U.S. DEPARTMENT OF ENERGY

Achieving American Leadership in the Electric Grid Supply Chain

Summary

The U.S. electric grid consists of more than 22,000 generators; 55,000 substations; 642,000 miles of high-voltage lines; and 6.3 million miles of distribution lines that serve 153 million customers.

To date, much of the smart grid transformation has focused on applying advanced digital information and communication technologies to the power grid to improve the system's efficiency, flexibility, and security. To achieve the full value of grid modernization, we also need advances in grid hardware.

Many critical components supporting the power grid have limited to no domestic manufacturing capacity and face complex challenges in supporting a rapid expansion of the grid to meet multiple objectives, including decarbonization goals.

Key Findings and Opportunities

Large Power Transformers (LPTs)

Large Power Transformers (LPTs) are used to step up voltage to decrease the power losses from electricity transmission, and to step down voltage for distribution at lower, more usable voltage levels. It is estimated that over 90 percent of the nation's consumed power passes through an LPT (Office of Electricity 2021).

Bottlenecks in component suppliers also limits manufacturing capacity. It was estimated that in 2019, utilized domestic capacity was about 40%, and 82% of LPTs consumed in the United States were imported (U.S. Department of Commerce 2020).

High-Voltage Direct Current (HVDC) Transmission

High-Voltage Direct Current (HVDC) transmission provides an alternative electrical transmission system to conventional alternating current (AC) which increases the power grid's capacity to receive, transmit, and deliver a large amount of energy. HVDC technology is more cost-effective compared to HVAC for longer transmission distances. In addition, this technology improves grid resilience and security, and operation flexibility and accommodates the integration of renewable energy transmission into the existing grid to reach the nation's goal of carbon neutrality. Many large-scale renewable resources are in remote or

offshore areas, which are typically far away from load centers, and require efficient delivery of the energy over long distances.

The major bottleneck of this supply chain is due to low demand for two reasons: projects require collaboration from multiple Regional Transmission Organizations (RTOs); and cost recovery is hard to forecast making investment decisions risky.

Policy Next Steps

Large Power Transformers

- **Engage government and private sector to expand RD&D** to improve modularity, create flexible designs, improve efficiency, and lower manufacturing costs of LPTs and related materials.
- **Expand mechanisms such as competitive grants, direct loans, and loan guarantees** that support domestic LPT manufacturing capabilities and job creation.

High Voltage Direct Current Transmission

- **Incentivize domestic production of energy components on government supported projects** through requiring domestic content standards for Federal procurement of grid components including HVDC, wherever possible. HVDC is the key DC long-distance transmission technology to achieve 30 GW offshore wind farm to onshore grid integration (Department of Energy 2021). By increasing domestic HVDC component manufacturing, the business case is improved for manufacturers to locate their facilities in the United States.
- **Expand mechanisms such as competitive grants, direct loans, and loan guarantees** that support domestic HVDC manufacturing capabilities and job creation. ■

Download the full document and the corresponding other documents that are part of the DOE response to the supply chain executive order at: www.energy.gov/policy/supplychains