UtilityWeek™

In association with Ordnance Survey

INSIGHT REPORT

Create reliable records today – transition to intelligent asset management tomorrow

In this report

Creating more reliable records of asset information, and making them easier to access and use, will play a key part in the utilities sector's transition to a smart, net zero future. But what's the state of play on industry asset information today and where do utilities aspire to be in the near-term future?

Introduction

The utilities sector has entered an intensely challenging period of transformation where old rulebooks must be rewritten as the heavy weight of expectations from government, the regulator and society for a smart and efficient transition to a more sustainable future bear down.

The drive for transformation can be seen with particularly sharp clarity in the energy industry. A future is fast-approaching in which our energy system must service demand from electric vehicles (EV) as the dominant form of consumer transport, where renewables and their fluctuating power levels form a greater share of supply, and where diverse low carbon heating options are at play – including hydrogen and biomethane.

For energy network operators, this prospect will undoubtedly entail an expensive overhaul of physical infrastructure. But upgraded and extended asset bases will also need to go beyond the siloed operations of the past with capability to respond to new trends in supply and demand, interactions between previously disparate systems and new commercial considerations as markets for energy flexibility grow.

In this exciting but challenging future, where more and more energy resources are connected at distribution level, dynamic system operation based on accurate information about assets and devices, as well as the environment they are operating within, needs to become a hygiene factor.

But for this to happen, there are some major developments needed. While many networks have been working for years now to digitalise asset information, the availability and quality of data is still patchy with significant variations between companies. And there remain untapped areas of potential when it comes to creating a complete picture of individual assets and their situations and making this picture visible beyond the confines of a single organisation to other stakeholders with vested interests.

With these considerations front of mind, Utility Week has partnered with Ordnance Survey to create this report which showcases industry sentiment on key issues including:

- **The quality and completeness of asset data**
- **How this can be improved**
- **Which projects and initiatives are doing best at driving this agenda forward**
- **How to approach the challenges and opportunities entailed in making data interoperable across organisational and even sector boundaries**
- **What industry and societal value is tied up in improvements to asset data**

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

What data do we have?

Based on the contributions of several network industry representatives to this report, it would be fair to say that there is a varied landscape across transmission and distribution licence holders when it comes to the reliability and completeness of information held about their asset bases.

To some extent, this diversity can be attributed to a legacy of fragmented approaches to data collection and aggregation across the industry. In different companies, similar data is often held in different formats, or uses different taxonomy. There are variances between organisations in terms of who is responsible for data capture, governance and data quality. And significant differences exist in the way older data sets have been digitised – if at all – and how information is used to support decision making.

> We've basically got every single bit of pipe digitised in a mapping system and its geographically accurate and it holds the details of the size, the material it's in and the pressure it runs at"

Ian Dunstan. asset strategy manager, **Wales and West Utilities**

Then too, the evolution of the sector over time has plated a role in creating a complex ancestry for data, as mergers and acquisitions have seen information hived off from its original context and merged with its adoptive organisation. In many cases, the organisations we see operating in the landscape hold asset data which was recorded long before they formed in their current guises.

Acknowledging this messy data heritage, and in the knowledge that the rapid system developments referenced above will require more consistent and strategic data strategies, all energy networks are striving to rationalise and improve their position on asset data. They understand the compelling need to become more adept and agile at leveraging data for new and emerging demands in system operation, and that this will require coordination across the many internal organisational systems in which data is held, as well as with external stakeholders.

For many though, there is also important foundational work to complete on asset mapping and filling gaps in their knowledge about the location and condition of assets.

Notwithstanding question marks over the role of gas in the future net zero energy system, created by uncertainty on the road forward for low carbon heating, it's this sector which has arguably been ahead of the game when it comes to digital asset mapping.

Wales and West Utilities' asset strategy manager, Ian Dunstan explains that the Health and Safety Executive's mandate in 2002 that all iron gas mains should be replaced by 2032 with plastic or composite alternatives, was a watershed for asset intelligence in the industry. The Iron Mains

Replacement Programme, which identified a need to modernise the gas grid in the interested of public safety and network resilience, placed an early emphasis on creating digital records of assets.

"As a result of [that programme], there has been a huge amount of work done to digitise assets in a GIS (geographic information system)," Dunstan says. "We've basically got every single bit of pipe digitised in a mapping system and its geographically accurate and it holds the details of the size, the material it's in and the pressure it runs at etc, so we're in a pretty good place."

He explains how Wales and West Utilities uses both GIS and Enterprise Resource Planning tools – in this case provided by software giant SAP – which together offer both location and condition asset information. "We use SAP to assign work and record data about those assets. So, if we're going to do maintenance, SAP will have details on that asset. The work will then get created through an order that goes out to the field. They do the work and record it, then that information comes back in and updates the asset record."

This understanding expands beyond the asset itself and takes into account how that asset could impact or be impacted by its surrounding environment, Dunstan adds. "As an example, I could tell you where our eight-inch iron pipes are within 30 meters of a school so that's the sort of stuff that we're using this data for to understand the risks of the assets."

While this digitalisation of asset information and key processes for operations may have been driven by the safety-focus of the mains replacement programme, Dunstan explains that it is now standing Wales and West in good stead as it looks to transform for the future. For instance, location and condition data is being used in innovation projects exploring the cost implications of moving to a hydrogen network. "Having that data at our fingertips – the diameter, material, location of our assets – means we have been able to put forward a good view [to government] of what it's actually going to cost."

"We're focusing our work to increase the granularity and certainty around those [lower voltage] assets – both linear and static assets"

Jon Berry, digitalisation and data manager, **Western Power Distribution**

Power networks may not have had a mandated driver like the mains replacement programme to spur asset mapping and digitalisation efforts. However for the past decade growing demand for the connection of renewables and, more recently, other distributed energy resources, have created strains on capacity. Meanwhile, regulatory penalties for supply interruptions have also helped to focus minds on the importance of having accurate information about the location of assets.

As such, Western Power Distribution's (WPD) digitalisation and data manager, Jonathon Berry is pleased to say that the network's asset mapping campaign is now "relatively complete".

"I wouldn't want to say this is 100 per cent complete, as there are always areas for improvement, but we have really focused on understanding the physical location of our assets to maximise how we use, operate and locate for faults, for instance," he explains.

In a bid to help other infrastructure owners improve the efficiency of their field operations, and also to support transparency and efficiency in connections requests, Berry says that WPD has also taken the leap to making asset location data "open". This means it is hosted on a portal which can be freely accessed by third parties such as water companies or housing developers.

In terms of data gaps, Berry observes that most networks have a good understanding of where their assets sit when it comes to higher voltage levels. But accuracy and understanding typically decreases at lower voltage levels and is still fairly minimal when it comes to the 11kV networks which feeds power directly into homes.

Like most power distribution companies, Berry says the next steps in asset mapping and intelligence building will focus on improving visibility here. It's a critical, albeit challenging step for the industry, he adds, as they move to support the national transition towards net zero and ensure the distribution system is ready to support more flexible use of energy by more power-dependent low carbon devices, such as electric vehicles and heat pumps.

"We're focusing our work to increase the granularity and certainty around those [lower voltage] assets – both linear and static assets," Berry says. "Historically accuracy and understanding has gone down with voltage but we're working hard to bring that up to what we need to make sure[...] we have that understanding so we can reduce assumption and increase the utilisation of the system."

Back in the gas industry, data inaccuracies tend to be driven less by the steps down from transmission-level pressures, and more by asset age. Wales and West's Dunstan observes that most gas networks own at least come assets which data back to the Edwardian era, meaning that as far as asset records go, "some of these pipes have been drawn from records that were 80-100 years old."

To help root out inaccuracies in these very old records – which were clearly created before digital parameters were a consideration – Dunstan adds that Wales and West has developed an effective "error management process" which flags incorrect information and prompts updates to digital records as soon as a problem is discovered in the course of maintenance and repair work.

> Our final step has to stay dedicated to making sure that every single object or asset – whether it be a section of cable, a cable join, a wood pole – is an object within that digital system that you can select and hold data against effectively.

Matt Webb, head of enterprise data, **UK Power Networks**

It's not just the gas sector which has to deal with problems arising from archaic asset records however. UK Power Networks' (UKPN) head of enterprise data, Matt Webb says it's a bugbear for his organisation too.

UKPN is about half way through its journey towards total digitalisation of asset information, says Webb, admitting this is somewhat behind where some other power networks are today. As this process of digitalisation has gathered pace however, he says there has been a learning process around how to handle older asset records.

"If you go back 30/40 years, the maps of our network were hand drawn. They were then semi-digitalised, so scanned into a GIS many years ago, and now they [are being] incrementally updated into a full digital form."

As UKPN heads into the homeward straight of its drive for digitalisation of asset information, Webb says he's committed to ensuring an absolutely complete digital picture. "Our final step has to stay dedicated to making sure that every single object or asset – whether it be a section of cable, a cable join, a wood pole – is an object within that digital system that you can select and hold data against effectively. That's where we've got a gap, but we are in the process of undertaking a large conversion activity that will fully digitise our entire GIS over the next four years."

With this in place, Webb says UKPN will be better equipped to handle the growing dependency on power distribution networks to support decarbonisation of transport and heat and to facilitate growth in demand response markets, all of which will create new expectations for asset performance and overall network reliability.

Which initiatives are accelerating progress?

The previous section of this report shows there is some way to go before full digitalisation of asset data – in which networks and other stakeholders can be totally confident – is a universal reality. However, progress towards realising the dream is gathering steam with several important collaborative initiatives showing that pooling resources and know-how can be a powerful catalyst for change.

The UK's energy networks have so far played a critical role in individually improving the quality and completeness of their asset data. But the ideal is to bring these different silos of information together to form a single national map of the energy system and, eventually to link this with digital maps of other critical infrastructure and parallel sectors too. It's something which has been done in other countries with huge benefits generated says the Energy Networks Association's (ENA) head of innovation and development, Randolph Brazier.

"If you look at the Australian energy system, that's the gold standard. They have a map with network data, environmental data, flooding data, population data, weather data, agricultural data, aviation data... It's all on one map and you can layer it on top of each other."

As part of their efforts to match this antipodean model, the ENA has been working with Ordnance Survey and software provider 1Spatial to build an integrated digital map of the UK's energy system, which will include data on network assets, generators and energy intensive users.

The National Energy System Map was on one of the key recommendations of the UK government's Energy Data Taskforce. As set out in its paper 'A Strategy for a Modern Digitalised Energy System', it argued that creating a national digital map is a key foundation for a "fit for purpose" energy system of the future.

At Utility Week's recent Network Asset performance conference Laura Sandys, the former chair of the Energy Data Taskforce, who now preside over its follow-up, the Energy Digitalisation Taskforce, reiterated just how important such a digital map will be.

"We articulated a whole system strategy, that a modern digitalised energy system will be absolutely crucial to deliver net zero," she said. "We covered the visibility issue around data, around infrastructure and assets and now [in the new Energy Digitalisation Taskforce] we're moving towards looking at the dynamics of this new system, the operational optimisation. We need the energy system map in place to achieve that."

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Randolph Brazier, head of innovation and development, **Energy Networks Association**

The ENA has so far collected whole systems data from gas and electricity networks and developed a map, but it is still proof-of-concept, as Brazier explains. "The data is effectively static data, so what we want to do going forward is make the data more dynamic and live. So that will be the next stage of the project to make it more of an enduring solution."

Elsewhere in the UK, other work is also forging ahead to add accuracy and detail to intelligence about where key infrastructure assets exist, what state they are in and how they might respond to changes in their environment. One project in particular is aiming to light up the gloomy world of subterranean assets where keeping up to data and precise asset information is especially challenging.

The idea for a National Underground Asset Register (NUAR) initially sprang out of the water sector where the vast majority of assets beyond treatment plants are underground. At Northumbrian Water's Innovation festival in 2018, a pivotal "sprint" event, run in conjunction with Ordnance Survey, identified that a common map of underground assets could reduce barriers to innovation, enabling new visions for sustainable cities and smarter, safer field operations.

During the five-day sprint, the first integrated underground map of parts of the Northeast was developed. The early-stage asset register was then combined with the findings of parallel industry schemes – such as a project carried out by Thames Water and Transport for London which at around the same time had completed an underground data proof of concept initiative in London – and taken forward by the Geospatial Commission in 2019, together with six partner bodies:

British Geological Survey, Coal Authority, HM Land Registry, Ordnance Survey, UK Hydrographic Office and the Valuation Office Agency. Collaboratively, they have been striving to map the nation's underground assets with a view to generating commercial and social benefits as well as industrial efficiencies.

The National Underground Asset Register Pilot proved that a secure data exchange platform to collate asset data from a wide network of utility providers is feasible. Covering two geographies, London as well as the North East of England, time and cost savings for planners and engineers, as well as safety benefits from avoiding asset strikes were established.

Northumbrian Water Group CEO, Heidi Mottram, laid out the advantages of having all this data in one place, during a recent project update on NUAR pilots, saying it "will help improve safety for workers, the efficiency of planning and completing jobs and most importantly there will be real, positive, benefits for our customers."

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Heidi Mottram, CEO, **Northumbrian Water Group**

As well as these national projects, utilities are doing a lot of work individually to improve the quality and pervasiveness of their own asset location and condition data.

UKPN's Webb, gives one example of how his organisation is applying new technological solutions such as LiDAR scanning (3D scanning) to better understand the risks that surrounding environments have on UKPN's assets.

"[We're using] full 3D scanning for vertical and horizontal clearances and year-on-year vegetation encroachment to measure growth rates, which we can then extrapolate and forecast how we should prioritise vegetation management. We also identify low conductors or developments of new buildings or structures that are too close to our network," he says.

Elsewhere, with distributed generation and the number of EVs set to rise exponentially over the coming years, growth in low voltage-level connections are set to have a transformative impact on power distribution network assets and operations. Discussing this, Webb says, "There are various new devices and monitoring techniques that give control and visibility at a very, very granular level.

"With that comes increased insight, automation, and it enables us to identify developing faults even before they occur, for instance, by looking at things like partial discharge. So, it allows us to manage the network far more proactively rather than being reactive, post event."

WPD is also investing in the sector's future, as Barry, notes, "We are doing some fledgling work around machine learning and algorithms to drive insights into how we maintain the assets, where and when we should reinforce, and how we should operate them going forward. This investment will make sure we're maximising the value of the assets we've got and really target reinforcement out on the network."

The potential of AI and machine learning was mirrored in the Energy Data Taskforce's report, which highlighted it as a way to further drive productivity and efficiency gains, with Sandys stating that the industry was "going to have to be a lot savvier when it comes to algorithms in terms of system design".

CASE STUDY: Cross-sector data collaboration through CReDO

The Climate Resilience Demonstrator (CReDo) project is developing a digital twin across energy, water and telecoms networks to provide a practical example of how connected data and greater access to the right information can improve climate adaptation and resilience.

"What they're trying to do is create a digital twin that models the interaction between electrical, water and telecoms assets under the influence of environmental factors," says UKPN's head of enterprise data, Matt Webb, whose organisation is one of the collaborating partners on the project, along with Anglian Water and BT.

He explains how the modelling exercise is assessing the interdependency of assets to better understand the risk attached to certain sites in the event of an environmental event such as a tidal surge that may cause floods.

By using this tool, he says, "very quickly you can expand your sphere of influence and change your perspective on the criticality of a site. For example, if you had a secondary substation with one customer you might say its non-critical. However, if that one site is a BT exchange that serves a lot of telecom infrastructure and critical business that [criticality] changes. So, we're really trying to be more sophisticated in the application of our data using modern techniques."

Visit https://digitaltwinhub.co.uk/credo/ to find out more.

What is a digital twin?

According to the Centre for Digital Built Britain, digital twins are realistic digital representations of physical assets. For example, a digital representation of an aeroplane that can be used to monitor and predict performance, feeding out insights and interventions. These insights lead to better interventions and unlock real-world value from assets through financial savings, improved performance and services, and better outcomes for society.

Overcoming barriers

There are several challenges ahead for the industry as energy system becomes increasingly digitalised and intertwined with parallel sectors, from transport to telecoms and water.

The nature of energy supply is set to change dramatically with dependency on power as the driving force behind mobility and, to an uncertain extent heating, rising. Meanwhile, greening of the gas grid via injection of more distributed sources of bio-methane and, in the longer term, hydrogen will fundamentally alter the shape and purpose of gas infrastructure. And across the board, the prospect of energy flexibility and "whole system" operation mean confidence in the condition and responsiveness of assets to varying trends in supply and demand needs to grow.

Speaking at Utility Week's recent Network Asset Performance Conference, SSEN operations director Eliane Algaard articulated a few of the areas of uncertainty for asset and operations leaders when it comes to enabling this vision of the future energy system. Among her key asks to help resolve these, was a big focus on improving industry collaboration with new stakeholders.

> There are big challenges around data sharing," he comments. "What can we share? Who can we share it with? What data counts as critical infrastructure that we can't necessarily just display open to the public?

Randolph Brazier, head of innovation and development, **Energy Networks Association**

"We are forecasting to move from sixty thousand electric vehicles to about five million by 2050," she said. "And in terms of heat pumps, it will go from the current 18,000 to about to 2.5 million. So, we have to map out the opportunities and the capacity with the local authority, we need to engage with them in terms of what's the best combination of energy source."

The ENA's Brazier agrees that it will be essential for the industry to find effective, time efficient ways of collaborating with more partners as the drive to reach net zero ramps up. He's optimistic that work on the National Energy System Map will help develop useful new processes for cooperation across industry boundaries, including showing how data can

be shared without fear of commercial, operational, security or legal compromises.

But while the National Energy System Map project and others are trying hard to tackle data sharing issues, Brazier says it remains a key barrier to innovation. "There are big challenges around data sharing," he comments. "What can we share? Who can we share it with? What data counts as critical infrastructure that we can't necessarily just display open to the public? The second challenge is actually getting the data. What format is it in? How accessible is it? Is it in the same format, using the same parameters? So, as a simple example, one network might use kilowatts, while another network might use megawatts."

Furthermore, once technical issues around data sharing are overcome, the Energy Data Taskforce warned that the utilities sector must address a significant skills gap before it can be confident that new clarity around asset location, condition and empowerment is leveraged to its full potential. Key digital and engineering expertise are in shockingly short supply across the sector, it observed in its report.

Many networks are acting now to try and address this shortfall, including WPD. The network's Jon Barry says, "We are bringing new types of people into the industry that we haven't had before. We now have data scientists who understand how to maximise the value from data and drive insights.

"We've started a data science degree apprenticeship with Nottingham University and we're taking four data science degree apprentices this year. But we are also skilling existing staff and supporting them through that transition to a more digital future. So we're training and upskilling internally to ensure our people can access the data and use it as efficiently as they need to."

A final consideration, but a critical one, as networks seek to improve the accuracy, reliability and variety of information they hold on both their own assets, and the proliferating range of devices connected to their infrastructure, it to keep public interest firmly in sight.

While there are whole range of things which it may be within the art of the possible to do with better insight into the location and activity of static and mobile assets, Eric Brown, chief technology officer for the Energy Systems Catapult urges that the potential for generating public good should be the defining factor in deciding which opportunities are pursued.

"You can achieve net zero in many ways," he says. "You can do it badly or you can do well. But you need to do it in a way that optimises not just climate change outcomes, but also societal benefit for those that matter, the consumers and the citizens."

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Eric Brown, chief technology officer, **The Energy Systems Catapult**

Solving the data challenge together

Chris Tagg
Head of OS Connect
Ordnance Survey

Data on assets is going to become increasingly important as we drive toward a net zero carbon future.

Driven by BEIS (the Department for Business, Energy & Industrial Strategy), Ofgem and Energy Systems Catapult, the digitisation and synergy of the industry is picking up pace, particularly as energy systems become more localised with distributed assets.

New elements on the supply side will decentralise networks and grids, with more wind parks, solar farms, and hydrogen and biogas plants coming online.

The management of both supply and demand is becoming increasingly complex, particularly in regard to electricity. The industry also needs to be able to respond to the inherent characteristics of renewable energy such as fluctuating, localised supply.

The location element to asset data is key to unlocking this. That means understanding where assets are, where customers are, and where the industry's organisations operate and the way their networks are composed.

When Ordnance Survey (OS) started to look into how utilities access other companies' data for things like maintenance, we found a clunky, complicated and inefficient process, which led to potentially unsafe working conditions for the field workforce.

As such, we started a pilot in North East England, working with asset owners in the energy, water and telecommunications domains to see how they could effectively share their data. This then graduated into what is now the NUAR (National Underground Asset Register) programme run by the Geospatial Commission, with OS also providing technology to the Greater London Authority for a second pilot in London.

More recently OS has created a Proof of Concept National Energy Systems Map for the Energy Networks Association. Working with all major Network Operators in power and gas, we created an integrated picture of the energy network in Great Britain. In doing this, we made utility network data interoperable and negotiated a number of barriers to collaboration.

We learned some key things from this process, including that many utilities have different methods for storing data and use a variety of formats. To lower the barrier for participation, we accepted their data in whatever form and found a way to harmonise it, working very closely with the utility companies to understand their data and integrate it with similar data from other providers. We essentially developed a common data standard to publish the energy network. We had to develop a security approach that balanced data access against critical national infrastructure considerations and the need to protect this data.

Compared to the technical integration we found the development of legal framework to be more challenging. However, discussions with legal departments from all network operators resulted in a framework that every single company signed up to.

We had to develop a security approach that balanced data access against critical national infrastructure considerations, particularly in London where security services are cautious about publishing data or giving widespread access.

A key finding was that if you get the community element right you can really achieve a lot of collaboration and cohesion between these different organisations. There is greater recognition now that they are in this together and it makes business sense for them to work collaboratively.

We also see a very positive drive for innovation across the different utility commodities and, at OS, we want to listen to the energy and water sectors so that we can match our expertise to their evolving needs as well as supporting them beyond traditional mapping.

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