VIEW POINT

HOW AI CAN HELP UK'S ENERGY NETWORK OPERATORS ACHIEVE ED2 GOALS

Abstract

As UK's energy network operators endeavor to comply with price control regulations, they must look for ways to transform operations and bring in new efficiencies. This paper outlines the key electricity distribution goals that distribution network operators must prioritize over the new few years. It also examines how artificial intelligence can drive the transformation and help achieve positive outcomes.

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Introduction

Most distribution network operators (DNOs) in the UK are looking to become distribution system operators (DSOs) in a few years to achieve the electricity distribution goals of Revenue = Innovation + Incentives + Outputs - Electricity Distribution or RIIO-ED2, as set by the Office of Gas and Electricity Markets (Ofgem).

The ED2 program that runs from April 2023 to March 2028 is focused on driving efficiency, reliability, sustainability, and customer service in electricity distribution networks. According to Ofgem, the key objectives of DSOs in the UK are to:

- Evolve to meet the demands of low carbon energy systems
- Create flexible networks that enable the latest technologies

ED2 has proposed several goals such as customer engagement, energy efficiency, and low-carbon technologies that favor electric vehicle (EV) management, as well as regulatory compliance and transparency. To achieve ED2 goals, DSOs must enhance the reliability and resilience of their entire network systems to withstand increased loads as well as disruption from cybersecurity threats, climate change, and other risks. Further, these goals must be met within the stipulated timelines and support net-zero requirements.

AI – Helping DNOs Meet ED2 Goals

DNOs are shifting their focus toward automating their business process and technologies to derive positive outcomes. Artificial intelligence (AI) is a key transformation enabler that can help drive innovation to meet ED2 goals. Here are some ways in which AI can help DNOs transition to DSO capabilities:

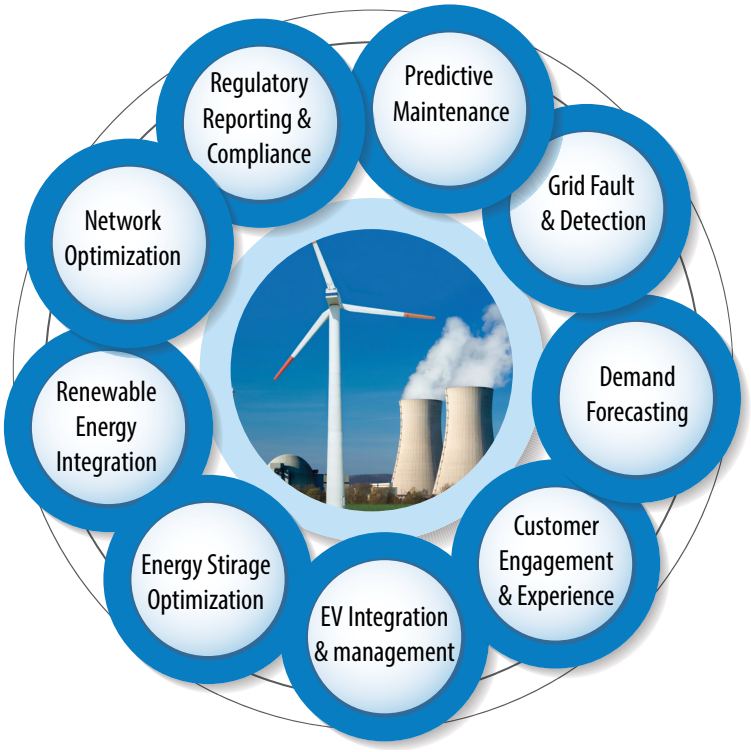

Figure 1 – How AI can transform operations in energy networks

- **Predictive maintenance** – Predictive AI models can use statistical analysis to identify patterns, anticipate behaviors, and forecast future events. These capture inputs from multiple data sources like sensor data and historical maintenance records. AI models can also predict when and where equipment failures may occur in terms of patterns and probability. This will enable DSOs to proactively run maintenance tasks before incidents occur, thereby reducing downtime and maintenance costs.
- **Grid fault and detection** – AI models can detect and isolate faults in real-time rather than using time-based isolation. AI anomaly detection models can analyze real-time data from the grid to track and identify probable anomalies and incidents. They can distinguish between transient faults and permanent issues, enabling faster and more accurate responses for timely resolution and a secure grid.

- **Demand forecasting** – Some AI models can leverage forecasting techniques like random forest (RF) and support vector regression (SVR). Such models can be pre-trained with vast sets of smart meter data, historical consumption data, weather forecasts, and other variables to enable accurate predictions of energy demand during peak and off-peak times. Such forecasts can be applied at multiple levels across the utility value chain for improved demand-supply balance supply and grid reliability.
- **Customer engagement and experience** – AI personalization can provide targeted recommendations to customers based on their consumption history and usage patterns. This can include time-of-use (TOU) suggestions for appliances, which can also be well integrated with marketplace with key recommendations on products as well. This will enhance customer experience and enable effective automation in demand-response programs.
- **EV integration and management** – With on-demand EV charging services being made available in the distribution network, there will be a significant impact on the grid load. AI can help manage EV charging schedules by periodically analyzing usage patterns and grid conditions so as to avoid overloading the grid infrastructure and intelligently balancing supply. AI can also optimize charging times, thereby giving customers the benefit of lower TOU tariffs.
- **Energy storage optimization** – Energy ecosystems are seeing a rapid increase in the number of batteries used to store energy. The fluctuating demand for energy required at multiple sources can cause outages. AI can help balance and optimize the charge and discharge cycles of storage systems by analyzing grid demand patterns and energy prices. This will increase the longevity of batteries as well as improve integration with the grid.
- **Renewable energy integration** – Renewable energy generation has become integral to reducing carbon emissions. AI can predict the output of renewable energy sources such as solar, wind, and tidal by analyzing climate and historical performance data on a timely basis. This can help DSOs integrate renewable energy sources into the ecosystem and effectively manage the variability of supply, demand, and usage.
- **Network optimization** – AI models can create various simulations and scenarios by collecting relevant data from multiple sources such as energy assets, climate, and temperature. The results from such simulations can help optimize the configuration of distribution networks, thereby minimizing losses and improving power reliability.
- **Regulatory compliance and reporting** – As data collection and analytics become automated, AI can be used to trigger automated regulatory reporting in near real-time. This will reduce the administrative burden on DSO employees while improving accuracy. Further, efficient and accurate data reporting will help DSOs comply with regulatory rules and foster trusted interactions within the marketplace.

Leveraging AI to drive such transformation requires initial investment to build a robust data infrastructure. More importantly, DNOs must choose a technology partner with the knowledge and expertise to deploy innovative solutions. They should evaluate the credentials of their chosen implementation partner in running large language models (LLMs), ensuring model maturity, and delivering the expected outcomes. This will help them advance toward their ED2 goals of creating a more resilient, efficient, and sustainable electricity distribution network.

Conclusion

As energy network operators digitalize their operations to meet RIIO-ED2 goals, it has become imperative to bridge gaps in areas such as cybersecurity, network planning, demand forecasting, and predictive maintenance. AI can help DNOs transform into DSOs and drive greater value by ensuring data harmonization, enhancing customer engagement, automating anomaly detection, and improving grid reliability and security. A key success factor is having the right technology partner with deep domain knowledge and implementation expertise in AI and LLMs. This will help achieve ED2 goals of building low-carbon energy systems and flexible energy networks equipped with the latest technologies.

About the Author

Vijay Kumar Mududhudla is a Principal in Domain Consulting, with over 21 years of experience in the energy and utilities sector across multiple geographies. He serves as a domain expert and transformational leader for energy and utility clients in the UK and EMEA region, guiding organizations through digital strategy changes and managing large-scale transformation programs across the utility value chain.

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