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### **What role might digitalisation play in transforming power networks going forward?**

'Digitalisation' is a word that is mentioned a lot in the modern corporate world, but can be understood differently depending on context. Oxford Dictionaries defines it as 'The conversion of text, pictures or sound into a digital form that can be processed by a computer', possibly akin to entering data into a system so that it can be analysed by a computer. For UK Power Networks, this means 'realising business opportunities and value, presented by digitisation', essentially using analysis and smart assets to make a more efficient grid.

To look at how digitalisation will affect power networks, we must first assess the state they are in. The UK grid was introduced in 1933, before computers even existed, never mind digitalisation. It powered 9 million users through a 132 kV and below system. BEIS data shows that in 1948, about 48 TWh of energy was supplied. In 2019, that figure was 289 TWh from a grid now expanded to include over 20,000 km of 400 kV and 275 kV lines, connecting 181 large stations.

Electricity consumption in the UK is clearly growing in both size and complexity. The exponential rise of electronic device ownership, the advent of the Internet of Things, and soaring sales of battery electric vehicles (BEVs) are placing growing demand on the grid. At the same time, rapid decarbonisation of a grid that only ten years ago was 69.4% powered by coal and gas means that the source of our energy is changing all the time. To add further complexity, the grid doesn't just send electricity to users now, it receives it too. Around 1.5 million houses have solar panels fitted and many have small wind turbines. When the electricity generated by these is not being used, it is sold to the grid. Home power storage, such as the Tesla Powerwall, and BEVs which can send energy back to the grid, also adds complexity and changes the shape of demand.

If all of this were tracked manually, it would be almost impossible to keep the grid balanced. Developments in smart asset technology, machine learning and big data management over the last decade have presented the opportunity to make the grid more self-sufficient. Using smart assets such as smart meters to underpin research, big data can be used to accurately predict demand and low-level supply from household generators like solar panels, as well as analysing outputs from industrial generation sources to reliably balance the network, optimising supply to be as green as possible. To save money, the grid can also be optimised to reduce the cost of payments that need to be made to suppliers that are offline in low-demand scenarios. Deep learning can be used to analyse the network for faults, helping to predict occurrences and inform the design of the next generation as well as quickly and accurately identifying faults, which can then be efficiently repaired.

Reliable and abundant electricity underpins modern society, and cybersecurity is becoming ever more important both locally and internationally. In any network with connected assets, there will always be a data security risk. Digitalisation, managed

correctly, can also help to manage this risk, for instance using blockchains could help protect personal data and maintain the integrity of the system. Nonetheless, security remains paramount to the grid, and must be maintained throughout the regeneration of it. This will become increasingly important as Power Line Communication and Broadband Over Powerlines are introduced.

Digitalisation brings many benefits to the grid, but its primary role will be decreasing the cost of energy transportation from generator to socket. Digitalisation means a grid that is constantly monitoring its own condition and faults, and predicting its future state accurately, all of which amalgamate to increase efficiency, with less energy and time being wasted than ever before.

In conclusion, digitalisation will revolutionise power networks in a way not seen since their inception. More accurate prediction and data management will combine with efficient, smart assets and numerous renewable energy sources to create a secure grid with lower running costs, emissions and waste. On top of this, digitalisation will help to future-proof the network, with sensors communicating data that will provide the foundations for research into future technologies.