

# TRANSMISSION BUSINESS



**Transforming Today  
for a Better Tomorrow**









# About BHEL

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BHEL is India's largest engineering and manufacturing enterprise in the energy and infrastructure sectors. Established in 1964, we are a leading power equipment manufacturer globally and one of the earliest and leading contributors towards building an Aatmanirbhar Bharat. We serve our customers with a comprehensive portfolio of products, systems and services in the areas of Power (Thermal, Hydro, Gas, Nuclear & Solar PV), Transmission, Transportation, Defence & Aerospace, Oil & Gas, and Water.

Right from developing country's power generation capacity to creating multiple capabilities in country's core industrial & strategic sectors, BHEL is deeply aligned to the vision of a self-reliant India.

## **BHEL has a widespread network of**

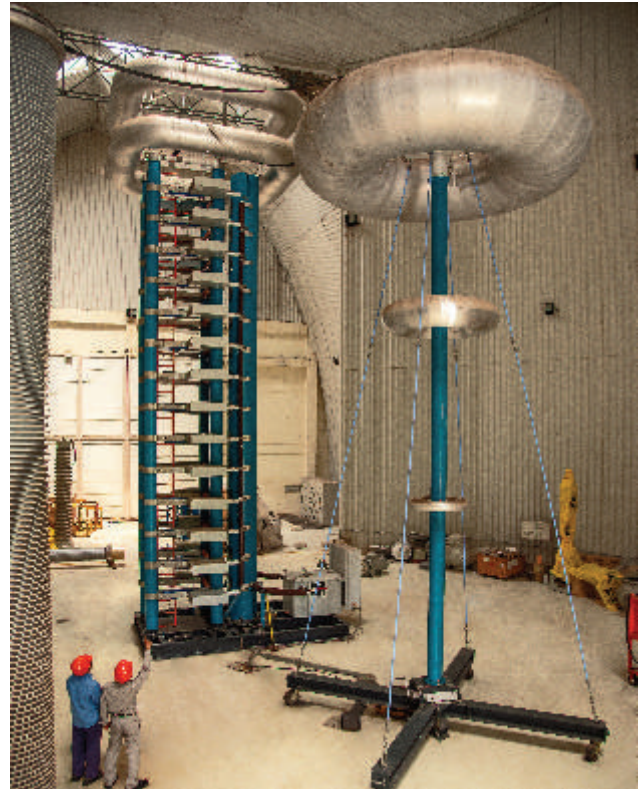
- 16 Manufacturing Plants
  - 2 Repair Units
  - 4 Regional Offices
  - 8 Service Centres
  - 15 Regional Marketing Centres
  - 3 Overseas Offices and more than 150 Project Sites
  - Footprints in 86 countries across 6 continents
  - Installed more than 1000 utility sets in Thermal, Hydro, Nuclear & Gas based Power Plants
  - Contributes to 53% of Total Installed Conventional Power Generation Capacity
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# BHEL in Power Transmission

## A Powerful Presence of Over Four Decades

BHEL is a well-established solution provider in the field of power transmission having a vast experience of more than 4 decades in this Industry.

Having its core competencies encompassing design, engineering, manufacturing, construction, testing, commissioning and servicing, BHEL offers a wide range of Transmission Systems and products with contemporary technologies and conforming to International Quality standards.



*Ultra High Voltage Laboratory  
established at Corporate R&D, Hyderabad*

**45+**  
years of  
Experience

**225+**  
Electrical Substations &  
6 major HVDC Projects

Supplied  
**7,00,000+** MVA  
Transformer/Reactors

*400 kV Switchyard at 1x700 MW Bellary, STPS*





# Concept to Commissioning and Beyond

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Practising the philosophy of concept to commissioning and beyond, BHEL is committed to provide customer-oriented cost-effective transmission solutions and services as an EPC contractor for EHV substations, High Voltage DC (HVDC) converter stations and Power Quality & Stability Solutions (FACTS) backed by expert Power System Studies.



*765/400 kV Substation at Raichur*



## **EHV Substation:**

BHEL has a rich EPC experience of execution of EHV & UHV class Electrical Substation/Switchyard projects(both AIS & GIS type)ranging from 33kV to 765kV. With modern EPC infrastructure, expert man power and world class in-house facilities, BHEL has executed more than 225 substations in India & abroad for utilities and industries covering a vast array of applications:

- Grid Substations
- Tailor-made Power system for oil refineries
- Industrial Receiving Substations
- Switchyards for Thermal, Hydro, Nuclear and Renewable Energy based Power Generating Stations
- HVDC Converter Stations and associated Switchyard



## HVDC Systems and Products:

BHEL has vast expertise in HVDC domain and has executed major HVDC projects upto 800kV in India.

BHEL has state of the art manufacturing facilities for HVDC equipment and has supplied own make major products like converter transformers, reactors, thyristor valves, control panels, capacitor banks, instrument transformers, insulators, SCADA etc for these projects.

Major projects executed by BHEL are :

- 1500 MW,  $\pm$  500 kV Rihand-Delhi HVDC project.
- 1500 MW,  $\pm$  500 kV Chandrapur-Padghe HVDC project.
- 200 MW, + 200 kV National HVDC Experimental Line.
- 2500 MW,  $\pm$  500 kV Balia-Bhiwadi HVDC Project
- 6000 MW,  $\pm$  800 kV North-East Agra UHVDC Project (World's largest multi terminal HVDC System).
- 6000 MW,  $\pm$  800 kV Raigarh-Pugalur UHVDC project.



*498 MVA, 400 kV Converter Transformer for Ballia-Bhiwadi HVDC Project*



*Indoor DC hall at NE Agra HVDC terminal*





## Flexible AC Transmission System (FACTS) solutions

BHEL provides turnkey solutions for Reactive Power Management systems for both grid and industrial applications.

BHEL undertakes the complete feasibility studies, system studies, system design and installation on turnkey basis. The major FACTS solutions offered by BHEL are:

- Fixed Series Compensation (FSC)
- Static VAR Compensation (SVC)
- IGBT based Static Compensators (STATCOM)
- Thyristor Controlled Shunt Reactor (CSR)
- Phase Shifting Transformer (PST)



*Fixed Series Compensation Scheme at Ballabhgarh*

# Innovations & Solutions

## Phase Shifting Transformer (PST)

An innovation of BHEL's in-house R&D, PST is a combination of Shunt & Series transformer units that control real power flow between the two networks by providing desirable phase shift between the systems. BHEL has designed, manufactured, installed and successfully commissioned India's first and the only 400 kV PST at Kothagudem TPS of TSGENCO (Telangana State Power Generation Corporation Limited).



*India's first 400 kV Phase Shifting Transformer*

## Thyristor Controlled Shunt Reactor (CSR)

BHEL indigenously developed and commissioned India's first Controlled Shunt Reactor for application in 400 kV system which offers all the advantages of a permanently connected shunt reactor while overcoming its disadvantages through thyristor valves based control system to operate it on continuous mode. With this, the required amount of reactive power (from zero to full capacity) can be controlled based on grid requirements .



*India's first 400 kV Controlled Shunt Reactor  
at Itarsi Substation*

## Gas Insulated Switchgear (GIS)

Over a period of time, GIS has gained popularity in Power Transmission considering its compactness, reliability, ease of maintenance and its growing application in the areas having space limitations.

Under the Govt. of India's Initiative of Atma Nirbhar Bharat, through its in-house R&D efforts, BHEL has indigenously developed Gas Insulated Switchgear (GIS) for EHV range.

BHEL offers prompt after-sale services by its expert engineers and assures ready availability of crucial spares for the GIS.



*BHEL make 145kV GIS at Vittalwadi Substation*

## Digital Substation Solution:

BHEL has successfully commissioned Digital Substation solution with India's first indigenously designed and developed 420 kV Fibre Optical Current Transformers (FOCTs) along with IEC 61850 compliant Intelligent Electronic Devices (IEDs) viz. Merging Unit (MU), Switchgear Control Unit (SCU) and Bay Control Unit (BCU) at Bhiwadi (Rajasthan) .

BHEL is fully geared-up and now offers the complete EPC solution in this domain.



# Manufacturing Capability and Offerings

BHEL has state of the art manufacturing facilities and offers the following in-house manufactured products:



*Country's first 1200kV power transformer at PGCIL's Bina test station*

## **Power Transformers / Reactors**

- HVAC Power Transformers for voltage up to 1200 kV
- HVDC Converter Transformers up to 800 kV
- Series and Shunt Reactors up to 765 kV
- Dynamically Controlled Shunt Reactors up to 400 kV
- Phase Shifting Transformers for EHV & UHV applications
- Special Transformers including Dry type Transformers up to 15 MVA

## **Instrument Transformers**

- Current Transformers up to 400 kV
- Fibre Optical Current Transformers up to 400 kV(FOCT)
- Electro-Magnetic Voltage Transformers up to 220kV.
- Capacitive Voltage Transformers up to 1200 kV

## **Control & Protection Equipment**

- Control & Relay Panels
- Substation Automation System (SAS)
- SCADA
- Bay Control Unit (IEC61850 Compliant)
- Merging Unit (IEC61850-9-2-LE Complaint)
- Switchgear Control Unit (IEC61850 Compliant)

## **Switchgears**

- Vacuum Circuit Breaker (3.3 kV - 33 kV)
- Gas Insulated Switchgear (GIS) for EHV range.



*80 MVAR, 765 kV shunt reactor at Greater Noida Substation*





*400 kV Substation at Andal, West Bengal*

### **Capacitors**

- HVDC and FACTS applications
- SVC as Shunt capacitors, AC filter capacitors
- Series capacitors in FSC/TCSC

### **Bushings**

- Wall bushings up to 245 kV
- Oil cable box bushings up to 400 kV
- Bushings for higher creepage, cantilever load & altitude (145 kV-420 kV)
- OIP condenser bushings-52 kV to 525 kV for transformer application

### **Thyristor Equipment**

- Thyristor Valves for HVDC transmission up to 800 kV

### **Insulators**

- Disc insulators up to 1200 kV AC (530kN) & 800 kV DC (420kN) application.
- Hollow Porcelain up to 765 kV
- Solid core insulators up to 400 kV



*Thyristor Valves for Raigarh-Pugalur HVDC project*

- Long Rod Composite Insulators up to 765 kV AC (210kN) &  $\pm 800$  kV DC (420kN) application.

### **Power System Studies**

BHEL has a team of experts who have vast experience with utilities and manufacturers in India and abroad. BHEL undertakes Power System Studies, Feasibility Studies and Insulation Coordination Studies, etc. using the latest hardware and software tools.





*765/400 kV Bhuj (new) Substation.*



*Ultra High Voltage Testing Laboratory at Bhopal*

## A Trusted Partner

- A rich experience of more than four decades in Power Transmission & Distribution.
- Proven performance in multiple profiles-EPC contractor, equipment supplier, consortium partner and service provider
- Dedicated infrastructure and experienced manpower for manufacturing and commissioning of transmission equipment
- An enterprise with a wide-spread manufacturing base, regional centres and offices across the country to respond with minimum turnaround time and to provide after-sales-services and spares on long term basis.

## Testing Facilities

BHEL has ultra high voltage laboratory at par with international standards and is one of the largest screened testing facilities in the world for testing Transformer, Valves (Thyristor, IGBT) attached to its manufacturing plants.



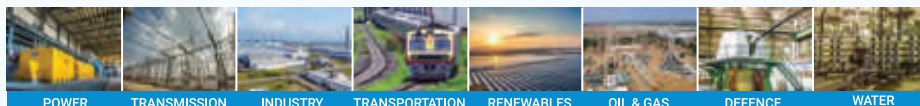


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