

## INSIGHT REPORT

# Balance energy demand today – deliver on net zero tomorrow



### In this report

- The role of location data in energy service today
- How location can underpin flexibility
- The barriers and challenges to innovation
- How standards are helping interoperability

#### VIEWPOINT

Chris Tagg, Head of OS Connect



As the energy transition picks up pace, network operators will look to demand rather than generation to balance the system. While the flexibility market has started to establish itself, the power of location has yet to be fully unlocked and realised. Industry experts predict that a whole range of business models are likely to emerge around fixing balancing issues locally. But how do network operators ensure they can be facilitators rather than barriers to connecting technology before it connects to the system?

## Introduction

According to National Grid's Future Energy Scenarios, the UK's electricity requirement could be as much as 113GW by 2050 at peak times due to increased electricity demand from heat and transportation.

Demand is set to increase rapidly from the late 2020s as government policy on both gas boilers and fossil-fuel-powered cars come into effect, driving uptake of both heat pumps and electric vehicles (EVs) by consumers.

Some of this demand will need to be met by additional renewable energy generation, but National Grid also expects to be able to harness EVs and heat pumps, among other technologies, in order to produce up to 44GW of demand-side response (DSR) to help flatten the demand curve.

Time-of-use tariffs and the opening up of the Balancing Mechanism to distributed assets to help balance electricity supply and demand in real-time means a range of services and business models is already starting to emerge around DSR.

This DSR is offering flexibility to National Grid, allowing distribution network operators (DNOs) to avoid traditional reinforcement of the network, and making energy bills cheaper for consumers.

However, flexibility has the potential to provide even more benefits to the system in the future if DSR markets have an increasing focus on location.

Both energy suppliers and the companies aggregating distributed resources to provide flexibility believe DNOs, National Grid and Ofgem could leverage location data to better incentivise DSR but recognise that DNOs especially have a difficult task

on their hands just forecasting where these markets are likely to develop.

Ensuring DNOs can be facilitators rather than barriers to DSR and reap its potential benefits means they must cross-reference multiple data-streams in order to build a picture of the future and create valuable opportunities for flexibility markets – a task made more difficult by a lack of standards and interoperability around data.

Many in the industry welcome the work being done in the wake of the Energy Data Taskforce to improve this area, and believe collaboration is the key to ensuring data security can be maintained while this important resource is mined by multiple parties.

To explore what role location data is playing in net zero energy service today and what barriers must be overcome to realise the innovation pipeline Utility Week has partnered with Ordnance Survey to produce this report which covers key topics including:

- **To what extent location data is being leveraged today**
- **The potential business models of the future**
- **What initiatives are helping overcome the barriers to energy service innovation**
- **Whether standards could help or hinder innovation by technology providers**

Many thanks to the varied commentators who gave their time and insights to help form the content of this report.

## How location could underpin flexibility

The extent to which location data is already being used to create net zero energy services varies depending on which area of the market they are being developed in.

Location is already a feature of services being developed by flexibility aggregators for National Grid's Balancing Mechanism, and by DNOs to allow distributed generation to connect, but is yet to be a real feature in offerings to consumers from the supply market.

However, all areas of the market are in agreement that if it is not already the case, location will become a key foundation stone to unlocking innovation centring around net zero in the near future.

Until recently National Grid has purchased the majority of its flexibility services on a national basis.

Where it is starting to look at location to manage specific constraints, such as through the Constraint Management Pathfinder, the focus has been on large generators such as windfarms.

I would be inclined to give National Grid very high marks in terms of how they procure things, but they have got quite a bit to do around location in terms of buying flexibility from small resources."



Alastair Martin, founder, **Flexitricity**



"There's very little I see National Grid doing to get beyond those resources when it comes to locational matters. I would be inclined to give National Grid very high marks in terms of how they procure things, but they have got quite a bit to do around location in terms of buying flexibility from small resources," says flexibility aggregator Flexitricity's founder and chief strategy officer Dr Alastair Martin.

Where location is playing more of a role for small resources is at distribution level, he adds.

However, the constrained areas highlighted by DNOs are extremely location specific, and the current size of the DSR market is limiting opportunities for the two to overlap frequently.

Increasing the attractiveness of the DSR market offered by DNOs would encourage more customers to engage and solve this issue.

On the supply side DSR offerings are focused on time, such as Octopus Energy's Agile Tariff, which allows customers to benefit from cheaper electricity prices if they shift their electricity use to times of low demand, rather than location.

Being able to harness the power of location is firmly set in their sights though, says Devrim Celal, chief executive of KrakenFlex, a distributed energy resource management system owned by retailer Octopus Energy.

He says that KrakenFlex already has a wealth of granular data including location at its disposal – up to 20 million pieces of data a day from a single asset – and its main challenge is extracting value from the data.

"The challenge is not so much getting the data but using it. There are three stakeholders – the DNO, the energy retailer, and the transmission system operator.

“These could have conflicting views on how to use the data, as what could be a good action point for a retailer could be a bad one for a DNO, so the first step is unearthing the data and then agreeing a way forward to optimise the system.”

Ted Hopcroft, an energy and utilities expert at PA Consulting agrees that a focussed approach will be necessary.

“A collective understanding of the key goals, requirements and roles and the problem we are trying to solve is needed,” he says, “to avoid the industry drowning in a data ocean and make the task more manageable.”

Both Martin and Celal agree that the main barrier to innovation is a lack of real markets and opportunities to entice consumers into offering DSR.

“DNOs have definitely taken a step forward,” says Martin. “But signals are not coming through for companies to really get deeply into developing large numbers of customer resources for DNO-led flex because the prizes are just too widely distributed.”

For Martin one area that is ripe for innovation but currently lacks the financial incentive to drive it is in allowing renewable generation to connect to the network without constraints on output or huge connection charges by investing in local storage.

DNOs are already producing heat maps for renewable generators highlighting areas of the network where connection will be costly or where they may see their generation constricted at times of peak generation.

However, the real value of these heat maps cannot be realised without corresponding maps detailing the opportunities for DSR, he says.

If you have locational pricing and that price is going up then it says something is out of balance in the market, so it informs that investment decision.”



Devrim Celal, chief executive, **KrakenFlex**

“Why is nobody in, for example, the South West investing in ice stores or large cooling loads at their offices and data centres to buy up that excess solar before it has to travel and cooling off the heat map? Instead of creating that economic value we are just throwing it away,” says Martin.

“To me that’s the first location element that DNOs should have been moving forward with - creating ways of incentivising the beneficial use of green energy in the location where it is generated.”

For KrakenFlex, the real prize of location data would be the introduction of locational pricing to the supply market, which would allow consumers to also potentially benefit from local generation and only pay for the infrastructure they actually use.

Octopus Energy is already testing the concept through its Fan Club Tariff, which is offering consumers in Market Weighton and Caerphilly



the opportunity to benefit from between a 20-50% reduction in their electricity prices when Octopus’ two wind turbines in these areas are working.

KrakenFlex also sees market potential on the supply side for alleviating congested zones by placing storage assets in the locality, but big changes will be needed to realise these opportunities.

“DNO markets are not markets, they just buy some services at an auction, and they buy what I call sledgehammer services, which provide insurance if everything fails,” says Celal.

“I think where it needs to move to is locational pricing to make use of locational data and to emphasise the need for investment.

“If you have locational pricing and that price is going up then it says something is out of balance in the market, so it informs that investment decision.”

## The barriers and challenges to innovation

While locational pricing would also have political and regulatory barriers, much of the responsibility for tackling the challenge of how to engage consumers in smart energy services falls to DNOs and National Grid as the TSO.

They alone can create markets for flexibility centred around both consumers and generation in which real innovation can occur, but both the DNOs and National Grid are still undertaking the transition to become truly digital.

“The DNOs and TSO are not digital entities, they are still the entities they were 100 years ago when they were set up to build a system that runs on measuring for the worst-case scenario and building enough substations and copper wires to manage in that scenario.

“As opposed to the way we think about the system, which is you get that data, you forecast and you optimise the problem to run within the existing system,” says Celal.

Despite approaching it from this antiquated perspective, Western Power Distribution (WPD) has led the way in establishing flexibility markets for local areas, and its efforts to date have been effective, avoiding £39.4 million of network reinforcement.

Energy service providers clearly feel that they could go further, but one main challenge faces DNOs particularly in producing what the industry desires – the fact that they must try and predict the future.



We know that low voltage networks are becoming more important in the migration to a more decentralised energy system, but the DNOs are struggling to know what's required where.”



Ben Godfrey, distribution system operator manager, Western Power Distribution

They are faced with the task of trying to forecast what generation will connect and what demand will be available, while also not knowing how much flexibility will be able to be provided.

DNOs have a level of certainty around what generation will want to connect in the future, and where, as generators must apply to connect or notify network operators.

However, for demand, such as EVs and heat pumps – both of which place considerable strain on networks when clustered together – there is no prior warning.

“We are looking to understand the requirements of the network out to 2050 so we need to make sure that we are putting forward forecasts on what we think is going to happen,” says Ben Godfrey, distribution system operator manager at WPD.

WPD is creating its forecasts based on datasets around historic uptake of technology, the effects of clustering, and combining this with social, economic and behavioural data such as budgetary constraints.

“We know that low voltage networks are becoming more important in the migration to a more decentralised energy system, but the DNOs are struggling to know what's required where.

“This is a challenging situation for DNOs as they understand where to prioritise investment. There's a bit of a chicken and egg situation here,” says Chris Tagg, head of OS Connect at Ordnance Survey.

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Projects such as one undertaken by Ordnance Survey's Rapid Prototyping Team using geospatial data to map where in-home charging of EVs is likely to occur will be valuable for cross-referencing, as is data from companies such as Rightcharge.

The company is supplying UK Power Networks with location data based on interactions with its EV comparison website by consumers looking for EV charging in specific postcodes; which acts as an early warning system.

But DNOs are being hampered in their efforts to forecast by a lack of granular data as they have limited access to smart meter data due to rules around customer privacy.

"In order for us to drive the most amount of benefit out of this data we need to get as granular as possible and that's one of the restrictions that's proving quite tricky – being able to have granular data down to the household level and being able to map them together," says Godfrey.

While a balance must be struck between the benefit of the grid and planning versus people's individual privacy or commercial sensitivities, "we're leading with too much caution, and not taking large enough steps to make the data accessible," warns one data expert who asked to remain anonymous.

"At the moment our energy system is planning with a bit of a blindfold on."

Dan Travers is head of data at Subak, a non-profit accelerator that funds and scales non-profit organisations that are tackling climate change through open-source data. "A utopian result will be when everyone who adds new energy assets to their home, or their factory, or warehouse, is required to



report both the metadata of the facility overall, as well as the basic data, such as location."

Progress is being made as WPD is the first network operator to agree a customer privacy data plan with the smart metering Data Communications Company, which allows it to access data on an aggregated feeder level basis – between 20-100 customers.

Ideally network operators would like data at an individual household level, but Godfrey says this should be sufficient for decisions on the high voltage transmission network.

"We want to go further than that and use customer data to understand customer behaviour down at the lower voltage (LV) network.

"That's probably something that we would look to revisit, perhaps not now, but certainly off the back of the Energy Data Taskforce work and the movement for more open data we think that would be a really good use case for us," says Godfrey.

Randolph Brazier, director of innovation and electricity systems at the Energy Networks Association (ENA), believes monitoring equipment

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Randolph Brazier, director of innovation and electricity systems, **Energy Networks Association**

on LV parts of the network would also help plug the data gaps and help DNOs drive towards net zero.

"We've been lobbying for the regulator to enable us to invest in LV monitoring. It's a least regrets part of digitalising the network and moving to a smart grid," says Brazier.

In the meantime, Godfrey says the energy regulator Ofgem has a potentially significant role in facilitating data transfer as it manages schemes such as the Feed-in-Tariff (FIT).

"One of the successes we have had in the last year is getting an agreement with the regulator for it to share data back to us on customers who have accessed the FIT and Renewable Heat Incentive so we can make sure our records are as up to date as possible."

He adds that this role is likely to expand in the future as Ofgem takes over the role of regulator of heat networks as well.

"A big share of the impact on networks is likely to be heavily related to the roll out of heat networks so good data sharing across the whole industry is going to be key for that."



## How standards are helping interoperability

For WPD the biggest barrier that it needs to overcome is standardising all of its data and the way it references it, as much has grown historically without good rule sets, making comparison with third party data a challenge.

“For us creating a standard data dictionary that is mapped across different industries, suppliers, networks and third-party organisations such as Ordnance Survey is crucial,” says Godfrey.

“Standards enable interoperability of information and are critical to the effective exchange of data and the derivation of trusted insights” agrees David Henderson, Chief Geospatial Officer, Ordnance Survey.

“The ability to better access knowledge about the energy ecosystem will enable quicker decision making, the creation of new services and allow consumers to be more proactive.

“Whilst collaboration is key across all sectors in terms of driving digitalisation; the effective exchange of data, skills and knowledge are paramount to achieving better outcomes.”

But Damien Kelly, an innovation lead at Innovate UK, believes industry reluctance to relinquish control of data is rife.

“I’ve worked in some of the big utilities over the last ten years and their business models are based on the proprietary approach and they are struggling to work out how a business model could work around open source because it shifts the focus onto quality and service as opposed to locking someone in. But if we’re serious about net zero it’s the only way to go,” he says.

The Energy Data Taskforce report published in 2019 has succeeded in galvanising action towards at least agreeing a common data standard.

In order for us to drive the most amount of benefit out of this data we need to get as granular as possible and that’s one of the restrictions that’s proving quite tricky.”



Ben Godfrey, distribution system operator manager, Western Power Distribution



However, Hopcroft says there is still debate in the flexibility market about whether a focus on standards or specifications would be best.

“A standards-only approach may create interoperability issues, restrict market access and risk stranded assets or customer lock-in.

“But developing detailed specifications for a market where there will be a plethora of devices and services, many of which are not yet available, is likely to bring progress to a screeching halt,” Hopcroft warns.

Celal shares his concerns, adding that standards also risk stifling innovation.

“I’m more open for innovative companies to set their own standards and in turn interoperability will come through some standards, but only some.

“For example, if EV original equipment manufacturers are starting to all agree on certain standards then that’s good, but those should be limited so if you want to pull data every second from different points within an asset, the standards shouldn’t be my limiter to getting to that detail.”

He believes the market is rushing ahead of the debate around standards and specifications and is already starting to solve the problem.

One effort by the industry to act on the taskforce’s recommendations while this debate continues has been the creation of the National Energy Systems Map (NESM) by the ENA, which was launched in October and gives users information about energy network assets, where those assets are located and who owns them.

Created in partnership with Ordnance Survey and 1Spatial, the map aims to help make it easier for renewables and other low carbon technologies to connect.

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Ted Hopcroft, energy and utilities expert, PA Consulting

Laura Sandys, chair of the Taskforce, said it was “supportive of what the industry is trying to do with NESM, and very pleased that they are taking this forward.”

Kelly is confident that a carrot and stick approach from Ofgem and BEIS will eventually succeed in ironing out network data interoperability and accessibility issues.

Indeed, the Energy Digitalisation Taskforce (EDiT) has focussed heavily on bringing about standardised approaches and interoperability in its major report which was published in January, and has also called for a kind of automatic asset registration Travers hoped for.

“That’s one of the big messages around the digitalisation taskforce – making all data interoperable so we can speak the same language and have a level playing field,” says Kelly.



Sandys hopes that both BEIS and Ofgem will act within the next few months to start realising at least some of the report’s recommendations, such as the creation of a customer consent dashboard and a “digital spine” to allow basic data to be basic data to be shared across the system.

Some of the recommendations will take up to five years to implement, meaning a roadmap must be laid out in the very near future if standards are to be in place ready for the expected surge in electrical demand at the end of this decade as the race to net zero gathers pace.

**Chris Tagg**Head of OS Connect  
Ordnance Survey

In order to drive net zero and achieve emissions reduction goals, both in Great Britain and worldwide, energy systems need to change. It's a matter of electrifying – transitioning from fossil fuels to electric and generating our electricity as sustainably as possible.

However, while we continue to find and develop sustainable alternatives to systems and infrastructure, such as train travel, it isn't always feasible to overhaul and change within typical net zero timeframes (Great Britain's general economy has a deadline of 2050; the energy sector needs to improve by 2035/2040). In addition to increasing electricity production, we need to make our energy system more flexible and adapt the networks already in place.

Our energy sector needs a very significant amount of investment and innovation, and the availability and accessibility of data is expected to be a key enabler. In

a recent report, published by the Energy Digitisation Taskforce (EDiTF), one of six key recommendations is to deliver the interoperability of data.

The number of organisations associated with our energy systems, and the number of parties who hold relevant data, is increasing. Data will typically be held and managed where it is created, using different systems and slightly different approaches. Communication between the organisations holding data and their systems is a critical requirement, to better monitor and manage our energy system. Making data interoperable means that data can be accessed and used across individual system boundaries.

We appreciate the investigation completed by the EDT. We support the view that data needs to be accessible, though we also acknowledge that data interoperability can be a difficult concept to implement. Difficult, but not impossible.

Ordnance Survey (OS) has developed its own expertise in data interoperability, for more than 20 years, helping to define data standards and data access protocols. Together, working with the wider geospatial industry, as well as numerous collaborations with data owners such as DNOs like UK Power Networks and local authorities, we've demonstrated the art of the possible in delivering normalised data. Sources may well differ, but we have created harmonised network data for national

coverage, such as the National Energy Systems Map (NESM). We have collaborated with a wide variety of organisations successfully achieving secure ways of sharing data in innovative ways; both technological but also creating the right terms and conditions to facilitate data sharing.

There have been concerns regarding conflict between the practical implementation of data interoperability in the short term, and the development of data standards. Having data standards in place can be perceived to be restrictive in implementation; and agreeing the standards can take a long time, during which the market continues to move.

However, through our work internationally supporting the creation of Open Geospatial Consortium (OGC) standards in location data, OS understand the sweet spot needed to achieve the most out of standards, and have developed data standards in parallel to their implementation in projects. Effective data interoperability is dependent on the right level of standardisation, and while these standards can fuel innovation, they also need to evolve as time goes by.

Challenges faced by the industry will change and evolve, too. Identifying 'what the drive to net zero needs to be' will become 'how the drive to net zero can be achieved.' We will continue to facilitate interoperability of energy data using location to support the industry on its' journey to innovate.

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Ordnance Survey provides national mapping services for Great Britain and is a world-leading geospatial organisation.

We empower businesses with data insight that drives efficiency and progress in a fast-moving world.

Our location data solutions and services provide a complete view of infrastructure assets above and below ground.

Our commitment to geospatial innovation helps energy, water and telecom network operators in Great Britain see a better place.

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