

Role of Smart Grids in Building Smart Cities

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According to a study by the WHO, nearly 54 per cent of the global population resides in cities, which is an increase of 30 per cent since 1950. The urban residents are forecasted to rise to 60 percent of the world population by 2030, adding 2.5 billion more people to urban areas by 2050. With such rapid growth, future cities need to become smart to make judicious use of non-renewable resources and existing infrastructure and mitigate the impact of climate change and global warming.

However, what is a smart city? It is an intelligent metropolitan that employs innovative technologies to enhance the performance of vital local services, including energy, water, transportation, healthcare, waste management, and public safety. The use of various channels of communication and information technology (IT) allows smart cities to effectively address many challenges such as a rapidly expanding population, environmental sustainability, and economic viability to offer a safe, secure and clean environment to its residents.

While there are several features of a smart city, the single most important aspect is its energy infrastructure, which impacts all critical functions of the city and a Smart Grid is the required solution for a sustainable, resilient and affordable energy infrastructure. But what is a Smart Grid? It is a dynamic, interactive, and real-time infrastructure concept that modernizes power systems through automation, remote monitoring, and control. It also can be used to provide information to consumers about their usage and cost to enable them to make informed decisions.

When designing a smart grid architecture, many utilities select OSGP as the platform for their smart grid. The Open Smart Grid Protocol (OSGP) is targeted at utilities that want a multi-application Smart Grid infrastructure instead of a meter centric infrastructure. OSGP is not just applicable for meters; it's for a variety of smart grid devices. The OSGP Alliance, a non-profit corporation composed of utilities, manufacturers, and integrators, is responsible for promoting the adoption of OSGP, supporting the publishing and maintaining of the OSGP specifications and standards, as well as supporting the certification process of OSGP compliant devices. OSGP provides the basic infrastructure to enable insight of the LV network within a city to better manage electricity network. Some of the benefits associated with OSGP include:

- Reduced operational costs through better insight in assets utilization, for example phase balancing.
- Grid mapping functionality to provide a better understanding of the grid's actual structure.
- Integration of distributed generation and electrical vehicles by having more detailed per-phase information, which helps determine more accurately the capacity of a LV segments.
- Improved reliability of the low voltage grid from the substation to customer.

Research and Markets' 'Emerging Markets Smart Grid: Outlook Report' states that most Smart Grid investments have been concentrated in developed nations. Countries in North America, Western Europe, and East Asia represent over 75 per cent of the installed base of smart meters and other pioneering smart grid initiatives. For instance, the United States passed a bill for Smart Grids as early as in 2007 to begin earmarking funds to develop its smart grid infrastructure.

Since then, the US Government has launched several initiatives, including the Smart Grid Investment Grant (SGIS) for 2009-2014 to modernize the country's electrical infrastructure. The \$8 billion joint investment program, consisting of 99 cost-shared projects and involving more than 200 electric utility providers and participating organizations, deployed more than 15 million smart meters, 1,200 phasor measurement units, 19,000 units of distribution technology, and an assortment of customer systems. Likewise, nearly 30 Smart Grid Projects with a total investment of EUR 300 million were started in Europe during the same time period.

Now many developing countries are exploring the multiple benefits of Smart Grids. Almost 50 countries have forecasted to invest a combined total of \$268 billion in building Smart Grid infrastructure in the next 10 years. Among them is the MENA region that is rapidly adopting renewable energy initiatives to manage its robust energy demands. It was estimated that the deployment of Smart Grids in the GCC can help the region save up to \$10 billion in infrastructural investment by 2020.

Smart Grids are modern intelligent, communicating power networks that are the future of the energy sector as they have the tremendous potential to improve the quality of power and make energy sources reliable through demand response and comprehensive monitoring capabilities. OSGP provides the necessary functionality and performance required to enable the smart grid services needed to establish smart cities. Through the intelligent use of digital technologies and innovative application, smart grids can contribute in the development of zero-energy buildings and green communities. Smart Grids also encourage consumers to rationalize their consumption by bringing them closer to energy sources and providing them greater control over their usage. However, initial installation cost pose a significant challenge, which can be addressed by selecting the right infrastructure, formulating supporting policies and offering incentives by governments to encourage investment in transforming legacy power networks to Smart Grids.