This massive project, albeit still termed a demonstration project, consists of a 640 km long 1000 kV transmission line with two substations and a switching station, with a nominal voltage of 1000 kV and a maximum operating voltage of 1100 kV, and is estimated to have cost RMB5.7-billion (about US$830-million or R6.7-billion). During December 2008 commissioning tests were conducted at the substations and commercial operation started on 6 January 2009.

**A world first**

It is the first time ever that a transmission system of this voltage level utilising GIS and HGIS has been put into commercial operation and it represents the most significant international achievement in high voltage power transmission. The project is a key element in the development of China’s electric power transmission backbone, the UHV power highway as it is known, transmitting power from the coal-based power stations in the north-east and the hydro-based power stations in the central and southwestern regions of China, to the massive load centres on the eastern and southern seaboard.

**Reliable and dependable power supply to drive economic development**

In his keynote address to the 2009 UHV conference, Liu Zhenya, President of the SGCC, alluded to the critical importance played by the SGCC (the largest of China’s two power transmission utilities) in the socio-economic development of the country and in pursuing a clear objective for the development of clean / renewable energy to become a major component of the country’s energy supply. By the end of 2008, SGCC had in operation 619,000 kilometres of transmission lines (above 35 kV) and a transformation capacity of 1.6 TVA. The SGCC sold 2124 TWh of power with an income of RMB1156-billion (US$172-billion/ R1387-billion), making the SGCC rank 24th on the 2008 Fortune Global 500 list. Liu indicated that it is forecast that by 2020, China’s electric power generation capacity would reach 1600 GW (South Africa’s present installed capacity is about 40 GW), while demand will reach 7700 TWh. The clear need for SGCC to develop an efficient UHV power highway to get such massive quantities of power to consumers is thus obvious, and even more so, considering that the SGCC serves more than 1 billion of China’s population and covers an area of nearly 8.5 million square kilometers! By 2020 China’s clean and renewable energy (wind, solar and hydro) capacity will reach 570 GW (about 35% of installed capacity).

Being strong is the basis of being smart

A critical element in the development of a UHV grid in China is the construction of a strong and smart grid. “Being strong is the basis of being smart”, hence the importance of UHV for the development of a smart grid. SGCC’s goal of a smart grid is an IT-based, digitalised, automated...
and interactive grid that is reliable, economical, with high efficiency, clean and environmentally friendly, transparent and interactive. SGCC UHV backbone will soon comprise networks of 1000 kV AC, ± 800 kV DC and ± 1000 kV DC, supported by subordinate grids at lower voltages. SGCC plans to have a fully integrated smart grid in operation by 2020.

Trans-Africa Projects participation

A Trans-Africa Projects delegation comprising of Barrie Badenhorst and Chris van der Merwe, respectively General Manager and Power Systems Consultant at TAP were invited by the SGCC to attend the conference. TAP was the design consultant for the Northwest China Grid Corporation when it developed its 750 kV AC system demonstration project (referenced to South Africa’s 765 kV AC grid). They then also participated in an exclusive site visit, together with the Secretary General of CIGRE, Jean Kowal; Enno Liess, Vice President of the IEC; Dr. Klaus Froehlich, Chairman of the CIGRE Technical Committee; and Alessandro Clerici of WEC, to the Jingmen Substation (3000 MVA transformation capacity and 600 Mvar reactive shunt compensation at the present demonstration phase) at the southern end of the 1000 kV line and to the Three Gorges hydro-electric dam project (which is about 200 km from the substation).

As a matter of interest, the Three Gorges Project will within the next few months have all 32 of its turbines operational and will then generate more than 22 000 MW (32 x 700 MW), which is more than half of South Africa’s installed capacity.

Localisation and strategic development

China and her power utilities have very strategically utilised the development of its electrical power generation and transmission network to stimulate a world standard domestic power equipment manufacturing base. For the 1000 kV project, it successfully developed its 1000 kV/1000 MVA single phase transformers – a world first – and equally so its 1100 kV 320 Mvar single phase shunt reactors; and a world-best 1100 kV, 6300A, GIS (with a rated breaking current of 50 kA), on top of which massive quantities of research and development went into tower design (the highest of which is 123 m where the line crosses the mighty Yellow river), cable and conductor production, and insulation, amongst others. The only commercial production base for equipment in the 1000 kV voltage range is now in China.

It was remarkable that, during rigorous questioning by the delegation, a functionary at the Jingmen substation explained that after its first four months of operations, the 1000 kV line has not had a single fault; design, operational or otherwise. This was borne out by the logs kept at the substation control centre. The main thrust behind the development of the UHV power highway is responsibility SGCC carries to ensure a reliable and dependable power supply for the continued and accelerated economic development of China. It is the result of a rational and integrated development planning process in China, something many other countries can surely learn from. When a foreign delegate mentioned that it took a certain part of his organisation more than 18 years to finalise planning for the construction of a short power line, it was met with astonishment by his hosts. That sort of thing does not happen in China! It took China four short years from initial planning to the operationalisation of its 640 km long 1000 kV Line. That must also be a world-beating first!

A case indeed of “Being strong is the basis of being smart”!

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