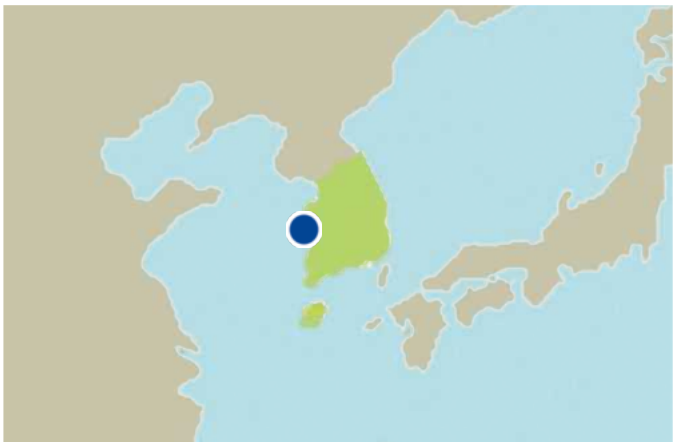
GE
Grid Solutions

Buk-Dangjin - Godeok
Transmitting Power to Cities

GE's HVDC technology to power a new industrial city in South Korea

Birdseye view of Pyeongtaek Godeok New International City
Source: Pyeongtaek City Hall. 000 GYEONGGI URBAN INNOVATION CORPORATION's public work is used according to KOGL

Imagination at work



33 km undersea HVDC line to the coast

Project Overview

Country:	South Korea
Project:	Buk-Dangjin - Godeok
Customer:	Korea Electric Power Corporation (KEPCO)
Technology:	High Voltage Direct Current (HVDC) Line Commutated Converter (LCC)
Scope:	Design and supply of equipment for an LCC-Bipole: 2 converter stations including converter transformers, thyristor valves and control system
Rating:	3 GW, ±500 kVDC

Customer Challenges

Looking for Energy Independency

With 51.4 million people[1], South Korea has experienced nearly a 53% growth[2] in electricity consumption in the last decade alone. South Korea is an energy-intensive nation, standing at eleventh worldwide in terms of total energy consumption. The country faces the ambitious challenge of providing efficient energy to its densely populated areas.

South Korea imports a remarkable 98%[3] of the total fossil energy it consumes. Since 2006, the Korean government has developed many new energy policies to become more energy independent, meet growing demand and increase energy efficiency.

Transmitting Power from Generation on the West Coast to Samsung Electronic Factories in Godeok Industrial Complex

Samsung will invest 100 trillion KRW ($86.5 B USD) to build the world largest semi-conductor factories, at least 3 factory lines for memory semi-conductors and one for display panel in Godeok Industrial Complex by 2022. It is essential to secure the reliable power supply to operate semi-conductor factory.

The West coast area of South Korea has a high number of thermal power plants feeding the very populated region south of Seoul, with extra high voltage AC transmission lines and its towers connecting the power plants to the Seoul Metropolitan Area.

Additional EHV transmission lines are very difficult to build in these areas because of environmental issues, civil complaints and stable operation of AC grid. The government has decided that the best solution to avoid such issues in the future is the use of High Voltage Direct Current (HVDC) in conjunction with cables.

HVDC Key Benefits

- Efficient transmission of electricity through insulated cable over long distances
- Fast, accurate, fully-controllable and measurable power flow
- Generation from remote source may be injected directly where needed
- HVDC converter station presents lower environmental impact compared to generation plant
- HVDC underground cable significantly reduces right-of-way visual impact compared to overhead line

Sources:
1 World Bank, https://data.worldbank.org/country/korea-rep
2 INDEX Mundi, https://www.indexmundi.com/g/g.aspx?c=ks&v=81
3 EIA, https://www.eia.gov/beta/international/analysis.php?iso=KOR

The Solution

In mid-2014, GE was awarded Phase I of a HVDC Line Commutated Converter (LCC) project through its joint venture, KAPES, to design and supply equipment for a 33 km energy corridor in Pyeongtaek area, part of the greater Seoul region.

The 1.5 GW power capacity HVDC link is configured as an asymmetrical monopole, with a rating of 0 to +500 kVDC. The link will transmit energy produced by the Dangjin power plant in the west of South Korea to Godeok, east of Seoul.

In late 2018, GE was awarded through KAPES the second phase of the project, adding another asymmetrical monopole with an additional power capacity of 1.5 GW, completing the HVDC link in a bipole configuration with 3 GW power capacity and ±500 kVDC.

The project will allow KEPCO to deliver a reliable supply of electricity to the new industrial complex and the residents across the Asanman Bay to the densely populated west coast of Godeok, bypassing a 100 km detour that an alternating current (AC) scheme would have used and avoiding the construction of a new overhead line.

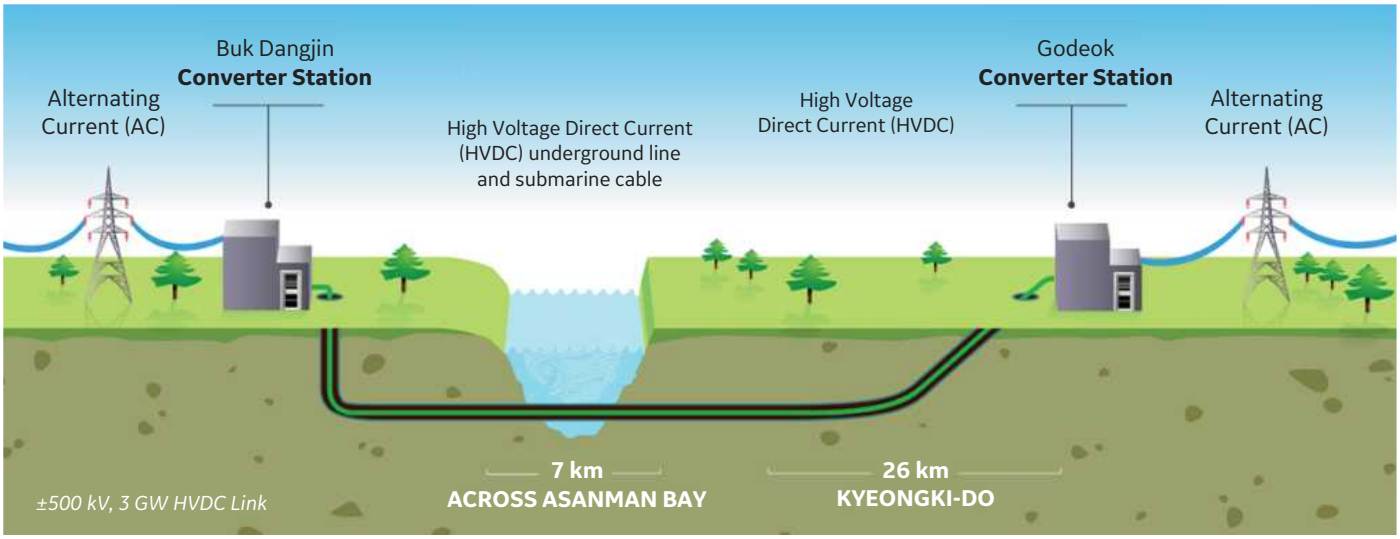
HVDC technology provides the fastest and most accurate power flow control capability, effectively preventing the spread of blackouts. It reduces transmission losses by 30% compared to conventional alternating current lines, thus being more economical and environmentally-friendly.

North East Asia Super Grid

KEPCO, the South Korean utility and one of the largest in the world, is responsible for 100% transmission and distribution of electricity and contributing to 80% of Korea's electricity generation. But KEPCO's network is a stand-alone system which doesn't have any link with other grids of neighbor countries.

KEPCO is driving the North East Asia Super Grid project to overcome this, importing cheap renewable power from Gobi Desert and West China, and swapping the power among neighboring grids.

HVDC is key to enabling this large-scale project, with benefits such as higher operational efficiency in power supply, more active exploration of regional energy resources such as gas and hydro power, and integration of renewable energy sources for future growth.



Buk Dangjin project overview

KAPES Joint Venture

In 2012, Grid Solutions, previously Alstom Grid, and Korea Electric Power Corporation (KEPCO), announced the creation of their joint venture KAPES, with the focus of delivering HVDC and FACTS projects in South Korea, critical to ensuring the country's sustainability and reliability.

The long-term strategic aim is to increase Korean transmission grid capabilities based on Grid Solutions Power Electronics technology, and support the long-term plan of KEPCO to reinforce its grid using HVDC, and to develop the North East Asia Supergrid.

With this project, KAPES is now in charge of three EPC projects (Buk-Dangjin phase 1 and 2 and East Power phase 1), one refurbishment project in consortium with GE (Rehabilitation of Haenam-Jeju link), as well as the maintenance of the Jindo-Jeju link.

This demonstrates the success of the strategy to localize GE technology, via transfer of competence to KAPES and license to manufacture core components to a local manufacturer. This long-term investment sets an example of a win-win strategy for GE and KEPCO, as well as for Korea.

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