

# HYDRO POWER

Harnessing the  
Power of Water



*Kaleshwaram LIS, Telangana - India : BHEL has designed and manufactured one of the largest single-stage centrifugal pump-motor sets of the world*

## 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 58.17%, has established 16 manufacturing plants spread across India, producing capital goods for the customers in domestic as well as international markets. The Company

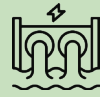
has steadily expanded its product portfolio through both partnerships with global OEMs as well as in-house product development. The in-house product development is backed by consistent investment of ~2.4% of revenue on R&D and innovation. At BHEL, we firmly believe that serving our customers, protecting 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.



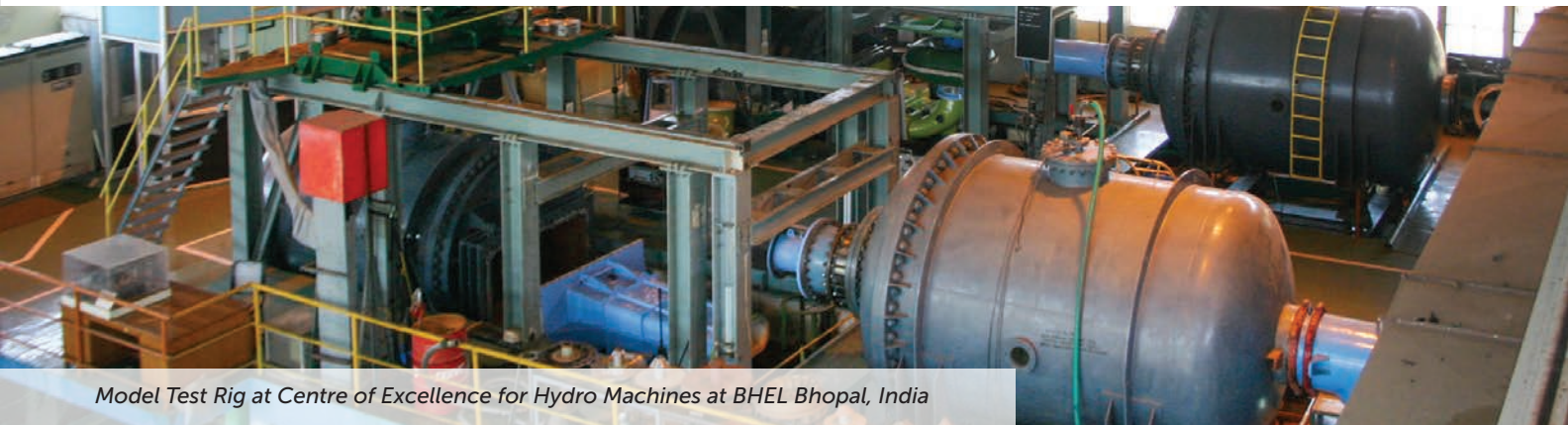
*3x110 MW Kishanganga Power station in Jammu & Kashmir, India, commissioned by BHEL*

## BHEL: Leader in the Hydro Power Sector

- BHEL's portfolio of 550+ Hydro sets with 35 GW+ cumulative capacity in India & abroad.
- Commissioned 48 Pump-Motor sets (3.4 GW) and 53 Pump-Motor sets (7.2 GW) under execution.
- Some of the world's highest capacity single-stage pump-motor sets (up to 145 MW) developed & manufactured for Palamuru Rangareddy LIS, Telangana, India
- Highest head Francis Turbine in India developed, manufactured & commissioned for Kameng HEP, Arunachal Pradesh, India
- One-stop solution for Hydro Power Equipment
  1. Dedicated design, engineering, erection and commissioning teams
  2. Dedicated after-sales support



**ANNUAL MANUFACTURING CAPACITY OF 2500 MW IN HYDRO BLOCK FOR HYDRO SETS AND FURTHER EXPANDABLE UPTO 7-8GW**

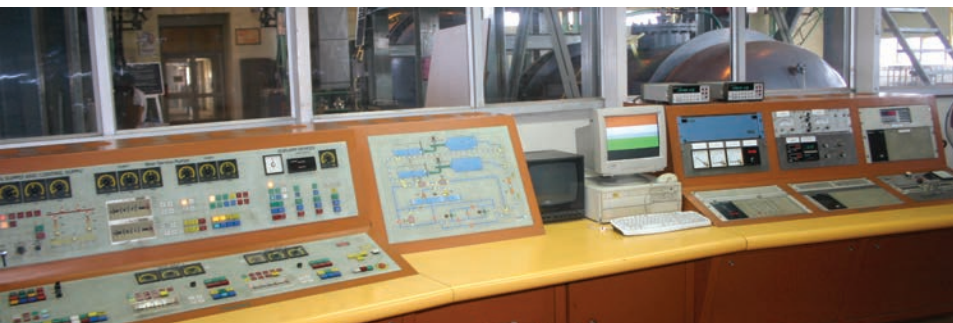


Model Test Rig at Centre of Excellence for Hydro Machines at BHEL Bhopal, India

## BHEL: Technology Edge

Centre of Excellence for Hydro Machines at Bhopal, Madhya Pradesh

- One-of-its-kind facility in India
- State-of-the-art facilities for R&D, design, development and testing of Hydro-Turbines



## Detailed Project Engineering

- Strong engineering base with over 50 years of proven experience
- Facility for Computational Fluid Dynamics Analysis, Finite Element Analysis and Hydraulic Transient Analysis facility
- Expertise in Electronics systems like Static Excitation System, SCADA, SFC, etc.
- Dedicated teams for plant engineering, BOPs and site services

# BHEL Offerings

## Hydro Generators and Motors

BHEL has capability for engineering, manufacturing, installation and commissioning of custom-made Salient Pole Vertical Synchronous Hydro Generator sets up to 400 MW rating, Lift Irrigation Schemes (LIS) motor sets up to 200 MW rating, Reversible Generator-Motor sets up to 350 MW rating, Bulb Generator sets up to 10 MW rating and Horizontal Generator sets up to 20 MW rating along with matching Static Excitation System/ Brushless Excitation System.

### Hydro Generators and Motors : Capabilities

- Power Generation
  - Vertical Hydro Generators
  - Horizontal Generators
- Synchronous Motors for Lift Irrigation Schemes
- Reversible Motor-Generator for Pump Storage Plant (PSP) Scheme
- Renovation, Modernisation and Uprating of Old Machines (BHEL and non-BHEL)

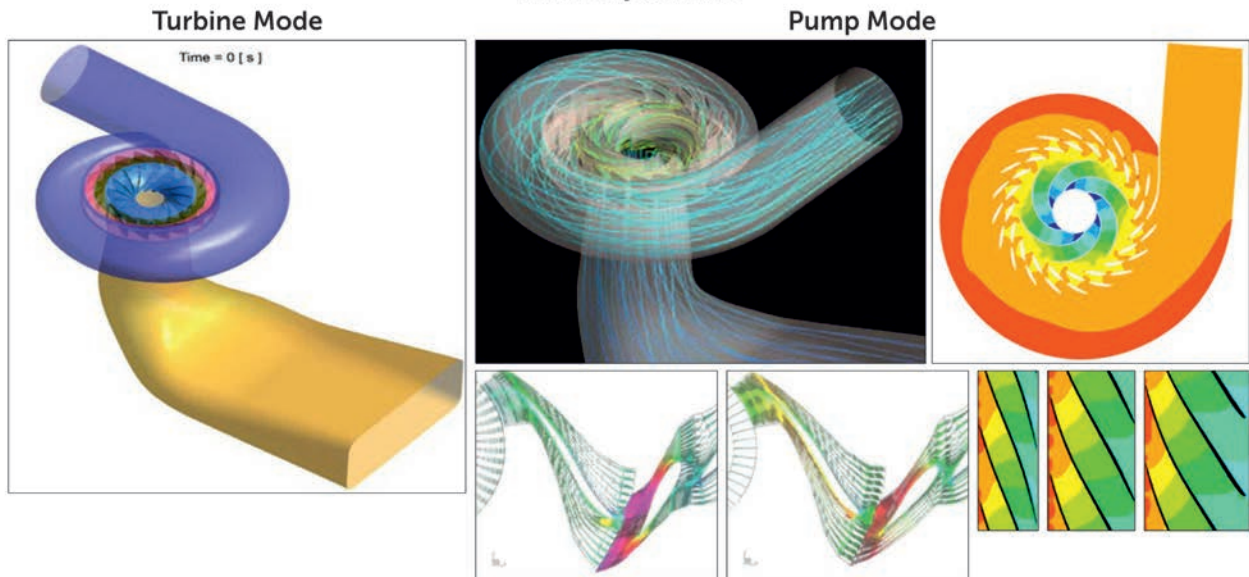
## Hydro Turbines and Pumps

We have the capability for engineering and manufacturing of custom-made conventional Hydro Turbine sets of Francis and Pelton type up to 400 MW rating, Kaplan type up to 100 MW rating , Bulb type up to 10 MW rating, Pump-Turbine sets up to 350 MW rating, high capacity Pump sets for Lift Irrigation Schemes (LIS) up to 200 MW rating and Turbines for small Hydro Power Plants.

### Hydro Turbines and Pumps : Capabilities

- Francis Turbines (up to 400 MW)
- Kaplan Turbines (up to 100 MW)
- Pelton Turbines (up to 400 MW)
- Pumps for Lift Irrigation Schemes (up to 200 MW)
- Reversible Pump-Turbines for Pump Storage Plants (up to 350 MW )
- Butterfly & Spherical Valves
- Microprocessor-based Digital Governors
- Plant Layout & Mechanical BOPs

### BHEL Capabilities



Exterior view of (Inset: Generator floor) 4 x 130 MW Parbati-III HEP, NHPC Ltd. In Himachal Pradesh, India



New CNC Hydro facility set-up in Bhopal Plant, India, for augmenting hydro manufacturing capacities

## Manufacturing Facilities

### Strong Manufacturing Base

- Hydro Turbine manufacturing facility spread over 1,00,000 square metres
- Dedicated shop floor for Hydro Generators
- Large-scale CNC Machining facility
- Large associated fabrication facility
- HVOF coating facility for Turbine components
- Large base of experienced ancillary units in close vicinity of all manufacturing units
- Hydro Generators: Large sized VPI plant for VPI winding
- Insulation Lab for Conducting Type Tests Like BDV, Impulse and Accelerated Ageing Test
- 7-axis Robotic Coil Taping Machine

### Supporting Units

- Central Foundry & Forge unit for Shaft forgings
- Central Stamping & Fabrication unit for laminations of hydrogenerator



Largest manufacturing base for Hydro equipment in India





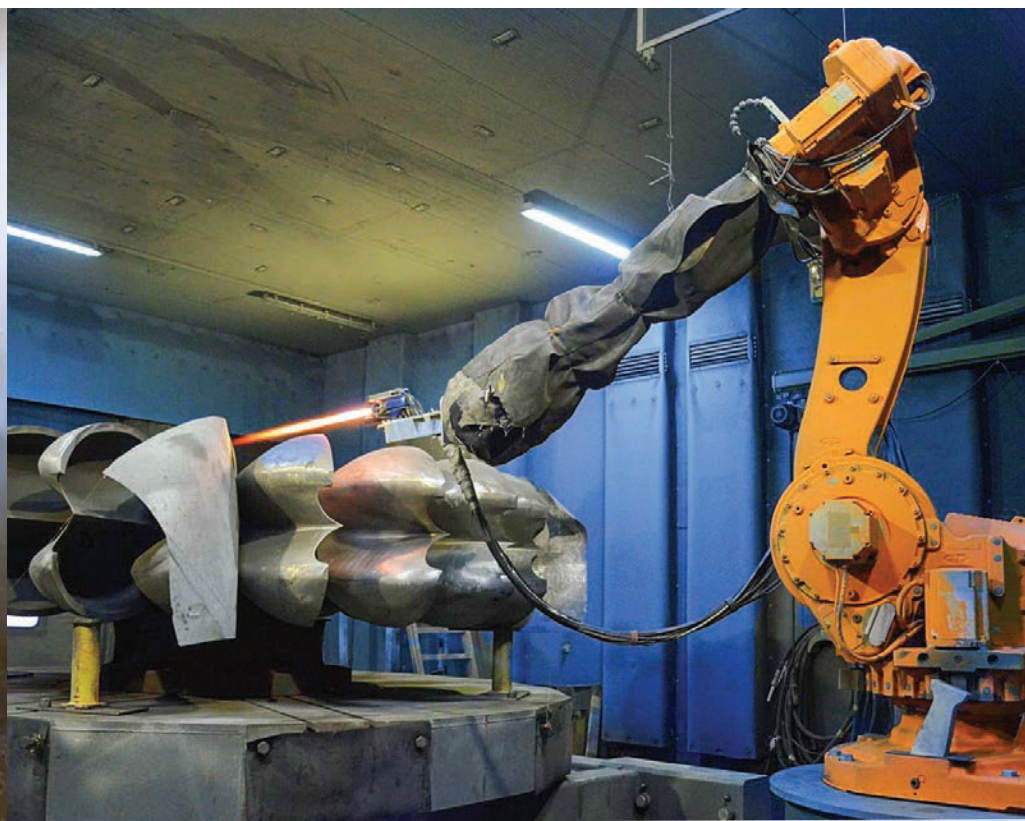
Hydro power plant at Bhutan, 720 MW HEP Mangdechhu designed, manufactured and commissioned by BHEL, was jointly inaugurated by Hon'ble PM (India), Sh. Narendra Modi and Hon'ble PM (Bhutan), Dr. Lotay Tshering in August 2019

## Highest Rating Machines by BHEL

Description	Project	No. x Rating	Runner Dia.	Max. Head
Highest Unit Rating Kaplan Turbine	Polavaram Hydro Power House, Andhra Pradesh	12x80 MW	6850 mm	31.0 m
Highest Unit Rating Centrifugal Pump	Palamuru Rangareddy Lift Irrigation Scheme Stg 2 & 3, Telangana	9x145 MW	4460 mm	139.0 m
Highest Unit Rating Pelton Turbine	Parbati-II Power house, Himachal Pradesh	4x200 MW	3090 mm	845.0 m
Highest Unit Rating Francis Turbine	Arun-III Power House Nepal	4x225 MW	4460 mm	312.0 m
Highest Head Kaplan Turbine	Dudhganga Power House, Maharashtra	2x12 MW	2200 mm	62.0 m
Highest Head Pelton Turbine	Pykara Ultimate Stage Power house, Tamil Nadu	3x50 MW	2200 mm	1039.0 m
Highest Head Francis Turbine	Kameng Power House, Arunachal Pradesh	4x150 MW	3100 mm	531.0 m

## Notable Machines Supplied by BHEL

S. no.	Description	Rating
1	Highest Capacity (vertical)	4x200 MW, 375 RPM for <b>Parbati-II HEP</b> , Himachal Pradesh
2	Biggest in Physical Size	6x150 MW, 136 RPM with a frame diameter of 13.4 m for <b>Srisailem HEP</b> , Andhra Pradesh
3	Heaviest Thrust Bearing load	1800 tons for 4x75 MW, 150 RPM for <b>Ukai HEP</b> , Gujarat
4	Highest Speed Machine (Vertical)	1x20 MW, 750 RPM for <b>Kundah 'V' HEP</b> , Tamil Nadu
5	Highest Capacity (Vertical) (Generator / Motor - JV)	6x200 MW, 136 RPM for <b>Sardar Sarovar River bed</b> , Gujarat
6	Highest Capacity (Horizontal)	4x12.5 MW, 600 RPM for <b>Rammam</b> , West Bengal
7	Bulb Generators (JV)	2 x 9 MW, 125 RPM for <b>Mukerian HEP</b> , Punjab
8	Highest Capacity Vertical Motor	7 x 139 MW, 214.3 RPM for Kaleshwaram LIS Pkg-8 in Telangana
9	Highest Speed (Horizontal)	3 x 1.5 MW, 1500 RPM for <b>Gumma HEP</b> in Himachal Pradesh
10	First 60 Hz Generator	1 x 61.2 MW, 360 RPM, 13.8 kV for <b>Bihai, Taiwan</b>
11	Highest Voltage rating	2 x 100 MW, 428.6 RPM, 15.8 kV for <b>Namchien Hydro Power, Vietnam</b>



5 axis Impeller Machine (Left) and Robotic HVOF Coating Facility (Right) at BHEL Bhopal



3x14 MW Salma Hydropower Project commissioned by BHEL in Afghanistan

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