

India Inc's maiden High Voltage Direct Current (HVDC) System project

A historic journey of building bulk power highway with capacity to transmit 2500 megawatts of power from Mundra (Gujarat) to Mohindergarh (Haryana) in a single hop of about 1000 kilometres

This journey dates back more than a decade ago when Adani Power Limited acquired an order to provide 1424 MW power to the state of Haryana for 25 years. Considering the available business infrastructure of that time this was a herculean task. The Mundra - Dehgam Transmission system built could cater at maximum about 1200 MW.

The need of the hour was strengthening the system which presented key challenges such as adding new lines, space limitations in existing substations and additional transmission cost.

We went back to the drawing board. What followed was hundreds of man hours of extensive brainstorming, empirical calculations macro-economic analysis and weighing long-term business opportunities. High Voltage Direct Current (HVDC) Transmission system emerged as the path towards a robust future. Incidentally, Haryana was constructing a 400 KV substation at Mohindergarh which was touted to become the hub for other load centers in the state.



It was a Eureka moment. It was decided that HVDC transmission system that shall act as a bulk power highway with capacity to transmit 2500 megawatts of power from Mundra (Gujarat) to the load centers in the National Capital Region (NCR) through an inverter station at Mohindergarh (Haryana) in a single hop of about 1000 kilometres. This was the first time any private player was getting into constructing a transmission system to build such a system.

But HVDC technology requires special know how and cutting edge equipments. So far only two government agencies could opt for this technology. There was risk and there were chances of failure but taking calculated risks has been a signature feature of the Adani Group. After a careful evaluation of the pros and cons a conscious decision was taken to go for HVDC.

What is HVDC?

HVDC transmission system consists of a rectifier station to convert power from 400 KV alternating current to 500 KV Direct current, a two-pole transmission line which converts power from 500 KV Direct current form to 400 KV alternating current mode.

HVDC transmission system can transmit bulk power over long distances in a single hop over a single transmission line. Besides being economical over long distance, the technology also minimizes transmission losses, less disturbance en-route to the residents and the flora and fauna.

Another unique feature of HVDC transmission system is its capacity to precisely control the amount of power which should be transmitted. This capability of HVDC makes it most useful during grid disturbance in preventing blackouts.

"High Voltage Direct Current (HVDC) is state of art technology that can transfer the bulk power from one place to another place with single hop over long distance. This system offers variety of fine control to change power at will and other stabilising features. The system is also cost effective and acts as a fire wall against cascade disturbances.,



Fig. Mundra HVDC Switchyard

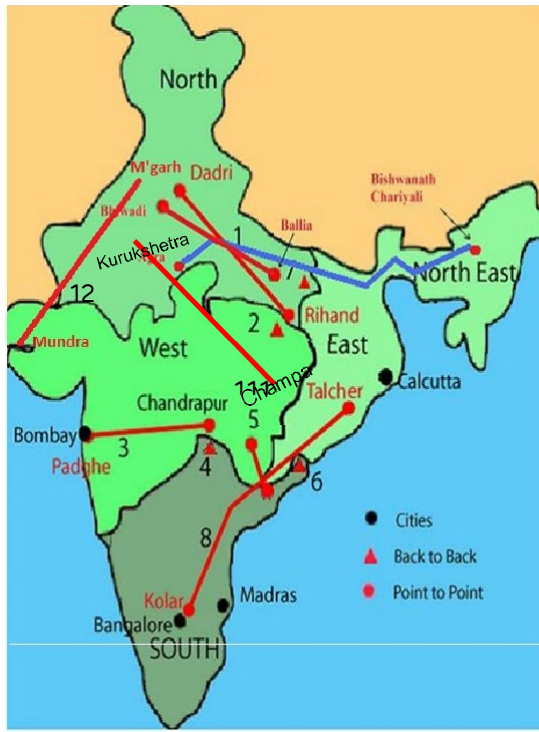


Fig. HVDC Terminal



Fig. Mohindergarh HVDC Switchyard

HVDC Scenario in India:



- 1 – Rihand-Dadri (+/- 500 kV,1500MW)
 - 2 - Vindhyachal (2 X250 MW)
 - 3 - Chandrapur-Padghe (+/- 500kV,1500 MW)
- MSTCL
- 4 - Chandrapur-Ramagundam (2 X 500MW)
 - 5 – Barsoor-Lower Sileru (100 kV, 100MW)
 - 6 – Gajuwaka (1 X 500 MW + 1 X 500 MW)
 - 7 - Sasaram (1 X 500 MW)
 - 8 - Talcher-Kolar (+/- 500 kV, 2000MW, upgraded to 2500 MW)
 - 9- Ballia-Bhiwadi (+/- 500 kV,2500MW)
 - 10- NER-Agra (+/- 800 kV, 6000 MW Multi-Terminal, under execution)
 11. Champa-Kurukshetra (+/- 500kV, 6000 MW)
 - 12. Mundra- Mohindergarh (+/- 500 kV, 2500MW)**

The onset of HVDC Journey:

It was the very first time that any private player was getting into constructing such a kind of system in India which made it certain that it was not going to be a smooth sail. There was much preparation work to be done before getting on the floor. Since, HVDC was a relatively newer technology, having sound knowledge and technical know-how for the same was essential. Getting people skilled in this area was a tedious task. Talent acquisition wasn't easy. As a result, trainings and knowledge sharing forums were organized for all the people involved in the project. For empowering our manpower we conducted the following measures

- Class room trainings in erection and commissioning
- Site visits of experts for assessment and addressing doubts
- Lectures and on-site training by Siemens
- Weekly knowledge-sharing sessions
- Visits and trainings at similar HVDC station under operation i.e. Talcher - Kolar and Ballia - Bhiwani

Simultaneously, international bids were invited to build HVDC terminal station and line. Since it was something that was not an ordinary job, each contractor was meticulously evaluated and allocated for the specified jobs.

Experience during Construction of HVDC:

In the transmission sector there is a common saying, "Each tower foundation is a project in itself". The experience was no different.

- Severe Right of Way
- Scarcity of experienced and Skilled manpower/Contractor
- Forest Approval- tedious process.
- Unpredictable weather condition
- Challenging terrain and approaches.

During the construction of HVDC line in 2010, the nature went against us. There was unprecedented rain in creek area of Gujarat. The stringing work was nearly impossible as the region was submerged in chest-high water.

Even under such adverse situation, Team Adani refused to give up.

We owe our success such committed teams.

It is often said that challenges always make us stronger. While executing HVDC stations, we came across unique problem.

Thyristor in HVDC stations are housed in valve hall, which is kept air tight and slightly pressurized to avoid dust entry. Inside the valve hall aluminium cladding is provided to give electromagnetic shielding as technical requirement.

Conventional valve halls are huge concrete structure and take considerable time to construct. Mundra-Mohindergarh was fast track project, to avoid bottling of power. It needed out-of-the-box thinking.

Our engineers had explored various possibilities in consultation with suppliers and came out with unique solution for going for Pre-fabricated steel structure valve hall, which was not tried by anyone earlier.

Prefabricated structure allows parallel working using modern construction tools like man lifter, Pneumatic spanners etc. This involved altogether different type of structure involving suspended heavy load from the roof. The new valve hall design has steel lattice structures with cladding inside and outside with appropriate exits for high voltage power. Precision in fabrication was another challenge. The market was explored and best vendor was selected. This type of fabrication was new to the vendor. The vendor also took it as a challenge and finally we could complete the valve hall structure in very short time. This was very unique experience for us.

HVDC project has many 'first' to its credits:

- **First private** sector Company in the country to build High Voltage Direct Current (HVDC) System spanning ~1000 Kms, with maximum capacity of 2500MW
- **First project** of this nature to be completed in a record time of 24 months and **First** of its kind project registered in Clean Development Mechanism (CDM).
- **First** to use pre-engineered building solutions for valve hall instead of conventional concrete structures.



Fig. HVDC Valve Hall