for the right technology solution."

Steve Edwards, who oversees a significant flexibility operation at Steel firm Liberty House (which owns Simec and in house power generation firm Marble Power), agrees that networks may ultimately require a lot of voltage control, which only fast acting assets can deliver.

"Voltage issues are below the water line at the moment, but are emerging," he says. "If we are going to make the DNOs run their networks harder, then they are going to have to run them closer to their voltage limits."

However, he says in the short-term, "I don't see the value from the DNO contracts getting anywhere close to National Grid, and I don't know the numbers to say whether that value [ultimately] migrates from transmission down to distribution."

European transmission system operators. Six TSOs are involved (GB, France, Switzerland, Spain, Portugal and Italy).

Currently scheduled to go live by September 2018, TERRE will have impacts on the national balancing markets, and it is perhaps no coincidence National Grid is looking to redesign its products to a similar timetable.

Given its imminence, Baringa Partner's Eamonn Boland expresses surprise that TERRE appears to have received little input from demand-side players.

TAKE NOTE

"I don't think it is getting the level of attention it merits, considering its potential for wholesale reform of how the primary revenue stream of

flexibility in GB today might change in the future," says Boland.

Welsh Water's Andrew Heygate-Brown agrees.

"The potential marketplace [enabled by TERRE] is massive," he says. "Yet we are the only demand-side management service provider that has been involved in the consultations and the working group."

Heygate-Brown says there is a very real need for demand-side firms to involve themselves in TERRE, as well as pushing for GB market changes.

"The key will be access to the same interface for all parties," he suggests.

"We need to have equal access as part of Project TERRE and ensure DSR providers can be included within that."



Matt Watson, WPD



Andrew Heygate-Brown, Welsh Water

Unlocking the SME market

This year's survey suggests strong appetite for DSR within the SME sector, but limited routes to market. Industry participants outline potential solutions

While some aggregators are actively targeting the SME market, most will not look at loads below 250kW.

According to Enernoc's head of European sales, Sam Scullini, cost versus return is a key barrier.

"SMEs have their own cost structures and will look at the time, the disruption and the revenue – the same questions as everybody else. But when you are talking about smaller numbers, it might not squeeze the juice for them."

While government's smart systems and flexibility plan outlines a vision of DSR for all, bringing smaller firms into balancing is commercially challenging. Scullini says it is something the market must collectively crack.

"Right now, if you have to plug in hundreds or thousands of MPANs from a small business, that is a tonne of paperwork," says Scullini. "How do you automate that, is there a way to make it easy and frictionless on the aggregator side as well?"

Martyn Gilbert, executive energy manager at BIU, says mid-market customers are starting to realise they may have some flexibility to sell and that clients with "offices with decent sized chillers" are enquiring about DSR possibilities. The main driving factor, he says, is rising non-commodity costs.

The TPI and its aggregator partners would technically look at flexible loads as small as 100kW for DSR. "That brings into play some office sites," says Gilbert. "However, in reality, I think the smallest single load [we have looked at to date] is about 250kW."

Engie, which manages around 500MW of flexibility primarily from large assets, is also pushing into the mid-market.

"We are increasingly focusing on assets we can control via BMS, for example, and looking at how we can reduce the cost of delivering

flexibility from smaller assets," says Mark Cavill, head of demand response services at the utility's energy solutions division.

LOOK BEYOND DSR

Cavill agrees 250kW per site is probably its minimum threshold, but says asset availability is a more important factor.

"You can have a megawatt that is only available 10 hours a year. If you have 250kW available all year round, that is more valuable. So it is about what assets are available, what can be flexed and for how often."

Cavill believes SMEs can unlock broader value by assessing flexibility.

"Often, when we undertake a flexibility audit, we also find thousands of pounds of energy efficiency savings," he adds. "By doing DSR on that pump, the drive, the air con, we gain second by second data and visibility of any issues."

STANDARD KIT APPROVAL

Graham Oakes is chair and chief scientist at Upside Energy, a company he founded to focus specifically on aggregation of small loads.

Oakes believes the SME market could become DSR mass market within "a couple of years", provided some technology issues and associated costs can be cracked.

Echoing Sam Scullini's point around admin burden, Oakes cites the testing process for frequency response as a significant hassle factor.

"National Grid's underlying assumption is that they are dealing with 50MW power plants and its testing process [is set up for] bespoke sites. But at a small business, you are looking at a standard UPS or another standard bit of kit," he says.

"National Grid just has no way of dealing with the fact that you are going to send them 500

spreadsheets of data, every one of which is going to be exactly the same, because you are processing a standard bit of kit. They are just not set up to handle that kind of volume."

In fairness, Oakes says Grid had no historic reason to do anything differently. But he says Upside is now "talking to Grid about setting up a process that is based upon type approval of kit rather than bespoke site-based approval."

He believes that will start to open up the SME market. Another solution might be to examine how well frequency actually needs to be read.

CHEAP FREQUENCY METERS

"There are a lot of pieces of kit out there that will read frequency arguably to National Grid's standards that cost £5-£10 a piece. But the only frequency meters that National Grid approves cost £300-£400," says Oakes. "Putting that into a small site means the first couple of years' benefit is gone and it is no longer economic."

Oakes says it is such "little things" that stand between the SME market and economic viability.

"Right now, it is just not quite there. But it is certainly very close – and National Grid is very keen to open up this market because it is in its interest as much as everyone else's."



Graham Oakes, Upside Energy

Storage: The money and the power

Can huge interest in storage be converted into gigawatts on the ground? Market participants outline the risks and the rewards

This year's survey confirms strong interest in battery storage, both from I&C businesses and the public sector, as well as energy companies and developers.

In its latest set of forecasts and across all of its scenarios, National Grid predicts around 6GW of storage will be on stream by 2020, around double current volumes, which include large scale pumped hydro.

Those predictions suggest confidence that the market can overcome the primary challenge of revenue certainty.

Government has stated it will legislate to end double charging and classification issues. When that happens, it will help business cases. But, there are also proposals to de-rate batteries significantly within the capacity market, which will hinder business cases.

Some 500MW of battery storage projects secured contracts within the December 2016 capacity auction. They must be online by 2020.

Last year National Grid's Enhanced Frequency Response tender awarded 201MW of four-year battery storage contracts that have to be online by 2018.

But the SO is now looking at a different procurement structure for frequency response, which alters the risk profile for those looking to map out bankable revenue streams.

Meanwhile, a flattening of distribution charges has altered some business cases, and a sweeping review of network charges may throw further uncertainty into the mix.

Larger developers and asset owners appear confident that they can manage those risks – and believe most volume coming forward in the next few years will be grid scale. But there is much for them to ponder.

CHANGE

"There is a lot of simultaneous change occurring, which creates

Energy storage to 'wipe out' battery storage?



Scott McGregor, CEO redT, believes battery storage as opposed to energy storage is unsustainable – and many of today's frequency response "arbitrage exploitation" opportunities may not exist in three years' time.

Neither, he says, will some of the assets.

"The returns [for frequency response] are currently good. But those batteries will degrade and have to be thrown away – and that revenue opportunity will also run away pretty quickly."

McGregor points to California, where those that piled into frequency response are now hamstrung from stacking other revenues by warranties that only allow single services. Even where warranties permit more services, assets will degrade more rapidly, he says.

"Lithium is very good if you focus it on a short cycle, not very often. Do that and it will last you ten years," says McGregor. "But if you try to frequently perform multiple functions, the lithium will be gone in a few years."

McGregor thinks the solution is flow-based energy storage, which his company produces, potentially in tandem with lithium or lead acid as a hybrid.

"The flow machine, is your workhorse. It will handle 60-80% of the work all day long: shifting solar, providing long duration services. Your lithium will provide short spikes of power. Combine the two and the lithium will last ten years, potentially even 15," says McGregor.

If technology companies can prove their assets are long-term, it will alleviate some of the finance challenges around storage, McGregor believes.

"Utility industry debt finance is what expanded the renewables industry significantly. Storage will be the same," says McGregor. "All of it is equity financed at the moment. Once you prove that storage is around for 20 years, debt will pile in."

Moreover, when investors realise there are assets that can provide multi-services over decades without degradation, "they will wipe out those short return assets," says McGregor.

SOLAR AND STORAGE

McGregor says solar and storage is a natural progression for I&C firms.

"They can [then] use their solar to handle overnight demand load – it's a massive commercial opportunity," says McGregor. Equally, he says businesses that can no longer secure PPAs due to daytime export limitations on distribution networks, should consider storage.

As well as finance issues, firms surveyed for this report suggest policy and regulatory uncertainty is hampering investment decisions. But McGregor is sanguine.

"Irrespective of government action, the policy of increasing renewables is going to drive storage," he says.

"While good policy can make markets more efficient, that's actually irrelevant. The increase in solar and wind is going to make storage mandatory."

De-rating batteries in the capacity market

The proposal to de-rate batteries in the capacity market is misguided, according to Flexitricity chief strategy officer Alastair Martin.

"The argument is that everybody should be able to deliver for two hours. But the system doesn't always need two hours," he says.

"The longest frequency deviation that I have records for occurred in May 2008 – which is also the lowest that I have seen in industry. It hit 48.8Hz and took 15 minutes to climb back up to normal levels," says Martin.

Martin believes that the problem raised by the proposal "can be dealt with by letting the market work ... through value stacking", and that the modification is essentially "about squeezing out competition" by those keen on building power stations.

high, uncertainty" says Sonia Quiterio, senior expansion manager at UK Power Reserve, which plans to deploy some 120MW of storage after securing 15-year contracts in the Capacity Market.

"We see that [uncertainty] as a challenge. But we do have very strong commercial experience in the UK and we know that eventually, these problems are going to be removed in some way, and this is what we expect from National Grid, Ofgem and Beis."

Applauding the resolve from government and regulator around classification of storage and double charging, Quiterio says they now have to deliver.

"It is a welcome message. But, if they want to see large volumes of storage deployed in the next three or four years, they have to take real action and establish an actual timeline as to when they will take those actions," she says.

"So these are the challenges that I see: Regulatory framework, definition of the asset, market design."

While Quiterio sees grid-scale assets dominating in the short-term, she says UK Power Reserve believes behind the meter (BTM) storage "will

Risk, uncertainty, finance: Public sector challenges

Devon County Council has considered energy storage to monetise onsite back-up. But investment levels and paybacks are significant hurdles, given revenue and regulatory uncertainty.

Quotes received to date are "not ridiculous" but paybacks are over 10 years, says corporate energy manager Alastair Mumford.

"The council doesn't really have an appetite for that kind of investment," he says. "There is also such a great level of uncertainty over some revenue streams. So I don't feel confident to argue that we should make an investment."

If policy changes occur, says Mumford, "then that changes everything and you are stuck with a very expensive box with lots of chemicals in it".

PPA ROUTE

The Council explored siting batteries on redundant land sites with a developer. But high connections charges "meant none of them stacked up".

However, Mumford says Devon hasn't given up on storage.

"My conclusion is that it is high risk, therefore we don't want to be the primary investor. So we would go down the Power Purchase Agreement route, make little or no capital investment, and share the revenue with the developer." Mumford though says only two firms have offered that type of deal, "So I have concerns about the sustainability of that market".

FUNDING

Councils will struggle to progress storage without funding, says Mumford, with Devon currently bidding for European Regional Development Funds to support the installation of renewable technology collocated with storage and EV charging points. It has secured some European Regional Development Funds for its Zero Emissions Buildings Catalyst, part of which will fund integration of solar and storage in one of its public buildings.

"But that [project] is only viable because we have a chunk of European money to put towards it. Without that, it is not going to work."

boom" in later years.

"There are many applications for I&C customers," she says.

VOLTAGE CONTROL

In the meantime, Quiterio believes voltage control will be a significant revenue stream for battery storage – provided it is 'stackable'.

"National Grid is developing voltage control [products], which is really interesting," she says. "Along with voltage control, if you have

a big enough battery, you can do arbitrage, you can do peak shaving or you can do load shifting if you are collocating with any other asset [such as renewable generation]."

The ability to combine as many revenue streams as possible – revenue stacking – makes a stronger business case. However, some products, such as EFR, stipulate exclusivity, which Quiterio hopes will not be the case with future products such as voltage control.

Sonia Quiterio, UK Power Reserve



Alastair Mumford, Devon Council

Insufficient independent expertise

Marks & Spencer is considering battery storage. Energy efficiency manager, Maria Spyrou, needs to write a tender specification, but says independent expertise is thin on the ground.

"It is very difficult to write a spec. Because the technologies are so different - you don't want to be too specific but neither do you want to say 'I just want a battery'," Spyrou explains.

"Finding partners that can support us in writing that tender spec that are not actually battery manufacturers themselves is extremely challenging."

While battery manufacturers are happy to help, the retailers' procurement rules prevent working with technology providers for any project worth more than £500K.

"So if the manufacturers are the only experts it becomes very difficult to move the project forwards."



I&C: Not just about the money

Martyn Gilbert, executive energy manager at third party intermediary BIU, says clients are expressing interest in storage, but that interest is driven largely by approaches by equipment vendors.

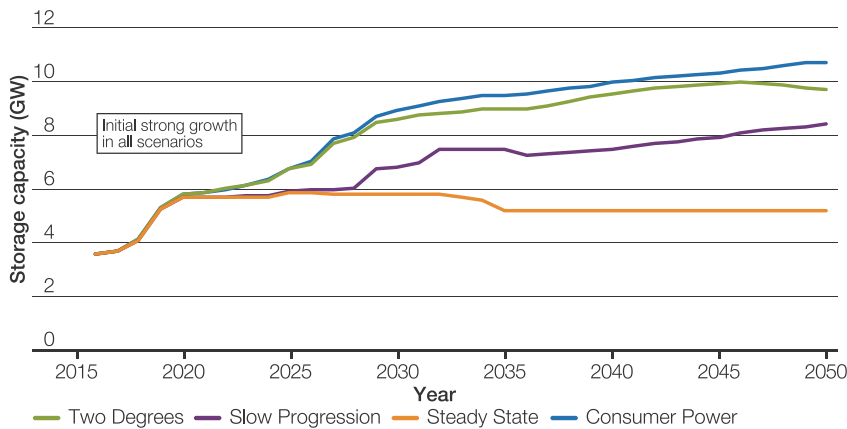
But he says interest is not purely revenue-driven. "Some clients expressing interest are those that are experiencing brownouts or small dips in supply and that is something that their standby generation has no ability to compensate for," says Gilbert. "So it may be that a battery solution would work better for them in those circumstances."

He says revenue challenged clients, particularly manufacturers, are looking more seriously at lease and operate arrangements which help them avoid cost without requiring capital investment.

"Where [storage projects] become Opex related, provided clients can show a net gain, then it is far more attractive to them in that context."

Figure 4.7
Storage capacity to 2050

Source: National Grid



DNO/DSO MARKETS

Steve Edwards, who heads up Flexibility for steel group Liberty House and its internal power company, Marble Power, thinks distribution networks will also be a significant market for batteries and voltage control.

"Talking with DNOs, they see an awful lot more issues than National Grid necessarily does, or has to deal with. So the voltage issues I

think are below the water line at the moment, but are emerging," he says.

If DNOs run their networks harder, says Edwards, it follows that they must run them closer to their voltage limits. "It would make sense for them to do that using dynamic services to help ensure supply. Because that means you end up making better use of your network overall and that has to be a cheaper solution to the

end customer."

Edwards is unsure whether the value "ultimately migrates from transmission to distribution" for that kind of service. In the short term he does not see "the value from the DNO contracts getting anywhere close to National Grid".

But bringing the DNOs into the picture "increases the value opportunity," he says. "And from an economists' perspective, you are devolving the problem to where it originates," Edwards suggests.



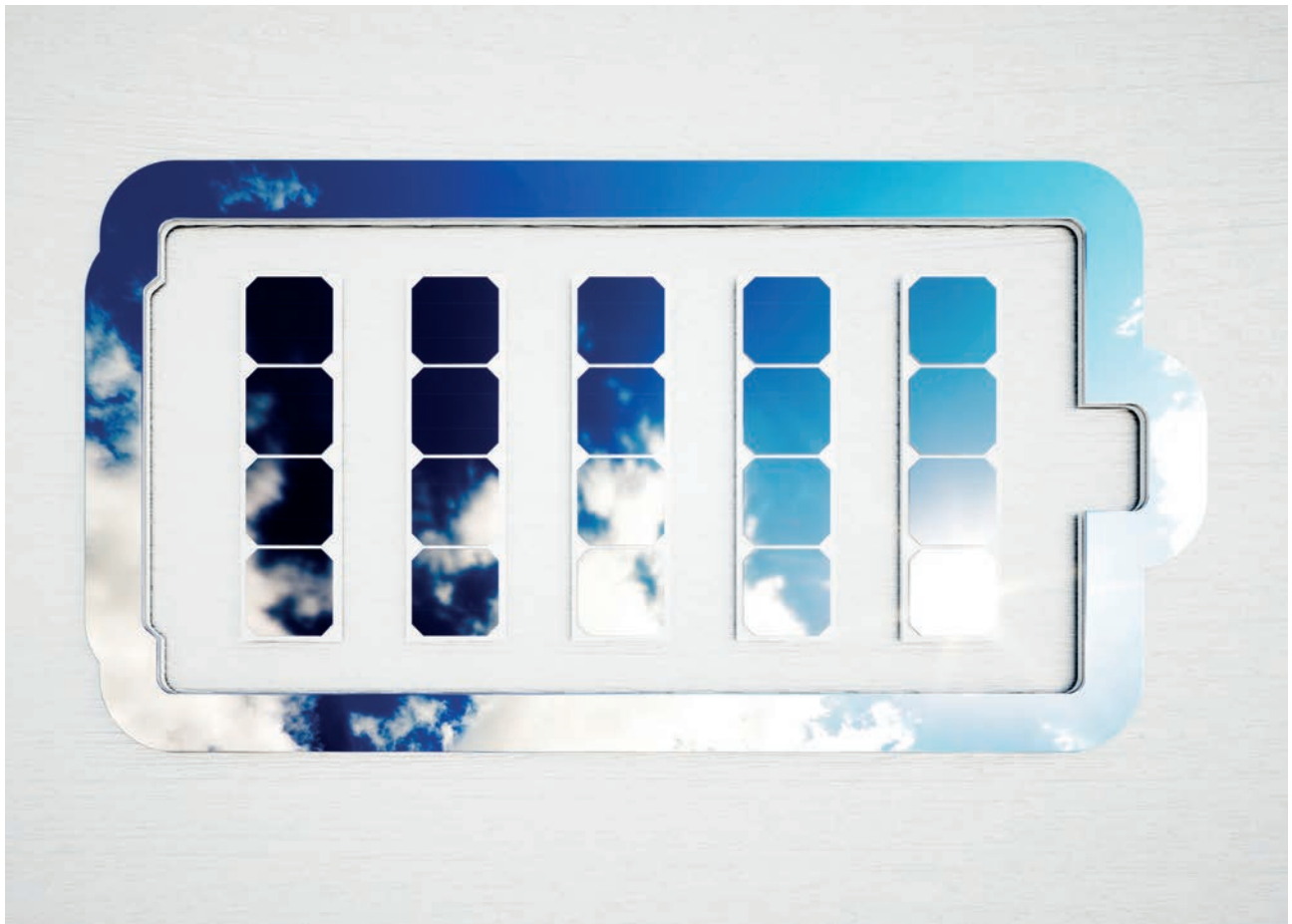
Martyn Gilbert, BIU



Steve Edwards, Liberty House



Eamonn Boland, Baringa Partners



PLACE YOUR BETS

Eamonn Boland, of consultancy Baringa Partners, believes DNOs may eventually become a key market for batteries.

While it is currently “a difficult market to size if you are a developer, we see it as being a very attractive space for the right technology solution”.

That technology may not be short-discharge batteries, he

says, underlining redT chief Scott McGregor’s points about longer term storage potentially offering some level of future proofing (see box, p34).

“Lithium-ion batteries are very good solutions for what the market is asking for today – for fast injections of power over short timescales,” says Boland.

“But it is not clear if they will continue to be the solution of choice

in 4-5 years’ time, when perhaps wholesale power arbitrage is the primary revenue stream, or DNO grid services requiring four hours of load shifting is the larger market, or if DNOs are looking for voltage support,” he suggests.

“How people manage that changing market outlook with the technology they invest in today [is a key challenge].”

Batteries and DSR: Sweat assets, maximise income

There is some debate around batteries potentially cannibalizing some DSR revenues. But many believe combining assets can create capabilities and income greater than the sum of their parts.

“If you are providing a balancing service to National Grid, you could use batteries for the first few seconds and then utilise other assets for the duration [of the event],” says Mark Cavill, head of demand response services within Engie’s Energy Solutions division. “You can look at it in a virtual power plant manner. Those are the interesting solutions.”

Cavill sees batteries moving beyond niches into “mainstream merchant applications” and says Engie predicts “large volumes being deployed” within five years.

But for now, he thinks energy companies and those familiar with traded markets may be the initial driving force.

“If you are using a battery in a merchant manner, trying to generate revenue from different services that are not necessarily 100% certain is going to add a lot of risk into that business case,” says Cavill.

Restore’s Louis Burford broadly agrees with both Cavill and redT’s Scott McGregor.

“There remain some significant question marks over standalone batteries: degradation, warranties and revenue streams, which creates challenges for investors,” he says.

“But by combining multiple assets that offset specific weaknesses, you start to build some very compelling portfolios and extremely versatile capability.”



Making arrangements more suitable to the changing energy landscape

By Louise van Rensburg and Shai Hassid, Energy Systems, Ofgem

It has been an eventful year since the 2016 *Energyst* report on Demand Side Response (DSR). We have witnessed unprecedented levels of DSR volumes in the last T-4 capacity market auction, with volumes tripling and reaching 1.4GW of DSR capacity. Alongside this, we have also seen more DSR winning contracts in different balancing services when competing against other technologies. These and other developments have strengthened our confidence in DSR delivering even more value to consumers going forward.

The DSR sector has been rapidly evolving. We have seen new entrants to the sector, offering new and innovative DSR propositions to customers. We have also witnessed acquisitions of aggregator companies and collaborations between companies and utilities offering DSR. This signals the emergence of new business models for the provision of flexibility. Following the growing success of DSR among industrial and commercial consumers, we expect to see DSR realising its potential among smaller scale consumers in the future as well.



Our joint November call for evidence with government set out our intention to remove regulatory and policy barriers to a smarter, more flexible system. This includes making it easier for all providers of flexibility, including storage and customers offering DSR directly or through aggregators, to access markets and compete on a level playing field. There were over 250 responses to the call for evidence and the outcome of our work is set out in our Smart Systems and Flexibility plan published jointly with government this July. Most of the changes should



take place within the next two years.

ACCESS FOR ALL?

Independent aggregators can accelerate the uptake of DSR among consumers. Integrating aggregators into existing arrangements and allowing them access to markets that they cannot use at the moment (such as the electricity balancing mechanism) will need careful design. If we can do this successfully, it will bring benefits to customers. To explain our views, we published a letter alongside the action plan discussing key issues to consider

Why are you not providing DSR?

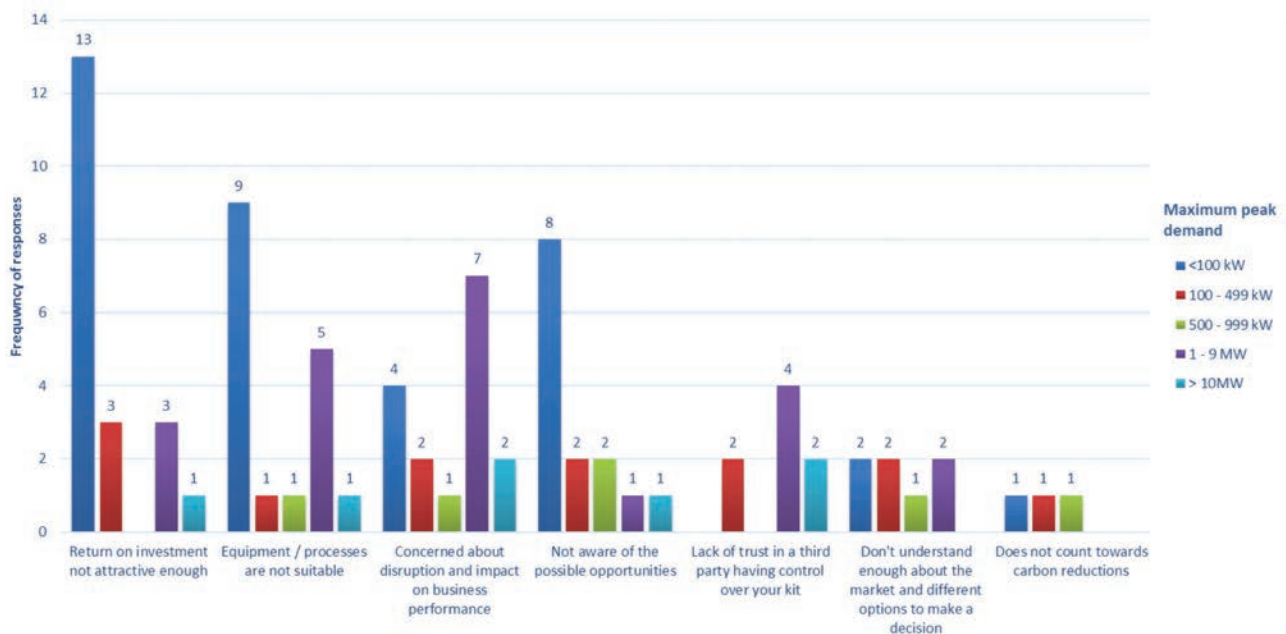


Fig 1: Ofgem analysis based on survey results

Source: The Energyst



when designing arrangements to accommodate aggregators. We believe the views presented in the letter can be helpful in current and future industry discussions. We strongly encourage stakeholders to participate in the different industry code modification discussions and contribute to shaping tomorrow's market arrangements.

STORAGE RULE CHANGES

Storage is another provider of flexibility. We also looked at what needs to be done to make sure it can compete on a level playing with other forms of flexibility. We concluded that storage should be defined as a distinct form of generation in regulation and legislation. This will help to ensure that we and industry can make the rule changes needed so that network charges paid by storage are consistent across GB. We also want to licence storage as a specific type of generator. The licence will allow storage facilities to stop paying levies that fund Government environmental programmes, which are charged to end consumers. This, and a range of other charging proposals we have made, will improve the ability of storage to compete.

Additionally, we confirmed our view that network operators should not be looking to develop any new storage facilities of their

own. Instead, they should be buying storage output from other providers. This is important because we want to see competition in provision of storage services and for network operators to remain neutral market facilitators that are impartial in the way they manage their networks. On this we have also asked the Energy Networks Association, through their Open Networks project, to report on how parties will deliver opening up the delivery of network requirements to the market so that solutions such as storage or DSR can compete directly with more traditional network solutions, including as an alternative to reinforcement. As part of this, we have asked that network and system needs be signalled well in advance, to inform investment. National Grid, through its Power Responsive programme, will also be working on simplifying their products and informing potential providers of services about the opportunities for getting involved.

TRICKLE DOWN EFFECT?

These themes of investment opportunities and information were reflected in this year's Energyst survey. The chart (left) from the survey report, shows that a lot of customers with lower peak demand said that the main reason they didn't participate in DSR is because of low

returns. And a lot of customers with lower peak demand said they were not aware of DSR opportunities. So, with the barriers mentioned above being unlocked, we expect that awareness of increased DSR opportunities could increase participation by these smaller demand customers.

TRUST, CHANGE, KEEPING UP

It is also interesting to note that the issue of trust in third parties, such as aggregators, has come up. This has been recognised among aggregators as an important issue. Our research showed good support for the current work by the Association for Decentralised Energy to put in place a code of conduct for aggregators. We support the development of the code and once it is in place, we will observe how effective it is. We will keep existing protections for consumers that use aggregators' services under review.

It is important that policymakers and regulators keep pace with the rapid changes we are seeing in the energy sector. We must all work together so that consumers can enjoy the full benefits of a smarter, more flexible energy system. We are therefore looking forward to continuing our engagement with consumers and working alongside the industry as the system evolves.

Understand assets, improve core business



BIU is a third party intermediary with numerous large and mid-market clients across the industrial, commercial and public sectors.



Historically, it has focused on procurement, management and efficiency, but is moving deeper into flexibility as market disciplines begin to converge.

Executive energy manager, Martyn Gilbert, says clients are becoming more interested in DSR, driven largely by rising non-commodity costs.

The firm has therefore struck strategic partnerships with aggregators and aims to broaden the scope of its DSR offering.

Gilbert says customers with standby generation are becoming more interested in monetising assets that are otherwise declining in value, while clients in the manufacturing sector in particular are sharpening focus on cost control and revenue opportunities.

While interest in DSR is increasing, Gilbert says knowledge and understanding is a limiting factor. He agrees cultural resistance and fear around technical risk is inhibiting market take-up, but believes those barriers can be overcome by challenging customer perceptions around risk and outlining revenue opportunities.

He also says mid-market customers are waking up to the fact that they may have sufficient flexibility to benefit from aggregation,

and that DSR is not necessarily the preserve of large energy users.

So what advice can BIU offer to organisations considering DSR/DSM opportunities?

"It dovetails with Esos, the Energy Savings Opportunity Scheme," says Gilbert.

"Fundamentally, it is around understanding the significant energy-using equipment across your portfolio and asking whether and when it needs to be in use. Only from that point will you have an understanding of what you may be able to harness in programmes such as DSR.

"Everyone is focused on core business, but if you take a step back, you may find there is a better, more efficient way of doing whatever it is you do."

Think creatively to unlock value



Enernoc believes the tide is turning for DSR. Sam Sculli, the firm's regional director, European sales, says programmes like National Grid's Power Responsive campaign are starting to bear fruit.



Moreover, a strong clearing price in the Transitional Arrangement (TA) Capacity Market auction specifically for turn down DSR earlier this year, has alerted more businesses to the potential revenues that can be unlocked from flexible consumption.

"The message is getting out there," says Sculli. "We have had a lot of inbound calls this year. That suggests businesses are becoming more

engaged with DSR – and that is a real positive."

While there is some uncertainty over market prices, Sculli is confident the firm can find ways to combine and optimise the new sources of flexibility it is now testing for customers as part of the Transitional Arrangement programme.

In addition, Sculli believes Enernoc's recent acquisition by global utility, Enel, brings considerable opportunity and resource to the aggregator. Enel also operates a significant renewable energy division, Enel Green Power, which recently acquired one of only eight Enhanced Frequency Response contracts tendered by National Grid.

"Enernoc is very bullish that a large utility is buying us to build out its solutions business," he says. "That

is going to have a positive result for Enernoc and its customers globally."

Enernoc, which claims a 6.8GW portfolio across markets including North America, Europe, Asia and Australia, offers Capacity Market, STOR and frequency products to UK customers and has the ability to provide Demand Turn-Up. Large firms on its books include Anglian Water, EMR Group and London Underground.

Sculli's advice to potential customers mulling DSR provision, or working out how to unlock more?

"Ultimately, continue to think creatively about your business, because your competitors probably are," he says.

"There should be a way to take the opportunity and find value if you think creatively about it."

Blend data, technology and agility



Engie's DSR asset pool stands at around 500MW.

Mark Cavill, head of Demand Response Services at the

firm's Energy Solutions division, believes portfolio breadth and technical expertise set it apart.

"The portfolio is a mix of generation and turn down and encompasses everything from small back-up generators, to 50MW OCGTs, to smaller compressors through to huge 5MW mills," says Cavill.

"We work well within more complex environments, where a customer wants to partner around DSR and wants the end-to-end journey managed," he adds.



Cavill says businesses considering DSR should first understand their flexibility and then ensure that counterparty contracts are not restricted to single services.

That boils down to "working in partnership so that both parties are incentivised to extract the maximum value from the flexibility," says Cavill.

Technology also plays a key role and Cavill says Engie aims to launch an AI-driven platform within a year.

The company last year acquired digital energy management firm C3 Resources and Cavill believes its machine learning algorithms will optimise revenues for customers by automating decisions based on real-time data.

"Ultimately our strategy is working out how can we input significant volumes of market data – e.g.

intraday imbalance markets, external weather, Net Imbalance Volumes, energy specific data from large scale generation, energy prices, network costs and all the different third party elements - and create an optimisation engine," says Cavill.

"Then we can determine the best times for flexibility for certain services within customer priorities and parameters. We can crystallise that value and automate it for them."

In the meantime, Cavill says businesses considering DSR should: "Do your own research, understand your commercial drivers for doing it and go into it with open eyes, because typically it is a non-core business activity. However, by working with a transparent partner, it is one that is eminently achievable for most businesses."

Access all available markets



Within its broader flexible portfolio, Eon currently has some 160MW of flexibility under contract from around 20 industrial and commercial businesses – and the supplier is expanding its DSR footprint.

Eon believes the value of flexibility will increase - and says its ability to access all revenue streams, contracted and merchant, creates a competitive advantage.

"A benefit of having the synergy between supply and flexibility is that we are able to take a holistic approach to help customers to optimise across the different markets and benefit from the wholesale



energy markets as well as National Grid DSR schemes," says Annalisa Bell, sales and origination manager at Eon's Virtual Power Plant & Flexibility Unit

"It is key to stack revenues from all available markets. For example, accessing the Capacity Market where you can secure value four years ahead; then building in value from different markets. Understanding how all these pieces can come together for an individual customer is necessary to maximise value."

Agility within contracted products and traded markets ensures maximum value for customers, says Bell. Eon, experienced in more liquid flexibility markets via its Virtual Power Plant team in Germany, believes that know-how will prove useful as National Grid brings its procurement

processes closer to real time.

However, Bell acknowledges that from a customer perspective, DSR can appear complex and uncertain. She says it is up to the service provider to "take customers on a journey" of understanding, simplify market complexity and create bespoke products that best fit their assets to assuage any fear of technical and commercial risk.

So what steps should businesses mulling DSR provision consider?

"Talk to a trusted energy partner. Assess the options available and speak with people who can help you understand the market and what is right for you," says Bell.

"All customers are different and they all have different requirements, so it is about finding the right solution for your business."

Identify the opportunity, then maximise it



“The power grid is becoming more complex. With complexity comes opportunity - and the opportunity will sit with the businesses that have identified their flexibility, for sure,” says Restore UK vice president, Louis Burford.



While revenues in various DSR programmes will fluctuate according to supply and demand, he says “the value of flexibility as a whole is only going to increase, because volatility is only going one way”.

As National Grid moves closer to real time procurement of balancing services, Burford believes the DSR market will become more accessible.

“A demand-side consumer does not have the luxury of predictability that a power station operator has. However, as those markets move closer to real time, businesses have a better view of whether or not they can monetise flexibility at that time.”

While National Grid’s moves to simplify its product suite are welcome, Burford believes emerging opportunities throw up new complexity. He says that is where technology will differentiate aggregators.

“The intelligence has to come from predictive software and machine learning that understands patterns, not just in the way that a consumer uses their equipment, but also what is going on in the wider market,” says Burford.

“If you have the right incoming

feeds into systems and the right intelligence behind that, you are going to capture the most value.”

Burford’s advice for businesses thinking about DSR?

“Take small steps. That builds confidence that participating in DSR is less disruptive than a lot of people believe,” says Burford.

“Work with people that know what they are doing, because while there is value to be had in a flexible megawatt, what if there are actually two megawatts there?” he adds.

“Look at track records, look at the public auctions to see what prices aggregators are achieving and hold them to it. It is not a commoditised market, aggregators do not all achieve the same price - there is an element of trading expertise and experience that differentiates them.”

Combining procurement, flex and storage



UK Power Reserve specialises in flexible assets, and is building out an 823MW portfolio. That includes 120MW of battery storage for which it secured 15-year contracts in the December 2016 Capacity Market auction.



In terms of demand-side response, the company struck a deal last year with Total Gas & Power to provide DSR and aggregation services.

Ian Tanner, power & markets manager at UK Power Reserve, says the partnership is bearing fruit, as procurement and management can be aligned with flexibility schemes and security of supply programmes

such as the Capacity Market, with customers gaining the benefit of two sets of expertise.

UK Power Reserve believes “that flexibility is going to increase in value, driven by the changing generation mix and the loss of the spare capacity,” says Tanner.

While providing revenue certainty to DSR customers amid energy market flux is a challenge, the firm is confident it can maximise the value of flexibility across all markets, however they may change.

Tanner says the company has equally strong data security credentials, which helps alleviate growing market concerns over cyber security.

“We have our own data centres, they are all protected with their own security systems in place,” he says.

DSR customers are mostly large I&C businesses, and include the likes of Network Rail and Pilkington Glass.



Meanwhile, the company is also examining how it can maximise the opportunities presented by battery storage.

Its current focus is primarily on grid-scale projects and applications, but UK Power Reserve believes behind the meter storage will “boom” in coming years, says Sonia Quiterio, senior expansion manager.

“There are many applications for I&C customers,” says Quiterio. “We are leveraging our partnership with them and aim to be a market leader in this space.”

Clearing the first hurdle



G59 Professional Services was established to make the demand-side response (DSR) journey as painless as possible for clients with existing and new generation assets, including batteries.



The company specialises in G59/3 applications, financial modelling, technical specifications and project management for Blue Chip companies, including Marks and Spencer.

Its mission is to help organisations clear the first hurdle in providing DSR – and ensure optimal returns.

The G59/3 application process essentially allows businesses to participate in DSR. Many businesses

have generation assets, but are restricted in terms of the power they can push back onto the grid. Obtaining 'long term paralleling' capability for those assets requires permission from the distribution network operator.

If permission is granted, that enables businesses to:

- Participate in STOR, Capacity Mechanism, TRIAD management without any outage issues and maximise revenue through exporting any spill.
 - Obtain Power Purchase Agreements (PPAs) to generate further revenue from export spill.
- However, the G59/3 document is highly technical in nature.

It requires in-depth knowledge of the electrical characteristics of your system, calculation of various short

circuit current conditions and half hourly analysis of site demand and generator output.

If the application is not completed correctly, DNOs will "stop the clock" on the application, according to G59 Professional Services director, Mark Thomas.

He says the process can be challenging even for Blue Chip companies, which is why G59 Professional Services was founded by Chartered Electrical Engineers with experience in bringing assets into DSR with minimum cost and fuss.

The company provides all associated technical services and can assist with specification and tendering for works, aggregators, and PPAs. The firm also advises on electricity supply contract types to maximise revenue gains.

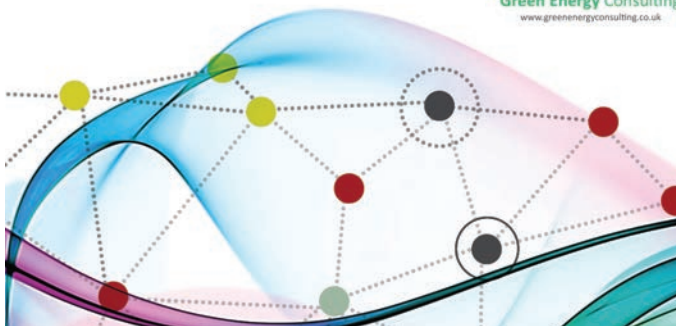
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