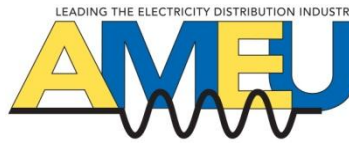


TECHNOLOGY DEPLOYMENT AS A SMARTER INDUSTRY ENABLER



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AMEU CONVENTION

15 – 17 OCTOBER 2012

1. Executive overview

Due to the generation challenges which surfaced during 2007/08, the generation related requirements are currently receiving significant attention. The transmission infrastructure in general performs well and it is underpinned by a well-defined investment plan¹. The latest Eskom annual report confirms the performance of amongst others the transmission system as well as the distribution system. From these results it is clear that the distribution system requires urgent attention and this is equally applicable to the electricity distribution infrastructure under control of the municipalities. The South African electricity distribution industry is confronted by numerous and significant challenges that impact directly on the sustainability of the industry and the ability to provide a reliable service to electricity customers. While the distribution grid served the country well in many aspects, the electricity grid is aging, outmoded, and stressed.

All indications are that the electricity distribution operating environment will change significantly over the next couple of years. Most of the current distribution grid is not designed to accommodate for example; distributed generation, renewable solutions, or electric vehicles. This should however not be a surprise, since the current grid was not constructed with the 21st century power supply requirements in mind.

The availability of a more intelligent grid will not remove all the challenges associated with the electricity distribution industry. However it will enable the industry to better respond to situations such as when generation capacity constraints are experienced. At the sub-transmission level the current distribution industry in most cases do have an advanced level of grid intelligence and in some areas this is also applicable to the medium voltage networks/grid. However, there are no examples of advanced low voltage grid intelligence deployed to enhance customer service/interface, advanced customer communication or to enhance system operations.

¹ Eskom 2011. *Annual Report*.

2. Introduction

Without investment in the infrastructure and the introduction of intelligence in the grid, the unreliability of the electricity supply will continue. Therefore without the desired interventions, the cost to the economy as well as to the end customers due to distribution related outages will continue. Furthermore the current grid is vulnerable to attack and natural disaster with limited “self-healing” capability.

The demand for electricity is projected to increase substantially towards 2030 and the cost to build new generation is increasing dramatically². Electricity prices have increased drastically over the past couple of years and the approved tariff plan suggests that these increases will continue into the foreseeable future. Without addressing the grid intelligence i.e. making it smarter, it will become very difficult to match the grid reliability and availability with the projected economic growth targets. The current grid and technology deployed cannot support the projected economic growth or respond effectively to the broader dynamics affecting the grid. The inability to effectively introduce a demand response program is but one example.

South Africa has committed to substantial reduction of CO₂ emissions by 2035. To achieve this necessitate the integration of renewable energy into the electricity network/grid. It is important to note that the distribution grid, which includes the majority of the networks/grids operating at the 132kV level and below, will be critical in the realisation of this objective. Without an advanced level of grid intelligence the introduction of renewable opportunities cannot be effectively pursued in the distribution sector.

3. Industry Challenge

As stated, the electricity supply industry in South Africa is confronted with many challenges. Generation capacity shortage, poor performing distribution networks, ageing infrastructure, a significant infrastructure investment backlog, ageing workforce, inability to effectively introduce renewable energy options into the distribution grid and the inability to introduce effective demand response strategies are amongst the challenges facing South Africa. The increase in customer expectations, enhanced customer participation, introduction of distributed generation, the introduction of initiatives such as renewable energy options, the electric vehicle, etc. will change the electricity supply industry landscape and resource requirements significantly over the next five to ten years.

From a distribution perspective there are groups such as Eskom, some of the metros and some of the secondary municipalities who are in the process of addressing some of these challenges. However the larger population of the industry is not attending to these challenges. It is however important to note that where the interventions are taking place that they are not taking place within a national integrated framework.

² Eskom. 2011. *Annual report*.

This is however to be expected considering the structure of the electricity supply industry in South Africa and the lack of appetite to effectively reform the industry. The result is that there is a real risk that the investments might not be optimally leveraged or yield the expected results. Furthermore the risk of technology dumping and ultimately technology deployment without the required inter-operability is on the increase. In many cases procurement policies are also not geared towards the effective deployment of resources and investment in the infrastructure. The amount of un-invested money annually returned, in particular in the municipal sector, serves as an example. The good news is however that there is funding available within the industry which could be leveraged.

The complexity of the electricity supply industry structure in South Africa and the impact on effective business operations must not be underestimated. Neither must the inefficient operating regime of the industry be underestimated. At the root of the industry structural inefficiencies you have aspects such as dual regulation, a vertical integrated business competing with third tier government utilities, absence of clearly defined market rules, an unsustainable municipal financial model, etc. Furthermore the industry is driven by a “short term focus” while taking decisions with significant direct long term infrastructure, service delivery and resource implications. Considering the challenges facing the electricity distribution industry, it is not reasonable to expect that the current practice of “milking” the electricity business to support other municipal functions can be a sustainable model. It must be extremely difficult to effectively run an electricity distribution business with a “balance sheet” that can barely support the “bulk electricity purchase and the human resource bill” i.e. after the “shareholder cut”. While the principle of allowing a shareholder to derive a return on their investment is not disputed, there is a need for an urgent review of the current municipal funding model.

It is widely accepted that the average age of the electricity distribution industry infrastructure in South Africa is approximately 45 years. Furthermore the estimated R35billion³ in respect of the distribution industry infrastructure investment backlog is also in general accepted. Therefore it is reasonable to expect that South Africa is three to five years away from unprecedented distribution infrastructure failures. However, the question remains whether we are waiting for “I told you so” or whether the industry leadership will own up to the challenge and do something about it before it is too late.

4. Industry Opportunity

The current electricity distribution grid was not constructed with the 21st century power supply challenges in mind. The need to address the 21st century power supply challenges and the urgent distribution infrastructure investment requirements presents a significant opportunity for South Africa. Over the past decade or so significant progress was made in many parts of the world in respect of technology development and the effective deployment thereof. While South Africa is confronted with substantial infrastructure investment requirements and resource shortages, it is

³ Figure adjusted to 2012 value based on the EDI Holdings 2008 study.

now the opportune time to pursue advanced technology solutions. The incremental investment requirement to introduce advanced technology options will be insignificant in relation to the overall investment requirement. Furthermore the introduction of advanced technology options will enrich the work of the current employees and potentially enhance the attractiveness of careers in this industry.

The ENERGY SECURITY MASTER PLAN –ELECTRICITY, 2007- 2025, provides a good reference point to evaluate the ability of the electricity distribution industry to effectively respond to the objectives/goals for South Africa: The master plan presents the following objectives/goals:

- Supporting economic growth and development;
- Improving the reliability of electricity infrastructure;
- Providing a reasonably priced electricity supply;
- Ensuring the security of electricity supply as set by a security of supply standard;
- Diversifying the primary energy sources of electricity;
- Meeting the renewable energy targets as set in the EWP;
- Increasing access to affordable energy services;
- Reducing energy usage through energy efficiency interventions;
- Accelerating household universal access to electricity;
- Clarifying some of the policy issues in the context of an evolving electricity sector.

The introduction of Smarter Grid Technologies/grid modernisation can provide the answer to some of the abovementioned opportunities/objectives. Smarter grid deployment will also directly contribute amongst others to the realisation of the energy security goals and objectives as set out in the National Energy Act, 2008 (No. 34 of 2008).

5. Technology as a Smarter Industry Enabler

It is essential that the electricity distribution industry grid must become smarter. A smarter grid will lead towards a smarter industry which will in turn directly contribute towards job enrichment and a reduction in operating costs. While the transmission grid in South Africa can be regarded as “relatively smart” the distribution industry has a long way to go. This is in particular true for the lower voltage networks within the distribution industry. It is therefore argued that South Africa should follow a structured approach towards the implementation of smart grid solutions. The South African Smart Grid Initiative (SASGI) is a vehicle which could be used to realise this objective in the interest of South Africa and the electricity distribution industry. The diagram below presents an indicative picture of how smart grids can be used as an enabler to enhance the efficiency of the current electricity distribution industry.

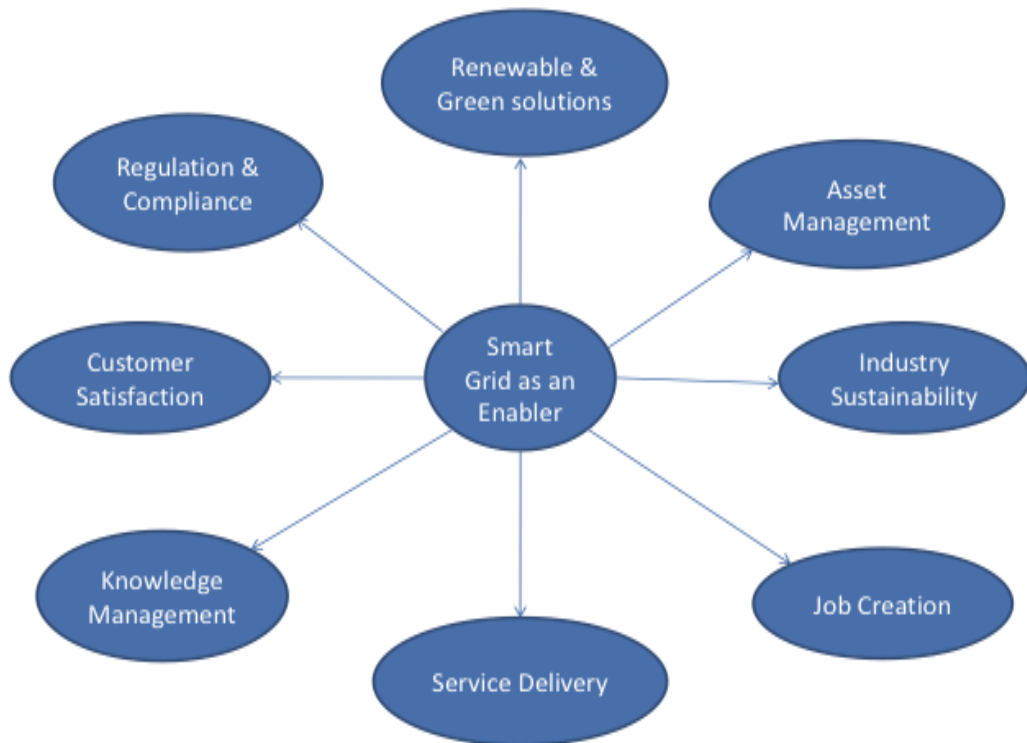


Figure 1: Smarter grid as a Smarter Industry enabler

At its core Smarter Grids are a sophisticated information system that would allow grid operators much greater visibility into the complex inner workings of the grid and achieving wide-area situational awareness. The same information system would provide customers with amongst others a window into their own energy use, giving them the tools to make better choices that align with their own values and needs. On the other hand it will assist the industry to achieve greater operational efficiency. Through a new paradigm of involving consumers with interactive loads that respond to the overall needs of the grid, the power providers and the power users work together to create the best possible electric grid at the least cost to the economy and the least impact on the environment. Data flow and information management is therefore central to the smarter grid. Considering the current grid status in South Africa it is envisaged that smarter grid options could be introduced in a phased manner i.e. a comprehensive smarter grid could evolve over a period of time. This approach would allow for the selection of the relevant enablers, which will best satisfy the specific needs of a utility and its customers.

A recent study conducted by Gridwise Alliance, an USA institute established by the industry alliance to provide direction in respect of smart grid development, provides some very profound insights. The study amongst others indicated that a reduction in overall energy demand has been demonstrated by:

- Oklahoma Gas & Electric - 1-2 % through volt/VAR control and 9 % through demand response;

- Pacific Gas & Electric - 17 % through the SmartRate program and 20% through energy efficiency programs.

Through distribution automation Southern California Edison achieved, in respect of average Customer Minutes of Interruption (CMI) per circuit, outage reduction duration of 33 minutes (47%). While there are numerous other projects at different stages of smart grid implementation, the overall improvement indicators are very positive. It is important to note that a smart grid is more than just a smart meter.

6. Conclusion

Smarter Grids can be positioned as a business enabler as part of the customer interface, maintenance, refurbishments, strengthening and new network programmes. Relative to the distribution asset base and the cost of the planned programmes, the costs associated with the simultaneous introduction of Smarter Grids is small, especially compared to the lifetime benefits. While more detailed financial analyses are required, there are numerous business cases demonstrating the financial returns, which can be expected. The Italian system installed by Enel S.p.A. of Italy (Telegestore), which could be regarded as one of the first smarter grid deployments, provides for a very good case study. This smarter grid was completed in 2005 at a project cost of 2.1 billion euro. This project is providing a return of 500 million euro per annum. Furthermore, significant business and customer benefits are claimed⁴. Similar initiatives have been successfully implemented in countries such as America, Australia, Europe and the United Kingdom. Therefore, ample international learning experiences are available which can be drawn from.

To leverage the opportunities and to realise the potential to be derived through the deployment of technology to get a smarter grid, it is essential to establish a Smart Grid vision for South Africa. The next step would then be to align all the efforts, share the learning and to move forward in an integrated manner.

Technology deployment and grid modernisation will lay the foundation for a *Smarter Industry*. *Getting smarter* will take the industry forward and directly contribute to the sustainability of the industry. Furthermore a smarter grid will facilitate enhanced customer participation which in turn will give us *smart customers*.

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⁴ NETL.2008. Modern Grid Initiative Powering our 21st-Century Economy.