Smart Grids Survey

The likely nature and scale of investment in, and manufacturing potential for smart grid related technology and equipment

2013-2014

Report Prepared for:

The British High Commission &

Department of Economic Development and Tourism

Western Cape Government

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EXECUTIVE SUMMARY

South Africa has developed and documented a Smart Grid vision through work by SANEDI and the South African Smart Grid Initiative, and the municipalities have been made aware of this vision through interactions with the Association of Municipal Electricity Utilities and appear to have bought into the vision (Bipath, 2014).

However all the potential smart grid technology customers (Eskom, the Metros and the local municipalities) are currently financially constrained. This, coupled with other municipal spending priorities, such as housing, roads and sanitation, has resulted in great pressure on any smart grid investments. Particularly as there is a large historical backlog in maintenance and expansion expenditure on electricity infrastructure, estimated at R 27.4 billion in 2008 (Masembe, 2013:1).

On the smart grid technology supply side there appears to be enough capacity to supply whatever smart grid technology is needed on South Africa – however, at present it is mainly supplied from overseas, albeit with some local assembly, support, warranty servicing and consultancy services. In order for local manufacturing to take off, the local market for smart grid products would need to expand greatly so that local manufacturers could attain high enough volumes in order to compete against the big global smart grid suppliers.

In order to obtain information about the nature and scale of likely smart grid investment & potential manufacturing activity, a survey was done focussed on companies operating in South Africa that provide smart grid related services. Twelve companies were identified as having some relevance to the smart grid industry in South Africa. Where detailed information could not be obtained directly from these companies, more general information was obtained from Internet searches, supplemented by discussions with colleagues and input from other smart metering and smart grid vendors.

In answer to the central question of this deliverable: “What is the likely nature and scale of investment in, and manufacturing potential for smart grid related technology and equipment?”:

- Currently, the likelihood of investment in smart grid related technology and equipment is low, with the nature of the investment most likely forming part of upgrading / replacement of existing infrastructure
- Currently, the potential for local manufacturing of smart grid technology is small

Recommendations were derived from the results of the survey, and can be summarised as:

- Increase funding availability for smart grid projects
- Increase customer knowledge of smart grids, especially with regards to its benefits and costs
- Grow the availability of people with the required skills for smart grid planning, procurement, implementation and running of smart grid systems
- Smart grids should be considered as part of an integrated energy management plan, not piece-meal.
- Grow an understanding among municipal decision makers as to the value of planning in terms of shared services, rather than a silo-type approach.
- Reduce the complexity and constraints of the current municipal procurement and supply chain management processes. In order to aid this process a separate guidelines document was generated, “D6 – Understanding Municipal Procurement Processes”.

LIST OF ABBREVIATIONS

AMEU	-	Association of Municipal Electricity Utilities
AMR	-	Automatic meter reading
IDP	-	Integrated development Plan
MFMA	-	Municipal Finance Management Act
SALGA	-	South African Local Government Association
SASGI	-	South African Smart Grid Initiative
SCM	-	Supply chain management
SCMP	-	Supply chain management policy
SG	-	Smart grid
SM	-	Smart meter
T&D	-	Transmission and distribution (electrical)
WCG	-	Western Cape Government

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GLOSSARY

Advanced metering infrastructure (AMI)	AMI is a composite technology composed of several elements: consumption meters, a two-way communications channel and a data repository (meter data management). Jointly, they support all phases of the meter data life cycle — from data acquisition to final provisioning of energy consumption information to end customers (for example, for load profile presentment) or an IT application (such as revenue protection, demand response or outage management) (Gartner, 2014).
Asset management	In the context of electrical infrastructure, this is the process of recording data in an asset accounting system about an electrical asset. The level of detail depends on the requirements – it could include: asset description, age, value, geographical position (GPS coordinates), address, associated business name and contact details, service history, fault history etc.
Automated meter reading (AMR)	The capability of reading meters remotely and automatically using smart meter telecommunications and storing this data in a billing or accounting system.
Carnegie-Mellon Smart Grid Maturity Model	This is a tool for assessing an electricity utility's progress towards a smart grid implementation (Carnegie Mellon, 2014).
Condition monitoring	As applied to electricity grid infrastructure, condition monitoring includes monitoring and recording of equipment operating conditions such as temperature, voltage, current, vibrations, operational changes (e.g. switch operations, tap-change operations).
Conventional or non-smart meters	These are meters that are essentially stand-alone and can't be read or updated remotely. That is they have to be physically read and updated.
Energy balancing	The process of measuring the energy supplied and consumed within a defined area so as to identify missing energy (e.g. due to electrical losses, theft or incorrect metering).

NRS 049, 049-2, 049-3	A South African specification for smart prepayment metering systems (CTES, n.d.; SABS, 2008).
Pre-paid meter	An energy meter that can accept payments for electricity, usually through a key-pad, apply a stored tariff and keep a running total of the amount of energy credit remaining.
Revenue protection	Processes and systems put in place to minimise the loss of electricity sales revenue due to theft and inaccurate metering and billing.
Smart grid	A Smart Grid is an electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies (definition from the European Technology Platform Smart Grid).
Smart meter	A meter that measures energy consumption (in this report) over specified intervals, has two-way communications capability, stores metering data in registers, supports a variety of tariffs (e.g. time of use, inclined block, maximum demand, free basic electricity) which can be remotely updated, can switch attached loads on command and interfaces to data concentrators.
Smart meter communications (or telecommunications)	A smart meter has to be able to communicate with other devices, such as a data concentrator, for the purpose of transmitting data such as meter readings, tamper alarms, or for receiving data such as tariff updates. The communication is usually by Wifi or cellular GPRS or by power line carrier (PLC).
STS	Standard Transfer Specification. "STS is a secure message system for carrying information between a point-of-sale and a meter, and is currently finding wide application in electricity metering and payment systems" (STS Services, 2014). It is commonly used to support a coupon-based payment method for pre-paid meters. One buys a coupon from a vendor and enters the code into the pre-paid meter which then credits one with the number of units purchased.
Supply chain management (SCM)	A set of processes designed by the National Treasury and backed up by legislation, which controls how government entities carry out their procurement of goods and services.
Tamper detection	Preventing and detecting attempts by customers to cause meters to

and protection	under-read energy usage.
Vending and billing	The process of selling and dispensing electrical energy and accounting for it.

1. INTRODUCTION

1.1 Intended Audience

- Western Cape Government: Department of Development and Tourism
- Municipal Electricity Departments
- Smart grid related businesses in South Africa
- GreenCape staff working in the smart meter and smart grid arena

1.2 Study Background

The Department of Development and Tourism (DEDAT) and GreenCape have entered into an agreement under which GreenCape was to carry out a number of projects; one of these is the Smart Grids Project. In the 2013/2014 Business Plan for these projects, it is stated:

"It is generally accepted that implementation of smart grids by electricity distributors will lead to improved energy efficiency and is an essential investment to get the "green" economy going. However, without fully understanding the potential financial and technology implications and the potential benefits of such an investment, it is unlikely to be made. An opportunity exists to do a detailed study that will outline the financial costs and benefits and technological solutions required to implement a smart grid. Such a case can be used to help local authorities across the province make informed decisions about smart grids that will lead to improved service delivery and efficiency. The implementation of smart grids is expected to lead to significant jobs growth"

(GreenCape, 2013a:Section 2)

This report addresses one of the deliverables for the smart grids project, namely:

"Indication of the nature and scale of likely investment in smart grids and potential manufacturing activity related to smart grid technology and smart grid enabled energy equipment"

(GreenCape, 2013:Section 3.2)

1.3 Aims and Objectives of the Study

The main aims of this study were:

- To investigate the likely smart grid (SG) investment by SG customers in smart grid technology in selected SG market sectors:

  Metros

  Municipalities

  Eskom

  Independent Power Producers (IPPs)

  Industrial heavy industries

  Commercial

  Housing estates

- To identify the main companies operating in the SG industry
- To describe the range of SG products and services offered by these companies
- To establish which SG products are locally manufactured and which are imported
- To assess the potential for local SG manufacturing to meet the likely SG demand
- To investigate what barriers the South African SG industry faces and, in particular, identify the barriers to local manufacture
- To recommend incentives and policies which encourage local manufacturing of SG equipment

1.4 Study Area

The study was restricted to SG companies operating in South Africa, although many SG companies operate globally and have manufacturing facilities around the world.

As described in the literature review (Section 0), there are many different views on what comprises SG and SG technology.

For this study, a SG is considered to be an electricity and information network that intelligently integrates all entities connected to it so as to deliver sustainable, economic and secure electricity supplies (see the definition in Section 1.5).

The SG technology considered here comprises the broad segments described in more detail in Section 1.5, these being:

- Customer applications
- Automated metering infrastructure
- Grid applications
- Integration of distributed generators into the grid

Because the first two segments have already been covered in another GreenCape report on smart meter localisation (GreenCape & Atkins, 2014), that information won't be repeated here.

1.5 Research Methodology

Literature Review

Smart grid companies

Twelve companies were identified as having some relevance to the SG industry in South Africa. A list of these companies is given in Appendix A Smart Grid Related Companies.

These are: ABB, Actom, Alstom, Aurecon, CTLab, Itron, Landis+Gyr, Powertech, Schneider Electric, Siemens. The researcher was able to get detailed information from five of these at the time of writing (Alstom, Aurecon, CTLab, Itron, Powertech and Siemens). The information on the others was gathered from the Internet.

Smart grid definitions

The definition chosen for this study was:

"A Smart Grid is an electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies"

(European Technology Platform, 2014:FAQ)

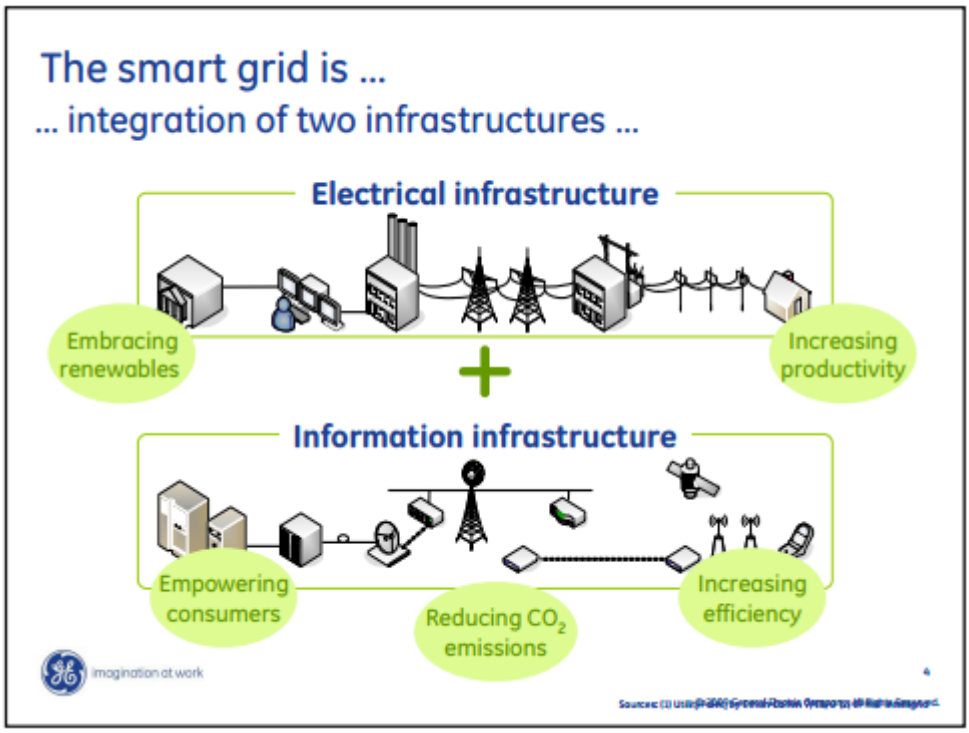

Figure 1 The Smart Grid at Work - Source: (GE, 2014b)

Smart grid equipment segments

There appears to be no general agreement as to what is meant by “smart grid equipment categories”, but for this study the SG equipment segments, based on a McKinsey study (Booth, Demirdoven, & Tai, 2010:46) with some additions, were chosen as:

- Customer applications support

  In-home display of energy usage and pricing

  Intelligent appliances that optimise their operation based on energy prices at different times

  Home automation

- Automated metering infrastructure (AMI)

  Usage interval data reporting

  Outage reporting

  Remote load control

  Energy theft prevention

- Grid applications

Grid automation (fault detection and location, self-healing)

Loss reduction

Remote monitoring

Load balancing and equipment loading optimisation

- Integration of distributed generators into the grid

Power quality control (over/under voltage, power factor, frequency, ripple)

Network protection (overload, islanding isolation)

Billing and power purchase agreement management

This study focussed on the grid applications with some attention to the small, but growing segment of distributed generators (DG) and their integration into the grid, but will exclude the customer applications and AMI because these two have been covered elsewhere, as explained in the literature review.

Smart grid company survey

At the time of writing, of an initial 11 SG-related companies, detailed information was obtained directly from six of them (Aurecon, Alstom, CTLab, Itron, Powertech and Siemens) and more general information was obtained from an Internet search on the others, which information was supplemented by discussions with colleagues and input from other SM and SG vendors.

A questionnaire was developed (see Appendix B Smart Grid Questionnaire) which was sent to some of the participants after introductory phone calls and emails to establish the correct people to contact. The questionnaire was then used as a check list during interviews and Internet research.

Some respondents requested that their comments and information be treated as confidential and not be attributed to them or their company (e.g. sales revenue, pricing and future strategy information).

The survey information was captured on spreadsheets.

Limitations of this study

Although the size of the sample survey might appear to be too small to give reliable results, the SG industry in South Africa is itself small and is dominated by a few big players.

Note that confidentiality constraints, whether voiced by the respondents or not, will mean that some information will be missing and what is provided might be biased in favour of each

company's agenda (e.g. big importers might want import tariffs and local manufacturers might not).

On balance it is felt that the sample analysed here does give meaningful results.

2. STUDY RESULTS

2.1 Local Smart Grid Equipment Manufacturers

The question of what exactly constitutes local manufacture in South Africa is complex. There are a number of reasons for this:

- There is no local manufacturing industry for electronic components in South Africa (for instance integrated circuits, capacitors etc.) and there probably never will be because of the small local market and resulting high costs due to low volumes), therefor all electronic components must be imported
- There is a lack of smart grid technology testing facilities and consequently assembled PC boards might have to be sent out of the country to be tested and then re-imported – this makes it difficult to prove what is made locally and what isn't
- It is not clear to what extent local assembly of components and PC boards into finished products, installation, training, support and warranty servicing counts as local manufacture

The general feedback from the companies interviewed was that there was little true local manufacturing of smart grid technology happening in South Africa at present, mainly because of the lower costs of imported products and the good track record of the big, established overseas smart grid companies.

2.2 Importers, Re-sellers and Solution Providers

Itron

Vendor type

- SG solution provider, end-to-end metering, vending and billing solutions, pre-paid and split meter local manufacturer, imported SM solution provider.

Smart grid activities

- They focus on the smart grid, and increasingly, smart cities. They don't supply SG equipment themselves, but partner with smart grid companies such as Siemens, ABB and Alstom. Itron is strong on analytics and data management. They are a big, global company.

Customers

- In South Africa, they service 130 municipalities, including Drakenstein, Mossel Bay and George. They also have customers throughout Africa.

Local content

- Import or buy their SG equipment from other suppliers. High local content for pre-paid and pre-paid split meters, with a factory in Atlantis. Waiting for critical mass before starting local SM manufacture

Access to municipal smart grid and smart meter rollout plans

- Not discussed.

Size

- 150 staff in Cape Town and 100-150 in Atlantis for prepayment meter manufacture.

Barriers to smart grid local content and business opportunities

- No SG equipment manufactured locally at present, so it has to be imported. The general economic climate, constrained budgets result in a lack of SG project funding. The lack of holistic planning for SG result in piece-meal solutions and little exploitation of possible synergies through shared services projects (e.g. electricity and water and SG could share a communications infrastructure).

Ideas for improvements

- Metros/munics/utilities need to take a holistic view of their service provision and plan for electricity, water and data access to customers.
- Plan for end-to-end systems, covering metering, meter management, SG systems, data management, information systems, system integration and analysis systems to realise the total benefit potential from such integrated systems.
- Use the ‘carrot’ rather than the ‘stick’ in promoting local SM and SG industries, that is provide incentives rather than imposing import duties on electronic components for SM and SG.
- Streamline the municipal procurement processes

Aurecon

Vendor type

- Consulting Engineers

SG activities

- Management consulting, feasibility studies, data and system integration, business case development, revenue management (water and electricity), don't sell or manufacture meters. Use the Carnegie-Mellon Smart Grid Maturity model (Carnegie Mellon, 2014).

Customers

- South Africa: Municipalities/Metros (e.g. Ekurhuleni, Ethekwini).
- Sub-Saharan Africa: Mocambique/EDM, Zambia/Zesco.

Local content

- No manufacturing at all. For consulting, they use locals wherever possible, but sometimes funders constrain this.

Access to municipal smart grid rollout plans

- Need to work at it. They have key client relationship executives.

Size

- 3 500 all divisions, 400 electrical-related.

Barriers to SG local content and business opportunities

- Customers tend to ask for the wrong things and don't plan SG correctly.

Ideas for improvements

- SASGI, NERSA and the DOE should educate the metros and munics on SG.

Siemens

Vendor type

- Electrical engineering consultants, manufacturers, equipment suppliers, project managers. A big global company.

SG activities

- They see themselves as a SG enabler and integrator rather than a product supplier. They do energy automation, transmission and distribution (T&D), outage management, smart grid services, asset management services. Happy to use equipment from other suppliers.

Customers

- All energy utilities (including large power suppliers or consumers). For example, Eskom, 8 Metros, munics, metals and mining companies.

Local content

- At present they manufacture their SG products at various sites globally (including under licence in China), but not in South Africa at present. They use local staff for their service provision, testing and warranty delivery, with backup from elsewhere as required. Open to increasing local content.

Access to municipal smart grid rollout plans

- Difficult to get access to municipal SG plans. They have done some energy automation and asset management projects (e.g. supplied meter hardware to Tswane).

Size

- 2 000 (3 000 in Africa and 360 000 worldwide)

Barriers to SG local content and business opportunities

- Lack of focused funding
- Lack of client technical knowledge
- Lack of standards (although impressed with SABS performance)
- However they didn't think tariffs should be imposed on imported SG equipment as there are no real local alternatives and tariffs would then damage the industry.

Ideas for improvements

- Rather than imposing import tariffs, we should look at the customer needs compared to what is available and find ways to address the gap. Import duties would be regressive and would hurt the SG industry generally.
- Find positive ways to encourage localisation.

Alstom

Alstom South Africa was contacted and the researcher was referred to Actom, which manufactures electrical equipment for Alstom.

Alstom South Africa does not include a smart grid division at present and therefore it was suggested that Alstom Grid be approached and this was underway at the time of writing.

Vendor type

- Alstom is a global energy engineering company, covering a large range of energy products and services. Alstom Grid (formerly Areva T&D) is one of its divisions.

SG activities

- Provides grid devices and instrumentation, using Actom as its main manufacturer.

Customers

- Utilities, Metros, municipalities, industry and commerce.

Local content

- This depends on whether Actom manufactures or imports the particular product.

Access to municipal smart grid rollout plans

- Alstom has good relationships with the municipalities.

Size

- 450 permanent and 800 being trained, in South Africa (93 000 worldwide).

Barriers to SG local content and business opportunities

- Referred to Actom on local content.

Ideas for improvements

- Not discussed due to insufficient interview time.

Actom

At the time of writing, contact had not yet been made with Actom, so this information is based on Internet research.

Vendor type

- Power engineers, manufacturing and supplying a wide range of energy related equipment for generation, transmission and distribution. Actom signed a cooperation agreement with Alstom Grid in 2013 in the energy business in South Africa.

SG activities

- Manufactures generation, transmission and distribution equipment

Customers

- Utilities, Metros, municipalities, industry and commerce.

Local content

- Actom has a strong focus on local content and manufactures many products in South Africa under licence to international partners.

Access to municipal smart grid rollout plans

- Actom and Alstom have been involved with Eskom and the Metros and municipalities for many years and so have good relationships with them.

Size

- 7 500

The answers to the rest of the survey questions are unknown.

Powertech

Vendor type

- A subsidiary of Altron. Powertech manufactures cables, transformers, switchgear. Does system integration with SCADA and ERP systems like SAP. They also do process control, energy efficiency, cogeneration and generally offer a wide range of products and services in the electrical and electronics industry.

SG activities

- They provide smart components for devices, such as bi-directional comms, central data collection and control systems, interface drivers. Also, they are a developer, manufacturer and distributor of medium to high voltage Protection Relays, Surge Protection Equipment, Industrial Earth Leakage Relays, Energy and Demand Metering and Protection Test Equipment. They atre stron in systems integration.

Customers

- Utilities, Metros, municipalities, industrial and commercial businesses.

Local content

- They manufacture electrical grid products such as transformers, surge suppressors, protection relays, energy and demand meters locally. They also manufacture under licence from ABB.

Access to municipal smart grid rollout plans

- They appear to be well-entrenched and enjoy good access to local government electricity businesses.

Size

- 4 500 in Africa.

Barriers to SG local content and business opportunities

- Municipalities can't sustain themselves financially well enough to invest in the required infrastructure. The current three year contract limit is a problem for long term contracts, but can be worked around. Note that Powertech is involved in the City Power and Tswane electricity tenders.

Ideas for improvements

- Suppliers need to become service providers on a risk/reward basis and provide the capital supported by long-term contracts
- The municipal procurement processes should be adjusted so as to facilitate longer term service agreements
- Suitably skilled people are required in the municipalities to design and prepare the tender specs and to evaluate tender responses in an expert manner

CTLab

Vendor type

- Power quality instrument design, development, manufacture, installation and support.

SG activities

- Manufacture PQ meters locally and abroad. Also do consulting, compile regulator reports, carry out baseline analysis, planning, audits, outsourced monitoring services etc.

Customers

- Eskom, all the South African Metros, most of the local municipalities, (Ekurhuleni, Buffalo City, Umhlatuze) as well as Namibia REDs. Also, the Southern African Power Pool.

Local content

- This is a complicated issue. All electronic components are imported (e.g. ICs, capacitors etc. This applies to all SA companies as there is no local electronics components industry in SA and there probably never will be). Some assembly is done here, some overseas, some testing done here and some overseas (because SABS/SANA don't have the capability).

Access to municipal smart grid rollout plans

- Yes, they have good access to most municipalities and Metros: for power quality metering.

Size

- 21 plus access to outsourced resources. They have the capacity to meet the entire South African demand for PQ meters. They would outsource to Plessey for additional assembly line capacity if required.

Barriers to SG local content and business opportunities

- Lack of funding for development and manufacture
- Lack of funding for local government and Eskom customers
- Having to pay VAT on imported components at the time of import, instead of at the time of sale of completed units. This causes cashflow problems as the components are bought in bulk and might sit in stock for 6 months, also there is an admin overhead for avoiding double VAT payments on the components
- Overseas perceptions - Africa and South Africa are not seen as being capable of producing high-tech products
- Flawed munic tender processes which result in badly constructed tender specs due to lack of knowledge, or spec deliberately designed to favour a particular vendor (e.g. a recent tender for PQ meters deliberately excluded responses using the NRS 048 spec put forward by NERSA and specified the Elspec spec instead, thus guaranteeing the Elspec would win the tender
- Corruption and collusion in the procurement process

Ideas for improvements

- Increase funding for localisation
- Increase funding for utilities and munics to move towards smarter grids
- Change the VAT rules to accommodate imported components for local assembly
- Use trade delegations to improve SA's tech credibility
- Change the tender process to force an open RFI (request for information) phase on which to base the tender spec. This will result in better and more appropriate tender specs, fairer competition and better results for the munics
- Improve the procurement processes to reduce corruption and collusion

Landis+Gyr

No response had been received from Landis+Gyr at the time of writing.

Vendor type

- Manufacturer, retailer, implementer, consultant in the smart meter and smart grid field (Gridstream - an end-to-end smart grid solution)

SG activities

- Gridstream is their key offering for smart grids, comprising: metering, communications, network management, software, grid and consumer applications, and professional services in a single secure and integrated platform.

Customers

- Utilities, Metros, municipalities and their customers.

Size

- 5 300 globally, South Africa numbers unknown.

The answers to the rest of the survey questions are unknown.

Schneider Electric

This section is based on Internet research, as at the time of writing Schneider Electric had not yet been contacted.

Vendor type

- Schneider supplies a wide range of energy and electrical products and services globally. These include: home energy solutions, grid solutions, integrating renewable energy, smart grid

SG activities

- Smart generation, flexible distribution, energy efficiency, demand response.

Customers

- A very wide range of customers. For smart grid related products and services, these include, utilities, Metros, municipalities, industrial businesses (e.g. mines), commercial businesses and many more.

The answers to the rest of the survey questions are unknown.

General Electric (GE)

This section is based on Internet research, as at the time of writing GE had not yet been contacted.

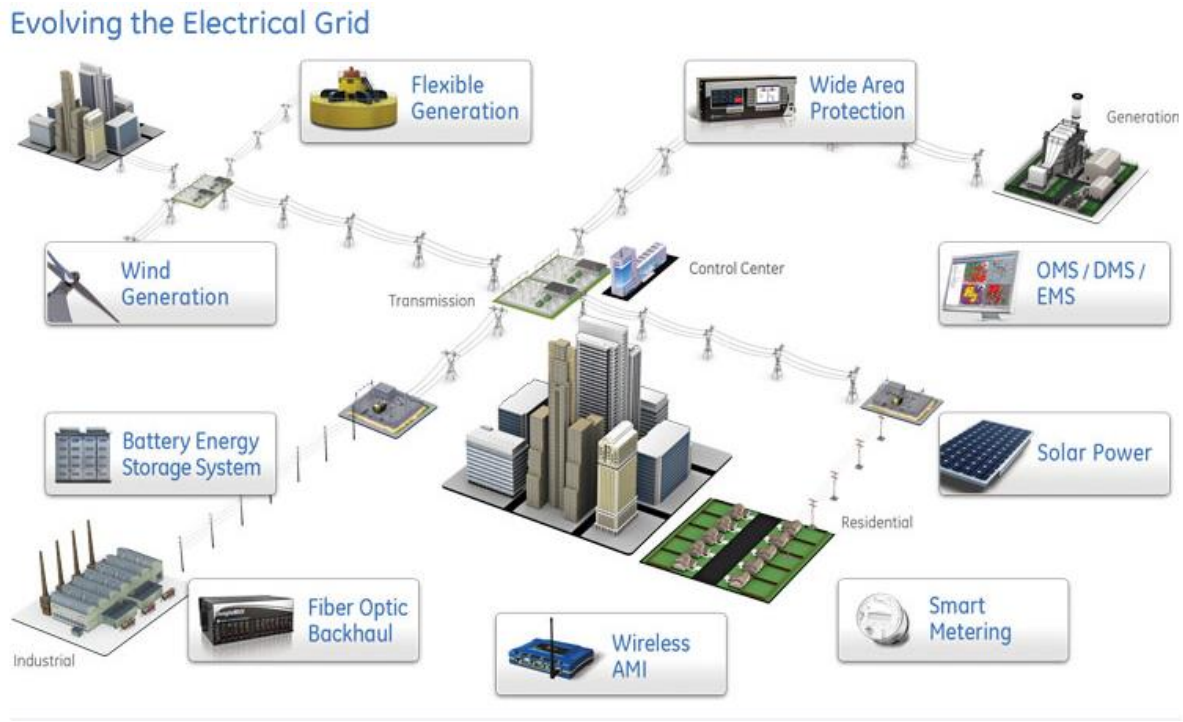

Figure 2 GE Smart Grid Activities - Source: (GE, 2014a)

Vendor type

- Electrical engineering developer, manufacturer, supplier and service provider. GE provides a wide assortment of integrated equipment for power delivery and electrical distribution and control solutions to manage power in a variety of residential, commercial and industrial applications.

SG activities

- See Figure 2. GE's activities include: development and supply of: generation technology, battery energy storage systems, renewable energy grid integration equipment, grid management and automation, outage management, energy efficiency project implementation, advanced metering infrastructure (AMI) and smart meter project. GE is shifting more and more into analytics and software as devices become more intelligent and generate more data. GE has coined the term "Industrial Internet" (Berst, 2012).

Customers

- Energy and electrical distribution for utilities, Metros, municipalities, independent power producers (IPPs), industrial, commercial and businesses.

Local content

- No information was found on GE manufacture of smart grid equipment in South Africa.

Size

- 500 in South Africa.

The answers to the rest of the survey questions are unknown.

ABB

This section is based on Internet research, as at the time of writing ABB had not yet been contacted.

Vendor type

- ABB South Africa offers a wide range of power and automation technologies solutions from a comprehensive product and service portfolio. In South Africa, the group has a strong local manufacturing capability with manufacturing sites around the country.

SG activities

- ABB has a large selection of intelligent electronic hardware, they are also strong in energy management IT systems (they own Ventyx, Insert Key Solutions and Obvient Software). ABB claims a leading position with regards to market and technology for smart transmissions and distribution equipment and systems (such as grid stabilisation, high voltage direct current (HVDC), wide-area monitoring systems, sub-station and feeder automation, SCADA and smart meters.

Customers

- These include utilities, independent power producers (IPPs), Metros, municipalities, as well as industrial and commercial businesses.

Local content

- The group has a strong local manufacturing capability with local manufacturing sites around the country at Longmeadow and Alrode, Johannesburg, and local branches in Cape Town, Port Elizabeth and Durban.

Access to municipal smart grid rollout plans

- ABB has been a supplier of electrical equipment to municipalities for many years and has a good track record with them and so presumably has good access to municipal planners.

Size

- 1 800 in South Africa (150 000 globally).

The answers to the rest of the survey questions are unknown.

3. ANALYSIS

3.1 Scale of investment in SG infrastructure in South Africa

Before discussing barriers to local SG manufacture, it is useful to analyze why the demand for SG equipment is not much higher than it is. This is relevant, because without a large, local market for SGs, it is difficult for a local manufacturer to be competitive against imported SG products.

Whilst SG technologies are mature and are widely used elsewhere in the world (e.g. EU and US), there has been a low take-up of SG equipment in South Africa.

The benefits of SG appear to be well understood by policy-setting bodies such as the South African Smart Grid Initiative (SASGI) as can be seen by the SASGI vision (Bipath, 2014). However, there is a huge backlog of investment in the electricity transmission and distribution (T&D) networks – this was estimated to be of the order of R 27.4 billion in 2008 (Masembe, 2013:1) – and there is great pressure to fix the basics first before venturing into the more sophisticated SG territory.

In addition to this, Eskom and the municipalities are suffering from restricted funding availability. In Eskom's case this is because of their heavy new-build commitments and strong resistance against the high electricity tariffs needed for Eskom's financial sustainability. For the municipalities, the funding pressure comes from the general economic climate coupled with other municipal spending priorities (e.g. developmental and societal projects, such as housing). This has made it difficult for SG projects to get significant traction.

In summary, the main barriers to SG take-up in South African municipalities and utilities were identified in this survey as:

- Lack of funding for SG projects as described above
- Lack of customer knowledge of and experience with SGs (SGs seen as complex and expensive)
- General shortage of people with the required skills for SG planning, procurement, implementation and running of SG systems
- Piece-meal planning of the electrical infrastructure (SGs should be considered as part of an integrated energy management plan, which would incorporate advanced metering infrastructure (AMI), integrated information systems, grid automation,

distributed generator (DG) integration along with the SG and SM telecommunication requirements)

- The lack of planning for shared services which then makes each service more expensive on its own (e.g. the SG/SM communications and systems infrastructure could be shared amongst electrical energy metering, water metering and gas metering instead of each having to cost-justify their own)
- The complexity and constraints of the current municipal procurement and supply chain management policy (SCMP) which result in much effort on the part of the potential suppliers and the municipality before any project can get into the Integrated development Plan (IDP), the municipal budget and finally out to tender (Republic of South Africa, 2005)
- In addition, the SCMP makes it difficult to get long-term off-balance sheet deals approved – these are deals which may be fully or partially funded by a technology provider or service provider in return for monthly payments – a type of risk-reward scheme. The contract term has to be long enough so that the service provider can recoup its capital, this could be as long as 15-20 years, if one wishes to keep the monthly payments low. Generally the SCMP favours short term contracts of one to three years.

Altogether, these barriers are holding back SG take-up and delaying the potential SG benefits. This also has a knock-on effect on smart meter (SM) projects and shared services projects, which would otherwise be able to dilute the cost of the communications infrastructure.

3.2 Impacts on local manufacture of smart grid equipment in South Africa

The key to cost-competitive local manufacture of any technology is:

- to have sufficiently high volumes to compete against imports
- to be able to know and predict what the customers want
- to have a fair business playing field, free of monopolies and corruption
- and, possibly, to receive government support through incentives of various kinds.

This study found this to largely be true for the South African SG (and SM) manufacturers as well, with the key barriers being:

- SG sales volumes not high enough to get sufficient economies of scale to be cost-competitive against imported SG products

- The presence of large global companies in the South African SG market, leading to monopolistic conditions, because the big players are well-know and have long track-records with Eskom and the municipalities and therefore tend have an advantage over local newcomers
- The lack of clear incentives and policies to promote local manufacture and local purchase of SG systems and products

All these factors need to be addressed before the local SG manufacturing industry is likely to become competitive and flourish – with all the attendant benefits that localisation brings: job creation, skills creation, balance of payment improvement through import reductions, cost-savings, better fit of the technology and systems to South African conditions and export possibilities to other countries.

4. CONCLUSIONS & RECOMMENDATIONS

In answer then to the central question of this study: “What is the likely nature and scale of investment in, and manufacturing potential for smart grid related technology and equipment.”

4.1 Currently, the likelihood of investment in smart grid related technology and equipment is low, with the nature of the investment most likely forming part of upgrading / replacement of existing infrastructure

As discussed in the Analysis Section 3.1, the demand of SG equipment is likely to be low whilst the tight financial situation for Eskom and the municipalities continues and whilst the backlog in T&D investment for basic maintenance and expansion is being addressed.

It has been argued by Dr Bipath of SANEDI (Bipath, 2014), that rather than spending money on replacing old infrastructure with old technology, it would be better to leapfrog into the SG world and get the SG benefits as well as addressing the backlog problems (similar to what has happened in South Africa and Africa, with cellular technology overtaking land-line telecommunications). There have also been some innovative suggestions as to how the electrical infrastructure could be funded; one of these was for the “creation of a dedicated fund to support the maintenance of municipal infrastructure”. This was suggested by the Consulting Engineers South Africa (Creamer, 2014).

Which route will be taken by Eskom and local government remains to be seen.

4.2 Currently, the potential for local manufacturing of smart grid technology is small

As long as the demand for SG equipment in South Africa remains low, there is little reason for anyone to invest in local SG manufacture. What might change this would be if the SG investment were to rise (possibly as a result of big government infrastructural spending focused on the electricity sector) of if significant local manufacturing incentives for SG equipment were to be put in place. These could take the form of tax-related incentives, government grants, loan guarantees. The companies surveyed felt that a “carrot” approach to encouraging local manufacture would be better than the imposition of punitive tariffs on SG equipment (which would just slow down SG implementations even more).

4.3 The current situation can be improved if attention is given to a number of recommendations

Recommendations were derived from the previous Analysis section, and can be summarised as:

- Increase funding availability for SG projects
- Increase customer knowledge of SGs, especially with regards to its benefits and costs
- Grow the availability of people with the required skills for SG planning, procurement, implementation and running of SG systems
- SGs should be considered as part of an integrated energy management plan, not piece-meal.
- Grow an understanding among municipal decision makers as to the value of planning in terms of shared services, rather than a silo-type approach. (e.g. the SG/SM communications and systems infrastructure could be shared amongst electrical energy metering, water metering and gas metering)
- Reduce the complexity and constraints of the current municipal procurement and supply chain management processes.

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APPENDIX A SMART GRID RELATED COMPANIES

Table 1 Smart grid-related companies

#	Name	Vendor type	Phone	Email	Contact person	URL
37	ABB	ABB South Africa offers a wide range of power and automation technologies solutions from a comprehensive product and service portfolio. In South Africa, the group has a strong local manufacturing capability with manufacturing sites around the country.	0215067700	peter.corbishley@za.abb.com	Peter Corbishley	www.abb.co.za
16	Actom	Power engineers	011 820 5111	Jack: jack.rowan@actom.co.za Brian Brian.van-rensburg@actom.co.za	Jack Rowan Brian Van Rensberg	www.actom.co.za
35	Alstom	Alstom is a global energy engineering company, covering a large range of energy products and services. Alstom Grid is one of its divisions. Actom manufactures on behalf of Alstom.	+27 11 518 8100	hugh.kennedy@power.alstom.com	Hugh Kennedy	

5	Aurecon	Consulting engineers	Attie 082 376 1619 012 427 3608	attie.senekal@aurecongroup.com	Stephan Schulze (left Aurecon). Now Attie Senekal and Kobus van den Berg	www.aurecon.com
35	CTLabs	PQ instruments ranging from our flagship, the Class A ImpedoDUO producing network coherent data within 200 ns, to cost effective voltage only Class B instruments are on offer. Also do consulting : regulator reports, baseline analysis, planning, audits, outsourced monitoring services etc.	021 880 9915	info@ctlab.com	Willie van Wyk	www.ctlab.com
38	GE	Does just about everything. Including "GE provides a wide assortment of integrated equipment and systems to ensure safe and reliable power delivery. Electrical distribution and control solutions manage power in a variety of residential, commercial and industrial applications."and "GE electrifies the world by providing energy products and services to more than 120 countries."	+27 11 237 0000	Use the form	???	www.ge.com/za/

3	Itron	Manufacturer, retailer, implementer	0219281700, Ivar Kilian +27 82 9032476	Either imraan.mohamed@itron.com or ivar.kilian@itron.com	Imraan Mohamed, Marketing Manager Smart Grids and Meters. Ivar Kilian, BDM	www.itron.com
13	Landis+Gyr (subsidary of Toshiba Corporation)	Manufacturer, retailer, implementer, consultant in the smart meter and smart grid field (Gridstream - an end-to-end smart grid solution)	+27 12 645 3100 and +27 83 448 5191 (Johann)	Johann.vanwyk@landisgyr.com, Mmatholo.Mabotja@landisgyr.com, Thabiso.Moiloa@landisgyr.com	Johann van Wyk (SM support), Thabiso Moiloa (BDM), Mmathola Mabotja (Sales Mgr)	http://www.landisgyr.com/
15	Powertech	developer, manufacturer and distributor of medium to high voltage Protection Relays, Surge Protection Equipment, Industrial Earth Leakage Relays, Energy and Demand Metering and Protection Test Equipment.	0124267200, Kobus Morgan 083 325 3729	Kobus.Morgan@powertech.co.za	Kobus Morgan, PowerTech Renewables	www.powertech.co.za or www.strike.co.za
39	Schneider Electric		+27 11 254 6400	wally.springorum@schneider-electric.com	Shaun Wilson, director of Professional Services, Wally Springorum LV, Ntombi Mhangwani	www.schneider-electric.com/site/home/index.cfm/za/

8	Siemens		010 222 7303	johan.helberg@siemens.com or andrew.turner@siemens.com	Johan Helberg, Director of SG Services Andy Turner (referred by Johan)	www.siemens.com

APPENDIX B SMART GRID QUESTIONNAIRE

The detailed answers to these questionnaires are confidential at the request of several of the participants.

Table 2 Smart grid questionnaire

#	Question
1	What is the primary focus of your business?
2	What are your main products?
3	What specific smart grid equipment do you offer and who manufactures it and where?
4	What are your main services?
5	What are your customer groups (segmentation)? (e.g. Eskom, IPPs, Metros, munics, heavy industry, commercial, residential estates, minigrids)
6	Which are your recent projects?
7	What are the details of these?
8	Have you won a smart grid contract with a municipality? If so, what are the details of the contract? (which munic, when started and finished, what products, what documentation is publically available?)
9	What access do you have to municipal smart grid roll-out plans?
10	Where are you based?
11	Where are most of your customers?
12	How many staff do you have?
13	How big is your smart grid business in terms of annual turnover?
14	What is your smart grid manufacturing capacity?
15	What is your local content strategy?
16	What is the current local content of your smart grid products?
17	What are the barriers to increasing your local content?

18	How best to overcome the barriers to increasing your local content?
19	What are the barriers to your business?
20	How best to overcome the barriers to increasing your business?
21	Which of your competitors offer locally manufactured products?
22	Which of your competitors offer imported products?
23	Who is the smart grid contact in your company?
24	Tariffs/duties on imported SG equipment, would they help your business or hinder it?
25	What is the likely SG equipment purchases in SA over the next five years?
26	What is the likely SG equipment purchases growth in SA over the next five years?
27	What SG equipment is likely to be purchased over the next five years (% breakdown by equipment category)