

Case study

Client name: UK Power Networks

Service provided: Smart grids



Ricardo
Energy & Environment

Supporting a DNO to realise benefits of distribution network visibility

Our experts provided business process and technology advice to UK Power Networks as part of this complex project.



"This project has successfully demonstrated the need to improve visibility of the distribution networks at 11kV and below to assist with the transition to a smarter grid and incorporation of low carbon technologies, especially the increase in domestic micro generation, and the electrification of transport and heating. Improved visibility is expected to enable distribution network operators (DNOs) to make smarter decisions in the areas of network planning, asset management, new connections and network operations."

**Sarah Carter, Managing Consultant,
Ricardo Energy & Environment**

UK Power Networks is a UK-based distribution network operator (DNO) responsible for power distribution in the East of England, London and the South-East. The network operated by the company comprises some 170,000km of underground cables and overhead lines, together with more than 130,000 substations. The company is responsible for delivering safe, secure and sustainable electricity supplies to 8,000,000 homes and businesses.

As the Distribution Network Visibility Project demonstrated techniques that could be applied by other UK DNOs, it received funding from Ofgem through the Low Carbon Networks Fund (LCNF).

The aim of the project was to assess the benefits that can be achieved by making better use of existing data sources, by turning data into actionable information using a variety of visualisation techniques and through enhanced monitoring of the distribution network.

To ensure the successful delivery of this complex project, UK Power Networks entered into a collaboration agreement with Ricardo Energy & Environment (to provide business process and technology advice) and Capula Ltd (to cover database upgrading and software delivery).

Project focus

By making use of existing monitoring devices installed on 65% of secondary substations in London, UK Power Networks assessed benefits relating to system planning, asset management, operation and network control.

The project focused on the following benefit areas:

- Providing a daily overall network summary report considering secondary substation utilisation, high and low voltages, out of balance current and voltage, harmonic distortion and substation ventilation.
- Enabling proactive network management by prioritising specific substations or identifying network areas with issues for further investigation, thus potentially avoiding or reducing customer interruptions, reducing losses and preventing potentially dangerous network conditions.
- Evaluating the impact of changing load patterns and demand growth on the future development of the networks to enable enhanced future planning.
- Assessing available spare capacity for different load profiles resulting in enhanced connection techniques to better utilise existing assets.
- Developing and trialling techniques for measuring power flows in areas where monitoring is sparse or non-existent.
- Providing real-time power flow and forecasting information to network operations.

What we did

Key deliverables for which we were responsible included:

- Facilitating stakeholder workshops to obtain the views of UK Power Networks technical staff on the key requirements of the standalone and integrated solutions.
- Evaluating the potential benefits of the project across a range of control, system planning, operations and connections business processes.
- Managing a process of analysing, testing and releasing the full potential of monitoring equipment to increase the visibility and integrity of system operating data.

- Developing, designing, testing and managing a full range of non-invasive real-time 415V to 33kV network monitoring and analysis systems for control, asset management and planning applications.
- Developing the functional specifications of the standalone and integrated solutions.
- Providing inputs to reports for the UK Power Network's management team and to the Low Carbon Networks Fund Annual Conference, which is organised by Ofgem.
- Providing training and user guides to integrate the use of the software into business as usual within the connections, planning and asset management business areas.

We facilitated workshops for UK Power Networks staff at a number of the company's offices and operational sites. Our experts also attended equipment tests and installation work on behalf of UK Power Networks that was carried out at independent testing facilities and substations.

Outcomes and insights

The project demonstrated:

- The importance of system data validation, aggregation, analysis and presentation in providing readily usable and reliable information to network planners and operators.
- The opportunities that exist to enhance network planning and operating business processes by drawing on information that demonstrates trends in network and equipment performance.
- New techniques for monitoring using a range of equipment, monitoring zones, virtual remote terminal units (RTUs), and sequence component transform between high voltage (HV) and low voltage (LV) measurements.

In addition, the project promoted carbon reduction in the power distribution sector by providing high-quality data and analysis that will enable network planning and operations to be optimised. An important goal in this process is enabling the distribution networks to accommodate increasing quantities of renewable distributed generation, while minimising network losses and optimising the use of existing assets.



For more information, on our smart grids services, please contact one of our experts at enquiry-ee@ricardo.com or +44 (0) 1235 753000

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Work described herein that took place before November 2014, was carried out by PPA Energy. In November 2014, PPA Energy transferred its business to Ricardo plc. As part of the restructuring of the business, all PPA Energy staff transferred to Ricardo Energy & Environment, a trading name of Ricardo-AEA, and wholly owned subsidiary of Ricardo plc. For more information, please visit ee.ricardo.com/cms/PPA-ownership