

## **HEAVY ELECTRICAL EQUIPMENT**

### **BACKGROUND & HISTORICAL TRENDS**

#### **Electricity in India**

Unlike other technological developments in the West, which were introduced in India after a time lag, electricity was introduced in India in the form of galvanic electricity (both electro chemical and electro magnetic) through telegraphy. The first experimental line was set up in Kolkata in 1839 at the Botanical Gardens along the river Hooghly.

Electricity in the form of lighting arrived 35 years later with the former princely state of Bikaner introducing electricity in the subcontinent. In 1886 Jamsetji Tata installed a dynamo driven power plant in his residence, which was later extended to the adjacent Gymkhana Chambers ten years later. When the Taj Mahal Hotel was built in 1903, it was equipped with a modern power generator.

The Government of India invited Crompton to help in the preparation of an Electric Lighting Act in 1896. Subsequently, the Indian Electric Company Ltd. was registered in London in January 1897, which changed its name to become the Calcutta Electric Supply Corporation (CESC). A CESC power station started its operation on April 17, 1899.

The first major hydroelectric project (4.5 MW) in India was on the Cauvery river at Sivasamudram, commissioned by the Maharaja of Mysore in 1899. It commenced power supplies to the Kolar Gold Mines in 1902. The capacity was increased to 42 MW in stages by 1927.

In 1903, the Madras Electric Supply Corporation of India Ltd. installed a power plant and subsequently set up power plants in different cities including Karachi, Kanpur, Allahabad, Nagpur, Rangoon and Tibet.

The Tata Hydroelectric Power Supply Co. was registered on November 7, 1910 and the license obtained by the syndicate for power generation was transferred to the Company. The country's largest hydropower station was commissioned in 1911 with a 32 MW capacity which transmitted power to Bombay on a 110 kV transmission line. To meet the increased load demand, Tata Sons Ltd. promoted a new Company - Andhra Valley Power Supply Co. in 1916 and commissioned a 72 MW power plant at Shivpuri in 1922. A third company – Tata Power Co. Ltd. was incorporated in 1919 and set up a 88 MW generating station at Bhira in 1927.

During this decade major railway workshops, defence installations, ordnance factories, collieries, dockyards, oil, flour, jute and textile mills were equipped with diesel or steam driven generators and electric drives.

<b>Break up of Present Installed capacity</b>		
Fuel	MW	%
a. Thermal	81,681	66.4
i) Coal	68,308	55.6
ii) Gas	12,172	9.9
iii) Oil	1,202	0.9
b) Hydro	31,865	25.9
c) Nuclear	3,310	2.7
d) Renewable	6,158	5
	123,014	100
<b>Present Transmission System</b>		
	MVA	Ckt.Km
765/ 800 kV	-	1,323
400 kV	76,010	63,129
220 KV	142,242	107,625
HVDC	30,000	5,876

Source : Ministry of Power

By the time India got her Independence in 1947, the total installed capacity in the country was 1392 MW (884 MW Thermal and 508 Hydro).

<b>Highlights of the Indian Power System</b>				
			<b>1950</b>	<b>2005</b>
1.	Generation Capacity installed	MW	1,700	123,014
2.	Transmission Lines	Ckt. MW	2,700	250,000
3.	Village Electrification	Nos.	1,500	475,000 (81%)
4.	Per Capita Consumption	Kwh/year	15.6	606

Source : Ministry of Power

Since then, India has come a long way with an installed generating capacity of 115544.81 MW as on 31-01-2005.

Despite this achievement, the ever-increasing demand for power has led to a widening gap between the supply and demand. The Indian power sector is a core infrastructure sector and its expansion is essential for the success of economic development of India. The Government has therefore, rightly laid emphasis on this sector and plans to add 70,000 MW of new installed generating capacity by the end of 2012. In other words, it means an addition of 10,000 MW every year on an average.

## Advent of manufacturing of electrical equipment in India

In the beginning, no overseas company set up a manufacturing facility in India. They were merchandising and contracting through their local agents in India like Kilburn & Co., Martin & Co., Killick Nixon, F&C Osler & Co. Balmer Lawrie, Jessop & Co., John Flemming etc. Anticipating the growing demand for electricity, particularly in the textile mills, Greaves Cotton, the biggest group of spinning mills, set up its electrical engineering department in 1904 while F&A Parkinson and Verity & Co. holding Agency for Crompton took up contract jobs for electrification.

After commissioning, the Calcutta and Madras power plants, Crompton established its offices in the two cities in 1899 and 1904 respectively. GEC (India) Ltd. came to India in 1911 as a distributing company, Siemens in 1922 and AEI (India) Ltd. in 1924. Indian Cable Co. set up a manufacturing plant in Jamshedpur in 1923, Westinghouse Brakes & Signals in Calcutta in the late 1920s, Crompton Parkinson in Bombay in 1937, Philips Electrical Co. (India) Ltd. in Calcutta in 1931, Union Carbide (India) Ltd. for batteries (National Carbon Products) in 1934 and AEI Manufacturing Co. Ltd. in Calcutta in 1939.

Among the Indian companies, Bengal Lamps was established to manufacture electric lamps in 1932, India Electric Works Ltd. started an integrated design ceiling fan factory in Calcutta around the same time. Other important companies include Larsen & Toubro (a partnership of two enterprising young Danes) in 1938, Bajaj Electricals (1938), Ess Ess Kay Engg. (1935), Jyoti Ltd. (1943), Mysore Electricals (1945), Kirloskar Electric (1946) and GFM Manufacturers, Punjab (1946) etc.

## International Trends

Over the past two decades, the power plant equipment industry has been witnessing a process of consolidation. In the late 1970s there were 10 to 12 players and today there are about 4 to 6. This consolidation has resulted in stronger companies with increased size, economies of scale, wider product ranges and enhanced financial strength. They now have greater access to markets and higher bargaining power as a result of combined technological strengths. The major consolidation which has taken place is detailed below:

### **Eighties :**

- GEC UK + Alcatel France → GEC Alstom
- ASEA Sweden + BBC Switzerland → ABB
- ABB acquired 39 companies and the power transmission and power distribution business of Westinghouse Electric Corporation to become a technology leader in T&D business.

### **Nineties**

- Siemens acquired Westinghouse's fossil power plant activities in 1998 and also Voith Germany's Hydro division and Parson's Power Engineering, UK

- Babcock Borsig Power took over B&W Spain
- GE Hydro bought over Kvaerner
- GEC Alstom and ABB merged to become ABB-Alstom Power (AAP)

## **2000**

- Alstom bought ABB's stake in AAP
- GE (USA) bought EGT, France

## **2003 & 2004**

- Siemens AG bought Alstom's industrial turbine business
- Areva bought Alstom T&D business
- Hitachi Japan took over the assets of insolvent Babcock Borsig.

In the case of the user sector there has been a shift in the fuel mix used to generate electricity since the 1970s. The use of oil has declined after the oil shocks. Prior to the oil shocks, oil accounted for nearly 23% of the fuels used in electricity generation, but since then, its share has fallen to under 10% today.

While coal continues to remain the dominant fuel for electricity generation, generation from nuclear power increased rapidly from the early 1970s to the mid 1980s, while natural gas fired generation has grown rapidly in the 1980s and the 1990s.

Hence the technology and equipment for electricity generation has also undergone a shift from mainly coal and oil based to natural gas, hydro and nuclear. In the future renewables will make its presence felt.

## **Current Status in India**

The Indian heavy electrical equipment industry has registered a 27% growth during 2004-05 as compared to the year 2003-04.

The performance of the heavy electrical equipment industry is closely linked to the power programme, which continues to languish due to fund constraints. The progress on the reform front for State Electricity Boards has also been rather slow. Theft of power, free / subsidized electricity and heavy T&D losses are the major issues responsible for the weak financial condition of the SEBs and require serious attention.

During the 9<sup>th</sup> Five Year Plan (1997-2002), the Indian Government had fixed a target of 40245.2 MW for capacity addition, comprising 29545.5 MW thermal, 9819.7 MW for hydro and 880 MW for nuclear. Unfortunately, due to various constraints, the Government itself could add only about 19,000 MW compared to the planned addition.

A capacity addition of 41,110 MW has been targeted for the 10<sup>th</sup> five-year plan. The details are provided below:

### Capacity Addition Programme for the 10<sup>th</sup> Five-Year Plan

	Hydro	Thermal	Nuclear	Cumulative Capacity
Central Sector	8742	12790	1300	22832
State Sector	4481	6676	0	11157
Private Sector	1170	5951	0	7121
<b>Overall</b>	<b>14393</b>	<b>25417</b>	<b>1300</b>	<b>41110</b>

Source: Annual Report 2004-05, Ministry of Power

In order to mobilize additional resources for the electricity sector, the Government formulated a policy in 1991 to encourage greater investment by private enterprises in the power generation sector. In spite of an encouraging response to this from domestic and foreign developers, the contribution from the IPPs has just been about 3,500 MW.

### \*Capacity addition achieved during the last 6 years

Year	Capacity Addition (MW)*		
	Centre	States	Total
1997-98	333.0	2893.50	3226.5
1998-99	991.6	3250.40	4242.0
1999-00	1615.4	2892.10	4507.5
2000-01	659.0	3116.66	3775.66
2001-02	905.0	2210.25	3115.3
2002-03	1210.0	1440.30	2650.3
2003-04	3035.0	916.62	3951.6
2004 –2005 (upto Feb 2005)	2585.0	1058.92	3643.9

Source Annual Report – Ministry of Power, Govt. of India

### All India Power Requirement Forecast for 9<sup>th</sup>, 10<sup>th</sup> and 11<sup>th</sup> Plan

Year	Energy Requirement MKWh	Peak Load MW
1997-98	436258	73458

1998-99	469057	78936
1999-00	502254	84466
2000-01	535903	90093
2001-02	569650	95757
2006-07	781863	130944
2011-12	1058440	176647

Source: 15<sup>th</sup> Electric Power Survey of India

### **Electricity Act 2003**

The early initiatives in terms of reforms were not effective because of the emphasis on power generation and not on transmission and distribution.

The Electricity Act 2003 has attempted to address generation, transmission and distribution. It has opened up competition in the power sector, kept the consumer as a focal point and provided avenues for investment. Further, generation has been de-licensed, the captive power policy has been liberalized and open access provided for transmitting power. Apart from this, stringent provisions have been provided to minimize theft and misuse. The Act has also given consideration to promoting access to electricity in rural areas and by the economically weaker sections of society.

### **Accelerated Power Development Reform Program (APDRP)**

In February 2001, the Government introduced a programme with a vision of supplying reliable, affordable and quality power for all users by 2012. Greater emphasis was provided to upgradation of sub-transmission and distribution through 100% metering, reducing T&D losses, energy audits, power factor correction measures etc. A qualitative improvement in power supply at the consumer end is expected so as to raise the level of satisfaction besides improving revenue realization for the utilities. The programme is being implemented in the areas of distribution reforms, which will result in improving the financial health of the State Electricity Boards undertaking reforms. Out of the total sanctioned amount, Rs.4112 crores has been released by Government till March 2005.

### **Transmission and Distribution**

Evacuation of power from generating stations to the load centers is as important as power generation. Several inter-state and inter-regional transmission lines exist to facilitate the integrated operation of the state system with the regional grids.

The regional power grids in the northern, western, southern, eastern and north-eastern regions of the country were established for optimum utilisation of the unevenly distributed power resources in the country by facilitating intra-regional and inter-regional power exchanges to the extent feasible depending upon day to day power availability and load conditions. Transfer of surplus power to the other power deficit regions is given the first priority.

Keeping in view the envisaged additions to the generation programme, a perspective transmission plan has been drawn up indicating the major inter-regional transmission highways to be developed by 2012 and this will lead to the formation of a strong National Grid. The capacity of inter-regional lines by the end of the Eleventh Plan would be about 30,000 MW from the present Inter-regional transfer capacity of 9500 MW. Investment of about Rs.2,00,000 crores has been estimated for the associated transmission systems including creation of a National Grid.

### **Private Sector Participation in Power Sector**

Post the Electricity Act 2003 the private sector's interest in investing in this sector has revived. An "Inter-Institutional Group (IIG)" and a "Green Channel" have been constituted to facilitate financial closure of Independent Power Producers (IIPs).

Almost all sectors of the electrical industry are indicating growth. Products like energy meters show a technology shift, as there is greater demand for electronic meters than conventional electromagnetic meters.

The power equipment industry in India is on a growth path. The momentum is expected to continue with the Ministry of Power outlining its vision for providing "power for all by 2012", and the Government of India is planning huge investments to achieve this objective. Industry feels that the future is encouraging and challenging for the domestic manufacturers.

### **Scope of the Study**

For the purposes of the study, the following product / equipment categories were taken to comprise heavy electrical equipment:

- Power and Distribution Transformers
- Switchgears
- Electric Motors
- Generators
- Alternators
- Turbines
- Capacitors
- Energy Meters
- HT Circuit Breakers

The companies chosen were those who are manufacturing complete equipment and were in the organized sector.

All the international players manufacturing these electrical equipment barring a few like Eaton are present in India either as JVs or subsidiaries.

The market share and total market size of the product range covered by the study is given below. These include companies who manufacture components as well as complete equipment.

<b><u>Major Products</u></b>	<b><u>Companies</u></b>	<b><u>Market Share (%)</u></b>
<b>Transformers</b>	<b>Total No. of companies : 79</b>	
	Crompton Greaves	21.37
	Bharat Heavy Electricals	15.41
	Vijay Electricals	15.41
	Alstom	9.98
	Emco	7.45
	Bharat Bijlee	4.06
	A B B	3.44
	Indo Tech Transformers	3.40
	R T S Power Corpn.	2.31
	Accurate Transformers	2.07
	E C E Industries	1.93
	Marson's	1.45
	Andrew Yule & Co.	1.36
	Kirloskar Electric Co.	0.64
	Alfa Transformers	0.55
	Star Delta Transformers	0.43
	P M Electronics	0.28
	Shilchar-Payton Technologies	0.25
	Toyama Electric	0.06
	Sulzer Electronics	0.06
<b>Total Market size : Rs.1859.7 Cr.</b>		
<b>Motors &amp; Generators</b>	<b>Total No. of companies : 126</b>	
	Bharat Heavy Electricals	15.59
	Crompton Greaves	10.44
	Powerica	6.13
	Siemens	5.24
	Sudhir Gensets	5.14
	Kirloskar Electric Co.	4.39
	Kaytee Switchgear	3.74
	Hindustan Powerplus	1.73

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	Jeevan Diesels & Electricals	1.51
	Alstom	1.35
	A B B	1.34
	Bharat Bijlee	1.33
	GMMCO	0.90
	Wartsila India	0.66
	Jyoti	0.60
	T I L	0.55
	Cummins India	0.37
	Rajendra Electrical Ind.	0.36
	B P L Engineering	0.25
	Igarashi Motors India	0.24
	T T G Industries	0.23
	F A L Industries	0.23
	I F B Industries	0.20
	International Combustion (India)	0.19
	Sai India	0.15
	Man B&W Diesel India	0.10
	Jem Industries	0.10
	Stone India	0.09
	Belliss India	0.07
	Deepak Industries	0.05
<b>Total Market size : Rs.3951.8 Cr.</b>		
<b>Switchgears</b>	<b>Total No. of companies : 105</b>	
	A B B	12.00
	Larsen & Toubro	9.93
	Siemens	9.52
	Crompton Greaves	8.18
	Alstom	7.03
	Bharat Heavy Electricals	5.27
	Bhartia Industries	2.11
	Indo Asian Fusegear	1.98
	Havell's India	1.77
	Elpro International	1.66
	Controls & Switchgear Contactors	1.06
	Modison Metals	0.99
	North-West Switchgear	0.74
	Jyoti	0.59
	Andrew Yule & Co.	0.37
	Integra Hindustan Control	0.28
	Datar Switchgear	0.27

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	J S L Industries	0.23
	Toyama Electric	0.20
	Lakshmi Electrical Control Systems	0.18
	S&S Power Switchgear	0.17
	Beardsell	0.16
	Autometers Alliance	0.15
	Indian Rayon & Inds.	0.12
	Elhard Marketing	0.06
	Indiana Current Control	0.03
	Hansu Controls	0.02
	Macneill Engineering	0.02
	Bombardier Transportation India	0.01
	Asian Electronics	0.01
<b>Total Market size : Rs.3252.8 Cr.</b>		
<b>Energy Meters</b>	<b>Total No. of companies : 33</b>	
	Secure Meters	26.55
	T T L	19.27
	Genus Overseas Electronics	11.33
	Larsen & Toubro	8.02
	Havell's India	7.70
	Accurate Meters	4.05
	Precision Meters	4.02
	Bharat Heavy Electricals	3.03
	Iskraemeco Seahorse	2.40
	Alstom	1.96
	E C E Industries	1.28
	Namtech Electronic Devices	0.61
	Wellwin Industry	0.11
	India Meters	0.10
	Revera Appliances	0.05
	Baroda Electric Meters	
<b>Total market size : Rs.761.1 Cr.</b>		
<b>Capacitors</b>	<b>Total No. of companies : 46</b>	
	Keltron Component Complex	4.11
	Bharat Heavy Electricals	2.60
	Globe Capacitors	1.93
	Incap	1.55
	A B B	1.35
	CTR Manufacturing Industries	1.00
	Universal Cables	0.89
	Gujarat Poly-Avx Electronics	0.53
	Keltron Electro Ceramic	0.51
	Pan Electronics (India)	0.39
	K. Dhandapani & Co.	0.34
	Gujarat Mulco Electronics	0.27
	Saif Electronics	0.22
	Dalmia Cement (Bharat)	0.06

<b>Total Market size : Rs.751 Cr.</b>		
<b>Steam &amp; Hydro Turbines</b>	Total No. of companies : 10	
	Bharat Heavy Electricals	68.73
	Triveni Engineering & Inds.	5.88
	Belliss India	0.51
	Kirloskar Brothers	0.07
<b>Total Market size : Rs.1191.9 Cr.</b>		

- Source: CMIE, Industry Market Size and Shares, February 2005
- Total Market Size of all the sectors comprises of Rs.11,770 Crores

### Structure of the Sector

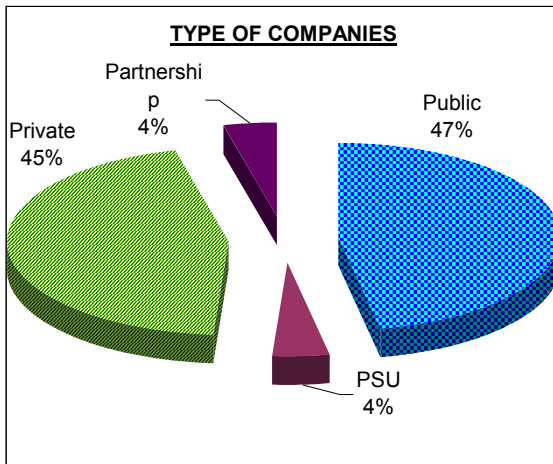


Chart 1

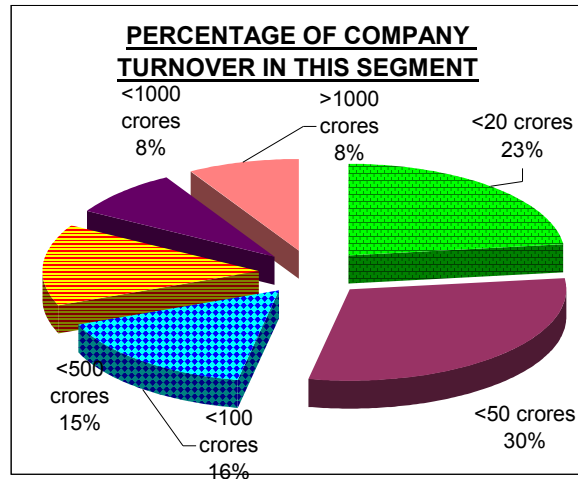


Chart 2

The segment has a fragmented structure with 53% of the manufacturers with a turnover of less than Rs.50 crores. This is also due to the fact that there are many companies in the unorganized sector who are manufacturing transformers, switchgears, contactors and energy meters in the low technology band. This is in evidence mainly in the product categories which are of standard nature. In power generation equipment where the emphasis is mainly on projects the market is dominated by a few large players.

51% of the industry comprised of public limited companies including PSUs and the balance were private companies including closely held, partnership firms and subsidiaries of multinationals.

When the equipment manufacturers were asked about their opinion about the future structure of the sector, 34% of the companies had no opinion or vision about the future. 46% felt that there will be consolidation / shake out and 20% were of the opinion that the entry of foreign players in the industry will lead to fragmentation.

It is expected that product segments like high voltage transformers, turbines, HT circuit breakers, higher capacity electric motors, generators and alternators will witness a consolidation phase in India. In the low voltage equipment categories where the technology barrier is not high, the industry will witness fragmentation with

more players entering India especially from China which is expected to be a strong competitor.

However, the majority of the respondents felt that only players who have proven technology, produce quality products and render a package of services will be able to survive in the future.

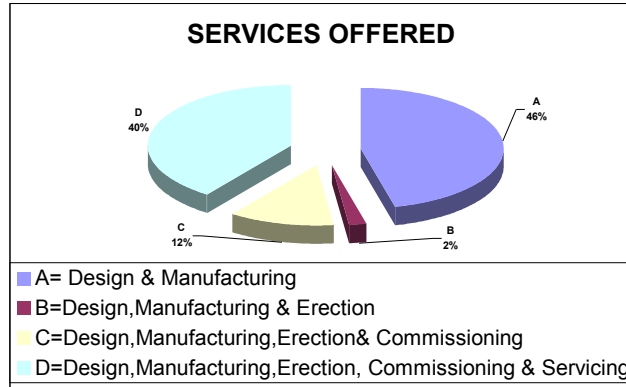


Chart 3

Only 40% of the manufacturing companies were involved in the entire range of activities like design, engineering, manufacturing, erection, commissioning and servicing. These companies are also EPC contractors in the power sector.

The other companies are manufacturing products which are supplied directly to OEM's, or to the utility companies, or through distribution channels and hence activities like erection and servicing are not required.

## Technology

The manufacturers and users felt that the technology available in India for most of the products was available in India barring a few products required for high voltage lines. Raw materials like CRGO steel, amorphous cores for low loss transformers, high voltage insulation papers, cables and joint accessories above 132 kV, OPGW, G/S above 145 kV, disturbance recorders for 132 kV Sub-stations are still imported since they are not manufactured either due to lack of availability of technology, or the volumes required are not economical.

POWERGRID has already implemented/implementing the following new technologies and the domestic companies are quickly gearing themselves to either developing or acquiring these technologies.

- Modern route survey technique using GPS, GIS, satellite imagery, ALTM etc
- 765 kV transmission system
- Flexible AC transmission system (FACTS)
- High surge impedance loading line
- Multi circuit and compact tower
- Gas Insulated switchgear in urban/scarce land areas
- Enhanced thermal limit (95 deg. C.) for transmission line
- High temperature endurance conductor (235 deg. C.) etc.

## **Transformers**

The Transformer Industry in India has developed for over 50 years and has a well developed technology base upto 800 KV technology class. The industry is gearing up to meet the requirements of the country for the higher voltages. 765 KV transformers are available in India through imports, however, the technology is not. BHEL is in the process of indigenously developing the technology for this class of transformers.

In the global market, performance of Indian products are acknowledged to be technically at par with the leading international companies. Driven by a strong R&D base at company as well as at a national level, Indian products are continuously upgraded to meet the emerging market requirements.

Besides meeting the domestic requirements, Indian companies are exporting transformers to over 50 countries including the USA, Europe, South Africa, Cyprus, Syria, Iraq and other Middle East and Far East countries.

India has proven technology to manufacture a wide range of power transformers, distribution transformers and other types of special transformers for welding, traction, furnaces etc. Today, about 95% of the transformers installed in the Indian power network are of indigenous origin. Energy efficient transformers with low losses and low noise levels are being developed to meet international requirements.

Manufacturing facilities for winding conductors, bushings upto 420 KV class etc. are well established. However, raw materials for transformers like CRGO (electro grade silicon steel) and higher grades of copper are not manufactured in India. This creates difficulties for the manufacturers.

## **Switchgears and Controlgears**

Continuous power supply is a crucial requirement for industry. This makes switchgear and controlgear indispensable not only in transmission and distribution of power, but anywhere where there is a need to access and control electricity.

Switchgear and controlgear are necessary at every switching point in power systems. The switchgear and controlgear industry in India is a fully developed industry, producing and supplying a wide variety of switchgear and controlgear items needed by the industrial and power sectors. In India, the entire range of circuit breakers from bulk oil, minimum oil, air blast, vacuum to sulphur hexafluoride (SF<sub>6</sub>) are manufactured to standard specifications. This industry sector in fact manufactures the entire voltage range from 240 KV to 800 KV. Switchgears can be categorised into three groups:

- Low voltage switchgear (upto 1100 V)
- Medium voltage switchgear (upto 36 KV)
- High voltage switchgear

The low voltage switchgear product range is classified into domestic, power distribution system and industrial control system. In the case of low voltage switchgears, MCBs are fast replacing rewireable switch fuses. Low voltage switchgear is showing a high growth rate; partly due to high demand for MCBs in the housing sector and MCCBs in rural electrification. The medium voltage switchgear include products below 33 kV such as various types of circuit breakers viz. ACB, OCB, MOCB, VCB etc.

The high voltage switchgear group includes products above 36 KV such as SF6 breaker, GIS, lightning arresters and composite insulators etc. SF6 technology is now giving way to the self-blast mechanism and this technology is not available in India.

Secondary equipment such as relays used for various types of fault protection, known as control-gear, have made significant advances due to major developments in the field of electronics. The digital relays are fast replacing the conventional relays due to technology advancement, compact size and reliability.

As per current trends, in addition to protection and control of power, monitoring and signaling are becoming an integral part of switchgears. With monitoring, the fault conditions can be predicted whereas signaling helps to know the status of switchgears at various locations.

MCC distribution panels and elaborate control systems based on microprocessor and computer controls are also available for power station and dispatch centers, major receiving centers and industrial complexes. Current trends demand compact, small, low weight equipment with high quality, high reliability, low maintenance and easy accessibility. Indian manufacturers meet all these expectations of the user industry.

Gas insulated switchgear is likely to witness a higher demand in the future due to increasing urbanization and lack of space. It also has the advantage of not being influenced by the vagaries of nature.

### **Electrical Rotating Machinery**

Rotating machines, whether motors or generators, are among the crucial equipment required while running a manufacturing unit. Whereas motors are drivers of the machinery, generators play an equally important role in the precarious power availability situation in India.

Riding on the growth of industrial development, the motor sector grew rapidly to meet the requirements of general-purpose motors in all segments of industry. Its growth was boosted further by the requirement of special purpose motors for specific applications in cranes, cement mills, machine tools, mining, textiles and agricultural pump sets. EE motors incorporate the latest developments in design and material technology resulting in minimum losses both for cores and windings.

The generator industry in India is catering to the alternative power requirements of large and small units, commercial establishments and the domestic sector as a whole. Domestic manufacturers in India are capable of manufacturing AC generators right from 0.5 KVA to 25,000 KVA and above with specified voltage ratings. State-of-the-art generators with electronic AVR units, permanent magnet excitation, class H insulation, single bearing construction, brush-less etc. matching the latest technology abroad, are also available.

In today's situation, the need to be economically competitive is of utmost importance. Savings in electrical energy makes practical sense for all sectors of industry as well as in agriculture. Energy efficient (EE) motors are the solution.

### **Capacitor Industry**

The power capacitor industry is largely dependent on power development programmes. The demand for HT and LT power capacitors has improved and the industry has posted a modest growth of about 8%. Electricity Boards and utilities are also encouraging installation of capacitors by industrial and commercial consumers through a combination of penalties and incentives in electricity tariffs. Due to the existence of a large domestic market, many foreign manufacturers have started marketing their products in the country with low pricing, causing a great deal of concern to the domestic industry. Though this industry has good design capabilities, there are gaps in terms of manufacturing technology largely due to lack of economies of scales and automated manufacturing technologies.

### **Energy Meters**

With the demand for advanced features, technology which is available in India has shifted from conventional electromagnetic meters to electronic meters where the capital investment requirement is comparatively low.

### **Turbines**

The capacity established for manufacture of various kinds of turbines such as steam & hydro turbines including industrial turbines is more than 7000 MW per annum in the country. Apart from BHEL which has the largest installed capacity of 6000 MW p.a. there are units in the private sector who are also manufacturing steam & hydro turbines for power generation and industrial use. The manufacture range of BHEL includes steam turbines, boilers and generators upto 500 MW for utility and commercial cycle application and is capable of manufacturing steam turbines with supercritical steam cycle parameters and matching generators of upto 660 MW unit size. Facilities are also available for 1000 MW unit size. BHEL is planning to increase its range of turbines upto 660 MW. AC generators manufactured in India are at par with AC generators manufactured abroad and consistently deliver high quality power with performance. Domestic manufacturers are capable of manufacturing AC generators from 0.5 KVA to 25,000 KVA and above with specified voltage ranging.

BHEL has the capability to manufacture gas turbines upto 260 MW (ISO) rating under licence from GE. The advancements in gas turbine technology involve combustor technology wherein sequential firing of cannular type of combustors (as in GE machines) is undertaken depending upon the part load conditions wherein a stoichiometric fuel mixture is maintained all through with a flame control facility by injecting steam, excess air (1.82 times). This helps to keep the Nox in low two digits somewhere around 20 ppmvd. The steam cooling arrangements are provided in H-technology machines which are not produced in the country. BHEL continues to manufacture G-technology machines (one standard lower than the H technology) although the demand for such machines are not high.

Siemens Ltd. has introduced a higher version of gas turbine with a capacity of 238 MW with advanced control mechanisms.

Another advancement had been made in terms of seal technology in gas turbines. The high-tech seals (special alloy) were introduced by GE in the newer version which increases the efficiency of the machine by 1 basis point and enhances power output by 3.3% which is significant in any module of a CCGTY (Combined Cycle Gas Turbine) module.

Complementary to the steam turbine technology is the online diagnostics coupled with advanced control and instrumentation which is becoming common in other parts of the world. This is not available in the country even with the recently imported power packs. In India, we continue to work with the off line diagnostics which is entirely dependent on human interfaces.

## **Design & Engineering**

This industry depends a great deal on design and engineering since most of the products need to be reengineered and designed to customer specifications. The basic technology used by most of the companies except for the international companies operating in India are of the 1970s. Since then technology transfer has been fairly limited and R&D activity has also been negligible although a few companies are specially engineering their products for each application and developing technology to meet customer requirements.

The companies who have responded to the study feel that design and engineering is their key advantage compared to companies abroad because of the availability of qualified engineers. However 8% of them do not have design and engineering facilities and they outsource the same as and when required. Out of the balance companies who have in-house design & engineering, 5% of the companies also cater to design & engineering jobs for external clients. All of them use CAD / CAE for their engineering jobs.

Only 33% of the companies have technology transfer agreements and another 30% were planning technology tie-ups to upgrade their products / processes. 100% of the companies who have technical agreements have completed technology absorption, or are in the process of completion. 10% of the companies have

reported having problems in retaining employees who are trained abroad and retaining qualified and trained personnel may become a major constraint in a company's growth strategy if not adequately addressed.

Today transfer of technology is not very easily available because of the falling customs duties where companies prefer to market their products directly, instead of manufacturing them in India.

## **Research and Development**

Research and development is a priority focus area in the power sector. Broadly R&D has two dimensions (a) R&D for Industry manufacturing electrical equipment for generation / transmission and distribution of power and (b) the applied research involving improvement of efficiency and effectiveness of various techniques, procedures, processes, maintenance and upkeep of equipment.

The cost of research being prohibitively high, it is necessary that the state-of-the-art technology which has been developed in other parts of the world is transferred to India in order to assimilate and build on these. Since electrical specifications and norms vary in different countries, it is very important for the companies operating in India to adapt the technologies to suit Indian conditions.

82% of the companies have reported spending on R&D for new product development or product innovation. A majority of the companies have started investing into R&D since the 1990s except for the market leaders who have been investing in R&D for many years.

- The percentage of sales spent on R&D ranged from 0.2% to as high as 10% of gross sales. However the industry average of the amount spent on R&D as a percentage of sales was negligible at 0.5% whereas the international leaders spent as much as 5-6% of their sales. For example in 2004 Siemens spent approximately 5063 mn. Euro and ABB US\$ 690 mn. whereas BHEL the highest spender in India spent approximately Rs.1252 mn.

45% of the companies have said that Government should allocate separate funds for R&D to encourage companies. The companies gave the following suggestions:

- The products developed by the indigenous companies should be bought by the user sector to encourage companies. For this purpose the Government may give adequate relaxations for purchase norms for the state owned utilities, or some form of incentive for procurement of innovative new products certified by the industry associations.
- Funds to be earmarked for development of specific technology to suit Indian conditions.
- Funds should be used to encourage technology, which improves productivity, reduces power consumption and also environmental risks.

- Funds should be allocated for projects of a collaborative nature with Institutes of higher learning, or Government sponsored research institutions.

### **Management Efficiencies**

Even though the market size of this industry is in excess of Rs.21,000 crores, the industry needs to adopt more innovative and aggressive marketing strategies.

It was noted that approximately 34% of the companies did not have a strategic planning process or were at least aware of the importance of strategic planning. 27% of the companies have said that they have established procedures of strategic planning and 29% did in-depth strategic planning.



Chart 4

When asked what should be a company's strategy to enhance market share, among those companies who followed a strategy to enhance their market share, the majority felt the top priority would be to enhance quality and service. The second priority they felt should be aggressive marketing. Third was to reduce costs and lastly by increasing the product range of equipment.

However, an aggressive marketing strategy though considered the second highest priority, was followed only by 34% of the companies. These are the large companies and have 85% of the market share out of the companies surveyed. 38% do not even collect competitors' information.

From the above statistics and feedback received, it can be seen that the majority of the Indian companies have inadequate marketing strategies. It is a handful of 15-20 companies who do so and hence there is a big difference in the turnover of these companies and the rest of the manufacturers.

The market leaders are also looking at both organic and inorganic methods of growth. The quality consciousness of the industry was comparatively high with 95%

of the companies either ISO certified, or seeking certification. However, there are a few smaller players who do not, or cannot, adhere to a strict quality regime due to cost factors and they are for example reported to use second grade copper and CRGO.

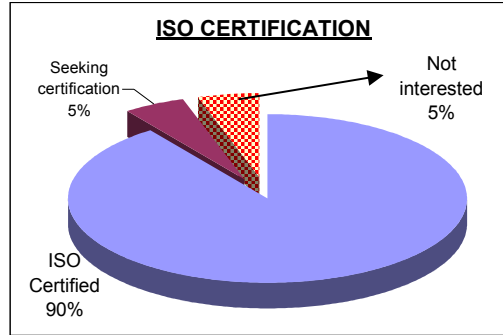


Chart 5

The users had fewer complaints about the quality problems, which verifies the quality consciousness of the industry. However, some users felt that the quality defects may not be visible immediately since for such equipment, failures are noticed after a time gap.

The testing facilities for higher voltage testing of circuit breakers and transformers are a major constraint in India. The testing facilities for the other product categories also need to be further upgraded. CPRI is the only testing facility in India and is not fully equipped to cater to the growing industry. Some of the very high voltage equipment manufacturers need to transport their equipment to KEEMA, Netherlands for testing thereby increasing the cost and the delivery factors.

The leading companies are constantly upgrading their business and manufacturing processes to be cost competitive due to increasing costs both in the case of raw materials and manpower. However, the majority of the companies are not fully aware of the advantages of implementing soft technologies, which are widely adopted by companies abroad.

Only 35% of the industry are implementing, or have implemented soft technologies like Six Sigma, Lean manufacturing, or 5S to make themselves competitive in the face of increasing international competition both in the domestic market as well as in exports.

The penetration of computerization, or usage of computerization is not very high in this sector. The level of computerization is indicated in graphical form below. The low level of IT usage is also evident from the fact that the percentage of IT expenditure to sales in the last one-year has been a meagre 0.6% of sales i.e. the industry has reported spending only Rs.125 crores in 2003-04. The training of employees for use of computers, however, has undergone a significant increase over the past few years showing the growing awareness of employers on the importance of usage of computers.

The low level of computer usage for business transactions may be due to the fact that the end users and the supplier base are not highly computerized.

ERP or enterprise resource planning is an industry term for the broad set of activities supported by multi product application software that helps a manufacturer or other business to manage the important parts of its business including product planning, parts purchasing, maintaining inventories, interaction with suppliers, providing customer service and tracking orders.

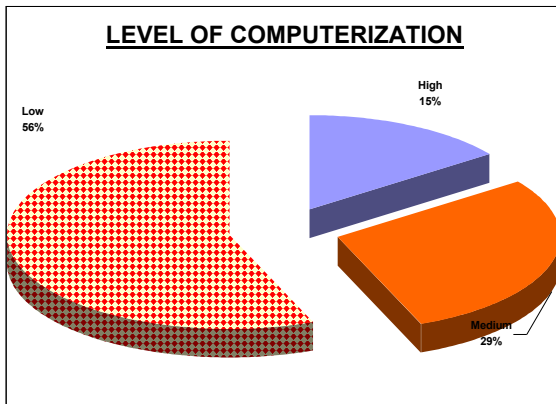


Chart 6

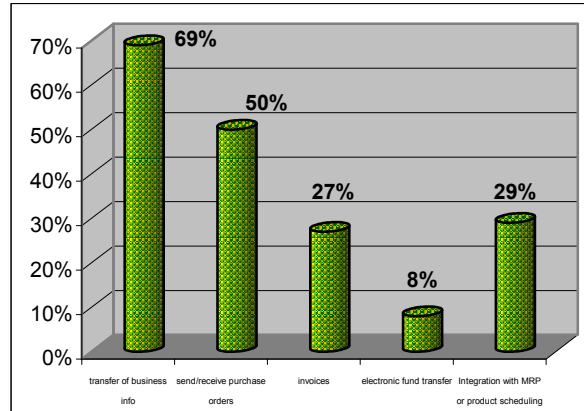


Chart 7

Supply Chain Management (SCM) is the management of the entire value added chain, from the supplier to manufacturer right through to the retailer and the final customer. SCM's primary goal is to reduce inventory, increase the transaction speed by exchanging data in real time and increase sales by implementing customer requirements more efficiently.

CRM (Customer Relationship Management) entails all aspects of interaction a company has with its customer, whether it be sales or service related. CRM is an information industry term for methodologies, software and usually internet capabilities that help an enterprise manage customer relationships in an organized way.

A handful of companies comprising of 20-25% of the industry have implemented, or are in the process of implementing ERP/SCM or CRM. This low level of investment in IT is reflected in the delivery commitments by the companies, inventory management and relatively low operational efficiencies.

This sector is very sensitive in terms of the need to provide continuous reliable and quality power. Hence the availability of spare parts and service engineers is crucial to the success of a company's growth.

Training of service engineers and employees make an impact on the profitability of the company since good service and customer relationships will help companies to

enhance their market share. Therefore companies need to increase their expenditure on training and HRD.

However, the level of expenditure on training was comparatively low and it has had an impact on the poor delivery commitments by the companies. This will hurt the industry in the future when the demand increases and qualified trained manpower will become a constraint.

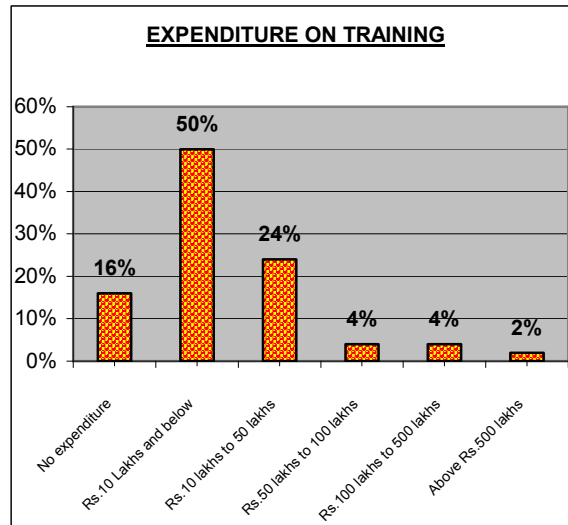


Chart 8

The manufacturers feel that to counter the decreasing customs duties and the increasing competition from Chinese companies especially in the standard product segment, the edge would be provided by servicing customers. Hence more and more companies are focusing on improving servicing and product quality. 40% of the companies responding to the study had services beyond warranty and the majority were in this business since inception. Response time varied depending on the type of equipment and location of clients. However, on an average it varied between 24 hours to 4 days.

Training customers on the appropriate usage of products and their maintenance will be the CSFs for the companies. Proper training would ensure better customer satisfaction, efficient handling of the equipment and a value added service and for this companies would need to allocate higher amounts for training and computerization.

From the user feedback it emerged that the delivery commitments of the industry were not upto the mark. However, the industry had reported that approximately 90% of the equipment by the major players are delivered on or before delivery dates. The main reason cited for the delays in delivery by the manufacturers were attributed to :

Delays in customer clearance for items like LT transformers, switchgears, energy meters, VCBs.

Delays in design clearance for items like HT circuit breakers, MCB's, standard products.

Delays due to non-availability of materials, or manufacturing mainly in items which are custom built or high-end technology equipment.

**Benchmarking with International Companies**

Some broad indicators in terms of benchmarking of the industry on the basis of financial parameters has been done against a few global players. This is provided in **Annexure I**.

The companies against which Indian companies have been benchmarked are Schneider, Siemens, GE and ABB. They are leaders in their respective fields.

**Operational Efficiencies**

**Financial Parameters**

Sales have been on the rise even during the recessionary period because of the demand from the power sector. The growth rate has been excellent in 2004-05 as compared to 2003-04 at 27% and that too over 21% over the previous year. Exports as compared to domestic sales, have fallen in 2004-05 after a 7.8% growth in 2003-04.

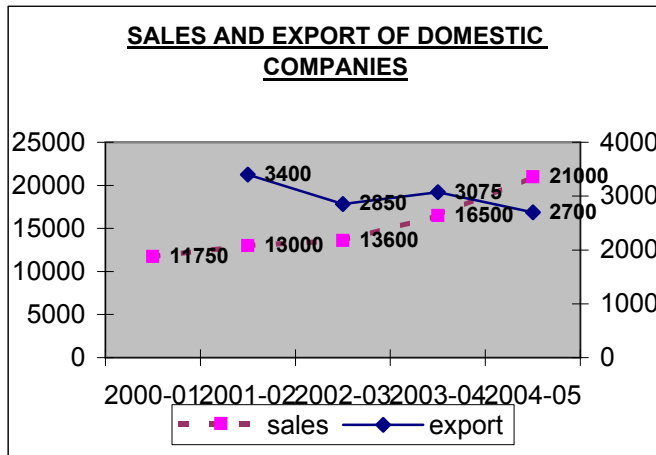


Chart 9

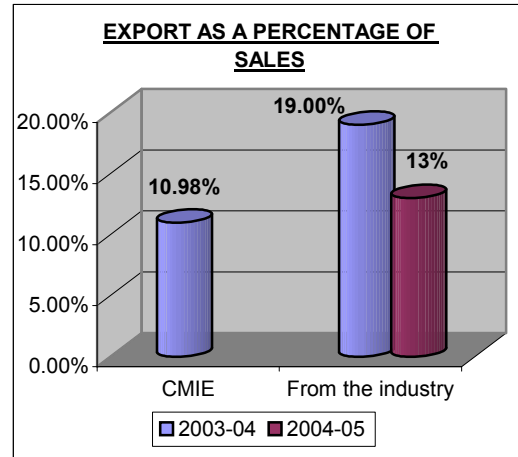


Chart 10

The previous year has witnessed an unprecedented rise in basic metal prices like copper, aluminium, and CRGO steel. This is evident from the graph below.

Further, due to the inverted duty structure, companies have increased procurement of complete equipment, or SKD units thereby adding to the cost of raw materials and bought outs.

The CMIE industry financial aggregates and ratios also supports the fact that the percentage of raw material cost to net sales had increased, marginally from 61.6% to 63.8% in the years 2002-03 and 2003-04 respectively.

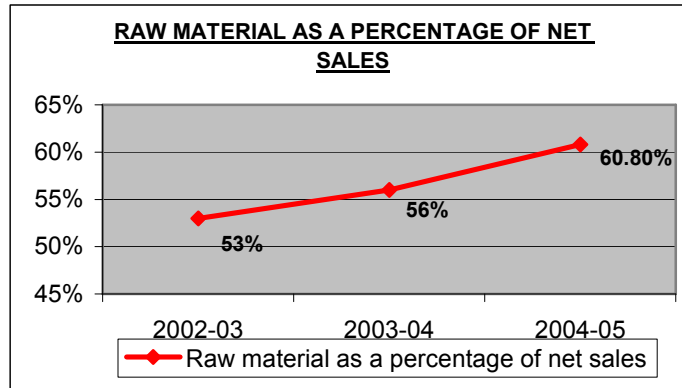


Chart 11

Companies are striving to bring down costs due to the spiraling raw materials prices and many have been successful in reducing power consumed over the years.

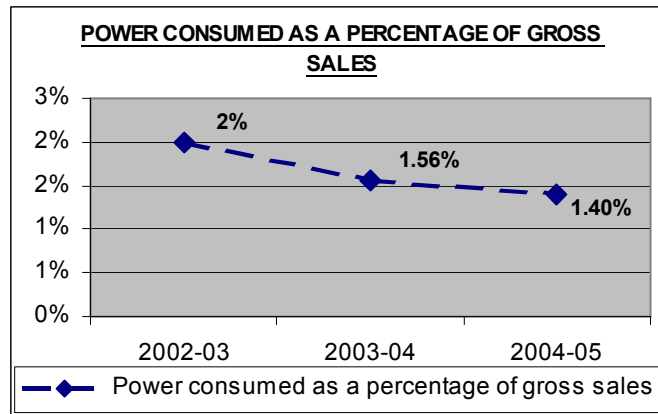


Chart 12

Value added for an industry is the difference between the value of the output and the value of the inputs namely raw materials & bought outs. In other words we can attribute this difference to the value added to the product by the company. In this sector it has been noted that the value added as a percentage of net sales has shown a sharp decline from 45% in 2002 to 43% in 2003 and 30% in 2004. This is mainly due to two reasons:

- The unprecedented increase in the cost of raw materials like copper, aluminium and CRGO steel and the inability of the industry to increase prices to that effect has made a dent on the profit margins and value addition.
- Secondly with the reduction in customs duties and the inverted duty structures, companies find it economical to import complete equipment, test

it and sell thereby value addition is only in terms of profit margin and testing charges.

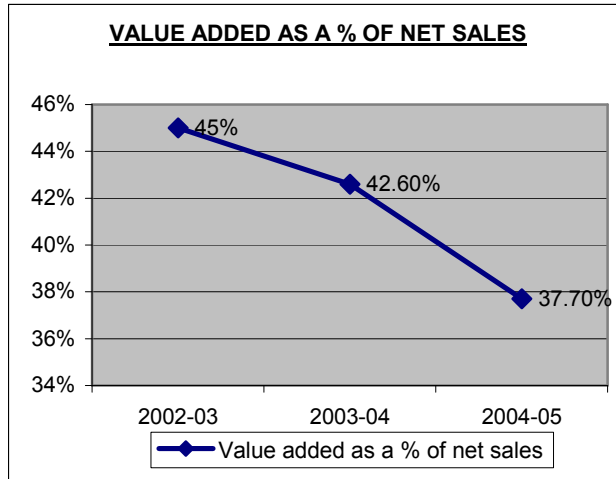


Chart 13

The inventory management of the industry is not at par with global standards, which is affecting the operational efficiencies of the sector.

Inventory on an average was found to be 22% of net sales. Average turnover of inventory for 2004-05 was found to be 4.6 or in other words companies held inventory for 80 days on an average.

Another fact which emerged from the survey was that companies had to keep inventories of finished goods because clients were either not ready with their projects, or payments. In the case of raw materials, since CRGO steel had to be imported by companies, the procurement lead time for imports for most companies ranged between 60 days to 120 days because of poor port connectivity and infrastructure and the time taken for clearance of imported goods. Hence the inventory turnover of the industry was low compared to the international trends in this sector.

**The inventory turnover for global companies was between 6.5 - 8.**

Another weakness of the industry is the high receivables which have an adverse impact on the bottom-line of the companies.

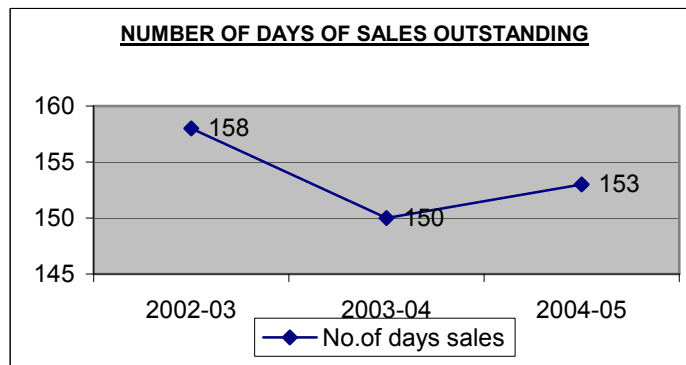


Chart 14

As is evident from chart 14, the number of days of sales outstanding in this sector is very high. The main reason being that for most of them, the utility companies like the SEBs were their clients. The delay in payments is reflected in the higher number of days of sales carried by the companies on an average thereby affecting their profitability.

**Compared to this, the global leaders carried between 55-75 days of sales as receivables.**

The working capital requirements of the electrical sector are the highest among the four sectors surveyed, mainly because of the high inventory and receivables carried by the sector. This adversely impacts the profitability of the sector.

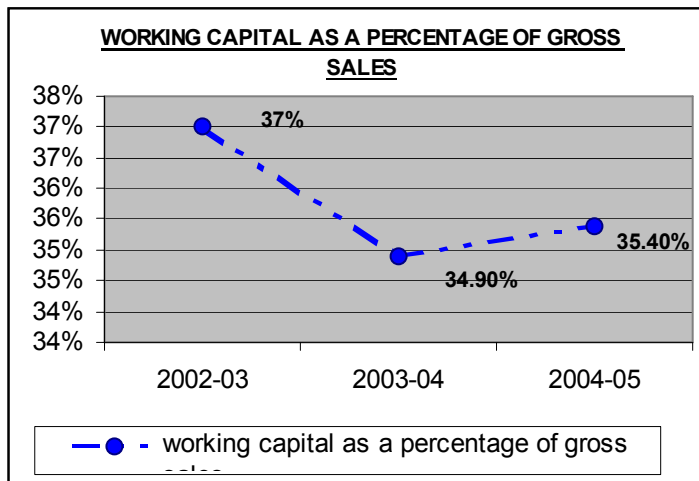


Chart 15

On an average, working capital as a percentage of gross sales was found to be 35.4% in 2004-05.

Average cost of wages to gross sales for the industry was found to be 11% in 2004-05. This varied from a low of 3% to a high of 27% in the case of public sector undertakings.

**The global leaders have a much higher cost of wages to sales at 30 - 35%.** This is the main reason why international companies are looking at India to outsource components and products for their sales worldwide.

The average sales per employee was found to be Rs.26 lakhs. The range varied from a low of Rs.5 lakhs to a high of Rs.76 lakhs per employee. The average value added per employee was found to be Rs.9 lakhs with a low of Rs.1 lakh and a high of Rs.23 lakhs. The variations are bound to be large because some companies manufacture only standard products and some companies do not offer the entire range of services. For example, those companies who do not have their own marketing set up will tend to have higher sales per employee, or companies who manufacture high value equipment will have higher sales per employee.

**The global standard of sales per employee was in the range of Rs.60 - 90 lakhs in 2004.**

**Profitability**

The capital employed by the companies responding to the survey has seen an increase of only 3.25% in 2004-05 over 2003-04. This low increase shows the lack of confidence of the equipment manufacturers in the long-term growth prospects of the industry.

This is further highlighted if we look at the capex plans of the industry. Only 14 companies have reported a capex programme of Rs.1900 crores for the next two years when the industry is handicapped with a gross capacity constraint. However, there are companies who have been reported to be investing in China and other countries for their future growth.

Most of the companies have had debt restructuring and reduced their high interest bearing loans due to better profitability in 2003-04. On an average, the ROCE was 8.3% in 2004-05 for the companies who have reported their figures. Return on capital employed is low compared to international standards because of low productivity and poor working capital management.

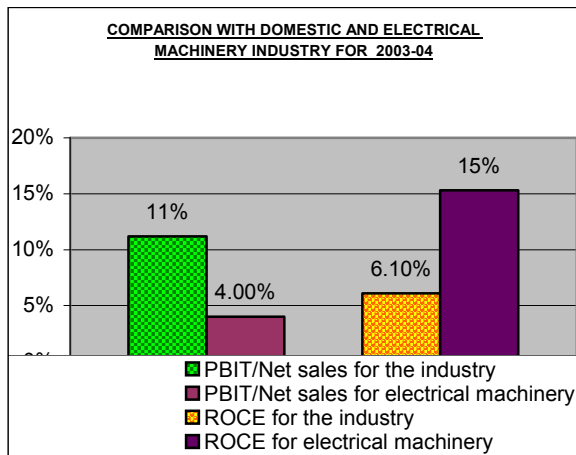


Chart 16

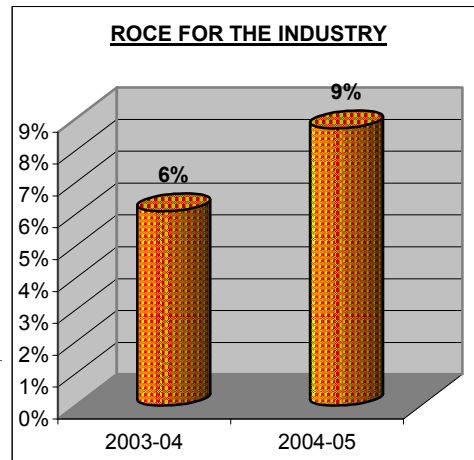


Chart 17

PBIT to net sales for 2004-05 increased by 22% to 13.7% on an average. PAT to net sales increased by 18% to 8.2%. PBIT as a percentage of sales ranged from a low of 1% to a high of 20% for some companies. PAT as a percentage of sales also ranged from losses for some companies to a high of 12%.

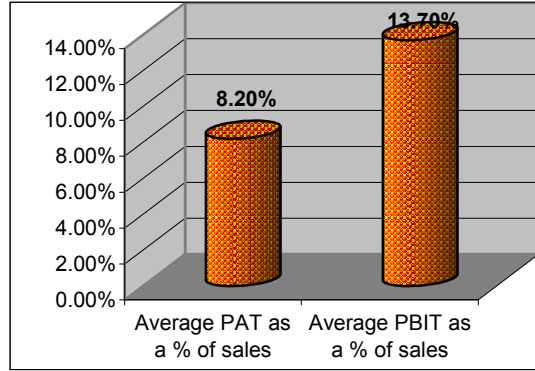


Chart 18

It was noticed that in general, 60% of the companies in this sector had a debt to equity ratio of less than one. It was also noticed that companies which had a high debt to equity ratio, incurred losses. Many companies have done debt restructuring in the past two years. However a few still need to restructure their debt.

### Capital Investment

Only 25% of the companies surveyed have capex plans of an amount of Rs.2,000 crores over the next 2-3 years.

### Productivity Parameters

#### Machine and Labour Utilization

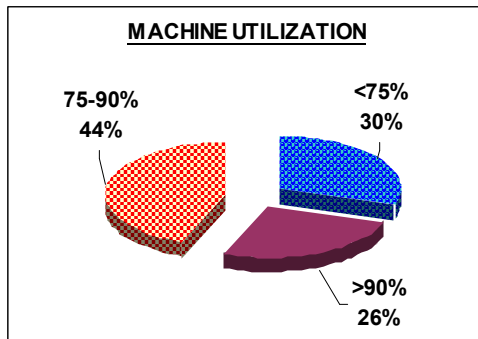


Chart 19

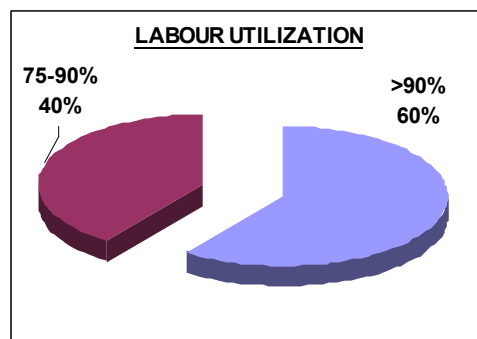


Chart 20

Labour utilization is comparatively higher in this industry as compared to the other sectors of the capital goods industry. This was due to two reasons:

- Turbine blading and transformer/motor/generator winding is a highly labour intensive job.
- Many companies have undergone downsizing and the balance have not added manpower compared to the growth in sales.

Machine downtime ranged from 0.15% to a high of 10% in some cases and hence machine utilization was mainly in the range of 75 to 90%.

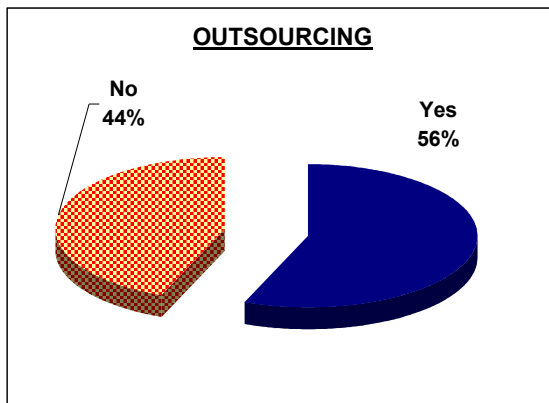


Chart 21

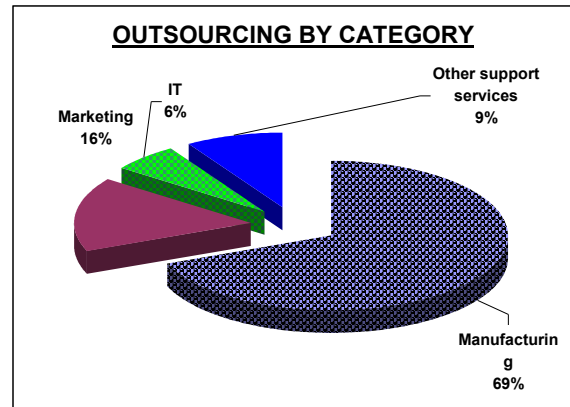


Chart 22

In this sector a very significant amount of subcontracting in the non-core manufacturing activities takes place. Generally, low value added labour intensive activities, assembly work and coil processing jobs are subcontracted. This subcontracting is basically done due to capacity constraints and cost considerations.

### **User Sector Feedback**

From the responses received from some of the major users of electrical equipment, it was noticed that the utility sector had started investing in transformers, generators, capacitors, switchgears and energy sectors in a big way since the inception of the Electricity Act 2003.

The user industry was of a divergent nature with regard to the equipment required and the technology levels in use.

However responses from the user sector have shown that most of the procurement is being done for replacement of the existing equipment. Since the technology level of the equipment is at par with international levels, imports are not very high. Users imported equipment only in cases where technology was not available, or domestic companies were not able to meet the delivery requirements. In the case of energy meters the imports were high because of cost considerations.

The user sector felt that quality of domestic equipment, technology, spares and service availability were at par with imported equipment. The prices have risen in the recent past due to escalation of prices of basic raw materials like CRGO, copper and steel. Deliveries of the domestic manufacturers were found to be very poor and at times the delays ranged from 6 to 12 months. The reasons attributed to this are mainly the unprecedented rise in raw material prices and capacity constraints.

The users felt that with the demand in generation, transmission and distribution expected to increase in the future, domestic manufacturers should augment their

manufacturing capacity along with testing facilities. The manufacturing techniques require improvement through strict quality control checks and more automation to enhance productivity.

**Market Situation and Demand**

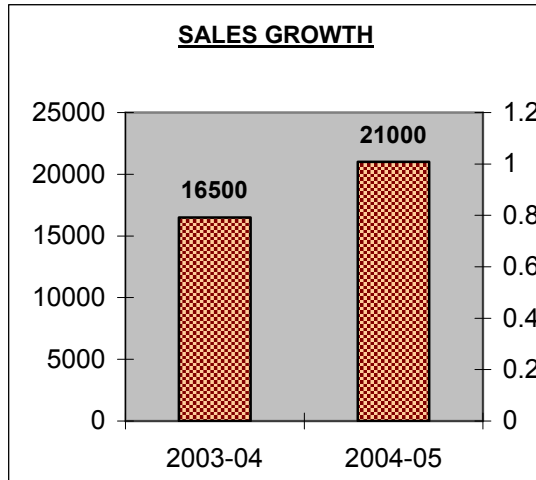


Chart 23

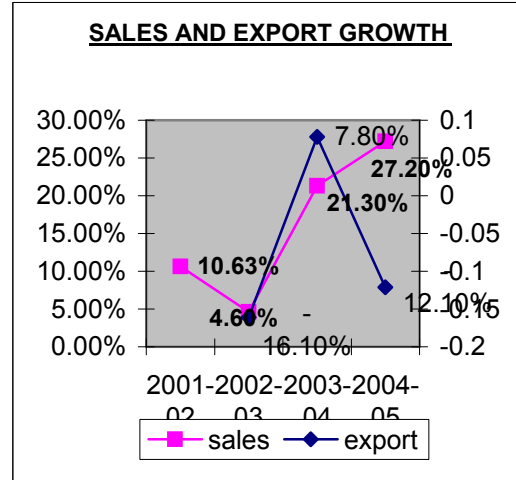


Chart 24

The sales turnover of the companies in this particular sector who have responded to the survey is given below for the years 2003-04 and 2004-05:-

The year 2004-05 has seen average sales growth of 27% with some of the companies showing sales growth rates of more than 100%. Some companies in the SSI segment have shown a fall in sales by 25%. This is due to the increasing imports of low cost items from China and Taiwan in the context of reduction in customs duties.

Out of the companies covered by the survey, only 78% exported their products to either other customers, or to their own parent company. However these companies had approximately 13% of their sales as exports.

The export growth rate shown by these companies was 7.89% in 2003-04 over 2002-03. This growth rate has been negative in the year 2004-05 over 2003-04 at -12.2% because the major exporters had a lower export figure. On an average the smaller and medium companies fared better in exports over the previous year.

The reasons for the fall in exports were:

- The two major exporters in value terms had higher export sales in 2003-04 as compared to 2004-05 because of their order book position.
- Not many projects abroad were finalized in 2004-05 and they are likely to be done in 2005-06.
- The domestic demand was very buoyant and companies could not cater to the export market because of capacity constraints.

The order backlog as on 31<sup>st</sup> March 2005 was Rs.36,000 crores. The growth projections for 2005-06 is Rs.27,500 crores, a jump of 33% on an average. The higher order backlog is due to certain orders booked by companies which are to be completed over a span of two years.

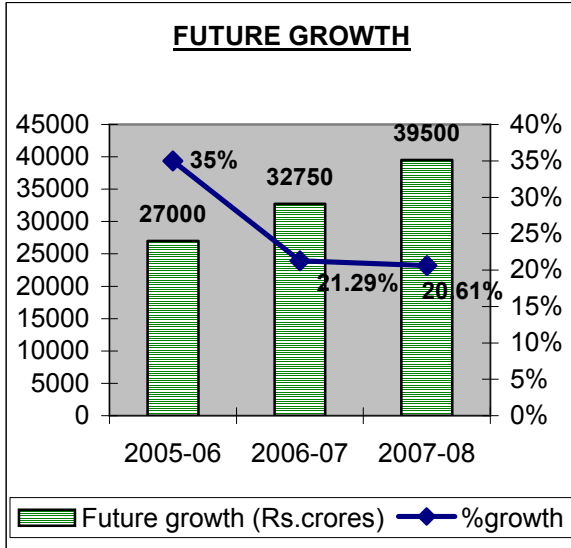


Chart 25

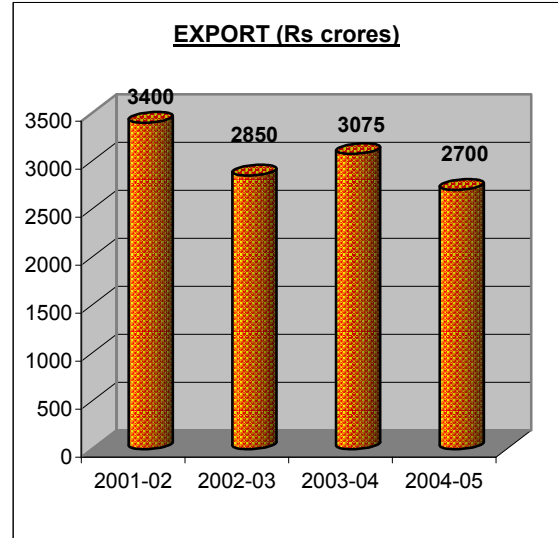


Chart 26

The domestic companies have a competitive advantage in standard electrical products like switchgear, distribution transformers, steam turbines up to 50 MW, AC and DC motors, HT Motors, AC generators, energy meters and HT circuit breakers. These products are exported to different markets as indicated in Annexure II.

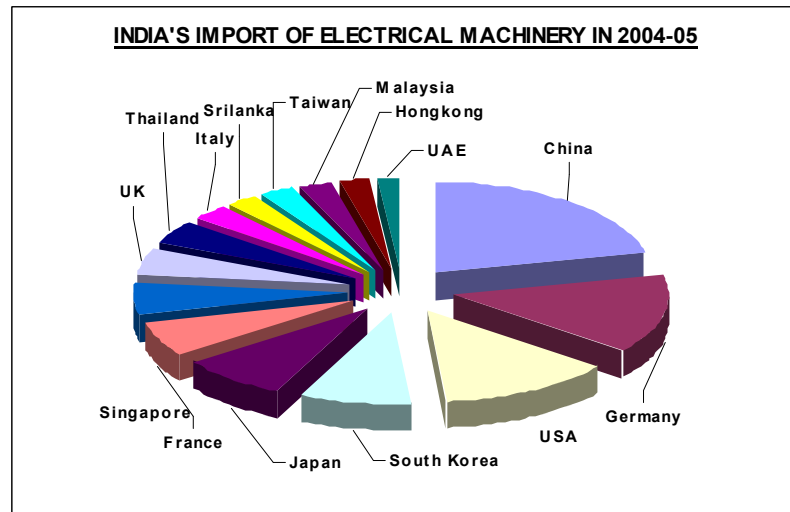
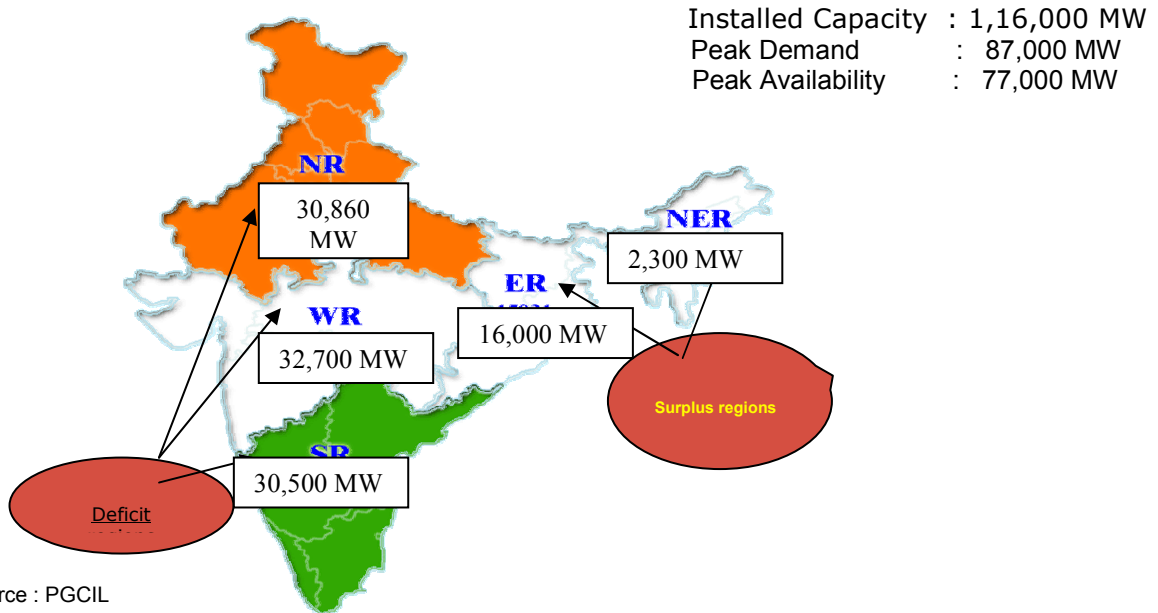


Chart 27

Source : Compiled by CII from CMIE data

To make a further impact in overseas markets and to consolidate their position, companies need to get themselves certified with OHSAS – 18000 on occupational health and safety and ISO 14000 on energy management systems.

## Indian Power Scenario – at a glance

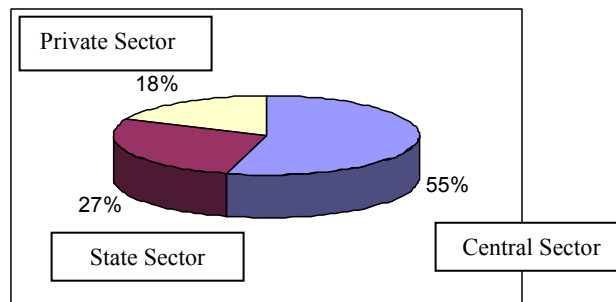


In India, infrastructure is clearly one area where the Government policy thrust is expected to continue. In the infrastructure business, the power generation sector got a dual boost on account of the effects of the passage of the Electricity Act 2003 as well as the Government’s ambitious “power for all by 2012” program which has led to the finalisation of several power generation schemes particularly in the thermal and hydro sector. The central sector is practically shouldering the entire responsibility of capacity addition with the SEBs continuing to be burdened by huge losses. However, major Indian private sector players have evinced keen interest in developing large capacities, particularly after the discovery of large gas reserves in the country.

The renewed interest among Indian and foreign promoters in new generation projects and the recovery in the utility sector, will lead to new projects. In view of the recent gas finds in the private and public sectors, gas will emerge as the major source of power generation if the prices are reasonable. The new renewable energy policy aims to provide electricity to remote villages through renewable stand-alone systems and local electricity grids.

### Generation Capacity by 2012

To meet the requirements, a total of 212,000 MW of generating capacity would be required.



Source : PGCIL

Chart 28

The Government continues to play a major role (72%) in the capacity addition in the generation side.

The present inter regional grid capacity is 9500 MW. The Government is aiming to increase inter regional capacity to 30000 MW through a national grid by the year 2012 comprising of high capacity HVDC and HVAC lines (both 765 KV and 400 KV) and 50,000 MW by 2016. 765 kV transmission lines inter-connecting ER, WR and NR would be completed. This expansion coupled with the permitted entry of the private sector in transmission, will lead to greater investments from the public and private sectors in the T&D sector. In the past, the track record has been an addition of only 3000 MW/year, but private participation and higher budget allocations will lead to an addition of 5000 MW/year. The grid network has to be strengthened. Upgradation of city distribution and strengthening of the rural grid will provide opportunities for secondary distribution systems and reliable overhead equipment. Secondary distribution growth is likely to grow by 20% in the next two years. As the number of planned generation projects increases, they will in turn make extra additions / enhancement in the transmission sector and corresponding expansion / improvement in the distribution sector. This offers greater opportunities for the high voltage, medium voltage and energy management segments. The announcements made by the Power Grid Corporation (PGCIL) on new investments will boost demand for high voltage, protection and substation automation equipment.

The Electricity Act 2003 is opening up opportunities for private sector utilities in the generation, transmission and distribution. The provisions of the Act offer opportunities for risk mitigation and payment security as the monopolistic model of supplying power only to SEBs would be replaced by opportunities of supplying power directly to the consumers. This is also expected to lead to higher investments in captive power generation capacity.

Several State Electricity Boards have tied up funding from multilateral international agencies like IBRD/ADB/OECF and this will generate good demand for standard products.

For the immediate 10<sup>th</sup> Plan period, the Working Group on Power constituted by the Planning Commission, has estimated a feasible capacity addition of 46,939 MW, made up of 24,405 MW in the Central sector, 12,033 MW in the State sector and 10,501 MW in the private sector. The estimated fund requirements for these investments are about Rs.566,000 crores.

The 16<sup>th</sup> Electric Power Survey estimates for future energy requirement and peak load requirements are detailed in the table given below:

<b>Energy and Peak Load Estimates</b>										
Region	Energy Requirement (Billion KWh)					Peak Load (MW)				
	2001-02 Energy Demand	2001-02 Energy Met	16th EPS Forecast			2001-02 Peak demand	2001-02 Peak met	16th EPS Forecast		
			2006-07	2011-12	2016-17			2006-07	2011-12	2016-17
North	150	142	221	309	430	23,200	21,346	35,540	49,674	69,178
West	175	157	225	299	396	26,510	22,024	35,223	46,825	61,966
South	141	128	194	263	355	22,757	19,201	31,017	42,061	56,883
East	51	50	70	90	117	7,940	7,648	11,990	15,664	20,416
North-East	6	6	10	14	21	1,148	1,043	1,875	2,789	4,134
Total	523	483	720	975	1,319	81,555	71,262	115,645	157,013	212,577

Source : Reliance Review of Energy Markets.

The energy requirements are expected to increase to 720 billion KWh, 975 billion KWh and 1,319 billion KWh by the end of the 10<sup>th</sup> Plan (2006-07), 11<sup>th</sup> Plan (2011-12) and 12<sup>th</sup> Plan (2016-17) respectively.

The peak load requirements in the same timeframe are expected to increase to 112,645 MW; 157,107 MW and 212,577 MW respectively. The implicit CAGRs in the 16<sup>th</sup> EPS forecasts in the growth of energy requirement and peak load during the fifteen year forecast period are about 6.5% p.a. between 2001-02 to 2016-17.

The Indian power sector needs investment close to US\$ 700 billion (Rs.32,000 billion) in the next 30-40 years to meet the above energy demand scenario.

#### Investments required in the power sector by 2012

Total investment envisaged	- Rs.800,000 Cr.	(US\$ 174 billion)
Generation sector	- Rs.500,000 Cr.	(US\$ 108 billion)
Transmission sector	- Rs.130,000 Cr.	(US\$ 28 billion)
Distribution sector	- Rs.170,000 Cr.	(US\$ 38 billion)

#### **Inter-State Transmission System Plan:**

Transmission development in Central Sector -

	By the end of 10 <sup>th</sup> Plan (additional)	By the end of 11 <sup>th</sup> Plan (additional)	Total
Tr. Line (ckt. km)	31480	29200	60680
No. of Substations	46	14	60
Capacity (MVA)	30800	12605	43405

Additional Transmission system by 2011-12:

765 KV - 5400 ckt. km  
 HVDC - 1600 ckt. km  
 400 KV - 53000 ckt. km

Note: There will be an additional transmission scheme for power transfer from NER to NR/WR etc.

**Requirement of Substation Equipment:**Estimated by 10<sup>th</sup> Plan (2006-12)

Equipment	765 kV	400 kV	220 kV
Bays	62	774	3200
Transformers	36 (1 Ph)	422 (1 Ph)	740 (3 Ph)
Reactors	76 (1 Ph)	234	--
Circuit Breakers	125	1393	3000
Isolators	375	4025	12240
CVT	185	1278	2960
CT	560	6966	9180
LA	186	2322	9600

**Requirement of Materials:**

Estimated by 10th Plan (2006-2010)

Estimated Tower and Foundation:

Fabricated Structure Steel	725,000 Tons
Reinforcement Steel	220,000 Tons
Concreting	2,270,000 Cu.m.

**Estimated Conductor, Hardware & Accessories:**

Conductor (Moose/Bersimis)	236,000 kms
Hardware Fittings	350,000 sets
Vib. Damper for conductor	1,000,000 Nos.
Bundle spacer	1,700,000 Nos.
Spacer Damper (Quad)	250,000 Nos.

Reviewing the present state of the transformer industry, it can be seen that implementation of the Accelerated Power Development Reform Program (APDRP) and introduction of the Accelerated Rural Electrification Programme (AREP) are responsible for growth in production of distribution transformers. The health of the transformer industry is closely related to power development as its major customers are State Electricity Boards (SEBs), who under the APDRP initiative of the Government have taken up improvement of distribution systems in a big way. PFC, REC are also providing funds for such projects. International funding agencies like the World Bank, JBIC, ADB are prepared to invest in such projects. The Nuclear Power Corporation has also decided to go in for major expansion. All these initiatives will lead to increased business prospects for the sector.

The present size of the switchgear market not including domestic switches is around Rs.2800 crores. Low-tension switchgear is indicating continuous growth due to the growth in the industrial and housing sectors. This industry will continue to grow in excess of 20%. Distribution reform programmes, growth in the construction industry, commercial buildings, export opportunities etc. have contributed to its remarkable growth. While the local market potential has attracted MNCs to set up shop in India, a few Indian companies are also examining the possibility of setting up manufacturing facilities in other developing economies like China.

Investment in manufacturing is looking at scaling up the production capacities in many sectors and signals of a capacity overhang that had dragged down investment since the mid 1990s are not there. Industry sectors like oil, cement, steel and aluminium have increased their capacity utilization and are now looking at future demand which will further boost the demand for products required by the industrial customers like rotating machinery.

Growth of the rotating machinery industry is an indicator of industrial growth as these products are primarily used in the power equipment industry. Substantial growth of more than 70% in high-tension motors implies that investment activities in power stations and core sector industries are increasing. The small motors have also shown good growth of about 15% due to a large export market and the momentum gathered by the white goods industry as a result of the overall economic growth in the country.

Energy efficient motors are going to gain importance with the focus on energy savings. Though the initial cost of these motors may be slightly higher than that of standard motors, the initial extra cost is compensated by the savings in electricity cost due to their superior efficiency. Hence companies are positioning themselves in this product category by either developing, or procuring technology.

The business scenario is very dynamic for energy meters with an increasing number of manufacturers getting into the fray and competing in the growing Indian market. Various SEBs have floated a large number of tenders but decisions have been considerably delayed in most of the cases. Manufacturers also complain of the frequent changes in the specifications and the variety of specifications followed across States which forces the manufacturers to manufacture a variety of models and hence their profitability suffers. The expected delivery period is also very short, putting tremendous pressure on the manufacturers. Import of meters especially from China is a big threat to the domestic industry.

The global power industry has been facing uncertainties in the post-Enron collapse. In this context, utility companies have been going slow on their investments. This is partly attributable to the sluggish state of the global economy and because of unsatisfactory financial performance of many acquisitions in the electrical power sector. The move towards electricity market restructuring and reforms is gaining momentum. The total worldwide order booking for power plant equipment has been much below the manufacturing capacity leading to more aggressive marketing by global power plant equipment manufacturers who have also been undergoing consolidation. While there has been a decline in overall orders in the previous years, many developing nations are planning to expand their electricity infrastructure over the coming years. As per the estimate (International Energy Outlook 2005) the electricity sector investments of the developing countries in Asia are expected to be the fastest growing in the world in the next two decades.

In 2000, fuels accounted for 64.5% of the annual electricity production comprising, coal 36%, natural gas 19.5% and oil 9%. Of the balance 35.5% electricity

generation, the hydro generation sector contributed 19%, nuclear 1% and the rest 0.5% came from other sources, including renewables.

In 2000, about 15,430 tera watt-hour (TWh) of electricity was produced globally, translating into an average per capita electricity consumption of about 2,548 KWh/person. The per capita electricity consumption in North America was much higher at 11,618 KWh/person followed by Japan at about 8,502 KWh/person and Western Europe at 6,295 KWh/person. The Asian average stood at 975 KWh/person.

The top five countries in terms of overall installed capacity include the US (795 GW), China (294 GW), Japan (229 GW), Russia (203 GW) and Canada (111 GW). India ranks 8<sup>th</sup>.

The top five countries in terms of installed hydro generation capacity include the US (99 GW), China (70 GW), Canada (67 GW), Brazil (59 GW) and Russia (43 GW), together accounting for 49% of the world hydro capacity.

The top five countries in terms of nuclear capacity include the US (98 GW), France (63 GW), Japan (45 GW), Germany (22 GW) and Russia (21 GW), together accounting for 70% of the world nuclear capacity.

Globally, investments in the power sector account for on an average 60-65% of gross energy investments.

Electricity generation is expected to nearly double between 2002 and 2025, from 14,275 billion kilowatt hours to 26,018 billion kilowatt hours. The strongest growth in net electricity consumption is projected for the emerging economies of the world. Robust economic growth in many of the emerging economies is expected to boost demand for electricity to run newly purchased home appliances for air-conditioning, cooking, space and water heating and refrigeration.

Worldwide consumption of electricity generated from nuclear power is expected to increase from 2,560 billion kilowatthours in 2002 to 3,032 billion kilowatthours in 2015 and 3,270 billion kilowatthours in 2025. Higher fossil fuel prices and the Kyoto Protocol are expected to improve prospects for new nuclear power capacity over the forecast period, and the world nuclear generation forecast includes construction of new nuclear plants in several countries.

The global electricity sector investments over the next 3 decades i.e. 2020-30 is expected to be about US\$ 10 trillion which is 60% of total energy investment. This is three times higher than investment in the electricity sector during the past 30 years. Out of the above, US\$ 5.5 trillion is to be spent on T&D 30% on transmission and the rest on distribution

As per the estimates (International Energy Outlook 2005) the electricity sectors of the developing countries in Asia are expected to be the fastest growing in the world in the next two decades.

A rapid growth in demand for electricity is also envisaged in the countries in the Middle East. The other promising markets are the South East Asian countries especially China. Much of the growth in renewable energy sources is expected to result from large-scale hydroelectric power projects in the developing world, particularly China, India and Laos.

Moreover there are global opportunities in servicing of generating machinery, which can be used by countries like India who have the human resources for studies like residual life assessment studies for boilers and for servicing. This availability of skilled manpower can be used to advantage by companies in exploring new business opportunities like system studies, diagnostics services, system augmentation and asset management for utility companies across the world.

Bangladesh will generate a huge demand for transformers since a major part of Bangladesh is yet to be electrified.

As per a study conducted by the Fredonia Group, world electric power equipment demand will grow by 4.5 percent annually through 2008. The Asia/Pacific and North American regions will remain the largest markets, with Western Europe also important. Widespread electricity sector deregulation will boost gains in the industrial and commercial market.

As per the same report, the US market for electric power equipment will reach US\$ 17.7 billion in 2006, driven by industrial spending and electric generating capacity by non-utility generators (NUGs). Switchgear relays and power transformers will grow the fastest based on growth in systems automation, power trading, voltage conversions and equipment upgrades.

## **ROADMAP**

The heavy electrical industry has had a remarkable growth path in India. Its fortunes have been closely linked to development of the power sector in the country. Arising out of this, it has undertaken significant expansion and development in view of the growth in the domestic requirements for electricity in the country. In the process it has played a very important role in the Indian power development programme.

The industry has now reached a point where it needs to consider certain specific initiatives for the overall development of the sector. Companies will need to upgrade their present range of products since a new range of products with the latest technologies catering to gas based and nuclear power projects will be in greater demand. Enhancement of capacities is also a must to meet the huge demand and supply gap likely to be created. The survey results indicate fairly limited capital investment plans in the industry. Once again it is the larger companies who are planning to go in for capital expenditure. The optimistic demand projections indicate that this level of capital expenditure will be inadequate. The industry obviously feels that it is not prepared to increase this without seeing tangible evidence of actual increase in investment in power development programmes especially in view of the fund constraints for such programmes and the

absence of private sector investment in power. Should investments take place, the industry will be faced with substantial imports of equipment as it will take a fairly long time for it to gear up to meet these requirements.

The levels of technology currently in use barring some critical areas of high technology are at par with international norms. India has the advantage of availability of highly skilled manpower at relatively low cost and this can certainly help to shape technology growth and development of this sector especially in the context of expansion in global markets.

This sector is experiencing difficulties in technology transfer since foreign companies can now directly participate in infrastructure projects. The increase in FDI is not always translated into technology transfer. Moreover major global equipment manufacturers are reluctant to transfer technologies to Indian companies since they would like to sell the equipment directly.

The level of R&D and technology innovation within the country is very low by international standards, at the same time Indian companies are not able to tie up technological agreements, which can significantly help them to enhance their levels of technology. Overseas companies prefer to either directly manufacture equipment or bring in imported equipment. This does not augur well for the future of the industry and it needs to enhance technology levels.

The level of activity and expenditure in R&D is low when compared to international companies because the huge investments required are not sustainable by Indian companies since their size is smaller compared to the global players. Today, most in-house R&D is involved largely in quality control and product improvement / development. This leads to the industry being dependent on the collaborator for technology.

To encourage companies to invest more into R&D, the following measures can be taken:

- Since 765 kV sub-stations will be in greater demand, companies having the capability to develop the technology indigenously should be encouraged by assuring orders for say 800 MW thermal sets and 765 kV sub-stations to enable the companies to invest in the development of this technology.
- When GOI provides a line of credit to another country for a new power sector project, procurement of a certain percentage of products should be from Indian companies.

Another major constraint faced by the domestic manufacturers of high voltage equipment is the availability of testing facilities. At present only CPRI has the facilities for testing such equipment, however they are not completely equipped. At present the manufacturers of very high voltage equipment send their products to KEEMA, Netherlands, which is not only a cumbersome process, but also an expensive one.

- Government needs to immediately look into this on an urgent basis and equip CPRI adequately. More testing facilities needs to be set up on the lines of CPRI to cater to the increasing future demand.

Another issue which is emerging is that initiatives need to be taken within the industry in order to enhance operational efficiencies through computerization, training etc.

Companies need to continue focusing on operational excellence, cost optimization and exports to be profitable in the face of ever increasing competition. Improving processes by benchmarking with the best for faster delivery of superior quality products/services will be the only factor that can help companies gain a foothold in export markets, as well as enhance their position in the domestic market.

With more and more private sector participation taking place in transmission and distribution, companies should give more emphasis to strategic planning and marketing if they want to enhance their share of domestic, as well as exports markets. Aggressive marketing through International trade fairs, international bidding, building of the India image and understanding the psychology of international clients is a prerequisite for enhancing market share in export markets.

Since this sector is very sensitive in terms of the need to provide customers reliable and quality power, availability of products, spare parts and service engineers at the shortest possible time is of crucial importance to the industry.

For this, the industry needs to invest more on human resources development and training to achieve a highly motivated, knowledgeable and trained sales and service force to offer immediate help to the customers at the time of a breakdown.

Moreover there are global opportunities in servicing of generating machinery, which can be accessed by countries like India who have the human resources for servicing and undertaking studies like residual life assessment studies for boilers/turbines. These advantages can result in companies exploring new business opportunities like system studies, diagnostics services, system augmentation and asset management for utility companies across the world.

While Indian manufacturers are conscious of technology levels in view of the critical nature of equipment supplied, there is an issue of delays in delivery and extended lead times required for supply of equipment.

The customers' requirement is for shorter delivery time, which may not be possible with the present production capacities available and the constraints in the supply chain. During the year 2004-05, Copper and CRGO prices touched a new high. CRGO was in short supply as International manufacturers were unable to meet the demands of the transformer industry worldwide. Along with the increase in metal prices, CRGO prices increased by 40% compounded by non-availability. Logistical challenges associated with procurement of raw materials need to be specifically addressed by industry. Demand forecasting is a critical capability when working

with global suppliers and the industry in India needs to gear up to these challenges in terms of balancing inventory and shortages.

With the decreasing customs duties, the domestic companies are at a disadvantage due to the inverted duty structure and the absence of a level playing field. Further there are certain raw materials and components required for 765 KV T&D equipment which are not manufactured in India.

The following items should be allowed to be imported at 5% customs duty :

- CRGO steel used by the transformer industry
  - For 765 kV Transformer
    - Electro grade copper for transformer winding
    - Special insulation components, press bore items and sudden pressure relays for high voltage rating
  - For 765 kV circuit breaker:
    - Voltage grading capacitor and SKF tube 280
- The Government has announced a very ambitious plan of addition to power generating capacity of about 60000 MW during the 11<sup>th</sup> Plan Period. Testing of most of the electrical equipments is mostly carried out at **CPRI**, which can test equipment of very large capacities and higher voltages. It has been observed that many testing facilities at CPRI are old and there is a need for augmentation of these facilities since the present capacity of CPRI is inadequate both in terms of capacity and voltage class.

In the highly competitive environment, many countries use non-tariff barriers to protect / promote manufacturing industry from their countries. Insistence on testing at specific laboratories is one such NTB, which makes products commercially non-competitive.

CPRI therefore needs to aggressively market itself and convince international buyers of electrical equipment to ensure that such terms do not affect its operations as well as export of electrical equipment from India.

**Hence there is an urgent need to make an investment of about Rs. 700 crores to make CPRI a test laboratory with modern testing equipments to make the industry more cost competitive and also to reduce the delivery period and to remove the non-trade barriers at times faced by the industry .**

- CRGO (Cold Rolled Grain Oriented) Electrical Steel is a special steel required in the manufacture of electrical Equipment like very large generators, transformers etc.

The process being intrinsic, CRGO is manufactured by 11 Manufacturers in the world, major countries of manufacture being Japan, Germany, USA, France, Korea, China etc. **However, the 'hot bands' required for the manufacture of**

**CRGO are made by only 6 manufacturers who control the supply and price of the material**

The country is facing an acute shortage of supply along with high price fluctuations and erratic delivery schedules and production of this steel is non-existent in India. Globally there is very limited know-how available in the area of manufacturing quality CRGO steel. Unavailability of CRGO steel is hampering manufacturing of electrical equipments severely. Since the quantity required by the domestic manufacturers may not be economically viable at present, with the increase in demand the volumes are likely to be substantial. Further India can also be one of the sources of supply of this steel. With a large number of steel alliances involving Indian companies it is envisaged that a Steel plant manufacturing steel for the capital goods may be thought of for which, It is estimated that an investment of approx. **Rs. 5000 crores** is needed. The 11<sup>th</sup> Plan may provide for a substantial amount on this account if a facility could be put up on a P-P-P model.

Finally the financial health of an organization is most important to be competitive among the world's best. Slow down of the restructuring process of Electricity Boards and their financial turnaround may become a constraint for the electrical equipment manufacturers since a large sum of outstanding appear in their books and this would hamper the financial development, if no positive steps are taken immediately.

The high level of outstanding is adversely affecting the profitability of the sector.

- Since most of the user sector are Government controlled, GOI should stipulate that dues should not be accumulated for more than 70 days.
- Companies need to be more conscious of their outstanding levels and strive to bring it down.

The industry in India is focused largely on domestic demand. Currently the export volumes are less than Rs.3,000 crores out of total sales of Rs.21,000 crores. The larger companies are significantly involved in exports. There are tremendous opportunities for the heavy electrical industry in India to enter global markets if the companies are able to match quality and technology levels at competitive prices. There is every reason to believe that the better managed Indian companies who are already involved in exports in a fairly big way will be able to enhance their export business prospects. It is necessary for the middle order of this industry sector to look at exports seriously. This will help them to emerge as bigger and better players not only in the domestic scenario, but also in the global markets.

## Annexure-I

<b>BENCHMARKING FOR HEAVY ELECTRICAL SECTOR</b>									
<b>INDIAN COMPANIES (Rs. crores)</b>		<b>EATON( \$ million)</b>		<b>GE( \$ million)</b>		<b>SNEIDER (Million Euro)</b>		<b>SIEMENS(Million Euro)</b>	
	<u>2004</u>		<u>2004</u>		<u>2004</u>		<u>2004</u>		<u>2004</u>
Sales	21000	Group Revenue	9817	Group Revenue	152866	Sales	10365	Total revenue	75167
		Sales (segment)	3072	Sales (segment)	55005	Cost of goods sold	5965	Sales (segment)	74573
		Cost of goods sold		Cost of goods sold	42695	R&D	535.2	Cost of goods sold	53320
						EBIT	1310.7	R&D	5063
		EBIT	859	EBIT	32516	Inventories	1369.7	EBIT	
						Receivables	2136	Inventories	11295
		Receivables	1612			Employees	84866	Receivables	11275
						Employee cost	3380.3	Employees	419200
								Employee cost	
% growth in sales	27	% growth in sales	22	% growth in sales	10.1	% growth in sales	18		
Raw Material consumed to sales (%)	61	Cost of goods sold to sales (%)		Cost of goods sold to sales (%)	77.5	Cost of goods sold to sales (%)	57.5	Cost of goods sold to sales (%)	71.5
R&D/Sales (%)	0.5					R&D/Sales (%)	5.1	R&D/Sales (%)	6.70
EBIT/sales (%)	4.6	EBIT/total revenue (%)	9	EBIT/total revenue	21.2	EBIT/Sales	12.6		
Inventory turnover	13.7					Inventory turnover	7.56	Inventory turnover	6.6
No. of days sales outstanding (days)	153	No. of days sales outstanding (days)	60			No. of days sales outstanding	75	No. of days sales outstanding	55
ROCE (%)	8.3	ROCE (%)	13	% increase in EBIT	4.2				
Sales/employee	26					Sales/employee	0.12 or (Rs 63 lacs)	Sales per employee	0.18 or (Rs 95 lacs)
Cost of wages/sales (%)	11					Cost of wages/sales (%)	32.6		

**1 Euro=Rs.  
52.5**

**Annexure-II****EXPORTS FOR ELECTRICAL MACHINERY SECTOR- MOTORS****Commodity:** 850120 UNIVERSAL AC/DC MOTORS OF AN OUTPUT >37.5**W Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-2004	2004-05	%Growth	2003-2004	2004-05	%Growth
1.	AFGHANISTAN TIS		0.13			0.01	
2.	ARGENTINA		3.48			0.15	
3.	BANGLADESH PR		7.54			0.12	
4.	CANADA		1.14			0.05	
5.	CHANNEL IS		0.25			0.03	
6.	TAIWAN	5.50			1.09		
7.	CHINA P RP	0.01			0.00		
8.	EGYPT A RP	69.48	9.68	-86.07	15.97	1.60	-89.98
9.	ETHIOPIA	115.41	0.59	-99.49	9.95	0.02	-99.80
10.	GERMANY		27.64			1.02	
11.	GHANA	0.94			0.08		
12.	ISRAEL	3.14			0.35		
13.	ITALY	58.55	8.23	-85.94	4.44	0.69	-84.47
14.	JAPAN		0.02			0.00	
15.	KENYA	8.52	12.60	47.91	2.27	3.15	39.07
16.	KUWAIT	1.10			0.20		
17.	MALAWI		0.18			0.02	
18.	MALAYSIA	9.24	0.58	-93.67	2.00	0.06	-97.10
19.	MEXICO	4.78			1.50		
20.	NEPAL	1.40	1.11	-20.65	0.05	0.20	300.00
21.	NETHERLAND		0.02			0.00	
22.	NEW ZEALAND		13.14			0.52	
23.	NIGERIA	395.34	467.78	18.33	73.90	92.05	24.56
24.	OMAN	9.96	0.13	-98.74	1.13	0.01	-99.12
25.	RWANDA		0.05			0.00	

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26.	SAUDI ARAB	49.02	0.23	-99.54	6.00	0.02	-99.67
27.	SEYCHELLES		1.64			0.07	
28.	SINGAPORE		12.86			0.38	
29.	SOLOMON IS	0.10			0.02		
30.	SOUTH AFRICA	2.56	0.74	-70.92	0.20	0.04	-80.00
31.	SPAIN	5.11			0.20		
32.	SRI LANKA DSR	1.07	11.91	1,010.13	0.03	3.01	9,920.00
33.	SUDAN		105.78			25.73	
34.	SWAZILAND	17.62			4.42		
35.	SWEDEN	55.78	7.38	-86.77	1.72	0.12	-93.02
36.	SWITZERLAND	47.81	25.72	-46.21	3.62	1.08	-70.08
37.	TAJIKISTAN		0.82			0.10	
38.	TANZANIA REP		1.08			0.22	
39.	THAILAND	9.03	8.58	-4.95	0.42	0.30	-28.50
40.	UGANDA		1.03			0.11	
41.	U ARAB EMTS	60.18	3.20	-94.68	11.63	0.52	-95.56
42.	U K		9.06			0.97	
43.	U S A	178.59	43.10	-75.87	25.84	3.33	-87.13
44.	ZAMBIA	3.31			0.20		
	<b>Total</b>	<b>1,113.56</b>	<b>787.43</b>	<b>-29.29</b>			

**Commodity:** 85012000 UNIVERSAL AC/DC MOTORS OF AN OUTPUT > 37.5 W  
**Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-2004	2004-05	%Growth	2003-2004	2004-05	%Growth
1.	AFGHANISTAN TIS		0.13			0.01	
2.	ARGENTINA		3.48			0.15	
3.	BANGLADESH PR		7.54			0.12	
4.	CANADA		1.14			0.05	
5.	CHANNEL IS		0.25			0.03	
6.	TAIWAN	5.50			1.09		
7.	CHINA P RP	0.01			0.00		
8.	EGYPT A RP	69.48	9.68	-86.07	15.97	1.60	-89.98

FINAL REPORT ON THE INDIAN CAPITAL GOODS INDUSTRY

9.	ETHIOPIA	115.41	0.59	-99.49	9.95	0.02	-99.80
10.	GERMANY		27.64			1.02	
11.	GHANA	0.94			0.08		
12.	ISRAEL	3.14			0.35		
13.	ITALY	58.55	8.23	-85.94	4.44	0.69	-84.47
14.	JAPAN		0.02			0.00	
15.	KENYA	8.52	12.60	47.91	2.27	3.15	39.07
16.	KUWAIT	1.10			0.20		
17.	MALAWI		0.18			0.02	
18.	MALAYSIA	9.24	0.58	-93.67	2.00	0.06	-97.10
19.	MEXICO	4.78			1.50		
20.	NEPAL	1.40	1.11	-20.65	0.05	0.20	300.00
21.	NETHERLAND		0.02			0.00	
22.	NEW ZEALAND		13.14			0.52	
23.	NIGERIA	395.34	467.78	18.33	73.90	92.05	24.56
24.	OMAN	9.96	0.13	-98.74	1.13	0.01	-99.12
25.	RWANDA		0.05			0.00	
26.	SAUDI ARAB	49.02	0.23	-99.54	6.00	0.02	-99.67
27.	SEYCHELLES		1.64			0.07	
28.	SINGAPORE		12.86			0.38	
29.	SOLOMON IS	0.10			0.02		
30.	SOUTH AFRICA	2.56	0.74	-70.92	0.20	0.04	-80.00
31.	SPAIN	5.11			0.20		
32.	SRI LANKA DSR	1.07	11.91	1,010.13	0.03	3.01	9,920.00
33.	SUDAN		105.78			25.73	
34.	SWAZILAND	17.62			4.42		
35.	SWEDEN	55.78	7.38	-86.77	1.72	0.12	-93.02
36.	SWITZERLAND	47.81	25.72	-46.21	3.62	1.08	-70.08
37.	TAJIKISTAN		0.82			0.10	
38.	TANZANIA REP		1.08			0.22	
39.	THAILAND	9.03	8.58	-4.95	0.42	0.30	-28.50
40.	UGANDA		1.03			0.11	
41.	U ARAB EMTS	60.18	3.20	-94.68	11.63	0.52	-95.56

FINAL REPORT ON THE INDIAN CAPITAL GOODS INDUSTRY

42.	U K		9.06			0.97	
43.	U S A	178.59	43.10	-75.87	25.84	3.33	-87.13
44.	ZAMBIA	3.31			0.20		
	<b>Total</b>	<b>1,113.56</b>	<b>787.43</b>	<b>-29.29</b>			

**Commodity:** 85013210 D.C.MOTORS **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	AFGHANISTAN TIS	16.28			0.01		
2.	ALGERIA	20.96	3.43	-83.63	0.02	0.10	455.56
3.	ARGENTINA	9.90	66.43	570.95	0.08	2.38	2,988.31
4.	AUSTRALIA	10.62	57.20	438.84	0.03	0.18	557.14
5.	AZERBAIJAN		1.45			0.00	
6.	BAHARAIN IS	20.73	87.03	319.92	0.16	0.05	-71.87
7.	BANGLADESH PR	62.31	44.58	-28.45	1.16	0.17	-85.14
8.	BARBADOS	0.41			0.00		
9.	BELGIUM	6.85	6.89	0.57	0.03	0.02	-40.00
10.	BENIN	1.27			0.00		
11.	BHUTAN	33.00			0.05		
12.	BOTSWANA		11.87			0.05	
13.	BULGARIA		0.06			0.00	
14.	BURKINA FASO		0.31			0.00	
15.	CANADA	31.28	17.59	-43.77	0.13	0.20	55.12
16.	CHAD		0.58			0.00	
17.	CHILE	2.87			0.03		
18.	TAIWAN	65.22	96.35	47.73	0.34	0.22	-34.71
19.	CHINA P RP	35.00	21.56	-38.38	0.10	0.81	748.96
20.	COLOMBIA		2.18			0.12	
21.	CONGO P REP	3.39	28.48	739.95	0.01	0.16	980.00
22.	CYPRUS	8.59	5.35	-37.74	0.05	0.19	240.00
23.	DENMARK	0.60			0.00		
24.	EGYPT A RP	12.86	34.63	169.26	0.10	1.97	1,826.47

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25.	ERITREA		1.98			0.01	
26.	FRANCE	6.12	38.26	524.80	0.02	0.04	75.00
27.	GERMANY	128.80	160.67	24.74	0.82	1.52	86.89
28.	GHANA	3.36	29.72	785.34	0.01	0.19	1,384.62
29.	GREECE	14.73	7.78	-47.16	0.09	0.05	-46.24
30.	GUINEA	11.31	0.68	-94.02	0.01	0.01	-57.14
31.	HONG KONG	0.77	0.20	-74.69	0.00	0.00	-25.00
32.	INDONESIA	37.80	7.49	-80.18	0.14	0.04	-70.34
33.	IRAN		11.85			0.05	
34.	IRAQ	27.18			0.03		
35.	IRELAND		0.27			0.00	
36.	ISRAEL	42.42	71.48	68.50	0.16	1.31	718.13
37.	ITALY	40.99	360.67	779.97	0.18	1.80	908.99
38.	JAMAICA	0.79			0.00		
39.	JAPAN	6.29	18.70	197.19	0.03	0.35	1,022.58
40.	JORDAN	1.81			0.00		
41.	KAZAKHSTAN	1.96			0.00		
42.	KENYA	34.05	37.47	10.07	0.34	0.25	-26.27
43.	KOREA DP RP	11.68			0.03		
44.	KOREA RP	28.06	12.52	-55.38	0.24	0.15	-36.55
45.	KUWAIT	23.07	3.01	-86.97	0.09	0.03	-72.04
46.	LEBANON	6.68	16.73	150.44	0.01	0.07	630.00
47.	MADAGASCAR		2.16			0.01	
48.	MALAWI	1.46	10.75	634.08	0.01	0.11	714.29
49.	MALAYSIA	8.41	41.21	390.16	0.03	0.13	396.30
50.	MALDIVES	0.22	1.76	712.53	0.00	0.02	633.33
51.	MALI		14.00			0.02	
52.	MALTA		0.45			0.00	
53.	MAURITANIA	2.88			0.01		
54.	MAURITIUS	2.40	4.13	72.14	0.01	0.11	1,528.57
55.	MYANMAR	4.40			0.02		
56.	MEXICO		0.13			0.00	
57.	MOROCCO	1.92	1.54	-19.93	0.00	0.01	133.33

## FINAL REPORT ON THE INDIAN CAPITAL GOODS INDUSTRY

58.	NEPAL	54.15	15.07	-72.17	0.18	0.42	138.07
59.	NETHERLAND	2.95	0.54	-81.72	0.05	0.01	-78.00
60.	NEW ZEALAND	25.03	21.04	-15.93	0.06	0.28	405.36
61.	NIGERIA	7.89	14.31	81.48	0.05	0.22	296.36
62.	OMAN	41.59	38.68	-7.00	0.49	0.49	0.41
63.	PAKISTAN IR		5.64			0.02	
64.	PANAMA REPUBLIC		0.54			0.01	
65.	PERU	1.09	1.89	72.48	0.01	0.01	-27.27
66.	PHILIPPINES		4.53			0.01	
67.	QATAR	1.16			0.00		
68.	ROMANIA	0.95			0.01		
69.	RUSSIA	3.03			0.00		
70.	RWANDA	7.39	2.26	-69.38	0.02	0.01	-57.14
71.	SAUDI ARAB	170.01	17.38	-89.77	2.13	0.05	-97.55
72.	SENEGAL		0.09			0.00	
73.	SINGAPORE	32.98	20.74	-37.10	0.08	0.07	-5.13
74.	SOMALIA	6.09			0.02		
75.	SOUTH AFRICA	48.17	13.41	-72.16	0.61	0.09	-85.46
76.	SPAIN	20.43	47.66	133.29	0.11	0.64	462.28
77.	SRI LANKA DSR	82.43	85.05	3.17	0.75	0.41	-45.52
78.	SUDAN	19.65	0.08	-99.59	0.30	0.00	-99.67
79.	SURINAME		56.53			0.15	
80.	SWAZILAND	31.12			0.66		
81.	SWEDEN	133.50	178.19	33.47	0.93	1.35	44.62
82.	SWITZERLAND	102.33	188.25	83.96	0.82	1.57	91.72
83.	SYRIA	10.96	2.59	-76.38	0.04	0.10	170.27
84.	TANZANIA REP	10.35	3.95	-61.78	0.02	0.01	-26.32
85.	THAILAND	94.89	44.73	-52.86	0.54	0.37	-32.78
86.	TOGO	0.21	11.55	5,369.55	0.00	0.04	3,800.00
87.	TRINIDAD	0.33			0.00		
88.	TURKEY	33.13			0.19		
89.	TURKMENISTAN	7.24			0.02		
90.	UGANDA	17.49	6.43	-63.21	0.07	0.14	101.45

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91.	U ARAB EMTS	244.50	139.10	-43.11	1.21	1.48	21.76
92.	U K	8.56	107.69	1,157.83	0.04	1.12	2,764.10
93.	U S A	1,869.89	491.69	-73.70	10.24	16.68	62.94
94.	VIETNAM SOC REP	37.27	2.22	-94.04	0.36	0.04	-88.98
95.	YEMEN REPubLC	3.49	12.55	259.30	0.01	0.28	3,871.43
96.	ZAMBIA	0.32	0.20	-38.10	0.00	0.00	50.00
97.	ZIMBABWE		6.07			0.01	
98.	UNSPECIFIED	23.34			0.35		
	<b>Total</b>	<b>3,945.61</b>	<b>2,882.26</b>	<b>-26.95</b>			

**Commodity:** 85013310 D.C.MOTORS **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	ANGOLA		140.82			0.02	
2.	ARGENTINA	37.48			0.01		
3.	AUSTRALIA	10.55	0.49	-95.35	0.00	0.00	-40.00
4.	BAHARAIN IS	2.89	48.01	1,562.45	0.00	0.01	300.00
5.	BANGLADESH PR	180.99	3.35	-98.15	0.03	0.02	-41.18
6.	BELGIUM		3.62			0.01	
7.	BHUTAN	8.27			0.00		
8.	BRAZIL		1.10			0.00	
9.	CANADA	39.86	0.65	-98.37	0.02	0.00	-88.24
10.	CHAD		3.70			0.00	
11.	TAIWAN	131.65	68.16	-48.23	0.06	0.05	-18.64
12.	CHINA P RP	5.46	10.94	100.27	0.03	0.07	94.12
13.	COLOMBIA	4.33	2.39	-44.85	0.00	0.01	1,000.00
14.	DJIBOUTI		21.19			0.01	
15.	EGYPT A RP	44.99	34.16	-24.07	0.02	0.12	505.00
16.	ETHIOPIA	0.34			0.00		
17.	FRANCE	21.51			0.01		
18.	GERMANY	89.91	11.15	-87.59	0.03	0.00	-80.00
19.	GHANA	3.08	16.06	421.59	0.01	0.08	650.00

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20.	GREECE		1.33			0.00	
21.	HONG KONG	11.78				0.00	
22.	INDONESIA	9.11	0.69	-92.47	0.01	0.00	-84.62
23.	IRAN	58.94	68.20	15.72	0.01	0.01	85.71
24.	IRAQ		1.08			0.00	
25.	ISRAEL	15.68				0.00	
26.	ITALY	2.09	58.55	2,707.98	0.00	0.20	9,950.00
27.	JAPAN	13.11	1.22	-90.71	0.11	0.00	-95.61
28.	KENYA	2.77	36.29	1,210.15	0.00	0.01	266.67
29.	KOREA RP		17.16			0.00	
30.	KUWAIT	20.49	2.12	-89.66	0.04	0.00	-97.67
31.	LEBANON	11.91	14.91	25.22	0.01	0.02	54.55
32.	MALAYSIA	5.47				0.00	
33.	MYANMAR		5.77			0.01	
34.	NEPAL	4.06	9.48	133.63	0.00	0.04	1,850.00
35.	NETHERLAND		527.79			0.20	
36.	NEW ZEALAND		3.37			0.07	
37.	NIGERIA	18.23				0.02	
38.	NORWAY		38.50			0.02	
39.	OMAN		1.23			0.00	
40.	PORTUGAL		14.70			0.01	
41.	QATAR		7.75			0.01	
42.	RUSSIA		1.60			0.00	
43.	SAUDI ARAB	1.25	2.55	103.40	0.00	0.00	-75.00
44.	SINGAPORE	21.48	66.08	207.63	0.02	0.04	100.00
45.	SOMALIA		0.97			0.00	
46.	SOUTH AFRICA		2.67			0.00	
47.	SPAIN	15.22				0.00	
48.	SRI LANKA DSR	18.27	56.57	209.56	0.01	0.02	187.50
49.	SUDAN	3.09				0.00	
50.	SWAZILAND		10.62			0.00	
51.	SWEDEN		20.82			0.01	
52.	SWITZERLAND	43.87				0.03	

53.	TANZANIA REP	0.90	10.42	1,054.36	0.01	0.01	85.71
54.	THAILAND	77.34	9.73	-87.41	0.04	0.02	-48.57
55.	TOGO	4.45	38.33	760.50	0.00	0.05	2,550.00
56.	TURKEY		20.93			0.00	
57.	UGANDA		6.90			0.00	
58.	U ARAB EMTS	10.59	55.89	428.00	0.02	0.13	560.00
59.	U K		6.80			0.14	
60.	U S A	400.40	97.16	-75.73	1.12	0.36	-67.94
61.	VIETNAM SOC REP	20.43			0.01		
62.	UNSPECIFIED		1.22			0.02	
	<b>Total</b>	<b>1,372.25</b>	<b>1,585.18</b>	<b>15.52</b>			

GENERATORS

**Commodity:** 850162 AC GENERATORS (ALTERNATORS) OF AN OUTPUT EXCEEDING 75 KVA BUT NOT EXCEEDING 375 KVA **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	BAHARAIN IS	14.46			0.01		
2.	BANGLADESH PR		2.04			0.01	
3.	BHUTAN		9.08			0.00	
4.	BOTSWANA		20.95			0.11	
5.	CHINA P RP	2.11			0.00		
6.	FRANCE	4.15			0.00		
7.	GREECE	12.43			0.00		
8.	INDONESIA		39.28			0.11	
9.	JAPAN	3.56			0.00		
10.	LEBANON		171.02			0.11	
11.	LIBERIA	2.12			0.00		
12.	MALAYSIA	11.22			0.00		
13.	MALDIVES		0.12			0.00	
14.	MEXICO	3.65			0.00		
15.	NEPAL	13.48			0.04		
16.	NIGERIA	2.37	96.14	3,949.19	0.00	0.04	3,500.00

17.	SINGAPORE	107.29	17.28	-83.90	0.04	0.01	-81.82
18.	SOUTH AFRICA		20.55			0.01	
19.	SRI LANKA DSR		1.98			0.00	
20.	SWEDEN		4.39			0.00	
21.	TANZANIA REP	21.71			0.01		
22.	UGANDA		13.18			0.02	
23.	U ARAB EMTS	369.58	68.78	-81.39	0.13	0.05	-64.29
24.	U K		3.06			0.00	
25.	U S A	17.83	176.25	888.41	0.01	0.08	650.00
26.	VIETNAM SOC REP		4.41			0.01	
	<b>Total</b>	<b>585.96</b>	<b>648.52</b>	<b>10.68</b>			

**Commodity:** 85016200 AC GENERATORS (ALTERNATORS) OF AN OUTPUT EXCEEDING 75 KVA BUT NOT EXCEEDING 375 KVA **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	BAHARAIN IS	14.46			0.01		
2.	BANGLADESH PR		2.04			0.01	
3.	BHUTAN		9.08			0.00	
4.	BOTSWANA		20.95			0.11	
5.	CHINA P RP	2.11			0.00		
6.	FRANCE	4.15			0.00		
7.	GREECE	12.43			0.00		
8.	INDONESIA		39.28			0.11	
9.	JAPAN	3.56			0.00		
10.	LEBANON		171.02			0.11	
11.	LIBERIA	2.12			0.00		
12.	MALAYSIA	11.22			0.00		
13.	MALDIVES		0.12			0.00	
14.	MEXICO	3.65			0.00		
15.	NEPAL	13.48			0.04		
16.	NIGERIA	2.37	96.14	3,949.19	0.00	0.04	3,500.00
17.	SINGAPORE	107.29	17.28	-83.90	0.04	0.01	-81.82

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18.	SOUTH AFRICA		20.55			0.01	
19.	SRI LANKA DSR		1.98			0.00	
20.	SWEDEN		4.39			0.00	
21.	TANZANIA REP	21.71			0.01		
22.	UGANDA		13.18			0.02	
23.	U ARAB EMTS	369.58	68.78	-81.39	0.13	0.05	-64.29
24.	U K		3.06			0.00	
25.	U S A	17.83	176.25	888.41	0.01	0.08	650.00
26.	VIETNAM SOC REP		4.41			0.01	
	<b>Total</b>	<b>585.96</b>	<b>648.52</b>	<b>10.68</b>			

**Commodity:** 85016410 AC GENERATORS (ALTERNATORS) OF AN OUTPUT >750 KVA BUT ≤2000 KVA **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	ANGOLA		6.90			0.00	
2.	AUSTRIA	13.87			0.00		
3.	BELGIUM		2.02			0.00	
4.	BHUTAN	121.30			0.00		
5.	CHINA P RP		6.56			0.00	
6.	DJIBOUTI	2.13			0.00		
7.	INDONESIA	32.55			0.00		
8.	JAPAN	16.65	15.96	-4.18	0.00	0.00	0.00
9.	KOREA RP	10.04			0.00		
10.	MALDIVES	13.24	1.96	-85.17	0.00	0.00	0.00
11.	NEPAL		1,219.57			0.50	
12.	NIGERIA		10.03			0.01	
13.	OMAN	5.72	2.55	-55.51	0.00	0.00	200.00
14.	ROMANIA	23.65			0.00		
15.	SAUDI ARAB	10.11			0.00		
16.	SINGAPORE	83.87	283.64	238.20	0.03	0.09	244.00
17.	SRI LANKA DSR	30.06	11.12	-63.01	0.00	0.00	100.00

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18.	SYRIA	17.17			0.00		
19.	THAILAND		15.71			0.01	
20.	U ARAB EMTS		36.74			0.02	
21.	U K	130.61			0.00		
22.	U S A	9.76	20.06	105.55	0.00	0.00	0.00
23.	VIETNAM SOC REP	4.37			0.00		
	<b>Total</b>	<b>525.09</b>	<b>1,632.81</b>	<b>210.96</b>			

**Commodity:** 85016420 AC GENERATORS(ALTERNATORS) OF AN OUTPUT >2000 KVA BUT <=5000 KVA **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	JAPAN		117.92			0.00	
2.	U ARAB EMTS	37.43			0.00		
3.	U S A	59.90			0.00		
	<b>Total</b>	<b>97.33</b>	<b>117.92</b>	<b>21.15</b>			

**Commodity:** 85016430 AC GENERATORS (ALTERNATORS) OF AN OUTPUT >5000 KVA BUT <=15000 KVA **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	JAPAN	54.87	97.46	77.63	0.00	0.00	-75.00
2.	MALDIVES		128.77			0.00	
3.	MYANMAR		34.38			0.00	
4.	NEPAL		10.67			0.00	
	<b>Total</b>	<b>54.87</b>	<b>271.28</b>	<b>394.44</b>			

**Commodity:** 85016440 AC GENERATORS(ALTERNATORS) OF AN OUTPUT > 15000 KVA BUT <=37500 KVA **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	U S A	123.33			0.00		
	<b>Total</b>	<b>123.33</b>					

**Commodity:** 85016450 AC GENERATORS (ALTERNATORS) OF AN OUTPUT > 37,500 KVA <= 75,000 KVA **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	U ARAB EMTS		1.78			0.00	
	<b>Total</b>		<b>1.78</b>				

**Commodity:** 85016460 AC GENERATORS (ALTERNATORS) OF AN OUTPUT > 75000 KVA BUT<=137500 KVA **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	THAILAND		28.12			0.00	
	<b>Total</b>		<b>28.12</b>				

**Commodity:** 85016470 AC GENERATORS (ALTERNATORS) OF AN OUTPUT >137500 KVA BUT <=312500 KVA **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	AUSTRALIA	386.64			0.00		
2.	FRANCE		22.68			0.00	
	<b>Total</b>	<b>386.64</b>	<b>22.68</b>	<b>-94.13</b>			

**Commodity:** 85016480 AC GENERATORS (ALTRNATORS) OF AN OUTPUT> 312500 KVA **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	CHINA P RP		8.15			0.00	
2.	NETHERLAND		6.71			0.00	
3.	SRI LANKA DSR		7.16			0.00	
4.	SUDAN		11.52			0.00	
5.	U ARAB EMTS		35.09			0.01	
6.	U S A		5.62			0.00	
	<b>Total</b>		<b>74.26</b>				

ALTERNATORS

**Commodity:** 85016100 AC GENERATORS (ALTERNATORS) OF AN OUTPUT NOT EXCEEDING 75 KVA **Unit:** Nos.

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	AFGHANISTAN TIS		231.15			0.27	
2.	ARGENTINA		0.90			0.00	
3.	AUSTRALIA		0.48			0.01	
4.	BAHARAIN IS	0.36			0.00		
5.	BANGLADESH PR	1.32	2.10	58.61	0.00	0.00	0.00
6.	BHUTAN	4.97			0.01		
7.	CANADA	1.41			0.00		
8.	CHINA P RP	10.13	68.11	572.21	0.01	0.03	433.33
9.	FRANCE	8.27	18.55	124.20	0.01	0.03	86.67
10.	GERMANY	13.32			0.02		
11.	INDONESIA	2.11			0.00		
12.	JAPAN		0.33			0.00	
13.	KENYA	15.06			0.07		
14.	KUWAIT		0.25			0.00	

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15.	LEBANON	4.61	57.77	1,153.69	0.01	0.16	1,490.00
16.	LIBYA		1,288.33			0.20	
17.	MALAYSIA	1.04			0.00		
18.	MYANMAR		9.18			0.01	
19.	MEXICO	9.08			0.01		
20.	MOZAMBIQUE	1.76			0.02		
21.	NEPAL	13.08	5.02	-61.63	0.02	0.10	395.24
22.	NETHERLAND	1.22			0.00		
23.	NIGERIA	39.58			0.20		
24.	SAUDI ARAB	13.06			0.00		
25.	SENEGAL		0.36			0.00	
26.	SINGAPORE	67.95	25.64	-62.26	0.09	0.03	-69.23
27.	SOUTH AFRICA		16.38			0.06	
28.	SPAIN	1.48			0.00		
29.	SRI LANKA DSR	1.73	10.12	485.70	0.00	0.02	1,500.00
30.	SWITZERLAND	2.46			0.03		
31.	TAJKISTAN		19.38			0.00	
32.	TANZANIA REP		1.36			0.00	
33.	TOGO	1.03			0.01		
34.	U ARAB EMTS	150.67	65.09	-56.80	0.12	0.05	-53.91
35.	U K	0.55	158.41	28,500.49	0.00	0.43	21,600.00
36.	U S A	107.33	0.54	-99.49	0.47	0.00	-99.57
37.	VIETNAM SOC REP		6.30			0.01	
	<b>Total</b>	<b>473.59</b>	<b>1,985.75</b>	<b>319.30</b>			

CAPACITORS

**Commodity:** 85322300 OTHR FXD CAPACITORS, CERAMIC DIELECTRIC, SINGLE LAYER

**Unit:** KGS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	AUSTRALIA		0.03			0.01	
2.	SINGAPORE	0.15			0.01		
3.	SPAIN	1.49	0.26	-82.79	0.06	0.06	0.00
4.	SWITZERLAND	0.60			0.01		
5.	U K	3.01	7.99	165.12	0.01	0.04	400.00
	<b>Total</b>	<b>5.25</b>	<b>8.28</b>	<b>57.62</b>			

TURBINES

**Commodity:** 84068100 OTHER TURBINES OF AN OUTPUT > 40 MW **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	BANGLADESH PR	59.41			0.03		
2.	LIBYA		289.71			0.02	
3.	SRI LANKA DSR	11.05	2.25	-79.66	0.00	0.00	-50.00
4.	U S A		2,274.60			0.00	
5.	VIETNAM SOC REP	0.21			0.00		
	<b>Total</b>	<b>70.67</b>	<b>2,566.56</b>	<b>3,531.85</b>			

**Commodity:** 84068200 OTHER TURBINES OF AN OUTPUT <= 40 MW **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	BANGLADESH PR		252.26			0.03	
2.	FRANCE	7.60			0.00		
3.	IRELAND	2.57			0.00		

4.	LIBYA		68.41			0.00	
5.	NETHERLAND		402.33			0.00	
6.	PHILIPPINES		34.34			0.01	
7.	TANZANIA REP		15.39			0.00	
8.	U K	0.77			0.00		
9.	U S A	2,300.00	18.36	-99.20	0.00	0.05	5,200.00
	<b>Total</b>	<b>2,310.94</b>	<b>791.08</b>	<b>-65.77</b>			

**Commodity:** 84101390 TURBINES ETC OF POWER>80000 KW **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	SRI LANKA DSR		20.77			0.00	
	<b>Total</b>		<b>20.77</b>				

**Commodity:** 84118220 GAS TURBINES OF POWER>15000 UP TO 30000 KW **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	GERMANY		34.27			0.00	
2.	LIBYA		9,751.33			0.05	
3.	OMAN	28.71			0.00		
4.	U S A		2,707.26			0.00	
	<b>Total</b>	<b>28.71</b>	<b>12,492.85</b>	<b>43,411.47</b>			

**Commodity:** 84118230 GAS TURBINES OF POWER>30000 UP TO 60000 KW **Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	LIBYA		678.64			0.01	
	<b>Total</b>		<b>678.64</b>				

**Commodity:** 84118250 GAS TURBINES OF POWER>90000 UPTO 115000 KW  
**Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	JORDAN	146.17			0.00		
2.	U K	796.29			0.01		
	<b>Total</b>	<b>942.47</b>					

**Commodity:** 84118260 GAS TURBINES OF POWER>115000 KW  
**Unit:** NOS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	LIBYA		14,749.30			0.01	
2.	NORWAY		46.93			0.00	
3.	U K		636.03			0.00	
	<b>Total</b>		<b>15,432.27</b>				

BOILERS

**Commodity:** 84021920 FIRETUBE BOILERS,VERTICAL  
**Unit:** KGS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth
1.	AFGHANISTAN TIS	25.85			19.00		
2.	BELGIUM		3.25			0.03	
3.	CANADA		2.83			2.00	
4.	U ARAB EMTS		0.23			0.40	
5.	U K		0.16			0.01	
6.	U S A		1.17			0.12	
	<b>Total</b>	<b>25.85</b>	<b>7.65</b>	<b>-70.40</b>			

**Commodity:** 84022000 SUPER-HEATED WATER BOILERS  
**Unit:** KGS

S.No.	Country	Value in Rs. Lacs			Quantity in thousands		
		2003-04	2004-05	%Growth	2003-04	2004-05	%Growth

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1.	AUSTRALIA		0.15			0.09	
2.	BAHARAIN IS		0.14			0.02	
3.	BANGLADESH PR		8.58			0.20	
4.	EGYPT A RP	3.20			0.18		
5.	ETHIOPIA	0.44	2.29	421.14	0.06	0.67	1,016.67
6.	GERMANY	0.05			0.05		
7.	GHANA		0.46			0.15	
8.	INDONESIA	10.90			5.00		
9.	IRAN		2.61			0.10	
10.	JORDAN		7.86			2.15	
11.	KENYA	0.59	4.53	663.51	0.06	1.17	1,845.00
12.	KUWAIT		2.75			1.15	
13.	LEBANON	1.84			0.38		
14.	MADAGASCAR		1.92			0.22	
15.	MALAWI		0.00			0.00	
16.	MALAYSIA	1.95	36.63	1,781.62	0.25	30.47	12,086.40
17.	NEPAL	1.44	8.37	481.49	0.20	1.20	500.00
18.	NIGERIA	1.24	13.84	1,016.99	0.20	0.90	351.00
19.	QATAR	0.71	1.26	78.17	0.12	0.08	-30.83
20.	SAUDI ARAB		0.09			0.02	
21.	SEYCHELLES		2.47			1.00	
22.	SINGAPORE		0.87			0.00	
23.	SOUTH AFRICA		0.59			0.40	
24.	SRI LANKA DSR		46.57			23.70	
25.	TANZANIA REP	2.69	6.04	124.65	0.14	1.56	1,047.06
26.	TURKEY	20.13			2.15		
27.	U ARAB EMTS	5.08	8.21	61.77	0.74	5.52	648.37
28.	U K	0.08	0.07	-11.04	0.01	0.00	-28.57
29.	U S A	4.18	7.12	70.37	0.50	0.35	-30.00
30.	ZAMBIA		2.81			0.70	
	<b>Total</b>	<b>54.51</b>	<b>166.25</b>	<b>205.01</b>			

<b>ANNEXURE-III</b>					
<b>ELECTRICAL SECTOR – INDIAN PROJECTS</b>					
<b>Sl.</b>	<b>Project Name</b>	<b>Location</b>	<b>Capacity (MW)</b>	<b>Target date of commissioning</b>	<b>Status</b>
1	Mangalore Thermal Power Project (TPP) (coal)	Karnataka	1015	September 2008	Equity tie up is then main outstanding issue
2	Pathadi TPP (coal), Chhattisgarh (Ph-II)	Chhattisgarh	300	February, 2009	One major issue that is critical for expediting the progress of the project and to achieve financial closure is allocation of coal linkage/coal block.
3	Wangtoo hydro electric project (HEP)	H.P.	1000	December, 2011	Equity tie up is the main outstanding issue. PPA is also to be finalized. Transmission scheme is also to be finalized.
4	Reliance Energy Dadri CCPP (Gas)	Uttar Pradesh	3500	2008-09	One major issue that is critical to the progress of the project and to achieve financial closure is tie up for supply of gas
5	Coal based TPP at Vile,	Maharashtra	1000	2009-10	EPC Bid on ICB Route is the major issue crucial to the project to achieve financial closure.
6	Gas based GPEC-II Power Plant in Gujarat	Gujarat	1050	October, 2007	EPC, PPA and FSA are the major pending issues.
7	Hazira CCPP (Gas), Gujarat		1500	Module-I: 31st December, 2007, Module II :31st December, 2008 PPA, Fuel	PPA, Fuel Supply Agreement and evacuation of power are the main outstanding issues.
8	Vizag Thermal Power Project	Andhra Pradesh	500	December, 2007	One major issue that is critical for

	near Visakhapatnam				expediting the progress of the project and to achieve financial closure is finalisation of PPA with PTC
9	Kattupalli CCPP, T.N.	Tamil Nadu	1000	September, 2008	Two major issues that are critical for expediting the progress of the project and to achieve financial closure are:-a) Finalization of PPA and b) Equity tie up
10	Rosa Power Project near Singrauli, U.P.	U.P	567	December, 2008	Sourcing of coal is a major issue which is to be sorted out.
11	Karrbi Langpi Hydro Electricity Project	Assam	100	June 2006	

	<b>Company Name</b>	<b>Project Name</b>	<b>Location</b>	<b>Capacity (MW)</b>	<b>Target date of completion</b>	<b>Cost (Rs. crores)</b>
12	Gujarat State Energy Generation Ltd	Combined Cycle Power (Hazira) Project	Hazira in Surat district of Gujrat	200-250	2008	700
13	Rajasthan Rajya Vidyut Utpadan Nigam Ltd	Dholpur Power Project Phase-I	Dholpur, Rajasthan	440	31.03.2006	1155
14	Andra Pradesh Power Generation Corporation Ltd	Bhoopalapally Power Project	Warrangal, Andhra Pradesh	500	30.06.2008	2100
15	Andra Pradesh Power Generation Corporation Ltd	Vijaywada Power Project Stage-IV	Krishna District, Andhra Pradesh	500	30.06.2008	2706

<b>CENTRAL ELECTRICITY AUTHORITY PROJECTS</b>		
<b>Projects having TEC of CEA</b>		
	<b>Name of the Project</b>	<b>Capacity (MW)</b>
16	Baspa Stage - II HEP (M/s JPIL)	300
17	Malana HEP(Malana Power Company Ltd.)	86
18	Tawa HEP( M/s Hindustan Electro Graphite)	13.5
19	Paguthan CCGT ( M/s Gujarat PowerGen Ltd. )	655
20	Hazira CCGT (M/s. Essar Power Ltd.)	515
21	Baroda CCGT (M/s. GIPCL)	167
22	Surat Lignite TPP (M/s GIPCL)	250
23	Dabhol CCGT (M/s. Dabhol Power Co.)	2015
24	Trombay TPP(M/s BSES	180
25	Dahanu TPP(M/s BSES)	500
26	Bhira PSS(M/s Tata Electric Com.)	500
27	Jegurupadu CCGT (M/s. GVK Industries)	216
28	Godavari CCGT (M/s. Specturam Tech.)	208
29	Guntur Branch Canal-HEP,	3.75
30	Peddapuram Samalkot CCGT(BSES Andhra Power Ltd.)	520
31	Kondapally CCGT(Lanco Industries Ltd.)	350
32	LVS Power Ltd	36.8
33	Toranagallu TPS (M/s. Jindal Tractebel )	260
34	Shivpur HEP (M/s Bhoruka Power Company)	18
35	Belgaum DGPP(M/s Tata Power Co.Ltd)	81.3
36	Tanir Bavi Barge Mounted Power Plant(Tanir Bavi Power Co.)	220
37	Bellary Power Project (M/s Rayalseema Alkalies & Allied Chemicals Ltd.)	20
38	Neyveli TPS - Zero Unit (Ms. ST-CMS)	250
39	Pillaiperumalnallur CCGT(M/s PPN Power)	330.5
40	Samalpatti DGPP(M/s Samalpatti Power Co.)	106
41	Maniyar HEP(Carborandum Universal)	12
42	BSES( Kerala Eloor Project(M/s BSES(Kerala Ltd.)	173
43	Budge-Budge TPP(M/s CSES)	500
44	Jojobera TPP (M/s Jamshedpur Power Co. )	240

<b>UPCOMING POWER PLANTS</b>				
<b>S.No</b>	<b>Company</b>	<b>Capacity</b>	<b>Location</b>	<b>Value (Rs. Crores)</b>
45	MPSEB	210 MW	Amarkantak TPS	625
46	Ispat Industries	110 MW		17000
47	WBPDCL	Coal handling plant for Sagsardhi Power Project (600 MW)	Sagardighi	250
48	WBPDCL	Capacity expansion of Santaldihi TPS Unit V (250 MW)	Santaldihi	5500
49	Eastern Energy	1000 MW power plant (4 coal based power plants of 250 MW each)	Jharkhand	5000
50	Tenughat Vidyut Nigam limited	3 x 210 MW units	Tenughat, Jharkhand	2050
51	Tata	1000 MW power generation project in Bangladesh	Bangladesh	5000
52	Nalco	240 MW captive power project	Angul, Orissa	1200
53	Jindal Steel Power Ltd	200 MW captive power plant at proposed steel plant	Keonjhar, Orissa	1000
54	Tata Power	3000 MW	Jharkhand	12000

**Tentative Thermal Power Projects identified for 11th Plan****7.3 Projects where clearances / inputs are being arranged.**

Sl. No.	Project Name/Unit No.	State	Implementing Agency	Capacity (MW)
<b>Central Sector</b>				
1.	Bokaro TPP U-1	Jharkhand	DVC	500
2.	Derang TPS	Orissa	NTPC	800
3.	Durgapur Steel TPS	West Bengal	DVC	1000
4.	Ennore TPP U-1, 2	Tamil Nadu	JV- NTPC/TNEB	1000
5.	Farakka STPS St.III U-1	West Bengal	NTPC	500
6.	Hirma TPP II U-1, 2	Orissa	NLC	2000
7.	Ib Valley STPP (Daripali)	Orissa	NLC	800
8.	IGTPP Bhaiyathan JV with CSEB	Chhattisgarh	NTPC	1320
9.	Jayankondam Lignite	Tamil Nadu	NLC	1000
10.	Kayamkulam CCPP Module-1, 2,3	Kerala	NTPC	1950
11.	Kodarma TPP U-1, 2	Jharkhand	DVC	1000
12.	Lara STPP	Chhattisgarh	NTPC	2400
13.	Maithon RBC TPP U-1, 2	Jharkhand	JV DVC/ Tata	1000
14.	Nabi Nagar U-1, 2	Bihar	NTPC	1000
15.	Neyveli TPS-III Exp. U-1, 2	Tamil Nadu	NLC	1000
16.	North Karanpura TPP U-1, 2,3	Bihar	NTPC	1980
17.	Panchet Hill TPS	West Bengal	DVC	1000
18.	Sesan	Gujarat	NLC	1000
19.	Talchar Gajamara STPP	Orissa	NTPC	800
20.	Tripura Gas GT+ST	Tripura	ONGC	750
21.	Tuticorin St.IV U-1, 2	Tamil Nadu	JV of TNEB & NLC	1000
			<b>Sub Total</b>	<b>24050</b>

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Sl. No.	Project Name/Unit No.	State	Implementing Agency	Capacity (MW)
<b>State Sector</b>				
1.	Akrimota Extn.	Gujarat	GMDCL	250
2.	Bakreshwar Extn. U-1	West Bengal	WBPDCCL	500
3.	Bellary TPP Extn. U-2	Karnataka	KPCL	500
4.	Bhusawal Extn.	Maharashtra	MSEB	500
5.	Bidadi Extn.	Karnataka	KPCL	700
6.	Chanderi CCGT JV	Madhya Pradesh	MPSEB	1000
7.	Chhabra TPS	Rajasthan	RRVUNL	500
8.	Dholpur CCPP St. II	Rajasthan	RRVUNL	330
9.	Doraha CCGT	Punjab	PSEB	1000
10.	DPL TPS U-1	West Bengal	DPL	500
13.	Garo Hills	Meghalaya	MESEB	360
14.	Giral Lignite Based TPP St.II U-2	Rajasthan	RRVUNL	125
15.	Harduaganj TPP	U.P.	UPRVUNL	500
16.	Hazira CCPP Extn. GT +ST	Gujarat	GSECL	200
11.	Ib Valley	Orissa	OPGCL	500
12.	Kapurdi Lignite	Rajasthan	RRVUNL	500
17.	Katwa	West Bengal	WBPDCCL	1000
18.	Keshoraipatam	Rajasthan	RRVUNL	330
19.	Khaperkheda TPS Extn. U-1	Maharashtra	MSEB	500
20.	Kota TPS Expn.	Rajasthan	RRVUNL	195
21.	Lakwa WHRU ST-2	Assam	ASEB	38
22.	Malwa TPP	Madhya Pradesh	MPSEB	1000
23.	Marwa TPP U-1, 2	Chhattisgarh	CSEB	1000
24.	Muzaffarpur TPP	Bihar	BSEB	500
25.	Namrup Extn. GT-1, GT-2	Assam	Assam Govt.	100
26.	Paras TPS Extn. U-2	Maharashtra	MSEB	250
27.	Parichha TPP Extn.	U.P.	UPRVUNL	500
28.	Parli TPS Extn. St.II U-2	Maharashtra	MSEB	250
29.	Pragati Ph. II	Delhi	PPGCL	330
30.	Raichur U-8	Karnataka	KPCL	210
31.	Raichur II TPS	Karnataka	KPCL	500
32.	Sagardighi TPP Extn. U-1,2	West Bengal	WBPDCCL	1000
33.	Talegaon TPP	Maharashtra	MSEB	1400
			<b>Sub Total</b>	<b>17068</b>
<b>Private Sector</b>				
1.	Aditya TPS	U.P.	Birla	1000
2.	Anguri CCGT GT+ST	Assam	ASEB	100
3.	Anpara 'C' U-1, 2	U.P.	UPRVUNL	1000
4.	Auranga TPP	Jharkhand	Tata Power Co. Ltd.	1000
5.	Bawana CCGT GT+ST	Delhi		1000
6.	Bhavnagar Lignite	Gujarat	Nirma Group	250
7.	Budge Budge Extn.	West Bengal	CESC	250
8.	Dadar & Nagar Haveli Gas Plant GT+ST	Dadar & Nagar Haveli (UT)		1000
9.	Dadri (Reliance) CCPP (Ph-I & Ph- II)	Uttar Pradesh	Reliance Energy Pvt. Ltd.	3740
10.	Faridabad II	Haryana	ABAN	1050
11.	Gautami CCPP GT+ST	Andhra Pradesh	GVK	134
12.	Godavari CCPP Ph-II GT+ST	Andhra Pradesh	Spectrum Power	359
13.	Goindwal Sahib TPP	Punjab	GVK Power	500
14.	Ib Valley TPP St.II U-5	Orissa	AES Ib Valley Corp.	500
15.	IGCC project, Madras Refinery	Tamil Nadu	Madras Refinery	500

Sl. No.	Project Name/Unit No.	State	Implementing Agency	Capacity (MW)
16.	Jegrupadu Extn. II	Andhra Pradesh	GVK Power	220
17.	Kannur CCGT GT+ST	Kerala	Kannur Power Projects	513
18.	Nagothane Ph. I, Ph.II, Ph.III	Maharashtra	Reliance	4050
19.	Nuelpoi	Orissa	CESC	500
20.	Paguthan CCPP	Gujarat	GEPC	1050
21.	Pathadi TPS Ph.III	Chhattisgarh	Lanco Amarkantak	600
22.	Pipavav CCPP GT+ST	Gujarat	KRIBHCO	615
23.	Rosa TPP	Uttar Pradesh	Rosa Power Supply Co.	600
24.	Torangallu TPP	Andhra Pradesh	Jindal Tractbel	500
25.	Vemagiri CCPP St.II GT+ST	Andhra Pradesh	VPGL	370
			<b>Sub Total</b>	<b>21401</b>
			<b>Total</b>	<b>62519</b>
			<b>Grand Total (7.1+7.2+7.3)</b>	<b>81434</b>

### OVERSEAS PROJECTS

Sl.	Authorizer	Home Country	Description of Project	Host Country	Projected Amount (Rs.Crores) [1 USD= Rs.45.27]	Date of Expiry	Fund- ing Authority
1	Ministry of Industry Vietnam	Vietnam	VN-2nd Transmission and Distribution	Vietnam	1448.64	None	World Bank
2	Albanian Power Corporation	Albania	Power Sector Generation and Restructuring Project	Albania	510	31.01. 2008	World Bank
3	Ministry of Industry, Cambodia	Cambodia	Rural Electrification and Transmission Project	Cambodia	307.47	30.06. 2009	World Bank
4	Ministry of Water and Power	Afghanistan	Power Transmission and distribution Project	Afghanistan	106.38	None	ADB
5	Electricity Authority of Cambodia	Cambodia	Greater Mekong Subregion Transmission	Cambodia	200.54	None	ADB

			Project				
6	Electricity Authority of Laos	Laos	Lao Nam Theun 2 Power Project	Laos	6564.15	None	None
7	Electricity of Vietnam	Vietnam	An Khe Kanak Hydro Electric Power Project	Vietnam	1557.2	Started in Oct 2005	None
8	Electricity of Vietnam	Vietnam	Srepok 3 Hydro Electric Power Project	Vietnam		Will start in Dec 2005	None
9	Electricity of Vietnam	Vietnam	Tranh River 2 Hydro Electric Power Project	Vietnam		Will start in Dec 2005	None
10	Electricity of Vietnam	Vietnam	Huoi Quang Hydro Electric Power Project	Vietnam	(Rs1312.83 Crore)	Will start in Dec 2005	None
11	Electricity of Vietnam	Vietnam	Chat Hamlet Hydro Electric Power Project	Vietnam		Will start in Dec 2005	None
12	Kazakhstan Electricity Grid Operating Company	Kazakhstan	North-South Electricity Transmission Project	Kazakhstan	728.12	31.12.2009	World Bank
13	Ministry of Industry, Vietnam	Vietnam	Second Transmission and Distribution Project	Vietnam	1466.83	31.12.2010	World Bank
14	Kazakhstan Electricity Grid Operation Company,	Kazakhstan	North-South Electricity Transmission Power Project	Kazakhstan	452.7		World Bank
15	Elektrownia Belchatow	Poland	Belchatow II Power and	Poland	6337.8		EBRD

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	S.A.		Energy Project				
16		Argentina	Norte Grande Electricity Transmission Programme	Argentina	1584.45		IADC
17		Brazil	North west electrification program	Brazil	45.27		IADC
18		Brazil	ATE II Transmission Project	Brazil	280.67		IADC
19		Mexico	Energy Efficiency Project II	Mexico	226.35		IADC
20		Paraguay	Power Transmission and Distribution Project	Paraguay	362.16		IADC
21		Venezuela	Electricity of Caracas	Venezuela	339.52		IADC
24		Russia	Russia-Federal Grid Company Modernization of Transmission Infrastructure	Russia	785		EBRD
25		Venezuela	Tocoma Hydroelectric Power plant	Venezuela	3395.25	2012	IADC
26	Egyptian Electricity Holding Company	Egypt	Eg-El Tebbin Power Project	Egypt	1131.75		World Bank
27	PT PLN Persero	Indonesia	Renewable Energy Development Project	Indonesia	728.84		ADB
28	Egyptian Electricity Holding Company	Egypt	El Kureimat Thermal Power Project	Egypt	1082.54		AFDB