







POWER & ENERGY

3x660 MW Lalitpur Supercritical Thermal Power Plant





Bharat Heavy Electricals Limited

About BHEL

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 to its customers 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 is leveraging on its technology capabilities and committed workforce to transform itself. Asserting leadership in core business, diversifying the business mix, cost optimisation, efficiency optimisation & innovative technological solutions are the major enablers driving company's competitiveness in its businesses.

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



800 MW Supercritical Thermal unit in Bellary, Karnataka

Bharat Heavy Electricals Limited

193 + GW power generating capacity installed across the world

Undisputed leader amongst India Power Plant manufacturers

BHEL is synonymous with the growth of Power sector in the country. We are one of the few companies in the world having the capability to manufacture the entire range of power plant equipment, with proven capabilities for executing thermal, gas, hydro and nuclear power projects.

BHEL's first coal-based set was installed at Basin Bridge in Tamil Nadu in 1969. Since then, BHEL has joined an elite club of select global giants by installing a staggering 193 GW+ of power generating equipment worldwide.

660 MW supercritical unit of Lalitpur Super Thermal Power Project (STPP), Uttar Pradesh



Coal Shed under construction at 2x660 MW Maitree Supercritical Power Project in Bangladesh - EPC by BHEL

Thermal Power

BHEL has proven turnkey capabilities for executing power projects from concept to commissioning.

We are capable of executing coal-based power projects on Engineering, Procurement & Construction (EPC) basis for subcritical & supercritical technologies up to 1,000 MW rating.

BHEL also offers state-of-the-art emission control equipment for coal-based plants for lower carbon footprint complying to the revised emission norms notified by the Government of India. BHEL is the pioneer in domestic manufacture and supply of Flue Gas Desulphurisation (FGD) System for SOx control and is executing a large number of orders for FGD systems for both, old and new plants. In addition, BHEL is also offering Selective Catalytic Reduction (SCR) system for NOx control for coal-based plants. In the gas-based power segment, BHEL offers gas turbines and matching generators ranging upto 299 MW (ISO) rating, tailored to meet specific needs, for both open and combined cycle operation.

Commissioned Power Projects Based on CFBC Technology upto 250 MW rating

TECHNOLOGY FOR A SUSTAINABLE FUTURE

- In-house development of Advanced Ultra Supercritical (AUSC) technology, Low Rating Supercritical Sets and Coal Gasification for Coal to Chemicals
- Secured orders for 56 supercritical steam generators (27 SGs have been commissioned) and 51 supercritical turbine generators (21 TGs have been commissioned) in India
- Manufacturer of Circulating Fluidized Bed Combustion (CFBC) Boilers
- Supplying Electrostatic Precipitators (ESP) for control of Particulate matter for boilers

2x660 MW Super critical power plant under commissioning by BHEL at Suratgarh, Rajasthan



Nuclear Power

INTE

50% of India's Total Installed Nuclear Power capacity amounting to 6.78 GWe comes from BHEL manufactured Steam Turbine Generator Sets Reliable Partner in development of Indigenous Nuclear Power Program since its inception in 1974 NPCIL's Kaiga Unit-1 equipped with BHEL-supplied nuclear power equipment



Steam generator for Nuclear Power Corporation of India Limited (NPCIL)

A leader in the Indian Nuclear Power Industry

Only Indian Company to supply Nuclear Steam Turbines for Indian Nuclear Power Programme.

Only Indian Company associated with all 3 stages of Indian Nuclear Power Program.

BHEL has supplied and installed complete Turbine Island equipment for 12 out of 18 PHWRs that have been installed in the country, accounting for 74% of India's Indigenous installed capacity. BHEL is executing Turbine island equipment for 4x700 MWe PHWRs and has successfully synchronised India's highest rated first 700 MWe Turbine at Kakrapara Unit 3. Customer in turn has reposed faith in BHEL by placing the largest order in Indian Nuclear Segment of Rs. 10800 Crs. for installation of 6x700 MWe 'TG Island' on 'EPC basis'.

BHEL has also executed the Turbine Island equipment for 2nd stage FBR of 500 MWe rating being constructed at Kalpakkam by BHAVINI. For the 3rd Stage of Nuclear Power Programme, BHEL has developed the Secondary Cycle (Power Generating Side) for 300 MWe Advanced Heavy Water Reactors (AHWR) in association with BARC.

For the projects being installed under foreign cooperation, BHEL has been lending its capabilities for execution of both Primary Side and Secondary Side Erection Packages.

With competences across both Primary and Secondary Side of NPP, BHEL is gearing up for development of complete EPC capabilities in Nuclear Power Segment.

Hydro Power

Harnessing the Hydro power

BHEL is one of the leading players in the hydro power segment with a portfolio of over 500 hydroelectric sets, and a cumulative capacity of more than 31,000 MW globally.

With 46% of country's installed hydro power capacity equipped with BHEL supplied

electro-mechanical equipment, BHEL is the market leader in the Indian hydro power segment.

BHEL's hydro plants are successfully performing in India & across the world including Afghanistan, Azerbaijan, Bhutan, Malaysia, Taiwan, Tajkistan, Rwanda, Thailand, New Zealand, Nepal & Vietnam BHEL has the capability to deliver complete hydro power plants including design, engineering, supply/ logistics and erection & commissioning.

Hydro turbines in the range of 5 MW to 400 MW unit sizes of various impeller types namely Francis, Kaplan and Pelton along with matching generators are designed, engineered, manufactured and tested at BHEL's own manufacturing plants. 88% of the total installed capacity in the state of Arunachal Pradesh in the hydro sector is through BHEL equipment.

BHEL commissioned the 4x150 MW Kameng Hydroelectric project- the largest unit rating (150 MW) hydro power project in Arunachal Pradesh. The Francis Turbine commissioned in the project is designed to operate at a rated head of 501 meters, making it the highest head Francis Type Hydro Turbine in the country. The project is expected to generate 3,353 Million Units (MU) of clean electricity annually.

25 MW Floating Solar power plant at NTPC Simhadri



Renewables

BHEL: One Stop solution for Solar

BHEL is one of the first engineering enterprises to manufacture solar photovoltaic (SPV) cells and modules in the country and was successfully able to demonstrate its capability even before the solar sector witnessed active growth and development in India.

Since then, BHEL has been continuously developing its solar portfolio and today, is one of the few companies in India which provides end-to-end in-house solutions for all solar power needs - including conceptualisation, design, engineering, manufacturing, erection, testing, commissioning and O&M - with proven expertise of over three decades. With its state of the art solar cell and module manufacturing capacity of 105 MW/annum and 226 MW/annum and dedicated in-house R&D facility, BHEL is the only enterprise in India which manufactures almost the entire range of equipment of a solar PV plant including PCUs, Power Transformers, SCADA, HT panels etc.

BHEL's solar portfolio of more than 1225 MW comprises of commissioned (more than 830 MW) and under execution plants located across the country ranging from ground mounted, roof top, canal top to floating solar PV plants.

Our Major Customers in Solar Business:

- NTPC Ltd. GSECL GIPCL
- ▶ NLC India Ltd. ▶ KPCL ▶ WBSEDCL
- ▶ WBPDCL ▶ BEL ▶ HPPCL
- REIL (Rajasthan Electronics & Instruments Limited)
- ► Gautam Solar Pvt. Ltd. ► IOCL ► NEEPCO
- ► Electricity Department Daman & Diu ► ONGC Ltd.
- DNH Power Development Corporation Ltd.
- GEDCOL



BHEL continues to contribute significantly towards achieving the Govt. of India's target of establishing 100 GW solar energy capacity by 2022 and 300 GW by the year 2030

BHEL is currently the leading EPC player in the floating solar PV segment with a portfolio of more than 228 MWp. BHEL has a rich expertise of engineering and execution in the segment with anchoring and mooring solutions suiting customer specific requirements of man-made reservoirs, natural reservoirs etc.

BHEL has commissioned the largest floating solar PV plant of India of 75 MW capacity at NTPC Ramagundam, Telangna while another 25 MW is under commissioning. BHEL has also to its credit the development of first-of-its-kind 1.7 MW Solar PV plant at Bina, Madhya Pradesh for Indian Railways. This development through partnership with Railways ensures that solar power is evacuated at 25kV single phase and directly fed into traction substation. Single-phase 850 kW solar inverters and 400V/25 kV dry type transformers for outdoor duty were specifically developed in-house for this project. This development is expected to pave the way in using the huge land bank of Indian Railway's for captive green energy generation, reducing the dependence on grid power.

BHEL is the exclusive supplier of space-grade panels and batteries to ISRO (Indian Space Research Organisation) for their space programs since 2001.

Major project references:

- (1) GSECL Raghanesda, Gujarat 100 MW (Ground Mounted)
- (2) NTPC Ramagundam, Telangna 75 MW (Floating)
- (3) GSECL Dhuvaran, Gujarat 75 MW (Ground Mounted
- (4) GIPCL Charanka, Gujarat 75 MW (Ground Mounted)
- (5) NLC, Neyveli, T.N. 65 MW (Ground Mounted)
- (6) NTPC Simhadi Andhra Pradesh 25 MW (Floating Solar)

Power Transmission

BHEL is the leader in the field of Power Transmission in India offering a wide range of Transmission Products and Systems and has a proven track record across the globe.

BHEL undertakes Turnkey Transmission Projects from concept to commissioning on EPC basis which includes EHV & UHV Substations/Switchyards of both AIS (upto 765kV) and GIS types (upto 400kV), HVDC converter stations (up to ± 800 kV), Reactive Power Compensation Schemes and Power System Studies. BHEL has developed and manufactures Gas Insulated Switchgear (GIS) (up to 400 kV) and Transformers & Shunt Reactors (up to 765 kV). The company also developed & supplied

One Stop Solutions

Wide spread manufacturing base and a rich experience of 4 decades in Transmission sector



1200 kV CVT, 1200 kV Auto Transformer and 530 kN porcelain type disc insulators for the first 1200 kV test station in the country.

In the FACTS domain (Flexible Alternating Current Transmission Systems), BHEL is offering in-house developed Systems and Solutions like Fixed Series Compensation (FSC) schemes for 400 kV lines and Controlled Shunt Reactor (CSR) schemes for dynamic reactive power management of long 400kV transmission lines. For controlled power flow in 400kV systems, BHEL's indigenously developed India's First Phase Shifting Transformer (PST) is

Major Products manufactured:

- EHV Power Transformers
- Converter Transformers for HVDC Applications.
- Phase Shifting Transformers (PST)
- Shunt Reactors
- Instrument Transformers (Conventional and Fiber Optic Type (FOCT)
- Dry Type Transformers
- Vacuum & SF6 MV Switchgear
- EHV Gas Insulated switchgear
- Bus Post Insulators
- Composite Insulators
- Ceramic Insulators

commissioned at Kothagudem Thermal Power plant of TSGENCO (Telangana).

BHEL has been contributing in the field of Ultra High Voltage Direct Current (UHVDC) projects in India which includes major projects like world's largest ±800 kV, 6000 MW UHVDC Multi-terminal transmission link between North Eastern part of India and Agra (Uttar Pradesh) and ±800 kV, 6000 MW UHVDC Link between the Western Region Grid (Raigarh, Chattisgarh) and the Southern Region Grid (Pugalur, Tamil Nadu) which is another milestone project in UHVDC segment.

Other major critical equipment:

◆ Capacitor Banks ◆ Control & Protection
System ◆ Substation Automation System
◆ Digital Substation Solutions ◆ Thyristor
Valves for HVDC Applications ◆ LT Switchgear



Valve hall of ± 800 kV 6000 MW NER-Agra Multi-Terminal HVDC Project





Water Management

The first One Million gallons per day sea water Reverse Osmosis (SWRO) Desalination plant in India for public utility needs was set up by BHEL in Narippayur, Ramanathapuram district, Tamil Nadu in the year 1999. Since then BHEL has executed number of Water treatment plants for power plants & industries and one of the largest among them is Membrane-based Raw Water Treatment Plant (96 MLD) for the petrochemical industry at Opal Dahej. Presently BHEL is executing

 17.6 MLD Desalination plant at 2x660 MW Maitree Thermal Power Station, Bangladesh

- 2. 16 MLD Desalination Plant at 2x660 MW Udangudi Thermal Power Station, Tamil Nadu
- 13.44 MLD Desalination plant at 2x660 MW Ennore Thermal Power Station, Tamil Nadu
- 4. 57.6 MLD Ultrafiltration plant at NTECL Vallur Thermal Power Project, Tamil Nadu

Apart from above desalination plants BHEL is also executing Water treatment plants which include Pre Treatment (PT), Condensate polishing Unit (CPU), Demineralization (DM) etc. BHEL has a dedicated Pollution Control Research Institute (PCRI) and extensive lab facilities to carry out preliminary water characterization for process design and process optimization at various stages of plant operation and support in performance evaluation of the different treatment plants, assessment of water/effluent/sewage characteristics and water audits etc.

In addition BHEL is addressing Sewage Treatment Plant (STP), Lake Purification work etc. Currently, BHEL is executing an order from M/s Raipur Development Authority (RDA) for construction of six decentralized Sewage Treatment Plants (STPs) of cumulative capacity of 25.42 MLD in Raipur, Chhattisgarh.

Complete Water Treatment Solutions which include:

- Pre Treatment Plant (PT)
- Sea Water Reverse Osmosis Plant (SWRO)
- Demineralization Plant (DM)
- Effluent Treatment Plant (ETP)
- Sewage Treatment Plant (STP)
- Zero Liquid Discharge (ZLD) system.



Serviceafter Sales

In line with its commitment to complete customer satisfaction, BHEL lays special emphasis on after sales service. Prompt and efficient handling of customers' concerns is an assurance that accompanies BHEL's involvement in any project.

8 organized service centres Routine services offered by BHEL:

- Trouble shooting
- Overhandling
- Repairs



A dedicated Spares & Services Business Group (SSBG) has been set up to provide a single-window facility to customers for all post warranty solutions be it spares, services or R&M/ uprating requirements of power plants both in utility and the captive power segments.

BHEL has also developed the expertise to undertake Renovation, Modernization and Uprating of old power plants and Life Extension Programme (LEP) for aging sets. Converting PF coal-fired old boilers into FBC type, changing blade profile in turbines and switching from micalastic/ H-type insulation to F/greentype insulation in electrical machines are a part of R&M and LEP resulting in enhanced efficiency of the respective products as well as the power plant as a whole.

Other benefits of R&M/ uprating include:

- Life extension of the plant by 15-20 years
- Restoration of lost capacity and/ or enhancement of rated capacity
- Increase in safety, reliability, availability and operational flexibility
- Improvement in aux power consumption, plant heat rate, plant emission level, etc.
- Introduction of state-of-the-art systems/ technologies for better O&M practices
- Optimizing cost of generation
- Compliance to statutory pollution norms BHEL ensures timely availability of spares and also provides special training to customers' O&M personnel







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