SP Group Visits Taipower for Technical Exchange on Energy Transition, AI Applications, and Grid Flexibility

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On August 13, 2026, Mr. Kane Neo Tong Leong, General Manager of SP PowerGrid, the transmission and distribution network operator under Singapore's SP Group, led a delegation to Taiwan Power Company (Taipower) for a technical exchange. The morning meeting for executives was chaired by Taipower President Tien-Ho Kuo and attended by Chief Engineer Han-Hsi Chang and senior representatives from the Department of System Operation, Department of Corporate Planning, Department of Business, and Taiwan Power Research Institute (TPRI). In the afternoon, Vice President Chien-Hsun Liu chaired a technical exchange session attended by representatives from 12 Taipower departments. The discussions covered topics including energy transition, grid development and flexibility strategies, power system operational safety, digitalization initiatives, artificial intelligence applications in power systems, and the development of distributed energy resources. Both parties shared their planning approaches and practical experiences in addressing the challenges associated with net-zero transition and the rapid growth of emerging electricity demand.

Under the theme of "Energy Transition, Grid Development, and Flexibility Strategies," both parties exchanged views on the structural changes and challenges facing power systems under the global transition toward net-zero emissions. Discussions covered long-term grid resilience planning, practical implementation experience, and future development strategies.

SP Group is Singapore's principal transmission and distribution network operator, serving approximately 1.7 million customers. Its power system has a peak demand of approximately 7.4 GW and comprises more than 28,000 kilometers of power cables, over 19,000 transformers, and 12,000 substations. According to SP Group, its System Average Interruption Duration Index (SAIDI) for FY2025/26 was approximately 0.33 minutes per customer per year. Singapore's transmission system primarily comprises underground cable networks operating at 400 kV, 230 kV, and 66 kV. To support the nation's 2050 net-zero emissions target, Singapore is pursuing multiple energy pathways, including solar photovoltaic (PV) deployment, low-carbon electricity imports, and hydrogen, while strengthening supply reliability and grid resilience through digitalization and grid investment.

One of the key topics discussed was the rapid growth of electricity demand from data centers and semiconductor manufacturing facilities. SP Group noted that these sectors currently account for approximately 20% of Singapore's total electricity consumption but have contributed approximately 90% of total system demand growth over the past five years.

Given that large industrial facilities can typically be completed within 18 to 24 months, while new transmission and substation infrastructure may

require five to eight years or longer, managing the mismatch between load growth and grid expansion has become a critical planning challenge. SP Group therefore reviews each data center and major load application on a case-by-case basis, considering factors such as requested capacity, voltage level, location, and impacts on the surrounding network. For approved data centers, semiconductor facilities, and other customers connected at 66 kV or above, the full contracted capacity is generally incorporated into its rolling ten-year network development plan. Where local network capacity is constrained, SP Group may recommend alternative locations, coordinate development priorities with government agencies, or adopt phased energization arrangements.

The two parties also exchanged views on load forecasting methodologies. Singapore's Energy Market Authority (EMA) develops national demand forecasts using a top-down approach based on macroeconomic and demographic trends, while SP Group employs a bottom-up approach that incorporates actual system demand, approved and contracted loads, and future demand information provided by government agencies and customers. Taipower shared its experience in coordinating large-customer service requests and discussed the importance of information sharing and long-term planning to support future load growth.

Grid infrastructure development and "build-ahead" planning constituted another major topic of discussion. SP Group explained that a new ground-level substation typically requires approximately eight years to complete, while an underground substation may require ten to fifteen years. Roughly half of the overall project timeline is associated with land acquisition, regulatory approvals, cable routing, road excavation permits, environmental considerations, and construction coordination rather than actual equipment installation.

To address future demand uncertainty, the Singapore government is considering a potential "Build Ahead" mechanism that would allow strategic grid infrastructure to be constructed before demand is fully confirmed, with the government assuming the investment risk associated with insufficient asset utilization. Although the proposal has not yet been finalized, SP Group emphasized that early reservation of substation sites and cable corridors through urban planning processes could significantly reduce future development constraints.

Taipower shared its experience with the "transportation-network-integrated grid development" approach, under which power infrastructure projects are coordinated with road, metro, and highway construction projects. The two organizations agreed that early coordination among utilities, government agencies, and urban planners is essential for reducing project lead times and facilitating future grid expansion.

Digitalization and artificial intelligence (AI) applications were another important area of exchange. SP Group reported continued deployment of substation sensors and development of digital twin technologies with sensors now installed at 151 substations. It also uses machine learning to analyze partial discharge (PD) signals, incorporating experienced engineers' interpretation expertise into the models to improve equipment diagnostic

efficiency.

Taipower shared its own experience deploying on-premises generative AI and Retrieval-Augmented Generation (RAG) technologies for applications including load forecasting, engineering drawing reviews, equipment replacement assessments, test report analysis, and event investigations. Both organizations emphasized that AI currently serves as a decision-support and knowledge-management tool rather than a replacement for engineering judgment.

The discussion also covered asset management and operational safety practices. SP Group regularly analyzes failure statistics for cables, transformers, switchgear, and shunt reactors and uses the results to guide maintenance testing, condition monitoring, and asset replacement programs. For underground cable protection, SP Group requires advance excavation notifications, cable record verification, qualified cable detection personnel, trial excavation, work permits, risk assessments, and on-site supervision. If cable locations cannot be positively identified, work must be suspended until the issue is resolved.

Taipower introduced its “Five-One” operating principle, together with personnel protection procedures, work-zone management practices, lockout and tagging systems, dedicated equipment keys, and centralized risk-control mechanisms. It also shared its practices for self-protection, mutual protection, and supervisory oversight. Both sides also exchanged views on the use of QR codes, wearable cameras, augmented reality, and smart glasses to support field operations and safety management.

The development of distributed energy resources and virtual power plants (VPPs) was another key topic. SP Group has established the first phase of a 30 MW VPP program integrating battery energy storage systems, solar PV, and electric vehicle charging infrastructure. The aggregated resources are capable of providing frequency regulation, voltage control, active power control, and dynamic load management services. SP Group also plans to leverage five-minute smart-meter data to improve visibility of low-voltage demand and distributed generation resources.

Taipower shared the progress of its electricity trading platform, which had 108 qualified market participants and approximately 3,058 MW of registered capacity as of the end of July 2026. The company also introduced its demand response programs, time-of-use tariffs, energy storage participation mechanisms, and smart inverter functions, including Volt-VAr, Volt-Watt, and active power curtailment capabilities.

The exchange provided a valuable opportunity for both organizations to share experiences and perspectives on large-load integration, grid planning, digital transformation, asset management, AI applications, and distributed energy resources. Through discussions on practical implementation approaches and future development strategies, both parties enhanced their understanding of the challenges and opportunities associated with energy transition and grid modernization.



Figure 1. Mr. Kane Neo Tong Leong (front row, second from right), General Manager of SP PowerGrid, led an SP Group delegation to visit Taipower. The morning executive-level meeting was chaired by Taipower President Tien-Ho Kuo (front row, third from right).



Figure 2. The afternoon technical exchange meeting, chaired by Vice President Chien-Hsun Liu, brought together representatives from 12 Taipower departments and SP Group to discuss power system operational safety, digitalization, and AI applications in the power sector.