

Map infrastructure of K-Power Grid opened... GIST unveils 'Korean-style' next-generation power grid platform

- *The Power Grid Research Center at the Research Institute for Solar and Sustainable Energies, which opened in September 2025, bears its first fruit in building Korean-style energy infrastructure*
- *Implementation of a nationwide power grid using only publicly available data... Korean researchers can conduct research based on a Korean-style power grid instead of overseas models*
- *Datasets, maps, and analysis tools are fully open; the center is expected to evolve into a public research platform through continuous updates*



▲ *Group photo of the Power Grid Research Center at the GIST Research Institute for Solar and Sustainable Energies. (Fifth from the left in the front row) Yun-Su Kim, Director of the Power Grid Research Center.*

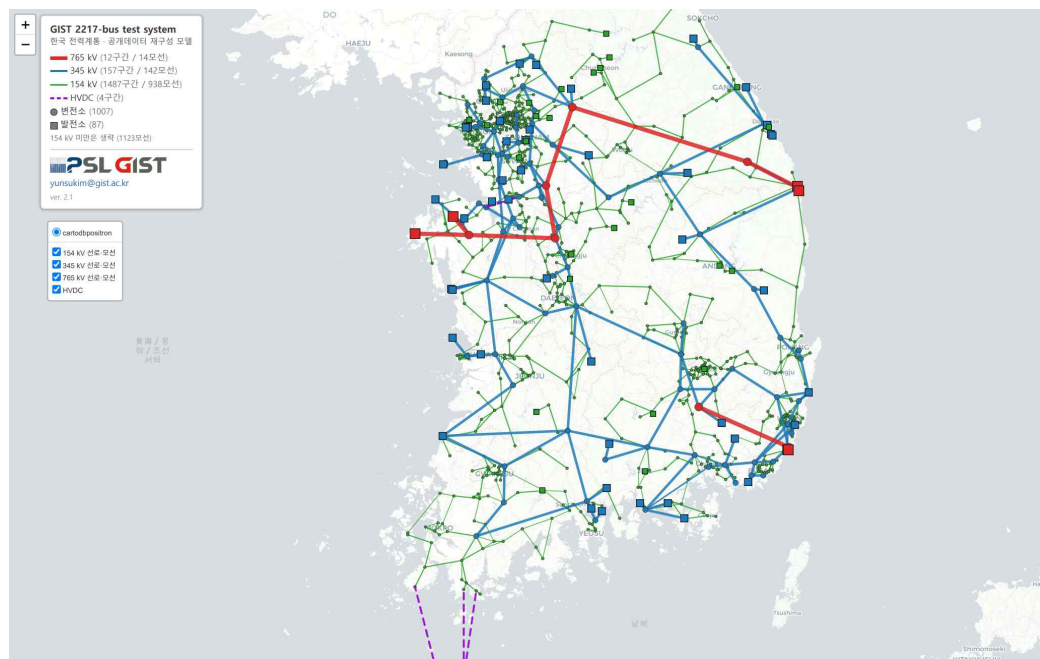
The Gwangju Institute of Science and Technology (GIST, President Kichul Lim) announced that the Power Grid Research Center at the Research Institute for Solar and Sustainable Energies (Director Yun-Su Kim, Professor of Electrical Engineering and Computer Science) has developed the "GIST 2217-Bus Test System," a simulation model that implements Korea's entire power grid on a computer using only publicly available data, and has released it for free.

This achievement is part of the establishment of a research foundation for a Korean-style next-generation power grid, which has been pursued by the Power Grid Research Center since its opening in September 2025. It has laid the groundwork for domestic researchers to conduct research in an environment that reflects the actual characteristics of the Korean power system.

Simulation research analyzing how electricity flows along the power grid is essential for the stable supply of electricity from power plants to homes and industrial sites.

However, as detailed information on actual power grids is not disclosed due to national infrastructure security, domestic researchers have been conducting their research by relying on overseas test system models provided by the Institute of Electrical and Electronics Engineers (IEEE).

However, Korea's power grid differs from those of other countries in structure, with power generation facilities concentrated in coastal areas and electricity demand concentrated in the capital region; therefore, relying solely on overseas models had limitations in reflecting the characteristics of the Korean power system.



▲ *Single-line diagram of the GIST 2217-bus test system. It visually represents the overall structure and connectivity of Korea's power system by distinguishing and displaying 765kV, 345kV, and 154kV transmission lines, buses, power plants, and substations.*

The research team constructed the simulation model, the "GIST 2217-bus test system," by utilizing publicly available map information and power statistics data, rather than using confidential data from the actual power grid.

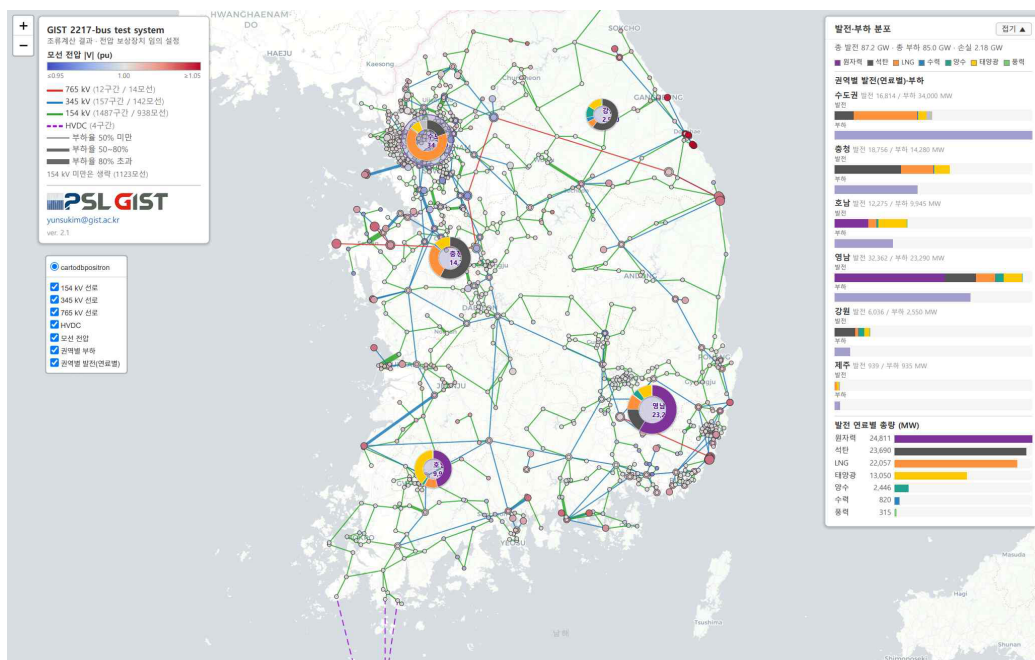
The constructed power grid model consists of 2,217 busbars* and approximately 3,700 transmission lines, reflecting the power grid connecting major power plants and substations nationwide, as well as the interconnection network for Jeju Island. Unlike overseas power grid models primarily used by researchers, this model is characterized as a 'Korean-style' model that reflects the structure and characteristics of Korea's power system.

Furthermore, it has been confirmed to perform calculations stably even under conditions simulating peak hours during the summer when power consumption is high, thereby securing a level of reliability suitable for actual power grid research.

** busbar: A connection point in a power grid where power plants, substations, and transmission lines are connected to collect and distribute electricity.*

Moreover, the power grid dataset, map, and construction and analysis tools have all been made public, allowing anyone to download and use them without separate permission. An interactive map is also provided, allowing users to directly view the power grid structure in a web browser.

The unveiled model is expected to be utilized in various fields, including analyzing how much more renewable energy, such as solar and wind power, can be connected to the power grid, conducting response studies simulating power outages, researching power grid operation strategies for the era of carbon neutrality, and developing power grid management technologies using artificial intelligence (AI).



▲ *Simulation results of the GIST 2217-bus test system. The results display transmission lines with different thicknesses based on line utilization rates and busbars with different colors based on bus voltage. By showing load by region and generation by fuel type together, power flow and grid operation status can be checked at a glance.*

Center Director Yun-Su Kim stated, "We hope this unveiled model will serve as a starting point for research targeting Korea's power grid and as a shared research platform." He added, "Moving forward, we will continuously update the model to adapt to changes in the power grid and reflect the actual operating characteristics of generators and renewable energy facilities to develop it into a Korean-style power grid platform that can be utilized by both domestic researchers and companies."

The model data and related materials are available for free on the GIST Power Systems Laboratory website (psl.gist.ac.kr).

Meanwhile, GIST stated that this research achievement takes into account both its academic significance and potential for industrial application, and that discussions regarding technology transfer can be conducted through the Technology Commercialization Center (hgmoon@gist.ac.kr).