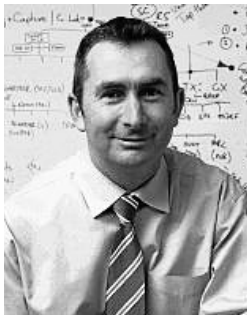
Expert Insights

SMART Energy

—One Eskom view of the future highlighting the need for strategic partnerships.



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There is surely no more exciting place to be at the moment than in the energy industry. An industry faced with enormous challenges but also technology opportunities that threaten to revolutionise the business model and operations of a traditional power utility such as Eskom. Climate change, finite fossil reserves, rising prices, societal inequalities and global economics are amongst the many macro drivers pressurizing utilities to relook their strategies. As they do they are looking to distributed generation, energy storage, metering, ubiquitous communications and the internet of things (amongst others) to become 'smarter'.

Eskom is quick to point out that current networks and operations are not dumb but acknowledges there is major room for improvement towards more intelligent networks. There are seemingly as many definitions of Smart Grids as there are people prepared to offer one so it does not add a lot of value to focus on one particular view, or indeed one particular technology. I have often described Smart Grids as supervisory control and data acquisition (SCADA) on steroids. Fundamentally, all applications involve some form of control and data acquisition through a telecommunications media. Whether it is controlling and visualizing a 400kV circuit breaker or a household appliance, the principles and challenges are the same. What speedy advances ininformation and computer technology (ICT) bring to the power grid however are opportunities to connect devices in the 'internet of things'. This brings endless possibilities. Imagine a world in which every single electrical energy device is 'connected' and every device has the ability to communicate and respond to outside stimulus and commands. Right down to light bulb level – current light-emitting diode (LED) bulbs could rely on universal serial bus (USB) sockets and internal processors to bring intelligence to this the most basic of appliances. Is it possible to control every light bulb on the planet simultaneously? Technically yes but the back end systems and processes as well as the infrastructure, standards, protocols etc. are a long way behind.

Eskom Research, Testing and Development (R,T&D) is working on various projects that all have an element of 'smart' to them. Online Coal Analysis allows the combustion characteristics of the fuel to be known before it enters the plant and thus enables better operational decision making. It also assists in contract management issues with suppliers. Similarly real time analysis of pulverized fuel boiler operating conditions allows improvements in efficiency and reduction in boiler tube wear rates and failures. Rooftop photovoltaic (PV) and other distributed generation technologies offer promise to the utility if their characteristics can be controlled en masse and today's inverters can be managed to provide many benefits to the power system operator. Most utilities have smart metering projects and Eskom is no different. We are focusing on functionality and pushing for open source solutions and standards. In a country struggling to meet electrical demand the need for real time demand-side management (DSM) is paramount and appliance control and real time pricing are just two ways to achieve this, both enabled by smart technologies. Visualisation, simulation, and data management are also key areas of study with cyber security rapidly rising in importance as a research area.

The list is seemingly endless and it is often harder to decide what areas of smart grid not to pursue than to succumb to the temptation to try a bit of everything. Research management becomes even more difficult when offered such a sumptuous array of options and focussing on a few critical areas is required if results are to be of significant value. Partnerships with industry allow research groups to cover a lot more ground than they could do if they went it alone. No group has the skills and expertise in all these environments and by working with suppliers such as Hitachi the results can be delivered a lot more quickly. It is part of Eskom's strategy to

work with firms that are at the cutting edge of what is possible and we are happy to confirm that Hitachi is in this category. It is a healthy relationship in which the utility brings a need or a vision and the supplier brings the expertise and possible solutions. Of course it is not this simple in practice and many smart research projects end up looking very different in the final solution than they did at conceptualization.

There are four fundamental principles which Eskom looks for in all smart solutions. Firstly, as far as possible, it must be open source. We prefer common functionality which is not device or supplier specific. If a particular device fails, it should be replaceable from a number of sources. This relies on strong protocol based specifications and standardization where possible. My favorite example of this is USB – from printers to cameras to memory sticks – plug it in and it works. First time. This also implies backend software and systems should be similarly open and that brings the second principle into play. The power of the solution is in the app. Just like a tablet is pretty useless without applications so too the smart backend. And similar to tablet applications, anyone who has the training and inclination can write one. In the utility of the future it is highly likely that customers will write or purchase apps that meet their requirements. That access to energy and billing data will be open and that apps based on this data will be plentiful. The third aspect is that of integration – most smart apps and systems suffer from a failure to adequately backward integrate into legacy systems. This is crucial in the power sector given the size and scope of the applications – large investment has gone into developing these systems (billing, customer care, and work management, etc.) into which smart solutions must seamlessly integrate. And lastly but most importantly from a management point of view is the all-important business case, or more simplistically – why do it? Here we find that the answer lies less in one or two applications that stand alone but in the idea of sequential value add at declining investment cost. Take smart metering as an example. The upfront cost of the meter and its installation are the biggest components in the life of the asset. If the inherent technology is chosen wisely however, it is possible to build on this initial investment at very low additional cost. Adding appliance control, real time pricing, load limiting, power buy back schemes etc, to an installed platform is usually a firmware upgrade that can be downloaded to millions of devices from a central point and thus the incremental cost is very small for a large functionality increase. So taking a life time approach to the strategy is key to the success of the business case but also probably the hardest thing to do technically. To design a future proof, open source, standards based technology platform for a whole suite of apps to run on. But apply this through the electricity supply chain and you have the promise of a true smart grid.

We look forward to a continued relationship with Hitachi on the journey towards such a future as we know we cannot do it alone. Planning the future today in an uncertain world requires that all factors are considered and that best practices are fully understood so that confident decisions can be made. Our relationship with Hitachi builds our confidence and our understanding of the future – inspiring the next!