Smart grids (Part 3 (III))

Microgeneration

As with most *smart* jargon, there's no single definition of what constitutes *microgeneration*, but it's generally accepted to mean very small scale generation, typically serving a single home. Examples of microgeneration are solar panels (also referred to as *photo voltaic* or *'PV'* panels), wind turbines and micro CHP (small boiler-like units that generate heat for home heating from gas and produce electricity as a by-product). It's debatable whether microgeneration is part of the smart grid or one of the emerging factors that smart grids need to accommodate but, either way, it is set to influence future smart grids and is worthy of mention. Microgeneration presents a new set of challenges to distributors. In the case of three phase distribution systems (in which electricity is carried as three alternating currents in three circuit conductors), microgeneration can cause voltage imbalance if not evenly distributed across all three phases. It can also cause localized interference with communication systems. At volume, microgeneration could also result in reverse power flows (for example electricity flowing from the distribution grid back onto the transmission system).

Smart appliances

We're not talking fashion here, although many smart appliances are sleek and smart looking, and they, too, have a role to play in enabling smart grids. *Smart appliances* are your traditional domestic white goods but with some added ICT cleverness. That cleverness comes in different forms – some smart appliances can be controlled remotely by you, the owner, by your smart home (see the next section) or by a third party (an energy services company, for example) so as to run when power is at its cheapest or shut down when peaks occur. Smart appliances can, therefore, help flatten demand by moving consumption from peak periods to off-peak periods – a process known as *peak shaving*.

Smart homes

A *smart home* is another of those unspecified terms that means different things to different people. In this context, it means a residence fitted with a smart hub that can communicate with and co-ordinate a number of *smart appliances* so as to optimise energy consumption within the home. A smart home helps to take some of the burden of sustainable living off the shoulders of the home owner. As they become more prevalent, distributors will need to engage with smart homes instead of with individual smart appliances or individual, perhaps not-so-smart, consumers.

Smart meters

Whilst most people would agree that smart meters are an integral component of any smart grid, they aren't the same thing. *Smart meters* can provide distributors with an in-depth view of what's going on in their networks. Where previously a distributor's view of power flows stopped at substations, smart meters provide the potential for extending visibility right down to the end consumer. Depending on its IQ, a smart meter can also help the distributor adjust loads remotely, thus providing a powerful tool for managing the network. In most countries, where

metering is still the responsibility of the distributor, establishing a smart grid is often the driver behind smart meter rollouts. However, in countries where competition has been introduced in the energy sector resulting in unbundling of different roles and functions, new smart meter deployment models, such as the supplier-led deployment in Great Britain, have emerged. Truth be told, many stakeholders have an interest in the data and functionality on offer from smart meters:

✓ Suppliers see smart meters as an opportunity to win more customers through enhanced products and services whilst at the same time reducing their operating costs.

✓ Distributors see smart meters as the means of extending the smart grid down to the very end of the low voltage network.

From reactive to pre-emptive

For one of the world's largest power grid transmission operators, making sense of low-level energy events taking place in the grid was a huge challenge. While the majority of these events are harmless, others are indicators of upcoming problems and potential failures. The operator deployed complex event processing technology from TIBCO that continuously monitors all low-level energy events and correlates these into meaningful information. This makes it possible to rapidly identify important events, understand how these events are inter-related and thus spot issues with the power grid before any major disruption occurs. As a result, grid operation can focus on pre-emptive rather than reactive actions. With large transformers costing millions of Euros and requiring weeks, if not months, to replace, this has a huge impact both on the overall reliability of the network as well as operational costs.