



Logical and Fascinating

Our Solutions for Power Transmission

Power Transmission and Distribution

SIEMENS

Connecting Power – a Big Opportunity

New developments on the global power market





Consequences of the deregulated energy market

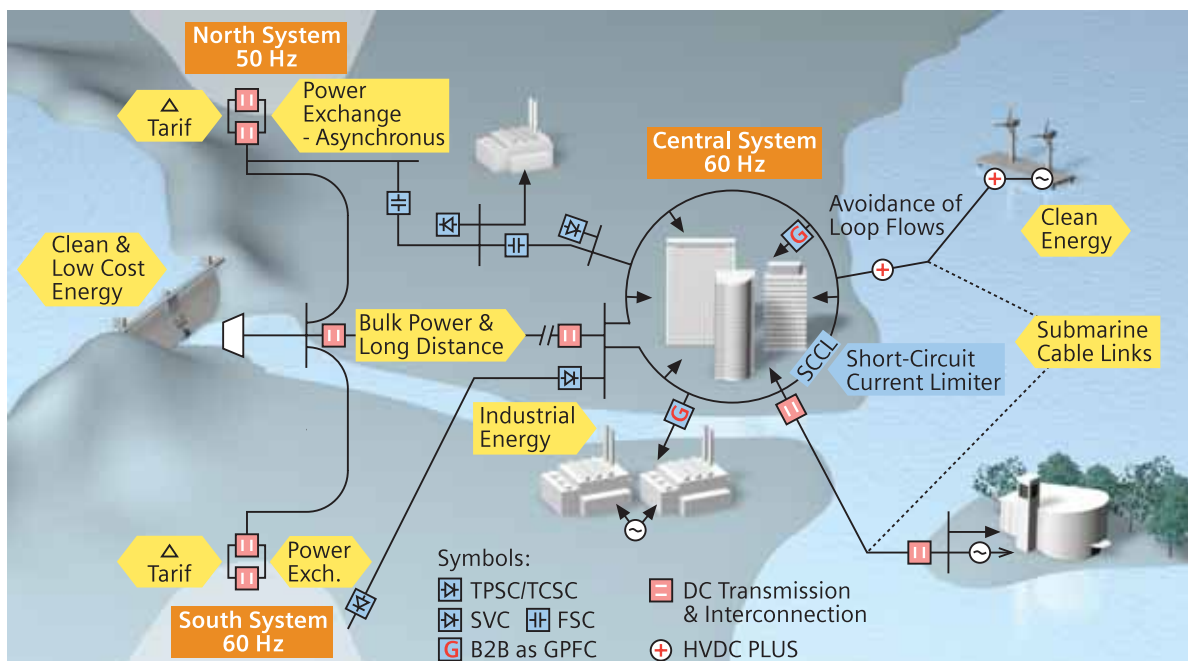
Following a number of initial years of adjustment, the changes resulting from the deregulated energy market have started to become apparent. And as they do, it is clear that the current trend worldwide is headed towards the interconnection of power generation systems. Interconnection allows exploitation of the advantages of different technologies for specific locations, and offers a way to achieve a cost-efficient and environmentally sound blend of conventional and regenerative methods of power generation, including nuclear, hydraulic, solar and wind power.

New challenges for power transmission

Feeding the power generated at different locations into previously separate power systems often calls for extraordinary power transmission and distribution solutions. Despite the challenges it poses, however, interconnecting different regions, countries or even continents remains a viable option for providing these areas with economical access to power. As solution providers with extensive experience in every aspect of power transmission and distribution, we've already implemented a number of projects linking power systems or connecting decentralized generating units to the grid. In each case, conditions were unique. And because we strive to provide our customers with the most cost-efficient results, our solutions using different technologies were also unique. This brochure offers descriptions of several such projects and solutions.

Advanced solutions for AC/DC transmission

Today's power transmission systems have the task of transmitting power from point A to point B reliably, safely, efficiently and ecologically. Siemens Power Transmission and Distribution offers comprehensive solutions, technical expertise and worldwide experience to help you meet these challenges. For each application and technical transmission stage, we offer optimized solutions with High-Voltage Direct-Current Transmission (HVDC) or Flexible AC Transmission Systems (FACTS) for the most efficient use of AC power systems and lines.



A Partner you can count on

Supporting you every step of the way



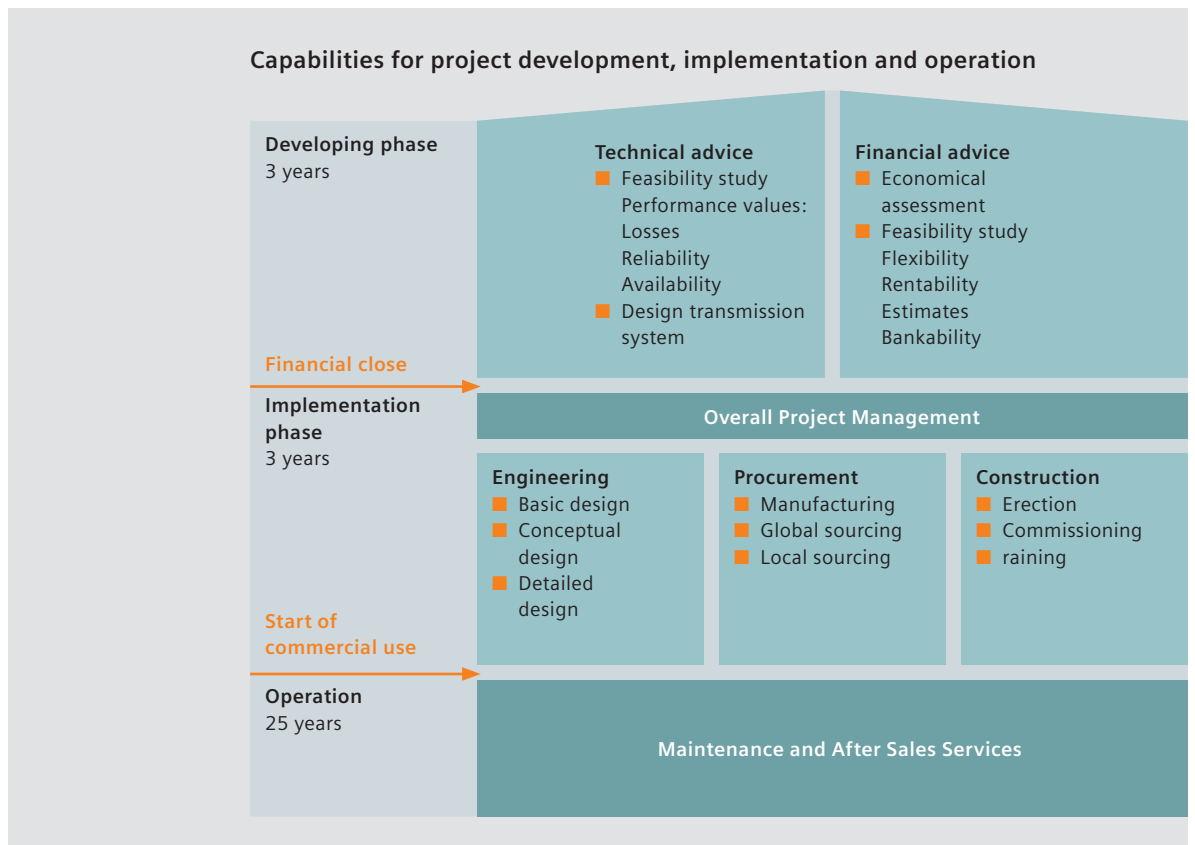


Trendsetters on the global energy market

At Siemens PTD, it's our goal to always have the right solutions ready to meet our customer's changing demands. That's why we're continuously monitoring the energy market for early signs of new developments – and constantly looking beyond just the technological aspects. Our comprehensive project support for all areas of power transmission and distribution means our customers can count on the best possible service worldwide at all times.

Partners throughout the life cycle of your system

We're with you every step of the way to help you develop your project, create financing solutions and provide project management. And our support goes beyond engineering, production and construction. It continues as the system is commissioned, as you need maintenance services, and even when it's time to modernize. As you can see, our partnership doesn't stop when a turnkey job is finished. We accompany our customers throughout the entire lifecycle of their system, offering them a wide range of services. Naturally, our products are of the highest quality and are always based on the most durable technologies.



Example: Neptune RTS DC Cable Link, USA

The purpose of the 105 km 500 kV DC undersea and underground cable link is to transmit 660 MW of power from the Sayreville substation in New Jersey to Duffy Avenue substation on Long Island, thus providing LIPA (Long Island Power Authority) with access to the very competitive PJM Interconnection, a multi-state energy market on the east coast of the USA. In a consortium with Prysmian, Siemens Power Transmission and Distribution will provide engineering, procurement and construction services for manufacturing and installation of the cable, construction of the converter stations and installation of station components. With the demand for electricity growing at a record-breaking pace on Long Island, this project will enable LIPA to improve its service to more than 1.1 million customers and provide an environmentally friendly, cost-effective solution to future power needs.

The project is scheduled for completion by the end of July 2007.



Example: Switchgear Project, Mexico

In response to a request for bids by the Mexican power supply utility Comisión Federal de Electricidad (CFE), Siemens offered 13 substations, based on the condition that payments would be effected in leasing installments starting from the turnkey completion of each substation.

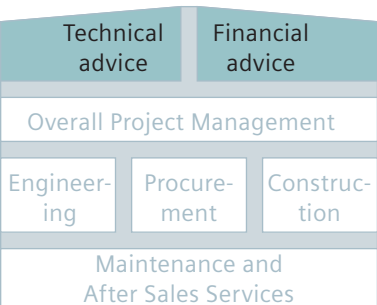
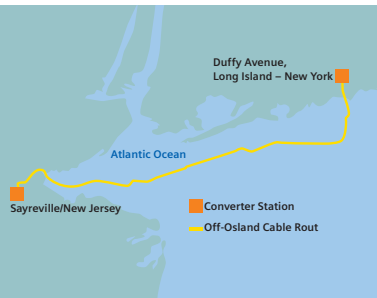
After having been awarded the project, Siemens established a Mexican project company which signed the contract and reached financial close with approximately US\$ 100 million through loans from professional investors in the US and Europe, as well as approximately US\$ 77 million through bank credits. It was also necessary to reconcile the various legal stipulations of Mexico, the US and England.

At completion of each substation, ownership has been transferred to a trust company (formed by the Siemens project company, CFE and a financial institution). With the last two installments per substation, ownership will be transferred to the CFE. The last payment will be effected in July 2013.



Good Advice for Turning Ideas into Projects

Benefit from our wide experience in international projects

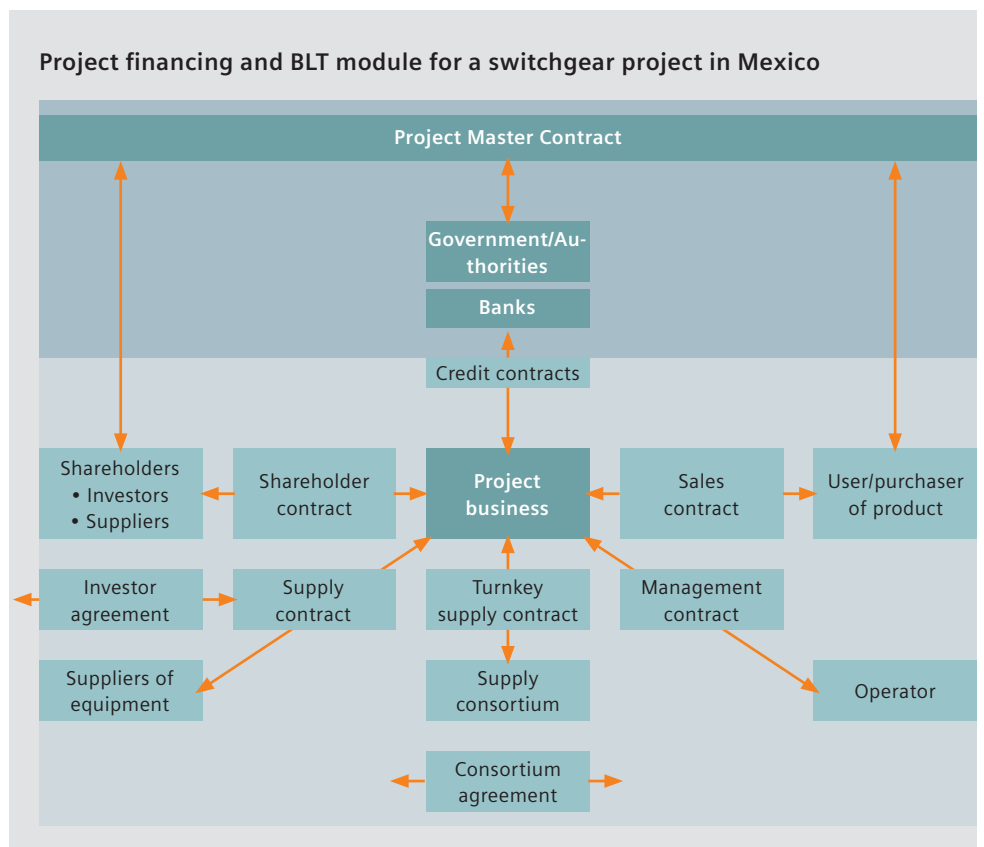


Project development

Given the complexity of today's projects, our customers are increasingly opting to include us right from the start in the development of their projects. In such cases, our consultants offer the benefit of their project experience to help clarify legal conditions, assess the various technical options and draw up feasibility studies. Often there's more than one technical solution for any given task. So it's extremely important to verify ahead of time whether, for example, a DC or AC transmission system will be best in terms of cost-efficiency, reliability and availability. With our help, you can be certain you're making the right decision.

Financing

Financial considerations should never interfere with the implementation of a carefully conceived and worthwhile project. That's why we offer individualized financing solutions, including developing a financing concept and finding the right partners to set you up in a win-win situation.



Example: Basslink, Australia

Although the idea of connecting Victoria on the Australian continent to the offshore island of Tasmania and creating a link for transferring the power generated at either end was conceived decades ago, its implementation was not begun until the year 2000. A joint consortium that includes Siemens and Pirelli was established for handling every aspect of this complex project. Our customer's requirement profile placed no limits on the technology but did define clear economic goals. The agreement had to guarantee high availability and a transmission efficiency of 97%. We accepted this challenge along with the many other country-specific obstacles needing to be dealt with during the pre-project phase. These included the preparation of environmental, cultural and sociological studies in close cooperation with our customer, establishing agreements with the aboriginal community and the Australian unions, and carrying out public relations work in Victoria and Tasmania. We took our role as consortium leader very seriously – and we were successful. With the support of the parent company, our local project team managed to pave the way for this extraordinary project. As of November 2005, hydro and wind power produced on Tasmania supply Melbourne during peak periods, while Tasmania's connection to the Australian power system ensures a reliable power supply regardless of climatic conditions.



Example: HVDC Turnkey Project, India

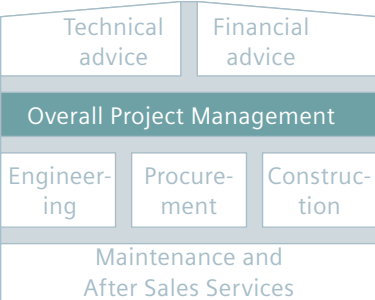
Two months ahead of schedule we managed to complete this complex turnkey project connecting India's Eastern Region with the Southern Region by an HVDC transmission system. The purpose of the project, which was partially financed by KfW, is to transmit 2,000 MW of electrical power from the subcontinent's eastern end to the rapidly growing industrial and high-tech areas in the south. We achieved our goal by establishing an HVDC connection that covered a distance of around 1,450 km. In addition to the technical implementation, this turnkey project also included design, financing and, of course, overall project management for coordinating all partners involved.





Decide what you need and let us take **care** of the Rest

If you wish, we can manage your entire project



Project management

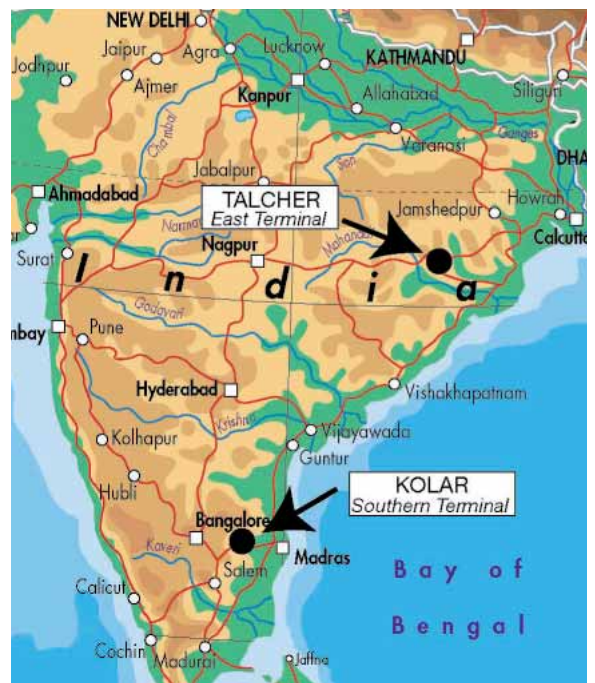
Supplying power is more than just combining a number of individual components. It calls for large-scale projects, such as transmission systems or industrial complexes, especially in countries where the demand for power is growing at an accelerated pace. The best partner to handle such large projects is an expert who can carefully analyze the demand, take an integrated approach to project planning and consider all the general conditions.

In other words, a qualified project partner providing high-quality components and services for both power transmission tasks and power system management, and who can also ensure that the systems are expertly installed.

Turnkey solutions

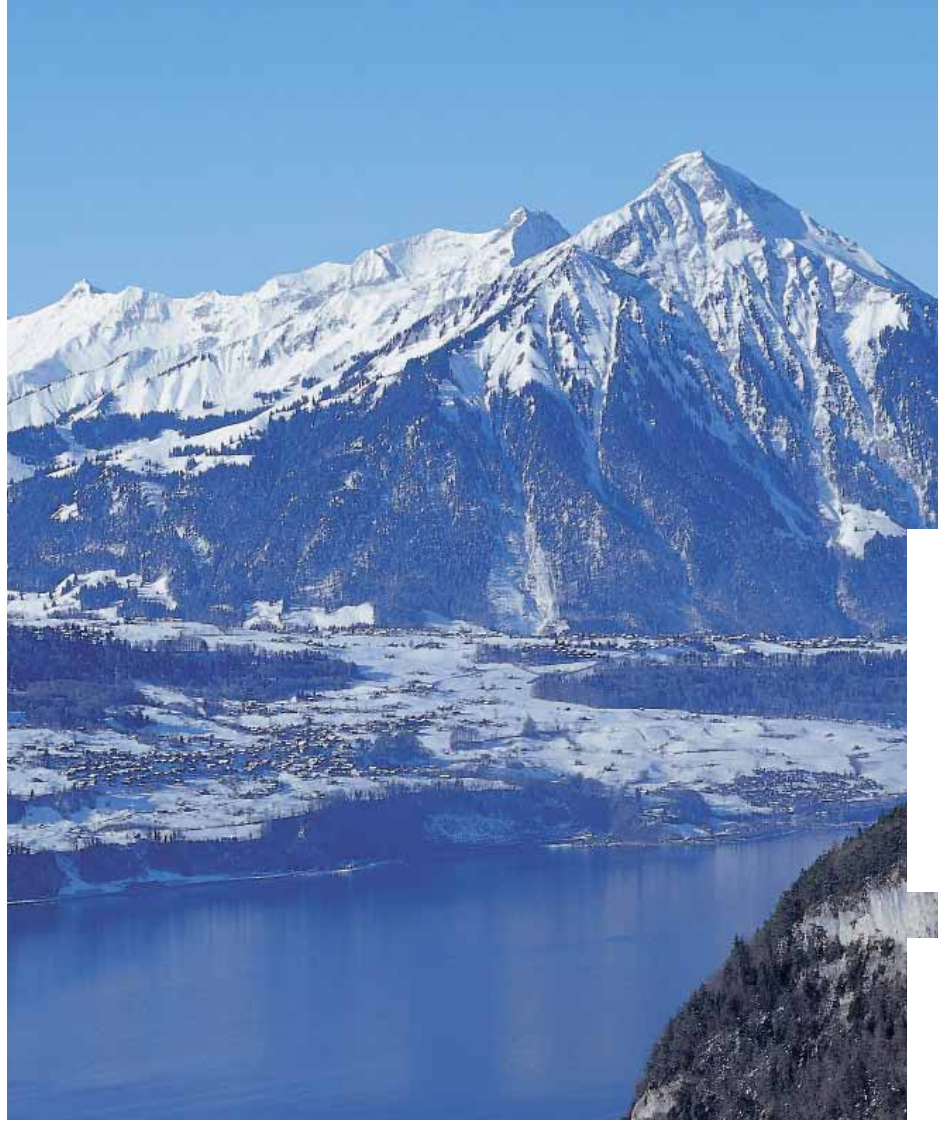
Based on our many years of experience, we're able to offer turnkey power transmission solutions that are tailored to individual requirements. We supply all components, including generator terminals, AC or DC transmission systems, as well as high-voltage interconnected power systems with high, medium and low voltage that finally reach the individual customers. What makes these turnkey solutions so attractive is that one party is responsible for coordinating the entire project, thereby reducing the number of interfaces between customer and supplier to a bare minimum.

Turnkey projects also reduce the customer's own share in project risks, since we're responsible for delivering a system ready for operation.



Example: GIL, Switzerland

The exhibition center in Geneva was getting crowded. A new hall was badly needed, but a 300 kV double overhead line stood in the way. Our answer was to go underground, bridging a distance of 500 meters and setting up the world's first high-voltage link featuring a gas-insulated transmission line (GIL) with $N_2 SF_6$ gas mixture insulation. The line owner based his decision to opt for a GIL solution over a cable solution on the GIL's much better values with respect to EMC. High sensitive electronic equipment can now be exhibited and operated in the new hall without any danger of interference from the 300 kV connection located below it. Technically speaking, this was the best and most cost-effective solution for the power network operator.



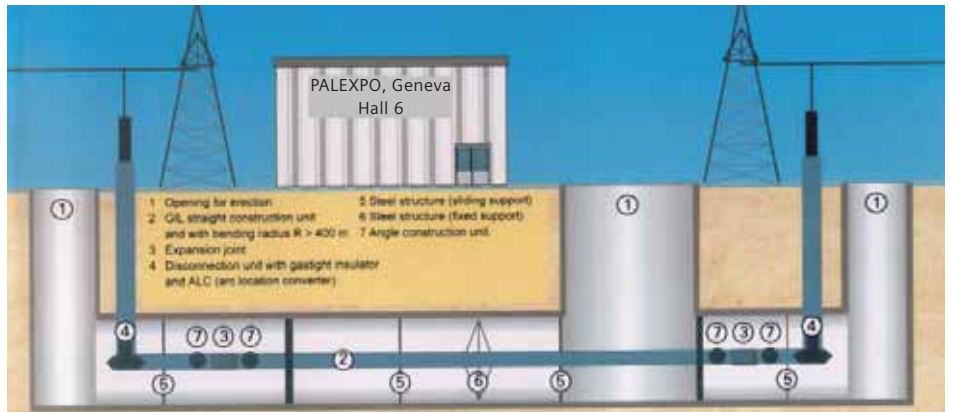
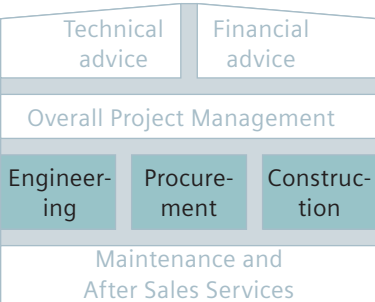
Example: "I-Shape" Project, Thailand

In Thailand, Siemens PTD was awarded a contract for delivery of a turnkey project providing a total of 15 AIS and GIS substations for the country's 115 kV grid. The name "I-Shape" comes from the fact that all the substations are located in the south of Thailand, which greatly resembles the letter "I". The main challenge in implementing this particular project was the precise logistics requiring that work be performed on all substations simultaneously throughout the delivery and installation period – with a distance of 800 km between the northernmost and southernmost substations.



EPC and Manufacturing Expertise

We'll find the most efficient solution with the best technology

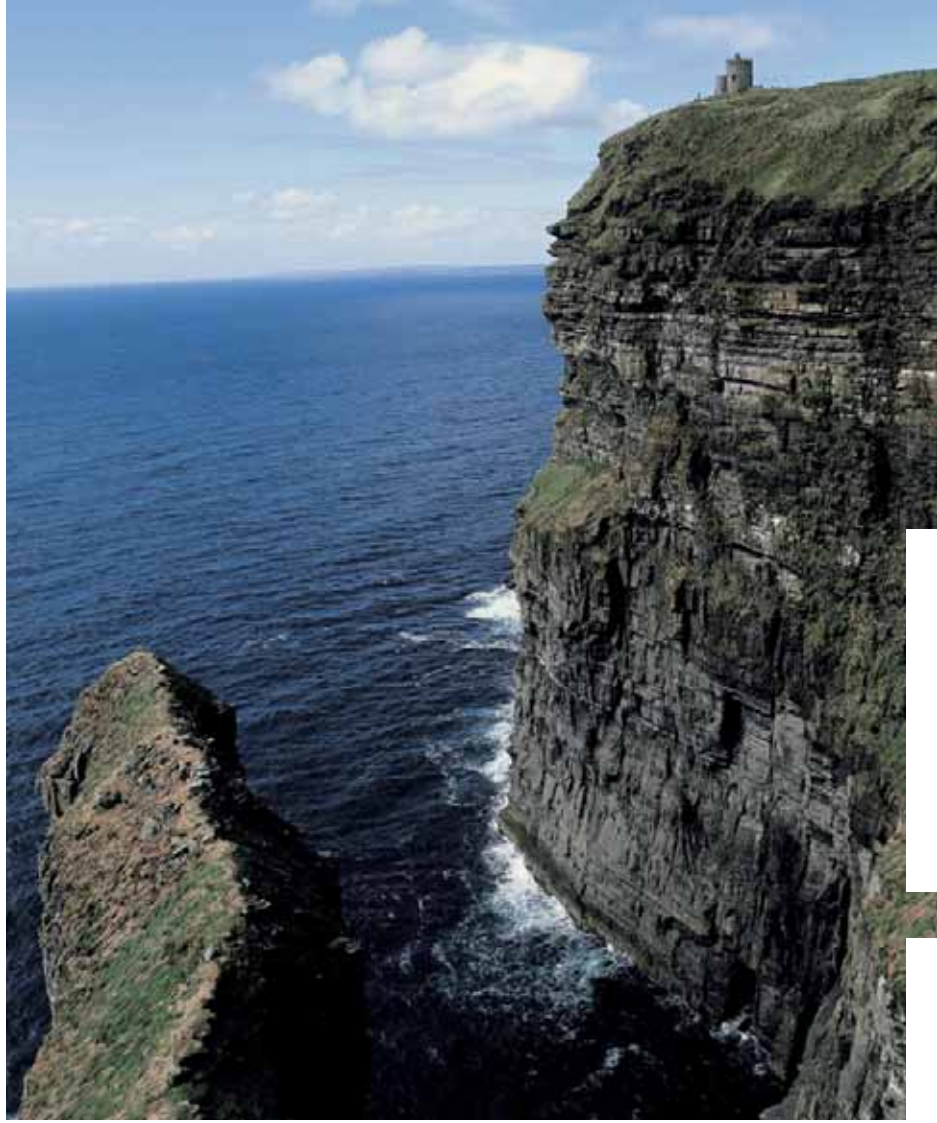


Engineering, procurement, production and construction

In addition to our comprehensive planning and management services, engineering is one of our special strengths, and we can produce or procure all necessary components and perform all construction work up to testing, commissioning and putting an entire system into operation. With Siemens Power Transmission as your partner, you benefit from our extensive manufacturing expertise and from the work of our experienced engineers who have already participated in a wide range of projects worldwide. Working on this excellent basis, we can provide the best technology for your project based on our own proven components and additional hardware purchased from reputable vendors. Our experts have the important task of determining which of the various technical options are best suited for implementing the project. They consider transmission capacity, transmission efficiency and the length of the transmission line, and once the best technical solution has been determined, they assess its long-term cost-efficiency for the operator. Only then can the actual implementation begin for installation and on-time commissioning.

Example: Moyle Interconnector, Northern Ireland/Scotland

With the Moyle Interconnector project, Siemens Power Transmission and Distribution linked the power networks of Northern Ireland and Scotland via two submarine cables along the bottom of the Irish Sea. This system serves to connect Northern Ireland to supply networks in Great Britain and, by extension, to the European network. Since completing this multi-year project, we have also provided full service for the new HVDC technology. This service package covers all the components implemented by Siemens for a period of five years and at a fixed price. A specialist service team frequently inspects all primary and secondary systems to ensure that the performance and availability levels, contractually stipulated for the HVDC system, are maintained.



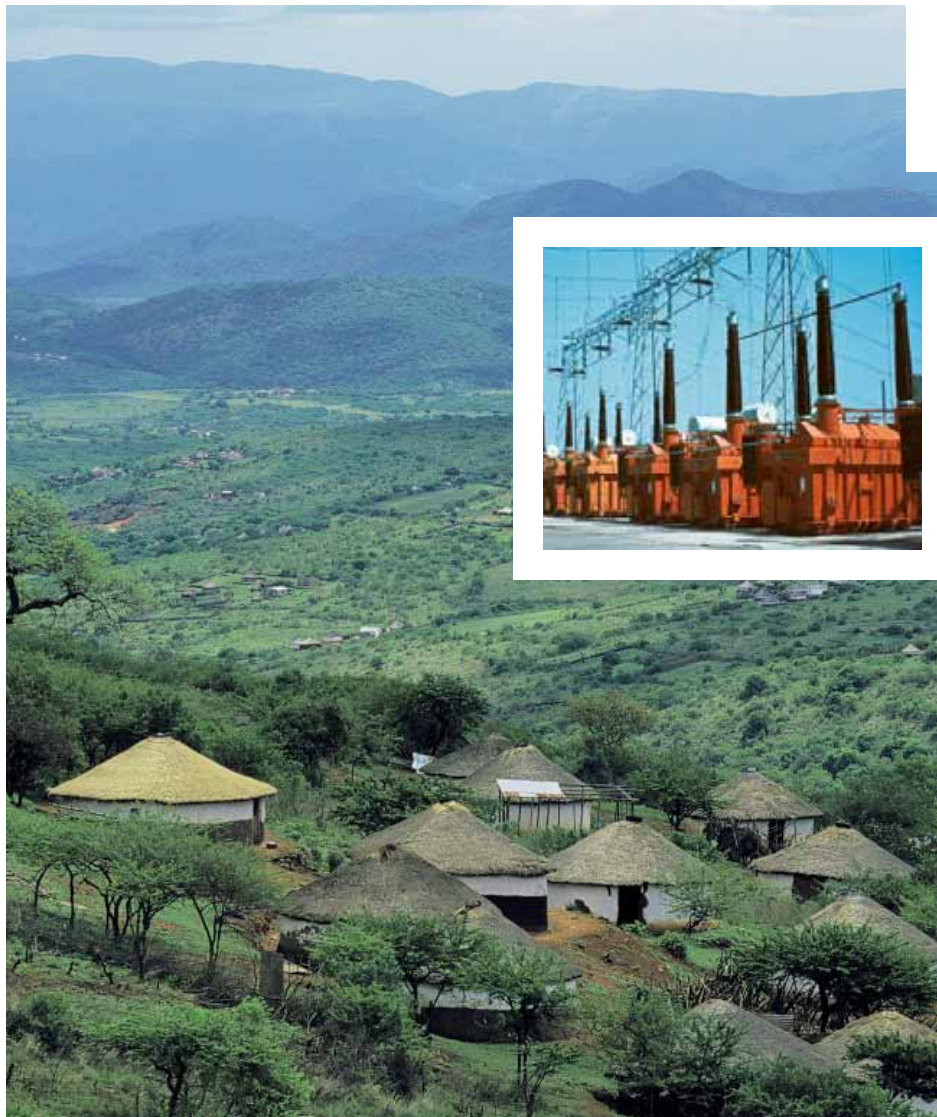
Example: Rehabilitating the Cahora Bassa Transmission System, Mozambique

The Cahora Bassa HVDC system is used to transmit the power generated in a hydroelectric plant on the Zambesi river in Mozambique to South Africa.

During the 1980s, the transmission line was extensively damaged by terrorist attacks and the system remained down until 1997, when Siemens undertook the rehabilitation of the two converter stations at Apollo in South Africa and at Cahora Bassa in Mozambique. In addition to carefully restoring the main equipment, the complete DC control was replaced by a fully digital, computerized system including a modern human-machine interface (HMI).

The Cahora Bassa HVDC converter station was additionally supplied with new state-of-the-art high-voltage SF₆ circuit-breakers, replacing the old high-maintenance air-blast breakers. The new system considerably boosts availability and reliability of the complex HVDC system in terms of operator guidance.

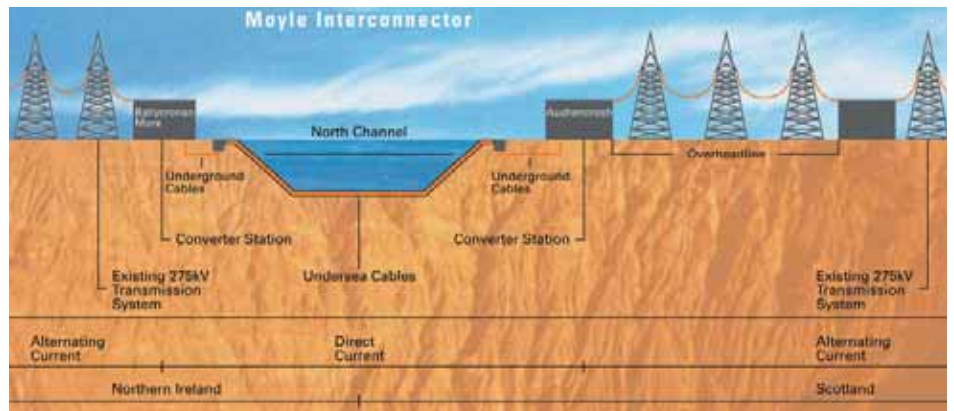
Carrying out high quality repair of the spare transformers on-site in Mozambique posed a special challenge, because the 180-ton units couldn't be transported across a damaged bridge over the Zambesi river.





Five, ten, twenty Years or **more**

Our partnership lasts a lifetime



Maintenance

Your system will operate at its best, when your equipment lasts a long time and provides continuous trouble-free operation. Our maintenance service ensures that all components are always running safely and reliably.

We continuously maintain your system through regular inspections, which naturally include all switchgear as well as secondary technology.

If a malfunction occurs during operation, we're immediately on the job, and our support team is available 24 hours a day, 365 days a year.

And with our increased use of state-of-the-art online monitoring and remote diagnosis systems, we offer you additional possibilities for keeping operating costs to a minimum.

Optimization and modernization

Obviously you can never replace your equipment and systems fast enough to keep pace with technological progress. But you can take advantage of the latest technological opportunities through the variety of optimization options provided by our retrofit and upgrade service. This fast and economical solution allows you to invest your capital wisely, and take full advantage of our experience in adapting older systems to new technical standards.

The right **Technology** to fit every Need

An overview of the technological solutions we offer

Flexible AC Transmission Systems (FACTS)



With this technology, Siemens Power Transmission and Distribution is offering high-performance components that optimize power systems. Typical applications for FACTS include fast voltage control, increased transmission efficiency over long lines, power flow control via meshed systems and power swing damping. With FACTS, more energy can be stably transmitted within the power system.

Efficient High-Voltage Direct-Current Transmission Systems (HVDC)



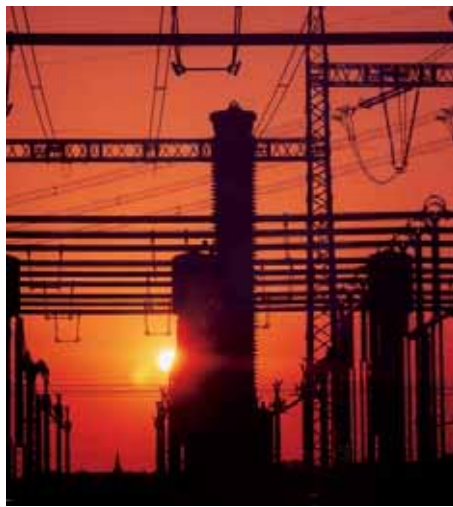
For bulk power transmission across distances over 800 km (500 miles) from 1,000–4,000 MW and more, High-Voltage Direct-Current Transmission (HVDC) is a cost-effective alternative to three-phase technology. The reduction in overhead line costs of up to 35 % quickly compensates for the higher investment costs demanded by this technology. HVDC technology has already been used numerous times for undersea transmission via submarine cables. The parallel operation of HVDC systems and HVAC connections has proven cost-effective in a number of cases. HVDC back-to-back converters allow coupling of grids, elimination of loop flows and controlling of power flow.

HVAC and HVDC grid access solutions for decentralized power generation units



Decentralized generating units are custom-engineered, which involves reconciling contrasting parameters, such as high reliability, low investment costs and efficient transmission in the best possible solution. Specific attention is paid to intelligently designing the “collection systems” at medium-voltage level, which is followed by the high-voltage transmission system offering the grid access. By relying on both transmission technologies, Siemens can offer AC and DC solutions at both the high and medium-voltage levels. The technical constraints of a decentralized generating unit in connection with AC cables are well known and addressed accordingly. Our engineering expertise includes everything from the conceptual and basic design to digital and real-time simulation, and we also assume responsibility for presenting the solution to the grid owner.

High-voltage switchgear (AIS/GIS/HIS)



Siemens Power Transmission and Distribution offers an extensive range of internationally proven air-insulated (AIS) and gas-insulated (GIS) switchgear from 52 to 800 kV for indoor or outdoor applications. This switchgear, along with our comprehensive expertise in system construction and engineering, allows us to offer the right solution for every application, from compact space-saving systems to turnkey switching substations.

Gas-insulated transmission lines (GIL)



When environmental or structural factors make overhead lines impossible, our “underground” transmission path is the ideal solution. Our gas-insulated transmission lines (GIL) are an economically viable alternative to conventional power cables. The high safety standard of these lines permits trouble-free installation in tunnels along any traffic routes, including railways and streets. And GIL is also available for direct underground burial, providing environmentally friendly, reliable power transmission.

Siemens AG
Power Transmission and Distribution
High Voltage, Project Development
P.O. Box 32 40
91050 Erlangen
Germany
www.siemens.com/hvdc-facts

Please contact us at:
E-mail: h-contact.ptd@siemens.com
hvdc-facts.ptd@siemens.com
ptdhgis@ptd.siemens.de

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