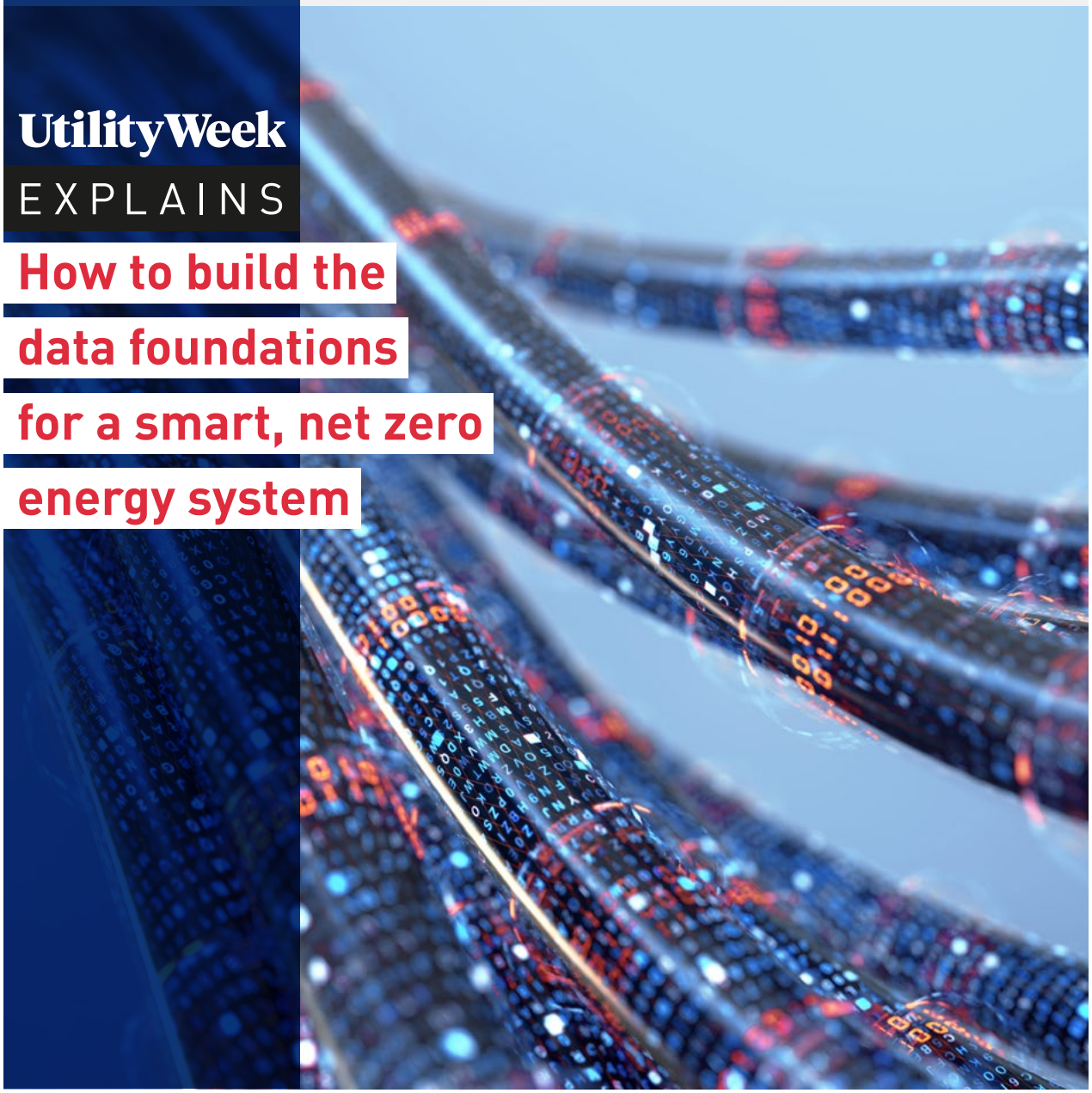
UtilityWeek

EXPLAINS

How to build the data foundations for a smart, net zero energy system



UtilityWeek

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In this report:

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EXPLAINS

INTRODUCTION

How to build the data foundations for a smart, net zero energy system

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The government's commitment to 68% renewable energy by 2030 is a key pillar of the UK's ambition to achieve its net zero emissions target. That radical decarbonisation of the UK energy system by 2050 will drive further proliferation of distributed renewable energy sources and other low carbon technologies over the course of the coming decade.

These technologies offer the promise of helping to decarbonise power generation and enable more efficient use of energy through flexibility and demand side response services. However, these potential benefits will only materialise if the UK's energy networks are also able to handle exponential growth in digital complexity.

It's a requirement that has been widely recognised and highlighted in strategic statements and papers from both Ofgem and the Department for Business Energy and Industrial Strategy, not to mention in the independent work of the Energy Data and Energy Digitalisation Taskforces. They set out a compelling case around the need to transform the energy system's existing digital architecture and articulate a vision for the digital capability that networks will need to display in the future.

However, getting there may be more difficult than we envisage, largely because network data is not yet in a fit enough state to support the agile and complex decisions that need to be made to enable the net zero transformation.

The question begs, what actions should networks be taking today to create the digital foundations for the networks of tomorrow? And what capabilities will they need to scale these foundations rapidly to handle growing complexity in data flows, use cases and accessibility?

In this **Utility Week** Explains report, created in association with Capula, we speak to future networks strategy manager Jim Allen about the essential considerations and building blocks for an effective network digitalisation roadmap. He also addresses some of the key challenges about industry readiness for digital transformation in the race to net zero.

Why does network data matter to the energy transition?

The move towards renewable energy generation creates a host of new network inputs including renewable energies, low carbon technologies, battery storage, and a range of activities taking place at lower voltage ranges. Supporting the growth of renewable energy assets and the associated increase in data relies on the systems that control and monitor them. We must bear in mind that any changes that are made to the network can have real time upstream and downstream consequences.

However, current approaches to energy industry operational data don't provide an integrated and umbrella view of how the assets will respond to the complex and dynamic events that may be applied to them.

Transmission and Distribution Network Operators [DNOs] are at the heart of the UK's energy transition as they're the ones that must establish how to best connect renewable energy, low carbon and storage assets in ways that are safe, reliable and securely deliver the societal and environmental benefits demanded of our future networks.

One of the most significant challenges being faced by the industry is how to ensure the integrity, quality, security and interconnectivity of its data for a growing range of internal and external use cases. It is imperative that we have the right data foundations and quality management processes in place to be able to see the best opportunities for innovation and investment, and to identify where gaps exist.

The energy transition will not move forward at the pace required without having a strong foundation

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of complete and accurate data, backed with cross industry alignment on analytics for making effective decisions about sector and market change. Without this, significant inaccuracies, inefficiencies and unintended consequences will become evident. This has potential to slow down or even derail the delivery our net zero energy networks.

Inherently, there is value in being able to simulate and model how third party assets and local networks respond to being turned off and on at any time. This is where data holds the key to benefits realisation from innovation; whether that's understanding how to deliver the right investment plans for our future energy system, devising new business models or innovating in our practices to meet our net zero ambitions.

From a consumer perspective too, new technologies connected into the network offer huge opportunities to both enhance customer experience and save customers money – a pertinent issue at a time when the cost of energy is headlining our daily news. Digital twins and modelling capabilities can highlight when to invest in the network, in the right places, at the right time, for the right reasons, with the right technologies, and at least cost to customers.

Are networks ready for the bigger role their data has to play in the future energy system?

Data underpins the drive for a zero energy system and yet we know that the current data foundations within energy companies are not yet fit for purpose. The reality is, we don't have a fully integrated and completely accurate view of asset data. And this is in a time when networks are under unprecedented stress as they become more complex and evermore dynamic in nature.

Instead, many data sets remain incomplete, inconsistent, and inaccurate leading to concerns about data quality. Likewise, this undermines confidence in the fitness of data for sharing and effective use in a growing range of operational and commercial use cases. Typically, little attention has been paid to prioritising data quality. It has been stored in different systems, in silos, which have made it difficult to use or compare. Similarly, data management processes have been inconsistent and inherently lack the maturity for scaling to the expected demands of the future energy system.

We have fallen into the trap of approaching data management very much as a compliance and

reporting exercise rather than seeing the inherent value in data as something that could be exploited to add business value, partly because, historically, use of that data wasn't so critical operationally. People devised their own workarounds, systems were designed in a piecemeal way to tackle specific problems, or people have turned to their own spreadsheets to support business decision making.

Put in the context of having a fully integrated data strategy and view of data across the piece, these approaches are clearly no longer fit for purpose. Our dependency on that data is greater than ever. However, it is only recently that data has been talked about as something that can really add value to a business; the new 'oil' if you like. Today, we recognise that the data held in systems is of fundamental importance, not only for current use-cases but also to future ones.

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Without appropriate data management practices, the cost of cleaning or reformatting any data that you have collected is greater than the value you could extract from it. Therefore, the focus today must be on making sure data is stored and maintained in a way that allows you to extract its current value while retaining its potential future value. It's about laying the foundations for the long-term data strategy.

Where do the biggest and most important gaps in the completeness of energy data currently lie?

One of the biggest challenges the industry faces is the proliferation of Distributed Energy Resources (DER) – including solar panels, wind turbines, heat pumps, battery storage and electric vehicle (EV) charging. At the same time, there is an increase in data associated associated with low voltage (LV) and the industry recognises that it needs to connect more and more of these devices into distribution networks.

Each of these different assets need to be monitored, controlled and assessed, meaning there is an increasing need for companies to access and share operational data to support decisions and drive advanced analytical models. This will inform their drive to net carbon zero and digitally efficient network operations.

As we look at the exponential rise in connections of sensors and renewable devices, being able to confidently test the viability of the network to run them efficiently becomes a core requirement. In turn, this means we need an overview of the whole energy system – and the whole energy lifecycle. Moves to mandate half hourly settlement for domestic retail customers will only pile further data requirements on top of those associated with the growth of DER.

The industry has attempted to address these data gaps through use of smart meter data, which has limitations in terms of connectivity and penetration levels. At the same time, Electralink, the data hub that underpins the UK energy market, offers some means of leveraging new intelligence about DER location.

Either way, network operators have got to somehow get hold of that data, make sense of it, and use it as the basis of decisions about how best to operate and invest in their network. It's a huge potential opportunity but presents significant business challenges. From the end users' perspective, there are massive data gaps that need to be filled and the network companies need to align government policies with their own efforts around data collection and control, so they are fully aware of the gaps and have plans to address them.

What are the best steps networks can take to address key data gaps?

The first stage is to identify the inhibitors to having an open data strategy. There aren't any technical reasons why progress isn't being made. Sharing data should be the de facto stance from the whole industry. And yet for many the idea of working in large consortia and taking an open data approach first, rather than protecting their own data, represents a big cultural shift. It's about aligning your strategy and approach to innovation with others through collaboration and that's one of the biggest challenges that needs to be addressed.

Establishing your data inventory allows you to create a clear picture of what you have and highlight any gaps. We recommend a data audit that engages all the different stakeholders including business analysts together with cross business representatives, customers and other stakeholders to establish your data requirements. Then it's a case of looking at your source assets that generate that data.

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As you begin to onboard new assets thinking about how data should be structured, stored and accessed is critical, as is in the adoption of internationally recognised standards. It's about envisaging what data needs to look like to support the system of the future and making sure there's enough flexibility and scalability built in, so if requirements change or additional ones emerge, you can positively respond to accommodate additional data connectivity demands.

Beyond filling data gaps, what new processes and data management principles should networks put in place to ensure data can be properly leveraged in a smart, net zero energy system?

Moving to the cloud requires different data structures and naming conventions that will facilitate future opportunities for cloud-related services. The reality is, it is not as simple as a lift and shift of what you currently have because you are going to need to use data in new ways, which means decisions on levels of asset investment and active operations will start to look and feel very different to those of today. It's a huge shift.

Due to the energy market structure of today, energy companies have not been encouraged to share data or open it to wider third party and or stakeholder scrutiny. However, the requirement and expectation to adopt more open systems and management processes is a key part of the energy transition.

The shift is being embedded in innovation programmes. But we are still a long way from adopting the technologies, systems and processes to support this change and to some degree a cultural change is required to establish open data as business-as-usual practice.

The Energy Data and Digitilisation Taskforces Taskforces have made significant inroads in pushing this agenda resulting in the Energy Networks Association workstream to implement taskforce

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recommendations. However, it's imperative that we see more cloud accelerator innovation projects being supported and promoted. The industry still isn't working together to tackle this, particularly as more open architecture platforms and cloud services will be crucial in driving standards and compliance, lowering data management costs and in enabling greater levels of competition in the market.

Organisations like Capula continue to innovate and lead the way in adopting Industry 4.0 and digitalisation technologies; helping companies optimise their legacy assets while adopting new and data centric approaches. Using appropriate technology bridges, these technologies help companies integrate their systems and build their data foundations for an increasingly connected and future proofed technology stack, utilising the latest Industrial Internet of Things and open architecture solutions on the market.

What other actions are essential to equip networks for exponential data growth in our future energy system?

Moving to the cloud is essential for both scalability and cost reasons. The exponential growth of data means that on premise storage is no longer a viable option. And yet the industry is stalling, partly due to a deep-rooted reluctance in sharing network asset data (legacy of this highly regulated environment) and a fear of the cloud as the place to securely store data on their critical national infrastructure. However, these are misplaced concerns around cyber risks associated with not hosting your own data and controlling how your data is accessed and used.

What is needed is an integrated system approach to how we decide investment in the future energy system and as part of that, accelerating the use of open architecture platforms and cloud services through the innovation pathways in new environments is critical. The Energy Data Taskforce is a good first step in this direction and company data strategies are evolving. But a faster pace is required in adopting Industry 4.0 technologies and cloud services to really drive the transition to a fully integrated, interconnected and open energy system.

As network companies respond to sharpening drivers for change in their data management and governance approaches they must face head on the issues created by legacy infrastructure and complex linear architectures. These lock data into technology and departmental silos which limit its value and the ability of networks to leverage it for decision making.

The need for completeness of data and trust in its quality to inform complex decisions is paramount.

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Network companies are now faced with a compelling need to change their traditional approach to data management and the systems that support it.

By targeting the value of data based on specific business use cases network companies can drive down costs and improve their operational efficiency. These use cases may vary across different businesses and industries, however the process of identifying the value and delivering a platform that is both horizontally and vertically extendable is largely consistent.

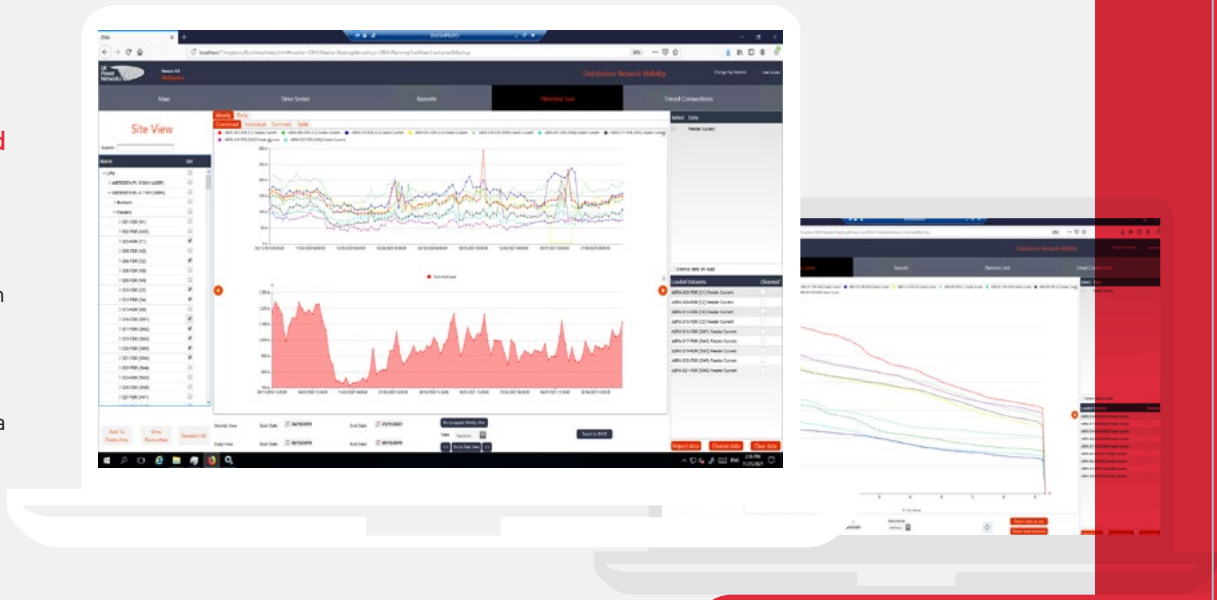
While there is a desire to develop increasingly advanced data models and the insight they bring, success or failure in this goal starts with the completeness and trust in the data and how this is managed and shared to inform these models. Wherever you are on this data journey Capula is well placed to help inform and guide you on how to best use these new Industry 4.0 and industrial internet of things technologies, all while maximising your legacy infrastructure.

How to build the data foundations for a smart, net zero energy system

CASE STUDY

UK Power Networks

Electricity Distribution Network Operators (DNOs) are working hard to build a cleaner, smarter integrated energy system which exploits new digital technologies by connecting and controlling physical infrastructure so it can deliver efficient, low carbon flexibility services.

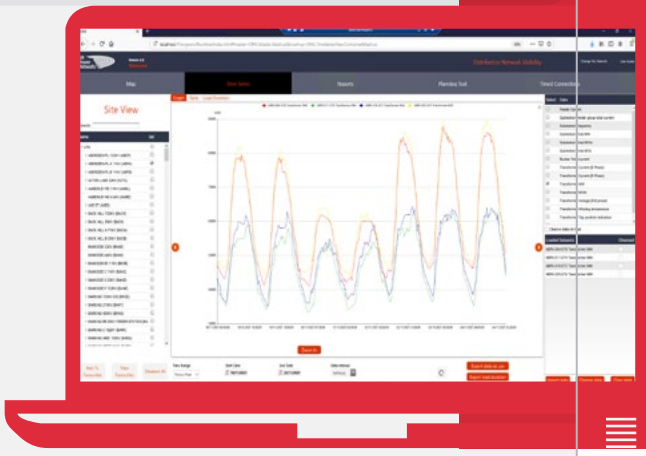


This transition to a smart future energy system prompted UK Power Networks (UKPN) to turn to Capula for a deeper and more holistic view of its network assets and their real time utilisation. Working closely with UKPN, Capula developed a Distributed Network Visibility (DNV) Platform. An enhanced industrial internet of things (IIOT) version of this system was implemented in April 2019.

An industry first, the IIOT cloud-based DNV platform is built on an open, scalable and flexible architecture and delivers near to real-time visualisation of network constraints and capacities across all voltage ranges. Through greater visualisation and understanding of local asset utilisation, UKPN has not only avoided costs and delays associated with network reinforcement, it has also resulted in better, quicker and more cost-efficient designs for customers who want to connect low carbon technologies.

The Capula IIOT system has delivered further significant efficiencies including speed of data handling, scenario modelling for timed connections, load profiling tools to identify points in time when the local network would have spare capacity for connection of low carbon technologies, data quality and cleansing functionality, and enhancements in low voltage visualisation as more and more devices are connected to the network.

Next generation use cases for the DNV are currently under evaluation including active network management curtailment assessment calculation, determination of different load scenarios, improved understanding of power flows and additional open data functionality to stimulate wider customer engagement and innovation.



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