Engineering India's Power

POWER & ENERGY

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3x660 MW Lalitpur Supercritical Thermal Power Plant

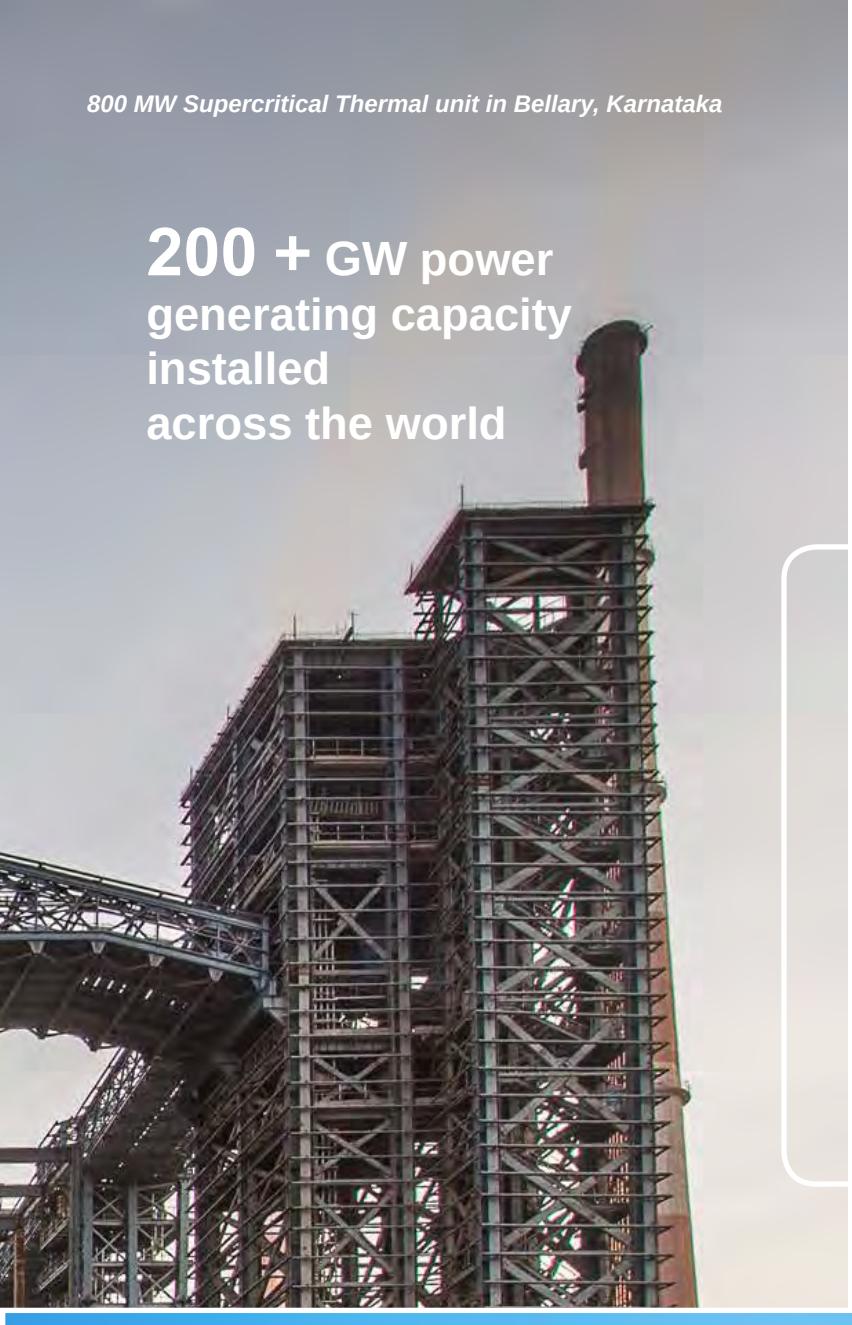
About BHEL

Since 1964, BHEL has been ‘Making in India’ as a leading Capital Goods sector company. Today, the company’s businesses are in the areas of power and industry, offering comprehensive solutions, including products, systems and services to power generation (thermal, hydro, gas, nuclear and solar PV), transmission, transportation, defence, aerospace, oil & gas and other core sectors of the country, and also abroad. BHEL, incorporated as a Public Sector Undertaking of the Government of India with a shareholding of 63.17%, has established 16 manufacturing plants spread across India, producing capital goods for the customers in domestic as well as international markets. The Company has steadily expanded its product portfolio through both partnerships with global OEMs as well as in-house product development. The in-house product development is backed by consistent investment of more than 2.5% of revenue on R&D and innovation. At BHEL, we firmly believe that serving our customers, protecting the environment, and contributing to society are intrinsically linked, and form the core of our corporate ethos. The Company has been supporting communities through programs like skill development; promoting health, hygiene & education; and running several programs on environmental protection & improvement.

Widespread network of

- 16 manufacturing plants
- 2 repair units
- 4 regional offices
- 8 service centres
- 15 regional marketing centres
- Footprints in 91 countries across 6 continents

Engineering India’s Power



800 MW Supercritical Thermal unit in Bellary, Karnataka

200 + GW power generating capacity installed across the world

Bharat Heavy Electricals Limited

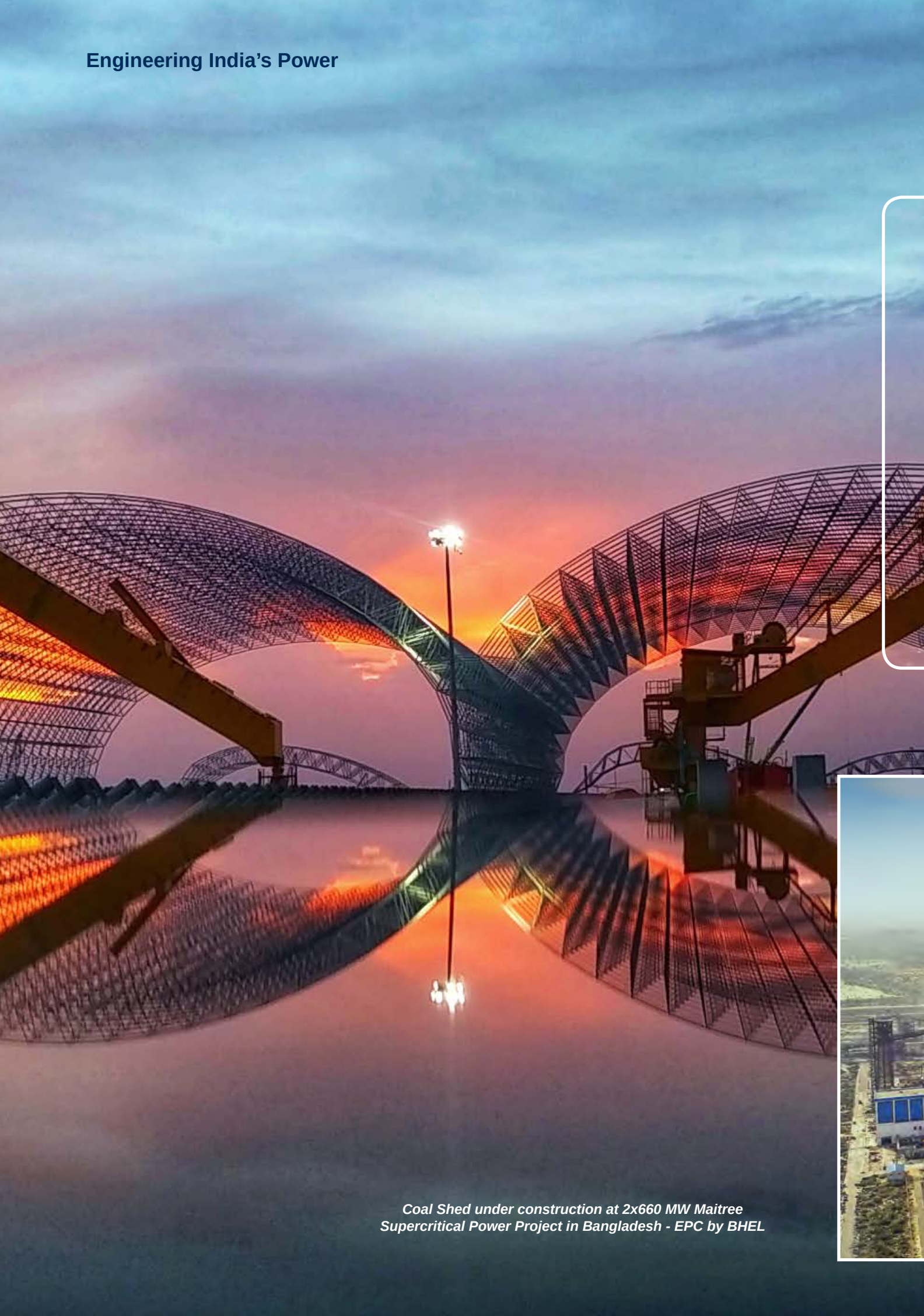
Undisputed leader amongst India Power Plant manufacturers

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 200 GW+ of power generating equipment worldwide.

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

Engineering India’s Power



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 unit rating.

BHEL also offers state-of-the-art emission control equipment (ESP, FGD, SCR) for coal-based plants for lower emission footprint complying to the revised 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 thermal 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 571 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

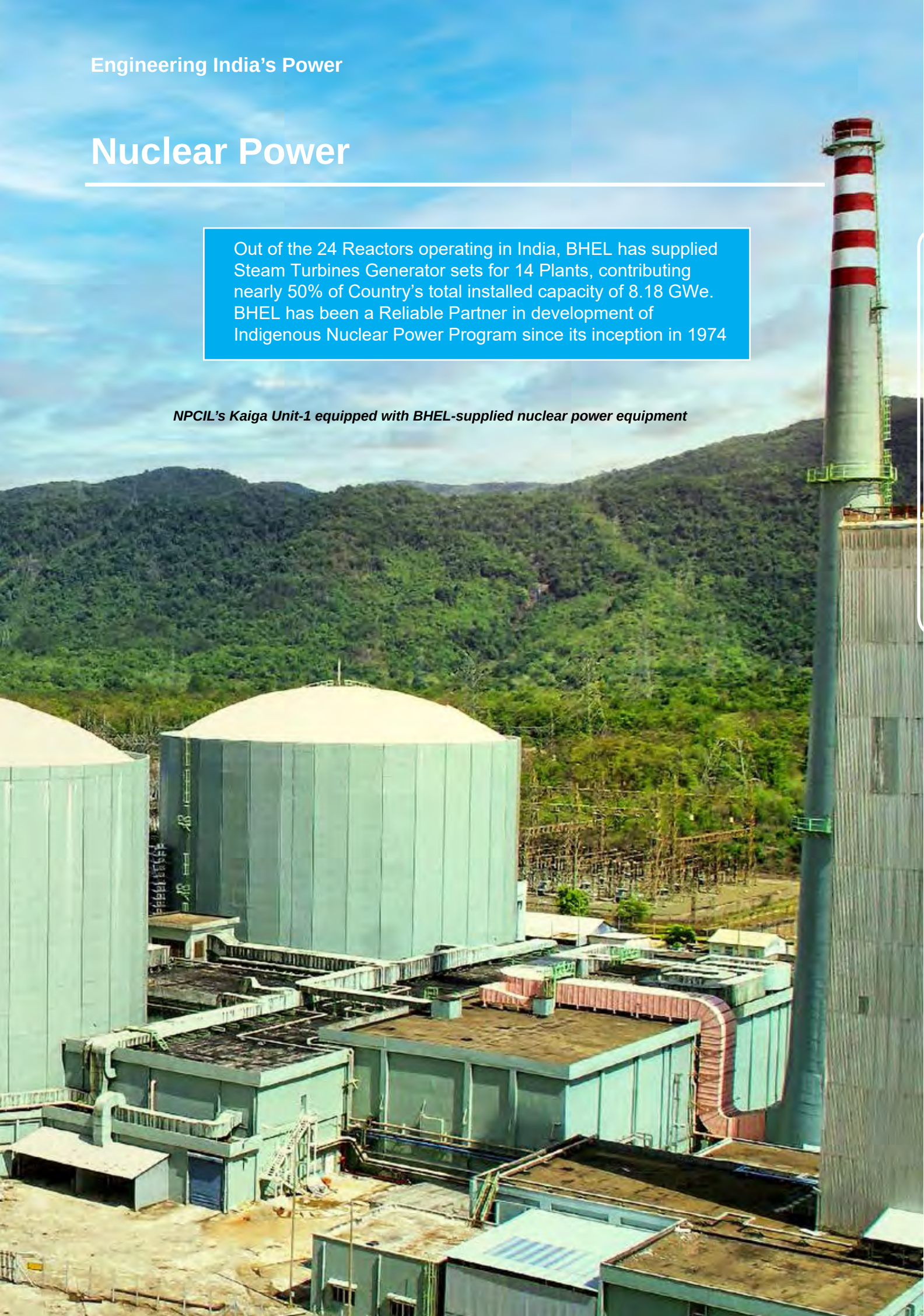
TECHNOLOGY FOR A SUSTAINABLE FUTURE

- In-house development of Advanced Ultra Supercritical (AUSC) technology, Low Rating Supercritical Sets
- Secured orders for 87 supercritical steam generators (SGs) and 80 nos. of Supercritical Turbine Generators (TGs), of which 35 SGs and 27 TGs have been commissioned in India.
- Capable of executing Circulating Fluidized Bed Combustion (CFBC) boilers, with subcritical parameters upto 350 MW and with supercritical parameters from 151 MW to 660 MW unit size for utilities.
- Indigenously developed Pressurized Fluidized Bed Gasification (PFBG) Technology, suitable for Coal Gasification.
  Syngas from Coal Gasification can be used for production of high end chemicals

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

Nuclear Power

Out of the 24 Reactors operating in India, BHEL has supplied Steam Turbines Generator sets for 14 Plants, contributing nearly 50% of Country's total installed capacity of 8.18 GWe. BHEL has been a 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

BHEL has been involved in development of India's Indigenous Nuclear Power Programme since its inception. The Three Stages of Indian Nuclear Power Programme, as envisioned by Dr. Homi Jehangir Bhabha, the father of Indian Nuclear Programme, has been successfully supported by BHEL by providing sustainable solutions for over 5 decades.

BHEL is the only Indian company with the unique capability to design, manufacture, supply and install Nuclear Steam Turbines.

For the First Stage of India's Nuclear Power Programme, BHEL's contribution started with the first Indigenously built 220 MWe Nuclear Power Plant at Madras Atomic Power Stations (MAPS), Kalpakkam, Tamil Nadu.

As on today, BHEL-supplied Steam Turbine Generator Sets for 10 units of 220 MWe and 2 units of 540 MWe (installed at Tarapur Atomic Power Stations- TAPS) are under commercial operations.

The two units of India's highest rated 700 MWe PHWR based Nuclear Power Plant, Unit 3 & Unit 4 at Kakrapar, Gujarat have been Commissioned in Jun 2023 and Mar 2024. BHEL is currently executing Turbine Island Package on 'EPC' basis for 8 Units of 700 MWe rated NPPs.

On the Primary Side, BHEL has supplied critical equipment such as Nuclear Steam Generators (45 Nos.-highest by any manufacturer in India), Reactor Headers (96 Nos.-highest by any manufacturer in India), End Shields, Hair Pin Heat Exchangers etc. for rating upto 700 MWe.

In addition to its proven capability in Control & Instrumentation (C&I) on Secondary Side of Nuclear power Plants, BHEL has also successfully executed Control Centre Instrumentation Package for 700 MWe Nuclear Power Projects.

Hydro Power

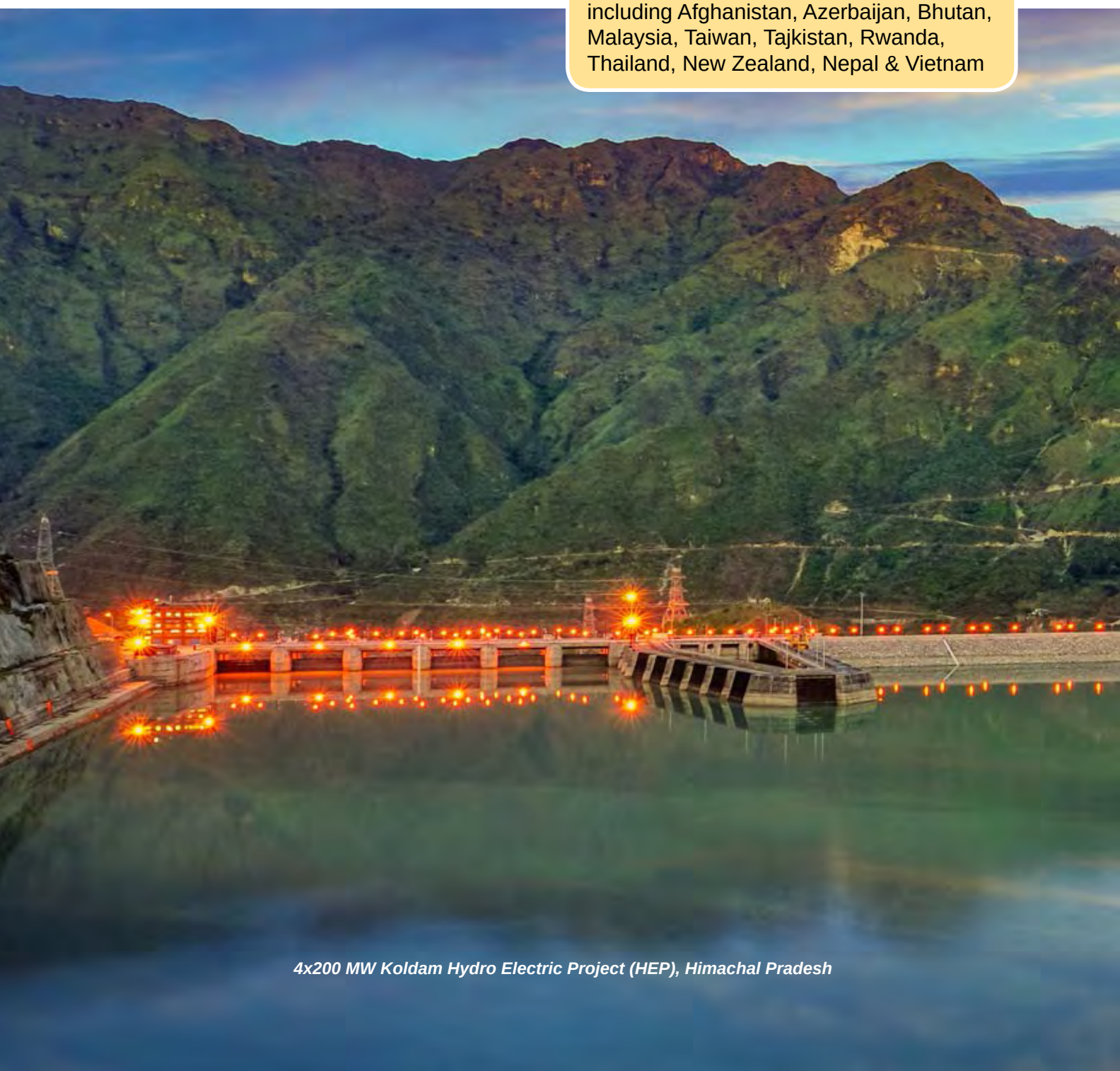
Harnessing the Hydro power

BHEL is one of the leading players in the hydro power segment with a portfolio of 550+ Hydro sets with 35 GW+ cumulative capacity in India & abroad.

With 45% 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 offers design, engineering, manufacturing, testing & commissioning of wide range of customized hydro sets of Francis & Pelton type up to 400 MW rating & Kaplan type up to 100 MW rating along with matching Generators. We are also capable of executing Electro- Mechanicals works for Pumped Storage Projects (PSP) i.e. Reversible Pump-Turbine & Motor-Generator sets up to 300 MW rating.

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



4x200 MW Koldam Hydro Electric Project (HEP), Himachal Pradesh

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 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.

BHEL has successfully commissioned two units of the 6x170 MW Punatsangchhu-II Hydroelectric Project (PHEP-II) in Bhutan. Executed as part of a bilateral agreement between the Government of India and the Royal Government of Bhutan, PHEP-II is a greenfield hydro project located in the Wangdue district of Western Bhutan. Significantly, the Francis Turbine installed in the project is designed to operate at a rated head of 241 meters – the highest for any Francis Type Hydro Turbine in Bhutan. On commissioning of all six units, the expected annual power generation will be 4,357 gigawatt-hours.

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 85 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 is 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
- WBPDCL ▸ BEL ▸ HPPCL
- REIL (Rajasthan Electronics & Instruments Limited)
- 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 500 GW renewable energy capacity by the year 2030

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 currently the leading EPC player in the floating solar PV segment with a portfolio of more than 152 MW. 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 100 MW capacity at NTPC Ramagundam, Telangana.

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 2x100 MW (Ground Mounted)

(2) NTPC Ramagundam, Telangana 100 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 a well-established solution provider in the field of power transmission with a vast experience of more than four decades. With its core competencies encompassing design, engineering, manufacturing, construction, testing, commissioning and servicing, BHEL offers a wide range of Transmission Products and Systems with contemporary technologies conforming to International Quality Standards.

45+
Years of Experience

Delivered
240+
Electrical Substations

Executed
6
major HVDC Projects

Supplied
7,50,000+
MVA Transformers/ Reactors

765/400 kV Substation at Raichur in Karnataka

KEY OFFERINGS

EPC Solutions:

- Substations (Both AIS & GIS type) (33kV-765kV)
- HVDC Converter Stations up to 800kV
- Flexible AC Transmission System (FACTS) Solutions
  - Fixed Series Compensation (FSC)
  - Thyristor Controlled Shunt Reactor (CSR)
  - Phase Shifting Transformer (PST)
  - Synchronous Condenser
- Digital Substation Solution

Products:

- Power Transformers up to 1200kV
- Shunt Reactors up to 765kV
- Instrument Transformers up to 1200kV
- Control & Protection Equipment
- MV Switchgears
- Gas Insulated Switchgear (GIS)
- Capacitors
- Insulators & associated Hardware
- Thyristor Valves

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

Service-after 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:**

  a.Trouble shooting
  b. Overhauling
  c. Repairs

A dedicated Spares & Services Business Group (SSBG) provides a single-window facility to customers for all post warranty solutions; be it spares or services requirements of power plants, both in utility and 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. Changing blade profile in turbines and switching from micalastic/ H-type insulation to F/green- type 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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