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ELECTRICITY SMART GRID

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1. Background/context

The Sustainable Development Goal (SDG) 7 *"Ensure access to affordable, reliable, sustainable and modern energy for all"* has the following targets

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services.

7.2 By 2030, increase substantially the share of renewable energy in the global energy mix.

7.3 By 2030, double the global rate of improvement in energy efficiency.

7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.

7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support.

These goals cannot be achieved with the technologies used in the design of electricity networks in the previous century. A radically different approach is needed and the so called 'smart grid' is a term used to embrace the application of modern electricity supply alternatives with ICT infrastructure to help achieve universal access to energy via modern and flexible electricity supply systems

At a global level, it is widely acknowledged that United States and Europe, for example have made progress towards grid modernizing electricity networks in the last decade specifically to address 21st century industry challenges. While there might be different drivers for grid modernization, in most parts of the world effective energy utilization, resource optimization, enhanced customer participation, introduction of renewable energy options, the gravitation towards electric vehicles, job creation, etc. play a key role in the deployment of smarter electricity networks.

In Africa, existing electricity grids are ageing, outdated, and under huge capacity constraints. The African Electricity Distribution Industry (EDI) in particular 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. Amongst others, there is an urgent need to address maintenance backlogs, refurbishments and

strengthening, unless an immediate and direct intervention is initiated, it will be very difficult for the industry in many African countries to recover from its downward trajectory.

Furthermore, it is important to note that the current electricity grid was not build with the 21st century grid challenges and requirements in mind, in particular the need to focus on energy efficiency and the effects of climate change. There is a massive opportunity to introduce grid modernization while addressing the infrastructure investment backlog, hence, investment in the infrastructure is required to meet the future electricity distribution requirements.

Africa is well positioned to learn from the developments in the rest of the world. Considering that Africa does not have to undergo the full technology development cycle, it is possible to select through the required applied research and establishment of standards the most appropriate Smart Grid options for Africa.

Based on the research work done by the South African National Energy Development Institute [SANEDI], it is envisaged that the introduction of Smart Grids in South Africa can serve as an enabler in addressing some of the challenges faced in the electricity supply industry. It has been identified that the introduction of smart grids will assist with dealing with challenges such as:

- Asset management
- Industry sustainability
- Job creation
- The need to improve service delivery, and
- Customer satisfaction.

The aim should be to have an economically evolved, technology enabled, electricity system that is intelligent, interactive, flexible and efficient and will enable Africa's energy use to be sustainable for future generations.

2. Findings, progress, implementation

Following on from the success of the first Africa Smart Grid forum, held in Abidjan in May 2014, the second Africa Smart Grid Forum held in Cairo, 5-7 March 2016, called on financial institutions and governments to work together to support and develop innovative financing instruments to support the concepts discussed and establish mechanisms to monitor the implementation of the recommendations of the forum. These mechanisms to serve as platforms for exchange of experience, to assist in the development of tender documentation, and in the presentation of technology concepts.

Also, the recommendations of the Forum to African countries are to:

i. Recognize the role of standardization and conformity assessment as a means to make the Smart Grid concept more available, flexible to integration of renewable energy for African utilities and populations.
ii. Call on African public services to join and support AFSEC as a platform for active participation in the process of standardization and conformity assessment.

iii. Operate and strengthen quality infrastructure related to electrical engineering by mobilizing experts and the provision of resources and support to increase their involvement at continental level (AFSEC) and international level (IEC)).
iv. Develop a strategic plan for smart grid development and have sufficient resources to implement it.
v. Initiate action to achieve energy savings in buildings and industrial infrastructure and integrate renewables in their energy mix for sustainable development of their economies.
vi. Ask African utilities and other stakeholders in charge of the electricity sector to work with ICT service providers to work towards the "Internet of Things" (IoT) to transform our continent by directly improving the well-being of African populations.

3. Challenges

On the one hand, in common with other continents, Africa cities are becoming increasingly challenged to provide the level of services and amenities that their increasing populations demand. It is expected that some 66% of the projected population of >2billion Africans will be living in cities by 2050. Large cities like Lagos and Cairo will continue to grow to be home to around 20million, each. Almost all such services and amenities require access to a reliable and sustainable sources of energy/electricity: public transport and lighting, health services, education services, water and sanitation systems, etc.), and the increasing dependence of end users of electricity for household and commercial use requires an equally reliable and sustainable electricity supply.

On the other hand, rural populations in almost all Africa countries are overwhelmingly underserved by the national electricity grid, and it has been recognized that even with the programmes such as the UN SE4ALL, the extension of the national grids will not reach most of these populations for decades. Other ‘smart’ distributed energy systems as alternatives are needed and are increasingly available in the form of microgrids/ minigrids using innovative forms of energy storage with renewable energy sources.

The growing pressure on all countries, including African countries to use energy increasingly efficiently is a major driven for smarter electricity systems that optimize the flow of electricity to minimize losses in transmission systems and distribution systems. Optimizing the end use of electricity also is becoming increasingly important in the interests of efficiency: more and more consumers are becoming ‘prosumers’ with their own renewable energy systems such as roof-top photovoltaics for which advanced metering systems are required when connected to the public electricity supply system. End use of low-voltage direct-current DC electricity in many appliances is a growing trend, and in the interests of efficiency, the concept of LVDC electricity networks is being established as an alternative to converting distributed alternating current (AC) and transforming it to DC at the point of consumption (computers, LED lighting, DC drives, for example).

All the above pressures make it incumbent for each Africa country, at a national level and cooperatively with neighboring countries to develop and obtain high-level buy-in for a National Smart grid strategy. Such a strategy could initially focus on some urgent drivers, for example, for

Improvement in network availability
Improved network security
Facilitation of energy management.
Improved productivity
Ability to accommodate renewable energy sources
Reduced technical and non-technical losses, and
Improved revenue collection.

While later in the strategy, systems could be rolled-out that allow for, for example,

Grid self-healing
Grid security
Grid reliability
Ability to accommodate alternative energy options e.g. renewable and storage in current electricity grid
Optimized asset and resource utilization
Technology enabled data conversion into management information, and
Ability to facilitate customer participation and communication.

None of the above developments and solutions can be successfully implemented and maintained without agreement on the technical standards required. AFSEC has already identified over 180 standards that should be adopted by Africa countries as national references that may be relevant for smart grids projects in their countries. Moreover at a continental level, projects under AU programs such as PIDA, should be referencing the standards recommended by AFSEC in the project documentation (enquiries for tenders, designs and contracts). However without the development of an appropriate regulatory framework to ensure compliance to standards and development of appropriate skills to be able to use the quality assurance systems, Africa will remain a target for dumping and for equipment that does not necessarily meet the requirements for long term performance and reliability.

4. Issues to be discussed by STC experts

The overarching question is ‘what needs to be done in Africa to unlock the potential of smart grid technologies to fulfill the targets of SDG 7?’

Resulting from the Africa Smart grid forums, there are several proposals to help Africa move more quickly and effectively to take advantage of the 21st century technologies that will enable smart and smarter access to, and use of electricity.

The recommendations from the second ASGF listed above (2.) provide some more specific proposals for discussion:

i. How to make policy makers in Africa recognize the role of standardization and conformity assessment as a means to make the Smart Grid concept more available, flexible to integration of renewable energy for African utilities and populations.

ii. How to sensitize African public services of the importance of joining and supporting AFSEC as a platform for active participation in the process of standardization and conformity assessment.

iii. How to strengthen and operate effective both national and pan African quality infrastructures related to electrical engineering by mobilizing experts and the provision of resources and support to increase their involvement at continental level (AFSEC) and international level (IEC)).

iv. How to develop a model for a national strategic plan for smart grid development and have sufficient resources to implement it.

v. What actions are required to increase energy savings in buildings and industrial infrastructure and to integrate renewables in their energy mix for sustainable development of their economies?

vi. What actions are required to ensure those African utilities and other stakeholders in charge of the electricity sector work with ICT service providers to work towards the "Internet of Things" (IoT) to transform our continent by directly improving the well-being of African populations?

5. Recommendations and Way Forward

The establishment of smart grids in Africa is a necessity. The development of a model for a National smart grid strategy for African states will be a first step in the journey.

Agreements on the technical standards required are essential, as are the effective use of systems for assessment of compliance to the agreed standards.

Thus, at the highest level of the AU, support for improving the national and pan-African quality infrastructure (Standardization and conformity assessment) for electricity networks is needed.

Membership of AFSEC by all member states and the availability to AFSEC technical experts to work on standardization and conformity assessment should receive high level support within the AU.

References:

South African Smart Grid Initiative: www.sasgi.org.za

United Nations sustainable development knowledge platform: https://sustainabledevelopment.un.org

Second African Smart Grid Forum: www.africasmartgridforum2016.org