

## Process and Features of Smart Grid, Micro Grid and Super Grid in South Korea

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**Abstract:** This paper describes the processes and features of Smart Grid, Micro Grid and Super Grid in South Korea briefly. In Korea, smart grid, micro grid and super grid are very hot issues and active business model and attractive topic in Korean as same as other countries nowadays.

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### 1. INTRODUCTION

Korean Smart Grid is, maybe alternatively, called as Power IT originally in Korea. After power system deregulation in Korean Electricity in 15 years ago, Korea electricity power market has been searching for new business issues and keywords. A new business model called “Power IT” in Korea is generally and widely known before the smart grid is introduced in Korea. Because IT (Information Technology) maybe was the best future business model in Korea at that time. Several kinds of attractive events have been opened after smart grid in Korea. Especially, launching smart grid test bed town in Jeju Island was able to make citizenship to understand smart grid. Additionally, Korea Smart Grid Association (KSGA) and Korea Smart Grid Institute (KSGI) hosted 2010 World Smart Grid Forum, sponsored by Ministry of Knowledge Economy and Presidential Committee on Green Growth in last government has been opened very successfully on starting stage. This was a good chance for announcing features of Korean smart grid to foreigners and overseas policy makers as well as rechecking identification and business model development of Korean style smart grid.

Micro grid in Korea is processed two kinds. One is energy self (standing alone) system style in small island. Another is campus micro grid which is focused on not only energy self system but also higher energy efficiency. A several small islands in Korea are opened as test bed level. An example of campus micro grid, Seoul National University (SNU) has recently decided to adopt micro-grid technology on Gwanak Campus. A micro-grid is an independent and intelligent energy system that maximizes the efficiency of electricity use through big data, Internet of Things (IoT) and Energy Storage System (ESS). A total of 22 businesses and organizations, led by LS Industrial Systems, a Korean corporation that manufactures and supplies electric power equipment, will invite.

Super Grid in Korea has a long history. After the Fukushima Nuclear Accident, the Japan Renewable Energy Foundation (JREF) put forward a proposal to interconnect Japan, Korea, China, Mongolia, and Russia with high-voltage direct-current

transmission lines. This provision aims at preventing further accidents from occurring in the future, as well as accelerating the development of renewable energy sources to reduce reliance upon nuclear power, reduce the cost of renewable energies, and provide energy security to Japan. This network will be called Asia Super Grid (ASG) or Northeast Asia (NEA) Interconnection. Ten years ago, before the JREF suggestion was put forward, South Korea and Russia have discussed the practical and theoretical implications of an interconnection between Korea (South Korea & North Korea) and Russia targeted for 2012. Three scenarios have been deeply considered. Theoretically, approximately 3 GW HVDC passing North Korea or servicing its electrical energy was suggested to maximize the capacity at that time. However, the plan was called off because of unfavourable political conditions, which presented a good opportunity for a more stable and cheaper energy supply. The Fukushima Nuclear Accident in Japan prompted the ASG to interconnect strategic countries in the Northeast Asia (NEA) with electricity generation areas in the Gobi Desert. A super grid implies technical and political challenges because of the large geographical extent. The project remains under negotiation, although the advantages are that demand and supply could be balanced more easily because regional differences are levelled out by the size of the system. However, the success of ASG or NEA program in Asia depends entirely on the political condition rather than the monetary investment and benefit analysis.

### 2. POLICY DRIVERS AND PROMOTION LAW FOR SMART GRID IN KOREA

The Korean government announced its CO<sub>2</sub> reduction target for 2020. Among the three options it had considered, Seoul chose the most stringent goal of cutting greenhouse gas (GHG) emissions that represents a 30% reduction from the estimated level of 2020. This goal is deemed very challenging since Korean industry had doubled its greenhouse gas emissions between 1990 and 2005, the fastest growth in the OECD. Korea has voluntarily set its 2020 emission reduction target. With this pledge, Seoul seeks to be a model for other countries including China and India who are categorized as developing countries under the Kyoto

Protocol. The two countries thus have no binding obligation but to announce its reduction target by 2030.

Korea is also pursuing sustainable development while dealing with climate change. At the same time, it is shifting toward a low carbon economy and a society capable of recovering from climate change. As part of these efforts, Korea launched a smart grid national project to achieve green growth in a transparent, comprehensive, effective, and efficient way. This project envisions laying the foundation for a low carbon, green-growth economy by building a smart grid. Thus, it can serve as a yardstick to evaluate the future of Korea's green-growth economy. In light of this, Korea came up with a proactive and ambitious plan to build a smart grid test-bed on Jeju Island to prove its determination in the low carbon, green-growth strategy.

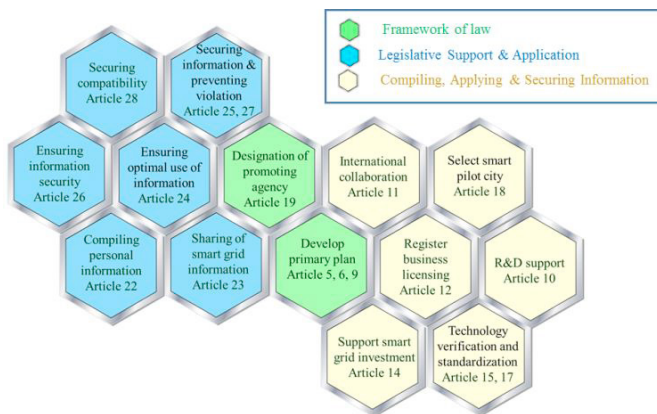


Fig. 1. Promotion law for smart grid in Korea

Parliament passed the bill of smart grid promotion law in 2011 to provide legislative support (Fig. 1). Smart grid is a new emerging industry and needs positive participation from related industries. It needs legislative support to sustain project and maintain industry participation. The promotion law also appease constraints such as the current Electricity Enterprises Act restricts the diversity of businesses, which means that Electricity Enterprise Act allows only monopoly system for electricity retails. It needs to transcend current legislative constraints by establishing a law and implementing next generation technologies to rise up the freedom of market.

Firstly, the framework of smart grid policy aims to develop/execute primary plan for smart grid by Articles 5<sup>th</sup>, 6<sup>th</sup>, and 9<sup>th</sup>. These Articles support to develop/ execute comprehensive plan for the deployment of smart grid and for the fostering of correlated businesses, and periodic transitioning plan for technology deployment/replacement to ensure participation from electricity suppliers and users. The Article 19<sup>th</sup>, designation of Korea's smart grid promoting agency, under the primary plan for Smart Grid designates one relevant institution as Korea's smart grid promoting agency and requires the institute to execute governmental policies, oversee R&D, smart demonstration, deployment and ensure information security.

Secondly, the legislative support & application provides register business licensing for smart grid (Article 12<sup>nd</sup>). The

individuals wishing to initiate a business for managing and supporting of smart grid industry may register via Minister of Ministry of Knowledge Economy (MKE). It supports smart grid investment (Article 14<sup>th</sup>). This Article provides a basis for companies to receive subsidy in the case that they are making business investment for the benefit of the public. It also select smart pilot city (article 18<sup>th</sup>). If necessary, smart pilot city will be selected for the wide deployment and dissemination of smart grid. The government will manage portion of the required expense. The Article 10<sup>th</sup>, R&D support, provides administrative, financial support regarding technology development, demonstration, policies and workforce development. And International collaboration (Article 11<sup>st</sup>) provides technological and resourcing support regarding international standard, R&D collaboration to help domestic companies to penetrate into international market. The Articles 15<sup>th</sup> and 17<sup>th</sup>, technology verification and standardization, enforce technology verification and technology standardization to secure safety of smart grid and its compatibility with related equipment and products.

Finally, there are some Articles in the compiling, applying & securing information. The Article 22<sup>nd</sup>, compiling personal information for smart grid, rules that compiling private information for smart grid cannot occur without the consent from the information provider, information provider can request access and deletion of his/her personal information and the information holder is required to take appropriate action. In the Article of sharing of smart grid information (Article 23<sup>rd</sup>), provides efficient service for grid consumers. A service provider can request to share collected information from another service provider and request to share information should be carried out, if not, appropriate action will be taken by the Minister. Ensuring optimal use of information (Article 24<sup>th</sup>), the minister of MKE advised to enact a legislation that includes procedural and standard regulation for optimal and appropriate use of collected information. To ensure information security for smart grid (Article 26<sup>th</sup>), smart grid business operator must install information security system to prevent illegal information exposure. The minister of MKE can enact information security guidelines which are to be abided by business operators. Securing compatibility for smart grid (Article 28<sup>th</sup>), the minister of MKE may advise business operators on technology standard, information access, service interconnection to ensure compatibility of smart grid. Securing smart grid information and preventing violation (Article 25<sup>th</sup> and 27<sup>th</sup>), the minister of MKE will take measures to protect smart grid from outside source intrusion. No individual has the right to access, manipulate, demolish, expose smart grid or take other violating actions without permission or justified reason.

### 3. KOREA SMART GRID ROADMAP

A smart grid refers to a next-generation network that integrates information technology (smart) into the existing power grid (grid) to optimize energy efficiency through a two-way exchange of electricity information between suppliers and consumers in real time. Building a smart grid can induce reasonable energy consumption, enable the provision of high-quality energy, and provide a wide array of

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