



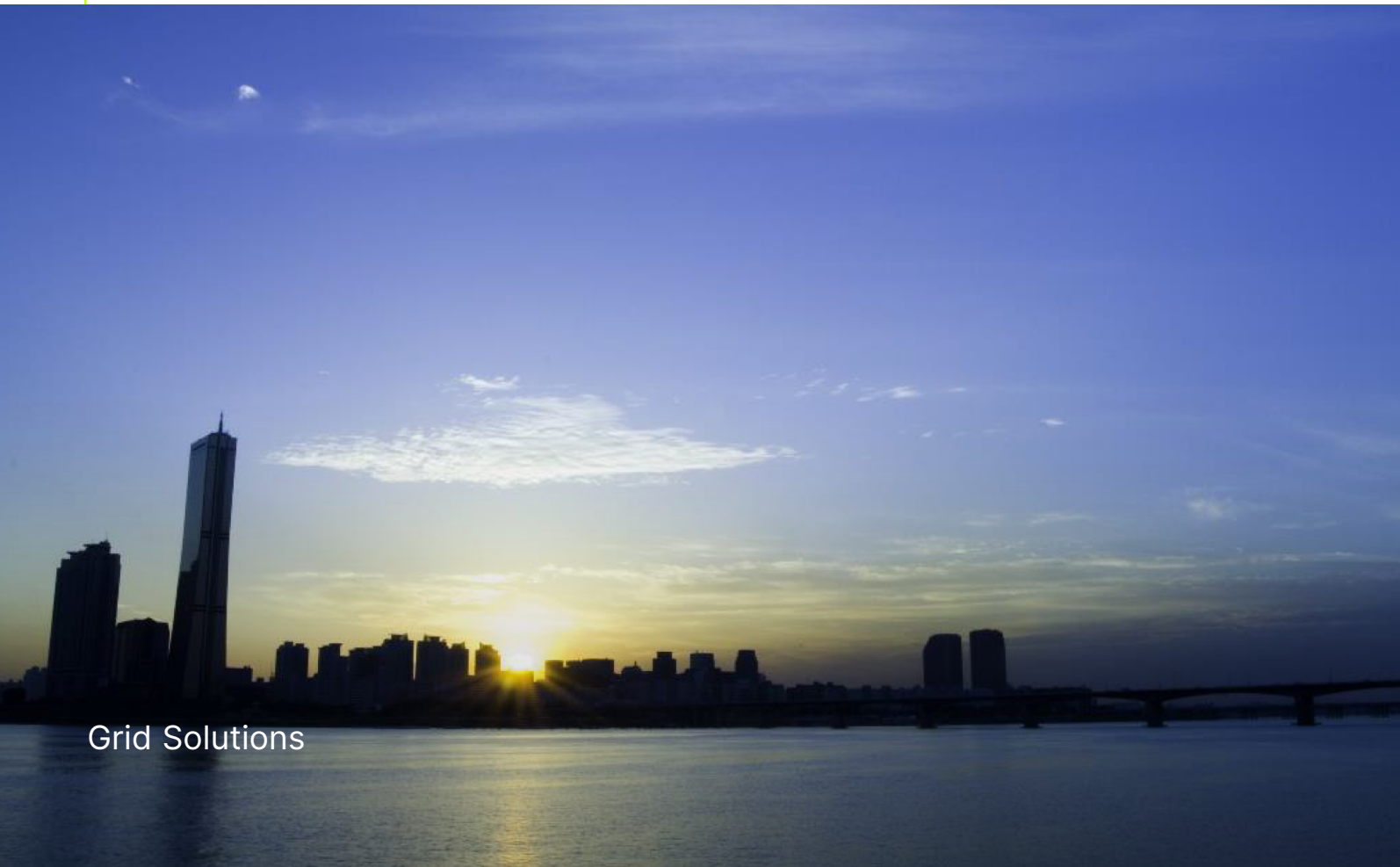
GE VERNOVA

Transmitting Power to Cities

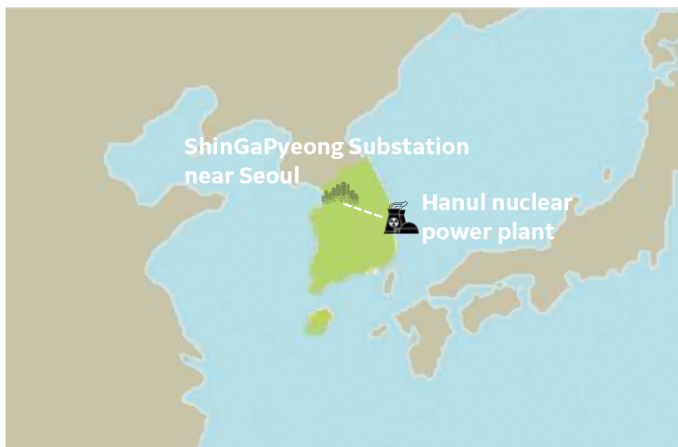
EAST POWER (EP) PHASE#1

GE Vernova's HVDC technology powers a densely populated South Korean city

Case Study



Grid Solutions



220 km energy corridor from Donghaean on the East coast, to Shingapyeong near Seoul metropolitan area

PROJECT OVERVIEW

Country:	South Korea
Project:	East Power (EP)
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:	4 GW, ±500 kVDC

CUSTOMER CHALLENGES

Looking for Energy Independency

With 51.4 million people¹, South Korea has experienced nearly a 53% growth² 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 East Coast to Consumption Centers

With electricity consumption increasing at a rate of 5% in recent years, South Korea is struggling to keep pace with power generation capacity. The country power reserve level had been below 10% since 2009 and it reached to 5.2%⁴ in 2012. Additionally, on 15th Sep 2011, KEPCO experience brownout due to shortage of electricity. South Korea already has plans to construct new power plants to address generation needs, but the challenge is to connect them to the grid and ensure that the energy can be efficiently transmitted to the load centers.

Over the next few years, South Korea aims to connect the plants, located mainly on the east coast, with the consumption centers on the diagonal of Seoul-Pusan. It has become increasingly difficult to obtain permits to build new overhead lines. 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>
4. http://www.index.go.kr/potal/main/EachDtlPageDetail.do?idx_cd=1163
<https://newsinfo.inquirernet/59327/s-korea-suffers-power-outages-amid-hot-weather>

THE SOLUTION

In 2017, GE Vernova was awarded, through its joint venture KAPES, the first phase of the East Power Converter (LCC) project to design and supply equipment for a 220 km energy corridor from Donghaean on the East coast, to Shingapyeong near Seoul metropolitan area.

The 4 GW power capacity HVDC link will be configured as a bi-pole, with a rating of ±500 kVDC. The link will transmit energy produced by the nuclear, thermal, and hydro power plants located in the east of South Korea, to the Gyeongju area, east of Seoul.

The project will allow KEPCO to deliver a reliable supply of electricity to people and businesses in the densely populated metropolitan area, allowing to bury cables in some areas where needed, thus reducing the length of a new overhead line.

The second phase of the project, which is expected to follow, will add another bi-pole with an additional power capacity of 4 GW, expanding the electrical transmission capability from the east coast to the metropolitan area.

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.

The infographic features a dark background with a stylized cityscape and power lines. It includes the following text:

- GE TO BUILD AN HVDC ENERGY HIGHWAY TO POWER SOUTH KOREA'S METROPOLITAN AREA**
- SEOUL** THE HVDC PROJECT INCREASES THE STABILITY AND RELIABILITY OF THE SOUTH KOREAN ELECTRICAL NETWORK BY ADDING:
 - 4 GW** OF POWER FOR SEOUL'S METROPOLITAN AREA
 - 220 km** OF ENERGY HIGHWAY TO POWER SEOUL'S ECONOMIC GROWTH
- SOUTH KOREA'S ECONOMY POSTS FASTEST GROWTH IN 7 YEARS**
- 35% GROWTH IN ELECTRICITY DEMAND IN THE LAST DECADE**
- PLANS TO ADD NEARLY 31 GW OF SOLAR AND 16.3 GW OF WIND POWER CAPACITY BY 2030**

KAPES JOINT VENTURE

In 2012, Grid Solutions, previously GE Vernova 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 Vernova (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 Vernova 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 Vernova and KEPCO, as well as for Korea.

For more information, visit
governova.com/grid-solutions

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