India – Perspectives of Grid Developments

Ever since its early days, Siemens has been known for its openness to international trade relations. Long before globalization became a buzz word, company founder Werner von Siemens looked beyond national boundaries. Siemens business in India started with the construction of the Indo-European telegraph line from London to Calcutta finishing in 1870. In this tradition Siemens PTD was conducting business with India for many years and nearly six years ago a new department was formed to offer more service to our customers.

It has grown steadily during this time and over the last five years has built up a reference project list of more than 225 switch bays for voltages ranging from 66 to 400 kV. The business includes various technologies ranging from air and gas insulated switchgear up to 765 kV, to HVDC and FACTS systems.

During the development a high value was set on issues as Project Management according to the latest project guidelines from Siemens refer to our Newsletter 04.10.: “Project Management (PM) @ Power Transmission and Distribution“, with distinctive competence in:
- Processing
- Engineering and
- a strong procurement department.

The Indian market for high voltage systems is developing at a rapid pace. This market includes FACTS (Flexible AC Transmission Systems) business. Increasing demand for electricity and a growing awareness of the need for reliable power supplies have prompted POWERGRID (the utility company which operates India’s high voltage transmission networks) not only to continue with its expansion program but also to strengthen its networks with FACTS systems. Under this expansion program Siemens already secured its first order to supply series compensation systems in mid-2003. A further order was placed in the summer of 2004.

The FSC Southern Region Project (ref. to “FACTS References”) includes a total of 4 nos. Series Compensation Systems in two double 400 kV transmission lines in both the Gooty and the Cuddapah substations in the southern part of the country. Siemens PTD Germany was responsible for the offshore package for this order while Siemens in Delhi processed the entire onshore part of this € 10 million project.
Three of the four FSC installed under this order (which is being financed by the customer) went into service on schedule in the Fall of 2004. The second FSC Bank in Gooty is due to be energized in February 2005, following completion of the new overhead transmission line being built by POWERGRID. The four FSC systems will then safeguard reliable power transmission from Eastern India to the South of the country. These overhead transmission lines, which run parallel to the HVDC interconnector linking Kolar and Talcher - also built by Siemens in “Power Transmission and Distribution East-South Project”, can actually carry up to 30% more power in the event of failure of the HVDC link. In this respect they provide a partial backup for the interconnector and so ensure reliable power transmission all down the line. FACTS

New project with new technology in Northern India
POWERGRID awarded Siemens the order for another four TCSC/FSC systems in May 2004. The services required under this FACTS order (known as the TALA High Capacity East-North Interconnector II-Project) will be split between Head Office in Germany and the Dehli Office in much the same way as for the previous project. The Reactors, Capacitors Banks, MOVs, Circuit Breakers, Spark-Gaps, Thyristor Valves and the Control System for this World Bank-financed project will be supplied by Siemens Germany, all other services will be provided by Siemens India. The two substations Purnea and Gorakhpur in northern India will have Fixed Series Compensation (FSC) and Thyristor-Controlled Series Compensation (TCSC). Refer to Fig. 1.

The project (worth of total of €25 million) will help to stabilize power transmission from NE India to the northern parts of the country. There, in a floodplain area between Purnea in Bihar State and Gorakhpur in the State of Uttar Pradesh some 50 km north of the Ganges, new 400 kV AC overhead power lines will be erected over a total distance of 475 km. These transmission lines are scheduled to enter into service in early 2006 at the same time as the FACTS equipment and will then provide a reliable transmission path for delivering power from eastern India to the load centers in the north of the country.

Siemens PTD portfolio - Outlook
This project and the previous similar one both utilize surge arrestors, reactors, series gaps and the bypass switches. Furthermore, all of the SIMATIC control and protection equipment and the Light Triggered Thyristor (LTT) Valves. Given the rapid growth in India’s energy market, PTD is committed to provide its FACTS technology and enhanced design.

References
Prestige projects processed by Siemens PTD India to date include the following:

- 400 kV air-insulated substation in Nelamangala commissioned is one of the largest substations in the whole of India and, with its recent extensions, possibly even one of the largest of all Siemens reference substations (with 21 Circuit-breakers for 400 kV and 18 circuit-breakers for 220 kV).
• 400 kV GIS THDC substation: This order includes 7 GIS bays and two tunnel-laid gas-insulated 400 kV tubular conductor systems of 752 and 765 meters in length. Work is due for completion in the spring of 2005.

• 500 kV DC 2000 MW HVDC East-South Interconnector II: Siemens India (ref. to: "HVDC References") was awarded the order for the air-insulated switchgear (including civil works), and is processing the ancillary systems and local services for this project. The DC transmission system was commissioned ahead of the scheduled delivery date. Refer to Fig. 2.

Fig. 2: East-South Interconnector II

• 400 kV series compensation systems for PGCIL: Three of the four FSC-stations were commissioned right on schedule in November 2004. The project will be finished in February 2005 with the commissioning of the last station.

• In addition to the domestic orders listed above, Siemens Ltd. has scored major successes in Bangladesh where it has an 80% share of the market. It has secured Siemens’ first turnkey order in Qatar, and has also commissioned several substations in Sri Lanka.

To summarize, Siemens PTD in India can offer highly developed turnkey capabilities for practically all conceivable project types in the HV business sector, which continues to grow throughout the region. Siemens PTD has a proven ability to conduct professional turnkey project business.

**International Workshop for ± 800kV HVDC systems**

Powergrid Corporation of India Ltd. (POWERGRID), the Central Transmission Utility of India and EPRI, USA – a leading research organization in the field of Electrical Power, in association with HVDC manufacturers are jointly organizing a workshop on ± 800kV HVDC systems. The workshop shall be held on the 25th and 26th February, 2005 at New Delhi, India. Siemens, one of the worldwide leading companies of HVDC technology is invited, too.

HVDC power transmission is an established technology for bulk power transmission over long distances from the remote generating stations to load centers. A number of long distances HVDC schemes are in operation across the world at voltage levels up to 500kV/600kV, for example Cahora-Bassa (1930 MW) and Nelson River 2 (2000MW) (refer to: "HVDC References"). However for transmission of bulk power of the order of 4000 – 6000MW over long distances (2000 – 2500 km), it is important that HVDC transmission technologies for voltage levels above ±600kV are developed.

The Government of India has taken initiative for harnessing over 50,000 MW power potential in different river basins in the country. There is large hydro potential in certain regions which is being developed in a phased manner. POWERGRID has been entrusted with the task of planning and implementing power transmission systems to link generation and load centers. The total power transfer capacity of about 12,000 MW would be required by the year 2016-17 and the length of the...
transmission lines involved would be in the order of 2000-2500 km. In view of this, POWERGRID is considering the adoption of UHVDC (Ultra High-voltage DC) systems up to ± 800kV voltage levels. Similarly in countries like Brazil, China, South Africa and Russia also a number of large capacity hydro-electric projects are being developed with load centers located at distant locations. For such very long distances/high capacity power transmission schemes, HVDC power transmission at voltages above ±600kV would provide techno-economical advantages.

The Electrical Power Research Institute (EPRI), USA had sponsored a research program to determine critical problems in developing HVDC converter station equipments for voltage levels higher than ±600kV. A similar study was carried out by CIGRE.

HVDC holds considerable technical and economical benefits. It provides means whereby more stability can be brought to a meshed network. Further, the ability to tap-off to supply remote loads needs further study. In many instances, it will be the particular applications themselves that will drive the adoption of HVDC.

The purpose of the workshop is to discuss all aspects of ± 800kV HVDC systems including the following issues:

- Assessment of technology for realizing HVDC systems up to 800kV
- Status of development of HVDC systems above 600kV
- Establish technical parameters of equipment exposed to HVDC voltages up to 800kV
- Development of prototype equipments and testing for HVDC voltages up to 800kV
- To understand the technical, economical and environmental drives behind future HVDC schemes
- Surface concerns relating to aging of existing HVDC schemes (lines and converters) and what this means for the future schemes.