



SIEMENS

Individual solutions for power system planning and operation

Rely on the leading knowledge and global experience of the Siemens Network Consulting experts

[siemens.com/power-technologies/consulting](https://www.siemens.com/power-technologies/consulting)

Answers for infrastructure and cities.

New challenges call for expert support

Reliable supply of electric power – at any time, any place, in any amount required, and always of the highest quality – is a key requirement for our modern, increasingly digital society. Meeting this requirement is everything but an easy task, and it has always relied on an extensive, complex, and sophisticated power generation, transmission, and distribution infrastructure.

Today, most power systems are facing drastic new challenges, such as the integration of large-scale renewable and distributed power generation, the introduction of Smart Grid technologies, an increasing degree of automation, faster and more detailed communications, and demand growing faster than capacity, all compounded by an increasingly aging infrastructure. The common denominator is that power systems are being called upon to operate closer to their limits, with higher intermittent power infeed, increasing transmission bottlenecks, stability issues, and risk of supply interruptions. In addition, market regulations, reliability standards, and advanced technologies are influencing economic and organizational framework conditions to a greater degree than ever before. Decreasing security margins, rising cost pressure, and increasing demand for system security and power quality even under operational contingencies must be managed in an economically efficient manner without compromising on safety or the environment.



On the way to a smarter, more efficient, and highly reliable power system

A number of different issues need to be addressed to get the power transmission and distribution infrastructure into shape for the next decades:

- ▶ **Long-term infrastructure investment planning:** A strategic and visionary road map is required for prioritization and early adoption of advanced technologies, risk reduction, and full-spectrum system planning.
- ▶ **Regulatory compliance:** Increasing regulatory compliance requirements and the need to move towards technical and operational excellence must be met.
- ▶ **Reliability:** Supply interruptions to customers must be assessed thoroughly to optimize the system's availability.
- ▶ **Performance:** Power supply must remain reliable with a growing share of renewable and distributed generation with a high degree of intermittency.
- ▶ **Security:** Transmission and distribution systems must remain stable after disturbances.
- ▶ **Technical infrastructure:** New equipment, such as Smart Grid technologies, is needed to meet the new, more demanding requirements caused by decreasing security margins, higher equipment utilization, and the increasing complexity of the systems.
- ▶ **Power quality:** Frequency, voltage profile, harmonic distortion, and other quality parameters need to be kept within permissible limits, even when operating under contingency conditions.
- ▶ **Efficiency:** In order to meet budgetary requirements, the infrastructure performance needs to become smarter and more cost-effective.
- ▶ **Safety:** Risks to people and equipment need to be minimized further.
- ▶ **Ecological performance:** Minimum environmental impact from power stations and network equipment, such as lines, are a must nowadays.



Network consulting that delivers on its promise

Siemens' network consulting services provide total strategic system planning services for operators, owners, and developers of power systems for public and private power supply. The solutions developed by Siemens' network consulting services, tried and tested in national as well as international projects, address the full spectrum of technical power system issues with the highest quality and the latest technology.

Maximum flexibility

Siemens' comprehensive portfolio, which comprises consulting services, system analysis tools, and training, provides the flexibility to generate optimized solutions to meet your individual needs. Whether the scope of your project is highly formalized grid code compliance validation, integration of Smart Grid technologies, the analysis of special equipment, or advanced dynamic analysis: The experience of the world-leading provider of network consulting services enables the development of a solution customized to your individual requirements.

Leading knowledge

Siemens experts are globally renowned for their in-depth knowledge built over decades of experience. By contributing actively to national and international committees and bodies, such as IEC, IEEE, CIGRE, CIRED, and VDE, Siemens influences future technical developments and standards. Together with continuous education and innovation, this forms the basis of Siemens' technological leadership.

Comprehensive network planning

Structuring and configuring your network demands an understanding of all technical and economical require-

ments. Siemens' objective is to facilitate reliable network performance and technology integration at any voltage level – including interconnection grid codes, regulatory compliance, system automation, protection coordination, power quality, and control strategies.

Focus on quality

The key focus of all Siemens network consulting services is on quality. This goes for all aspects of a consulting service. From the first inquiry and discussions, Siemens does everything to analyze and understand the specific situation and to deliver the optimum solution for each client's individual needs – considering the latest state-of-the-art technology as well as the practicability of proven solutions.

Vendor neutrality

Siemens' studies are based upon pure engineering and system optimization principles to address each client's situation. Equipment recommendations are equally vendor-neutral in order to achieve the optimal technical solution for the individual requirement. Siemens does not make recommendations for any specific equipment or vendor preference.

A comprehensive range of studies to support your needs

Siemens' portfolio of network consulting services covers the full range and complete life cycle of power system planning for public and private networks of any voltage level. While every single project has its individual needs, the available scope of services comprises all relevant aspects in the field of power system engineering. Thanks to the Siemens experts' vast project experience and comprehensive expertise, any conceivable requirement can be covered with a customer-oriented solution.

Steady-state system studies

- ▶ Network analysis – technical calculations of power networks in their present structure and configuration
- ▶ Network structure development – development and performance validation of alternative structures and configurations for power networks, from short-term operational planning to long-term master planning
- ▶ Neutral grounding studies – development and performance validation of appropriate neutral grounding concepts and configurations in power systems
- ▶ Earthing system measurement and design – measurement of specific soil resistivity, as well as development and performance validation of earthing system concepts and configurations
- ▶ Energy efficiency – analysis of losses in power systems and recommendation of efficiency improvements

Dynamic system studies

- ▶ Dynamic system analysis – modeling and analysis of dynamic performance of equipment, such as generators, motors, and systems
- ▶ Power electronics modeling and analysis – detailed modeling and performance analysis of AC/DC power converters, high-voltage direct current (HVDC) or flexible AC transmission systems (FACTS) equipment
- ▶ Controller and machine measurement, modeling, and analysis – detailed modeling and performance analysis of controllers, as well as measurement of controller response and performance on electrical machines

Transient system studies

- ▶ Transient studies – modeling and analysis of overvoltages and other transient phenomena, as well as detailed modeling and analysis of switching actions and their impact on system performance
- ▶ Insulation coordination studies – evaluation of voltage stresses and determination of appropriate insulation levels for equipment and systems



Protection and control system studies

- ▶ Protection system design and coordination – development of suitable schemes for power system protection and coordination of appropriate settings for protection relays
- ▶ Instrument transformer analysis – dimensioning of instrument transformers in substations and switchgear, especially current transformers in gas-insulated switchgear (GIS)
- ▶ System control and automation concepts – concepts, configurations, and equipment for communication, automation, and control in power supply systems

Power quality system studies

- ▶ Power quality measurements, analysis, and filter design – measurements, evaluation, and analysis of power quality phenomena, especially harmonics, development and performance validation of appropriate filters
- ▶ Interference and electromagnetic field analysis – analysis of interferences from power supply systems to other networks and systems, as well as modeling and calculation of electromagnetic fields

Technical-economic system studies

- ▶ Business case studies – modeling and analysis of economical concepts and aspects in the planning and operation of power systems for capital investment projects
- ▶ Energy market studies – modeling and analysis of entire power market and regulatory regimes and aspects, especially production cost modeling
- ▶ Asset management – modeling and analysis of the impact of asset service strategies with respect to the technical performance and reliability of power systems
- ▶ Due diligence – investigating and evaluating power supply operating companies considered as targets for future acquisition with respect to technical and economic current situation and performance as well as future plans

All requirements covered by a reliable partner

Siemens is a reliable partner for future extensions or modifications of your system and ensures optimized network performance through thorough consideration of the system as a whole. Aside from modeling, analyzing, and planning power systems, Siemens consulting services also cover the whole range of all requirements starting with analysis, evaluations by actual field measurements, disturbance investigations, such as post-event analysis, including proposals for suitable mitigation measures, and testimonials. Suitable software solutions round out the offering.

Studies	Measurements	Disturbance investigations	Expert testimony	System simulation and analysis tools
<ul style="list-style-type: none"> ▶ The typical core of Siemens' consulting services: based on the modeling, analysis, calculation and optimization of power systems ▶ Studies can also be complemented with additional services 	<ul style="list-style-type: none"> ▶ Practical evaluation of certain characteristics in power systems by actual field measurements of harmonics, earthing systems (soil resistivity, earthing impedances), and controller identification 	<ul style="list-style-type: none"> ▶ Expertise in analyzing the fragments of information that is available for post-event analysis ▶ Proposals for suitable mitigation measures ▶ Extended on-site surveys where required plus appropriate measurements 	<ul style="list-style-type: none"> ▶ Support in discussions with other stakeholders to present and explain technical aspects, concepts, and solutions 	<ul style="list-style-type: none"> ▶ Reliable tools from Siemens' leading Power System Simulator (PSS®) product suite ▶ Integration of commercially available third-party software tools into the delivery of the consulting services



Expertise at your fingertips – wherever you are

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



▶ PTI General

Siemens PTI's internationally renowned experts provide the knowledge and expertise required to combine individual equipment components to a complete power supply system that meets even the highest technical and economical demands. 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 regional offices around the globe, Siemens PTI is present on all continents. Wherever you are, Siemens PTI's unique supply network expertise is always in close reach.



▶ Software Solutions

Siemens PTI offers a suite of powerful software tools that support network 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 networks, 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.



▶ 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 provide a superior quality educational experience, so participants acquire practical skills with a focus on retaining these skills long term.

Published by and copyright © 2013:
Siemens AG
Infrastructure & Cities Sector
Wittelsbacherplatz 2
80333 Munich, Germany

Siemens AG
Infrastructure & Cities Sector
Smart Grid Division
Services
Power Technologies International
Freyeslebenstrasse 1
91058 Erlangen, Germany

Siemens Industry, Inc.
Siemens Power Technologies International
400 State Street
P.O. Box 1058
Schenectady, NY 12301-1058 USA
Phone: +1 518 395-5000

For more information, please contact
our Customer Support Center.
Phone: +49 180 524 84 37
Fax: +49 180 524 24 71
(Charges depending on provider)
E-mail: support.ic@siemens.com

Smart Grid Division
Services
Order No. IC1000-G240-A168-X-4A00
Printed in Germany | AL=N ECCN=N
Dispo 19210 c4bs No. 786
fb 5215 XX WS 0513X.X

Printed on elementary chlorine-free
bleached paper.

All rights reserved.
Trademarks mentioned in this document
are the property of Siemens AG, its affiliates,
or their respective owners.

Subject to change without prior notice.
The information in this document contains
general descriptions of the technical options
available, which may not apply in all cases.
The required technical options should therefore
be specified in the contract.