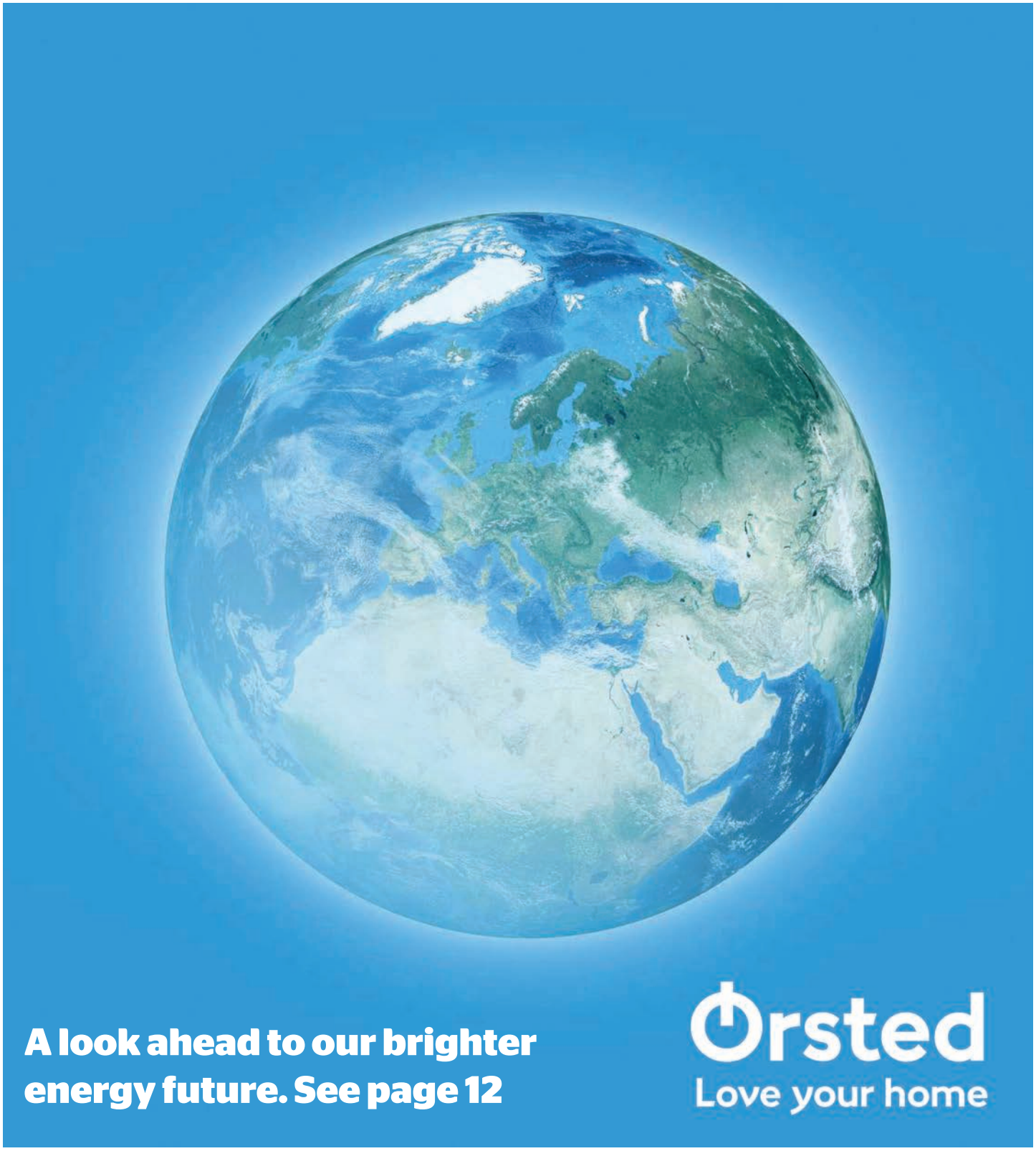
the energyst

"I predict an Ofgem defeat on Triad cuts" p52



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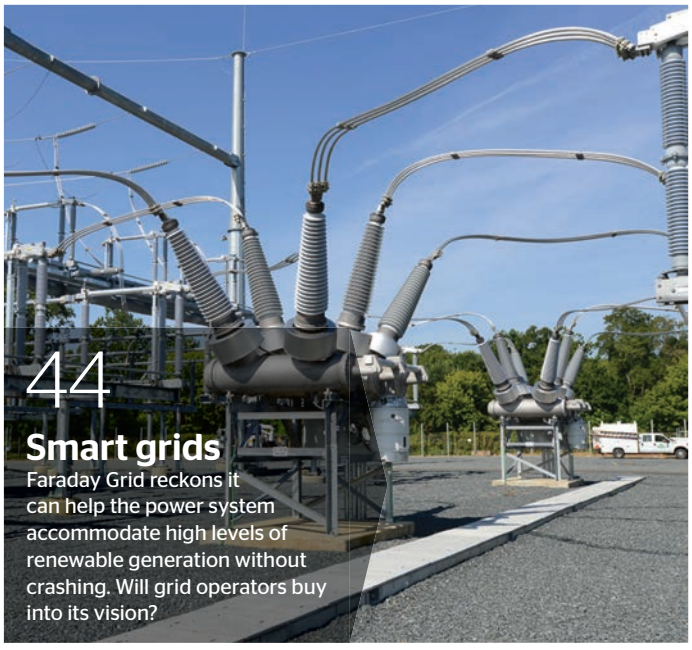

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What would Warren Buffett do?

Warren Buffett once said: "It is not necessary to do extraordinary things to get extraordinary results." He also said: "I don't look to jump over seven-foot bars; I look around for one-foot bars that I can step over."*

As well as spawning an industry in web pages detailing his top 10 quotes, from where the above were lifted, Buffett has made billions from taking a long-term view of companies. He analyses their underlying proposition, their strengths and their management teams to spot value that others often overlook in favour of shorter-term returns.

> ***A company that fails to implement efficiency measures is not working to deliver maximum shareholder value***

Corporate responsibility is arguably a proxy for good management. Energy management falls under that umbrella and its interesting to see government aiming to make energy reporting more transparent via a consultation which closes this month.

By making larger firms disclose consumption, emissions and, potentially, mitigation efforts (or otherwise), the government could bring a financial stick to bear: It could be argued that any company that fails to implement cost-effective efficiency measures is not working to deliver maximum shareholder value.

'Increased and more consistent disclosure of energy and carbon data will raise awareness of energy efficiency, and improve transparency for investors so they are better able to hold companies to account,' the consultation states. If the FD or CEO has to field awkward questions at the AGM about why they have not invested in energy efficiency measures – which have been pointed out to them via mandatory energy audits – it might increase the likelihood of action and investment where viable.

It might not, but it is a step in the right direction while enabling government to avoid taking a direct stick to businesses. And as Buffett suggests, lots of small steps can take us further than a giant leap.

But there's the rub: the government's proposals only apply to large companies.

While it published a glut of papers and consultations around clean growth and industrial strategy at the back end of 2017, there was arguably very little in terms of concrete plans or help for the UK's 5.6 million SMEs, which by volume make up 99% of the private sector.

Meanwhile, policy cost exemptions for the largest firms will push up energy bills for every other company.

So while policymakers should be congratulated for taking steps to shine a light on corporate energy, it would be refreshing to see the current government do something for the many and not just the few in 2018.

*Buffett also said "let blockheads read what blockheads wrote". All the best for the year ahead.

Brendan Coyne
Contributing editor

the energyst

Editor
Tim McManan-Smith
tim@energystmedia.com
t: 020 3714 4450
m: 07818 574308

Contributing editor
Brendan Coyne
brendan@energystmedia.com
t: 020 3771 1267
m: 07557 109724

Design and production
Paul Lindsell
production@energystmedia.com
m: 07790 434813

Sales director
Steve Swaine
steve@energystmedia.com
t: 020 3714 4451
m: 07818 574300

Commercial manager
Daniel Coyne
daniel@energystmedia.com
t: 020 3751 7863
m: 07557 109476

Circulation enquiries
circulation@energystmedia.com

energyst media

Energyst Media Ltd, PO BOX 420, Reigate, Surrey RH2 2DU

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Ofgem floats network charging options, moots charging for onsite generation

Ofgem has floated plans to make grid access rights flexible and capacity tradable as part of its major review of network charges.

The regulator said it is also looking at basing network charges on gross demand – not net. That would mean network charges for businesses even where they are using onsite generation.

While Ofgem will consult before taking any plans forward, it said any new arrangements will be in place by 2020/21.

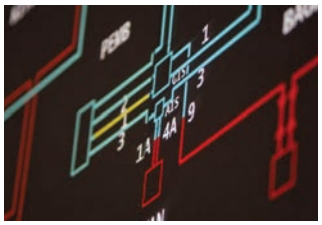
Ofgem is looking at both retrospective (residual) network charging, which helps pay for 'sunk' network costs, as well as how to charge for future access and use of the system.

Ofgem states that there may be 'considerable benefits to levying residual charges on final demand, compared to generation' and the regulator sets out ways that those charges could be applied.

It appears to rule out net charging but will give consideration to fixed charging based on profile class.

The regulator says while it would not apply gross charging to households, it sees merit in applying that approach to businesses.

Such a move would have implications for companies with onsite generation.



Network capacity could be traded, auctioned or transferred between users

Meanwhile, on forward looking costs, specifically connections, the regulator is looking at flexible arrangements in order to sweat network capacity.

"Those that are happy to have their output curtailed at times of system stress could be offered cheaper access. Network capacity could also be traded, auctioned or transferred between users," summarised Andrew Wright, Ofgem's senior partner for electricity systems.

"This could lower the overall costs to all customers of the energy system," he suggested.

See the draft guidance at http://bit.ly/2AnOuWO

Renewables-energy storage collocation guidelines published

Ofgem has published draft guidance around collocation of energy storage at renewable generation sites that qualify for subsidies under the Feed-in Tariff (Fit) and Renewables Obligation (RO) schemes.

The regulator underlined that the guidance is in draft form and suggested generators seek technical and legal advice before progressing collocation projects to avoid jeopardising their subsidy revenues.

The guidance states: There are four overarching principles that operators of RO generating stations or owners of Fit installations should consider when thinking about co-locating storage with generation accredited under the schemes. These are:

1. Co-located storage does not change generators' obligations

to comply with the RO and FIT scheme requirements.

2. Generators can only receive support for eligible renewable electricity generated by an accredited RO generating station or FIT installation.

3. Installing storage will not alter the Total Installed Capacity of the RO generating station or FIT installation.

4. The schemes' eligibility requirements are not changed by the type of storage technology.

See the draft guidance at http://bit.ly/2BrJDHq

SSE merger: customers will not feel billing pain

Npower has reassured its business customers that they will not experience billing problems as a result of the proposed merger of its retail operations with SSE's.

If the deal goes ahead, SSE will keep its business-to-business customers, while the new retail company will combine SSE's domestic customers and Npower's domestic and business customers.

The merger will require significant integration and billing systems changes tend to cause problems. Market analysis about the deal nods to the energy sector's chequered record on integration as a potential stumbling block.

It remains to be seen how that plays out in the domestic market, but an Npower spokesperson told *The Energyst* that "the integration of the billing system will not have any implications" for Npower business customers.

"The intention is to use SAP for SSE's domestic customers only as they are the only customers coming into the new company. SSE's B2B business is not coming to the new company but stays with SSE. Npower's SME customers are already on SAP while its large customers are not being moved onto SAP," added the spokesperson.

In November, Npower parent company Innogy wrote down the value of its UK retail operation by £427m, citing hardening market and political conditions. Npower posted a £92m pre-tax loss for the nine months to September.

Centrica acquires DSR aggregator Restore

Centrica has acquired demand-side response aggregator Restore for £62m. The firm, which operates across northern Europe, specialises in unlocking and monetising industrial flexibility. It claims a total portfolio of 1.7GW under management across Belgium, the UK, France and Germany.

The move comes as other energy companies look to partner with or acquire aggregators, with some market participants predicting further consolidation.

It also follows the recent acquisition of Enernoc by Italian utility Enel, and a major investment in Limejump by Statkraft, whose boss Erik Nygard has suggested the UK Big Six will have to acquire aggregators or "fall by the wayside".

With Centrica's resource and geographical footprint, Restore will now also target the US market.

Restore's co-founders Pieter-Jan Mermans and Jan-Willem Rombouts said: "There is clearly a momentum in the market right now so we are thrilled to be working with Centrica to further scale the go-to-market of Restore's software solutions and demand response services in the UK, North America and other international markets."

Jorge Pikunic, managing director of Centrica Distributed Energy & Power, said: "Restore's proprietary technology and track record with large I&C customers will add to our optimisation capabilities and enable growth opportunities as global markets for flexibility continue to evolve."

Limejump raises further cash to scale flexibility platform

Virtual power plant operator and energy supplier Limejump has raised further funds to scale its operations.

The company did not disclose the exact amount raised, but in a statement said that following its £3m series A funding in summer, lead by Statkraft Ventures, it has doubled the round.

SET Ventures is the new investor.

The Amsterdam-based venture capital firm specialises in early growth stage European technology companies with high growth potential and has a particular focus on energy, IT and communications.

"Limejump is one of the fastest growing European next-generation utilities," said Craig Douglas, investment manager at SET Ventures. "The scalability of their system and strong forward-looking team make Limejump a potential winner in the evolving energy value chain."

Limejump CEO Erik Nygard said SET Ventures' investment "further validates the business model and technology Limejump is developing. This is an exciting time in the energy space and it is important for us to align with the right type of investors".

Interested in demand-side response and battery storage? Download The Energyst's latest market reports at theenergyst.com

National Grid to bring wind and solar into FFR and details balancing services overhaul

National Grid is working with platform providers in a bid to allow non-dispatchable sources of generation such as wind and solar into frequency response.

The system operator will run a trial next year to see if intermittent sources of power can help keep the UK power system stable.

The proposal is among a number published by National Grid as it moves to rationalise its suite of balancing tools in a bid to mitigate a increasing power grid volatility.

Firm Frequency Response (FFR) is one of the main tools used by National Grid to maintain system frequency at around 50Hz.

The system operator's document says it will bring its procurement of FFR more closely in line with the wholesale market in terms of short-term and longer term tenders, as well as the 'blocks' of availability throughout the day that bidders can specify.

National Grid said it would also simplify FFR contracts, make its testing and compliance processes more suitable for new market entrants and review its exclusivity clauses, which will be welcomed by aggregators seeking to bid portfolios of flexibility into more than one place.

The system operator also shed some light on its thoughts for a replacement Enhanced Frequency Response (EFR) product, which last year awarded contracts to battery providers that could provide sub-second response.

National Grid said it is now considering a split product – one that effectively 'blasts' faults for 60 seconds in order to contain them, followed if necessary by a secondary service required for up to 30 minutes.

National Grid said it plans to procure these faster acting response services "towards the back end of 2018, subject to further analysis and modelling".

However, it underlined that the more fast acting services it provides, the less it may require other frequency services, which will affect revenues for current market participants.

National Grid also set out its plans for reserve products.

It will split out STOR products into those that can respond faster or slower than 20 minutes notice. For Fast Reserve, it will change its procurement to run different tenders for different time periods – and will no longer procure long term services until the impact of pan-European reserve services (TERRE and MARI) become clear. Those pan-European products could eventually replace some of the UK's Balancing Mechanism and reserve services, said National Grid.

The system operator said it is also working to implement a new dispatch platform for reserve services, much of which are currently manually instructed.

It will also apply the learnings from its close to real time FFR trial, which will run on a pay as clear, not pay as bid basis, to the reserve market.

National Grid said it would publish proposals around reactive power, black start and constraints in the first quarter of 2018.

More energy intensive firms to be exempt from policy costs?

More energy intensive firms could be exempted from energy policy costs, depending on the outcome of a consultation promised in the government's Industrial Strategy.

Currently, a small number of the largest industrial companies are able to avoid paying for government policy costs such as the Renewables Obligation and Contracts for Difference scheme, which are added to everyone else's bills.

Exempting those firms is intended to safeguard UK jobs and heavy industry.

However, many other energy intensives believe they are being placed at a competitive disadvantage by paying higher prices for energy compared with manufacturers in other countries. November's announcement appears to have given them little to cheer about.

Exempting firms is intended to safeguard UK jobs and production of energy intensive materials

> *[The lobby group was] disappointed not to see clearer proposals to benefit UK competitiveness on energy for ceramics and other energy intensive industries*

Laura Cohen, chief executive of the British Ceramic Federation, said the lobby group was "disappointed not to see clearer proposals to benefit UK competitiveness on energy for ceramics and other energy intensive industries".

She added: "We are also disappointed that government is unable to take forward, at this stage, our proposals for a ceramic sector deal."

Elsewhere, the Industrial Strategy reiterated government's intention to develop a new scheme to encourage energy efficiency investment by large firms, as outlined in the clean growth plan, published in October.

The government also promised to consult in 2018 on 'a package of measures to support businesses to further improve their energy productivity'.

Business energy supplier Yü Energy enters water market

Business energy supplier Yü Energy has entered water market. The company will trade as Yü Water.

Selling both water and energy to business clients can potentially deliver savings on administration and procurement costs.

A survey by *The Energyst* 12 months ago suggested that around nine in 10 firms would buy water and energy from a single supplier if it delivered cost savings. TPIs interviewed for our subsequent Directors' Report suggested consolidated billing may offer savings for large, multisite businesses that may otherwise deal with several regional suppliers.

Yü's move could indicate that more energy suppliers are planning to enter the water retail market. Gas supplier Regent acquired a water licence in February.

However, while some water companies have indicated privately that they may consider entering the energy retail market, no large supplier has yet done so.

Ofwat senior director Emma Kelso welcomed Yü's market entry.

"It's good news to see suppliers bring different areas of expertise to the water market – with Yü Water bringing theirs from a background in energy," she said.

Yü Group CEO, Bobby Kalar, said the firm's "focus remains on our core offering in the provision of energy, however this enables us to offer a bespoke, value-added service to our customers who seek the flexibility of a one-stop-shop for their utility needs".

■ Water regulator Ofwat has poached one of Ofgem's senior leaders to be its new chief executive.

Rachel Fletcher, a senior partner and board member, will join on 8 January after more than a decade with the energy regulator.

Fletcher replaces Cathryn Ross, who is heading to BT.

TPI Businesswise Solutions plots recruitment drive

Lancashire-based Businesswise Solutions plans to double its headcount and open a London office following a series of big-name client wins.

In recent months the firm has added AO.com, DFS, Daisy Group and Burnley Football Club to its client roster.

Boss Frazer Durris said the firm has set aside a £1m budget to double its headcount to 60 in 2018 as well as invest in a new energy management platform and office upgrades.

Durris congratulated existing staff on delivering a "fantastic year for the business" and said they played a "vital" role in the company's decision making.

LG Energy acquires fellow TPI Guild Energy

Lancashire-based LG Energy Group has acquired a controlling interest in Liverpool's Guild Energy for an undisclosed sum.

LGE managing director Asif Rizvi said the acquisition boosts the consultancy's footprint and broadens its market coverage, adding Guild's largely SME customer base to LGE's predominantly industrial and commercial operation.

"The sharing of people, knowledge and systems across the companies will only strengthen the management and direction of both businesses," said Rizvi.

Guild Energy co-founder Paul Trepte credited current MD Karen Trepte with delivering rapid growth, expanding the business from two people to 40 employees across two office locations in under two years. The firm said it is still hiring, aiming for 50-strong headcount by the start of 2018.

Paul Trepte said the merger would bring additional services to the firm's small business clients, giving "the SME world some of the client propositions that industrial and commercial customers have enjoyed for some time".

New PPA adds flexibility to mix

Total Gas & Power and Reactive Technologies believe they can maximise the value of solar via a hybrid power purchase agreement that exploits flexibility markets.

The companies say their 'Enhanced PPA' gives solar generators scope both to secure long-term revenues for their output, but also additional income via flexibility opportunities. Currently primarily imbalance markets, the technology company in future plans to bid into other niches.

The firms signed a framework agreement to collaborate in July and have subsequently won a tender for a long-term 310MW solar PPA, which they believe underscores their combined credentials.

Council plans giant battery

Swindon Borough Council has submitted a planning application for a battery storage facility with a capacity of up to 50MW/50MWh.

If consented, it would be one of the largest UK standalone batteries developed to date.

The application was made by Public Power Solutions, which is owned by the council.

BP buys into solar firm Lightsource

BP will pay £149m for a 43% of UK-based solar developer Lightsource. The firm, which manages 2GW of solar, will be rebadged as Lightsource BP. Nick Boyle, CEO and founder of Lightsource, said the deal made "strategic sense". BP CEO Bob Dudley said the firm was "excited to be coming back to solar".

Aggregator Flexitricity to become energy supplier, eyes balancing mechanism prize

Aggregator Flexitricity plans to become an energy supplier from mid-2018. The firm has applied for a supply licence and will target specific customers ahead of launch.

Some aggregators already hold a supply licence but do not actually supply much energy to their customers.

Instead, they use it to access the balancing mechanism (BM), which is becoming an increasingly valuable source of revenue for demand-side response providers.

The BM is a real-time balancing market used by National Grid to balance supply and demand, whereas its other demand-side response products tend to be awarded as contracts for set services for set durations. It provides a year round opportunity for

Alastair Martin: 'We intend to be an actual supplier'

those with flexibility to sell to National Grid. But currently, only those with supply licences can access the balancing mechanism, a market currently worth around £350m a year.

While Ofgem plans to make provisions for non-licenced parties to have some access to the BM, potentially by mid-2018, Flexitricity chief strategy officer, Alastair Martin, told *The Energyst* unfettered access on its terms was the primary reason to acquire the licence.

"We are not convinced that the arrangements coming forward will be sufficiently immune to soft power from incumbent suppliers. The BM has been in place for around 16 years and still customers can't participate. They could have participated all the way through if suppliers had made it possible. So if existing suppliers remain gate holders of the BM then we have to open the gate."

However, Martin said the company would not be a 'shell-type' supplier using the licence for the BM alone, but hopes to supply customers for whom its approach could unlock greater value. "We intend to be an actual supplier. Not to every customer we have, it will be quite specialist and will only suit some of them, such as those on a pass-through contract. We are not going to be offering people [long-term, fixed price] deals, if they need that, they should stay with traditional suppliers," he said.

"It will suit some customers, but not all. But there's a niche customer base out there who could do more if they had the opportunity. That's what this is about. We're cracking open the most important market in flexible energy for those who can both earn from it and contribute to it."

Initially the new service will be targeted at businesses and public sector organisations, and is particularly suited towards those that operate community energy schemes, combined heat and power generators and cold stores, as well as battery developers.

Tidal energy firm seeks funds as it clocks up 1GWh

Tidal energy firm Scotrenewables says its 2.2MW floating turbine has clocked up 1GWh at the European Marine Energy Centre (EMEC) in Orkney.

The company will now go to market for further funds to help commercialise its technology.

The SR2000, the company's first full scale turbine, was towed to Orkney from the Harland and Wolf shipyard in Belfast in 2016 for grid connected testing. Initial generation started in 2017 and the company claims it quickly set a world record for the highest export level from a tidal turbine of 2.2MW.

While the turbine has suffered some outages during that time, CEO Andrew Scott said the speed with which they could be fixed, using low cost vessels, "validates the engineering approach we have pioneered".

The firm recently appointed financial advisors Simmons & Company to initiate a fundraising effort to help the business transition to commercial operations and build its first arrays.

Atlantis plans 160MW Wyre estuary tidal barrage

Marine energy firm Atlantis is planning a 160MW tidal barrage in the Wyre estuary with company boss Tim Cornelius touting it as the "pathfinder project the UK government is looking for".

The firm has signed heads of terms with the Duchy of Lancaster for an option for the long-term lease of the riverbed and hopes to start building the array after obtaining consents, which would take about three years. The scheme would also act as a flood protection mechanism.

"We believe our tidal barrage and flood protection project in the Wyre estuary offers a route to low cost, predictable and sustainable domestic electricity supply," said Cornelius.

"This is the pathfinder project the UK government is looking for, with the potential to facilitate wide-scale development of the UK's enviable tidal range resources.

"The development, construction and operation of tidal barrages, a well understood and proven predictable renewable energy technology, will stimulate local economies across the country, establishing improved infrastructure and creating job and supply chain opportunities.

"Tidal barrages will also provide a good balance for the UK's renewable portfolio which is currently heavily weighted with intermittent offshore wind," said Cornelius.

Shell buy piles pressure onto energy incumbents

Shell is to buy First Utility, the largest of the independent energy suppliers.

Shell announced in the summer that it would re-enter the I&C market. Acquiring First Utility also gives it a 3% share of the UK domestic market.

First Utility grew rapidly up until 2014 but customer numbers have since remained relatively flat. That may now change. Mark Gainsborough, Shell's executive vice president of New Energies, said "the time is right to build upon our strong relationship with First Utility by investing to grow its business".

Aggressive customer acquisition would pile further pressure onto market incumbents. SSE and Npower are attempting to stem customer losses and untether other aspects of their businesses by creating a joint retail entity.

The remainder of the 'Big Six' suppliers are losing customers to more nimble rivals, with lower legacy costs and overheads. Smaller independents do not have to pay certain policy costs, which are then pushed back onto Big Six customer bills, exacerbating price differentials.

Meanwhile, other big guns are eyeing the market. Vattenfall, owned by the Swedish state, bought independent energy retailer iSupply in June. It may be that further deals are struck in 2018.

Mitie chief backs smart energy to revive fortunes

Mitie chief executive Phil Bentley says the FM firm's smart energy platform is "gaining traction" with 13 bids won in the past six months.

The former British Gas chief took the helm of the company in 2017 after a profit warning dented its share price. Mitie's value subsequently rose but has been on the wane since June this year.

However, Bently suggested the first half had been "solid" and that the company is "on track" to revive its fortunes.

The company has now installed 5,000 sensors via its Connected Workspace service, which aims to cut costs for companies by making smarter user of their energy via intelligent controls.

As well as making energy use more efficient, the aim is to make returns from selling flexible energy into contracted and non-contracted flexibility markets. Pilots are now live at Fujitsu and Allianz.

Posting half-year results, the company said it had won 13 bids from 62 clients to whom it has touted its Connected Workspace service. However, the division made a £500,000 loss, attributed to higher senior staff costs and a new sales and commercial team as it attempts to drum up more smart business.

Overall, Mitie posted a half-year loss of £5.5m versus an £86.8m loss for the same period in 2017.

The company said it had received bids for its property management division and is now treating it as a discontinued operation with a sale process under way.

Our brighter energy future

As we head into a new year, Orsted managing director Jeff Whittingham reflects on some of the key milestones of the past 12 months, as well as looking ahead to what we should anticipate for the coming year

From a sustainability perspective, 2017 has been year of notable progress. Firstly, in April we saw the first zero-coal day since the Industrial Revolution. Shortly afterwards, on 7 June, we saw another breakthrough, with renewables providing more energy than coal and gas for the first time ever. Combined with nuclear, low carbon sources were providing more than 70% of electricity in Great Britain.

Wind generation also continued to break records across Northern Europe – and still does. Around the same time, there was a renewed commitment to low carbon vehicles; our UK government announced its intention to ban the sale of new diesel and petrol cars and vans from 2040, hot on the heels of a similar commitment from the French government.

The autumn brought with it the much-awaited Clean Growth Strategy, articulating the UK's ambitions to make sustainability a cornerstone of the country's economic growth plans, a point which was further echoed in Beis' Industrial Strategy.

The season then ended with the COP23 talks in November, which the Climate Group described as concluding on a "positive and cautiously optimistic note", despite the withdrawal of the US from the Paris Agreement.

Finally, and on a more personal note, our company outgrew its roots as Danish Oil and Natural Gas (Dong), rebranding to become Ørsted at the start of November and furthering our commitment to a world powered entirely by green energy.

The renewable journey

Renewable energy has truly been on a phenomenal journey. Just five years ago, the government set a target to bring the cost of offshore wind down to £100/MWh by 2020.

Investments in innovation, technology and efficiency have enabled us to surpass that target, as a combined result of standardising components, increasing the scale of wind farms, driving greater efficiencies across project build and developing a solid supply chain.

Offshore wind achieved the lowest ever strike price for future projects, with our Hornsea Two project being awarded a contract for £57.50/MWh in 2017's CfD auctions – great news for our green transformation, not to mention crucial for the UK in working towards its carbon reduction targets. We truly believe that offshore wind can become the backbone of the UK's energy transformation.

While variability is often perceived as a barrier to providing baseload volume, the sector continues to make enormous progress. As offshore wind moves into deeper and windier waters, and the location of wind farms becomes more diverse, offshore wind will continue to provide an ever more reliable power supply.

We know that decarbonising the energy sector is vital to achieve the fourth and fifth carbon budgets but does it resonate with consumers?

We recently undertook the world's largest global attitudes survey to better understand sentiment in relation to green transformation, known as the "Green Energy Barometer". Some 26,000 people were surveyed across 13 nations, including 2,000 respondents in the UK. At a headline level, we found that an overwhelming 82% believe it is important to create a world fully powered by renewable energy. This support is primarily rooted in a combination of national pride about technology leadership, concern about climate change, economic advantages and societal benefits.

In 2018, we will see the inaugural "stocktake" of

Ørsted believes offshore wind will continue to provide an ever more reliable power supply

progress towards the Paris Agreement goals, known as the Talanoa Dialogue. Committed nations will assess where we are in achieving the collective goal of limiting global temperature rises to well below 2°C, where we want to get to and how to get there. The good news is that we are seeing genuine support for decarbonisation across the board, evidenced by our Green Energy Barometer as well as widespread business support and government movements including the Clean Growth Strategy.

It is clear that businesses have a significant part to play in achieving the targets described. Reducing carbon footprint has been high on the agenda for many organisations for some time now, and the collective efforts of UK plc are vital to our sustainable future.

Enabling businesses to make greener choices

While most businesses aspire to operate sustainably, for some it can feel like a luxury where greener options might come at a higher cost. This became evident when the Climate Change Levy (CCL) exemption for renewable electricity was removed in 2015, making green energy more expensive for businesses to buy. At Ørsted we believe that companies should be able to make environmentally friendly options without putting themselves at commercial disadvantage.

In 2016, we took the decision to invest to cover the cost of the price difference between green and black energy, so businesses could access 100% renewable electricity from our offshore wind farms without paying a price premium. This has really resonated with companies keen to act sustainably, reduce their carbon footprint and respond to the demands of their own consumers to be environmentally responsible.

Since then we have also launched our Corporate Power Purchase Agreement product. This enables organisations to support specific offshore wind farms via longer-term agreements. In return, they can fix the commodity cost for the duration of the agreement, introducing long-term price certainty into energy budgeting.

We see it as another way to help businesses to take confident, risk-free steps to reducing their carbon footprint for the longer term.

The Budget announced it would be making funding available to support the electrification of transport which, coupled with the focus on electric vehicles within November's Industrial Strategy, means a likely shift for companies' fleet vehicles. Integral to organisational transport strategies should be energy. Moving away from diesel and petrol vehicles is a great step in terms of climate change, but where electric vehicles are then charged with black energy, the move does not seem logical. Premium-free green electricity allows organisations of all sizes to maximise the benefit of shifting to electric vehicles – both environmentally and reputationally.

Benefit from a flexible approach

As our energy system transforms into one that is decentralised and more sustainable, we need to approach our interaction with it slightly differently. A key facet of our energy future is flexibility in consumption. Electric vehicles will have an exciting role to play in this going forward, with much work going into technology that alters charging patterns in response to system needs, helping to balance supply and demand more effectively. In the meantime, businesses are the most important parties in providing that balance, due to the higher volumes that they use in comparison with domestic users.

Demand-side response schemes are nothing new. Schemes such as Short-Term Operating Reserve (STOR) have been around for more than a decade now and most larger businesses have been reducing consumption during anticipated Triad periods for several years, in a bid to reduce transmission costs. What has changed in recent years is the sheer breadth of schemes available to enable as many companies as possible to contribute their flexible volume in return for a financial reward.

We are also seeing the rise of schemes such as Ørsted's Renewable Balancing Reserve, which complements DSR schemes by enabling businesses to earn revenue from the imbalance market as well, by helping to reduce Ørsted's own imbalance.

Working together to achieve environmental goals

More than ever, now is the time for companies to embrace sustainability. The government's Industrial Strategy is centred around the opportunity for the UK to put its best minds into environmental technologies, to create jobs and commercial advantage, so that our nation might take the lead on the global stage. Consumer demand reflects this ambition. Increasingly, organisations are standing up and stating their commitment to reducing the environmental impact of their operations.

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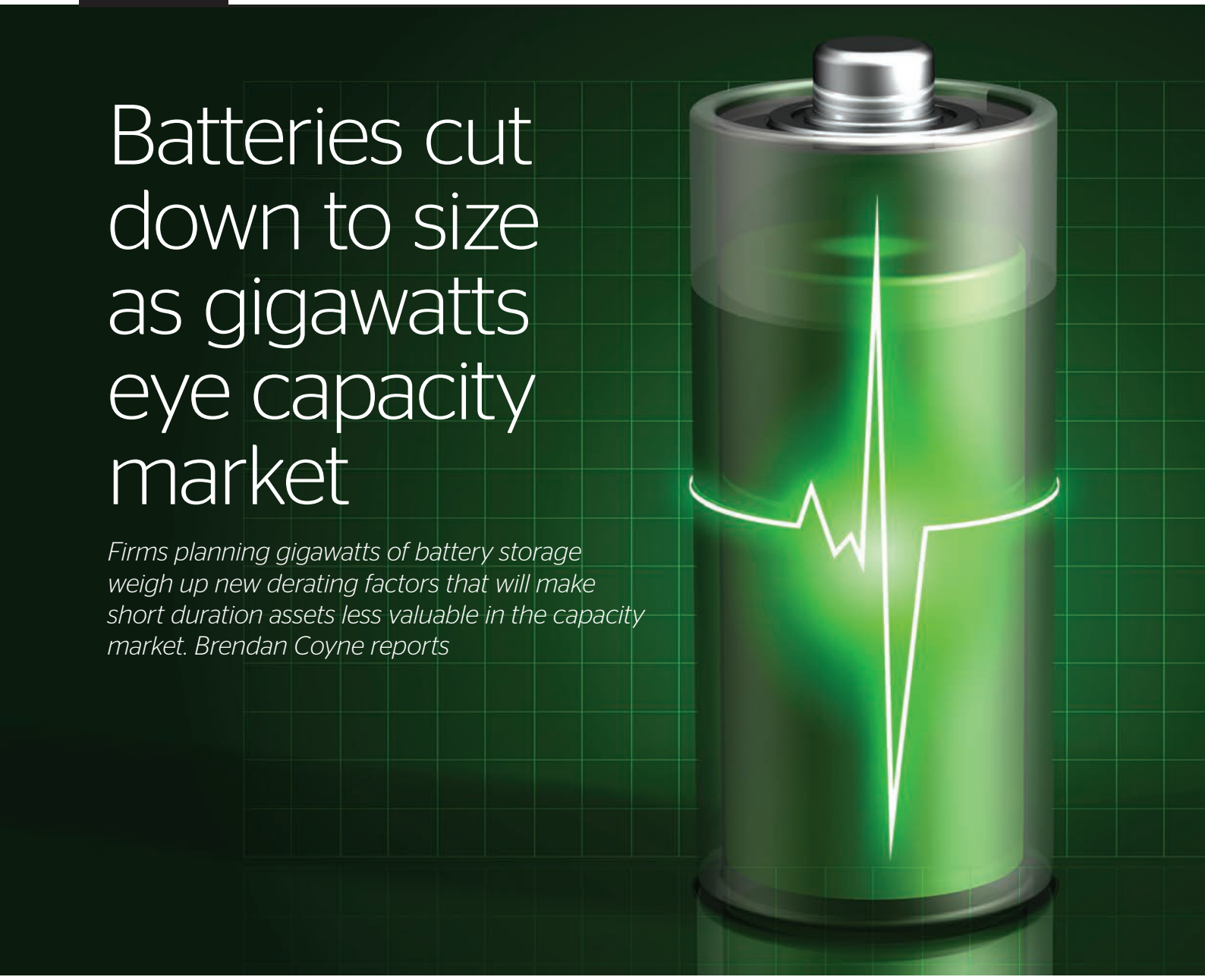
Batteries cut down to size as gigawatts eye capacity market

Firms planning gigawatts of battery storage weigh up new derating factors that will make short duration assets less valuable in the capacity market. Brendan Coyne reports



New capacity market rules mean that batteries that can deliver for 30 minutes will be rated at approximately a fifth of their maximum output while assets that can discharge for four hours will receive the same derating factor as pumped hydro (96%).

The changes follow concerns by Scottish Power, which owns a lot of pumped hydro, that batteries should not be treated on the same footing.

The capacity market (CM) is intended to improve security of supply over winter. Auctions run one year ahead of delivery (called T-1) and four years ahead (T-4).

Companies building new power generation assets can bid for long-term contracts of up to 15 years in return for guaranteeing to provide power over the winter peak. There are also short-term contracts available for existing generation of all types – from big power stations to small engines and demand-side response.

In future, there may also be scope for unsubsidised renewables to bid in to the market, with Ofgem set to consult in spring on how that might work.

Capacity market costs are added to energy bills.

Bankable revenue

For batteries, and other forms of generation, securing long-term contracts is important because it provides a small but 'bankable' part of the revenue stream required to make batteries financeable. Much of the other revenues batteries can try to accrue are merchant, or short-duration contracts.

Battery developers planning to build assets with shorter durations will now be bidding for less revenue, if they decide to bid.

However, the government

> ***Without derating, we would have seen a lot more batteries coming through***

said it had to ensure that it was not over-rewarding assets unable to provide cover for longer duration outages. National Grid analysis suggested the mean stress event duration is around two hours, but that most are under four hours.

The new derating factors, which apply going forward but not to existing CM contracts, reflect that requirement, said Beis.

Figure 1: Proposed storage derating factors

Minimum duration	2018/19 T-1	2021/22 T-4
0.5 hours	21.34%	17.89%
1 hour	40.41%	36.44%
1.5 hours	55.95%	52.28%
2 hours	68.05%	64.34%
2.5 hours	77.27%	75.47%
3 hours	82.63%	82.03%
3.5 hours	85.74%	85.74%
4 hours +	96.11%	96.11%

Source: National Grid

Adjust volume

Of approximately 27GW of potential new build capacity prequalified for the T-4 auction, around 4.8GW is new battery storage.

Storage developers must now carefully consider whether to build longer duration batteries or drop out, given the overall prequalifying volume of generation is around 30GW above the government's 50.5GW target. That could indicate a low clearing price, but the outturn will be influenced by coal stations and whether operators decide that staying open for four more years is worth their while.

Just over 2GW of storage also prequalified for the T-1 auction, which will have to compete with existing coal and gas plant as well as other forms of generation and demand-side response.

While some storage developers may lament the derating factors being published after auction pre-qualification results, Beis had served warning in July, and others believe government is taking a prudent approach.

UK Power Reserve has prequalified some 600MW of gas and 400MW of batteries within the auctions.

The firm's director of policy and regulation, Michael Jenner, said derating was "absolutely appropriate" and does not change the firm's "bullish outlook" for UK distributed gas generation and battery storage.

"If you are looking to design a market to deal with a stress event, you want to reward assets commensurate with their ability to help reduce those stress events," he told *The Energyst*.

"So derating of shorter-term batteries is absolutely appropriate. It will make the market think carefully about options – the incentive is now there for investors to think about building longer duration storage assets."

However, Jenner suggested derating factors could lead to fewer battery storage firms winning contracts than last year's 500MW.

"Each investor has to make its own decision. But I would expect this to have a significant effect on bidding prices. Without derating, we would have seen a lot more batteries coming through – with the derating factor applied, we expect to see a much reduced battery play."

While the auction outcome cannot be predicted, Jenner said he would "not be surprised if we saw fewer batteries win contracts than we saw last year."

While some developers may "take it on the chin", derating factors "could push a lot, if not most of it, out of the auction," added Jenner.

"We will be looking carefully at what this means for us in next year's auction but it doesn't change our ambitious growth plans for battery storage in the UK, nor our positive view for the development of the industry as a whole," he said.

What happens next?

The T-4 capacity auction starts on 6 February. It will procure power to be delivered in winter 2021/22. Previous T-4 auctions have cleared between £18 and £22/kW. It aims to procure around 50GW.

The T-1 auction starts on 30 January. It aims to procure around 6GW power for next winter. The last T-1 auction cleared at £6.95/kW. te

Georgina Penfold, CEO, Electricity Storage Network: "The changes to the derating factors for storage is significant, as it alters the business model for many projects depending on the relative power/energy ratios of the storage system. Inevitably there will be winners and losers. However, these changes were foreseeable. It is indicative of the fact that storage is becoming a mature technology.

"The government maintains that it is committed to the continued deployment of storage, and we are pleased to continue to work with them to promote appropriate development of storage assets both behind the meter and for system resilience."

Frank Gordon, policy manager at the Renewable Energy Association: "The changes are slightly less drastic than those first proposed but could make it harder for a number of battery storage projects to compete.

"This is one of many recent changes that are undermining the growth of this sector. Recent revisions to 'embedded generation' payments slashed the support that small-scale, distributed generation receives and there could be more pain for the sector in future grid payments reform. Considering government [has published proposals to] encourage future battery manufacturing, it seems strange to undermine the development of a battery storage market.

"The timing of these changes is our main criticism, however. They are being applied in the midst of an ongoing auction process, akin to changing the rules of a football match at half-time."

Scott McGregor, CEO, RedT: "'Derating' is a negative word. But RedT will get the full rating of 96%, because our flow machines are long duration energy systems. So we think the announcement is great news. The only guarantee that anybody has in this market is that policy will change. That makes it crucial for storage platforms to be flexible."

Batteries, Beis and bafflement

In derating batteries for the capacity market, Flexitricity's chief strategy officer Alastair Martin thinks National Grid has achieved the right answer. But was it set the right question?

I think National Grid adopted a good approach to the question it had been set. Its analysis method always struck me as the right one to apply to that problem. I am not convinced it was the right question, however.

The Capacity Market was intended to be additional to other revenue sources, which could include energy, ancillary services, locational support, and so on. Since those other revenue sources reward different capabilities in different ways, market forces will shape the capabilities which people will build, and the Capacity Market can be technology-neutral. That, at least, was the idea.

Beis has sent a baffling message, believes Alastair Martin

Market-force restrictions

For batteries, Capacity Market revenue alone cannot fund development, so they rely on contracts like frequency response to form part of the revenue stack. There is only so much half-hour-duration frequency response that National Grid can use. According to Capacity Market design principles, market forces should restrict the volume of half-hour batteries without anyone intervening in the Capacity Market.

There are other things beyond duration that affect what effect capacity has on system security, such as location, speed, inertia and reactive power capabilities. For example, when it is very windy, other generation in Scotland cannot help secure supplies in England and Wales, because if it is turned up, then the wind has to be turned down.

If Beis is removing technology neutrality from the Capacity Market, then it should be considering all of those other factors. As it is, it has cherry-picked the problem it is trying to solve, lost faith in the market on that score only, and sent a baffling message to the industry.

> *I am not seeing much that would suggest a breakthrough on long-range storage is imminent*

Hybrid storage the norm?

The other likely outcome is that hybrid storage/peaker sites could become the norm. A number of developers are already pursuing this variation – by pairing short-run batteries with engines, you get near-instant response coupled with potentially unlimited duration.

As a means of arbitraging renewables, it is not as good as true long-range storage would be, because once the battery is exhausted, the site becomes a peaking station with no heat recovery, and we already have lots of those. So the hybrid role is still subject to market-force restrictions.

I am not seeing much that would suggest a breakthrough on long-range storage is imminent. There are encouraging signs but those are coming from technology developers, not the Capacity Market.

On the auction volumes, between existing generation and proven DSR, there's 7.6GW in the T-1 auction. Another 6.5GW is available from unproven DSR and new-build generation. So the available volume dwarfs the requirement. Whether or not that means a price crash depends largely on how serious the bidders are. We can draw obvious inferences about short-run battery projects but, beyond that, pre-match analysis won't tell us how this is going to turn out.

On the T-4, the register looks in so many ways like previous pre-auction registers. Existing generation and proven DSR can meet all of the volume requirement. Whether the auction gets into new-build territory still depends on how existing stations view their energy market opportunities beyond 2021. Up to now, existing generators have been bullish.

The available gigawatts of generation from proven and unproven DSR dwarfs the requirement

New build CCGTs have remained locked out partly because of this, and partly because new-build peakers treat energy market revenue very differently. Given other recent developments on network charging, the peakers might alter their tactics. But little has changed for the existing generators other than 2025 getting closer. te

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Does my battery look big in this?

Victoria Box, external communications manager at the Energy Storage Network, explains why size matters when it comes to stacking services that underpin the economics of battery storage

Batteries are in vogue; understanding their size is crucial. Physical size is important for site space but there are two key battery characteristics we need to know when asking "is it big enough?": power, and energy capacity.

A battery's maximum power is measured in megawatts (MW) and its energy capacity is measured in megawatt hours (MWh).

The MW rating describes how much power a battery can store and dispense: this is the headline figure quoted in the press.

Ignore at peril

The MWh rating is more complex, and sometimes ignored – with serious repercussions. A car's engine size determines how fast the car can travel but the fuel tank size tells you how far you can drive it before you need to refuel it.

So, in a similar way, a battery's maximum energy capacity (MWh) dictates for how long the battery can provide its power.

It is no good having a 1MW, 0.5MWh battery if you need it to provide power for one hour before recharging – instead you would need a 1MW, 1MWh battery. The 1MW, 0.5MWh battery can dispense 1MW in 30 minutes. A battery may look big but its energy capacity may not be the right fit.

However, batteries can charge or discharge at less than their maximum power. So, a 1MW, 0.5MWh battery could provide 1MW for 30 minutes, or 0.5MW for 60 minutes.

> ***A battery may look big but its energy capacity may not be the right fit***

Crucially, the lifetime of many types of batteries can be prolonged by operating at less than the maximum power rating – and longer battery lifetime reduces the overall ownership cost.

Different battery types (such as lead acid, lithium ion and sodium ceramic) based on different electrochemical reactions have different power:energy ratios.

Different chemistries naturally suit different durations: for example, some lead acid batteries are great for high power output in vehicle starter motors; some lithium ion chemistries can be configured for either high energy capacity or high power output, and flow batteries often suit high energy capacities.

Specialist battery sales staff often refer to the 'C-rate' of a battery: asking them to use terms such as MW and MWh makes conversation much simpler.

Some batteries are asymmetric: they can discharge at a higher power rating than they can charge (or vice versa). This means that the power conversion system – the part of the battery system that turns AC into DC and back again – needs to be the right size for the maximum possible power rating.

Economically, we need to understand a system's requirements before selecting an ideal battery. One battery may look big but what capacity is needed? A system's needs may change over time, so headroom (both in power and in energy) is beneficial when planning.

Size matters

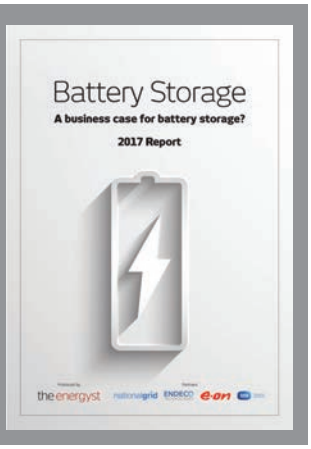
Energy managers installing a battery for frequency response and similar grid services can opt for a short duration battery; one with a lower energy capacity. These also work well for an uninterruptible power supply, providing that there is a back-up generator ready before the battery is exhausted.

However, an energy manager wanting to reduce peak demand will need a longer duration battery. Reducing demand for one half-hour period with a half-hour battery leaves no margin for uncertainty, and we would suggest a one-hour (or longer) system should be considered.

If the site has its own self-generation, the calculation of optimum size should maximise self-consumption and reduce expenditure on purchased electricity. This is more complex but help is at hand: suppliers are now able to work with users through the selection process.

When selecting a battery, looking beyond the biggest size label will get the fit just right. te

The Electricty Storage Network outlines the different types of energy storage, their attributes and applications in *The Energyst's* recent Battery Storage report. The report also contains the views of market participants, end-users, energy suppliers and National Grid, plus a survey of Energyst readers around their storage investment plans.Download it at: www.theenergyst.com



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'The key risk is volatility – and the key opportunity is volatility,' says Dave Cockshott, chief commercial officer at Smartest Energy

Where there's risk, there's money

Increasing market volatility in 2018 is compounded by rising policy costs and regulatory change. That presents greater risk but also significant opportunity for businesses that grasp it, say consultants and suppliers. Brendan Coyne reports

Average wholesale power prices are predicted to decline steadily for the next five years, according to ratings agency Moody's.

In a report published in November, the firm said it expects prices will fall from around £45/MWh today to £40/MWh in 2022.

Declining gas prices, low cost imports and stable carbon prices – the latter confirmed by the Autumn Budget – were the key drivers for its outlook.

However, traders interviewed by *The Energyst* said the outlook for both gas and electricity commodity prices may be more volatile than some suggest.

Meanwhile commodity prices now make up less than half of the power bill. For many industrial and commercial firms, non-commodity elements are set to increase to approximately two thirds of the bill by 2020.

So what should businesses do to insulate themselves from risk without paying through the nose while taking opportunities as they emerge?

Volatility: enemy and friend

"The key risk is volatility – and the key opportunity is volatility," says Dave Cockshott, who spent two decades at Npower and Inenco before joining Smartest Energy in 2017 as chief commercial officer.

"I think many people have become complacent about the wholesale markets, which have generally moved sideways for some time."

That may be a product of warnings of incoming volatility that "perhaps have not led to differentials being as high as I had expected. But that doesn't mean volatility is not coming," he says.

Cockshott was interviewed on 12 December, when an explosion at the Baumgarten import hub saw significant spikes in same day and month ahead gas prices, which were already rising due to a fracture at the Forties pipeline.

The Forties pipeline is one of the main routes into the UK for North Sea gas and oil. On the same day as the Baumgarten incident, the main Netherlands-UK pipeline (BBL) suffered a technical failure while Norway's Troll field had a power supply failure.

Cockshott said those outages and their impact on market prices illustrate that "event risk can still cause shockwaves of volatility".

Because the UK's largest gas storage facility, Rough, is closing, those shockwaves will likely be greater than they have been in the past, he suggested, particularly if the weather is less benign that last winter.

"When Rough was taken out of action, the market took it in its stride and didn't overreact. But there is a latent risk. Rough used to provide a cushion so we could draw down when needed. That cushion is no longer there, and markets will factor that into prices," says Cockshott.

"I don't think we should be overly worried, it's just that everything comes at a price."

For both gas and electricity, Cockshott said businesses should revisit risk strategies and stress-test them to react

Dave Cockshott

Matt Osborne

Nick Proctor

appropriately to foreseeable eventualities, "even if that reaction is to do nothing, which people forget is a decision in itself".

Upside risk

Inenco's Matt Osborne agrees lack of gas storage and a relatively bare forward schedule for UK LNG deliveries creates risks over winter. The firm is advising clients to look closely at hedging strategies to protect themselves as there is "more upside risk than downside potential" heading into 2018.

Osborne says Brexit's impact on Sterling and uncertainty over the length of French nuclear outages also creates power price risk. "As a range for 2018, we predict power prices could creep up between 5-20%," he says.

"If everything goes to plan, then prices will probably be relatively benign. But at the moment, there is some upside risk in the market ... It is perhaps not as benign [in the mid-term] as the Moody's report makes out," says Osborne.

Amber Energy CEO Nick Proctor agrees 5-20% upside risk is a "fair comment". But he underlines that only relates to the junior part of the bill. Non-commodity elements now make up the lion's share. He thinks too many businesses are complacent in that respect.

"It is negligent just to have a trading policy and not an energy policy," he says. With non-commodity aspects set to make up 65% of I&C bills within the next couple of years, Proctor expresses surprise that many firms remain singularly focused on commodity prices.

"In no other area of their business would they sign a contract based on 35% of its value," he suggests.

Proctor says while Amber's clients outsource that management strategies to its consultants, "when we pitch for new business, perhaps 50% are unable to competently talk about non-commodity costs".

"Energy policies must include trading, procurement and risk, as well as flexibility, energy reduction and behaviour change in the building," he says. "Businesses have to catch up." »

Figure 1: – Breakdown of an energy bill

Costs are scaled to 100GWh / 55-65 load factor / Customer in London

Charge	Cost p.a.	%	Forecast
Energy (inc. losses)	£4,926,381	46.5	↑
Supplier costs (inc. margin and risks)	£188,349	1.8	→
Transmission charges (TNUoS	£875,542	8.3	↑
Distribution charges (DUoS)	£983,078	9.3	↑
Balancing use of system charges (BSUoS)	£277,292	2.6	↑
Renewables obligation	£1,864,000	17.6	↑
Feed-in Tariff charge	£543,000	5.1	↑
Climate Change Levy	£568,000	5.4	↑
Contracts for Difference (CfD)	£221,834	2.1	↑
Capacity Market (CM)	£112,350	1.1	↑
Other charges (BSC, AAHEDC, Metering)	£30,753	0.3	↑
Total estimated cost	**£10,590,578**	**100**	↑

Source: Noveus Energy – Focus on Non-Energy charges, November 2017

Victory at the Energy Awards... again!

We are delighted to announce our managing director Richard Murphy has been awarded Energy Champion of the Year at the 2017 Energy Awards. This is another huge achievement for Richard and TEC after winning the Energy Buying Team of the Year at the 2016 awards.

The award recognises individuals who have made an evident impact on the energy industry. Richard's colleagues submitted the award on his behalf to demonstrate his dedication to both TEC and the wider sector. The submission emphasised Richard's experience and knowledge in the energy market in his 27 years in the industry. It also highlighted how Richard, when at CCS, was a key member of the team which established a compliant and efficient approach to buying energy in the public sector. This was just one example of how Richard has brought about positive change in the sector.

The submission particularly underlined the great work Richard has carried out since taking up the post of MD at TEC, transforming it into the member-focused organisation it is today.

The restructuring work which, among other things, insourced the energy trading function and also brought in energy experts has enabled TEC to deliver member-focused compliant energy frameworks which are truly ground-breaking. The implementation of TEC's flexible frameworks, a project Richard led, ensured the final offering to members was effective and efficient and was key to winning the 2016 award.

The submission for this year's award not only demonstrated the work Richard has carried out in the energy industry but also was filled with a range of quotes from past and present colleagues and customers. Passion, enthusiasm, keen educator and dedication were just a handful of positive words used to describe Richard.

Ian Lane from the University of the Arts London and TEC Board member commented: "Richard has successfully led The Energy Consortium from preferred buyer status to Strategic Partner in the Higher Education sector. He is an innovative thinker who understands how a member-led organisation, such as TEC, should operate and has a very clear understanding of what 'good' looks like. As a collaborator, Richard understands the education sector, our future challenges, and has keen key in helping over 85 organisations navigate their way through to cost effective and compliant energy purchasing."

Richard commented: "Those of us who devote our efforts to delivering the best for our teams, customers and the public purse do so without expecting awards or praise. To receive this was both a shock and an honour. I would not be able to have met my own high standards without great teams around me so it is as much recognition for them as it is for me."

Winning this award is a great achievement for Richard and the TEC team as a whole, and it brings external recognition that public buying organisations really can compete, innovate and make a real difference to the absolute benefit of the public purse.

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Matt Dracup, I&C energy services director, Engie:
"There is a danger of focusing on individual aspects of energy, which can result in value being missed. It's important to understand the inter-relationships of procurement, management and flexibility. Customers really need to look at procurement, energy efficiency, compliance, DSR, batteries etc together to identify the best areas for them to focus on."

Magnus Walker, director of trading and risk management at Inprova Energy:
"The extreme volatility of energy markets shows no signs of changing as we go into 2018. Overall last year there was a 45% price swing in wholesale power prices and market swings looks set to continue as European and global commodity markets become ever more linked. It's more important than ever to purchase energy wisely using market intelligence, and to ensure that procurement is underpinned by a 'bullet-proof' risk management strategy."

Jo Butlin, CEO, EnergyBridge:
"Businesses taking a genuinely integrated energy strategy across storage, generation and consumption are the ones that will win."

Laura Cohen, chief executive, British Ceramic Confederation:
"Improving UK Energy security, particularly gas security and reducing price volatility remains a priority for our members. We and others have already called on the government to mount a fresh inquiry into gas security, with particular reference to the adequacy of UK storage, gas price security and the possibility of taking some form of regulatory action to mitigate the impact of increased energy price volatility.

Laura Bazeley, risk manager, Mitie Energy
"We expect non-commodity charges for power to rise by around 15-20% next year for a typical large retail consumer, though the actual increase will vary significantly depending on distribution of sites and consumption profile.

Avoiding maximum demand penalties

Measuring maximum demand is not straightforward and requires an understanding of both reactive and active power, says Inprova managing Michael Dent. He says consultancies with data management services can guide businesses through the process but outlines the following key steps:

1. Understand your existing capacity agreement: Look at your history to see whether you have frequently hit or exceeded your Agreed Supply Capacity (ASC). This will identify whether DCP161 presents a risk.

2. Limit your power usage: Reducing your electricity usage, particularly your peak demand, could be a very effective method of countering charges. This will also reduce your overall electricity costs.

3. Don't set your ASC too high: It may be tempting to increase your ASC to avoid the risk of incurring penalties, but you will have to pay for any unused capacity, which could work out more expensive. Consider the future growth or possible contraction plans for your organisation and how this may impact on your capacity requirements.

4. Beware new meters: It is especially important for organisations migrating to half hourly metering to gain a firm understanding of their ASC and to ensure that it aligns properly with their existing and predicted future energy demand.

5. Plan ahead: Capacity planning must form an essential element of your energy strategy. It should be reviewed regularly and carefully.

Non-commodity changes – network costs

Three network charging changes that will affect business bills and cost avoidance strategies come into effect from 1 April 2018.

DCP161 and DCP228 affect distribution network charges, which make up 10-15% of the average power bill.

DCP161 affects network capacity. Businesses have a set capacity, agreed with their distribution network operator, around the maximum demand they can import. Today, if they breach that capacity, they just pay the standard rate for any excess. But from April, breaching the agreed capacity limit incurs a penalty charge up to three times the standard rate.

DCP228 affects time of use tariffs – red, amber and green, or RAG, rates. To date, red rates have been many times higher than green rates, leading companies to adopt red band avoidance strategies. But from April, the RAG rates are being flattened, so that the difference between red and green rates is much less. While some companies may see smaller bills as a result, others face higher charges as avoidance measures become nullified.

Meanwhile, the P350 Balancing and Settlement Code (BSC) modification changes the way businesses are charged for power transmission losses. According to consultancy Inprova Energy, that could increase electricity bills for London business consumers by around 1.5%. Business energy consumers in the North and Scotland, however, are likely to pay less.

Strategic shift

Jon Ferris, now at blockchain energy firm Electron, but who spent more than a decade with TPI Utilitywise, says DCP228 and DCP161 will affect network charge management strategies.

"There has been a big push over the last few years for half-hourly metered businesses to reduce agreed capacity with networks [because there was no penalty rate]," he says. "Now the penalty will be more punitive, so it is much more important to understand peak demand."

Meanwhile, flattening of RAG rates under DCP228 could make red band avoidance less viable.

"If a business has already invested time and effort adjusting equipment and processes to avoid peak charges, they will probably stick to the same approach. Because a lot of the cost [of avoidance] is around operational processes," says Ferris.

"Having changed them, you don't want to incur further cost by changing back again. However, if you have not already adopted red band avoidance strategies, it becomes questionable whether the operational cost of doing so is sufficient, given the flattening of the charges."

While changes to RAG rates may benefit some smaller firms, "they will really hurt companies that use a lot of power at off peak times, such as cold stores, data centres, those operating night shifts," says Inenco's David Oliver. "They might see £8-9/MWh increases for using power at night."

Oliver suggests changes to network capacity charges also create a dilemma for companies planning for the medium term.

"If you think you might need EV charging in the future, you may wish to hold on to your capacity, because it might be very expensive to get back," he suggests. If not, "you probably want to have a second look at it."

Counter volatility with flexibility

According to Noveus Energy MD Bobby Collinson, the key energy risk in coming years "is definitely in balancing. Why? Because changes to things like embedded benefits will discourage peaking plant from coming forward – and peakers are one way of managing balancing risk," he says.

"If you can't do that with peakers, more and more renewables coming online means balancing becomes pretty expensive."

National Grid has to keep the power system balanced. When supply and demand margins become tight, it pays generators – and aggregators – to pump power into the Balancing Mechanism, occasionally paying very high prices. These prices have to be higher than the generators would receive on the wholesale power market. And, if the system is tight, wholesale prices will also be high.

In the past, supply margins have been tightest over winter, which, as well as incentivising people to build new power stations, was a key rationale behind Capacity Mechanism. The Capacity Mechanism pays power generators (and demand-side response providers) to provide headroom on the power system over winter, with the costs added to bills (see box, right).

But last year imbalance prices topped £1,500/MWh in May, due to plant outages coinciding with low renewable generation. Prices also spiked in November.

Collinson thinks these "shoulder months" will continue to see volatility, which will impact energy strategies. But he agrees with Smartest Energy's Dave Cockshott that volatility is also an opportunity for those firms that can harness flexibility, or demand-side response.

Jon Ferris

Bobby Collinson

David Oliver

Jeff Whittingham

That opportunity will increase from November 2018, according to Jeff Whittingham, managing director of Ørsted Energy Sales UK (Ørsted is the new name for Dong Energy).

Speaking at the Emex conference in November, Whittingham explained that changes to the rules that govern imbalance pricing will see the price cap double to £6,000/MWh. Prices will also be set on the last megawatt hour as opposed to the last 50MWh, which is likely to make it a "spikier" market.

That means higher rewards for companies that can sell their flexibility into the balancing market, and potentially the wholesale market as well, where prices may react in tandem.

As a result, Whittingham said companies must now consider "flexibility risk management" as part of their energy strategy.

Smartest Energy's Dave Cockshott agrees. He suggests that most companies will find a degree of flexibility within their operations – if they look.

"Then it is about putting a price on that flexibility and taking the necessary steps to be able to react for an hour or so here and there when the price signals are right," he says.

"Getting into a position to monetise that flexibility is essential" for firms in 2018, Cockshott suggests.

"There needs to be a sea change in attitude towards flexibility, because it is a risk management strategy. You might have best risk management strategy ever written on the procurement side. But if that is all you have, then you are quite literally now only doing half the job." te

Counting the cost of policy

Policy costs, loaded onto electricity rather than gas, make up around a third of the overall power bill. Here's what the main elements are set to cost:

Capacity Market: The amount charged depends on business consumption, November to February, 4-7pm. Businesses consuming large amounts of power in those periods will pay more than those that don't. Moving demand out of the winter peak also helps half-hourly metered customers avoid Triad periods. Conversely, the more people that take avoidance measures, the more those that don't will pay. This winter, the CM will add £381m to UK business bills. Over the 278 applicable evening winter peak hours, that translates to an additional £33/MWh, says Inenco's David Oliver, "depending on a businesses' consumption profile". Next winter, that rises to £955m, which he estimates translates to £90/MWh during the applicable peak periods.

RO/CfD/Fit: The Renewables Obligation is the biggest policy item on bills. While the RO has closed to new schemes, renewables generators were allowed 'grace periods' and more generators are coming on-stream. With exemptions given to energy intensive firms, plus retail price inflation, RO costs look set to increase 15-20% year on year in 2018 to around £22MWh.
Exemptions for energy intensive industries will also push up Contract for Difference and Feed-in Tariff costs. For now these remain a relatively minor part of the overall bill, and deployment caps limit their increases. However, they will rise significantly in coming years.

CCL: Climate Change Levy costs will increase slightly in April 2018, before jumping sharply in 2019 due to the scrapping of the CRC as the Treasury looks to protect tax revenues.

New emissions laws take back-up generators out of DSR

Last-minute changes to emissions legislation could put a big dent in the market for demand-side response, say some market participants. Others say it will force the sector to clean up. Brendan Coyne reports

New emissions regulation will prevent thermal back-up generators from participating in demand-side response (DSR).

Defra laid draft Medium Combustion Plant Directive (MCPD) legislation in December, to be debated in January. If it is passed without amendment, it could have significant implications for businesses using on-site generators.

Back-up means back-up

Guidance issued by the department confirms that back-up generation can run for 50 hours without having to meet strict emissions standards.

However, Defra states unequivocally that back-up generation can only be used as emergency back-up and cannot participate in any kind of balancing service.

The guidance states: "'Back-up' generator is defined in the draft regulations as a generator operated for the sole purpose of maintaining power supply at a site during an on-site emergency. This means that back-up generators cannot remain excluded from the regulations if they operate for other purposes, such as the provision of balancing services, even whilst conducting testing."

Defra had already clarified in October that generators that take on new balancing services or Capacity Market contracts from 31 October 2017 that remain in force after the end of 2018 would lose transitional arrangement status.

That means generators that win contracts in the forthcoming T-1 and T-4 auctions in January and February will have to meet the new obligations by December 2018.

Generators that do not enter into new contracts running beyond next year do not have to meet the new requirements until 2025 or 2030, depending whether they are larger or smaller than 5MW (individually or collectively).

Clean up or drop out

The MCPD covers various emissions but the challenging aspect, particularly for older generators, is the limit of 190mg/Nm^3 for NOx (Nitrogen oxides). Even some gas plant will require abatement technology to meet that threshold.

While there is a year for companies bidding into the Capacity Market or entering into new balancing services agreements to clean up their plant, for some the cost to do so may outweigh the potential revenues available.

For those generators left standing, the upshot may well be higher revenues from programmes such as short-term operating reserve (STOR), or its equivalent once National Grid completes its balancing services redesign.

The legislation will also likely force some aggregators and suppliers to look much more seriously at 'load' DSR (turning equipment on or off) as opposed to generation.

Historically, the lion's share of DSR has come from generation.

Estimates for the amount of back-up generation in the UK range from 6GW-20GW, though much of it may well be too old or unreliable to provide DSR, even if engineering and operational staff could be persuaded revenues are worth the risk.

While some aggregators may have to rethink their business models as a result of the legislation, the government says it is determined to improve air quality.

The MCPD applies to plant between 1MW-50MW, either individual units, or aggregated smaller plant.

The Environment Agency is set to publish further guidance for plant operators in the New Year.

Reaction: DSR damager?

Simon Mitchell, solutions development manager in Eon's Business Flexibility team, is concerned that the government's proposed rule changes may potentially undermine the broader demand-side response sector.

"We fully supported the new MCPD regime, which was a proportionate method of introducing new emissions regulations in a way which would allow sufficient time for businesses to take appropriate action and plan investment strategies, backed by transitional arrangements lasting out to 2025 or 2030 depending on capacity size or running regime," he told *The Energyst*.

But changes to the legislation, inserted without consultation, have jaundiced the supplier's view.

"The sudden shift in policy position has fundamentally altered the regime, and the clear risk is that policy undermines not just investor confidence but also the decentralised energy agenda, of which

we know the government is supportive," said Mitchell.

"We are already having discussions with a number of customers on this issue and there is every possibility that this sudden change in regulation will cause a number of generators to withdraw assets from balancing services agreements and Capacity Market contracts, potentially causing new entrants to rethink or even reverse their investment strategies in this area."

Mitchell suggests the MCPD rule changes cut across government's broader security of supply initiatives: "The added risk is that a reduction in Capacity Market entrants affects the final auction prices and limits options when it comes to securing supply and the ability to utilise demand side response providers as part of the smart, flexible energy system that the government is trying to achieve."

Nasty surprise

Association for Decentralised Energy director Tim Rotheray also thinks Defra's proposal is misguided. Back-up plant has to run as part of a test regime to ensure it works when companies face a power failure, so why not allow firms that are footing the brunt of policy costs to earn money from their testing regimes, he argues.

"The kit is going to run and it has a 50 hour a year limit [under the MCPD], which is fine, no one is opposing that," he told *The Energyst*.

"But Defra changing the rules with no consultation was a complete surprise. Everyone agrees that improving air quality and reducing the amount of diesel in the system is vital. Yet Defra has published no evidence that this will improve air quality – and this kit is going to run regardless. How many hospitals [have back-up generators]?

They are under severe budgetary pressure and we are taking away their ability to generate revenue from an activity that they are already doing."

Rotheray agrees with Eon's view that the rule changes call into question government's perceived support for demand-side response.

"They undermine the ability of people who had made contracts based on the rules at the time to perform in [the new] market conditions," he said.

"As a result, there is a very real risk that people turn around and say 'DSR doesn't work' and if we undermine that potential, the cost of the energy system will be significantly higher."

Rotheray agreed with suppliers that the rule changes remove 'easy wins', by removing the ability for gigawatts of installed back-up generation to help balance the system in times of stress.

"If you start the DSR journey with something that is nice and easy, it is a fantastic way to give people comfort: 'You are running this kit anyway, we will run it at times that can generate revenue and once you are comfortable with that, we can try some more adventurous things'," he suggests.

"That journey is massively important. If you take away the easy wins, you make the journey much harder."

Hurting hospitals?

Hospitals make up a 'significant' part of aggregator Kiwi Power's portfolio. The firm reckons the MCPD rule changes could cost the NHS as much as £27m per annum.

The company came to that figure by taking earnings statements from its NHS clients and scaling them up on a £/MW basis according to comments made by former UK »

The sudden shift in policy position has fundamentally altered the regime

Simon Mitchell, Eon

Defra has published no evidence that this will improve air quality

Tim Rotheray, Association for Decentralised Energy

director of System Operator Cordi O'Hara that the NHS could potentially provide around 400MW of DSR.

"The last thing the country needs is for the government to place additional strain on the NHS budget," says Kiwi's head of public affairs and UK programme manager, Jonathan Ainley.

"The proposed policy will create a funding shortfall, requiring NHS Trusts to divert much-needed money away from front-line services towards generator maintenance, which is surely an outcome to be avoided.

Ainley urged Defra to reconsider "shutting out the NHS" from DSR. He said the department had provided "no evidence as to why backup generators should be excluded from all markets". He believes Defra is "acting on a misplaced assumption" that providing balancing services incentivises additional running hours.

"We know from operating a demand response portfolio that the opposite is the case, as generators only provide balancing services within their pre-determined testing regimes and the revenues gained from balancing services are reinvested to ensure resilience at all times," said Ainley.

"Defra's approach will leave consumers worse off, paying more for balancing services and suffering from increased emissions as backup generators continue to run and additional, larger plant run at the same times to provide the essential balancing services required by National Grid."

Ainley also accused the government of double standards when it comes to emissions from different types of generators.

"It is completely hypocritical to grant large coal-fired plant continued operating exemptions under the Large Combustion Plant and Industrial Emissions Directives and to safeguard over 750MW of inefficient 'diesel farms' from complying with the MCPD regulations whilst requiring backup generators to do so," he suggested.

An alternative view

Not everyone thinks the rule changes are bad news. UK Power Reserve (UKPR), which owns gas, battery and diesel generation assets, suggests it will force the sector to look at cleaner technologies or fit abatement measures to existing kit.

UKPR commercial development manager Marlon Dey agrees those complaining that 'easy wins' have been wiped out have a genuine complaint – but says that is precisely the point.

"They would be easy wins. But not all DSR is created equal. If the legislation means it will incentivise aggregators to work harder to harness clean DSR capacity rather than polluting back-up generation, that's progress towards a green, low carbon future," he told *The Energyst*.

"We need a step change around how our energy is produced and consumed. This is one piece of legislation that is driving industry to make the right changes."

> *The last thing the country needs is for the government to place additional strain on the NHS budget*
>
> **Jonathan Ainley, Kiwi**

> *The legislation is driving industry to make the right changes*
>
> **Marlon Dey, UK Power Reserve**

Abatement issues

UKPR will have to fit abatement technologies to some of its thermal plant, and Dey says it will do so in order to be compliant by the time it comes into force in 2019.

That way, the firm can keep signing new balancing and capacity market contracts and Dey says the legislation provides an "opportunity to re-price your revenue streams and factor in any costs to be recovered".

That aspect means the legislation "is not retrospective for businesses, which is one of the reasons why we support it".

While some market participants suggest the timetable is tight and the cost of fitting abatement technologies to meet the new emissions limits are prohibitive, Dey says that is not UKPR's view.

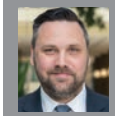
"The abatement technology is available today and the proposed timescales for implementation are feasible."

UKPR is also sceptical of the view that 'hospitals will suffer' due to the MCPD rule changes.

"This isn't an issue around hospitals – the legislation is being passed to reduce emissions, improve air quality to benefit public health and meet our environmental objectives. Out of all the generation assets in the UK, there is only a small fraction of assets being aggregated from hospitals," says Dey.

"It is unclear how much a hospital might be affected, but they can continue to operate like everyone else so long as they are compliant." te

Good news and bad news for DSR



Lee Stokes (pictured), head of demand management at Mitie Energy, says the MCPD changes will hit DSR business cases that are already under pressure from changes to Triad export rates. "Signs for long-term stability in the market are less than we would have hoped for," he says. "Confidence to embark on long term projects could be negatively impacted. DSR can still be an effective energy management strategy but plans now need to be even more carefully considered, based on initial Capex outlay, revenue returns and risks both current and future," Stokes suggests.

"But the good news for inflight DSR business cases is that the changes from MCPD should result in higher prices in both STOR and the Capacity Market," says Stokes. Meanwhile, rates for Triad avoidance remain "good ... for behind the meter in the short term" as Ofgem works through a significant charging review, which may take some time to complete.

Meanwhile, Stokes says the rule changes will focus minds more firmly on 'load' DSR, i.e. adjusting consumption patterns rather than generation. He suggests an integrated approach of maximum efficiency allied with reactive flexibility will help to "mitigate significant unit rate cost inflation that is being forecast".

CHP optimisation as a service

Reactive Technologies uses machine learning to optimise CHP run times and revenues

Reactive Technologies has launched 'CHP optimisation as a service'. Its initial client is a large retailer, for whom it is optimising "hundreds of small CHPs" around the country, according to head of retail, Mark Cavill, who recently joined the company from Engie, where he was head of demand-side response.

Cavill says the service takes in operational data, hashes it with industry data via Reactive Technologies' "machine learning algorithm" and works out the best way to run the CHPs for both optimal efficiency and revenue generation.

"A significant number of smaller CHPs were installed in the late nineties and early noughties when the technology basically assisted with planning applications," he says.

"Back then, gas prices were quite low and the spread between gas and power prices enabled CHP to really stack up."

Today that price spread is narrower, eroding the marginal benefit of running CHP.

Equally, building operations have changed over the last decade or two, while CHP operational strategies may not have kept pace, or been changed at all, says Cavill.

"As a result, many CHPs may be running when it is not economic to do so, or vice versa."

Mark Cavill: 'Savings range from 10% to more than 30%'

Data-driven heat and power

The service takes in weather data, BMS data and forecasted heat demand as well as power prices and third party charges.

"Based on all this data [for the retailers' CHPs], we created an automated process to capture all of the electricity price information specific to its contracts and sites, plus forecasted heat demand on each site, while looking closely at efficiency and operation of each CHP asset," Cavill explains. "Then we created an algorithm that we run to produce a schedule of when it is most economic to run each CHP."

That schedule includes running the CHPs within various flexibility programmes or to facilitate peak network charge avoidance.

"The resultant savings range from 10% to more than 30%," claims Cavill.

While the service currently produces the schedule, Cavill says "phase two is to install controls to remotely control assets", so maintenance teams do not have to input recommended run patterns.

Cavill says the service can work with "single massive CHPs down to hundreds of smaller distributed assets".

Sunny outlook for post-subsidy solar?

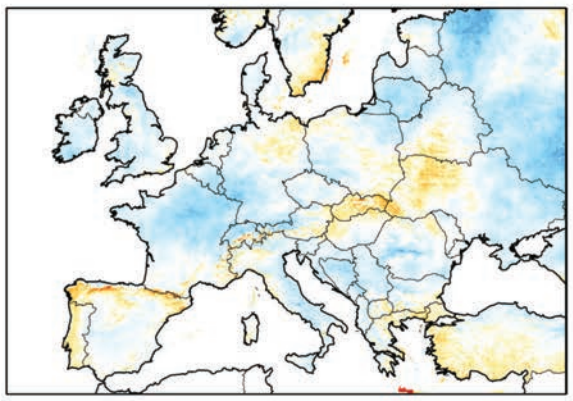
Subsidy-free solar can work in the UK under the right circumstances. But reducing risk and exposure may be critical, an insurer and a weather data specialist tell Brendan Coyne

Post subsidies, solar developers have to double down on costs and seek other revenue streams in order to make project economics stack up. Some are now looking at co-locating storage as a means of increasing revenue streams and returns, others are cutting costs by reducing system resilience.

However, there are ways of shaving cost and optimising solar returns without increasing project risk that could make projects more viable – with or without storage.

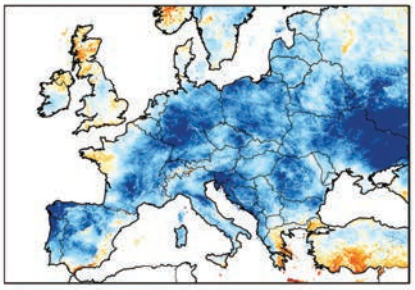
According to a specialist weather data provider, better weather data is one avenue worth pursuing. According to a specialist insurance provider, specialist insurance is another.

These may sound rather like sales pitches. Yet the ability to reduce performance risk can lower cost of capital. Providing banks with medium-term visibility on revenues, particularly where storage is concerned, could determine the fine margins between success and failure in a post-subsidy world.

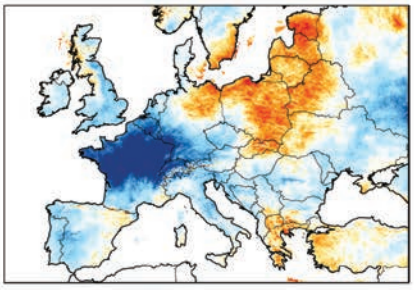


2016

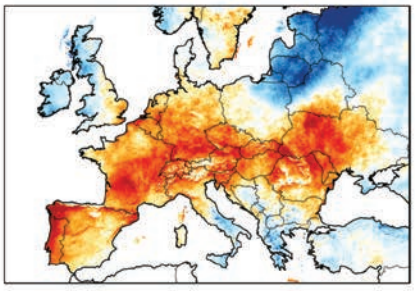
The 2016 Europe Solar Performance Maps show departure from average solar irradiance in GHI (or Global Horizontal Irradiance, the key variable for PV projects). Vaisala conducted the study by comparing 2016 data with long-term averaged values from its continually updated global solar dataset.



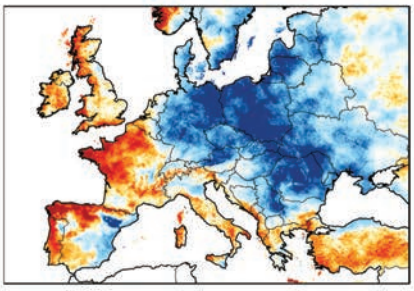
First Quarter



Second Quarter



Third Quarter



Fourth Quarter

Better weather data

Gwendalyn Bender is head of solar services at Finnish weather measurement company Vaisala. She believes as solar projects pursue merchant revenue streams as opposed to subsidies, "the willingness [of project backers] to absorb fluctuations that you can actually predict will diminish".

She says Vaisala's satellite data enables it to build a 20-year weather data set for solar, based on actual observations and imagery, with resource uncertainty of 4-5%. Factoring in variables – such as equipment performance, degradation, some tolerance around the ability to model actual project conditions etc – translates to an energy uncertainty, for solar operators/developers, of 7-9% over the asset life, says Bender.

She believes that the solar sector will need to become more efficient and attuned to stronger risk management principles now that subsidies have been turned off.

"When you have a high subsidy you can absorb an uncertainty, or an underperformance. But [in a post-subsidy world], if 2% is your revenue, that has a different impact," says Bender. "So there is more we can do to improve our project practices."

Bender says accuracy of whether data "is one of the largest components of energy uncertainty", in renewables projects. Yet while subsidies existed, "most of the market was probably built on freely available public data of a fairly low to poor resolution on typical averages", she says.

"That's great for understanding average conditions, but you have no insight into the variability at that site. So then people get surprises. They take all of the hit of low resource periods and can't take advantage of high resource periods.

"That is certainly something to keep in mind over next couple of years," adds Bender, "because you are likely looking at a market that does not understand the potential variability that exists."

Solar and storage data

Better long-term weather data will be complemented by short-term accuracy once batteries are collocated, says Bender.

"With any sort of dispatchability, knowing what is going to happen in the next couple of hours or days is extremely valuable," she says.

"I have had several conversations with banks regarding storage. They see it coming, that the tide is turning, but they are also inherently nervous. Solar people are inherently optimistic. They are coming in with expectations of how they are going to manage [storage] and how it is going to work, without necessarily having tested it," Bender continues.

"Banks are trying to get up to speed as fast as everyone. But anything you can do to prove that you have the data to operate more efficiently, to mitigate risk ... could go a long way towards giving them more confidence."

Hedging the new subsidy?

Fraser McLachlan, CEO of renewables specialist insurers GCube, believes hedging mechanisms against resource risk could be 'the new subsidies' for solar.

The company insures against lost revenue as well as physical assets and has recently sold its first weather transfer risk (WTR) packages in the UK.

Insuring against loss of revenues is a "self-funding proposition", says McLachlan, because it "enables developers to get a lower interest rate on debt".

The product can work as a swap, in a similar way to contracts for difference.

"So if it is a sunny year, and you are up, we will take some of your upside and vice versa," says McLachlan. "Banks like it because it provides certainty. They just want guarantees their investment will perform at a set rate."

Technical failure

McLachlan also thinks that tighter margins post-subsidies mean developers are looking closely at project costs, and the contingency measures they build in.

The result is "a lot more risk with regard to single point failures", says McLachlan (see box).

"As margins are squeezed, they are building projects to a price. From an insurance perspective, they are looking to transfer the risk back into the insurance market. So the risk profile is starting to go up for a lot of these projects."

> *If it is a sunny year, and you are up, we will take some of your upside and vice versa. Banks like it because it provides certainty. They just want guarantees their investment will perform at a set rate*

Battery cover

McLachlan says GCube "likes batteries" as an asset class, despite having been burned in the past – literally.

"Battery storage was one of the biggest claims we ever paid – a $34m claim – from a storage system that went on fire. So we learned pretty quickly," says McLachlan.

"But rather than run for the hills, we learnt a lot. We like batteries. Those sorts of storage solutions are where the industry is heading."

The fire risk from batteries "is not as benign as some may think", says McLachlan. "So you have to be careful about the people that you are working with and there has to be proper due diligence on some of the newer players coming to market."

Outside of fire risk, "it is pretty benign technology", says McLachlan. In terms of insuring storage against lost revenue, "the only other thing is trying to quantify the quantum of the loss in terms of the amount of power that would have been generated by the battery storage facility at the time it broke down", he says.

"That is the challenge – do you get paid for 20 calls [from the grid operator to provide services] or twice?" te

Cutting costs, transferring risk

GCube provides the following example of how solar developers are reacting to squeezed, post-subsidy margins:
With subsidy support, a project was able to configure a substation with dual transformers with a 70% capacity factor on each. The cost was an additional £4m to construct.

Conversely, a recent project 'built to price', had a single point transformer, such that if it failed the project would be offline for at least 12 months. This project saved £2.2m by doing this. Insurers took on the added risk but increased the underlying premium by 20%, so the rate went from 0.2% of capex and an annual premium of £340,000 to £408,000.

Does blockchain have a future in energy?

Blockchain is being talked up as an enabler of systemic change in the energy sector. Can it deliver, asks Mark Taylor, managing director at VuePoint Solutions

At VuePoint Solutions, we love to see new technologies coming along with the potential to enhance the market (we dislike the word "disrupt" as that infers causing a disturbance or problem which in our minds is negative). So we have been following the debate surrounding blockchain and its ability to enhance the energy marketplace with interest.

There is a lot of hype and excitement around, with claims it can revolutionise the marketplace and replace intermediaries and their fees etc.

Gartner currently has blockchain at the "peak of inflated expectations" stage of its hype cycle for emerging technologies for 2017 with a prediction that it will reach the "plateau of productivity" in the next five to 10 years.

So what do we think?

We honestly think that with the right application there is a place in the market for blockchain and, deployed correctly, it could be a very useful tool in enabling companies such as us to continue to deliver game changing technological solutions to make the lives of our customers better.

However, there are a lot of hurdles and complexity that needs to be overcome before it will deliver to the expectations of current hype, but this is exactly why we are starting to invest in the technology.

Blockchain was first mooted in 1991, but did not get any credible deployment until 2008 when it was coupled with Bitcoin. Based on a proof of work (PoW) method of adding to the chain, the cost of mining has risen as the complexity of the mathematical problem has had to get tougher to avoid the potential for the chain to be hacked.

It is reported that transactions can take up to seven minutes plus to get added to the ledger, which is no good in high-paced trading scenarios. As a consequence, other methods of adding to a blockchain have emerged such as the proof of stake method (PoS) used in the likes of Ethereum.

> ***Gartner currently has blockchain at the 'peak of inflated expectations' stage of its hype cycle***

In the PoW method, the miners are paid in coins for adding a transaction to the blockchain but in the PoS method there is no reward for forging (as the miners in this method are called), so they operate by taking a transaction fee, which for the cynical raises the question of the benefits over the traditional exchanges and OTC brokers.

Benefits and challenges?

To cut to the chase before you get bored, the key benefits as we see them are:

- Immutable record
- Distributed ledger, so easy to spot forged transactions
- Difficult and costly to hack (at least for PoW)
- Fully auditable
- Helps cut out the man in the middle man (possibly)

The key challenges are:

- Unstable and still emerging technology supporting the blockchain
- Processing power and cost of adding to the chain (PoW)
- Size of the distributed ledger so scalability issue
- Negative press around crypto currencies
- It is a distributed ledger so all can see the transactions so confidentiality issue

So without doubt, the overarching benefits of the technology in my opinion is the immutable record that is distributed and difficult to hack. However, depending on the method used to add to the ledger the costs and complexity, as well as the time to transact can rapidly rise or the sanctity of the ledger can be compromised.

There is also much debate about the true security of blockchain and its ability to withstand hacking with reported hacking by the "51 crew" in August 2017 on the Shift and Krypton blockchains with the group taking over 51% of the network and thereby "owning" the chain and the

> *There is much debate about the true security of blockchain and its ability to withstand hacking*

reported theft of $65 million from Bitfinx, to name a few.

Finally, there has also been a lot of negativity surrounding crypto currencies with JP Morgan boss Jamie Dimon claiming "cryptocurrency is only fit for use by drug dealers, murderers and people living in North Korea".

Currently there are 180 regular currencies across the world compared with more than 1,100 crypto currencies and that number is set to rise as more and more start-ups issue Initial Coin Offering (ICO) to backers in exchange for legal tender or other crypto currencies, which means there will be more and more investors losing money as some of these inevitably fail and the currencies become worthless.

So why invest in blockchain?

We believe what is really important is that you are able to understand the technology, and then to stand back from the hype and the criticisms and look at the benefits and pitfalls, with a cold and calculating eye, not distracted by hyperbole.

You need to be the enthusiastic evangelist but also the harsh and cynical analyst. In doing so, we believe you can look at what can be done that will bring cost-effective benefits and enhance the market place rather than disrupt it and deliver a "bubble fit to burst".

So we are investing in the concepts where we believe we can use it to better the lives of our customers and to improve the marketplace, while mindful we are not going to become the next tech giant on the back of it.

It is great to see other like-minded companies out there doing the same and extolling the virtues of this new technology and thinking outside the box in how it can work in the energy market. te

What is blockchain?

There is some confusion about blockchain with it often being synonymous in people's minds with crypto currencies such as Bitcoin but the two are completely separate.

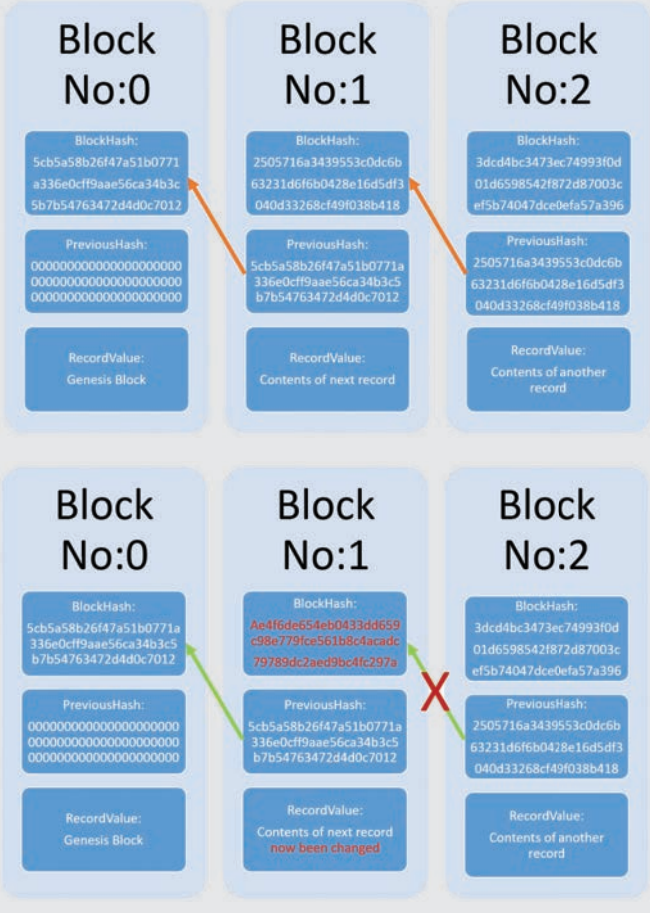
Blockchain is a simple concept that enables an immutable ledger – a record that once written cannot be changed – to be formed and shared. It is a fundamental technology that unpins crypto currency but blockchain does not have to be tied to crypto currency; technically you can have either without the other.

The easiest way to describe blockchain and its benefits is to consider a database entry, for example a record of a trade between two counterparties.

In normal circumstances it is possible for someone to make a change to an entry with sufficient permissions which could then call in to question the validity of the trade that has been made and lead to complications trying to settle.

Blockchain prevents any changes from being made by stringing together a series of transactions into a single chain where each record is linked to the previous record by the use of a hash function of the value of the previous and current transaction. If any changes are made then the chain is "broken" as the hash will change as shown in the basic example below.

This immutable ledger gives credence to the validity of the record of the trade and could be used, for example in the energy sector for a peer-to-peer trading network, enabling the recording of the trades as well as allowing for auditing and settlement.



A representation of how blockchain works

Not the definitive article

Electron's strategy director Jon Ferris explodes some of the myths surrounding blockchain's security, scalability and energy consumption

The increasing media coverage of Bitcoin may lead to a wider and better understanding of blockchain in the long term, but in the short term has entrenched a number of myths about security, scalability and energy consumption.

Bitcoin is the first, and most notorious, implementation of the concept of combining a distributed ledger, cryptographic techniques and decentralised consensus. But any reference to "the" blockchain ignores the growing number of alternative approaches.

Transaction records

A distributed ledger is a peer-to-peer database shared across a network, so that each participant has the same record of transactions. These transactions do not have to be financial, and can describe any digital aspect of an asset. For example, switching a meter from one supplier to another can be recorded as a transaction.

All transactions are broadcast to the network, which use cryptographic techniques to securely timestamp and record valid transactions in a block, appended to an encryption of all previous blocks. It is this chain of blocks which ensures that any attempt to alter a historic transaction will be rejected by the network.

A blockchain can be shared and accessed by anyone with appropriate permissions. As anyone can participate in the Bitcoin blockchain, it is known as permissionless. In order to ensure that the network agrees on a single state, participants are incentivised to compete with each other to add a valid block.

Fact from fiction

Permissioned blockchains require users to be granted approval to participate on the network or access particular information. In the highly regulated energy sector, connecting to the physical network is controlled, matching the approach used in a permissioned consortium blockchain. This structure is beneficial where data needs to be shared between a defined and regulated group of competing parties.

Blockchain platforms will bring lower costs and add value to the shared energy infrastructure in areas such as data ownership, trading and asset registration. The energy industry is highly regulated, and these platforms will be owned and managed by consortia overseen by a governance structure and regulation. There a number of reasons why the myths are not relevant to this approach.

> ***Blockchain platforms will bring lower costs and add value to the shared energy infrastructure***

First, these platforms will not be public, and the consensus mechanisms will use proof of authority or proof of stake, not proof of work. The astronomical power demands of the Bitcoin blockchain are not relevant when another consensus mechanism is used.

Second, because they are private consortium platforms, the consensus nodes will be run by industry participants. They will be subject to the same oversight as now, except the regulator would benefit from transparent and real-time information.

Third, all the instances of "hacking" relate to parties stealing crypto currency from insecure wallets or poorly written smart contracts. That's no different from what happened to Equifax when a security breach exposed a file containing 15.2 million UK records. It is not the same as saying that the blockchain was hacked – it was not and hasn't ever been. In any event, on a private chain the currency is only of value to the authorised nodes on that blockchain, so even if you could steal it you couldn't spend it.

Fourth, all transactions are visible (on most blockchains) but that is not the same as saying all the data is visible. There are many ways in which the transaction data can be secured, for example zero knowledge proofs, secret store, off chain data with on chain commitments, and secure multi-party computations.

Fifth, scalability is potentially an issue as we get to huge volumes of trades but there are a number of ways to mitigate this. But to put this in context Electron has replicated the UK's entire meter asset base and shown that it is possible to store all these on a blockchain with all the associated data. This platform processes transactions at a rate at least 10 times the peak throughput required in the Ofgem technical specification for the new central registration service.

There is no such thing as the definitive article when it comes to blockchain, and it is important to understand the appropriate implementation for the particular application. te

Electron will be hosting a hackathon in February 2018, for participants in its consortium to engage with a blockchain platform and develop solutions for a digital energy future.

For more information, register your details at www.kwhack.com

EVs as battery storage? 'It's never going to happen'

The idea of electric vehicles acting as meaningful energy storage has divided opinion

Energy Managers Association chief Lord Redesdale has poured cold water on the idea of electric vehicles acting as meaningful energy storage. Speaking at the EMA's Emex event in London, Lord Redesdale said that his view was based on his own experience as an EV owner.

"I have an EV. It's great. But I spend three hours charging it and then have to fight people for the [out of home] charging points. Why would I let anyone drain it [to provide grid balancing services]?"

"EVs being a source of standby [power] is simply not going to happen," said Redesdale.

EV owners could earn up to €1,300 per annum by allowing third parties to control their EV batteries when parked and connected to a charger

Speaking at the same session, Elexon's John Lucas said he held a "slightly less sceptical view".

"Having some level of controllability [over charging] so that they are not all charged over the peak demand period is key. It will be vital to the EV rollout.

"I do see clear opportunities for vehicle-to-grid [services]," said Lucas. "It is definitely part of the picture in my view."

EV manufacturers such as Nissan have suggested that EV owners could earn up to €1,300 per annum by allowing third parties to control their EV batteries when parked and connected to a charger.

Numerous other firms are positioning to act as a form of aggregator via electric vehicle batteries and charge points. te

EVs a resource, not a problem

Electric vehicles represent an opportunity for grid operators to balance networks and for their customers to earn revenue, rather than a network-busting problem, according to Northern Powergrid.

Launching its 'Customer-led Distribution System' project, the company outlined how it plans to create a smart local energy system. The firm sees electric vehicles and vehicle to grid services (V2G) as a key part of that plan.

"Change is coming, it is just a question of how fast," said head of trading and innovation, Jim Cardwell. "It is key for us to lean in and take a managed approach to the transition. We can't just sit back and see what happens. It requires collaboration. Not just with the motoring industry and charging infrastructure providers – but a number of other actors in the system to get things joined up."

He said that while a few years ago DNOs saw EVs as "a big problem about to land on us", the market has since moved forward. "Now we see opportunities to add value to customers – and see V2G as a resource for customers to sell services back to grid operators. That is an opportunity both for customers and us."

While there is some debate around customer acceptance of controlled charging, particularly out of home, the company suggested that compelling services could convince EV owners to opt in – and that providing those services could enable EV manufacturers to sell cars more cheaply.

> ***Change is coming, it is just a question of how fast***

Commercial development manager Liz Sidebotham added that, if customers accepted smart, or controlled charging regimes, "they can play an active part in system management and therefore become a resource rather than a problem".

Asked whether network operators could help solve interoperability and standardisation issues that plague out of home charging, Northern Powergrid policy and markets director Patrick Erwin said the DNO "absolutely has a role in this".

"We need to make the rollout work and [make it] as frictionless as possible. Some of that work will have to be done by government. But enabling the rollout of EVs will be a key part of DNOs role, along with enabling [V2G] services to customers."

The company has collaborated with carmaker Nissan on battery storage and is also working on second life battery use with Newcastle University, deploying used batteries on a farm to manage power costs – and said it is actively looking for other second life uses.

Meanwhile, Northern Powergrid is using a 2.5MW standalone battery, operated by Kiwi Power, to generate revenues for its innovation fund via FFR and Triad. te

Total triggers cost savings

For many custodians of multi-site portfolios, the options for accessing the energy markets are limited. Without the resources in-house to start trading wholesale gas and electricity, customers have traditionally either chosen a fixed price contract which places them at the mercy of timing to market or incurred the costs of using an energy broker to trade on their behalf.

This is about to change.

Total Gas & Power (TGP) has launched a new Managed Trigger Service, for both gas and electricity, which allows customers to engage directly with their supplier to access flexible procurement on the wholesale markets.

As a fully-managed trading and supply option, the Managed Trigger Service allows customers to devise a bespoke trading approach that suits their organisation's procurement risk strategy. TGP's team of expert energy traders then manage the purchasing of power on the customer's behalf.

So how did this come about?

Mark Davis, Head of Business Development at Total Gas & Power explains:

"So many customers were telling us they wanted the opportunity to benefit from flexible energy procurement but they don't have the resource within their organisation to step into that marketplace and take a flexible product. Their options were limited to either remaining on a fixed price or appointing a third-party intermediary to broker on their behalf, which incurs additional costs in the form of broker management fees".

> "The way we operate is to sit down with the customer to understand their risk appetite and to agree an approach to market which is bespoke to their needs and demand profile"
>
> **LEANNE QUAH**
> Energy Product Manager,

This conundrum has challenged energy managers for a long time, particularly those responsible for multiple premises, which individually have relatively modest consumption.

Choosing a fixed price energy contract is risky; prices may be attractive now but the buyer is exposed to the volatilities of the market. They miss the opportunity to benefit from a falling market since they are 'locked in' and when renewal is due, the buyer has no choice but to go with the market price at that time. This can result in significant price rises, which are devastating to a tight budget.

Organisations have traditionally avoided this risk by appointing a third-party intermediary, however this is often a decision made from compromise. Instead of using an intermediary, customers increasingly prefer to develop a direct relationship with their supplier. Davis explains:

"Customers want to buy energy flexibly but may not have the time, resource, or the Board sign-off to manage complex market information on a daily basis. This means that customers can be limited to either fixed price options or the use of an energy broker, incurring additional cost. If a customer has lower annual consumption, it can also mean the volume gets traded in a basket with many other customers and this may not offer the optimal approach for that portfolio."

Multi-site portfolios benefit by having the volume aggregated and procured as a single, larger basket but there is often a misperception that being placed in a "super-basket" with many other businesses will reduce costs through enhanced buying power.

This isn't always true.

Out-turned energy prices depend on when and how the trades are placed and the demand profile of the volume being procured. With lots of customers trading in the same manner, the shape of the basket profile may not offer the optimal approach to market for your portfolio.

> **Customers want to make cost savings by engaging directly with suppliers...**

A bespoke strategy can often be more effective but appointing a supplier directly can be daunting. It is important to have confidence that they will act in the customers' best interests.

Energy Product Manager, Leanne Quah has thought this through:

"The way we operate is to sit down with the customer to understand their risk appetite and to agree an approach to market which is bespoke to their needs and demand profile. We set reference prices, for either a season, a quarter or month-by-month, according to customer preference and work to deliver an outturn price that is as close as possible."

But what happens when the markets, which are frequently volatile, start to display unexpectedly bullish or bearish behaviour?

"Even if the contract is signed over a long-term, we would begin by working with the customer to agree a strategy for two years, with annual reviews.

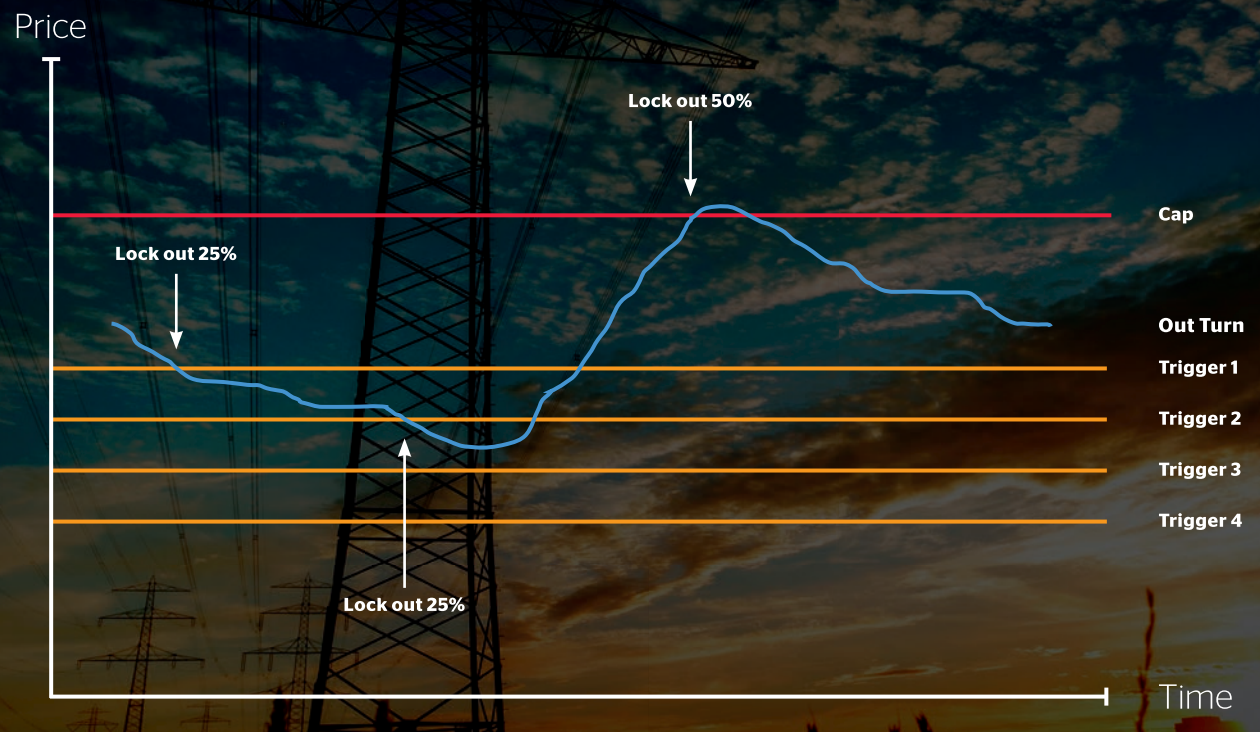
"Once the reference price is agreed, we determine the maximum variance from that price at which we would lock out tranches of volume on behalf of the customer.

"If the market hits that trigger price, we automatically buy that volume and then let them know".

This enables the customer to benefit

Managed Trigger Service

All volume is accounted for. If the market price ever hits the cap, then whatever volume is remaining that hasn't yet been locked via the triggers is locked out. Should there be any volume not yet locked and the market price never reaches the cap during the period, then the Day Ahead price is used for that remaining volume.



from a flexible contract without having to monitor the market or ring the procurement desk every day to make trades.

As energy prices fall, the team proactively locks out volumes of energy, which then support lower delivered costs in the following year's pricing. By agreeing in advance the flexible buying practices that can be deployed, TGP helps ensure customers never pay the highest price for energy.

Instead of trusting your energy budget to a third party, who is often paid on commission, the account management is handled directly by the supplier. Such collaboration enables both parties to set and maintain budgets, offering enhanced cost control. Customers have greater ability to hold the trading team to account and this suits a commercially astute supply chain management strategy.

Partnering in this way not only supports energy buyers but also provides access to the wealth of industry knowledge found amongst TGP's market experts, including information on forward pricing, price forecasting and update on legislative changes. This gives you confidence your energy budgets are in good hands.

Managed Trigger Service

- ✓ Fully Managed Account to suit your gas or electricity procurement requirements
- ✓ Bespoke Trading Strategy
- ✓ Ability to set maximum price at which to trigger purchase of all remaining volume to avoid risk in a rising market
- ✓ Ability to set a price to 'lock out' and benefit from a falling market
- ✓ Access to energy market experts

It is, quite simply, a great solution to effective energy procurement.

For further information on how Total Gas & Power can help your business to access the energy markets, please ring: **0800 542 3275**

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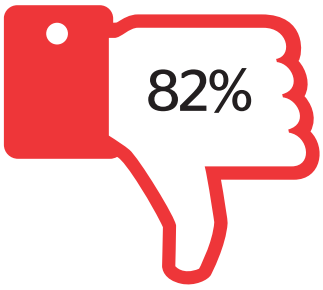
Make resilience a priority

British Gas Business boss Gab Barbaro says firms are risking significant loss of revenue by not having a formal energy resilience strategy

An enterprising energy manager is always looking for new ways to optimise their company's energy usage and reduce consumption.

In 2018, they will find themselves increasingly grappling with technology – a host of technological advances are now coming into their own, transforming the tools energy managers depend upon. From the proliferation of big data, artificial intelligence (AI) and distributed ledgers, the landscape is being radically reshaped, bringing new opportunities and benefits to business.



Firms that do not have a formal energy resilience strategy in place

Blockchain, a technology best-known for underpinning digital currency Bitcoin, is one of the latest innovations which can be applied to the UK's energy industry. It has the capacity to reduce energy costs in a variety of direct and indirect ways. For example, improving smart meter data records, allowing businesses the information they need to adapt, cut and even pre-empt their energy usage.

Blockchain technology enables an immutable ledger – a record that once written cannot be changed – to be formed and shared. It is hoped this could pave the way for a peer-to-peer energy trading network, facilitating secure recording of the trades as well as allowing for auditing and payment.

In 2017, Centrica invested in New York-based start-up LO3 Energy, a specialist in blockchain solutions for the energy market. LO3's platform stores and validates data, which allows consumers to generate, store, buy and sell their power.

It is exciting to witness this digitisation and democratisation of energy, which is enabling businesses to have more flexibility and control over how they buy and use it.

Centrica's Innovations division is also committed to investment in AI, pledging funds this year to UK-based energy management start-up Grid Edge to commercialise its cloud-based solution.

Grid Edge is developing AI to provide forecasts of a building's energy requirements over a four-hour period. This technology has been designed to help reduce energy consumption in large commercial buildings by up to 25%, lowering carbon emissions and energy bills for businesses.

Investment of this nature is vital in order for the UK's energy sector to advance and thrive. Energy managers should also be alert to these technological opportunities in order to serve their companies' evolving needs.

As the availability of real-time data enables businesses to get a tighter grip on their energy usage, the remit of the energy manager's role will undoubtedly move beyond procurement and purchasing agreements.

The prominence businesses attach to energy resilience and efficiency is clear: 88% of UK businesses surveyed in Centrica's 2017 UK Resilience Report stated it was "important", while 58% said it is "becoming critical". Despite this, only 16& of companies are making energy resilience a top priority, and only 18% of businesses have a formal strategy in place.

UK businesses without an energy resilience strategy are risking 17% of their revenue, equating to £2.8m each year in damages and lost opportunities.

Investment is required to address this, which in turn will serve to improve efficiencies and drive down costs.

Energy managers should lead the way in powering priorities for 2018 and beyond.

Ensure your business has complete visibility of your energy usage in order to make data-driven decisions. Revisit your efficiency improvements, from cost reduction through to battery storage, and consider self-generation to put yourself back in control with a sharing economy mind set.

Those who are able to demonstrate the value they can deliver to their organisation's bottom line through cost savings will consolidate the business case for further technological investment.

> ***Energy managers should lead the way in powering priorities for 2018 and beyond***

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In chains we trust

Karthik Suresh, director at Ameresco and UKAEE committee member, questions what blockchain really is and how might it impact the energy industry

Blockchains are hot. Search interest in the term has increased exponentially since 2015 alongside the growth of its cousin Bitcoin and the technology has been linked with applications that range from disintermediating the financial industry to ending world poverty.

The basic premise of blockchain is simple. Take a sentence, for example: "The UKAEE is running an evening of talks on energy trading using blockchain technology." Running this sentence through a piece of software called a hash generator results in something that looks like this: 4f7359e55ff958237b7d4df8054aa24a.

This is called a hash, a fixed-length coded version of the sentence.

If we run a different sentence through the generator with the words "on Wednesday 24th January 2018 at 17:30", we get a new hash that looks like this: db8d42b-378bebc86cdcaa6d476221b4f.

The two hashes are very different.

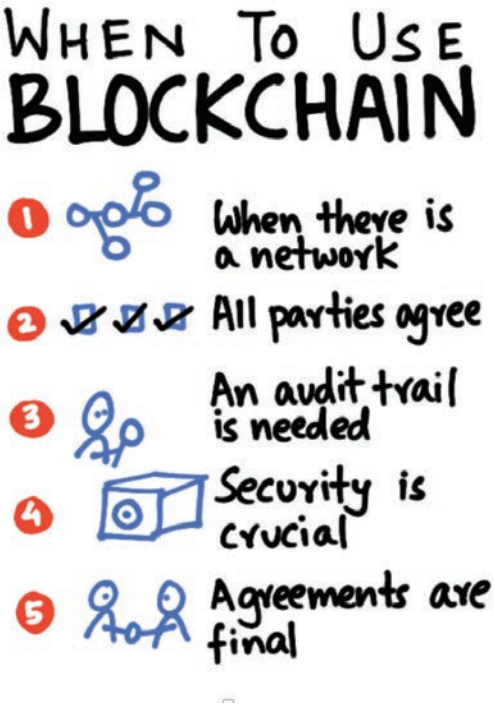
Now, if we took the hash of the first sentence and combined it with the text of the second sentence, like this: "4f7359e55ff958237b7d4df8054aa24a on Wednesday 24th January 2018 at 17:30", we would end up with a new hash like this: 5194308176defdf344a4639717c0455d.

In addition, we have just created a blockchain.

The two sentences are linked by the inclusion of the hash of the first one as part of the second sentence. The resulting hash is unique and changing even a single character in the first sentence will result in a completely different hash. It is also very hard to break the hash and work out the original contents – made even harder by using advanced cryptographic algorithms.

This chain can be extended indefinitely and creates a secure set of connected records – perfect for an application such as a financial ledger.

Without going into too much detail, this innovative way to connect information into a blockchain combined with the power of the internet to host and distribute multiple copies of it and a method to verify which blockchain is the right one through consensus – agreement between participants – has gotten many people very excited about the potential of blockchain based systems to change the world as we know it.



> ***Blockchain has the potential to make it easier, faster and more secure for participants in the system to record information, verify transactions and get paid***

Energy industry application

This is particularly interesting to the energy industry. The traditional model, especially with power generation, is for energy to be generated in one location and used elsewhere. In between the producer and consumer sits an entire industry of intermediaries, including suppliers, network operators, data collectors and settlement companies that make sure that every kilowatt-hour (kWh) of generated power is processed, priced and paid for. Energy data sits at the heart this operation, with kWh flowing, being lost and being used across the network.

At one extreme, we could replace the system that holds this national energy data with a blockchain-based one. The main players, generators, network operators, distribution companies and consumers would add their transactions to the blockchain and settle their accounts with each other. At the other extreme, you might have a community or village that decides to go mainly off grid and supply energy to each other but again recording and settling their transactions on a blockchain based system.

Blockchain, so what?

So what, one might think? We can measure energy and settle transactions now. How does blockchain change that? And the point is it doesn't. We will still distribute and use energy and create energy technology in the same way we have been doing so far.

The difference is blockchain has the potential to make it easier, faster and more secure for participants in the system to record information, verify transactions and get paid, and so could unlock more and smaller sources of generation than previously. By creating an ecosystem of

Anniversary event

Decentralised Energy Talks: Disrupt. Create. Innovate.
WeWork, Moorgate, London – 24 January 2018

January 2018 marks the UK Association of Energy Engineer's five-year anniversary. To celebrate, UKAEE invites you to an Energy Talks event on Wednesday 24 January 2018 at WeWork Moorgate, London from 5.30pm to 8.30pm.

New disruptive models of decentralised energy will be presented and will include talks given by key players on the legal, financial and infrastructural implications of decentralised energy. There will also be drinks and nibbles to toast the growth of this field and UKAEE. For more information please visit ukaee.org.uk

rewards and incentives, participants could also be incentivised to change their behaviour and reduce energy in return for tokens that can be redeemed for rewards.

One way to think about this is to compare it with how a membership scheme like Tesco Clubcard works. Tesco has effectively set up a parallel currency we earn by spending on its products that can be converted into spending in the real world at a market exchange rate. With blockchain, a network of neighbourhood shops can do the same thing and effectively compete with a global giant.

Or, coming back to our own industry, blockchain promises a transformation over control of data that is similar to the global shift from large centralised generators to distributed generation such as domestic PV.

Gaining market momentum

Blockchain is gaining market momentum, and scarcely a day seems to go by without another start-up announcing its blockchain technology and Initial Coin Offering (ICO). Those of us that may use this technology need to start by understanding how it works, the kinds of solutions that are out there and how we might be able to benefit.

As with any technology, there will be a number of market entrants, the number of options will increase exponentially, a few companies will gain disproportionate market share, there will be a shakeout in the industry and we will end up with a few firms that have sustainable business models – perhaps over a period of 10 years.

Right now, however, we should begin by considering how we could improve the way in which we trade and use energy by participating in a blockchain-based platform and whether we might have the ability to enter into a pilot to use blockchain to, quite literally, write our energy data. te

UKAEE is the UK chapter of the global energy management organisation, the Association of Energy Engineers (AEE), with its HQ in the USA.

UKAEE covers a range of expertise in the energy management and energy efficiency sectors. It delivers a range of technically focused seminars and offers excellent networking opportunities for energy and sustainability professionals.

It offers Continued Professional Development opportunities for AEE certifications such as Certified Energy Manager, Certified Measurement and Verification Professional and Certified Energy Auditor.

Membership to the UKAEE is currently free. For more information on UKAEE or how to join, please visit ukaee.org.uk

People power

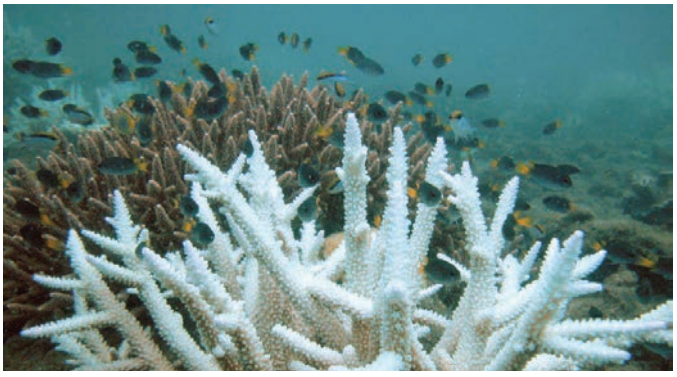
Let's be more proactive in sharing knowledge and empowering individuals to take responsibility for making better everyday choices, says Jes Rutter

It is my fervent hope that the huge popularity of the *Blue Planet* TV series, regularly attracting circa 10 million viewers, will open people's eyes like never before to the wonders of our world and to the impact that climate change is having on that world.

The last episode of series two revealed some shocking facts about our climate, our seas and our natural world. But despite this, there was a message of hope that changes for the better can be brought about by the actions of individuals. In the words of Vincent van Gogh: "Great things are done by a series of small things brought together," or, as one of the commentators in the programme says: "It comes down to us each taking responsibility for the personal choices in our everyday lives and it is those everyday choices that add up."

As energy professionals, we have taken on the responsibility of using our expertise to manage and reduce energy use, a major contributor to the high level of CO_2 in our atmosphere, which is accelerating climate change and causing the acidification of our seas evidenced so clearly by the bleaching of the Great Barrier Reef. With responsibility comes great power (with apologies to Spider Man for the paraphrasing!). So, it's down to us to educate people about how they can reduce energy use, reduce the level of CO_2 and help the environment.

We all know that an organisation's employees can be the most powerful asset in achieving and sustaining energy reductions and savings. They know the business processes and operations better than an outside consultant, and can be best placed to identify and implement energy saving opportunities.



Bleached Acropora coral (foreground) and normal colony (background), Keppel Islands, Great Barrier Reef

We know that savings achieved through changing behaviours can equal or exceed savings made through capital investment projects – at a fraction of the cost! We know how changing behaviour can have a direct and significant impact on saving energy. For example, we worked with a global power systems manufacturer to deliver a best practice LED lighting project which required a capital investment of £480k. The project was a real success and achieved energy savings representing 7½% pa of total site consumption. We delivered an extensive behaviour management programme to the same client for £30k and after 15 months they had also achieved similar energy savings of 7½% pa.

> ***It comes down to us each taking responsibility for the personal choices in our everyday lives and it is those everyday choices that add up***

But changing employee behaviours is not just about saving energy and costs, there are other benefits to increasing staff awareness and engagement too. Staff acquire new skills, increase their contribution to the business and build their own self-esteem. This can in turn take them into other positions within the organisation – positions with better prospects and/or better pay. Increased awareness will add personal value too as they apply their learning within the home environment.

Implementing a company-wide behavioural management programme will also:

- Support the achievement of and ongoing maintenance of certification to the energy management standard ISO 50001
- Spread the responsibility and ownership of energy saving throughout the organisation
- Help achieve energy, cost and sustainability targets
- Attract, retain and maintain a happy workforce and make the organisation an 'Employer of Choice'
- Save money on energy and operating costs and manage risk
- Differentiate the organisation from its competitors
- Generate innovation and learning
- Improve the business reputation and standing
- Provide access to investment and funding opportunities
- Generate positive publicity and media opportunities due to media interest in ethical business activities
- Send a message to all stakeholders within the organisation that there is a significant commitment to saving energy and that the organisation is corporately socially responsible

There really is no downside. te

Jes Rutter is chairman of the Independent Energy Consultants' group (IECg), Esta and managing director of JRP Solutions

To find out the latest on Behavioural Change programmes or to understand how Esta's Independent Energy Consultants can benefit your organisation as well as the wider industry role we have, come along as a guest to Esta's next Members' Meeting on 8 February in Birmingham. More details can be found at estaenergy.org.uk/events/esta-members-meetings/

Did Esos make you sick?

Former CIBSE president John Field outlines remedies for those that found Esos a headache

Have you got 'Esos-itis' – a commonly reported condition of Esos participants that get low or zero value from the scheme?

For customers who have this 'symptom' there is a remedy:

- Focus on practical cost saving and energy saving projects not reports and analysis
- Obtain minimum compliance and maximum value in keeping with the government objectives
- Don't pay a large amount for consultancy – it is rarely needed as often you have done more than you think

There is a remedy to 'Eos-itisis'

Here are some key principles to avoid the pitfalls of Esos:

Make use of previous work which identifies cost savings

Prioritise actions you are doing or want to do. If you have plans for property upgrades or changes, this a good time to incorporate energy improving changes and the investigations for the property work can be used to help with Esos compliance. Clearly any specific energy audit works you need should be Esos compliant.

Select energy saving winners

Achieving actual energy saving is about getting on with highly cost effective measures. For many companies there are still big savings available from these projects which often include LED lighting, controls improvements and operating practice. The Esos work can spell out how to progress these rather than just identifying them alongside more obscure projects.

On the other hand, larger scale plant replacement, fabric measures and renewables often have much poorer paybacks – but where justified these can usefully be progressed.

Use simple but frequent high-level reporting

Advanced metering and reporting can be used to engage directly with building occupiers and managers and then, in overview summary form with senior management. The high level company reporting can align with your Esos compliance of overall energy reporting.

Make sensible use of the ISO 50001 option for compliance

This is generally only suitable for certain organisations. It is usually only bigger or more energy-engaged companies who can justify it – or it can be an add-on to existing ISO 9000 Quality or 14000 Environmental systems they already have in place. If the ISO 50001 route is selected for Esos compliance, go for low-burden compliance without skimping on board level engagement and reporting.

Be ready for legislative changes

The government consultation on ending the CRC scheme is looking at increasing the value of Esos by making it more useful while reducing compliance cost. Esos work will have to prepare the information for the public disclosure which will replace CRC. An additional possibility is that companies will have to disclose their Esos opportunities and the action they have taken to save energy – this all adds to the need for effective integration and focus on practical and cost-effective energy saving projects. te

John Field is energy management director at Noveus Energy

Was Esos any good, asks government

The government wants the views of businesses that had to take an Esos audit.

Beis has commissioned external research to evaluate the effectiveness of the programme, which is overseen by the Environment Agency.

The Energy Saving Opportunity Scheme requires firms above a certain size or turnover to take an energy audit every four years. It must be signed off by a director, and the theory is that by pointing out easy energy efficiency wins, they take subsequent action.

Beis wants to hear from businesses involved about what worked and what didn't. Workshops and interviews will be carried out by Ipsos, the Carbon Trust and University College London, starting from this month and running through until April.

Firms interested in providing feedback on their Esos experience and whether it has proved effective, should contact ndeeevaluation@beis.gov.uk or email Alessandro.casoli@carbontrust.com

Meanwhile, the Environment Agency says civil enforcement proceedings are progressing against "a number" of non-compliant organisations and said it will name those organisations and the penalties imposed when applicable appeal times have elapsed.

Organisations Environment Agency has investigated for Esos compliance

The agency said it had investigated 2,400 firms, of which 240 had subsequently started the Esos process.

A further 190 enforcement notice cases are ongoing, according to the agency, which is also consulting on changing its enforcement and sanctions process. te

‘We come from the future to stabilise the power system’

Faraday Grid, co-founded by Australian Andrew Scobie, has set up shop in the UK. Its mission is to create “fit for purpose” energy systems that can accommodate large volumes of decentralised, intermittent generation without collapsing. Brendan Coyne reports

Edinburgh-based Faraday Grid claims it can massively increase grid capacity to carry renewables at no additional cost, while solving network volatility.

Other firms are currently doing clever things to better gauge inertia and its impacts but CEO Andrew Scobie says his company’s technology can take things a step further.

“We don’t measure the problem,” he states. “We solve the problem.”

If energy companies buy into the vision – and Faraday Grid technology can be proven to work at scale – the firm believes it can fundamentally change global energy infrastructure.

A bold claim, given grid operators are not known for taking risks on new technology.

Scobie, the firm’s CEO, accepts that at face value it is not an easy sell.

“Yes, they are risk averse. We’re talking about the nervous system of our economy. Energy impacts on everything. So people should be both cynical and sceptical, because the last thing you want to do is disrupt the energy system,” he says.

“But that is the reality – it is going to be disrupted. Renewables will destabilise the grid. That is Ofgem and Beis saying that, not me. The grid is becoming increasingly fragile,” says Scobie, and without intervention “it will crash”.

In that sense, technological change is no longer a risk for utilities, Scobie suggests. ”Business as usual is the risk.”

“We are finding that the distribution network operators and those involved in the energy system as a whole are enormously welcoming about things that are going to reduce risk.”

The Faraday Exchanger

The company’s premise is based upon what it calls the Faraday Exchanger. It is a piece of kit that replaces network transformers, which the company emphasises were not built for distributed energy and bi-directional power flows.

As such, Scobie says transformers are no longer fit for purpose and must be swapped out for “something smarter and much more dynamic”.

He bills the Faraday Exchanger as “the fundamental enabling technology” of a dynamically balanced grid. “It’s the equivalent of the router to the internet,” he suggests.

The company’s literature describes the Faraday Exchanger as: “A managed, high speed, power flow control device that dynamically maintains target voltage, frequency and power factor efficiently over a range of operation.”

According to the firm, the Exchangers require no external communications and are fully autonomous, and can be dropped into grids incrementally, under existing regulations, without breaking everything.

The Faraday Grid

Swapping out transformers for Faraday Exchangers (which Scobie says will cost the same as transformers, validating the firm’s “no additional cost” claim) enables the Faraday Grid.

The company’s literature describes the Faraday Grid as: “An autonomous, responsive, electrical meta-network, agnostic to generation and consumption, with its own inertia, enabling more productive, resilient and stable electricity transfer.”

Is anybody buying this?
Faraday Grid is backed by Canadian renewables developer and investor Amp. Scobie says Amp sees "immediate value" in the technology's ability to stabilise microgrids, which can be much more susceptible to variations in power quality and quantity.

"Amp runs domestic and commercial microgrids for some of the largest commercial companies in the world, so that is a direct [commercial] pathway for us," says Scobie.

He believes the company's technology has applications across the energy system, but thinks that in the UK, distribution network operators (DNOs) will be initial customers, given the volume of transformers on their networks and the impact of dynamic demand on their operations.

Scobie says the company is in discussions with five of the DNOs but talks with Scottish Power Energy Networks – and another network south of the border – are probably the most advanced.

However, the company says its first deployments will be with Amp in overseas markets next year. In the UK, it will make use of the Power Networks Demonstration Centre in Glasgow to optimise design architecture for UK grids before moving into commercial trials.

Any barriers?
Should those trials prove successful, there are no regulatory barriers to deploying Faraday Exchangers, says Richard Dowling, the company's head of government affairs and chief economist.

"One of the design characteristics [of the Faraday Grid] is that it can be built on individual basis and can therefore solve very localised problems. For example, in an area with a lot of rooftop PV, the local utility may be struggling to control voltage.

You can put a Faraday Exchanger in that location while being compatible within the existing grid," says Dowling.

"So it does not require any regulatory amendment for us to roll out the technology, which is fundamental to the approach we have taken."

Equally, removing the requirement for a large software layer by making the Exchangers intelligent, removes the cost and scalability problems that have scuppered attempts to rollout smart grids in the past, Dowling adds.

"It allows utilities to iterate our technology, which receives all the information it needs to self-manage from the electricity signal itself."

What they say:
"We are fundamentally a change to the common denominator of the energy system. We, in a sense, come from the future. Our backgrounds are in energy systems and complex manufacturing systems globally," says Scobie.

"We identified in our Australian utility clients that there was a very substantial problem in the physics and economics of the energy systems brought about by competing political agendas [the trilemma of affordability, security of supply and decarbonisation].

"The utilities sector in Australia has suffered in recent times, with four recent grid crashes. We worked with very large utilities over periods of time and while we could see the problem, none of the existing technology pathways could solve it, either technically or economically.

"Most people focus on intermittency. But at least half of the problem is physics, maintaining system balance, which is not about intermittency – it is volatility that knocks over grids. So to enable all of the other solutions that are imperative to our future, you must first solve energy system stability.

"The Faraday Grid is designed to solve that... and, so far, every door that we have knocked upon is open."

Emergent trading platform
Faraday Grid is also building a transactional platform, called Emergent, which is designed to sit on top of its smart grid and enable dynamic trading to help balance the grid using price signals. The firm believes this will complement its grid architecture by engaging consumers and generators and enabling them to trade power using dynamic pricing.

According to company literature, it is "a system of control that balances supply and demand across the entire energy system, using price as the key operational mechanism". te

Key features of the Faraday Exchanger

- Drop-in replacement for transformers at like-for-like cost
- Replaces the function of rectifiers, inverters and converters

- Scalable, cost-effective solution for large-scale electricity grids
- Ubiquitous technology with application for transmission down to consumer device

- Uses existing pole and wire grid infrastructure
- Can be deployed incrementally

- Subject to significant network effects
- Autonomous device = a resilient and flexible grid
- Does not require additional layers of control technology

> *Most people focus on intermittency. But at least half of the problem is physics, maintaining system balance, which is not about intermittency – it is volatility that knocks over grids. So to enable all of the other solutions that are imperative to our future, you must first solve energy system stability*

Market shifts make it critical to access all areas

Ability to access all markets will define successful DSR businesses, so firms considering putting their flexible assets to use should choose their partners carefully, writes Brendan Coyne

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] 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

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 *(pictured)* 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."

> ***We are starting to see a bit of conflict between the ability to monetise assets in more than one 'market'***
>
> **Louis Burford, Restore**

> ***We see the value of flexibility in traded markets increasing, as there is going to be an increasing need for flexibility in future***
>
> **Annalisa Bell, Eon**

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 right).

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 among 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.

"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. te

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

Alongside the Smart Systems Plan published in summer, 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.

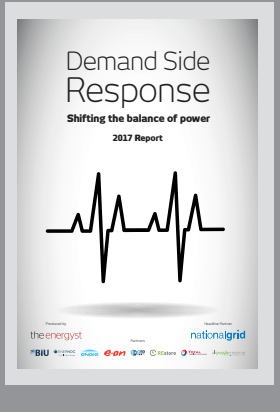
Paul Troughton, senior director of regulatory affairs at Enernoc *(pictured)*, said the regulator "seemed to have most of the important principles right" around permissions, baseline methodologies, information flows and balancing costs and delivery risks.

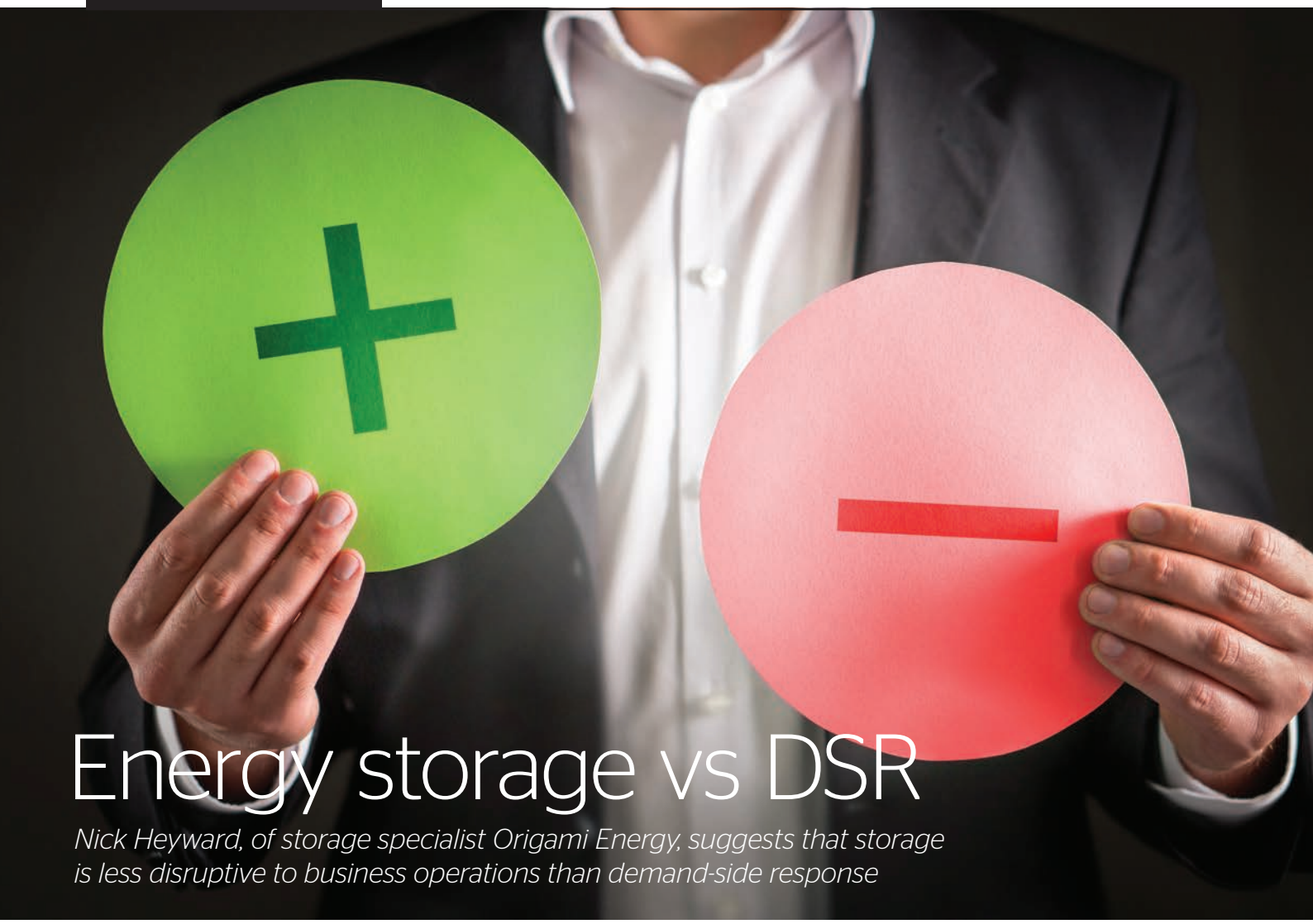
However, other than how long the proposals may take to implement, Troughton expressed concern over "the assumption that the supply market is so competitive that suppliers won't be able to erect barriers to deter customers from dealing with independent aggregators".

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 (eg 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."

This article was written for our DSR Report, download it at theenergyst.com/dsr





Energy storage vs DSR

Nick Heyward, of storage specialist Origami Energy, suggests that storage is less disruptive to business operations than demand-side response

The Energyst recently surveyed 180 businesses with an interest in responsive energy. Nearly two-thirds said that they did not participate in DSR. Of those, 77% said that they would be interested in doing so if it did not affect core business. Other barriers to entry included a lack of businesses awareness, fear of low ROI and/or having unsuitable equipment.

Energy storage can overcome many of the perceived barriers to adopting flexible energy systems, often providing adequate levels of flexibility for large energy users, negating the need for DSR.

Cost benefit analysis

The capital cost of energy storage is a key factor for businesses. While using DSR services usually incurs some costs due to modifications to asset controllers, staff training and so on, it is significantly cheaper in comparison to a new storage system.

However, purchasing a system outright is not the only way to adopt energy storage. Financing options are now widely available that reduce or eliminate capital expenditure.

Models vary, but many solutions involve a benefit share with the site owner, using a proportion of the income generated to cover the cost of the asset over a minimum contract term. This allows site owners to unlock the enhanced benefits of energy storage at an equivalent or lower cost to DSR.

Fully funded solutions also pass on investment risk of the energy storage (eg uncertainty in tendered market revenue streams) to the parties best placed to manage it.

No disruption

Participating in DSR typically requires control of individual machinery or processes to adjust the load drawn by the site.

While aggregators can reduce power demand significantly by halting large, energy-intensive processes, in many cases, businesses can only make minor adjustments to their processes. For example, reducing the speed of motor operation rather than turning off completely, or partial shutdown of a few assets in turn, rather than all assets together. This practical restriction limits the extent to which businesses can achieve power flexibility, even from large sites and assets.

The timing of the flexible response is as important as the magnitude (kilowatts). For example, the ability to reduce demand during peak winter charging periods is generally more valuable than removing loads during summer.

In some cases, the assets themselves restrict the level and duration of useful flexibility; when business-critical operations must be maintained as a priority over the flexible response. An example is cycling refrigeration to provide flexibility. A business can only keep assets like these idle for a certain duration before ambient conditions dictate that they must operate again to maintain the temperature. At other times, it may be unacceptable for a business to accept any form of process interruption, regardless of existing asset capability.

Energy storage overcomes these DSR

limitations by providing a separate source of flexibility, distinct from any associated processes or machinery.

The impact on operations and processes

Day to day use of energy storage has a negligible impact on business operations and processes, unlike typical DSR activities.

While it is possible to fully automate DSR, a business must always be able to manually override any turn down. For example, if adjusting the demand breaches acceptable operating ranges, or if the machinery is unexpectedly needed. Intervention is not necessary using energy storage. The capacity available may be drawn on at any time without any discernible impact on well-optimised site operations. On dispatch of a response from the storage asset, the site simply changes how much power it draws from the grid versus the storage.

More valuable flexibility?

The response from DSR is often considered to be less reliable than that from a physical asset such as storage, although many DSR providers would argue against this.

This can arguably be seen by considering the way network operators apply factors to 'derate' the level of response expected from DSR in comparison to other assets. By derating the response, the network operator reduces the extent to which they rely on the rated capacity and ultimately the amount they are willing to pay for this flexibility.

For example, UK Power Networks' Low Carbon London innovation project from 2014 studied the level of engagement and response from I&C demand response providers, specifically to help identify a range of 'reliability factors' for rating the expected contribution to network security from a range of several types of flexibility.

UK Power Networks applied reliability factors of 70-80% for DSR provided from the use of physical generating assets, such as diesel and storage.

However, the reliability factors for DSR provided from genuine demand turn down were in the range 54-64%.

A similar trait is evident in the relative 'derating' factors applied to different technology classes within the Capacity Market rules. DSR-based response attracts the second lowest de-rating factor (after nuclear) at 86.3%. The current derating factors for longer-duration storage are just over 96%, although as confirmed recently by government, storage with a lower-level of energy capacity, and therefore shorter duration of response, will be derated more significantly – as low as 17-21% for half hour batteries (see p14).

Fast flexibility

In addition to the reliability of flexibility sources, the speed of response is also becoming increasingly important for National Grid. As larger, traditional flexible carbon-intensive generation assets are replaced by renewables, the electricity grid's inertia is falling.

Inertia dictates how sensitive the system equilibrium is to sudden outages or faults – lower inertia means the frequency can fall more quickly in the event of a fault, making the system unstable.

Storage provides exceptionally fast response times and can reduce the overall flexibility needed by the system operator to mitigate frequency falls or rises. Traditionally, grid balancing is a carbon-intensive process and so energy storage lowers both costs and emissions.

In a recent analysis of this effect on the networks of Ireland, Queen's University, Belfast identified that 360MW of fast-acting storage could have provided the same amount of power after 0.1 seconds as the inertial response from 3000MW of traditional synchronous generators (about three quarters of Drax generating capacity).

The data demonstrates the added value derived from deploying fast-acting energy storage rather than DSR. Energy storage offers the provision of clean back-up power supply, which DSR cannot. In addition, the cost of using energy storage does not need to involve significant capital outlay, particularly when considering the availability of fully funded solutions.

Energy storage provides constraint management services without impacting business operations and helps utilise on-site renewables, which for some businesses is core to their corporate social responsibility goals.

Overall, compared with DSR, storage is a highly reliable and robust way of providing flexibility for critical applications. te

> *Storage provides exceptionally fast response times and can reduce the overall flexibility needed by the system operator to mitigate frequency falls or rises*

Ideal bedfellows?

Colocating batteries at solar farms could help solve intermittency while creating new revenue streams for operators. But there are some technical and regulatory hurdles to clear, writes Sweco's Vijay Shinde

Anesco's Clayhill solar storage development does not need to worry about Rocs as it is subsidy free

Solar generation is growing rapidly in the UK. In October 2017, total output stood at 12.5GW across more than 930,000 installations and capacity had increased by 7.7% compared with the same time last year, according to government figures. Ground mounted solar installations now account for 59% of the total output, with 6.5GW Renewable Obligation Certificates (Rocs) accredited.

Clearly the incentives for generating solar power have had an impact. However, a major challenge for this type of renewable energy generation is ensuring that the capacity it delivers marries up with energy users' demands.

Naturally, solar output is available during daylight hours, whereas demand for energy peaks in the evening. So, as solar generation becomes more prevalent, there is a risk that we could see thousands of operators competing during the day for a share of limited grid export capacity followed by a shortfall in supply after dark.

Colocated large-scale batteries offer a potential solution to this problem, enabling solar generators to export power to the grid when it is most in demand. However, retrofitting batteries to existing solar facilities is not a straightforward operation, and the technical and regulatory challenges involved mean it will need to be done on an entirely bespoke, site-by-site basis.

Compliance challenge

The most significant issue for solar generators and their

> *Seeking approval on retaining Rocs accreditation while colocating batteries on an operational solar farm will likely take several weeks to complete*

investors is retaining a site's Rocs accreditation after a storage facility is added. This is a critical concern, as Rocs make up a sizeable share of the revenue for solar generators.

At the heart of the issue is that any energy that has been drawn from the grid, stored and resupplied is not classed as green energy, and therefore is not eligible for Rocs, which apply only to sources that are 100% renewable.

Where the storage facility is located with respect to the different metering points in a solar installation is therefore particularly crucial.

A solar project typically will have two metering points – a generation meter, which monitors the amount of power generated directly from the solar farm, and an export meter, which records the amount of energy being uploaded from the site to the grid. These two figures could be different depending on a number of variables, including system losses and on-site electrical consumption

In order to comply with Rocs rules, operators will need to place any batteries behind the generation meter for the solar farm, as this will provide assurance that only green energy and not power from the grid is being used to charge the batteries.

Ofgem handed out its first accreditation for a solar generation and battery facility in September 2017, seen widely as a game changer for the sector, and the regulator has said it will assess eligibility for sites on a case by-case basis. It has recently published a draft guidance document on the arrangements for storage under the Renewable Obligation and Feed-in Tariff (FiT) schemes.

Any operators looking to go through the process are required to give notice of colocated storage in the same way as notifying any changes to the generating station or installation, or the way in which support under the scheme is to be claimed. Seeking approval on retaining Rocs accreditation while colocating batteries on an operational solar farm will likely take several weeks to complete.

Risk versus reward

Despite a solution to the issue of compliance with government incentives, there is an additional fundamental challenge that any operators investigating colocated batteries needs to tackle – designing a battery system that would be justified from a cost/benefit perspective.

Stacking revenue streams to make batteries viable for colocation is a complex calculation. Then, the supplier must design a system that will enable it to capitalise on the opportunity and integrate it with the existing site.

Yet, while we are a long way from having a one-size-fits-all solution for implementing storage in operational solar farms, the first steps have been taken in a process that promises to make solar power better able to meet the country's energy needs.

For those operators willing to invest the time and resources to investigate the possibilities that storage offers at their facilities, the benefits could be significant.

Looking at the bigger picture, systems that combine renewable sources and energy storage have the potential to help us as a nation to achieve our ambitious carbon-reduction targets in the years ahead, and the government should look for ways to help renewable industry embrace the technology. te

Vijay Shinde is grid services lead at engineering, environment and design consultancy Sweco

Can Ofgem expect to win the Triad judicial review?

Economist and consultant Franck Latrémolière thinks Ofgem will lose the legal challenge it now faces over cuts to embedded benefits

On 20 June 2017, Ofgem directed implementation of WACM4 of CMP264 and CMP265. This would change the Transmission Network Use of System charging methodology to phase out the major part of the benefit that most distributed generators receive if they generate power during triad periods. The change would affect charges from 1 April 2018, with the phasing out period ending on 31 March 2020.

A group of distributed generators are seeking a judicial review of Ofgem's decision.

While justice is, in principle, public, the courts are not pro-active in promoting hearing dates or access to records. The parties in this case have not shared much. I do not know what stage the process has reached, or what the arguments are on both sides. Can readers help?

Pending information, here is some speculation:

Ofgem may explain its decision by explaining that triad charges had grown out of proportion with any measure of the cost of transmitting power to meet peak-time demand from distribution systems, and therefore that giving Triad benefit to generators who offset that peak-time demand is overpaying these generators.

Ofgem may say that its decision would tend to restore a competitive playing field between distributed generation and generation that is connected to the transmission system or is too large to be exempted from paying transmission charges directly, in that after the cuts all these forms of generation would only receive benefits from offsetting local demand that are commensurate with the cost of transporting electricity to meet local demand.

In the context of a judicial review, such Ofgem claims are likely to be accepted by the court without much in-depth examination. They are probably true anyway.

Opposing arguments

What might the arguments be from the other side?

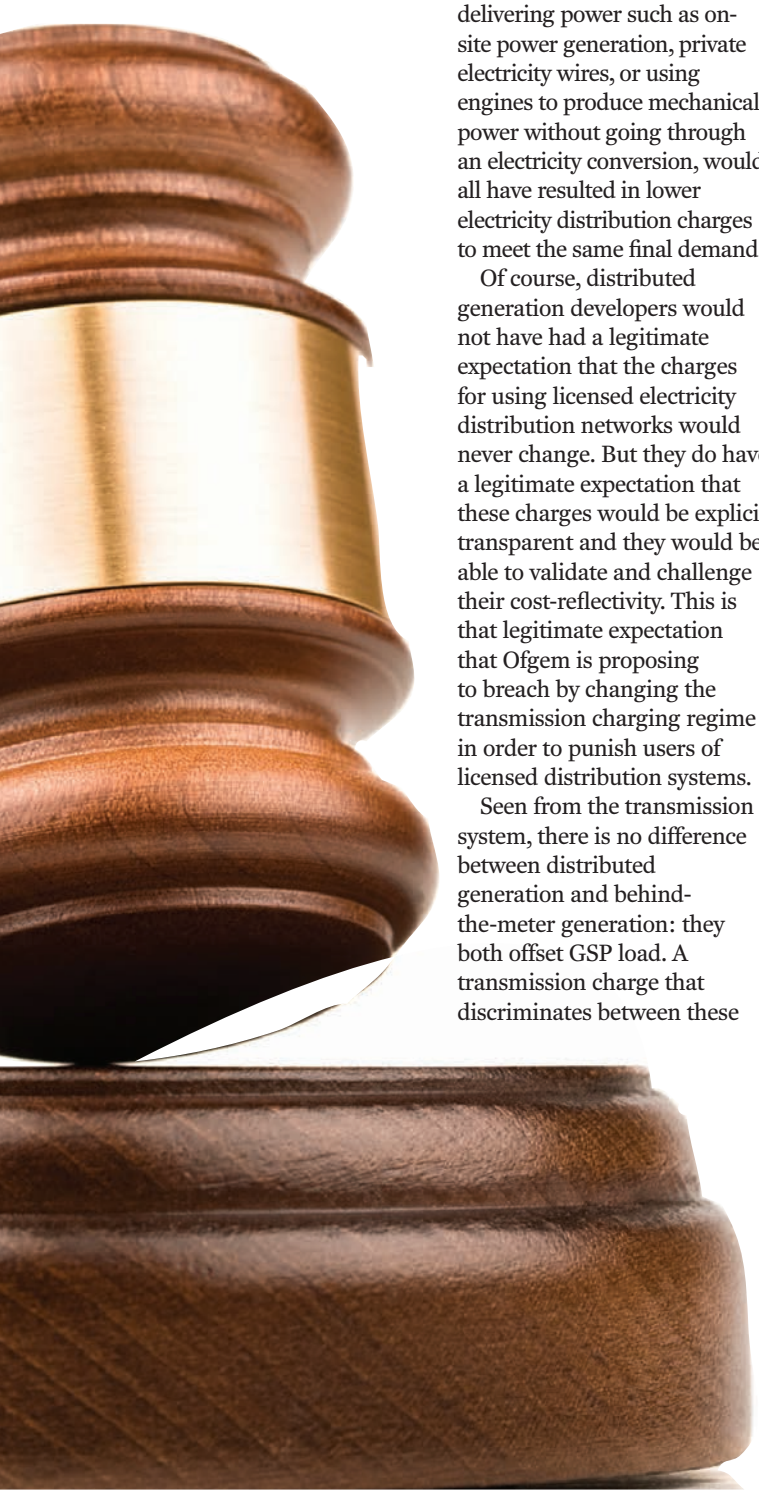
Some distributed generators might be tempted to vent their displeasure about the way in which the cut in Triad benefit would damage their business and make them regret bidding into the Capacity Market. They had an expectation that they would earn money from Triad benefit. They might threaten to throw their toys out of the pram, claiming that dashing their expectations will increase the return on capital that people require to play in the UK energy sector.

But their lawyers will probably convince them that a whinge about political risk does not win a judicial review; and that the expectation that was dashed was not a "legitimate expectation" on which they can hang a winning claim, because:

- They were not given that expectation by Ofgem or government
- Such an expectation would not be legitimate because (on Ofgem's evidence) it would amount to an expectation of being paid over the odds

So what is the real basis for seeking judicial review?

I think that it will turn on the allegation that investors who have backed distributed generation projects had a legitimate expectation that they would not be punished for using licensed



electricity distribution networks to distribute their output to customers.

By choosing to use licensed electricity distribution networks, these developers naturally accepted that there would be a charge. Currently that charge is primarily in the form of demand distribution use of system charges: other ways of delivering power such as on-site power generation, private electricity wires, or using engines to produce mechanical power without going through an electricity conversion, would all have resulted in lower electricity distribution charges to meet the same final demand.

Of course, distributed generation developers would not have had a legitimate expectation that the charges for using licensed electricity distribution networks would never change. But they do have a legitimate expectation that these charges would be explicit, transparent and they would be able to validate and challenge their cost-reflectivity. This is that legitimate expectation that Ofgem is proposing to breach by changing the transmission charging regime in order to punish users of licensed distribution systems.

Seen from the transmission system, there is no difference between distributed generation and behind-the-meter generation: they both offset GSP load. A transmission charge that discriminates between these

> *Can you excuse introducing one form of undue discrimination by reducing another?*

two scenarios is a backdoor way of punishing users of licensed distribution systems, without any cost basis, and without even going through the proper governance process for distribution charges.

A legitimate expectation?

Investors in distributed generation had a legitimate expectation that, in a civilised country, backdoor punishment of this kind would not receive regulatory approval.

In order to weaken arguments based on undue discrimination between front-of-meter and behind-the-meter generation, Ofgem might argue that their ongoing targeted charging review will remove that discrimination by forcing everyone to pay transmission charges on the basis of a measure of gross demand, not net import. Sounds powerful? But it would not be.

First, what the complaint would be about is a legitimate expectation that distributed generation would not be punished through transmission charges for using licensed distribution systems. That is not the same as jealousy about on-site generation not being punished too.

Second, it is hard to imagine a post-review world in which everybody would be punished equally. Ofgem does not propose to charge domestic demand on a gross basis, and it would find it difficult to charge a large municipal CHP microgrid scheme for a transmission system that it does not use. Ofgem cannot punish customers who disconnect from the system and run entirely on their own power sources and storage. Ofgem cannot punish the port that opts to build diesel cranes, instead of electric cranes powered by a biomass power station.

Ofgem might be tempted to re-emphasise the point that their change reduces discrimination between distributed and transmission-connected (or very large distributed) generation. And to note that exemptible distributed generation would still receive favourable treatment compared to transmission-connected generation, by avoiding transmission charges for export capacity and balancing services use of system charges.

That would not help. Can you excuse introducing one form of undue discrimination by reducing another? Even if you could, the pretence of symmetry would not be relevant: distributed generators had a legitimate expectation that they would not be punished for using licensed distribution systems, whereas transmission-connected generators had no basis for any legitimate expectation that the existing unfair arrangements would be rebalanced in their favour between 2018 and 2020.

Defeat for Ofgem?

I predict an Ofgem defeat. And because I am an eternal optimist, I predict that post-defeat Ofgem will redirect its targeted charging review so that it identifies the valuable services provided by the electricity system, and develops reasonable charges for these services, instead of the old approach of smearing all costs on demand and then firefighting the inevitable adverse consequences like excessive Triad benefits. te

Franck Latrémolière is an economist and consultant who finds electricity network charges interesting. He runs the dcmf.co.uk website

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Accelerated savings

Formula One-inspired aerofoil technology to deliver energy reductions in Sainsbury's cold aisle fridges

Sainsbury's is the first supermarket in the UK to roll out Formula One-inspired aerofoil technology on fridges in the cold aisles across all of its stores. The energy-saving technology helps to chill food to the same temperature while making the aisles warmer for customers.

The aerofoils, which will be introduced in aisles stocking products such as cheese, yoghurts and meat, will account for an energy reduction that equates to more than 320 million kettles boiled and 360 million toaster pop-ups. The fridges will remain at the same temperature to keep food cool and fresh. However, the aisles will be warmer for customers by up to 4°C – helping to make the shopping experience more comfortable for customers.

The aerofoil technology, which borrows from F1, prevents cold air from the fridges spilling out into the aisle by steering it directly back down into the fridge unit. The principle for the technology replicates aerofoil design with an aerodynamic profile that redirects air flow, similar to those seen on F1 cars. The aerofoil system is attached to the front of the refrigerator unit shelves to keep more of the cool air inside the fridges in the cold aisle of a supermarket.

The fridge technology will be installed across the Sainsbury's estate by the middle of 2018 and Sainsbury's will be the first retailer to retrofit the technology on such a large scale.

Head of sustainability Paul Crewe says: "By keeping the cold air in our fridges using this technology, we'll see an energy reduction of up to 15% which, when multiplied across all of our stores is a significant amount of energy saved. By looking outside of our industry, and borrowing technology from an industry that is renowned for its speed and efficiency, we are accelerating how we are reducing the impact on the environment whilst making shopping in Sainsbury's stores a more comfortable experience."

> *By keeping the cold air in our fridges, we'll see an energy reduction of up to 15% which, when multiplied across all of our stores, is a significant amount of energy saved*

Potential energy saving that Sainsbury's will achieve by using the cold air technology in its fridges

Williams Advanced Engineering, the division of Williams that commercialises F1-derived innovation and expertise, has created the technology in collaboration with UK start-up Aerofoil Energy.

Craig Wilson, managing director of Williams Advanced Engineering, says: "Our collaboration with Aerofoil Energy is a perfect example of how F1-derived innovations can have a tangible benefit to the general public and the environment. This technology has global potential and, the extensive tests we have carried out with the support of Sainsbury's, have shown the significant savings in operational costs and emissions are extremely promising."

Paul McAndrew, managing director of Aerofoil Energy, adds: "Bringing a new technology to market is extremely challenging but we have been fortunate to have a great partner in Williams Advanced Engineering and the support of Sainsbury's.

"This announcement of a mass-scale roll-out of our technology across Sainsbury's signals the successful conclusion of several years' of extensive development work, which can benefit retailers in the UK and globally in significantly reducing carbon emissions." te

Taking control of efficiency

A combination of efficient plant and efficient controls is the key to maximising the efficiency of heating plant, says Steve Lalyk of Hoval

In recent years the growing use of heating systems comprising multiple conventional and low carbon heat sources has created a need for more sophisticated control strategies. It has also become apparent that simply tweaking traditional controller designs to try to address these issues has only been partially successful.

Consequently, controllers now need to deliver effective control of a range of heat sources, with the ability to handle single units or operate cascades of heat sources. When mixed heat sources are in use, the controller also needs to take account of the characteristics of each heat source. These heat sources might include boilers (gas, oil, biomass), combined heat and power (CHP), calorifiers, heat pumps and solar thermal.

For example, when gas-fired CHP is used alongside gas-fired boilers the CHP will usually be used to meet base heat loads with the gas boilers providing a top-up at peak demand. This arrangement needs to maximise the run-times of the CHP, so it is important that the base heat load is sufficient for the CHP to run for at least three hours each time it fires.

This has control implications, because if the gas-fired back-up boilers are brought in too quickly the CHP may switch off, so that the required run-times are not met and the system is less efficient and cost-effective than should be the case.

> ***If the gas-fired back-up boilers are brought in too quickly the CHP may switch off, so that the required run-times are not met***

Getting connected

Remote monitoring of plant performance through the internet is now a requirement for many control systems, as may be integration with a building management system using OPC UA, ModBus or KNX interfaces, along with 'smart grid' readiness.

There is also growing demand for controllers that can operate within a heat network environment. Thus compatibility with 'supervisor' type controls will support real-time visualisation, monitoring and optimisation of district heating networks.

Equally, as mentioned earlier, controllers need to make it easy to re-commission the system to reflect changing heat loads through the life of the building. This may be the result of a change of tenants or other changes to building usage or staff densities over time, as well as improvements to the thermal performance of the building fabric.

Furthermore, 'plug and play' functionality will make it easy to extend the system in the future, if required, enabling further enhancements to efficiency as technologies improve or heat loads change.

In all these cases the control strategy needs to be updated accordingly and this is a far more straightforward process when using a control system that is easy to re-configure and re-commission. Ease of commissioning and re-commissioning is underpinned by use of plain language and step-by-step guidance for the commissioning engineer, along with alerts for any issues detected by the system.

Similarly, the interface for operating the system on a day-to-day basis needs to be easily understood by non-specialists. This doesn't mean that the level of control needs to be simple, it means the interface to the underlying sophisticated functionality must be user-friendly.

It is for all of these reasons that we have developed new designs of heating controller, re-engineered from the ground up. This latest generation of controls is already proving its worth in a wide range of project types. te

Steve Lalyk is senior applications specialist with Hoval

Distillery has biogas galore

Balmenach, one of Speyside's oldest whisky distilleries, is set to become one of Scotland's greenest after beginning a £3m project to significantly reduce the site's carbon footprint

Inver House Distillers has commissioned a new anaerobic digestion system for its Balmenach Distillery that breaks down the co-products of whisky production using micro-organisms to produce clean, methane-rich biogas to power the site.

The new technology will integrate with Balmenach's existing wood-pellet biomass boiler. Once complete, the combined system will generate enough renewable steam and electricity to meet 100% of the distillery's energy requirements with a surplus of electrical energy supplied to the grid.

When operational in summer 2018, approximately 130m^3 of whisky co-products (pot ale and spent lees) will be processed to produce 2,000m^3 of biogas each day, feeding a combined heat and power engine which will supply 200kW of power and 230kW of heat.

As well as the benefits of reduced emissions, improved energy efficiency and reduced operational costs, Balmenach's use of these technologies will significantly reduce heavy goods vehicle movements from its remote location in the Spey Valley. The new system will also return clean water to the nearby burn, and nutrient rich bio-solids to the land for barley farming in the Speyside region.

of the distillery's energy requirements will be met by the combined system

Commenting on the investment, Inver House Distillers' managing director Martin Leonard said: "Sustainability and consideration for the environmental impact at each of our sites is at the heart of our business strategy. With this new investment at Balmenach we are using the very latest technology to further that commitment, working with the best partners in the business to help us achieve our environmental goals. We also hope this investment will demonstrate how low carbon manufacture and clean growth are achievable, regardless of the size, location or output of the production site."

A team of specialist suppliers has been recruited by Inver House Distillers to deliver the new system.

Synergie Environ, the Glasgow-based low carbon energy engineering company, is project managing the installation at Balmenach through all feasibility, planning, permitting, procurement and construction phases.

Managing director Uisdean Fraser commented: We believe the project will deliver a malt whisky distillery which is powered entirely from renewable energy sources with the onsite combination of biomass for the primary heat source and electricity from the CHP powered by biogas from the anaerobic digestion plant.'

Clearfleau, a specialist provider of onsite biogas plants for the food and drink industry, is working with Inver House to design and build the new system.

Meanwhile Balcas operates the existing biomass steam system at Balmenach, which uses brites wood pellets produced from home grown Highland timber local to the distillery to produce zero carbon steam for the Balcas system.

In the two years since installation, it has enabled Balmenach to reduce its carbon footprint by 10,000 tonnes. te

Severn Trent builds three gas-to-grid plants

Severn Trent is building three new biomethane plants to turn sewage sludge and other feedstock into gas that can be injected into the grid.

Two sites in Stoke and Nottingham are already up and running with a third at Spondon due to come online in 2018.

Severn Trent currently produces the equivalent of 38% of the energy it uses and the new biogas plants are part of its plan to self-generate half the energy it uses by 2020.

According to renewable energy development engineer Martyn Lightfoot, they will also help keep bills down for customers.

"These new plants will help us save around £3m a year on our energy bills, and that saving will be passed on to our customers," said Lightfoot.

Each plant will produce up to 500m^3 an hour of biomethane from 1,000m^3 of biogas. The green gas generated at all three sites would be enough to heat more than 8,000 homes for a year, according to the firm.

To make it suitable for grid injection, the gas is washed at high pressure, then 'squashed' so it is at the same pressure as natural gas. It is tested for quality and an odour is added so it smells like normal gas. te

Solar 'absolutely still viable', batteries next

Nottingham City Council plans £3m solar PV expansion and launches framework to help others do the same. Brendan Coyne reports

Solar PV: coming to more Nottingham rooftops

Solar PV is "absolutely still viable" despite subsidies starting to wind down, according to Wayne Bexton, head of energy projects at Nottingham City Council.

The Autumn Budget confirmed Feed-in Tariffs (FiTs) will close in 2019. But falling costs mean PV will still make sense for both local authorities and commercial businesses, Bexton believes. The council is backing up that belief with a planned £3m investment in expanding its solar capacity in the next five years.

Bexton has spent the past two years delivering renewable energy and demand reduction initiatives for Nottingham's Energy Projects Service, which operates as a commercial business unit within the local authority.

The Energy Projects Service also undertakes work for commercial businesses and the returns and savings it generates are "'passported' into frontline services", says Bexton. "So it's a win-win."

The unit delivers everything from EPCs and energy audits to large energy projects across a range of technologies – from LEDS, chillers and virtualised servers, to solar and district heating – both locally and nationally.

Sunny outlook

Bexton says the company has driven solar installation costs to less than £1,000 per kilowatt peak. It can both fund installations and offer power purchase agreements (PPAs) for projects on buildings not owned by the council.

He believes those costs will fall further as market forces sharpen competition.

To that end, the Energy Projects Service has just launched a supplier framework that is available to every local authority in the UK.

It brings together approved suppliers and processes to reduce administration and drive down costs.

The framework "is split into easily accessible lots, covering everything from simply material supply to full design and implementation", says Bexton.

"It means we can act as a kind of gateway to other local authorities, so if they want [Nottingham Energy Services] to do the work, we will. But if not, they can access the framework for competitive bids – and competition is seeing prices tumble."

Wayne Bexton: 'It's a win-win'

Battery storage

Compared with PV, battery storage presents a risk profile which requires additional due diligence – and the council is trialling battery storage units adjacent to its solar carports in order to understand how to best stack revenues to ensure return on investment.

"Battery storage is an area we are looking to move into," says Bexton. "We have not yet committed to a large scale battery but are in talks with our distribution network operator, Western Power Distribution about how that might work and how risk might be shared."

In the meantime, the council has modelled the 33kV network around the city to see where batteries, potentially collocated with other forms of generation, might be sited adjacent to substations.

Fuel cells and mine water

A fuel cell trial, if successful, could also see gas boilers replaced across the city. Looking further ahead, the council is also examining the potential to use mine water and heat pumps to provide lower carbon heat from old coal mines that once powered the industrial revolution. te

See nottmcommercialservices.co.uk/energy-projects-service for further information, or email energyprojects@nottinghamcity.gov.uk for details on how to access the solar framework

The Oxford Energy Project was no mean feat but will deliver major savings

Healthier NHS finances

Heat and lighting upgrades by Vital Energi save two Oxford hospitals £7.5k a day, while a 15-year EPC contract from Veolia should save three hospitals in Morecambe Bay £1.3m a year

Oxford University Hospitals NHS Foundation Trust has slashed its energy bills by 48% thanks to a new shared £14.8m energy centre.

The first month's figures for the trust's Energy Project show savings of almost a £250,000.

The new energy centre uses a combined heat and power (CHP) engine and new combi boilers.

The hospitals, which are linked to the centre via 2.2km of heating pipes and high voltage cables, also replaced 6,407 light fittings.

Since coming online the energy bill at two hospitals within the trust has been cut almost in half.

In October 2016, the monthly energy bill for the Trust's Radcliffe and Churchill Hospitals (excluding PFI estates) was £484,175.03.

A year on, the same bill was £252,832.27, representing a saving of £231,343.03, or £7,462 every day.

The new infrastructure will also cut the trust's CO_2 output by 10,000 tonnes per year (the equivalent of 4,000 homes' CO_2 emissions) and guarantees to save the trust £461,746 (net) a year on its energy bills for 25 years.

The £14.8m project was carried out by Vital Energi.

Claire Hennessy, head of OUH operational estates and facilities management, said that the hospital trust was now "going into winter with reliable heat and power for the first time in decades".

She said that the reduction in CO_2 emissions and energy bill and maintenance savings were also highly welcome.

Meanwhile, in Lancashire, a 15-year energy performance contract (EPC) is set to save the University Hospitals of Morecambe Bay NHS Foundation Trust £1.3m a year through increased energy efficiency and reduced carbon emissions.

A key part of the project covers the design, delivery, installation, commissioning and subsequent operation of two 800kW CHP units that will reduce annual CO_2 emissions by 2,500 tonnes.

As well as generating power for the Royal Lancaster Infirmary and Furness General Hospital, the CHP will provide low temperature hot water (LTHW) at Furness and steam through a waste heat boiler at the Lancaster facility.

All three sites will undergo an LED lighting upgrade as well as new pumps and energy saving measures that are guaranteed under the contract, which also covers maintenance for the CHPs.

Estelle Brachlianoff, Veolia's senior executive vice president, UK and Ireland said: "Enabling the NHS to become more sustainable, and helping to focus budgets on patient care is very important as it enhances facilities and directly improves healthcare.

"Energy performance contracts meet these aims by delivering the necessary investment and payback to upgrade energy provision, reduce carbon emissions and build long-term energy resilience." te

CPD-accredited free guide to data acquisition

Synapsys Solutions is calling on the industry to be smarter about the way data is collected and actioned. This will be pivotal for optimising building performance in commercial buildings and to meet the ambitious 2020 targets, suggests the firm.

Energy costs can be the second largest business expense after wages, which in theory, should put efficiency near the top of the busines agenda. The choice of building services equipment can contribute up to 80% of energy costs, about 40% of which in a commercial building is HVAC, says Synapse. Approximately 20% of this could be easily saved through access to data that identifies peaks and troughs in energy usage, according to the firm..

Although a building management system (BMS) generates high volumes of data, it is not designed to analyse it. However, Synapsys Solutions has recently introduced a free CPD-Accredited Guide and presentation to Data Acquisition, which will explain why firms cannot simply rely on a BMS to operate a commercial building efficiently.

In order to achieve energy efficiency on a large scale, managers need to not only acquire data but also process and interpret it in order to facilitate behavioural change.

Tim Barnes, business development manager for Synapsys Solutions, said: "No two buildings are the same, therefore a one-size-fits-all solution does not apply. A building specific solution is needed to unlock potential savings and improve overall performance. By providing building owners and users with access and full visibility of their data, we believe this will be the catalyst in encouraging behaviour change."

To request a copy of the guide contact: tom.musselwhite@synapsys-solutions.com

£5k donated to Inspire Suffolk through Energy for Good scheme

East Anglian charity Inspire Suffolk has benefitted from a £5,000 donation from Energy for Good's not-for-profit energy purchasing framework.

Inspire Suffolk is Suffolk County Council chairman Stephen Burroughes' chosen charity for the year. The council used Energy for Good when seeking a new tender for its gas and electricity provision.

Based in Suffolk and north Essex, Inspire Suffolk makes a difference to the lives of local young people, supporting them onto a positive future through a range of personal and work-readiness programmes.

Suffolk County Council chairman Stephen Burroughes said: "We are delighted as an authority to work with Energy for Good in supporting our incredibly important corporate charity; Inspire Suffolk. Through using their not-for-profit purchasing framework, we have been able to redirect £5,000 to a cause which brings huge benefit to the local community."

Terry Baxter, chief executive of Inspire Suffolk, said: We are extremely grateful for the support of Energy for Good, and the chairman of Suffolk County Council for the very generous donation.

"This will make a significant difference to the young people we work with, helping them to take the next step onto a positive future."

Heat recovery system winner

Borders College in Galashiels has scooped a top award at in the Green Gown Awards for its installation of SHARC Energy Systems' heat recovery system.

The awards recognise exceptional sustainability initiatives being undertaken by universities and colleges.

The Best Newcomer Award was won for the work Borders College did alongside SHARC and Scottish Water Horizons.

Backed by investment from Equitix and the UK Green Investment Bank, the SHARC heat recovery system intercepts waste water from the adjacent town sewer line operated by Scottish Water.

The technology extracts the natural warmth contained within this water and transfers the heat to the clean side of the heating system via a heat exchange mechanism. The recovered heat is then amplified via heat pumps to generate the appropriate temperatures for use in buildings. The heat produced is being sold to Borders College under a 20-year purchase agreement, producing savings in energy, costs and carbon emissions.

The system now provides around 95% of the heat needed by the Galashiels campus and does not impact on the normal operation of the local waste water network.

ETI maps out £30bn in potential savings for UK heat networks

The Energy Technologies Institute (ETI) has released a report from its Heat Infrastructure Development project setting out eight route maps for cost reduction in District Heat Networks (DHN) which if implemented could save the UK up to £30bn.

The government's Clean Growth Strategy has highlighted a desire to build and extend heat networks across the country.

The 18-month project, commissioned by the ETI, and led by Aecom in association with Total Flow, assessed the potential cost reduction of the infrastructure and installation needed for district heat networks. The summary report identifies the ways these solutions could be rolled out and offers eight route maps that could deliver capital cost reductions of 30-40%.

Currently 56% of GB building heat demand is concentrated within only 4% of the geographical area, creating a real opportunity for effective heat networks. Each of the eight route maps details the challenges to be addressed, the proposed solutions, development and commercialisation, and a plan of work.

The summary report proposes that the funding needed to deliver the activities within the route maps should comprise a combination of approximately £10m from government and £5m from the District Heat industry, as well as the construction costs of demonstration projects which would also be funded by district heating scheme developers.

ETI project manager, Energy Storage and Distribution, Nicholas Eraut said: "At present only 2% of UK buildings are connected to district heat networks, and the high initial capital investment and long timescales for installation are key barriers to the wider-scale deployment of district heat networks.

"Our analysis indicates that close to half of the UK's existing heat demand could be economically connected to heat networks. We believe that, while industry can fund many of the activities required, central government is best placed to support the route maps in areas where commercial investment is unlikely."

The summary report *Reducing the capital cost of district heat network infrastructure*, can be found at https://tinyurl.com/yams5n4b

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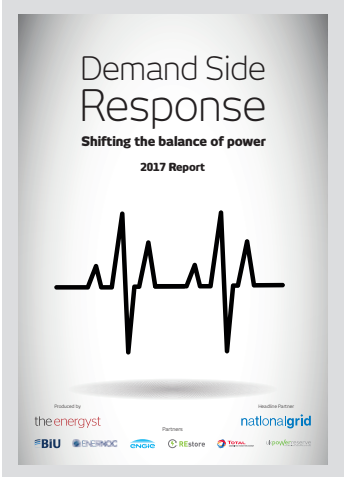

Jason Hunter

Dale Power's new energy storage sales manager on Star Wars, trusting politicians and life on Mars

Who would you least like to share a lift with? Elon Musk, Tesla CEO. I would have so many questions for him that the lift journey would be too short to fit them all in... could chat with that guy for hours.

You're God for the day. What's the first thing you do? Extend my powers for a month, so much to do, so little time, then solve the world's energy supply problem.

If you could travel back in time to a period in history, what would it be and why? January 1, 2016 and ensure that the government puts in place rules for truthfulness to be included in Referendum literature.

Who or what are you enjoying listening to? Currently loving Camila Cabello – Havana – YouTube link here: https://www.youtube.com/watch?v=bZbI9rmpaEw

What unsolved mystery would you like the answers The gold artefact (pictured below) is pre-columbian and dates back to Inca in South America. Is this a model of an aircraft? Or simply a bird?

Unsolved mystery: is it a bird or an early plane?

What would you take to a desert island and why? A car door, so that when it gets really hot, I can wind down the window to cool off. *Not everyone will get this, LOL.

What's your favourite film and why? *Star Wars – a New Hope*. I was seven when I first saw this back in the 70s. It was the game changer for sci-fi movies of the time.

If you could perpetuate a myth about yourself, what would it be? Having put a lot of thought into this question, I would rather myths about me were not perpetuated. I'm a straight up kind of guy and what you see is what you get.

What would your super power be and why? The ability to instantly transport. As they do in Star Trek. The time from sitting on motorways, not to mention the energy saving, can always be more productively spent.

What would you do with a million pounds? Probably the same as everyone else, donate some, spend some, save some and go on holiday?

What's your greatest extravagance? I remember a couple of decades ago I saw a Carlo Colucci wallet in a store in the Hague, by the time I'd paid for it I had no cash left to put in it.

If you were blessed with any talent, what would your dream job be and why? Were I smart enough, I would lead the Mars round trip programme to help humankind become Earth Independent in deep space. Unless we stop the harm we are doing to our small planet Earth we will, by the end of this century, need a new place to live to protect the future of our species.

> *I'd travel back to January 1, 2016 and ensure that the government puts in place rules for truthfulness to be included in Referendum literature*

What is the best piece of advice you've ever been given? Never give up. No matter what. Finish things that you start.

What irritates you the most in life? Wilful ignorance in people.

What should the energy users be doing to help itself in the current climate? Energy is a limited resource in the way we generate it today. Sooner or later we will run out of dead dinosaurs to burn. The most cost-effective energy is the energy that we do not use, so energy efficiency measures and energy reduction is a great place to begin. Once energy consumption is reduced, manging the time of purchase is the next big thing. If you can purchase energy during times of low demand, store it and use it during times of peak demand then you not only reduce your cost of energy, but also aid National Grid and improve our energy resilience.

What's the best thing – work wise – that you did recently? On 1 December, I joined Dale Power Solutions as national sales manager for Energy Storage. We are a 'one-stop-shop' covering the four key elements of an energy storage acquisition:

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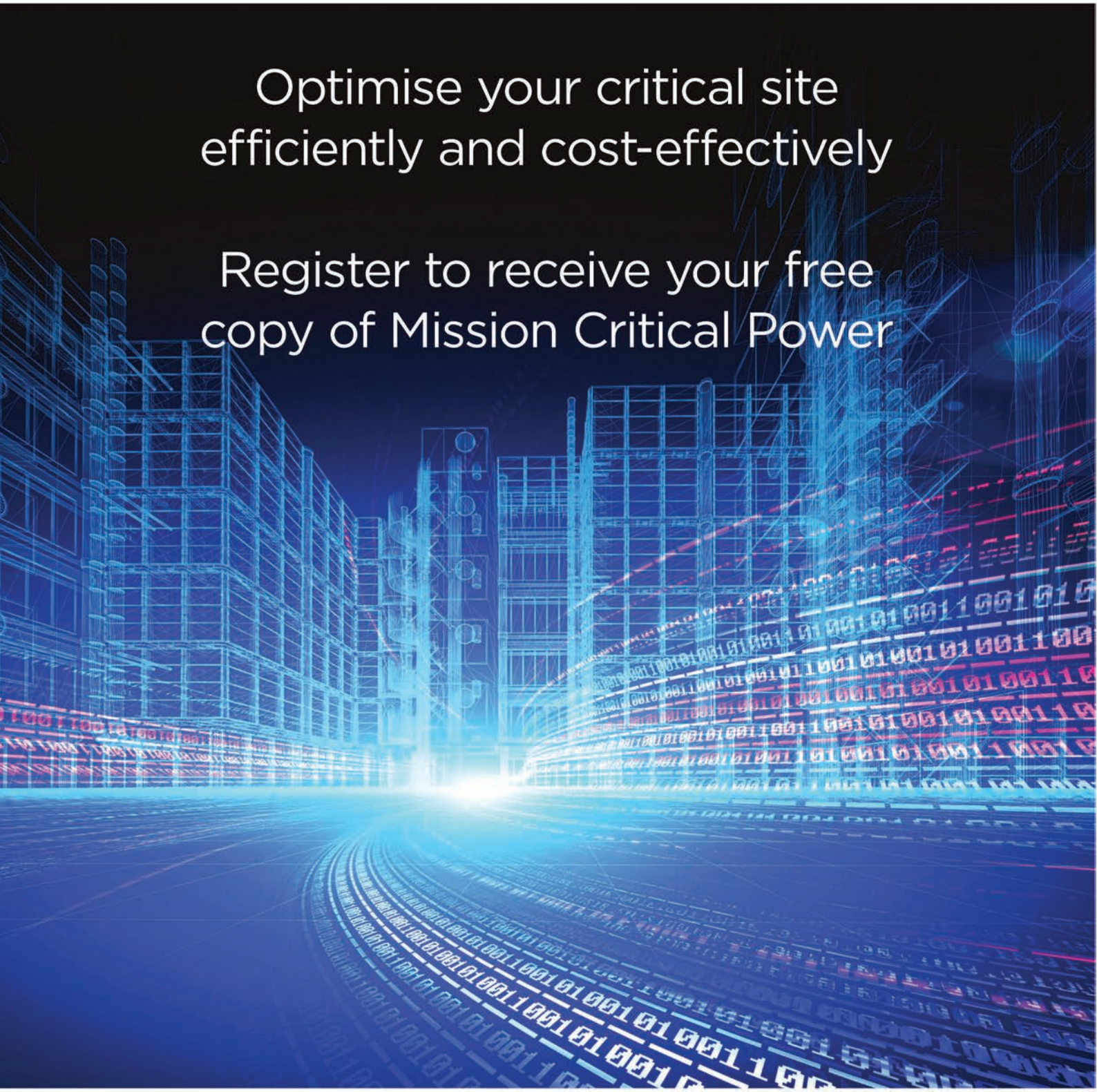

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