



**SIEMENS**



Comprehensive expertise for  
reliable and efficient power systems

Siemens Power Technologies International (Siemens PTI)

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Answers for infrastructure and cities.

# Succeeding in a changing world

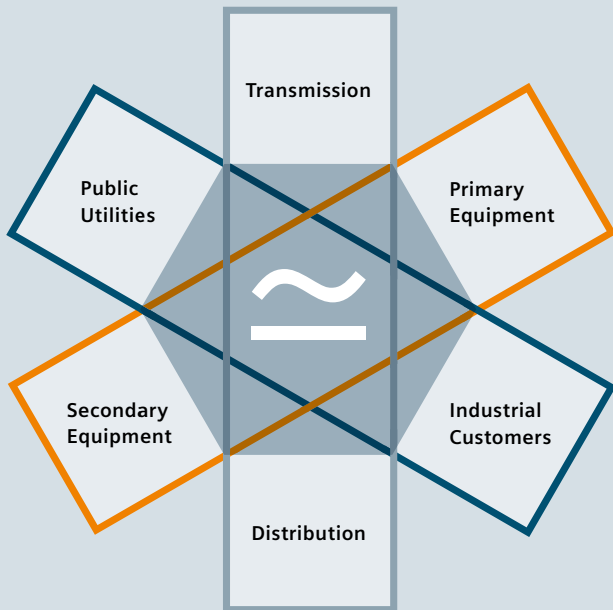
**Electric power systems are expected to guarantee the highest reliability possible – as cost efficiently as possible. Today, however, this goal is challenged by issues such as increased low and medium-voltage grid infeed from distributed generation, aging network and generation equipment, and market deregulation. At the same time, the emergence of new technologies and concepts for system design and operation requires new technical solutions and also impacts the established business processes. Proven professional support from power systems experts is vital to ensure the security, reliability, and efficiency of electricity networks in this challenging world.**

A well-structured, highly reliable electricity supply infrastructure is one of the most important elements of a profitable energy business – in general, it is vital for the functioning of our society and economy. Cost-efficiency, availability, and reliability, along with sustainability and resource-efficiency, are the main demands on today's energy system. However, the system is in a state of change, and network structures have to face new challenges: Low and medium-voltage grids often have to cope with network and power flow conditions they were not designed for. New technologies and new network equipment, such as virtual power plants, meshed HVAC and HVDC power transmission systems, FACTS technologies for AC network stabilization, even storage technologies, are becoming mature and widespread. New components, network design approaches, and communication technologies are being introduced – finally transforming the network into a highly automated Smart Grid.

Emerging on the business side, the increasingly important role of distributed power generation, such as wind farms and photovoltaics, has led to considerable changes recently. At the same time, new energy markets have been spurring large-scale energy trade and have created completely new business processes. The continuous growth of urban centers around the world entails a high demand for clever, space-saving, reliable, and cost-effective power supply solutions, while regulations are putting ever-increasing pressure on the cost of network configuration and operation.

All of these issues significantly increase the complexity in the delicate balance between cost-efficiency and power quality delivered by the power systems. In this changing, increasingly digital world, experts with comprehensive knowledge and proven experience can provide valuable support to planners, owners, managers, and operators of transmission, distribution, and industrial power systems.





## Your benefits at a glance

- ▶ A holistic, integrated perspective on the performance of the entire energy system
- ▶ Comprehensive and integrated strategy plan defining business modules and processes
- ▶ Independent and objective analysis of your system
- ▶ Innovative concepts and decades of international experience
- ▶ Familiarity with international and local standards and requirements
- ▶ Cutting-edge software solutions of the PSS® product suite
- ▶ Product training and professional education on transmission and distribution topics

# Products, solutions, and services that put you one step ahead

**Tackling the challenges the energy system poses today is not an easy task for all players in the energy business. Siemens Power Technologies International (Siemens PTI) provides the expertise and experience it takes to pave the way to smarter, more efficient, and highly reliable power grids at all voltage levels. Our solutions include consulting services, planning software, and professional training on all aspects of power transmission and distribution as well as Smart Grid technology.**

Siemens is a world leader supplying innovative products, solutions, and services that ensure the utmost efficiency and reliability of power transmission and distribution grids as well as industrial power networks. Siemens PTI provides the knowledge and expertise to combine the individual equipment components to form a complete electricity supply system that meets your technical and economic requirements and supports a clear set of strategic business objectives.

The comprehensive software and training portfolio, long-standing expertise in advanced power system technologies, and Siemens' financial strength are a sound basis for the development of state-of-the-art solutions that ensure the utmost reliability and efficiency of any supply network.

With 23 regional offices around the globe, Siemens PTI is present on all continents. Wherever you are, Siemens PTI's unique power system expertise is always in close reach.

# Benefit from comprehensive expertise and experience

Siemens Power Technologies International provides consulting services, planning software, and professional training on all aspects of power transmission and distribution as well as Smart Grid technology.

## Consulting and planning for electrical power systems

In today's complex and changing power system environment sound advice from power system experts is essential. Siemens has a legacy of world-renowned engineering experience and innovative software and technology. Our Consulting services range across technical, economic, and regulatory disciplines – addressing technical concepts, business models, processes and overall strategy. They include power system analysis and solution development, expert testimony, and industry training.

### ▶ **Steady-state system studies**

The structure and configuration of power supply systems form the basis for solid system performance and future challenges.

### ▶ **Dynamic system studies**

The assessment and optimization of dynamic aspects in the performance of systems, equipment and generators ensures stability and security.

### ▶ **Transient system studies**

Modeling and analysis of overvoltages and related insulation coordination studies are the foundation to the system's resilience to transient phenomena.

### ▶ **Protection and control system studies**

Protection and control are essential aspects for power system planning and operation, requiring sound analysis and design of related concepts and solutions.

### ▶ **Power quality system studies**

Analyses and design studies ensure that system performance and customer processes are not impaired by power quality issues, especially harmonics.

### ▶ **Strategy studies**

Effective prioritization of business objectives, comprehensive process assessments, roadmap development, business model evolution and optimized reference architectures to ensure overall economic effectiveness of the system.



## Software Solutions

Siemens PTI offers a suite of powerful software tools that support planning and operations engineers in their development of highly accurate and efficient power system analyses. The Power System Simulator (PSS®) product suite provides a complete set of integrated, conventional, and specialized tools for the simulation and analysis of transmission, distribution, and industrial power systems, as well as gas, water, heating, and cooling infrastructures. Easily integrated into any existing IT environment, these powerful and user-friendly tools feature an intuitive graphical user interface, customizable visualization options, automation capabilities, and efficient data management.

### **PSS® product suite**

Pinpoint solutions for any power system analysis task:

- ▶ Simulation and analysis of all kinds of electrical power transmission and distribution systems as well as pipe networks
- ▶ Fully integrated modular structure and licensing
- ▶ Integration and management of technical data and planning variants
- ▶ Tailored training, individual customer support, and regular user group meetings

## Siemens Power Academy TD

As specialists in training and continuing education, Siemens Power Academy TD offers professional training in the fields of power transmission and distribution, the industrial and commercial use of electrical energy, and Smart Grid technology. In more than 25 state-of-the-art training centers worldwide, Siemens Power Academy TD provides access to Siemens' expert knowledge and capabilities. Employing the latest teaching methods and highest-quality content, Siemens' certified trainers ensure a superior educational experience, so that participants acquire practical skills with a focus on retaining these skills long term. Training can be customized to meet individual requirements, and it can also be conducted on-site at the customer's facilities to avoid costly staff travel.

### **Standard and customized training**

Professional education that can be customized to your needs and goals:

- ▶ One-time training sessions or complete training programs
- ▶ Delivery at one of our worldwide training locations, at your own premises, or via e-Learning
- ▶ Small groups and high degree of practical orientation with hands-on instruction for best learning results
- ▶ Certification and qualification to ensure a high standard of quality



# Individual planning solutions to any system requirement

As fundamental changes take place throughout the entire energy system, challenges and demands on various entities within the system are changing accordingly. Many factors that were considered negligible in the past have become issues of high importance: power quality, reliable and efficient demand, and stricter contractual and regulatory obligations. Siemens PTI provides a comprehensive range of services for power generation, transmission, and distribution that help anticipate and prevent possible obstacles already in the planning phase. PTI's internationally renowned experts ensure trouble-free and efficient operation, supporting a sound strategy to meet clear business objectives.

## Power generation

Power generation has become much more diverse in recent years. Along with conventional power generation, today's energy system comprises a huge share of distributed generation: wind power, solar power, and biomass plants as well as other distributed generators, such as combined heat and power (CHP) plants. This situation poses new challenges to power plant and grid operators.

As grid infeed from distributed generation experiences a boom, especially on the low-voltage level, comprehensive grid code compliance at the point of common coupling and reliable grid connection have become topics of the utmost importance. The power networks within utility-scale wind farms and photovoltaic installations also require special attention, as the increasing size and output of such plants leads to even more new challenges. Since the output of renewable generation depends on intermittent meteorological conditions, different stochastic models must be applied, while the unique characteristics of energy storage technologies have transformed the concept of storage into a tool accepted by a modern electrical grid.

At the same time, demands on conventional power generation have changed to a considerable degree. Today, factors such as the reliable and safe transition to house load and extremely fast ramp-up and load shedding according to strict grid code regulations must be ensured. On the other hand, dynamic stability, generator protection, and shaft oscillations are matters of concern with modern high-performance plants.

Siemens PTI consulting services cover all such aspects and especially comprise:

- ▶ feasibility
- ▶ optimization
- ▶ rating of equipment
- ▶ fault detection and clearance.

## Transmission

The increasing diversity of the power generation landscape also has its effects on power transmission systems. The high-voltage grids have to collect and pool all large generation, link generation to the load centers, and provide the physical infrastructure for power trade. That's why demands on these grids are high, and network operators are expected and obliged to guarantee a number of parameters for different aspects such as frequency stability and system security.

Siemens PTI provides comprehensive services that support network operators in ensuring a steady balance of generation and load, voltage stability and provision of sufficient reactive power. The mitigation of transmission losses, system dynamics, and preparation for network upgrade and extensions are further fields of attention.

The range of available services comprises:

- ▶ dynamic security assessment
- ▶ wide area monitoring
- ▶ control for hybrid systems
- ▶ network concepts
- ▶ detailed equipment design
- ▶ technical feasibility studies
- ▶ substation and switchgear concepts
- ▶ maintenance and operation
- ▶ extension planning.

## Distribution

The increasing integration of distributed generation on the low-voltage level, the proliferation of Smart Grid technology, and the topological change from simple top-down distribution to active networks have turned the distribution side of the energy system into a focal point of interest. Today, utilities have to meet much stricter budget, reliability, loss control, and regulatory demands. At the same time, they encounter new tasks, such as service quality issues and manpower restrictions.

That's why distribution networks, which have long been considered a passive infrastructure with no specific need for in-depth examination, now require detailed conceptual development and weak point analysis as well as targeted asset management. Siemens PTI meets these new challenges and offers services such as:

- ▶ the Smart Grid Compass® methodology to develop comprehensive business strategies
- ▶ protection settings and power system analysis (PSA) consulting
- ▶ definition of mitigation strategies for power losses
- ▶ voltage control and harmonization of voltage levels
- ▶ load forecasting
- ▶ standardization of equipment
- ▶ concepts for neutral grounding.

### Industry

Reliable power supply is of the utmost importance in many industries, as today's production facilities and control electronics are extremely sensitive to disturbances and faults. The prevention of network disturbances such as harmonics and flicker, a high level of short-circuit power, and the handling of cogeneration requirements are main

fields of attention. As today's markets demand more flexible production, today's industrial networks must also provide the flexibility to follow these faster production cycles.

Siemens PTI provides industry-specific solutions for industrial sectors such as metals and mining, cement, automotive, and data storage. These solutions precisely consider the special demands of rolling mills, arc furnaces, large motors, welding machines, and semiconductors. Consulting and analysis comprise factors such as:

- ▶ switching transients
- ▶ insulation coordination
- ▶ inrush current
- ▶ different load cycles
- ▶ motor start behavior
- ▶ neutral grounding
- ▶ resonances and harmonics
- ▶ disturbance analysis
- ▶ determination of fault current level
- ▶ impact of external voltage dips
- ▶ protection settings.

## Planning tasks around the project life cycle



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Smart Grid Division  
Services  
Order No. IC1000-G240-A175-X-4A00  
Printed in Germany | AL=N ECCN=N  
Dispo 19210 c4bs No. 786  
fb 5215 WS 01141.0

Printed on elementary chlorine-free  
bleached paper.

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