

# Grid Modernization

Transmission Grids – the bedrock  
of the energy transition

[siemens-energy.com/transmission](https://www.siemens-energy.com/transmission)



## Sustainability is the core of our actions

Siemens Energy is fully committed to supporting the Paris Agreement and the UN Sustainable Development Goals. For more than 150 years we have been working on the transformation of the energy world. Our ambition as Siemens Energy is to achieve climate neutrality in our own operations by 2030 and to cover 100% of our own electricity consumption from renewable sources by 2023.

Furthermore, we want to make electrical transmission grids completely free of greenhouse gas emissions by ensuring maximum performance and health and safety standards to support the energy transition.

**“Transmission of electricity plays a crucial role in meeting growing demand for clean, affordable, reliable, and equitable power.”**

World Energy Council 2020

Performing while transforming: The role of transmission companies in the energy transition

## Why grid modernization is necessary

Electricity is a pivotal element in today's challenge to decarbonize society and limit global warming as defined by the Paris Agreement. To connect the dots from generation to the demand side, the electrical grid is the key component. Today's grids have not been designed for the challenge posed by the increasing share of renewable energies. Therefore, the grids have to be made ready for present and future requirements of CO<sub>2</sub> neutrality and renewables by maintaining the highest level of resilience and reliability.



Figure 1 Electrical transmission grid landscape

Seven facts on how modernizing the grid can enable the energy transition and ensure grid reliability:

 **1. Renew ageing infrastructure – Replacement, retrofit and refurbishment of assets is essential to keep pace with today’s grid requirements**

Due to different waves of investment, there has been an unignorable proportion of ageing infrastructure in the grid depending on the regions. To maintain grid reliability and prepare it for future challenges, replacements, retrofits, and refurbishments are necessary to apply the latest technologies for grid assets and operation.

 **2. Integrate renewables with efficient low-loss technology – HVDC is the technology of choice**

Bulk renewable power generation is mostly located in remote areas with a long distance to the consumer. HVDC is the technology of choice for efficient interconnections. To better enable multinational and meshed grids, the Multi-Vendor & Multi-Terminal HVDC systems technology is the key element for ensuring maximum resilience. In addition, loss optimization of key assets like transformers supports decarbonization by lowering the global warming potential.

 **3. Secure electricity supply in volatile producers’ and consumers’ environment – Grid stability with high power quality and resilience is mandatory**

With the increase in renewable infeed and decrease in fossil power generation, grid operation faces certain challenges, for example higher volatility, frequency fluctuations and less system inertia. Consequently, network reinforcements to improve grid stability are recommended, e.g. FACTS (Flexible AC Transmission) systems, phase-shifting transformers or asynchronous rotating energy system stabilizers.

Furthermore, assets with maximum resilience are essential to ensure safe power supplies. Siemens Energy has therefore created its grid resilience concept Pretact® to better protect key components against operational issues, natural disasters and other forced outages.

 **4. Digitalize the grid – Grid-edge by advanced sensors and data processing on substation level for best-in-class asset operation**

Grid complexity is increasing with the evolution of renewables. So, it is important to use state-of-the-art digitalization technologies to safely manage the new grid ecosystem and leverage all automation potential. Siemens Energy has digitally advanced its transmission portfolio by offering Sensformer®, Sensgear® or SensSolution®. The Senstechnology

enables better transparency, availability and operational efficiency thanks to data analytics capabilities embedded in primary assets and edge environments.

 **5. Apply alternative switching and insulation technologies – Phase out of SF<sub>6</sub> and other F-gases as well as mineral oil is possible**

The global warming potential of SF<sub>6</sub> is 23,500 times higher than the global warming potential of CO<sub>2</sub>. In addition, SF<sub>6</sub> stays in the atmosphere for up to 3,200 years. Therefore, Siemens Energy has developed its sustainable Blue Products to replace SF<sub>6</sub> in high-voltage switchgear systems. They are based on clean air insulation and vacuum switching technology with zero emission (GWP = 0) and zero pollution (non-toxic, F-gas-free). Under consideration of a timely defined roadmap, the phase out of SF<sub>6</sub> is recommended. We also suggest a similar phase-out of mineral oil and replacement with ester in transformers. The ester technology offers a very high degree of biodegradability and fire safety combined with lifetime extension.

 **6. Ensure the highest EHS standards – Fire-safe substations take things to the next level**

A continuous improvement in EHS standards aims to eliminate the risk of harm to people, environment, and assets. To set new standards in environment, health and safety for fire-safe substations, Siemens Energy has developed its Pretact EcoSafe™ concept. A near-zero substation failure rate will contribute to sustainable success and associated economic benefits.

 **7. Simplify regulatory landscape, stimulate modernization – Acceleration is decisive**

Due to the complexity of regulations, approval and implementation processes are often very time-consuming. To meet the climate goals and roadmaps, speed is decisive. For this the regulatory landscape addressing grid modernization areas needs to be simplified to accelerate the energy transition. In addition, incentives for new technologies and the required investments are important to avoid delays.



Figure 2 Electrical Transmission Substation – Main Components

## Published by

Siemens Energy Global GmbH & Co. KG  
Freyeslebenstraße 1  
91058 Erlangen  
Germany

For more information, please visit our website:  
[siemens-energy.com/transmission](https://www.siemens-energy.com/transmission)  
or contact us:  
[support.energy@siemens-energy.com](mailto:support.energy@siemens-energy.com)

© Siemens Energy, 2021

Siemens Energy is a trademark licensed by Siemens AG.

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract. All product designations may be trademarks or product names of Siemens Energy Global GmbH & Co. KG or other companies whose use by third parties for their own purposes could violate the rights of the owners.



**This white paper  
is a conceptual  
contribution to  
the energy tran-  
sition**