India’s rapidly expanding economy’s hunger for power is the nodal point for both the government and manufacturing industries. India has planned several capacity additions to overcome the huge challenge of the increasing gap between demand and supply of power. The country has planned capacity additions of around 75,000 MW during the next five year plan (2012-17) from conventional energy sources, such as coal, gas, and large hydro projects. In addition, around 13,000 MW of capacity addition is also planned from renewable energy sources. Supporting these massive expansion plans calls for improvements in transmission & distribution (T&D) infrastructure and in other grid related infrastructure. Usually some plants, especially hydropower plants, are constructed very far from the populated areas, requiring long distance transmission. Hence, there are high power losses in transmission and distribution. The T&D losses, amounting close to 30 percent, are one of the biggest challenges for the country.

The present scenario has made it imperative to take initiatives towards improving T&D and other grid related infrastructure. Recently, the country’s largest power transmission company, Power Grid Corporation, opted for ultra high voltage direct current (UHVDC) technology for creating power super highway, supplying the hydro electric power from north eastern India to the city of Agra. The company has selected ABB together with BHEL to deliver ultra high voltage transmission system for supplying hydropower to over a distance of 1,700 km. The deal is worth over $1.1 billion - ABB will deliver $900 million worth of the project and the remaining will be delivered by BHEL. The 800 kV UHVDC link will be able to supply electricity to over 90 million people and will prove beneficial to reduce transmission losses.

Both BHEL and ABB first implemented HVDC technology in India with 500 kV HVDC transmission system in 1991. BHEL has previous experience in handling projects, which include 500 kV, 1,500 MW Rihand – Dadri HVDC project; 500 kV of NTPC; 1500 MW of Chandrapur – Padghe HVDC project of MSEB; and 500 kV, 2,500 MW Ballia – Bhiwadi Project of PGCIL. Now the company along with ABB will execute a 800 kV project of PGCIL with system engineering, design, supply and installation of three HVDC converter stations. The system is expected to be operational in 2015.

India’s UHVDC transmission system is expected to be the world’s first UHVDC link with three converter
stations. Two converter stations will be used for converting power from AC to DC for transmission over a single line for delivering electricity to the third converter in the receiving station at Agra for converting power back into AC for its ultimate use.

Normally AC transmission offers high power handling capability for short distances. This capability is also dependent on the voltage of supplies and the thermal rating of the conductor. In case of long distance transmission, high impedance level reduces the capability of AC transmission lines. In such a scenario, DC technology is considered as a more economical and technically viable option, which offers 30-40 percent lesser transmission losses compared to AC lines at the same voltage levels. The technology with the help of rectifiers and inverters offers better control over voltage and current of electricity supplies and increases the energy efficiency. 800 kV UHVDC technology results in lower transmission cost for transmitting bulk power of more than 5,000 MW over distances of more than 1,000 km. It is also very useful for delivering electricity to the urban population with minimum number of transmission lines. The technology is capable of interconnecting large electricity grids and for stabilizing parallel AC systems.

The major challenges of deploying UHVDC technology are developing reliable equipment and systems for delivering electricity in a safer manner, and ability to withstand higher voltage levels. This calls for deployment of suitable equipments, such as transformers and breakers, among others, and new transmission lines and insulating equipments suitable for ultra high voltage supply. Presently, all the supporting equipments for 800 kV UHVDC system are available in the market. Although the initial investment in all these equipments and the technology seems too expensive, the lifecycle cost with significant reduction of T&D losses, reduced operational costs, and such other benefits make it economically feasible.

Please send in your views on this topic to pdewangan@arcweb.com.