2.1. BHEL - AN OVERVIEW

Bharat Heavy Electricals Limited (BHEL), a ‘NAVARATNA’ - one of the crown jewels of the Public Sector established in the late 50’s, is today, a name to reckon with in the industrial world. It is the largest engineering and manufacturing enterprise in India in the energy-related/infrastructure sector, today. It is the largest engineering & manufacturing enterprise of its kind in India and one of the leading international companies in the power field.

BHEL’s first plant was set up in Bhopal in 1956 ushering in the indigenous Heavy Electrical Equipment Industry, a dream which has been more than realized with a well recognized track record of performance. The company has been earning profits continuously since 1971-72 and paying dividends since 1976-77.

BHEL has, over the years, established its presence in over 60 countries of the world. With Corporate Headquarters in New Delhi, its operations are spread over 14 Manufacturing Plants and a number of Engineering & Service Divisions, Regional & Branch Offices in India and Abroad. These sets contribute 73% power generated in India comes from the BHEL built equipment. The wide network of BHEL’s 14 manufacturing divisions, four Power Sector regional centres, over 100 project sites, eight service centres and 18 regional offices, enables the Company to promptly serve its customers and provide them with suitable products, systems and services - efficiently and at competitive prices. The high
level of quality & reliability of its products is due to the emphasis on design, engineering and manufacturing to international standards by acquiring and adapting some of the best technologies from leading companies in the world, together with technologies developed in its own R&D centres. BHEL has acquired certifications to Quality Management Systems (ISO 9001), Environmental Management Systems (ISO 14001) and Occupational Health & Safety Management Systems (OHSAS 18001) and is also well on its journey towards Total Quality Management. BHEL has -

- Installed equipment for over 90,000 MW of power generation -- for Utilities, Captive and Industrial users.
- Supplied over 2,25,000 MVA transformer capacity and other equipment operating in Transmission & Distribution network up to 400 KV (AC & DC).
- Supplied over 25,000 Motors with Drive Control System to Power projects, Petrochemicals, Refineries, Steel, Aluminum, Fertilizer, Cement plants, etc.
- Supplied Traction electrics and AC/DC locos to power over 12,000 kms Railway network.
- Supplied over one million Valves to Power Plants and other industries.

BHEL’s investment in research and development is amongst the largest in the corporate sector in India. Products developed in-house during the last five years contributed about 7% to the revenues in 2005-2006.
**Human Resource Development Institute**

The most prized asset of BHEL is its employees. The human resource development institute and other HRD centres of the Company help in not only keeping their skills updated and finely honed but also in adding new skills, whenever required. Continuous training and retraining, a positive work culture and participative style of management, have engendered development of a committed and motivated workforce, leading to enhanced productivity and higher levels of quality.

**Health, Safety and Environment Management**

BHEL, as an integral part of business performance and in its endeavour of becoming a world-class organisation and sharing the growing global concern on issues related to Environment, Occupational Health and Safety, is committed to protecting environment in and around its own establishment, and to providing safe and healthy working environment to all its employees. For fulfilling these obligations, corporate policies have been formulated as -

- **Environmental Policy**
  - Compliance with applicable Environmental Regulation;
  - Continual improvement in environment management systems to protect our natural environment and control pollution;
  - Promotion of activities for conservation of resources by environmental management;
  - Enhancement of environmental awareness amongst employees, customers and suppliers.
BHEL will also assist and cooperate with the concerned government agencies and regulatory bodies engaged in environmental activities, offering the company’s capabilities in this field.

➢ **Occupational Health and Safety Policy**

- Compliance with applicable legislation and regulations;
- Setting-objectives and targets to eliminate / control / minimise risks due to Occupational and Safety Hazards;
- Appropriate structured training of employees on occupational health and Safety (OH & S) aspects;
- Formulation and maintenance of OH & S management programmes for continual improvement;
- Periodic review of OH & S management system to ensure its continuing suitability, adequacy and effectiveness;
- Communication of OH & S Policy to all employees and interested parties.

The major units of BHEL have already acquired ISO 14001 Environmental Management Systems Certification, and other units are in advanced stages of acquiring the same.

Action plan has been prepared to acquire OHSAS 18001 Occupational Health and Safety Management Systems certification for all BHEL units. In pursuit of these Policy requirements, BHEL will continuously strive to improve work practices in the light of advances made in technology and in occupational health, safety and environmental science.
2.2 SUMMARY OF BHEL’S CONTRIBUTION TO VARIOUS CORE SECTORS

BHEL’s operations are organised around three business sectors, namely *Power, Industry* - including Transmission, Transportation, Telecommunication & Renewable Energy - and *Overseas Business*. This enables BHEL to have a strong customer orientation, to be sensitive to his needs and respond quickly to the changes in the market. BHEL manufactures over 180 products under 30 major product groups and caters to core sectors of the Indian Economy viz., Power Generation & Transmission, Industry, Transportation, Telecommunication, Renewable Energy, etc.

*Power Generation*

Power Generation Sector comprises thermal, gas, hydro and nuclear power plant business. It possesses the technology and capacity to produce thermal sets with super critical parameters up to 1000 MW unit rating and gas turbine-generator sets of up to 255 MW unit rating. To make efficient use of the high-ash-content coal available in India, BHEL supplies circulating fluidised bed combustion boilers to both thermal and combined-cycle power plants. The Company manufactures 250 MW nuclear turbine-generator sets, and has commenced production of 500 MW nuclear turbine generator sets.

The power plant equipment manufactured by BHEL is based on contemporary technology comparable to the best in the world, and is
also internationally competitive. The Company has proven expertise in Plant Performance Improvement through renovation, modernisation and upgrading of a variety of power plant equipment, besides specialised know-how of residual life assessment, health diagnostics and life extension of plants.

**Transmission and Distribution (T&D)**

BHEL offers wide-ranging products and systems for T&D applications. Products manufactured include: power transformers, instrument transformers, dry type transformers, series and shunt reactors, vacuum and SF$_6$ circuit breakers, gas insulates switchgear and insulators.

A strong engineering base enables the Company to undertake turnkey delivery of electric substations up to 400 KV level, series compensation systems (for increasing power transfer capability of transmission lines and improving system stability and voltage regulation), shunt compensation systems (for power factor and voltage improvement) and HVDC systems (for economic transfer of bulk power). BHEL has indigenously developed the state-of-the art controlled shunt reactor (for reactive power management on long transmission lines).

**Industries**

BHEL is a major contributor of equipment and systems to industries: cement, sugar, fertilizer, refineries, petrochemicals, paper, oil and gas, metallurgical and other process industries. The range of systems and equipment supplied includes: captive power plants, co-generation
plants, DG power plants, industrial steam turbines, industrial boilers and auxiliaries, waste heat recovery boilers, gas turbines, heat exchangers and pressure vessels, centrifugal compressors, electrical machines, pumps, valves, seamless steel tubes, electrostatic precipitators, fabric filters, reactors, fluidised bed combustion boilers, chemical recovery boilers and process controls. BHEL is the only company in India with the capability to make simulators for power plants, defence and other applications.

**Transportation**

BHEL is involved in the development design, engineering, marketing, production, installation, maintenance and after-sales service or rolling stock and traction propulsion systems. In the area of rolling stock, BHEL manufactures electric locomotives up to 5000 HP, diesel electric locomotives from 350 HP to 3100 HP, both for main line and shunting duty applications. BHEL is also producing rolling stock for special applications viz., overhead equipment cars, Special well wagons, Rail-cum-road vehicle etc. BHEL is geared up to turnkey execution of electric trolley bus systems, light rail system etc. BHEL is also diversifying in the area of port handling equipment and pipelines transportation system.

**Telecommunication**

BHEL also caters to Telecommunication sector by way of small, medium and large switching systems.
Renewable Energy

Technologies that can be offered by BHEL for exploiting non-conventional and renewable sources of energy include: wind electric generators, solar photovoltaic systems, solar heating systems, solar lanterns and battery-powered road vehicles. The Company has taken up research and development efforts for development of multifunction amorphous silicon solar cells and fuel cells based systems.

2.3. PLANTS OF BHEL

To invest in human resources development sustained research and development, strive for excellence in management and other long range activities to ensure a leadership status for BHEL. Its main plants are –

- High Pressure Plant, Tiruchy
- Seamless Steel Tube Plant, Tiruchy
- Boiler Auxiliaries Plant, Ranipet
- Industrial Valves Plant, Goindwal
- Heavy Electricals Plant, Bhopal
- Transformer Plant, Jhansi
- Heavy Electrical Equipment Plant, Hardwar
- Central Foundry Forge Plant, Hardwar
- Heavy Power Equipment Plant, Hyderabad
- Electronics Division, Bangalore
- Electronic Systems Division, Electronics City, Bangalore
- Electro-poeceain Division, Bangalore
- Insulator Plant, Jagdishpur
- Component Fabrication Plant, Rudrapur
- Amorphous Silicon Solar Cell Plant, Gurgaon
- Heavy Equipment Repair Plant, Varanasi

2.4 ABOUT BHEL, HARDWAR

HEAVY ELECTRICAL EQUIPMENT PLANT (HEEP)

BHEL’s Heavy Electrical Equipment Plant (HEEP), established at Hardwar in 1963 commenced manufacture of thermal sets originally with Soviet know-how in 1967. After initial manufacture of 100 MW sets, HEEP went into the production of 200/210 MW sets. Keeping in view the increasing power demand and changing technology, BHEL entered into an agreement in 1976 with Kraftwerk Union of Germany for production of thermal sets with ratings 200 MW to 1000 MW. HEEP has manufactured, till September, 1993, 106 thermal sets of 200/210 MW, six sets of 235 MW for nuclear power stations and 13 sets of 500 MW capacity each. The design work has also been started at HEEP for development and manufacture of 800 MW sets in near future.

HEEP, over the years, has acquired the competence to manufacture higher size thermal sets by optimising the utilisation of existing capacities, modernisation of machine tools and installation of CNC machines. Facilities at BHEL, Hardwar today match with any international standard. Some of the more important facilities include -
Special Features

HEEP has successfully equipped its Blade Shop is equipped with sophisticated special purpose machines like Computer Numerically Controlled Machining Centre for fir-free root machine, CNC Machining Centre for T-root machining, 5-spindle 360 Circular Copy Milling Machine for machining of external and internal profiles of long twisted blades and other special purpose copy milling and grinding machines and testing equipment. The Blade shop is now equipped to manufacture blades of all sizes and designs for sets of 2000/210 and 500 MW ratings based on latest technologies.

Overspeed Balancing Tunnel

Hardwar Plant ranks among the top dozen international manufacturers of power equipment who alone have such a large size balancing tunnel. The balancing tunnel facilitates overspeed testing and balancing of rotors of conventional and nuclear turbines even upto 1300 MW capacity.

Turbo-Generator Test Beds

Two Turbo-Generator Test Beds in the Plant have been established to provide facilities for testing turbo-generators of ratings 200/210, 500 and even 1300 MW.

Miscalastic Insulation Plant

A most modern Miscalastic Insulation Plant has been set up and the Hardwar Plant is manufacturing all TG stator bars with this type of
insulation, which is superior in quality to other insulation systems.

**Other Facilities**

A number of computerised numerically controlled machine-tools, a Central Maintenance Workshop and a Power Electric Laboratory have been installed in the Plant. The MFD Lathe and CNC Vertical Borer enable machining of rotors upto 1300 MW rating and also machining accurate grooves in the castings respectively.

**Hydro Sets**

Based on the site and customers requirements, HEEP is capable of manufacturing hydro turbines and matching generators of various ratings with maximum hydro turbine runner diameter of 6600 mm. The Plant has already manufactured nearly 100 hydro sets of Pelton, Francis and Kaplan types with ratings from 5 MW to 250 MW.

**Electrical Machines and Control Panels**

BHEL, Hardwar has emerged as the largest plant in South East Asia, capable of designing and manufacturing large size tailor-made AC and DC Machines.

More than 8000 AC and DC Machines have been supplied to Power Projects; Steel, Cement, Rubber, Sugar, Fertilizer, Metallurgical Plants, Coal and Mining Industries, Refineries, Irrigation Schemes and so on. These include 1200 KW, 3000 rpm synchronous motor used for testing large size turbo generators; 6300 KW, 930 volts, 63-90 rpm DC Motor
for driving Plate Mill; 1670 KW; 728 volts, 58.12 rpm Mine Winder Motors, each weighing 40.5 MT and 2600 KW, 330 rpm Vertical AC Motors for driving Circulating Water Pumps for 500 MW Thermal sets.

BHEL Hardwar is constantly engaged in development of new design of electrical machines to suit specific applications and requirements of the customers as per international and national standards. Control panel for industrial drives/power stations are also designed and manufactured at BHEL, Hardwar. A large number of panels have been manufactured for ferrous and non-ferrous metallurgical plants, power stations, rubber industry, cement and paper manufacturing plants etc. Range of manufacture includes open and closed type panels for closed loop drive systems, motor control centres, power distribution boards etc.

**New Products**

Keeping in view the abundance of gas reserves in the country, HEEP has taken up the manufacture of large size gas turbines upto 200 MW capacity in collaboration with M/s Siemens of Germany. The combined cycle power plants are also being manufactured at the Plant. BHEL, Hardwar has also entered in the field of design and manufacture of nuclear sets of 500 MW ratings. The Plant has also taken up the manufacture of industrial heat exchangers. The other areas of diversification are Aviation, Medical Equipment, Defence and Mining Equipments.
**ISO Recognition**

As a part of its continuous journey in attaining excellence in quality management, HEEP, Hardwar has also received global recognition with the award of ISO-9001 certification for quality management by Bureau Veritas International for its products and ISO 14001 certification for environment management.

**Exports**

HEEP, Hardwar has exported its products to Iran, Russia, Iraq and Germany. The products exported include condensers for 800 MW thermal sets, turbine rotors, curtis wheel blades, gas turbine combustion chambers, haulage winches and electrical machines. Three gas turbines of 150 MW each of ISO ratings are also under manufacture for export to Germany.
HIERARCHICAL STRUCTURE OF
BHEL (HEEP), HARDWAR

SHRI D. K. MODY
(Executive Director, HEEP)

Shri O. P. Agarwal
HEEP GM (WE&S)

Shri H. R. Verma
HEEP GM (ENGG)

Shri T. K. Banerjee
HEEP GM (T & D)

Shri P. Engineer
HEEP GM (MM)

Shri J. A. Khan
HEEP GM (EM)

Shri A. K. Upadhaya
AGM (HRD)

Shri Ramesh Gawande
HEEP AGM (P & D)
CENTRAL FOUNDRY FORGE PLANT (CFFP)

BHEL's Central Foundry Forge Plant (CFFP) was set up at Hardwar with French collaboration. The construction started in 1974 and production was commenced in 1976. This plant has an inbuilt high degree of sophistication normally associated with much larger plants and has successfully developed various intricate castings and forgings which were hitherto imported.

Special Features

CFFP has successfully manufactured various types of steels, e.g., creep resistant steels, heat resistant steels, stainless steels, armour steels etc. as per Indian and International Standards. CFFP has been supplying sophisticated castings used in power sector e.g., steam turbine castings, turbo generator press rings and Francis runners, compressor castings etc. Critical Forgings manufactured by CFFP include HP, IP and LP rotors, and discs etc., for steam turbines, shafts, pole and plates, rotor bush etc., for hydro sets and discharge cover for pumps besides various types of critical forgings for Defence, Nuclear, Steel and Cement industries. CFFP is further upgrading and augmenting its facilities in the high growth and high technical areas.

CFFP has also exported motor frame and steam turbine castings and forgings to USSR and Germany. CFFP has successfully developed large size cheek casting for bowl mill for BHEL, Hyderabad and HP outer casing for 200 MW thermal sets of KWU/Siemens design.
CFFP has been recognized as a well-known steel maker- *Foundry and Forge Master* by Indian Boiler Board. The American Bureau of Shipping has also approved CFFP for the manufacturing of castings and forgings for ship building industry.

**HIERARCHICAL STRUCTURE OF BHEL (CFFP), HARDWAR**

**SHRI ANIL SACHDEV**  
Executive Director, CFFP)

- Shri K. L. Ghouri  
  CFFP GM (FIN)
- Shri M. V. C. Rao  
  CFFP GM (Tech.)
- Shri K. K. Gupta  
  CFFP GM (QM)
- Shri K. P. Singh  
  CFFP GM (MM)
- Shri M. M. Lamba  
  CFFP AGM (SF)
- Shri B. L. Yadav  
  CFFP AGM (P & D, EC)
POLLUTION CONTROL RESEARCH INSTITUTE (PCRI)

BHEL's Pollution Control Research Institute (PCRI) has also been set up at Hardwar with UNDP assistance to develop new technologies for prevention of air, water, noise and solid waste pollution. The Institute has already conducted a number of studies on the effect of emissions of industrial pollutants in and around the industries and thermal power stations. The institute is rendering consultancy services to a large number of government and private organisations.

- Central Pollution Control Board, New Delhi has assigned a project for 'Environmental Studied of Chardham in Uttrakhand' to PCRI. This type of activity is being carried out for the first time for these places.

- A training programme on 'Water Quality Management' was organised by PCRI for officials of Centre and State Pollution Control Boards, State Environmental Directorates and Major industries. This programme was sponsored by Central Pollution Control Board.

- As a part of its social obligation, BHEL, Hardwar is constantly striving to improve the quality of life in and around its township. This contribution covers almost all aspects of life-education, health, hygiene, entertainment and means of livelihood.

- To create more employment opportunities for widows and women
of weaker sections of society, new activities for manufacture of chalk and detergents have been added to the existing areas in Weaving Centre besides other Welfare Centres being run by BHEL's Ladies Club.

**HIERARCHICAL STRUCTURE OF BHEL (PCRI), HARDWAR**

**SHRI A. K. GUPTA**  
GM (PCRI, C & PR)

- Shri R. M. Singhal  
  AGM

- Shri R. M. Singhal  
  AGM

- Shri Tej Bahadur  
  Sr. DGM

- Shri P. K. Biswas  
  DGM
Manpower of BHEL, Hardwar  
*(HEEP, PCRI AND CFFP)*  
Ending June, 2006

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Chief Executives of BHEL, Hardwar

Direction towards Excellence

1. Shri D. R. Kohli 1963-66
2. Shri Jagdish Prasad 1966-69
3. Shri D. R. Malik 1969-72
4. Shri K. L. Puri 1972-75
5. Shri A. K. Khosla 1975-76
7. Shri P. S. Gupta 1978-84
8. Shri C. M. Gupta 1984-86
9. Shri G. Saran 1986-88
10. Shri A. D. Parashar 1988-88
11. Shri A. Gavisiddappa 1988-89
12. Shri D. V. Bhatnagar 1989-90
15. Shri H. W. Bhatnagar 1997-00
17. Shri S. K. Gupta 2004-06
18. Shri Anil Sachdev 2006-07
19. Shri D. K. Mody 2007-