

Smart Grid technologies for Distribution Network Operators Meeting the challenges of the energy revolution



FOR MORE DETAILS:

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The rise of distributed energy resources makes managing power networks harder. That calls for a new generation of smarter solutions

The increasing penetration of distributed energy resources (DER) is changing the nature of the electricity grid. Today, those resources include renewables (such as wind, solar and hydroelectric installations) and combined heat and power (CHP) schemes. Other technologies, such as battery storage systems, are on their way. The growth of these installations is helping to create an energy system that is cleaner, more flexible and more resilient, and providing new commercial opportunities for DER developers and users. It creates new challenges for the management of the grid, however, especially for distribution network operators, who must integrate them into their existing infrastructure.

Network owners now have no control over the production of energy, for example. Traditional dispatch schedules have been replaced by market mechanisms, in which producers bid to meet current and forecast demand. The availability of some renewable generation resources, such as solar and wind power, are intermittent

and unpredictable. At the same time, new sources of demand, from electric vehicles to heat pumps, are driving up both the size and volatility of that demand.

For DNOs (Distribution Network Operator), this transition means the passive distribution systems of the past are no longer fit for purpose. DNOs need to build more control and flexibility into their networks, and to take a more active role in their management, evolving into a new kind of organisation, the Distribution System Operator (DSO). Management of power distribution systems and the high penetration of distributed energy resources, creates a number of specific technical and commercial challenges and needs:

- DSOs need better algorithms for forecasting loads and generation capacity, so they can maximise the use of DERs while maintaining supply to all customers



- DSOs need smarter control systems to ensure power quality and voltage levels are maintained within limits, and that their networks can still provide active and reactive power to the wider grid when required
- Traditional unidirectional power flows are being replaced by more complex, bi-directional flows. DSOs need the ability to control the distributed energy resources in their network to prevent back flows at the points where their networks connect to higher voltage supplies from the wider grid
- DER capacity is increasing faster than investments in network capacity, so DSOs need new ways to optimise the capacity of their existing infrastructure, to prevent network congestion becoming the limiting factor in the development and use of DER
- Because the Transmission System Operator (TSO) has no network visibility on the (DNO) grid with no ability to monitor and control DER's, this makes it harder for the TSO to balance the supply and demand of the overall grid. Thus, TSOs and DSOs need new mechanisms to exchange system information automatically and more regularly to enable the control of the grid to be closer to a *whole system* approach.

How Capula can help

With over 40 years of control and systems integration experience in the power transmission and distribution sectors, Capula is ideally positioned to help organisations implement smart power distribution solutions. We have designed, implemented and supported control and automation solutions for power applications of all sizes from utility scale down to individual sites. Our solutions start with simple energy monitoring systems and extend to encompass automation of the most demanding networks.

Furthermore, as part of the EDF group, Capula can also help organisations to identify and access the right opportunities for participation in commercial energy markets, turning power assets into a source of additional profit. For more information visit www.capula.co.uk or contact: marketing@capula.co.uk.



Capula IMPERIUM Smarter Power
Distribution solutions have been developed to help network operators meet these challenges, enabling a smooth technology transition from DNO to DSO.

Those solutions include:

- Advanced load and generator forecasting algorithms optimised for networks with high DER penetration
- Active network management, maximising the connectivity of renewable energy resources while managing network congestion
- Virtual power plant functionality on the distribution grid, aggregating the various DERs on the network into single entity to ensure optimal power flows and keep voltage levels within limits
- Software-based Dynamic Limit Rating (DLR), which takes account of real-time environmental conditions to maximise the rated capacity of overhead power lines
- Advanced decision-support capabilities using Security Assessment and System Optimisation (SASO) technology to improve network control, performance and stability
- Self-healing capabilities with automatic feeder reconfiguration to improve network reliability and power availability under fault conditions.



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