Introducing Smart Meters in South African Utilities

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Utilities all over the world are today either considering or have already implemented Smart Meters. The concept of Smart Meters is usually associated with Smart Grid and Smart homes. In the US, AMI (Advanced Metering Infrastructure) is usually used to refer to the same technology and concept by large. The UK (United Kingdom) government has just published a white paper that, if voted into a bill, will see all residential customers in UK provided with smart meters by different utilities. This paper gives a general overview and world trends on Smart Metering, the needs and importance of Smart Metering, aspects to be considered when implementing Smart Metering and the impact of smart meters on utilities and customers.

Worldwide AMR deployment exceeds 60 million units [4]. About 25% of AMR systems worldwide are based on powerline technology (PLC) with nearly 1000 projects currently running. North America is the biggest AMR market worldwide. However, RF is the preferred technology. Europe is the biggest AMR market using powerline technology. Enel's project in Italy is the most well-known success story, which is based on Echelon solution. China and other developing countries in Asia are very aggressive in deployment of AMR. Powerline is one of the popular technologies under extensive field testing.

1. What are Smart meters?

A Smart meter generally refers to a type of advanced meter (usually an electrical meter) that identifies consumption in more detail than a conventional meter, and optionally communicates that information via some network back to the local utility for monitoring and billing purposes [1].

Similar meters usually referred to as time-of-use or interval meters have existed for years but Smart Meters usually involve a different technology mix such as real-time or near real-time reads, power outage notification, and power quality monitoring. These added features are more than simple AMR (automated meter reading).

2. Why do we need Smart Meters?

Since the inception of electricity deregulation and market driven pricing around the world, government regulators have been looking for a means to match consumption with generation. Traditional electrical meters only measure total consumption and as such provide no information of when the energy was consumed. Smart meters provide an economical way of measuring this information, allowing price setting agencies to introduce different prices for consumption based on the time of day and the season.

Electricity pricing usually peaks at certain predictable times of the day and the season. In particular, if generation is constrained, prices can rise significantly during these times as more expensive sources of power are purchased from other jurisdictions or more costly generation is brought online. It is believed that billing customers by how much is consumed and at what time of day will force consumers to adjust their consumption habits to be more responsive to market prices. Regulatory and market design agencies hope these "price signals" will delay the construction of additional generation or at least the purchase of energy from higher priced sources thereby controlling the steady and rapid increase of electricity prices.

3. Basic Technology Requirements

Of all smart meter technologies the critical technological problem is communication. Each meter must be able to reliably and securely communicate the information collected to some central location [1]. Among the solutions proposed are: the use of cell/pager networks, licensed radio, combination licensed and unlicensed radio, power line communication. The type of network used is also critical as it determines by large, the success of the project. As such one would find: fixed wireless, mesh network or a combination of the two. There are several other potential network configurations possible, including the use of Wi-Fi and other internet related networks. To date no one solution seems to be optimal for all applications.

The best communication technology will therefore have the following attributes [2]:

- Ubiquitous (Being present everywhere at once)
- Easy to install and maintain
- Cost effective
- Have the ability to provide new business model.

Rural utilities have very different communication issues than urban utilities or utilities located in challenging locations such as mountainous regions or areas ill-served by wireless and internet companies.

4. Benefits of Smart Meters.

During the European AMR & Smart Metering Forum, held in Amsterdam in June 2007, one of the questions for delegates to discuss in small groups was "Who pays for Smart Meters and who benefits?" The groups were made of Executives and Senior Managers from European Utilities. The group concluded that utilities

pay for the implementation of Smart Meters, but both utilities and customers benefit from smart meters in different proportions. This is true, but the opposite could also be true. Utilities could decide to raise tariffs to cover for large Smart Metering investments. This way, customers indirectly pay for the Utility's Smart Metering Investment. How then do all the different parties benefit from the implementation of Smart Meters?

- Utilities benefit from a reduction in customer management processes costs
- End user benefits from a better service with more customised tariffs
- The Economy benefits from better energy management

The above benefits are high level benefits applicable to most utilities in the world.

Benefits more applicable to South African environment are listed in the table below:

Distribution Operations	**Better Revenue Management**
– More Emergency Response Options – Avoided field WO – Network Visibility/ Outage Detection – Power Quality	– No estimations – Shorten Billing Cycle – Accuracy – Tamper – Credit Management – Shorten debtor days
Energy Management	**Customer Service**
– Load Shifting – Scalable Load interruption – Profiling – Forecasting accuracy	– Self help web portal – Tighter accurate customer data – Reduced calls? – Fast connect/disconnect process

More benefits to customers can also be realised if the utility is willing and able to implement new business models such as Home Network services (IPTV, VOIP & Internet). While these value added services may improve socials conditions in poor areas, they may not necessary feature in the vision of the company and such careful consideration should be given before these services are applied.

One good business model of providing these value added services is for the utility to team up with a suitable partner who will be willing to provide the services where the services do not form part of the core business of the utility. The main point here is that if the customer is provided with, for instance, a broadband network meant for metering, that network should be utilised to its full capacity by providing other value added services. There could be licensing issues involved if for example a telecommunication service is provided by the utilities or their partners. Another restricting issue with these services is that if the services are not well provided by the utility's partner, it could severely dent the image of the utility as customer may not always understand well the nature of the relationship between the utility and the partner. For this reasons, many utilities are reluctant to provide these services.

5. Implementing Smart Meters.

In order to decide on the right technology to be implemented, Hadden [3] argues that utilities should examine the costs and benefits of available Smart Metering systems, and choose the one that produces the best investment result for all stakeholders. If the study of costs and benefits includes all the value elements, the choice will be right.

The general approach in Europe and America when implementing Smart Meters is that utilities form long-term partnerships with suppliers who in most cases provide a complete solution that includes meters and applicable management systems. In most cases, no standard communication protocols are implemented; protocols tend to be proprietary and belong to suppliers providing meters.

In South Africa, the norm is to follow specific standards and protocols. The advantage of insisting on standard protocols is that meters from different suppliers can be installed in one area without the need to change Meter Data Management systems. At this stage there is no preferred communication protocol standard that utilities are following, particularly when credit meters are deployed in residential areas. It would be good for the Electricity Supply Industry to have standards for smart meters.

South African utilities will also have to map out requirements for Smart Meters suitable for South African conditions. Care must be taken not to over-specify requirement as these could lead to the escalation of Smart Meters costs. The more unique the requirements become, the more the product becomes expensive.

It is important to carefully decide on what should be standardised and what should remain proprietary. Some meter functionality will always remain proprietary to give meter suppliers completive advantages. What is important to standardise is the communication language between the meters are the different systems.

In his presentation at the Eruropean AMR & Smart Metering, Kaltenleithner[6] made the following notable comments that are true for South Africa:

- Full-coverage roll-outs need different technologies
- In metropolitan areas LBR (low broadband) PLC is a very economical solution
- Missing standardization of PLC/AMM (Automated Meter Management) systems.

- Missing standardization of communication techniques for integration of other medium meters
- In general – in different countries the legislation for building up AMM systems is missing

One challenging fact is the low consumption of electrical energy by current residential customers. This makes it difficult to justify Smart Metering projects. In South Africa, the Electrification Program must go ahead to meet the Universal Access to electricity vision of the government. The question the most utilities would like answered is how do utilities implement Smart Meters and still meet the requirements of the Electrification Program.

On the other hand, as time goes on, customers will start demanding the implementation of these meters once they realise the existence of these meters and associated benefits & advantages. It is therefore crucial for South African Utilities to start considering these advanced meters.

According to Tyrgg [5], AMR investment affordability depends on the following:

- Organizations needs and visions related to meter information management (need of additional features)
- Telecommunication solution (cost vs. possibilities)
- Reading rate of meters (daily, monthly or once a year)
- Network area structure and customer density
- Carefully planned concept and each process, example meter assembly is significant cost

6. Conclusions

Smart Metering has the potential to revolutionise the relationship between suppliers and their customers. Co-operation from all parties is vital for success. The world is convinced that Smart Metering will happen on a Global basis, it is not a question of "If", it is a question "when and how?"(Eric Fowler).

In South Africa, it is important that while we embark on the journey to implement Smart Meters, the fact is, it will not be cost effective to immediately provide every customer with smart meters. We therefore have to continue innovating on the best possible cost effective solutions to communicate with current installed meters. Like any other technology, the price of smart meters will go down when all utilities in the world start using these meter in full force and as such, one can justify installing these meters in rural areas then.

Bibliography

1. Information from http://en.wikipedia.org/wiki/smart_meters
2. Xeline Co., Ltd, Concept of Direct Load Control Systems, 2007
3. Hadden S, Making the Best Smart Meter Choice, Energy Central
4. FreeScale Semiconductor, Overview of PowerLineModem Reference Design Embedded Connectivity Summit 2004
5. Trygg P, Understanding AMR Cost Structures And Factors Effecting Return On Investment (ROI) Tampere University of Technology Institute of Power Engineering, Finland
6. Kaltenleithner J, GmbHCreating a reliable and scalable communications network to support metering data demand, Energie AG Data GmbH