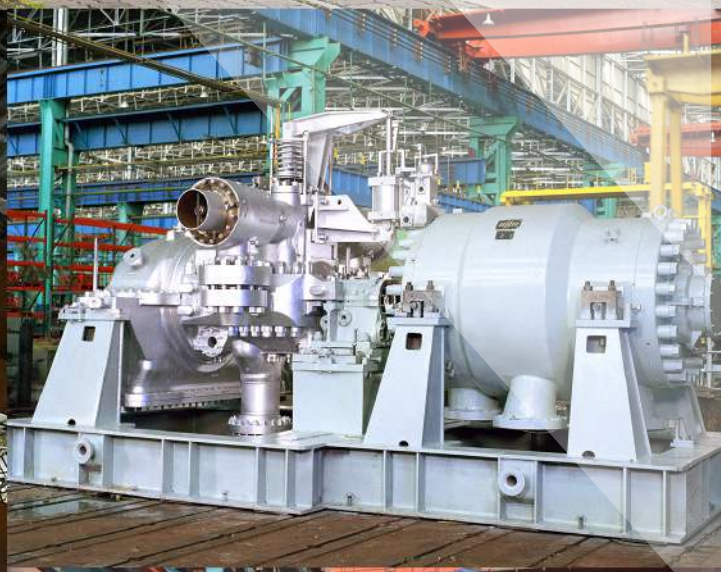


PRODUCT
PROFILE

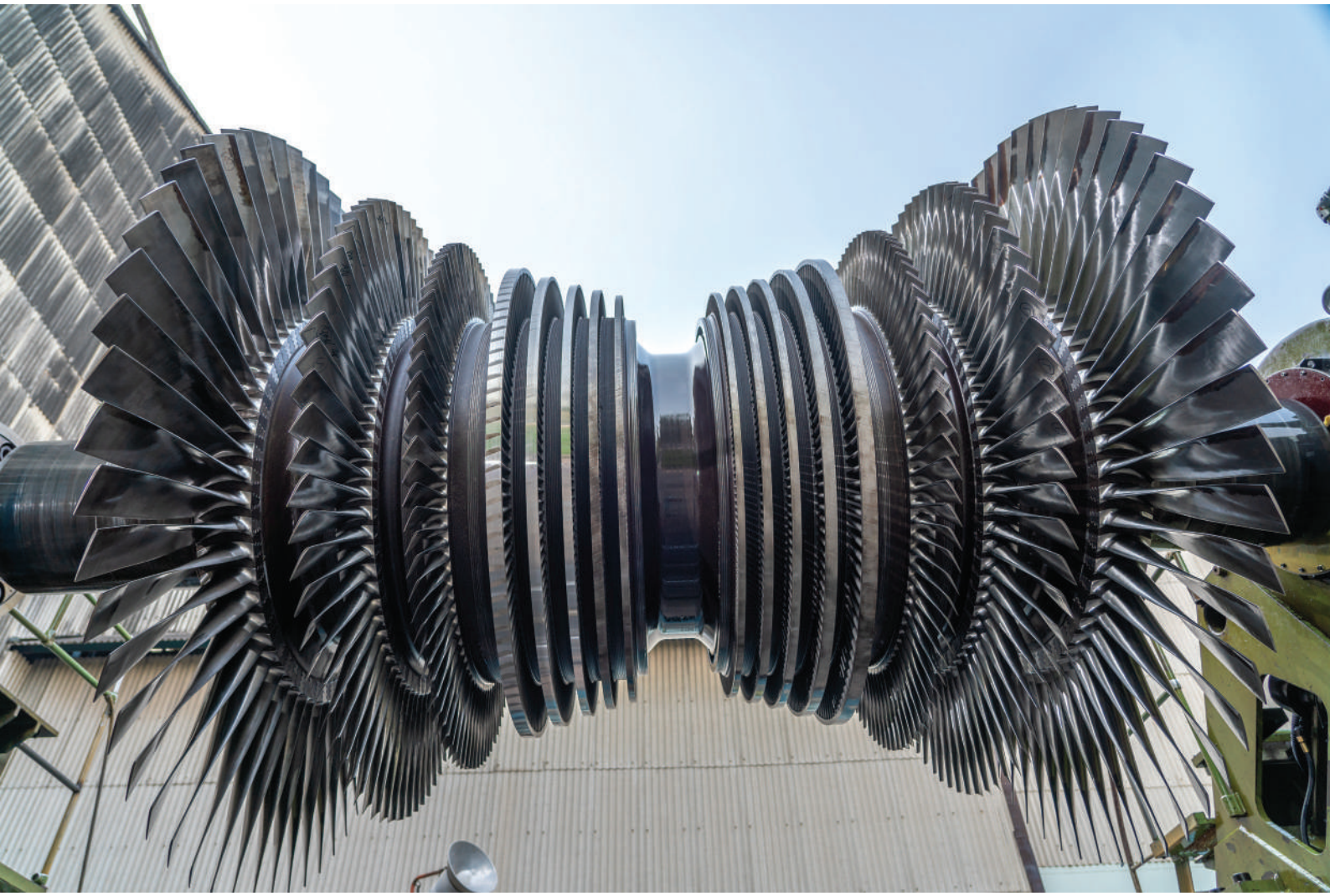
Inspiring Innovation
Engineering Dreams

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.



BHEL's Product and Service Profile includes design, manufacturing and installation in the following major segments:

COAL BASED POWER PLANTS

- Complete EPC solutions, including state-of-the-art Emission Control Equipment
- Steam Generators, Steam Turbines, Turbo Generators (TGs) along with regenerative feed cycle, up to 1000 MW unit rating, including 350 /660 /700 /800 MW unit rating sets based on supercritical technology and up to 600 MW unit rating sets based on subcritical technology
- Water and Air Cooled Condensers, Condensate Extraction Pumps, Boiler Feed Pumps, Duplex Heaters, Valves and Heat Exchangers – meeting requirement of TG Sets up to 1000 MW
- Residual Life Assessment (RLA) of old Thermal Power Plants
- Plant performance improvement and life extension through Renovation and Modernization
- Flexibilisation (flexi-operations) solution for power plants

GAS-BASED POWER PLANTS

- Complete EPC solutions, including Gas Turbines and matching generators ranging from 26 MW to 571 MW (ISO) rating with following features:
  - Gas Turbine based co-generation and combined- cycle systems for industry and utility applications
  - Capability to burn a variety of fuels (both gaseous and liquid including Blast Furnace Gas (BFG) & Coke Oven Gas (COG) for applications in the Steel Industry) along with mixed firing in different combinations of fuels
  - Low exhaust emission levels up to 15 ppm of NOx with Dry Low NOx (DLN) combustors & noise reduction.
- Combined cycle plants up to 838 MW with higher plant efficiencies

NUCLEAR POWER PLANTS

- Complete EPC solutions for TG island of PHWRs (Pressurized Heavy Water Reactors), FBRs (Fast Breeder Reactors) and AHWRs (Advanced Heavy Water Reactors) including Steam Turbine, Turbo Generators, Exciters (Brushless and Static), MSRs (Moisture Separator Reheaters), other heat exchangers and pumps
- Reactor side components like Steam Generators, Reactor Headers, End Shields, special purpose Heat Exchangers, Pressure Vessels, Motors, etc.

HYDRO POWER PLANTS

- Custom made conventional Hydro Turbines of Kaplan type up to 100 MW, Francis and Pelton types up to 400 MW.
- Custom made Salient Pole Vertical Synchronous Hydro Generator up to 400 MW with matching excitation system
- Reversible Pump-Turbines for Pumped Storage Plants up to 300 MW, and Fixed Speed Generator-Motors for Pump Storage Plants up to 300 MW
- High capacity pumps up to 200 MW and motor upto 200 MW for Lift Irrigation Schemes (LIS)
- Butterfly Valves, Spherical Valves and Auxiliaries for Hydro Stations
- Mini, Micro and Small Hydro Power Plants up to 25 MW rating
- Bulb turbines up to 10 MW and Horizontal Generator up to 20 MW along with matching generator & excitation system (Static/ Brushless)
- Microprocessor based Digital Governing System for all types of Hydro Power Plants





- Balance of Plant (BOP) & System Integration
- Renovation, modernization and uprating of Hydro Power Plants

SOLAR POWER SYSTEM

- Complete EPC solutions of Solar Photo Voltaic (SPV) Power Plants including:
  - Grid Interactive systems with & without BESS (Battery Energy Storage System)
  - Floating Solar Power Plants
  - Standalone Systems
  - Roof Top Systems
  - Hybrid Systems
  - Canal Top Systems
  - Erection, commissioning, O&M and consultancy services for all the above systems.

TRANSPORTATION SYSTEMS

- Rolling Stock including Electric locomotives, Diesel Electric locomotives, Semi-High Speed 'Vande Bharat' Trainsets, Track Machines and Diesel Electric Tower Car (DETC)
- Traction Motors and Traction Alternators
- Traction Drive System & Controls
- Traction Transformers

TRANSMISSION SYSTEMS

- Complete EPC solution for transmission systems including Extra High Voltage Substations (both Air Insulated Substation (AIS) & Gas Insulated Substation (GIS) types)up to 765 kV, and High Voltage Direct Current (HVDC) converter stations up to ± 800 kV
- Power Transformers up to 1200 kV & Shunt Reactors up to 765 kV
- Gas Insulated Switchgear (GIS) up to 420 kV
- Insulators up to 800 kV
- Flexible AC Transmission System (FACTS) Solution

DEFENSE AND AEROSPACE

- Super Rapid Gun Mount (SRGM) / Upgraded SRGM, including life time product support
- IPMS (Integrated Platform Management System) for ships
- Compact Heat Exchangers & Pump modules
- Space Grade Solar Panels & Batteries
- Motor Generator sets and Permanent Magnet based motors and generators
- Turbines, Turbo Alternators, Turbo Alternator Turbines, Condensers, Heat Exchangers & Valves for Naval applications

INDUSTRIAL SYSTEMS

- Complete EPC solutions for Process Packages and Equipment/ Solutions for Downstream Oil & Gas (DSOG) segment
- Top Recovery Turbine based Power Plant
- Coal Handling Plant and Ash Handling Plant including Civil & Structural, Mechanical, Electrical works and Automation systems
- Mine Winder Systems
- Electrics, Drives, Controls & Automation Systems for Processing & Compacting of Raw Materials, Iron Making, Primary & Secondary Steel Making, Casters & Steel Finishing like Mills & Process lines for both long and flat products
- Raw Material Handling Systems including Civil & Structural, Mechanical, Electrical and Automation systems for steel and other industries
- Electrics & Automation Systems for High Current Rectifiers of Smelters and Processing Mills for Aluminum Plants
- Automated Storage & Retrieval Systems (ASRS)





ENERGY STORAGE SYSTEM & E-MOBILITY

- Solar based Charging stations for Electric Vehicles charging
- Complete EPC Solutions for Battery Energy Storage System

DETAILED PRODUCT PROFILE IS AS FOLLOWS:

STEAM GENERATORS

- Steam Generators for utilities, ranging from 30 to 800 MW capacity, using coal, lignite, oil, natural gas or a combination of these fuels; capability to manufacture boilers with supercritical parameters up to 1000 MW unit size
- Circulating Fluidized Bed Combustion (CFBC) Steam Generators, with subcritical parameters up to 350 MW and with supercritical parameters from 151 MW to 660 MW unit size for utilities
- Fuel Flexible boilers capable of all combination of blending / co-firing diverse qualities of imported/ Indian coals, blending of lignite, petcoke, etc.
- Capability for manufacturing and supply of Steam Generators and Reactor Headers for Nuclear Power Plant as per ASME Sec.-III NB Class-1 requirements
- Steam Generators for industrial applications of the following types starting from 40 T/hr to 450 T/hr capacity, using coal, natural gas, industrial gases, biomass, lignite, oil, petcoke, bagasse or a combination thereof
  - Pulverized coal / lignite fired boilers
  - Stoker fired boilers
  - Bubbling Fluidized Bed Combustion (BFBC) boilers
  - Circulating Fluidized Bed Combustion (CFBC) boilers
  - Heat Recovery Steam Generators (HRSG)
  - Chemical recovery boilers for paper industry, ranging from capacity of 100 to 1000 T/Day of dry solids
- Expertise and capability in implementing the Biomass co-firing with coal in boilers
- Complete solutions for flexible operation of boilers

STEAM GENERATOR AUXILIARIES

- Air Preheaters
  - Tubular Air Preheaters
  - Rotary regenerative Air Preheaters (different types like Bisector, Tri Sector and Quad Sector)
- Particulate Emission Control
  - Electrostatic Precipitators with outlet emission as low as 15 mg/Nm^3 (efficiency up to 99.97%)
  - Bag Filters for utility and industrial applications
  - Mechanical Dust Collector
  - Ammonia Flue Gas Conditioning System
- Fans
  - Axial reaction fans of single stage and double stage for clean air application and dust laden hot gases applications up to 200°C, with capacity ranging from 40 to 1300 m^3/s and pressure ranging from 400 to 1,500 mmwc
  - Axial impulse fans for both clean air and flue gas applications up to 200 °C, with capacity ranging from 25 to 600 m^3/s and pressure from 300 to 700 mmwc
  - Single and double-suction radial fans (plate aerofoil bladed) for clean air and dust-laden hot gases applications up to 400 °C, with capacity ranging from 4 to 660 m^3/s and





pressure ranging from 200 to 3000 mmwc

- Pulverizers
  - Bowl Mills of slow and medium speed (for both pressurised & suction environment) with capacity from 10 T/hr to 120 T/hr
  - Ball Tube Mills from 30 T/hr to 110 T/hr
  - Wet Ball Mills (up to 50 T/hr) for FGD Applications
- Guillotine Gates & Dampers
  - Guillotine gates with electric/ pneumatic actuator. 100% leak proof with seal air (Maximum Width/ Height): Type 1: 7m/14.5m, Type 2: 14.6m/4.5m, Type 3: 11.5m/6.5m
  - Bi-plane dampers with electric/ pneumatic actuator. 100% leak proof with seal air (Maximum Width/ Height): Type-1: 7m/14.5m, Type-2: 12m/10.5m
  - Louver dampers (open close/ regulating) with electric/ pneumatic actuator (Maximum Width/ Height): Type-1: 6.5m/14.5m, Type-2: 12m/10.5m
  - Control dampers (regulating) with electric/ pneumatic actuator (Maximum Width/ Height): Type- 1:6.5m/14.5m, Type-2: 12m/10.5m
- Steel Chimneys
  - Steel Chimneys for flue gas exhaust applications with maximum height of 80 m and inner diameter up to 6.5 m
- Flue Gas Desulphurization (FGD) systems
  - Wet Limestone & Seawater based FGD systems
  - Absorber – DCFS (Double Contact Flow Scrubber) Technology
  - Wet Limestone FGD – Single & Twin Tower Absorber
  - Seawater FGD – Grid Tower Absorber
  - Absorber with & without Gas to Gas Heater
  - FGD with SO_2 efficiency of 99.9%
- De NOx solutions
  - In-furnace combustion control solutions to reduce NOx emission
- Selective Catalytic Reduction (SCR) systems (Honeycomb & Plate type) for NOx emission control
- SCR Plate Type Catalyst for NOx emission control
- Flexible operation of boilers for achieving 70-100% Turbine Maximum Continuous Rating (TMCR) at 3%/ minute ramp rate, 55-70 % TMCR at 2%/ minute ramp rate and 40-55% TMCR at 1%/ minute ramp rate as per CEA guidelines

SOOT BLOWER

- Long Retractable Soot Blowers (LRSB) for travel up to 12.2m
- Furnace Temperature Probe (FTP) for travel length up to 10m
- Long Retractable Non-Rotating (LRNR) soot blowers with forward blowing for Air Pre-Heaters
- Rotary Soot Blowers
- Rack type Long Retractable Soot Blowers
- Ash discharge valve for CFBC boiler application
- Soot Blowers with sequential PLC, control panel and integral starter

VALVES

- High and low-pressure Turbines Bypass Valves & hydraulic system for utilities and industrial application
- High and medium-pressure Valves, Cast and Forged Steel Valves of Gate, Globe, Non- Return





(Swing- Check and Piston Lift-Check) types for steam, oil and gas duties up to 950 mm diameter, maximum pressure class 4500 (791 kg/cm^2) and 650 °C temperature

- Hot reheat and cold reheat Isolating Devices up to 900 mm pipe size class 1500 and steam temperature up to 650 °C
- High capacity Spring Loaded Safety Valves for set pressure up to 372 kg/cm^2 and temperature up to 630 °C
- Automatic electrically operated Pressure Relief Valves for set pressure up to 320 kg/cm^2 and temperature up to 610 °C
- Safety Relief Valves for set pressure up to 421 kg/cm^2 and temperature up to 537 °C
- Reactive cum absorptive type Vent Silencers maximum diameter of 2700 mm
- Direct Water Level Gauges
- Angle Drain Valves - Single & Multi Stage for Turbine Drain Application
- Severe Service Control Valves for Re-Heater & Super Heater Spray Lines
- Quick Closing Non-return Valves for Extraction lines and Power Assisted Non-return Valves, up to 900 mm diameter, 158 kg/cm^2 pressure and 540 °C temperature
- Knife Edge Gate Valve of size 1300 mm & 1400 mm diameter for FGD applications

PIPING SYSTEMS

- Power Cycle piping, Constant Load Hangers, Variable Spring Hangers, Hanger components, Low Pressure piping including circulating water piping for power stations up to 1000 MW capacity including Super Critical sets
- Piping systems for Nuclear Power Stations, Combined Cycle Power Plants & Industrial boilers and process industries
- Prefabricated piping/ duct spools to cater to refinery segment complying with National Association of Corrosion Engineers (NACE) requirements

SEAMLESS STEEL TUBES

- Hot-finished and cold-drawn seamless steel tubes with a range varying from outer diameter of 21 to 133 mm and wall thickness of 2 to 12.5 mm, in carbon steel and low- alloy steels to suit ASTM/ASME and other international specifications
- Rifled tubes (ribbed) with a range varying from tube outer diameter of 38.1 to 63.5 mm and wall thickness of 5.6 mm to 7.1 mm, in carbon steel and low-alloy steels to suit ASME and other international specifications
- Spiral finned tubes with a range varying from tube outer diameter of 31.8 to 114.3 mm and wall thickness of 2.4 mm to 9.5 mm and with fin height of 12.5 mm to 21 mm and fin density ranges from 40 to 240 fins per meter, in carbon steel and alloy steels to suit ASME standards

PRESSURIZED FLUIDIZED BED GASIFIER (PFBG) (COAL TO CHEMICALS)

- PFBG technology for the gasification of coals including lignite to generate syngas and other products
- High-Pressure Oxy-blown coal gasifier of single unit capacity up to 2500 Tonnes per day, capable of producing syngas, to meet the following applications:
  - Hydrogen/Ammonia/Ammonium Nitrate
  - Methanol/Dimethyl Ether
  - Direct reduction of Iron ore
  - Power through IGCC
  - Synthetic Natural Gas

STEAM TURBINES

- Steam Turbines up to 1000 MW unit rating,





including 350/660/700/800 MW unit rating sets based on supercritical technology and up to 600 MW unit rating sets based on subcritical technology

- Steam Turbines up to 700 MWe ratings for Nuclear Power Plants
- 15000 HP Turbines for Marine Propulsion

TURBO GENERATORS

- Air, Hydrogen and Hydrogen/ Water cooled Turbo Generators up to 1000 MW unit rating along with related Auxiliary systems for Thermal/Gas Power Plants
- Air cooled up to 200 MW rating
- Hydrogen cooled up to 300 MW rating
- Hydrogen/Water cooled up to 1000 MW rating
- Generators for CCPP applications
- Generators up to 700 MWe for Nuclear Power Plants
- Generator Cooling System: Air, Hydrogen, Hydrogen / Water
- Excitation System: Brushless /Static
- Auxiliary Systems: Primary Water System, Seal Oil System, Gas System, etc.

HYDRO POWER PLANTS

- Francis and Pelton type Hydro Turbines up to 400 MW unit size
- Kaplan type Hydro Turbines up to 100 MW unit size
- Bulb type Hydro Turbines up to 10 MW unit size
- Salient Pole Vertical Synchronous Hydro Generator up to 400 MW unit size
- Horizontal Generator up to 20 MW unit size
- Reversible Pump-Turbines and Fixed Speed Generator- Motor up to 300 MW for Pump Storage Plants (PSP)
- High speed Pump & Motor up to 200 MW for Lift Irrigation Schemes (LIS)

INDUSTRIAL SETS

- Steam Turbine based Captive Power Plants
  - Steam Turbine-Generator (STG)/Boiler/ Boiler- Turbine-Generator (BTG)/Engineering - Procurement- Construction (EPC): Unit rating up to 200 MW
  - Non Reheat up to 120 MW unit rating
  - Reheat from 70 MW to 200 MW unit rating
- Steam Turbine to Mechanical drives like Compressors, Pump, Blowers, Marine Propulsion etc.
- Top Recovery Turbines (TRT) to meet the needs of Integrated Steel Plants
- Gas Turbine based Captive Power Plants GTG/ HRSG/ EPC: 26 MW (Fr-5) to 571 MW (Fr-9HA.02) with versatile fuel burning capability (gaseous and liquid, including BFG and COG for Steel Industry applications), mixed fuel firing options, low exhaust emission levels (up to 15ppm of NOx) through Dry Low NOx (DLN) combustors, along with noise reduction
- Process Packages/ Equipment/ Solutions for the Downstream Oil & Gas (DSOG) segment

CASTINGS AND FORGINGS

- Steel Castings from 0.5 MT up to 61 MT single piece and cast-fabricated Castings up to 120 MT weight and Forgings up to 36 MT in different material grades viz. Plain Carbon, Creep Resistant, Stainless Steel, Super Critical steels and Advanced Ultra Super Critical Alloy 625

CONDENSER AND HEAT EXCHANGERS

- Surface Condenser
  - For Thermal Power Plants up to 1000 MW





- For Nuclear Power Plants up to 700 MWe
- 12.5 MW Marine applications
- Industrial Condensers

- Air Cooled Condenser for 660 and 800 MW Thermal Power Plants
- Feed Water Heaters (High Pressure Heaters, Low Pressure Heaters, Duplex Heater, De-Super Heaters, etc.) including retrofitting of Non-BHEL heaters
  - Thermal from 7 to 600 MW (sub-critical) & 350 to 1000 MW (super critical with single stream)
  - Nuclear: 220 MWe, 500 MWe & 700 MWe
  - Industrial applications from 7 MW to 150 MW
- Moisture Separator & Reheater (MSR)
  - Nuclear: 220 MWe, 500 MWe & 700 MWe
- Live Steam Reheater (LSR)
  - 500 MW Fast Breeder Reactor (FBR) Nuclear sets
- D_2O and Moderator Heat Exchangers for Nuclear primary cycle
- Auxiliary Heat Exchangers for Turbo and Hydro Generators
  - Air Coolers (Frame & Tube Type)
  - Oil Coolers (Shell & Tube Type and Plug in Type)
  - Hydrogen Coolers (Frame & Tube Type)
- Transformer Oil Coolers
  - Shell & Tube Type: Single Tube or Concentric Double Tube Type
  - Frame & Tube Type: OFAF (Oil Forced/ Air Forced) with L-fin Tubes
- Air cooler for defense applications
  - Shell & Tube Type
  - CACW (Closed Air Circuit, Water Cooled) Type
- Butterfly Valves & Rubber Expansion joints for water application from 400NB to 2800NB
- Flash Tanks & Misc. Tanks for oil & water storage
- Auxiliary Heat Exchangers for Transformers
  - Oil Coolers (Shell & Tube Type Single Tube or Concentric Double Tube Type) (Frame & Tube Type)
- Drain Coolers
  - Thermal from 7 to 600 MW (sub-critical) & 350 to 1000 MW (super critical with single stream)
  - Nuclear: 220 MWe, 500 MWe & 700 MWe
  - Industrial applications up to 150 MW
- Auxiliary Heat Exchangers for general application and for Downstream Oil & Gas (DSOG) application
  - Water - Water Coolers (Shell & Tube Type)
- Gland steam condensers
  - Industrial applications from 7 MW to 150 MW
  - Thermal Plants up to 1000 MW
  - Nuclear Plants up to 700 MWe
- Air-cooled heat exchangers for GTG up to 126 MW (Fr-9E), and Compressor applications of all ratings for Downstream Oil & Gas (DSOG) application
  - Steam jet air ejectors for condensers up to 150 MW
  - Deaerators from 7 MW to 1000 MW
  - Gas coolers for compressor applications
  - Oil coolers- STG up to 150 MW, GTG up to 126 MW (Fr-9E)
  - Generator air coolers up to 150 MW STG and GTG up to 250 MW (9 FA)





PUMPS

- Pumps for various utility power plant applications up to a capacity of 1000 MW:
  - Boiler Feed Pumps (motor or steam turbine driven) and Boiler Feed Booster Pumps
  - Condensate Extraction Pumps including Drip Pumps
  - Circulating Water Pumps (Cooling Water Pumps)
  - Concrete Volute Cooling Water Pumps
  - Pumps (including BFP) for Secondary Side of Nuclear Power Plants up to 700 MWe ratings
  - Slurry Recirculation Pumps for FGD Applications

COMPRESSORS

- Complete range of Centrifugal compressors (driven by Steam Turbine, Electric Motor and Gas Turbine) along with auxiliary systems for all major compression applications in various industries like Refineries, Fertilizers, Petrochemicals, Oil & Gas, Steel, Power and Natural Gas Transportation sectors
- Offers Compressor packages for capacity up to 3,00,000 m^3/Hr for various gases like Air, CO_2, Syngas, N_2, H_2, NH_3, Natural Gas, Wet Gas, Propylene and other services
- Horizontally split type up to 40 bar design pressure
- Vertically split type up to 350 bar design pressure
- Oxidation Blowers for FGD Applications

SOLAR PHOTOVOLTAICS

- Multi/ Mono Crystalline Solar cells
- Multi Crystalline/ Mono-PERC PV Modules (up to 400 Wp)
- Solar Inverter for utility and railway traction application
- Power Transformers (15 MVA and above)
- Passive Solar Tracking System
- Space Grade Solar Panels

AUTOMATION AND CONTROL SYSTEMS

- Automation and Control Systems for
  - Steam Generator/Boiler Controls including Boiler Protection
  - Control & Protection Systems for Turbine & Generator for power plants
  - Boiler Feed Pump (BFP) Drive Turbine Control
  - Station Control and Instrumentation/DCS
  - Automatic Generator Controls
  - Vibration Monitoring System
  - Offsite/ Off base controls/ Balance of Plant controls
    - Ash Handling Plant (AHP)
    - Coal Handling Plant (CHP)
    - Water System for power plant
    - Mill Reject System (MRS)
    - Condensate On-Load Tube Cleaning system (COLTCS)
    - Gas Booster Compressor (GBC)
    - Condensate Polishing Unit (CPU)
    - Heating, Ventilation & Air Conditioning (HVAC)
    - Fuel Oil Unloading System (FOUS)
  - Hydro Power Plant Control System
  - Gas Turbine Control System
  - Nuclear Power Plant Primary Cycle Control





Centre Instrumentation Package (CCIP)

- Nuclear Power Plant Turbine & Secondary Cycle Control System
- Power Block of Solar Thermal Power Plant
- Industrial Automation
- Sub-Station Automation (SAS)
- Non-FST HVDC control panels
- Electrical Control System (ECS) for Refineries
- Energy Management System (EMS) for Power Plant
- Electrical Interface System for MV/LV Switchgear
- Electrical Interface System for Generator Synchronization

TRANSMISSION SYSTEMS

- Sub-stations/switchyards both AIS & GIS type ranging from 33 kV to 765 kV
- HVDC transmission systems up to ± 800 kV
- Digital Substation
- Flexible AC Transmission System (FACTS) solutions
  - Fixed Series Compensation (FSC)
  - Controlled Shunt Reactor (CSR)
  - Phase Shifting Transformer (PST)
  - Synchronous Condenser
- Power System Studies

SOFTWARE SYSTEM SOLUTION

- Performance Analysis, Diagnostics & Optimization (PADO) for Thermal Utilities
- Performance Calculation & Optimization system and Real Time Performance Data Monitoring system
- Open Platform Communications (OPC) connectivity from DCS to third party systems
- Enterprise Asset Management System (EAMS)
- Operator Training Simulator
- Remote Monitoring & Diagnostic System (RMDS)
- Software for electrical system analysis (load flow/ short circuit/ motor starting studies/ grounding studies/ relay co-ordination)

SWITCHGEAR

- Medium Voltage Vacuum Switchgear for indoor and outdoor applications for voltage ratings up to 36 kV and Gas Insulated Switchgears up to 420 kV
  - Indoor Switchgears
    - Up to 12 kV, 50 kA, 4000 A for thermal, nuclear, hydro and combined cycle power plant projects
    - Up to 36 kV, 31.5 kA, 2500 A for industries, solar power plants and refineries
    - Compact switchgear 12 kV, 25 kA, 1250 A for distribution system
  - Outdoor Vacuum Circuit Breakers
    - 12 kV, 26.3 kA, 1250 A for distribution segment
    - 36 kV, 26.3 kA, 1600 A for distribution segment
    - 25 kV & 52 kV (2x25 kV) Vacuum Interrupters and Vacuum Circuit Breakers for track side railway applications
  - Gas Insulated Switchgears
    - 36 kV, 40 kA, 2500 A for Refineries, Urban Distribution & Industries (Single Busbar & Double Busbar designs)
    - 420 kV, 40 kA, 3150 A for transmission sector (hydro station/ thermal power plant/ other substations)
    - 420 kV Gas Insulated Bus ducts





ON LOAD TAP CHANGERS (OLTC)

- On Load Tap Changer up to 765 kV class Transformer & Off Circuit Tap Switch up to 765 kV, 500 MVA class Transformer for various application like Power Transformer, Furnace Transformer, Station Transformer, Rectifier Transformer, etc.

L T SWITCHGEAR & BUS DUCTS

- Generator Bus-ducts (IPBD) with associated equipment to suit generator power output of utilities of up to 800 MW capacity
- 415 V LT Switchgear for Thermal, Hydro, Nuclear, Captive Power Plants & steel industry

TRANSFORMERS & REACTORS

- Power transformers for voltage up to 1200 kV
  - Generator transformers (up to 600 MVA, 420 kV, 3 Ph/ 400 MVA, 765 kV, 1 Ph/ 500 MVA, 420 kV, 1 Ph)
  - Autotransformers (up to 1000 MVA, 400 kV, 3Ph/ 600 MVA, 400 kV, 1 Ph/ 500 MVA, 765 kV, 1 Ph/ 1000 MVA, 1200 kV, 1 Ph)
- Converter Transformers/ Smoothing Reactors (up to 600 MVA, ±800 kV)/ (up to 254 MVAr, ± 500 kV) for HVDC transmission
- Shunt Reactors (up to 150 MVAr, 420 kV, 3 Ph/ 110 MVAr, 765 kV, 1 Ph)
- Controlled Shunt Reactors (up to 200 MVAr, 420 kV, 3 Ph/ 200 MVAr, 420 kV, 1 Ph/ 200 MVAr, 765 kV, 1 Ph) for
- Phase Shifting Transformers (up to 500 MVA, 400 kV, 3 Ph/ up to 500 MVA 400 kV, 1 Ph) for transmission lines
- Instrument transformers
  - Current transformers up to 400 kV
  - Electro-magnetic voltage transformers up to 220 kV
  - Capacitor voltage transformers (33 kV to 1200 kV)
  - 24 kV PR Class current transformer for HVDC Projects
- Special transformers
  - Rectifier transformer (up to 120 kA, 132 kV)
  - Furnace transformer (up to 33 kV, 100 MVA)
- ESP transformers up to 95 kVp, 1600 mA
- Dry type transformers up to 15 MVA, 36 kV
- Composite Monitoring System for Power Transformers

CAPACITORS

- H. T. Capacitors
  - Shunt, Series & Static VAR Compensation (SVC), Harmonic filter & HVDC applications (3.3 kV to 500 kV, 1 Ph/ 3 Ph capacitor banks)
- Capacitor Divider for CVT (33 kV to 1200 kV)
- Coupling Capacitor (33 kV to 800 kV, 4400 pF to 13200 pF) for transmission lines
- Surge Capacitor for protection of Generators & Transformers (11 kV to 40 kV)

BUSHINGS

- Oil Impregnated Paper (OIP) condenser bushings 52 kV to 500 kV for transformer applications
- 25 kV Locomotive bushings
- Wall bushings up to 245 kV

CONTROL GEAR

- Electronic controllers for ESPs in industries/ power plants
- Digital Static Excitation control system (2000 A, 400 V DC with redundant thyristor stacks & DC field breaker)





- Large current rectifiers with PLC Based digital controls
- Control & Protection Panels (up to 400 kV) For EHV Transmission projects
- Integrated excitation and protection panels for Synchronous Generator
- Digital Electro Hydraulic Governor (EHG) for Hydro Power Projects

INSULATORS AND CERAMICS

- Porcelain Insulators
  - Hollow insulators up to 765 kV for Transformers and SF_6 circuit breakers
  - Solid core insulators up to 400 kV for Bus Post & Isolators for substation applications
- Composite Long Rod Insulators
  - Up to ±800 kV, 420 kN for HVDC application
  - Up to 765 kV, 210 kN for HVAC application
  - Traction Insulators Stay Arm, Bracket and 9 Ton Insulators for Indian Railways
- Composite Hollow Insulators
  - Up to 400 kV for CT Housing Application
- Ceramic Lining (CERALIN) wear resistant material for Thermal Power Plant & Ash Slurry Application
- Industrial and Special Ceramics
  - Electronic Water Level Indicators (EWLI) used in Boiler Drum Water Level Monitoring (BHELVISION system)
  - Ceramic and Tungsten Carbide Flow Beans for Christmas Tree Valves
  - Grinding Media for Pulverizing in Thermal Power Plant

ELECTRICAL MACHINES

- AC Machines for Safe Area Application
  - Squirrel cage induction motors 150 kW to 22000 kW
  - Slip ring induction motors 150 kW to 10000 kW
  - Synchronous generators 1000 kW to 25000 kW
  - Synchronous motors 1000 kW to 15000 kW
  - Variable speed motors 150 kW to 19000 kW (Squirrel cage motors)
  - Variable speed synchronous motors 1000 kW to 8000 kW
- AC Machines for Hazardous Area Application (Fixed speed or with VFD)
  - Flame-proof squirrel cage induction motors (Ex 'd') (150 kW to 1300 kW)
  - Non-sparking squirrel cage induction motors (Ex 'ec') (150 kW to 22000 kW)
  - Increased safety squirrel cage induction motors (Ex 'eb') (150 kW to 4000 kW)
  - Pressurized squirrel cage induction motors (Ex 'p') (150 kW to 22000 kW)
  - Pressurized synchronous machines (Ex 'p') (1000 kW to 8000 kW)
- Industrial Alternators (Steam turbine, Gas turbine and Diesel engine driven) (3000 kVA to 25000 kVA)
- Vertical Motors for Primary Coolant Pumps for Nuclear Power Plants
- Induction Generators (300 kVA to 6000 kVA) for mini/ micro Hydro Plant.
- 2 Pole Air cooled Steam/ Gas Turbine driven Generators (3 MW to 160 MW)
- 4 Pole Air cooled Steam/ Gas Turbine driven Generators (3 MW to 40 MW)





- 2 Pole Hydrogen cooled Steam/ Gas Turbine driven Generators (36 MW to 270 MW)
- 200 kW HTSC Motor for Marine applications
- Permanent Magnet Based Generators and Motors up to 5 MW
- Permanent Magnet based Axial Flux Motors
- Gas Turbine Generators up to 270 MW

RAIL TRANSPORTATION

TRANSPORTATION SYSTEMS

- Semi High Speed Trainset (Vande Bharat)
- AC Electric Locomotives (up to 6000 HP, 25 kV AC)
- AC-DC Dual Voltage Electric Locomotives
- AC EMU (Electric Multiple Units) Coaches
- Traction Propulsion Systems for:
  - 6000 HP and 9000 HP IGBT based AC Locomotive
  - 3-phase IGBT based AC Electric Multiple Unit (EMU) and Mainline Electric Multiple Unit (MEMU)
  - Air-conditioned Electric Multiple Units (ACEMU)
  - ACEMU electrics for DC drives
  - Semi High Speed Trainset (Vande Bharat)
  - 1600 HP IGBT based DEMU (Diesel Electric Multiple Unit)
  - Metro train (DC-DC, DC-AC)
  - 1600 HP Multi-genset Locomotive
- WAG7 Locomotive with Regenerative Braking System
- Diesel Electric Tower Car
- Diesel Electric Shunting Locomotives (up to 1400 HP)
- OHE recording-cum-test car
- Dynamic track stabilizers
- Rail cum Road vehicle
- TCMS (Train Control & Monitoring System) Panels

TRANSPORTATION EQUIPMENT

- Traction Converter & Auxiliary Converter
- Vehicle Control Electronics
- Hotel Load Converter
- Composite Converter comprising Traction Converter and Hotel Load Converter
- Motorized bogies for mainline locos
- Traction Transformer
  - Up to 5400 kVA for conventional locomotives
  - Up to 9000 KVA for 3 phase drive locomotives
  - Up to 1200 KVA conventional AC EMU/MEMU
  - Up to 1578 kVA for 3 phase EMU
- 3-phase AC Traction Motors (axle hung /fully suspended type) up to 1200 kW for locomotives, train set & EMU application
- DC Traction Motors up to 630 kW for locomotives & EMUs
- Traction Alternators up to 3860 kW for Diesel Electric Locomotives
- Traction Generators up to 2000 kW
- DC Blower motors up to 50kW for dynamic braking system
- Motor Generator sets up to 25 kW for auxiliary requirements
- Eddy Current Clutch
- Traction gears and pinions for Locomotives & EMUs
- Specialized Wagons (up to 28 axle, 296 Ton)





- Railway Track Electrification
- Wheel and Axle machining
- Traction Converter (TC)

DEFENCE AND AEROSPACE

- Super Rapid Gun Mount (SRGM)/Upgraded SRGM 76/62 for naval ships
- Integrated Platform Management system (IPMS) for naval ships
- Static Main Motor Generator (SMMG)
- Rotary Main Motor Generator with Controls (RMMG)
- Permanent Magnet (PM) based Reserve Propulsion Motor and Drive.
- Frequency converters (PM based and conventional motor based) with drive controls
- Thermopressed Components for Tank Armor including Turret Casting for T-72 Tanks
- Liquid Cooling System for Jammer which comprises four modules namely ACM Module, Pump Module, PCM Module and Electronic Control Unit
- Casting and Forgings for ships
- Onboard Compact Heat Exchangers for various fighter aircraft platforms
- Fuel Tanks and other components for Launch Vehicles and Satellites
- Compact Brushless Alternators
- Space Grade Batteries
- Solar Panels for Satellites
- Li-ion cells for Launch Vehicles
- Li-ion batteries for aircraft applications
- Excitation System for Emergency DG Set for defence application

ENERGY STORAGE SYSTEM & E- MOBILITY

- DC fast charger for Electric Vehicles
- Direct Drive Permanent Magnet Motors and controllers for E-bus

OIL FIELD EQUIPMENT

- Oil Rigs – On-shore drilling rigs with AC-VFD and AC- SCR technology for drilling up to depths of 9000 metres, work-over rigs for servicing up to depths of 6100 metres, mobile rigs for drilling up to depths of 3000 metres, complete with matching drawworks and hoisting equipment including:
  - Mast and Substructure
  - Rotating Equipment: Drawworks; Rotary; Swivels; Travelling Blocks
  - Independent Rotary Drive (IRD) Unit
  - Dead Line Anchor
  - Mud System including pumps
  - Triplex Mud Pumps 5000 PSI Working Pressure
  - Mud processing equipment: Degasser, Desander
  - Sucker Rod Pump (Beam Pump Structure & Pumping Unit Gear Reducer)
  - Refurbishment and upgradation of Oil Rigs
  - 3-phase Oil Rig motor up to 1150 HP (for Drawworks, Mud Pump, Drilling)
  - Oil Rig motors up to 1000 HP (for Drawworks, Mud Pump, Drilling)
  - Oil Rig alternators up to 1750 kVA (for AC Power Pack)
  - AC/ DC Power Control Room for E760, E1400, E2000 & E3000 Rig
  - AC Power Pack up to 1430 kVA for DG sets
    - › AC Control Module
    - › DC Control Module
  - Driller's Console up to 3 Mud Pumps, IRD & Drawwork control & monitoring, load rating (0-1800 A, 0-1000 V)
  - Mobile Lighting Tower, Rig Lighting Tower
  - AC-VFD Controls for AC Rigs
  - STATCOM for power factor improvement in AC SCR Rigs
- Well heads and X-mas Trees up to 15,000 psi, Mud Line Suspension, Choke and Kill Manifold, CBM Wellheads, DSPM H- Manifold Assembly, Mud valves

FABRICATED EQUIPMENT AND MECHANICAL PACKAGES

- Cryogenic storage tanks, Mounded storage systems and storage spheres
- Pressure Vessels, Columns, Reactors/ Separators, Heat Exchangers
- Fired Heaters
- Purge Gas Recovery Unit
- Pressure Vacuum Swing Adsorption (PVSA) Oxygen System (MO_2) for medical applications
- Gear Box
  - Accessory & Load Gear Box for Gas Turbine Application
  - Gear box for Steam Turbine Application
  - Gear box for Boiler Feed Pump Drive Turbine (BFP DT) Application
  - Gear box for Air Cooled Condenser (ACC) fan Application
  - Gear box for Sucker Rod Pump (SRP) Application
  - Gear box for Independent Rotary Drive (IRD)
  - Gear box for AC Drawworks
  - Gear box for compressor drive application





INDUSTRY 4.0

- Remote Monitoring and Diagnostics System (RMDS) to provide plant wide operational and advisory support.
- KAMPAN 1.0 & Specialized Remote Vibration Diagnostic & Condition Monitoring System (RVDS) for continuous health monitoring for the critical main TG set, operating on a 24x7 basis, achieved through online remote monitoring of vibration and essential parameters of rotating equipment.
- Plant Automation Live Monitoring (PALM) an Android app for real-time remote monitoring of process parameters, featuring user-friendly schematics and graphical representations.
- Automatic Generation Control (AGC) is a system for adjusting the power output of multiple generators at different power plants, in response to changes in the load.
- Smart Project Management System (SPMS) for Tracking Man, Material and Machine using IIOT

DESALINATION AND WATER TREATMENT PLANTS

- Complete Water Management Solutions for Power Plants Industrial applications and Municipal applications with various treatment technologies:
  - Pre Treatment Plants (PT)
  - Desalination Plants
  - Demineralization Plants (DM)
  - Membrane Based Treatment Systems
  - Electro Deionization Plants
  - Effluent Treatment Plants (ETP)
  - Sewage Treatment Plants (STP)
  - Zero Liquid Discharge (ZLD) System
  - Cooling Water Treatment Plants
  - Tertiary Treatment Plants





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