

Part I

Looking at the 'Uneducated' Grid

Traditionally, power has been generated by a small number of large power stations. It is then transported at very high voltages to areas of demand on a transmission system and delivered at lower voltages to end users via a distribution network. Flows on the distribution network are generally one way only with power taken off the high voltage transmission network and supplied to the end consumer. Transmission systems have always been relatively smart but, on leaving the transmission network, things dumb down rapidly. Conventional distribution grids are built on a build and connect principle. When new housing is built, the network is sized for the likely maximum anticipated load by applying tried and trusted design principles. The infrastructure is then built, homes connected and little more needs to be done for the lifetime of the network.

However, the global warming-induced pressure for countries to move towards low-carbon economies is now challenging this traditional 'build and connect' culture. We discuss the business drivers for smart grids in

Part II but, suffice to say, electricity distributors are now being forced to move from a 'build and connect' to a 'connect and manage' culture. Distribution networks can no longer be left to their own devices but need to be actively managed, along with the consumers they serve, to cope with rapidly changing demands on the network.

Getting to a Smarter System

Smart grids don't usually start out smart. The vast majority of the electricity distribution network has been around for some time now and pre-dates the 'smart' era by several decades.

How a smart grid develops

A new network can be designed to be smart from the outset but the majority of grids need to become smart by adding information and communications technologies (ICT) to the existing 'dumb' network. So a smart grid is an electricity distribution network with some added ICT. Glad we cleared that up.

But, technology is only part of what enables a smart grid. A massive cultural change in the way distribution grids are planned, operated and managed is also required. Depending on the market, a fully functioning smart grid is likely to require a radical overhaul of existing commercial and regulatory relationships between distribution, supply, generation and transmission companies. And let's not forget the consumer who's an integral part of the transition to a low-carbon economy that smart grids are supposed to enable.

What a smart grid can do

A smart grid can provide better visibility of the electricity being distributed and can proactively manage both demand and generation connected to the network along with the network itself.

A smart grid helps deliver electricity more efficiently and reliably by:

- ✓ Automatically re-routing power, shifting loads and/or controlling embedded generation to manage constraints and outages on the network.

- ✓ Monitoring the condition of network assets and predicting failures, thus reducing maintenance costs.

- ✓ Intelligently managing the network to maximise the electricity distributed.

A smart grid can help 'sweat the assets', defer the need for reinforcement and thus, reduce investment costs.

However, with great power comes great responsibility . . . with so much automation and dependence on ICT, a smart grid must also be secure from malicious attack by incorporating cyber security at its heart.