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Business Focus Series

Electric Power Generation Markets in India and Pakistan

U.S. Agency for International Development
Office of Energy and Infrastructure
Bureau for Research and Development

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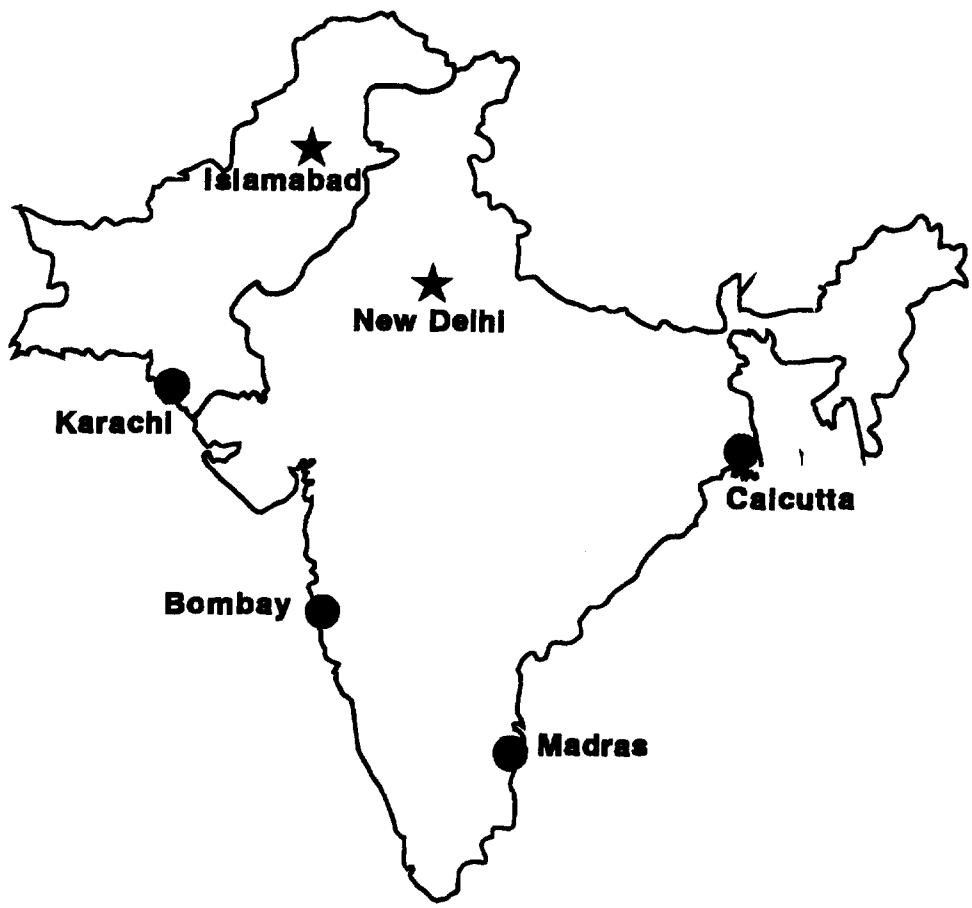

U.S. Agency for International Development
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Acronyms

ADB	Asian Development Bank
bcf	billion cubic feet
EIS	environmental impact statement
ESP	electrostatic precipitator
GATT	General Agreement on Trade and Tariffs
GWh	Gigawatt hour
IBRD	International Bank for Reconstruction and Development (World Bank)
IFC	International Finance Corporation
kWh	kilowatt hour
LNG	liquified natural gas
MDB	multilateral development bank
MMcmd	million cubic meters per day
MW	Megawatt
OECD	Organization for Economic Cooperation and Development
tcf	trillion cubic feet
USAID	United States Agency for International Development

India

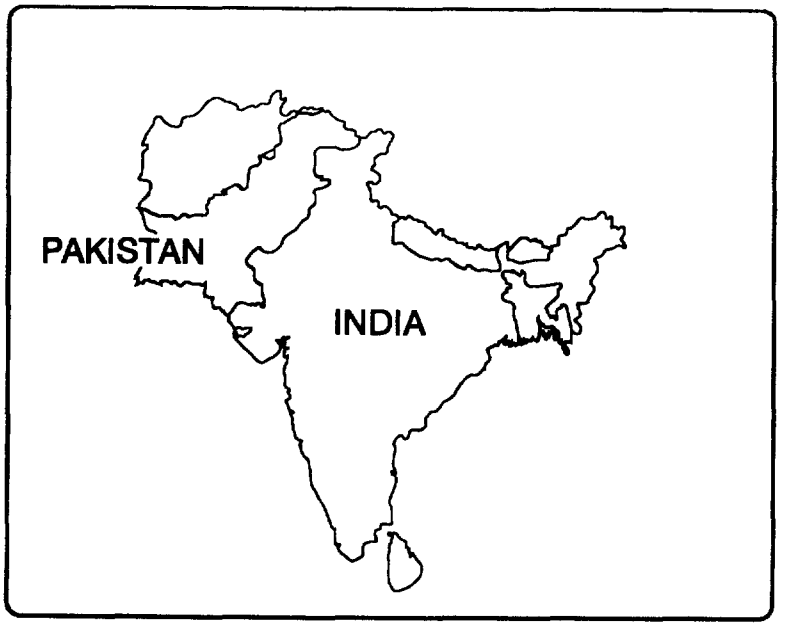
ABL	ACC-Babcock Limited
AEC	Ahamedabad Electric Company
APGC	Andhra Pradesh Gas Power Corporation
BHEL	Bharat Heavy Electricals Limited
BSES	Bombay Suburban Electric Supply Company
CEA	Central Electricity Authority
CESC	Calcutta Electric Supply Corporation
DOP	Department of Power
FIPB	Foreign Investment Promotion Board
GAIL	Gas Authority of India, Ltd.
GIPCL	Gujarat Industrial Power Corporation Limited
GLC	Gas Linkage Committee
GOI	Government of India
GSEB	Gujarat State Electricity Board
IDBI	Industrial Development Bank of India
IPC	Investment Promotion Cell

Acronyms

LIC	Life Insurance Corporation of India
MSEB	Maharahstra State Electricity Board
NHPC	National Hydroelectric Power Corporation
NRI	non-resident Indian
NTPC	National Thermal Power Commission
ONGC	Oil and Natural Gas Commission
PFC	Power Finance Corporation
SEB	State Electricity Board
TEC	Tata Electric Company
TNEB	Tamil Nadu Electricity Board

Pakistan

GOP	Government of Pakistan
HMC	Heavy Machinery Complex
HUBCO	Hub Power Company
KANUP	Karachi Nuclear Utility Plant
KESC	Karachi Electricity Supply Corporation
NDFC	National Development Finance Corporation
PED	Private Energy Division
PMDC	Pakistan Mineral Development Corporation
PPC	Private Power Cell
PSEDF	Private Sector Energy Development Fund
WAPDA	Water and Power Development Authority
WPPO	WAPDA Private Power Organization



Executive Summary

India and Pakistan are experiencing power shortages and unprecedented increases in the demand for electricity. Access to an adequate and reliable supply of electricity has been a constraint to growth in both nations and is a specific concern for industries choosing to locate in the region. Utilities planning expansion programs are generally revising their power requirements estimates upward in each subsequent forecast. Power generation expansion plans for both countries are ambitious: over the next five years, India and Pakistan plan to add more than 30,730 MW of new electric power generation.

New capacity additions in India and Pakistan will create a market for related equipment and services that is estimated to total $22.3 billion between 1992 and 1996. As shown below, although the total market in India is almost four times the size of the Pakistani power generation market, the amount of business likely to be captured by imports is roughly the same in each country ($4.4 billion). This is so because of the vastly different levels of domestic production capability in each country.

U.S. companies entering into or expanding in the Indian and Pakistani markets are likely to face heavy competition from traditional and new competitors, some market entry barriers, and many financial challenges. Over the time period discussed in this report, the United States is expected to capture up to 25 percent of the market for imported equipment in India, or $1.1 billion, not including licensing fees and profits which may be remitted back to the United States by U.S. licensors and joint venture owners. In Pakistan, U.S. companies will face heavy competition from new market entrants from China and existing market

players in Europe. It is estimated that U.S. companies will capture 10 percent of the market, or $437 million.

Market for Power Generation Equipment and Services, 1992-1996

	India	Pakistan
Planned Capacity Additions (MW)	24,266	6,465
Planned Capacity Additions ($ million)	17,694	4,604
Share of Domestic Production (% of total)	75%	5%
Domestic Production ($ million)*	13,270	230
Imported Equipment ($ million)	4,424	4,374
Imports from United States ($ million)	1,106	437

* includes production under foreign licenses and joint ventures.

Private Power Market Developments

The most significant change in the market for power generation comes from the introduction of private power. Private power offers U.S. companies new business opportunities in the development, construction, ownership and operation of new and, in some cases, existing power generation facilities.

The lack of government financial resources to bring on as much power generation capacity as is needed seems to be the driving force behind each government's commitment to private power. In 1986 Pakistan was one of the first developing countries to establish a legal framework and offer investment incentives for private power. By the end of 1998, Pakistan hopes to have added almost 4,000 MW of private power, representing about 30 percent of its new capacity additions. India's 1991 decision to change its laws and solicit private power projects is more recent and relatively more modest. By the end of the decade, India expects to have added 5,000 MW of private power, or about 10 percent of new capacity additions. Both countries have established dedicated government units to expedite negotiations and approvals.

There still remains a gap between government needs and actual projects developed. It is too early to tell if either country will be able to fully realize its plans for private power participation. Large-scale generation projects with output designed for sale to the electricity grid are likely to continue to encounter lengthy government approval processes and successive rounds of negotiation. Structuring financial packages acceptable to international

lenders can also take a long time when dealing with soverign guarantees, fuel reliability, currency and other issues. Project development costs can be quite high. Nonetheless, it is expected that several private power deals will be concluded over the next several years in India and Pakistan. U.S. developers could emerge as major players in each country.

The private development and ownership of power generation facilities could also change the dynamics of the suppliers' market for power generation equipment. For example, India has eliminated import tariffs on power generation equipment for private power projects. This opens up new opportunities to equipment suppliers for direct export sales as well as providing increased competition to existing domestic licensees. In Pakistan, the government is considering the privatization of its utility system; new ownership could change traditional equipment procurement patterns.

Utility Power Market Developments

Large conventional markets for power generation equipment still exist in both countries. This means that multilateral development bank lending (e.g., World Bank/IFC and Asian Development Bank) and bilateral aid will continue. Unfortunately, this is a market that has not favored U.S. exporters.

In India, as previously noted, domestically-manufactured products have a considerable price edge over imported goods, as well as market protection from high tariffs, especially for federal and state projects. U.S. companies can enter this market through licensing and joint venture arrangements. Companies such as General Electric have been able to capture market share through licensing with government-owned industries. This is a strategy that still holds substantial potential for the assembly and manufacture of key components, especially in the combustion turbines, combined cycle technology, and hydroelectric equipment market segments.

Unlike several European countries and Japan, the United Sates provides no foreign assistance for power generation projects in India. Equipment suppliers such as Siemens have won sales by linking their equipment to their country's foreign assistance and export credit programs.

In Pakistan, U.S. suppliers face no significant domestic competition. Competition comes from European and Japanese suppliers who appear to have access to better supplier credits and bilateral aid programs. In addition, Chinese suppliers have also recently entered this market. From time to time, the United States has been a successful a player in this game. In the 1980s U.S. foreign assistance was used for power generation. Currently, the U.S. ExIm Bank has an available line of credit with the Ministry of Finance for power projects. For the most part, however, the U.S. market share in the conventional power market in Pakistan has been only about 10 percent. As mentioned above, private power and

privatization present two strategies for increasing U.S. market share. Licensing and direct investment in domestic manufacturing represent another, perhaps less attractive, strategy.

Fuel Supply Considerations

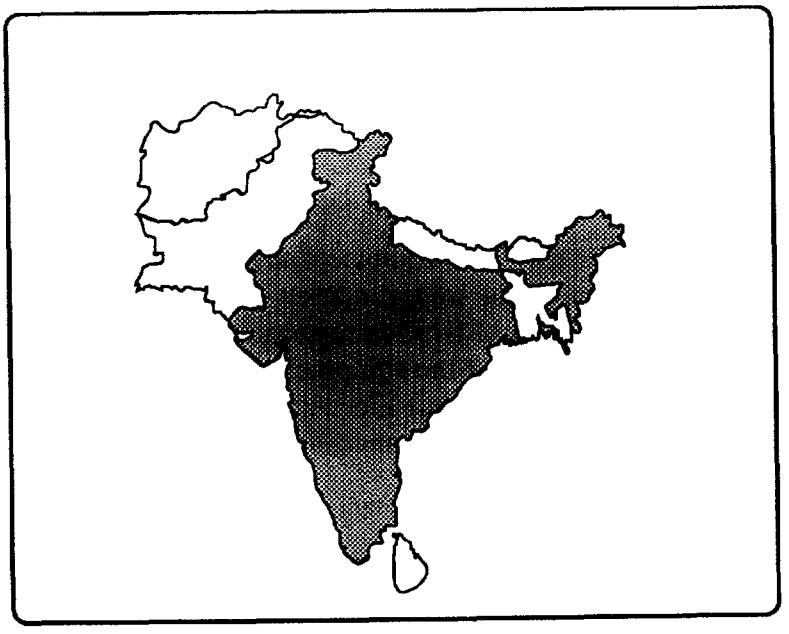
In both markets, fuel supply considerations are critical for project development. Both countries have state-owned oil, gas and coal industries that also face shortages of investment capital. Further, the fuel supply infrastructure -- pipelines, railways and storage -- are capacity constrained. As a result, new electric power project development must parallel growth in the energy supply sector.

Natural gas is a fuel of choice in both countries' power sector fuel mix: gas production grew six-fold in India and more than doubled in Pakistan during the 1981-1991 period. The power sector has shown a preference for natural gas-fired (and oil during the initial phase) combined cycle plants as a fast, clean, modular and relatively cheaper way to meet growing electricity demand. Other fuel possibilities include coal in India, oil in Pakistan, and renewable feedstocks in both countries, but rising costs, environmental concerns and development costs will dampen growth. Imports of fuel for private power projects is a sensitive issue as both markets are foreign exchange scarce.

Environmental Concerns

Electricity planners in India and Pakistan are increasingly faced with the problem of meeting electricity demand in both an economically viable and environmentally acceptable manner. The power sector can be a significant source of harmful emissions. The land use consequences of siting hydro power plants in environmentally or culturally significant areas has already raised concerns within both countries and among the multilateral development bank and bilateral donor community.

Power sector emissions are directly related to the generation mix and fuel characteristics, particularly the use and quality of coal and oil. Electric utilities' share of total coal-fired capacity is over 50 percent in India but significantly less in the Pakistani power sector. Indian coal is generally high in ash but relatively low in sulfur content. For example, the World Bank is cognizant of the environmental impacts from power projects and now requires filters and flue gas desulfurization or its equivalent on all of the fossil-fired projects that it finances.



India

India's recent willingness to liberalize trade and open its economy to foreign investment has been spurred, in part, by its growing deficit and trade imbalances. During the 1980s, India's industrial sector expanded at over 7.3 percent annually, and more than 35,600 MW of new electric power generating capacity were brought on line. Since 1990, however, the economy has not performed nearly as well, and power generating capacity additions have declined significantly. By the year 2000, the Ministry of Power plans (perhaps optimistically) to add more than 57,000 MW of electric capacity to meet the country's current and projected power requirements.

Over 95 percent of India's commercial electric capacity is owned by state and federal entities; private utilities own approximately 5 percent (however, self-generators account for an additional 9 percent of installed capacity). In 1991, the government, acutely aware that many of the country's utilities were unable to finance new power generation facilities, initiated radical changes in the Electricity Supply Act and other statutes to allow foreign development and ownership of power generation assets. Such reforms are expected to attract some of the much needed foreign capital and management skills to the power sector.

These reforms are also likely to contribute to a power generation equipment and services market estimated at nearly US $17.7 billion through 1996. As a result of lower tariffs on electric power generation equipment and overall growth in the power generation market, approximately one-fourth of the total market, or $4.4 billion, will be in imported equipment.

India

Based on their historical market position in India, U.S. equipment suppliers are in a good position to realize an estimated 25 percent share of the import market ($1,100 million) through electric power equipment and service sales. Should U.S. companies succeed in developing private power projects in India, the U.S. share of the equipment and services market could increase. Several U.S. companies, such as General Electric, will remain market leaders through direct sales from the United States as well as by continuing or bringing on new licensing arrangements.

Massive resources will be required to power India into the next century. However, the government cannot mobilize all the necessary resources, state governments and utilities are almost all heavily in debt, and available multilateral/bilateral financing will not be sufficient for this task. The government is thus trying to attract private capital into the power sector.

Power Sector Overview

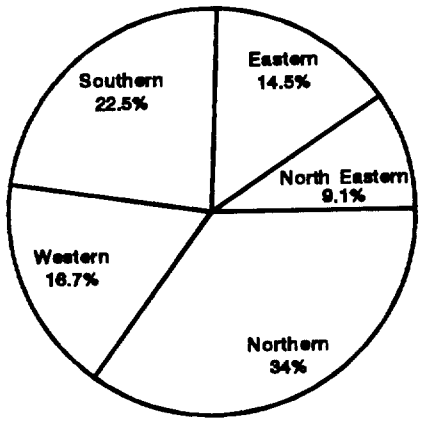
Demand for electricity in India outstrips supply, and the electric power supply shortfall is growing. India's electricity consumption increased at an average annual rate of 9.4 percent between 1986 and 1991 and is expected to grow 8.4 percent per year between 1992 and 1997. Although the country's annual power generation growth rate has historically remained around 10.3 percent (between 1950 and 1992), this level will not be enough to meet India's future demand for electricity. The Central Electricity Authority estimates that peak demand will reach 91,191 MW by 2000, 127,400 MW by 2005, and 172,260 MW by 2010. The government predicts energy shortages of 6.2 percent and peak demand shortages of 20.1 percent by the end of 1995.

India's electric power system has more than doubled in capacity over the past ten years (to an estimated installed capacity of 69,132 MW as of March 1992); nevertheless, electricity supply shortfalls are commonplace as a result of inadequate electric power capacity during peak times, low load factors, poorly maintained equipment, dispatch problems and other reasons. Plant load factors have been historically low, although modest progress has been made in recent years with power sector efficiency programs. The system-wide average thermal plant load factor increased from 44.2 percent in 1981 to 56.5 in 1991.

The Government of India (GOI) plans to help meet these shortfalls by adding almost 69,000 MW of new electric generation capacity over the next ten years, doubling the current size of the electric power generation system. An estimated $85 billion will be required for these additions.

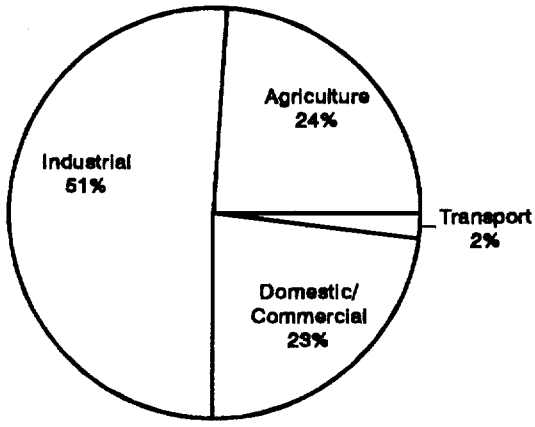
Public and private utilities account for the largest share of India's total installed electric capacity. In 1991-1992 they provided about 89 percent of the nation's electricity, with industry providing the remaining 11 percent in captive electric power generation. Industry's share is growing quickly as industries are forced to fend for themselves in India's unpredictable power supply market. This sector's need for power is reflected in its dominant share of end-use consumption. This share would be even larger if the government did not subsidize power provided to the agricultural sector.

Peak Power Shortages in India by Region



Source: "Power in Asia," *Financial Times Newsletter*, 1992.

Electricity End-Use Consumption in India, 1991-1992: Share of Total Generation



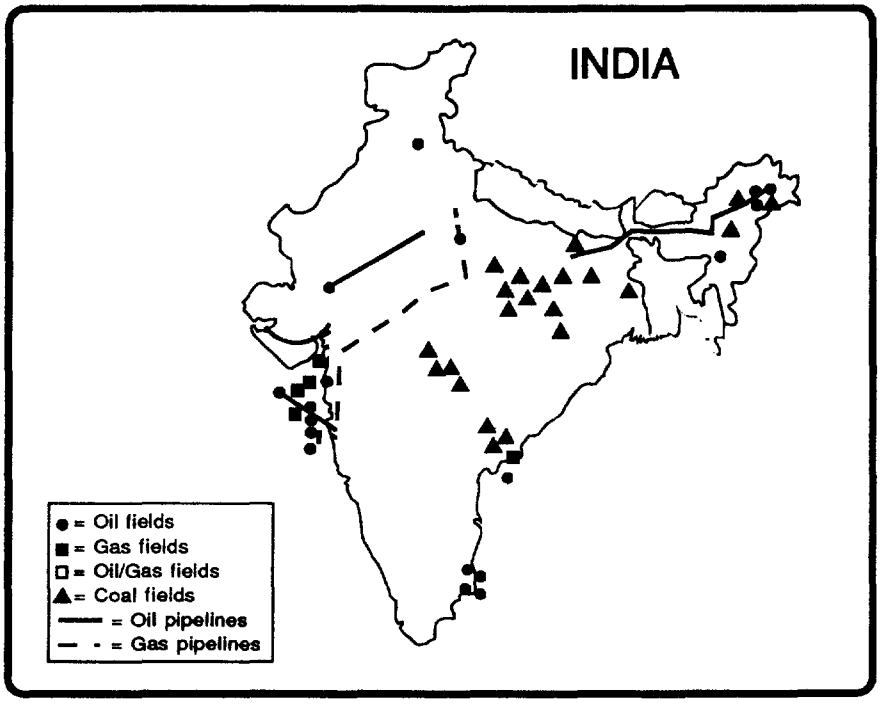
Source: CEA, *19th Annual Survey of Electricity,*

Resources

Most of India's electric power generation capacity is fossil-fuel based. Thermal generation, including coal, gas, and oil, accounts for 69.3 percent of total generation capacity (47,908 MW); hydropower provides 27.8 percent (19,219 MW); and nuclear power provides 2.9 percent (2,005 MW).

Because natural gas-fired projects are relatively economical, clean, have a short

gestation period, and offer easier fuel contracts than coal, India is moving towards using its natural gas resources. Hydropower's share of the power generation capacity shrunk from a high of 46 percent of grid-connected capacity in 1965 to today's 27.8 percent. This share is expected to fall even lower as environmental issues and local opposition to plant siting diminish GOI and multilateral development bank (MDB) commitments to hydropower. Nuclear power's share of generation capacity also is predicted to fall as investment slows.[1] India no longer receives technical and financial support from abroad to build nuclear plants, and the costs of constructing new plants and extracting thorium from existing sites are escalating rapidly.



[1] The potential developments in the market for nuclear power plants, equipment and services are not considered in this report because India is not yet a signatory to the 1968 Nuclear Non-Proliferation of Weapons Treaty (the U.S., former U.S.S.R. and Great Britain are the major signers). This treaty limits the spread of nuclear technology by agreement not to assist non-nuclear nations in obtaining or making nuclear weapons. However, the U.S. and Canada have provided equipment and technical know-how for India's nuclear power industry in the past.

Coal is India's predominant non-renewable energy resource. Recoverable reserves at the end of 1991 were on the order of 62.5 billion metric tons including anthracite/bituminous (97 percent) and lignite/sub-bituminous (3 percent). In that year the country produced 184.9 million metric tons of hard coal and 8.5 million metric tons of lignite/brown coal.[2] Although coal production increased annually by 6 percent under the Seventh Five-Year Plan (FY 1986-1990), the rate of new coal production is expected to remain fairly constant. Future coal production will require large investments in capital equipment.

Indian coal has a high ash content but a low sulfur content. Utility engineers and managers complain that domestic coal is expensive because its high ash content makes it less efficient than low-ash coal and ash disposal costs are more expensive. Despite the inefficiency and undercapitalization of Indian mines, coal output has managed to keep pace with increasing demand, although distribution has often proved a problem. Demand for coal in all sectors is growing, however. Coal output in India grew 27 percent between 1983 and 1990, while in the power sector alone coal-fired capacity expanded by over 75 percent. The power sector will likely consume about 63 percent of all coal mined during FY 1992, and its demand is increasing at a rate of 15 percent per year. India will need to begin importing coal to meet gross demand in the late 1990s.

India's proven oil reserves are small in relation to demand, which was on the order of 6.1 billion barrels at the end of 1991. Domestic production soared from 190,000 barrels per day to 645,000 between 1980 and 1991; nevertheless, oil remains the country's largest single import -- occasionally accounting for a quarter of the country's import expenditures. India imported an estimated 215.9 million barrels of crude oil and petroleum products between 1990 and 1991 at a cost of $3.8 billion in foreign exchange.

However, India's oil production is highly concentrated in the Bombay High wells, which are being overexploited while major areas of the country remain unexplored. This scenario is likely to change as India prepares to furnish oil and gas concessions to international oil companies.

Natural gas is becoming an increasingly important fuel in India, whose proven reserves are estimated at 25.8 trillion cubic feet (tcf). India's gas production in 1991 was on the order of 519 billion cubic feet (bcf) -- up six-fold over 1981 production. Natural gas has emerged as

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[2] *Annual Review of Energy*, British Petroleum Limited, London, England, June 1992. The reserve estimates vary widely according to the source of information. The figures stated here are below current GOI estimates.

an important supplementary source of energy; estimates indicate that 17 percent of available natural gas is used in power generation. The power sector must compete with the fertilizer and petrochemical industries for India's supplies of natural gas.

India's potential for hydropower is estimated at 90,000 MW. The country produced 210,000 GWh of hydroelectricity in 1991, most of it in the northern and northeastern regions. The expansion of hydro plants has slowed because of outstanding siting and environmental issues, however, which have stalled MDB plans for increased lending for hydro plant construction. The Narmada Dam project, for example, faces opposition from local villagers and local and international environmental organizations. The World Bank, which has already lent India $450 million for the project, is currently re-evaluating the project's future and its own policies on lending for projects of this type.

Government Institutions

Both federal and state institutions in India play important roles in the planning and delivery of energy services throughout the country. At the federal level, the Department of Power (DOP) within the Ministry of Energy is the key government unit responsible for the electric power sector. The DOP administers and implements legislation affecting power generation, transmission, and distribution, and formulates national power sector plans and policies. It also approves projects and monitors their progress.

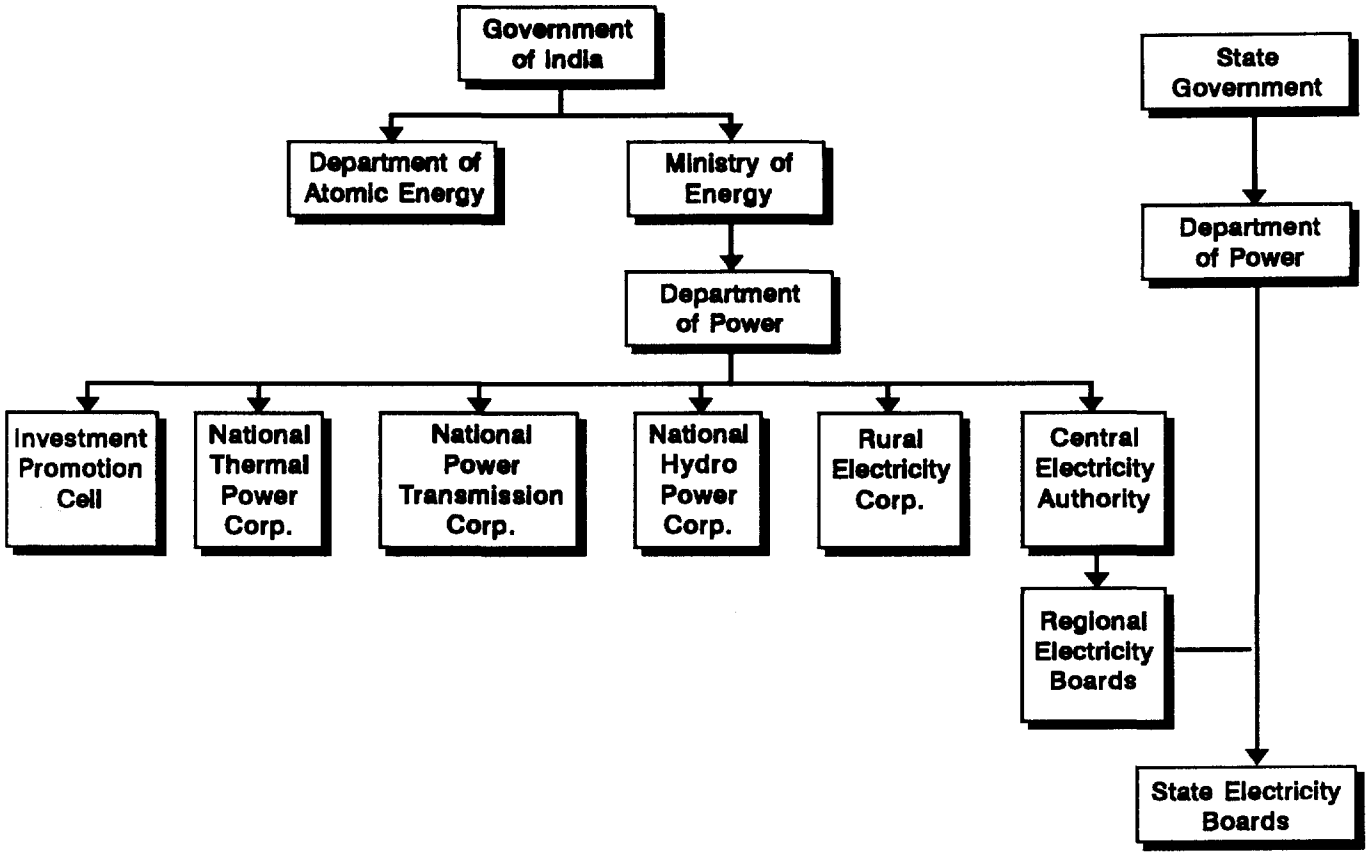
The Central Electricity Authority (CEA) is a federal agency that supports the DOP in national power planning. For example, CEA played a leadership role in the development of the first *National Power Plan*, which was completed in 1983. It also coordinates sectoral development and approves proposed generation, transmission or distribution projects with values of over $10 million.

Two agencies under the DOP are responsible for the construction and operation of generation and transmission projects. The National Thermal Power Corporation (NTPC) and the National Hydroelectric Power Corporation (NHPC) together developed, operate and manage some 25 percent of the country's public electricity supplies. Both agencies provide states with bulk electric power supplies, typically from large-scale power projects.

NTPC and NHPC are in the process of turning national transmission assets over to the National Power Transmission Corporation, which was created in 1989 to develop and operate

a national power grid. By the mid-1990s, it will probably control transmission throughout India.

Organizational Structure of India's Power Sector



State Electricity Boards (SEBs) play a pivotal role in India's power sector. SEBs are responsible for local electric power distribution and tariffs. They buy bulk power from NTPC and NHPC and from the other state-owned electricity generating corporations, which built and now operate 75 percent of India's public power generation capacity. Supposedly autonomous bodies, SEBs actually depend on state approval for decisions affecting investments, tariffs, finance, and personnel administration. Because state legislatures have their own political

agendas (e.g., subsidizing electricity tariffs or boosting employment figures by placing excess personnel in the power sector), SEBs often suffer from poor financial performance and excessive indebtedness. Only five of India's 18 SEBs are exceptions to this rule.

The financial condition of the state utilities has been so poor that the central government established the Power Finance Corporation (PFC) under the Department of Power in 1986 to mobilize resources and help the SEBs. One of PFC's mandates was to spur financial and operational reforms at the state level by making access to additional power sector resources contingent on improvement. PFC disbursements to SEBs and other public generating companies during FY 1990-1991 totalled only $308.6 million. This sum, however, does not provide PFC with significant leverage. The federal government has only limited leverage over the states because they are allocated budgetary resources on the basis of a previously agreed upon standardized formula. Despite this failing, PFC is expected to play an important role in promoting supply efficiency improvements, the rehabilitation and upgrading of generation facilities, transmission and distribution improvements, and environmental impact reduction (such as the installation of electrostatic precipitators).

India's energy resources are managed under the jurisdiction of separate departments within the Ministries of Energy and Natural Resources. The Ministry of Energy's Department of Coal and Department of Non-Conventional Energy Resources are responsible for coal and renewable fuels. Unfortunately, they often fail to work effectively with the Department of Power to create a vertically integrated power sector. Natural gas and petroleum resources fall under the jurisdiction of the Oil and Natural Gas Commission (ONGC) and the Gas Authority of India, Ltd. (GAIL), a natural gas distribution company. Because both bodies are accountable to the Ministry of Natural Resources rather than the Ministry of Energy, these fuels have not been aggressively exploited or marketed to the power sector in India.

Private Institutions

The private sector (private utilities and, recently, private power developers) plays a small but increasingly important role in power generation and distribution in India. As illustrated later in this assessment, the GOI is designing new institutions to facilitate private participation in power generation.

India has a long tradition of private utility participation in the power sector. Five private generation utilities, which were founded at the country's independence, retained their operating licenses long after SEBs took over most of the private utilities in India. The states

regulate these utilities, but have not attempted to interfere too greatly with their modes of operation. These utilities, shown below, are concentrated in Bombay City, Calcutta City, and Gujarat state. In addition, there are numerous industrial generators and 55 distribution licensees made up of 35 cooperatives, 11 municipalities, and 9 private companies.

Private and Industrial Electric Utilities in India ($ millions)

Private Utility	Installed Capacity, MW	Construction Program	1991 Sales	1991 Profit
Tata Electric Company (TEC)*	1,606	330 MW	223	17
Calcutta Electric Supply Corporation (CESC)	615	500 MW	187	8
Ahmedabad Electric Co. (AEC)	509	66 MW	97	3.2
Surat Electric Company	33	na	34	3.6
Bombay Suburban Electric Supply Ltd. (BSES)	distribution utility	500 MW	148	13
Industrial Generators				
Gujarat Industrial Power Corporation Ltd. (GIPCL)	66	111 MW	na	na
Andhra Pradesh Gas Power Corporation (APGC)	66	33 MW	na	na

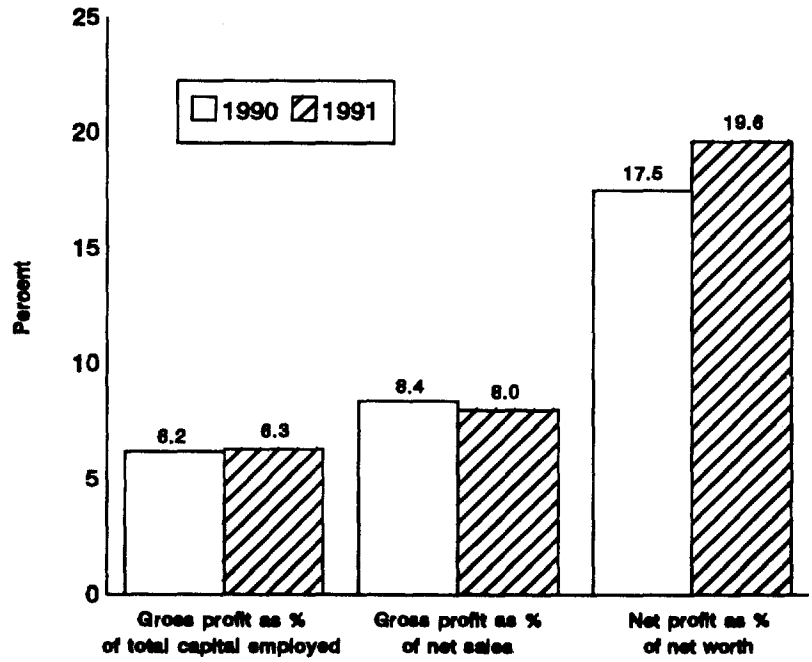
* TEC consists of three companies: Andhra Valley Corporation, Tata Power Co. and Tata Hydro Electric Company. na = not available.

Source: "Company Reports," *Economic Times*, Government of India, Department of Power, 1992.

Although these utility companies comprise less than 5 percent of grid-connected power capacity, they are an extremely important part of India's power sector. Because they are models of highly-efficient utility management and are located in important urban centers, they attract a

significant share of MDB financing. The exhibit on the next page shows some of these organizations' profitability.

Profitability Ratios for Nine Indian Private Power Companies



Source: Company Reports, September 1992.

The industrial sector is becoming a more important player in India's power markets. Industries are increasingly turning to captive power generation in the form of cogeneration or private mini-utility arrangements to secure their power needs. This is particularly true of firms located in areas that experience severe power shortages. In 1992, industrial generators were responsible for an estimated 6,250 MW (9 percent of total electric capacity) of captive power generation in the country.

The GOI is committed to mobilizing additional resources to help bridge the gap in supply by encouraging greater private enterprise investment in the electricity sector. Private

power developers are gaining entrance to several different market niches. These niches include baseload power plant construction, operation and transfer, and small plant development for specific industrial loads. Interested developers range from the largest equipment suppliers in the world (such as General Electric and Siemens) to new non-resident Indian (NRI) led firms. India's own private electric utilities are also beginning to explore power plant development opportunities outside their service territories. Last, previously distribution-only companies such as Bombay Suburban are now planning to construct their own capacity.

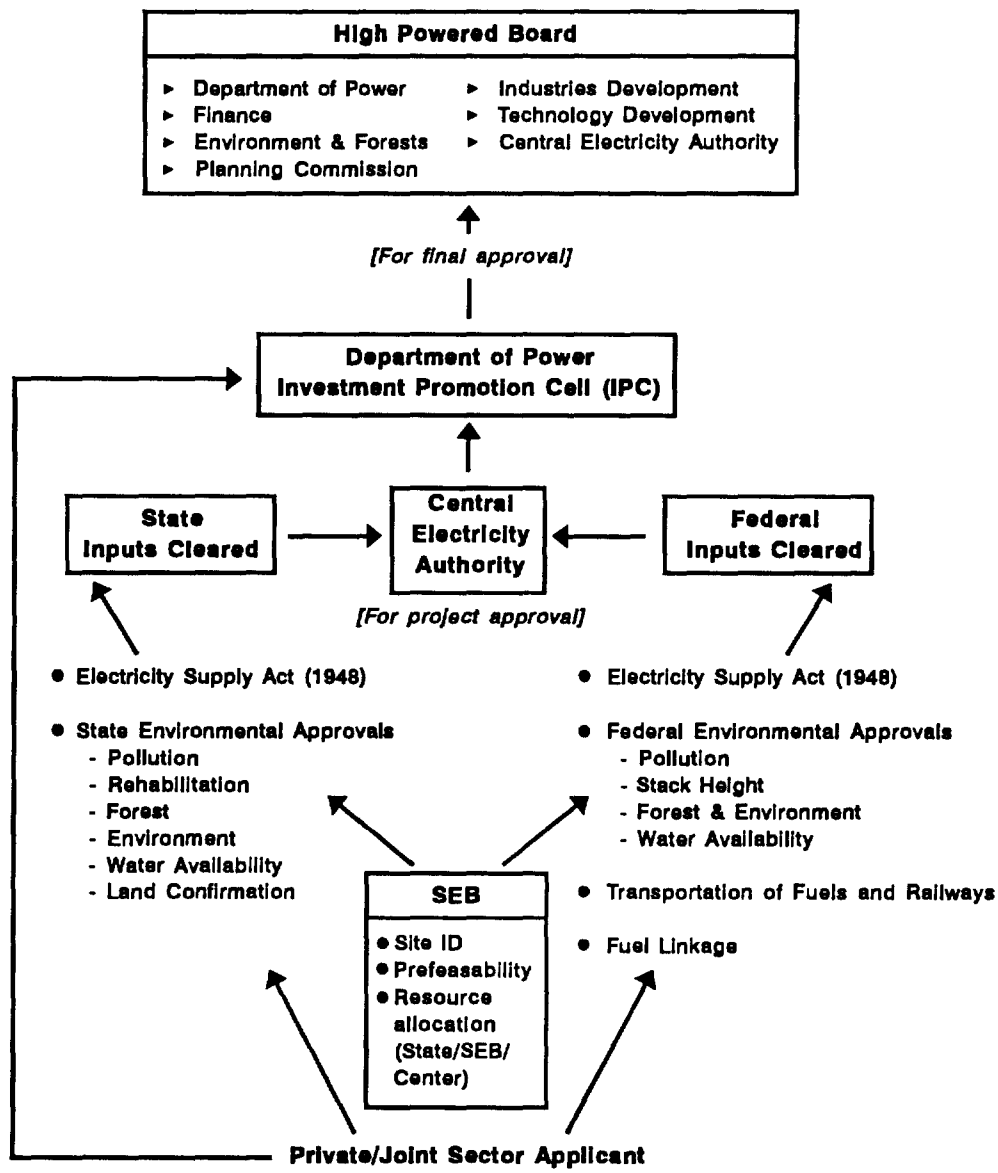
To expedite the independent power project approval process, the GOI established the High Powered Board under the chairmanship of the Cabinet Secretary (Chief of Staff). This board comprises heads of major ministries concerned with the power sector and has been established to resolve all outstanding issues pertaining to project approvals. The Board presides over the Investment Promotion Cell (IPC), which falls under the jurisdiction of the Department of Power and is designed to become the focal point for private power development in the country. IPC is a central source of information, orientation, and assistance. It provides project-specific information and can walk a potential developer through the steps required for project approval.

Framework for Private Participation in Power Generation

India's Electricity Supply Act governs power generation, transmission, and distribution. The present legal framework provides for three major categories of utilities: SEBs, licensee companies, and generating companies. SEBs usually generate and distribute electricity within a state. Licensees can generate, supply, and distribute power from their own stations or other sources to any specified area within the state. The federal and state governments own and promote generating companies, which generate power for the grid but do not retail and distribute that power. State governments also are authorized to permit non-licensees to supply electricity to the public.

The recent reform of the Electricity Supply Act encourages new participants to enter the power generation market in the form of private licensees and privately owned generating companies. These changes are very recent, however, and significant details must be worked out before any private power projects move into the construction phase. At present, a USAID-sponsored team of experts is working with the GOI to develop an institutional framework that allows for the proper screening and evaluation of private power proposals.

Approval Process for Private Power Project Authorization



Source: Ministry of POwer & Non-Conventional Energy Sources, Department of Power, New Delhi, March 1992.

New Rules for Private Investment in the Indian Power Sector

In 1991, the GOI announced a number of new rules opening the country to private power developers, both foreign and national.

- ☐ July: The Industrial Policy Resolution was modified, removing the power sector from the list of activities reserved for the public sector.
- ☐ September: The Electricity Supply Act of 1948 was amended, lifting many regulatory disincentives to private investors and providing for 100 percent private ownership (foreign or national) of power plants, 30-year licensing arrangements with 20-year renewals, and more attractive returns. Private generating companies and captive plants are allowed to sell to SEBs.
- ☐ October: The High Powered Board is established, chaired by the Cabinet Secretary, to promote private power and expedite project approvals.
- ☐ The government has also indicated that private power developers may import power generation equipment tariff-free.

Some specific changes of interest include provisions that raise the permissible debt/equity ratio of private power firms to 4:1; these firms can raise 20 percent of the total outlay through local public issues; the developer should contribute at least 11 percent in equity; no more than 40 percent of the total investment can come from the Indian Government; and 60 percent of the resources must come from outside the GOI, including equity. The government has developed a framework for a two-part tariff for power purchase agreements. The first part covers fixed costs based on standard performance. The second part ensures that variable expenses will be met based on units of electricity actually supplied, rewarding plant performance above the standard.

Incentives for new licensees include an increase in the rate of return to 5 percent over the central bank lending rate (currently at around 6 percent) for all new investments in power

generation,[3] capitalization of interest during plant construction at the actual cost (rather than a previously stipulated rate of 1 percent over the Reserve Bank of India's lending rate) for all construction activity, and extension of the initial licensee period to 20 years with subsequent extensions of 20 years to guarantee business stability.

Other amendments permit privately owned generating companies to sell power to SEBs for a specified time. These power sales would be regulated through a two-part tariff; the first part ensures the recovery of fixed costs[4] on a normative basis and the second part meets the variable portion of actual expenses. Foreign investors may repatriate 100 percent of their profits.

Further, both private licensees and proposed generating companies are now permitted a debt equity ratio of 4:1. Further, to ensure that the capital inflow contributes towards capital additionality in the power sector, no less than 60 percent of the capital requirement will be funded from sources other than state-owned financial institutions.[5] At a minimum, the development company must contribute 20 percent of the project's total cost in equity (at least 11 percent of which must belong to the promoter). Also, public financial institutions can provide no more than 40 percent of the remaining amount.

The developers' response to these new policies has been strong, and memoranda of understanding have been issued on projects totalling close to 10,000 MW. However, both developers and private utility companies have been cautious about the requirement to raise 60 percent of the total financing from private financial institutions. The questions surrounding the availability of sovereign guarantees are a larger concern, especially regarding the ability to attract private financing. Investors and bankers are also wary of the poor financial conditions of most SEBs and the institutional and political barriers to tariff adjustments. Mechanisms such as escrow accounts and revolving letters of credit would be required, but still may not be sufficient. Other issues, such as the quality and reliability of fuel supplies, as well as access to imported fuels, have been raised.

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[3] The "standard rate of return" is set by the 6th Schedule to the Electricity Supply Act and refers to the allowable rate of return of 2 percent over the Reserve Bank of India's lending rate.

[4] The fixed charge would include interest on loan capital, depreciation, O&M expenses, taxes on income (if any), return on the equity component, and interest on working capital. The variable charges would consist of fuel costs and variable operating costs.

[5] These institutions include state-owned banks, the Life Insurance Corporation of India (LIC), and the Industrial Development Bank of India (IDBI).

The reform in the Electricity Supply Act is a promising step towards injecting both foreign and domestic private capital in the power sector. Observers concur that this first round of reforms in the legislation is brief and broad, and that many other significant issues and reforms need to be worked out on a case-by-case basis. The IPC confirms that these were designed to allow the Cell to gain first-hand implementation and negotiation experience so as to refine the second round of legislation.

Current Situation

The GOI is currently focusing on four issues that it hopes will improve the current power situation. These are:

- ☐ implementing rapid electric capacity additions
- ☐ increasing private sector participation
- ☐ activating renovation and modernization programs for existing power stations
- ☐ designing large-scale energy conservation programs.

India's electric power expansion plans are critically underfunded. Federal and state government financial outlays are not sufficient to meet the requirements of building nearly 69,000 MW of new capacity by 2002. According to India's Eighth Five-Year Plan (1992-1996), most of the investment required to expand the power system will come from the public sector. The Plan expects that 84 percent of the total $34 billion will be financed by government sources (bolstered by multilateral and bilateral capital flows). This represents a public investment of $28.6 billion to install 23,308 MW of new capacity over the plan period. The private sector should finance the remainder -- about 16 percent or nearly $5.4 billion for an additional 5,000 MW in electric power capacity.

The public sector is increasingly investing in the neglected transmission and distribution (T&D) system and in the large existing stock of plants requiring rehabilitation. T&D has lagged far behind capacity additions, which received a disproportionate share of the investment devoted to the power sector. During 1985-1990, the government spent approximately $500 million on T&D, whereas generation absorbed $1.4 billion. In the area of rehabilitation, the first phase of India's program, which began in September 1984, targeted 34 thermal power stations at an aggregate cost of approximately $437 million. The second rehabilitation phase, due for completion during the Eighth Plan (1992-1996), will cover an additional 46 thermal power stations at a cost of $474.3 million (which includes $24.3 million

in World Bank assistance). Sixty-six hydropower stations also need to be renovated and modernized at an expected cost of almost $418 million.

As previously mentioned, the private sector is also expected to contribute to power sector development -- indeed, its preliminary response has exceeded GOI expectations. Following the September 1991 announcement of its new rules and amendments to the Electricity Supply Act, the GOI received proposals to develop 8,163 MW of capacity at an estimated cost of $7.2 billion. Private firms can also participate as utility licensees under new, more favorable terms, and India now permits some "cherry picking" -- pulling prime customers off the government-owned grid and onto a private mini-grid or as clients for captive power schemes.

The GOI has relaxed India's traditionally heavy restrictions on equipment imports to encourage the use of advanced power systems. Up to 55 percent of total power equipment requirements for a private project can now come from abroad, with up to 65 percent duty free for gas turbine projects. Combined cycle gas turbines are especially favored because they are clean, modular, fuel efficient, economical,and can use domestic fuel resources.

Despite government encouragement, numerous obstacles and risks remain for private power developers in India. Two of these, payment guarantee risks and fuel supply uncertainties, are discussed in the following sections.

Payment Guarantee Risks

Doing business with India's State Electricity Boards will not be easy. Only 5 of 18 SEBs turned a profit in 1990-1991 (Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, and Karnataka), and their cumulative losses during the course of the Seventh Five-Year Plan totalled $7 billion.

Subsidized power tariffs, especially for agriculture, are the major problem. Low thermal plant load factors, poor plant site selection, high transmission and distribution losses (caused both by technical problems and theft), unbalanced investment (investment is skewed in favor of new generation capacity at the expense of O&M, transmission, distribution and rehabilitation), inefficient bill collection, heavy interest payments, and federal preference for rural electrification schemes (in the states of Uttar Pradesh, Bihar, and Orissa) are also major problems contributing to the financial difficulties of SEBs.

Negotiating acceptable power purchase prices and ensuring compensation will be challenging in most states. The historic role of state governments in setting SEB tariffs at socially attractive levels perpetuates the bleak financial situation. One indicator of the extent of damage done by this practice is illustrated by SEBs: once they are authorized to raise tariffs (even by a modest 20 percent), their financial performance can improve markedly.

Progressiveness of Eighteen Indian SEBs

		Progressive		
Region	State Electricity Board	Most	Moderately	Less
Northern	Haryana			X
	Himachal Pradesh			X
	Jammu and Kashmir			X
	Punjab		X	
	Rajasthan		X	
	Uttar Pradesh			X
Western	Gujarat Electricity Board	X		
	Madhya Pradesh		X	
	Maharashtra	X		
Southern	Andhra Pradesh	X		
	Karnataka	X		
	Kerala			X
	Tamil Nadu Electricity Board	X		
Eastern	Bihar			X
	Orissa		X	
	West Bengal		X	
North Eastern	Assam			X
	Meghalaya			X

Source: Based on in-country interviews, September 1992.

Furthermore, not all Indian SEBs are enthusiastic about reform or private power generation in their service territories and are especially wary of "cherry picking," as would any U.S. utility. The table above shows those SEBs that are the most comfortable with private power (all of which are financially stable) and those that are less enthusiastic.
States that do not look favorably on private power do, however, become more open to the concept as they become more financially strained, and as they see the successes achieved by the SEBs that are actively encouraging the development of private power.

There are bright spots on the horizon in dealing with SEBs. The federal government recently developed a plan whereby at least 80 percent of the nearly $750 million in SEB debts to other government companies will be paid back.[6] Under this plan, the SEBs will be forced to settle arrears in installments against Eighth Plan proposed federal outlays. The successful implementation of this effort is vital to India's gaining control of its power sector, and will help the government to build credibility within the sector and improve its chances for foreign private and multilateral development bank participation in the power sector.

Uncertain Fuel Supplies

Developers face fuel supply risks in India. Coal demand in the power sector may soon outstrip production, supplies of natural gas are relatively inexpensive but not readily available, and hydropower is subject to variances in India's climate, irrigation priorities, and more recently, rising environmental concerns.

Coal. Coal mines and transport facilities are state-run operations that often experience strikes by government unions. Ensuring reliable coal deliveries is difficult, particularly for power plants as large as those being proposed in India. A standard 1,000 MW coal-fired power station burns about 1,000 metric tons of coal hourly. Because India's freight cars carry about 22 metric tons of coal each, a 1,000 MW plant will require 45 wagons of coal per hour -- about 20 trains a day.

Managers at several Indian utilities often complain of coal supply shortages despite sufficient pithead stocks. The Madhya Pradesh Electricity Board, for example, claims to have lost over 2.3 billion kWh of power during FY 1989/91 (the equivalent of almost 9 percent of

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[6] The largest of these arrears are to the following institutions: NTPC is owed close to $340 million, Damodar Valley Corp. $168 million, NHPC $52 million, and the PFC almost $17.2 million.

sales over two years) alone due to erratic coal supply. Even federal government-sponsored power plants have suffered shortfalls due to coal and lignite supply instability.

Private developers have been pressing for better, more reliable coal transport. Union activities at some mines have sometimes turned violent, leaving power stations in southern India (particularly in Tamil Nadu) without fuel for weeks. The federal government is now trying to better integrate the coal industry with railways and power stations to improve the efficiency and availability of coal supplies, but some groups see coal imports as the more reliable and possibly cheaper alternative.

Federal and state governments have tried to solve the transportation problem by locating coal-fired power plants at the coal mines themselves. The GOI is now trying to persuade private power developers and utilities to buy mines and build projects at the mine mouth. While several domestic private utilities are complying, foreign private power developers are less enthusiastic about entering the coal mining business. This solution also does not solve the problem of obtaining coal in non-coal producing states.

Importing coal, especially for new private power projects, is becoming more appealing not only because of the supply problem but also because imported coal is cheaper and better in quality. The regional price for imported coal is around $50 per metric ton delivered. The GOI levies a 30 percent import duty that raises the price to $65. Imported coal delivers about 6,000 kcal per kg of useful energy, or approximately 60 percent that of petroleum, which costs about $200 per metric ton. For the first time, the government is now evaluating the possibility of allowing coal imports as part of private power development. Many observers believe that as the Indian Rupee becomes fully convertible over the next few years, coal imports will surge.

Natural Gas. Using natural gas as a fuel for the power sector is a new phenomenon in India, with production having grown from 85 to 519 bcf in ten years. It is the cheapest fuel on the market (at around $67 per metric ton), and the fertilizer and petrochemicals industries are demanding increasing amounts of natural gas. Although the GOI is expanding production, shortages persist. The natural gas pipeline that connects Gujarat and Arabian Sea offshore gas fields to the power plant and fertilizer demand centers across the western and northern region is fully utilized, and a newly built natural gas-fired combined cycle power plant supplied by Asea Brown Boveri at Kawas Station is already experiencing some gas supply shortages.

At present, the GOI will supply gas only for baseload electric power plants. GAIL announced last summer that it will not be able to supply the 3.5 MMcmd of gas required to fire the 800 MW combined cycle Bawana plant near New Delhi, a plant that had been proposed as a peak-load unit by the local private utility.

The inter-ministerial Gas Linkage Committee (GLC), which was specifically set up to allocate gas among competing demand sectors, is under pressure to increase supply to the fertilizer and chemical industries. The GOI recently scaled down its estimates of 1993-1995 production levels by about 18 percent, to around 80 MMcmd. The power sector currently absorbs about 45 percent of available gas supplies, but new gas-based projects in the Eighth Plan have projected requirements of almost 240 MMcmd[7] of natural gas supplies.

The Oil and Natural Gas Commission is now under pressure from the World Bank and the ADB to undergo institutional, financial, and operational reform. The organization is currently implementing a gas-flare reduction project and is increasing its efforts to develop gas fields in order to bring proven reserves in the Western Region on-line as soon as possible. These developments are encouraging, but gas shortages are likely to persist unless new fields are located.

External Assistance to the Power Sector

International donor agencies, both multilateral and bilateral, play a vital role in India's power sector. Funding from all major sources between FY 1982 and FY 1991 amounted to nearly $7.5 billion.

The U.S. provides limited bilateral assistance to the Indian power sector. Japan, Germany, Britain and Canada all have completed or are developing tied-aid power projects in India.

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[7] Encouraged by a positive experience with projects totalling 2,500 MW of natural gas-fired capacity during the last seven years, NTPC has proposed a further 2,140 MW in existing plant expansions and 4,230 MW in new gas-based electric power projects. If realized by 1996, these would contribute over 6,000 MW in new capacity to the Eighth Plan.

Multilateral Development Bank Assistance to India for the Power Sector - FY 1982-1991
($ million)

Source	1982-83	1984-85	1986-87	1988-89	1990-91	Total 1982-91
IBRD	1,005	1,300	1,242	2,285	775	6,589
ADB	--	--	150	160	540	850
OPEC Fund	50	--	--	--	--	50
Total MDB	1,055	1,300	1,374	2,445	1,315	7,489

Source: The World Bank Group Annual Reports, Asian Development Bank, OPEC Saudi Arabia.

The World Bank. The Bank invests more in India than any other donor agency. Between April 1950 and November 1991, it committed 32 power sector loans totalling approximately $6.6 billion. It also furnished 18 international development assistance (IDA) credits worth $2.3 billion. This amounts to $8.7 billion, or 30 percent of total World Bank lending. These power sector loans have generally been used to develop large-scale hydropower, coal, and natural gas-fired power plants, to promote the formation of a national transmission grid, and to accelerate the development of a domestic power equipment and engineering capability (in both the public and private sectors). Many of these loans have been made directly to NTPC (nearly $4 billion or 45 percent of all power sector lending).

At present, the World Bank is making an effort to use its financial leverage in India to promote power sector institutional and tariff reform. The Bank is concerned with the poor financial performance of the SEBs and such chronic inefficiencies as transmission line losses, low load factors, and imbalanced resource allocation between generation, distribution, and rehabilitation segments. Beginning in 1990, the Bank began to shift resources away from government-owned utilities toward India's more efficient and financially sound private utilities. The TATA Electric Companies (TEC) received a loan for $98 million in 1990 and BSES $200 million in 1991 to build power generation projects.

The World Bank is also investing directly in power sector management. To improve the performance of SEBs, the Bank approved a power sector efficiency loan ($265 million) in

1992. It required that funds could be loaned only to those SEBs that developed credible plans to achieve financial solvency. The loans include various components, including one designed to improve SEB billing and collection.

The World Bank may cease lending to large Indian hydropower projects because of criticism both inside and outside India for its involvement in the multibillion-dollar Narmada Dam project. The project, which includes a dam, reservoir, hydroelectric power plant and irrigation canals, has significant environmental impacts that the Bank's independent expert review panel claims have not been adequately addressed.

The Asian Development Bank (ADB). The ADB and the World Bank play complementary roles in the Indian power sector, with ADB lending 25 percent of the amount of World Bank loans (nearly $850 million) between FY 1982 and FY 1991. Like the World Bank, the ADB is shifting its resources to private utilities while pressing for SEB reform. In late 1990, the ADB approved a $17.8 million loan to CESC and another $32 million to CESC in 1991. ADB lent PFC another $250 million in 1992 (in close cooperation with the World Bank) to promote SEB reform through the PFC's on-lending policies.

Bilateral Assistance to India for the Power Sector - FY 1982-1991 ($ million)

Source	1982-83	1984-85	1986-87	1988-89	1990-91	Total 1982-91
Canada	68.5	460.2	3.3	0.8	--	533
Germany	--	--	--	141	205	346*
Japan	153	7	81	494	--	735
Kuwait	91	--	30	--	--	121
Saudi Arabia	--	--	50	--	--	50
UK	17	40	--	--	--	57
USA	--	--	--	--	14	14 (est.)
USSR	--	--	356	--	--	356
Tot. Bilateral	176	500	439	636	219	2,213
Tot. Sector	1,231	1,800	1,813	3,081	1,534	9,701

* figures for Germany are for 1988-1991 only.
Source: The World Bank Group, data for Germany derived from the trade press, 1992.

Aggressive German Aid Flows for Power Projects in India

German aid to the Indian power sector is substantial and has helped to give German companies like Siemens a foothold in the market. German spending on Indian private utility power projects totalled more than $750 million between 1988 and 1992, with the Kreditanstalt für Wiederaufbau (KfW) accounting for about half. The KfW provides below-market credits that are often tied to the purchase of German equipment/services.

Two projects stand out. The Neyveli lignite mine and 2,000 MW power complex in Tamil Nadu is the single largest German-backed project. The project began over 17 years ago and includes Eastern European, Italian, and Indian BHEL/German equipment. The largest recent project is the Dadri combined cycle power plant, which is located 60 km south of New Delhi. The KfW funded the purchase of four gas and two steam turbines with Germany's Siemens the main beneficiary among suppliers.

The following table shows the recent projects that have received German funding.

Year	Project	Total Amount ($ millions)	KfW Share
1988	Neyveli II (lignite/power)	15	0
	Neyvelli III (lignite/power)	95	23
	Farakka (thermal)	46	23
1989	Neyveli III (lignite/power)	78	38
	Ramagundam (open cast mine)	113	57
1990	Dadri Combined Cycle (thermal)	279	140
	Uran Cogen (boiler/steam turbine)	130	65

Source: *Power in Asia*, July 27, 1992.

Former USSR. The demise of the USSR, formerly India's largest bilateral aid donor and barter trade partner, is having an effect on the recent evolution of the power sector in India. The USSR played a role in India's fossil and nuclear power program, which is now

floundering owing to a lack of resources. Soviet financial and technical support reached an estimated total of $356 million between 1982 and 1991; the loss of this support is putting added pressure on India to look to the private sector for assistance. The Indian Atomic Energy Commission is now discussing the possibility of joint government-private sector nuclear power projects.

It is unlikely that the Russian Republic will provide India with financial aid in the near future. The Russians prefer providing nuclear construction services and equipment at market prices to boost their own economy.

USAID. USAID is promoting private power development in India through the Office of Energy & Infrastructure's Private Sector Energy Development (PSED) program. This effort is designed to help India develop and implement the necessary institutional changes that will enable an effective private power system. Assistance in developing solicitations and methods of evaluating private power bids is an example of the kind of support USAID is providing. The Agency is also providing U.S. developers with support in entering the Indian market.

The U.S. also supports energy efficiency in India through its the Energy Management Consultation and Training Project (EMCAT). This program provides grants through the Industrial Development Bank of India (IDBI) to study potential cogeneration/energy conservation projects, establish demonstration projects in energy conservation, train energy auditors, and help establish Energy Services Companies (ESCOs).

USAID also complemented World Bank and ADB efforts to increase the effectiveness of the PFC. The U.S. is providing the PFC with a $14 million EMCAT grant to fund institutional support for an energy sector management effort. This grant was contingent on World Bank and/or Asian Development Bank PFC loan approvals, which together amount to over one-half billion dollars. USAID will train PFC staff and provide various consulting services and computer facilities.

Environmental Considerations

Environmental awareness is on the rise in India, particularly in the power sector. SEBs and private utilities have prepared a plan to implement air pollution control at older thermal power plants. The GOI and SEBs now require environmental impact assessments (EIS) addressing air, water, solid waste emissions, and human resettlement issues prior to the

Air Quality and Effluent Standards in India

Controlled Parameters	Units	Guidelines/Maximum Permissible Concentration
Particulate matter	for boiler size less than 200 MW	150 mg/Nm3 for protected areas 350 mg/Nm3 for other areas
	for boiler size 200 MW and above	150 mg/Nm3 for protected areas 150 mg/Nm3 for other areas
Sulfur dioxide	for boiler size less than 200 MW	stack ht = $14(Q)^{0.9}$ where Q is SO_x emissions in kg per hour
	for boiler size 200 to 500 MW	stack ht = 220 meters
	for boiler size 500 MW and above	stack ht = 275 meters
Effluent parameters	condenser cooling water	pH = 6 to 8.5 temperature = not more 5 deg C higher than intake pump free chlorine = 0.5 mg/lit
	boiler blowdown	suspended solids = 100 mg/lit oil and grease = 20 mg/lit copper and iron = 1 mg/lit
	cooling tower blowdown	free chlorine = 0.5 mg/lit lime = 1 mg/lit total chromium = 0.2 mg/lit phosphate = 5 mg/lit
	ash pond effluent	pH = 6.5-8.5 suspended solids = 100 mg/lit oil and grease 20 mg/lit

Source: *Guidelines on Environmental Pollution Control*, Gujarat Pollution Control Board, September 1992.

construction of new power plants. State environmental control boards review EIS reports, which must be approved before the Ministry of Energy and CEA provide final approval. The exhibit on the next page shows the environmental standards now in effect for India's power sector.

Private utilities and progressive SEBs are taking an aggressive approach to ensuring their own environmental compliance. Recently, for example, the Bombay Suburban Electricity Supply Ltd. prepared an environmental due diligence plan for the 2x250 MW coal-fired boiler plant at Dahanu. This level of environmental analysis is not routinely required in India.

Also, private utility companies and progressive SEBs have established separate environmental monitoring units to control and monitor air and water pollution. These will ensure compliance with measures reached in conjunction with the GOI and funding agencies (typically the multilateral banks or bilateral aid agencies).[8] As a result, there have been environmental improvements in the planning, design, construction, and operation phases of each project.

Environmental impact analyses are being followed up with investments in environmental mitigation equipment. Boilers are fitted with electrostatic precipitators (ESPs) to operate at greater than 99 percent efficiency. Ash handling is now mandatory at all thermal stations. Ash disposal is typically undertaken at or near the plant to prevent ash slurry from contaminating water supplies (a typical 2x250 MW coal-fired boiler can produce up to 2,000 metric tons of ash per day). Flue gas desulfurization units must be added if the project fails to meet the SOx emissions established by the GOI and the World Bank/IFC. Further, stack and ambient air quality monitoring stations are becoming a requirement at all new thermal stations.

Power Sector Market Assessment

Between 1992 and 1996, India seeks, quite optimistically, to add 24,266 MW of new electric power capacity. Over half of these additions will be supplied by 12,396 MW of fossil-fired

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[8] The Tamil Nadu Electricity Board's (TNEB) 2nd North Madras thermal power project comprising a 3x310 MW coal-fired project is supported by the ADB. This project entails significant environmental impact equipment: 99.5 percent efficient ESPs, a 275 m stack to disperse SOx emissions, a flue-gas desulfurization unit if high-sulfur coal is used in the future, and air monitoring.

A Historical Note on India's Record of Electric Capacity Additions

During India's First Five Year Plan (1951-1956), the country had an installed electric power capacity of 1,840 MW, 68.5 percent of which was thermal and 31.5 percent hydro. Most of the thermal capacity was located near Bombay, Calcutta and New Delhi. The capacity comprised mostly British built and imported oil- and coal-fired boilers and diesel generator sets. Since then, the electric power capacity and associated transmission network has grown. Installed electric generation capacity has grown at a sustained 9.5 percent annually since 1950 to today's 69,600 MW. The following table shows the additions to electric power capacity that have taken place.

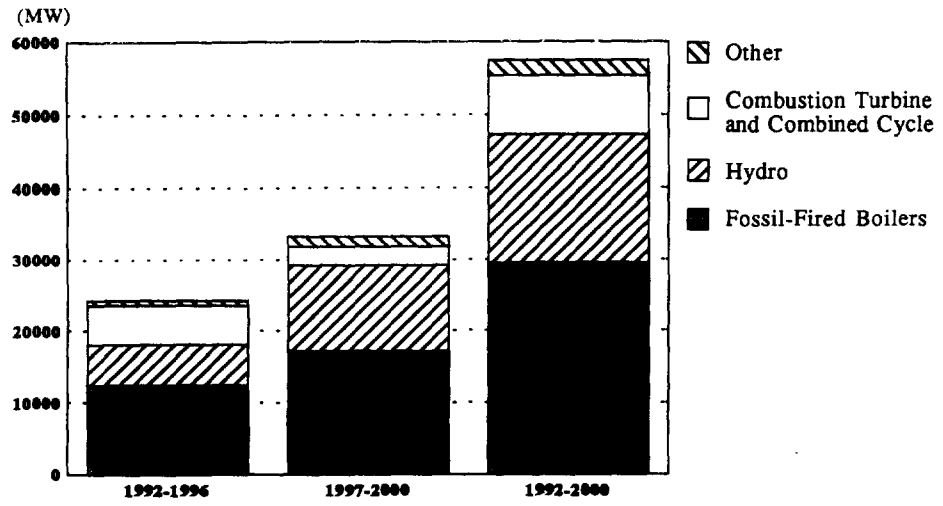
Official Plan	Built (MW)	Planned (MW)	Difference (%)
first 1951-56	1,100	1,300	-15
second 1956-61	2,250	3,500	-36
third 1961-66	4,520	7,040	-36
annual 1966-69	4,120	5,430	-24
fourth 1969-74	4,579	9,264	-50
fifth 1974-79	10,202	12,499	-18
annual 1979-80	1,799	2,945	-39
sixth 1980-85	14,226	19,666	-28
seventh 1985-90	21,402	22,245	-4
annual 1990-91	2,777	4,212	-43
annual 1991-92	3,027	3,811	-21

Source: Department of Power, May 1992.

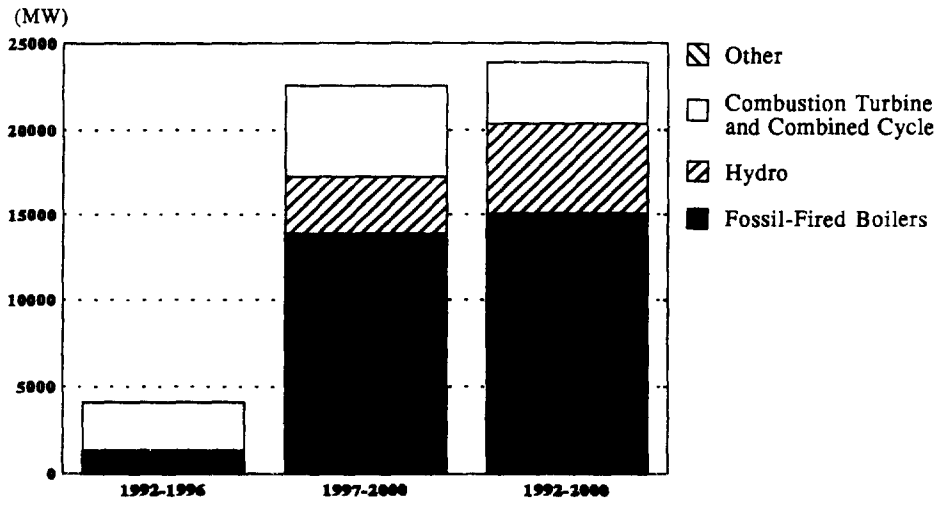
Note: Almost 70,000 MW of new capacity was added during FY 1951-1992 versus a planning target of almost 92,000 MW of new construction. During this time, electric plant retirements are estimated to be more than 5,500 MW of mostly thermal capacity.

India

1992-2000 Planned Capacity Additions (committed and uncommitted projects)



1992-2000 Capacity Additions for Uncommitted Projects



boilers (51 percent), 5,705 MW of hydroelectric power plants (23.5 percent), and 5,460 MW natural gas-fired combined cycle power systems and combustion turbine peakers (22.5 percent). The remaining 705 MW (2.8 percent) in additions will be mostly nuclear and some renewable energy power generation facilities.

Some of these projects are now in advanced stages of planning or are being implemented. Between 1997 and 2000, India will add a further 33,164 MW of new electric capacity, consisting of 17,070 MW from fossil-fired boilers (51 percent), 12,116 MW from hydro (37 percent), and 2,568 MW of natural gas-fired combined cycle (8 percent) and combustion turbine peakers.

During the past 25 years, Indian firms like the government-operated Bharat Heavy Electricals Limited (BHEL) monopolized power generation equipment sales in India. This trend is expected to move gradually towards imported equipment and technology, however, for the following reasons:

- ☐ ***Decreasing government patronage:*** Government companies (e.g., BHEL) face severe funding shortages and increased competition.

- ☐ ***Development of private power projects:*** Several U.S. and NRI-led private power proposals are in the early stages of negotiation. Some may evolve into projects that offer opportunities to use U.S. equipment and services, either through direct imports that may be available tariff free, or by ordering from U.S. licensees in India. The procurement of equipment using local currency may be important on some projects.

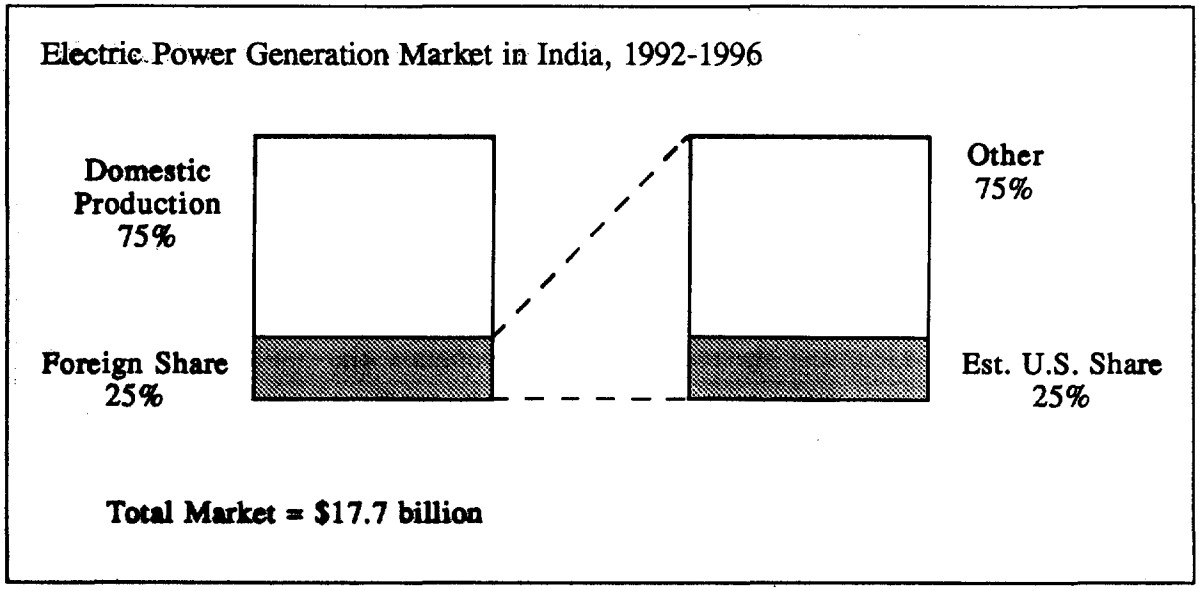
- ☐ ***Increasing U.S. direct foreign investment in the Indian power generation sector:*** Licensing agreements and joint ventures like that between Solar Turbine, Inc. and KOEL involve significant export shipments of turbine assemblies, components and services. These types of arrangements are expected to increase and contribute to increased U.S. exports.

- ☐ ***Policy developments***: Continuing economic liberalization in India will improve the climate for imports, particularly in terms of reduced tariffs on power generation equipment and Rupee convertability.

At present, the Indian power generation market is dominated by domestically produced units. The multilateral development banks sponsor a significant portion of private utility

power generation expansion and also assist NTPC in executing projects. Equipment that has recently been produced domestically includes two 500 MW coal-fired boiler units for Singrauli power station (which is owned by the Uttar Pradesh SEB) and two 500 MW coal-fired boiler units for the Chandrapur station owned by MSEB. Three 135 MW hydro turbines for the NEB Ranganadi station are now under construction at BHEL factories. BHEL also will provide two 250 MW coal-fired boiler units for the IFC-assisted BSES Dahanu project, which is scheduled to go on-line by 1994.

About 25 percent of the estimated $17.7 billion Indian power generation equipment market between 1992 and 1996 will be imported primarily from Europe, the U.S., and Japan, based on historical trends. Equipment imports will primarily be combustion turbine equipment. Other imports will include controls, special services, components, parts, and kit assemblies. U.S. firms can expect to hold a 25 percent share -- or $4.4 billion of this import market -- but they should prepare to compete aggressively as the market will be crowded. Some U.S. companies (e.g., General Electric) have licensing arrangements with BHEL for the manufacture of turbine equipment; these may prove an additional source of revenue.



India's traditional ties with British, German, and Canadian companies (together with these countries' large bilateral assistance programs to India) will continue to pose barriers for U.S. companies interested in the Indian equipment market. U.S. companies should be aware that several foreign equipment suppliers and Indian utility companies and constructors feel, however, that bilaterally funded projects are more expensive and result in greater dependence on the provider nations for spare parts and components.

Significant opportunities in power plant rehabilitation and modernization are also open to U.S. companies. The following exhibit outlines the government's planned expenditures for fossil-fueled power plant renovation and modernization. The majority of the work lies in the rehabilitation of thermal facilities. The GOI has budgeted $76 million per year to be spent on renovation and modernization during the Eighth Plan.

GOI Committed Expenditures for Power Plant Renovation and Modernization ($ millions)

Equipment Type	1992-1996	1997-2002
Boiler and Auxiliaries	85.3	95.0
Turbine and Auxiliaries	38.6	41.8
Controls/Instrumentation	24.2	17.2
Coal Handling Plant	56.8	7.8
Water Trt./Cooling Water	12.5	3.6
ESPs and Ash Handling	138.5	73.2
Fire Protection and Misc.	24.9	3.2
Total	381.1	270.0

Source: Power Finance Corporation, New Delhi, September 1992.

The installation of such environmental impact mitigation equipment as electrostatic precipitators (ESPs) is a high priority for India. Almost $139 million has been spent during the past five years on ESPs and associated ash handling equipment. U.S. companies are not very active in developing this market, despite the fact that the World Bank is devoting substantial resources to this activity and U.S. products and services in this market segment are

highly regarded for their reliability and flexibility under difficult conditions. Often, however, Indian industry considers U.S. equipment prices to be higher than competitor prices.

Domestic Competition

The domestic power equipment manufacturing industry consists of two major players: state-owned BHEL and ABL-Babcock, a licensee of Babcock & Wilcox, supplemented by a host of smaller companies that produce diesel gen-sets, gas turbines and boiler equipment. Historically, Indian manufacturers have been given a 15 percent price advantage in equipment bids issued by the GOI and SEBs. To spur competition and dismantle BHEL's monopoly, however, the GOI lifted barriers to domestic and foreign firms and eliminated the price advantage for local suppliers. They can now produce utility-scale power equipment above 60 MW with 51 percent foreign equity.

This move will substantially benefit BHEL's foreign competition. Such companies as Asea, Brown, Boveri (ABB), Siemens, GEC/Alsthom, General Electric, Westinghouse, and Mitsubishi, which in the past relied on licensing agreements with BHEL, can now build manufacturing capacity in India and market their products there. Furthermore, to meet the demands of India's growing industrial power requirements, firms like Thermax, Kirloskar Group, and Wartsila (Finland) have entered into joint ventures and licensing agreements to enhance their technology, competitive position and marketing. These agreements include technical and management know-how to build manufacturing facilities and the direct import of kits and components for assembly. The exhibit below provides an outline of major Indian power equipment companies and their capabilities in the utility and large industrial markets.

Bharat Heavy Electricals Limited (BHEL). BHEL was organized by the GOI in the early 1960s to meet the country's rapidly expanding electric capacity requirements. BHEL has 13 manufacturing plants that produce a diverse range of products and thermal and hydroelectric power generation equipment. Historically, BHEL commanded approximately 90 percent of India's power sector equipment supply market. Its power generation units account for nearly 65 percent (or 42,665 MW) of India's commercial installed electric capacity.[9] The annual design manufacturing capacity at all BHEL plants is large by any standards, currently

[9] BHEL has supplied 92 fossil-fired boiler units of 210 MW and 11 units of 500 MW capacity sets, 38 gas turbine units of up to 38 MW rating, and 189 hydro units up to 165 MW capacity.

Capabilities of Indian Power Equipment Companies

	Fossil Boilers				Turbines			
Domestic Vendors	Hydro	Gas	Coal	Oil	Steam	Gas	Waste Heat Boiler	Diesel
BHEL*	yes	yes	yes	yes	yes	yes	yes	yes
ACC-Babcock Ltd.	no	yes	yes	yes	no	no	yes	no
Thermax Group	no	yes	yes	yes	no	no	yes	no
Kirloskar Group	no	no	no	no	no	yes	no	yes
Wartsila	no	no	no	no	no	no	no	yes
Modi-Mirless	no	no	no	no	no	no	no	yes
Triveni	no	no	no	no	no	yes	no	no

* BHEL's design manufacturing capacity across 13 production plants is estimated at 4,500 MW for conventional steam, 1,000 MW for gas turbine units, and about 1,345 MW for hydro per year.

Source: Company reports and interviews with staff, September 1992.

estimated at almost 4,500 MW for thermal units, 1,000 MW for gas turbine units, and 1,345 MW for hydro.

Today, BHEL has an estimated 5,960 MW worth of orders on its books as part of the GOI's Eighth Plan. The company has a projected operating fabrication capacity of approximately 2,500 to 3,000 MW per year during 1992-1993. BHEL's comparative advantages include the following:

- ☐ provides price quotes and delivery in local currency
- ☐ maintains a wide manufacturing range; from 30 MW to 500 MW capacity power plants
- ☐ offers competitively priced turnkey services for power projects

- ☐ BHEL's international experience is small but has proven valuable for its development.[10]

BHEL operates under several licensing arrangements with major multinational power equipment and service companies. On the thermal side of the business, the company has an ongoing agreement with ABB-Combustion Engineering (U.S.) for fossil-fired boilers, and with General Electric, Inc. (U.S.) for gas turbines. Additionally, BHEL collaborates with Siemens Kraftwerke Union (Germany) for gas turbine and steam turbine technology and production know-how, and Promash Exports (former USSR) and Hitachi Corp. (Japan) for specific technology tie-ups. On the hydro power side of its business, BHEL's client list is also impressive. The BHEL Bhopal manufacturing unit is working with English Electric (UK) and General Electric (Canada) for the manufacture of high head, high output Francis-type turbines. The foreign technology arrangements and unit royalty accruals are paid for in hard currency and typically last for a 10-year period.

In recent years, as the government has scaled down its building program, BHEL's business suffered. As a result, the company has begun to diversify its operation to become less dependent on government business. Almost 20 percent of the company has been sold to other government financial institutions and a further 20 percent is expected to be sold off to the public and to foreign power equipment multinationals.

As part of this diversification strategy, Merrill Lynch (U.S.) and BHEL are negotiating a joint venture agreement to set up a financial services company. BHEL also is seeking to collaborate financially with SEBs and other heavy industries in public sector undertakings to bid and execute power projects all over the country. A recent example of the company's success in marketing the private sector is the 2x250 MW fossil-fired boiler project for the Bombay Suburban Electric Supply Company (BSES), which it won under a World Bank international competitive bid in June 1991.[11] BHEL's collaborative approach was deemed desirable to BSES as it made established technology available at the lowest possible price.

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[10] Recent BHEL international projects include sales to Malta (2x60 MW turbine and generator), Cyprus (2x60 MW turbine and generator) and Malaysia (4x60 MW and 8x120 MW rehabilitation). Construction on a pending order from Siemens (Germany) for 3x150 MW (ISO) gas turbines is to begin shortly.

[11] The BHEL package for the BSES Dahanu project, consisting of ABB-Combustion Engineering technology for the boiler and Siemens know-how for the steam turbine, won the project competing against ABB (Germany), Ansaldo (Italy), and a Electrim (Poland)/Alsthom (France) team.

BHEL has experienced similar advantages on other projects. During the Ahmedabad Electricity Company natural gas-fired combined cycle power plant equipment procurement process, for example, a single gas turbine was supplied by General Electric (U.S.) through BHEL; the other two needed for the project were fully assembled by BHEL in India. When the World Bank funded the 4x250 MW Koyna Stage IV hydro project, BHEL and General Electric (Canada) won the equipment procurement process by collaborating. BHEL will continue to maintain a dominant position in the Indian utility sector, but it will increasingly enter into consortia arrangements.

ACC-Babcock Limited (ABL). ABL, a licensee of the U.K. firm Babcock and Wilcox, is located in West Bengal state and produces power boilers of up to 500 MW capacity and provides turnkey projects of up to 210 MW capacity. The company is BHEL's primary domestic competitor, although its market share is nowhere near as strong as BHEL's. ABL recently began offering services for the renovation and modernization of existing thermal plants, winning the boiler modernization of the Neyveli project during early 1992. In addition, ABL's business units also design and fabricate cement manufacturing machinery, pressure vessels, electrostatic precipitators (ESPs), air quality control systems and machinery for metallurgy. ABL manufacturing units are located in West Bengal (Durgapur) and the southern state of Karnataka (Shahabad).

Like BHEL, ABL suffers from the financial difficulties experienced by India's power sector. The company was closed for a 20-month period beginning in October 1986 due to a lack of orders. ABL was rescued from bankruptcy and closure by a Department of Power takeover in June 1988. The takeover has not been entirely successful, however. Its financial losses amount to $41 million and further patronage from DOP projects has not yet materialized.

Since its takeover, ABL has commissioned three projects. These include the 3x210 MW boiler for the Bakreswar station for the West Bengal PDC, a 210 MW boiler for the Bokaro station of the Damodar Valley Corporation, and 3x26 MW power boilers for the Khammam Heavy Water Plant built by the Department of Atomic Energy. ABL plans to execute at least four more utility and industrial projects by 1995. These include the 2x250 MW Budge-Budge station for CESC and a retrofit of an electrostatic precipitator for BALCO and Nasik station in the MSEB region. The company also has begun work on the power boilers for the new Madras refinery project.

India

Overview of Selected Electric Generation and Auxiliary Projects Undertaken in India

Project/Major Equipment	Project Date	Major Supplier	Country of Origin	Approx. Value
2x250 MW coal-fired boiler and steam turbines at Budge Budge power plant for CESC	1995-1996	ACC Babcock Ltd. and NEI Parsons	India U.K.	$550 million
150 MW gas turbine and 80 MW steam turbine at Trombay 7 power plant for TEC	1994	BHEL, Siemens KWU	India Germany	$130 million
2x250 MW coal-fired boiler/steam turbine for BSES's Dahanu project	1994	BHEL, ABB-CE, Siemens KWU	India, U.S., Germany	$120 million
Francis turbines for 3x135 MW hydro Ranganadi power plant for North Eastern Electric Power Corp.	1996	BHEL	India	na
2x500 MW coal-fired Singrauli power plant for UPSEB	under dev.	BHEL	India	$240 million
2x500 MW coal-fired Chandrapur power plant for MSEB	under dev.	BHEL	India	$300 million
2x500 MW coal-fired Rihand power plant for NTPC	under dev.	Marubeni, Mitsubishi	Japan	$575 million
2x500 MW coal-fired Anpara power plant for UPSEB	under dev.	Marubeni, Mitsubishi	Japan	$1,040 million
3x144 MW gas turbines and 225 MW steam turbine for 650 MW turnkey Gandhar power plant for GSEB	1994	ABB	Sweden Switzerland	$275 million
3x88 MW gas turbines and 115 MW steam turbine for 414 MW turnkey Anta power plant for UPSEB	1990	ABB	Sweden Switzerland	$125 million

Source: Compilation of trade literature, data derived from BHEL and ACC-Babcock Limited company literature, and staff interviews, October 1992. Approximate value refers to the order given to major suppliers.

Market Overview of Selected Private Sector Power Proposals

Project/Major Equipment	Developer	Country of Origin	Approx. Value
500 MW coal-fired steam turbine power plant in Duburi, Orissa	Northeast Energy Services, Inc.	U.S.	$615 million
1,000 MW coal-fired power plant, Mysore, Karnataka	Northeast Energy Services, Inc.	U.S.	$1,071 million
2,340 MW coal-fired power plant, Ib Valley, Orissa	Southern Electric International	U.S.	$1,630 million
1,000 MW coal-fired power plant, Vishakapatnam, Andhra Pradesh	Mission Energy Company	U.S.	$1,071 million
2,550 MW natural gas-fired power plant, Dabhol, Maharashtra	Enron Power Corp.	U.S.	$2,100 million
400 MW coal-fired power plant, Jagarupadu, Andhra Pradesh	GVK Industries	U.S.	$331 million
210 MW lignite-fired power plant, Neyveli, Tamil Nadu	S.T. Power Systems Inc.	U.S.	$233 million
240 MW lignite-fired power plant Barsingar, Rajasthan	Coleman & Associates	Australia	$195 million
420 MW coal-fired Pench 1 power plant	Century Power	India	na
268 MW hydro Almati power station	Condotte, KPC	India Italy	$105 million
500 MW coal-fired power plant, Mangalore, Karnataka 500 MW coal-fired power plant, Bangalore, Karnataka	Cogentrix	U.S.	$333 million, $333 million
400 MW gas-fired combined-cycle power plant, Godavari basin, Andhra Pradesh	Spectrum Technologies	U.S.	$145 million

Source: Ministry of Power, Investment Promotion Cell, New Delhi, India and compilation of trade literature, October 1992.

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Future prospects for ABL look difficult; it has a backlog of only five 210 MW power boilers and a small number of ESPs. The firm continues to seek Department of Power support to further improve its boiler business.

Other Domestic Manufacturers. Smaller-scale electric power plants (less than 30 MW) in India are generally supplied by domestic firms with significant multinational technology licensing. These are concentrated in the industrial power plant market segment.

Hindustan Aeronautics Limited, the state-owned aircraft manufacturing company, is another Indian company that collaborates with foreign companies for gas turbine production. It has worked together with the Ingersoll Rand Corp. (U.S.) and Allison Engine Corporation (U.S.) for the manufacture of engines.

Kirlosker Oil Engines Limited (KOEL) recently collaborated with Solar Turbines, Inc. (U.S.), a wholly owned subsidiary of Caterpillar, Inc. (U.S.) for the marketing, servicing, and assembly of gas turbine kits.[12] The collaboration will allow for domestic manufacturing of gas turbines at a later date. Ultimately, the firm plans to expand into the steam turbine and generator market, and is expanding its market as a turnkey supplier of electric power services.

In summary, the power generation market in India could be very competitive in the future. The market is evolving towards increased imports of high-performance equipment that can meet India's urgent power needs. Observations based on discussions with sales representatives of foreign companies operating in India and the U.S. indicate the following trends:

[12] The KOEL product line includes the Mars, Centaur, and Saturn gas turbine series which serve the 1 to 10 MW range. KOEL also undertakes turnkey projects for the installation of cogeneration systems.

Summary of Major Indian Power Sector Trends

Equipment Trends	▸ Large coal-fired boiler steam turbine systems and natural gas-fired combined cycle power plants are the primary focus of the market. ▸ The industrial power market is financially stable and growing rapidly. Sales of small power systems (diesel sets, gas engines and turbines) are expected to maintain their strong growth. ▸ Hydro project development will be slower than expected.
Market Players	▸ European firms dominate in the supply of large-scale gas turbine and combined cycle plants. BHEL provides boilers, steam turbines (Siemens KWU) GE-licensed gas turbines (both industrial and utility scale), and hydro equipment. ▸ U.S. developers are important new players in this market. ▸ U.S. and Japanese suppliers hold a small import market share. However, U.S., European, and Japanese firms have a number of licensee arrangements with BHEL, ABL Babcock and other domestic players.
Market Drivers	▸ Bilateral deals played a significant role in the late 1970s and early 1980s but have diminished in recent years. However, they are expected to re-emerge in private power deals. MDB competitive bids for the state sector have remained steady, but private utility and NTPC construction programs are dominating the import market. ▸ Both local and foreign private power developers will probably influence the market towards high-efficiency equipment that may well be funded by export credit agencies.
Technology Trends	▸ The SEBs, private utilities, and NTPC prefer modular natural gas-fired combined cycle units. ▸ The BHEL-GE, and BHEL-Siemens/KWU manufacturing license for large combustion turbine machines is expected to evolve slowly to serve the domestic market. ▸ Applications that utilize and improve the combustion efficiency of local coal, such as fluidized bed combustion, coal gasification and combined cycle, and pre-combustion technologies such as coal washing will be in demand during the 1990s.

Market Entry Strategy

The Indian government recently made major reforms to its foreign investment regulatory regime and industrial collaboration guidelines as part of a sweeping effort to integrate India into the world economy. These changes were effected by the Rao administration to deal with the huge deficits that threatened to bankrupt India. If fully supported by the MDBs and implemented by the GOI, the new policies have the potential to significantly increase future Indo-American trade and investment. U.S. companies must evaluate their business prospects in light of these changes.

Foreign Investment Regulations

An important feature of India's new policy environment is the reform of direct foreign investment regulations. In the past, GOI policies restricted potential foreign investment and placed undue burdens on foreign firms operating in India. Foreign investment was permitted only in sectors that directly benefitted government objectives. Common restrictions included the extent of local content in manufacturing requirements, a 40 percent ceiling on foreign equity investments, export obligations, and official review of technology transfer.

The investment policy guidelines issued in July 1991 considerably relaxed or eliminated foreign requirements and simplified the process of direct foreign investment. Under the new policy, foreign equity ceilings are raised to 51 percent for most industries and can go as high as 75 or 100 percent for high-technology, tourism enhancing, and export-oriented projects. Private power development also has been selected as a key industry where 100 percent foreign ownership will be allowed. Furthermore, foreign power equipment and technology companies will be permitted to purchase parts of or form joint ventures with such national companies as BHEL and NTPC.

As a result of this revised investment policy, total foreign direct investment is expected to reach a modest $600 million in 1992, up from $200 million in 1991. Large Indian power equipment manufacturing companies are searching for and entering into a plethora of agreements with foreign multinationals. This activity has resulted in increased product announcements, redesign (and often rehabilitation), and improved research in the power equipment/industrial sector; these actions constitute a move towards improving product quality and performance. They follow policies employed by consumer goods companies over the past few years and signify a reversal of the decades-old trends towards closed-door, import-license, and quota-dominated systems.

Industrial Collaboration

In India, the term "collaboration" is used to refer to three types of cooperative business relationships. Each of these represents a possible market entry strategy: licensing technology to Indian firms, establishing joint ventures with foreign capital, or selling foreign technology directly to Indian firms. Forms of collaboration other than these arrangements are rarely, if ever, permitted in India. Distribution franchising is now being considered by the Foriegn Investment Promotion Board and some of the SEBs. Franchising, for example, does not exist because the use of foreign brand names for domestic sales is rarely permitted (however, General Electric Power Systems (India) recently started to market two-part electricity tariff meters under the GE brand name). Production sharing and risk service arrangements in "upstream" industries like coal, oil, and gas development are as yet uncommon due to government restrictions. The following exhibit illustrates the nature of collaborations in India's power generation equipment sector.

Major Foreign Technical Collaborators in the Indian Power Sector

Company	Country	Market Segments
Bharat Heavy Electricals Limited (BHEL)		
Siemens	Germany	gas and steam turbines, engineering
General Electric	U.S.A.	gas turbines, compressor drives, assembly, engineering
Asea Brown Boveri	Sweden	engineering
Hitachi	Japan	substations, components
English Electric	U.K.	high-head Francis turbines
General Electric	Canada	high-output turbines
ACC-Babcock Limited (ABL)		
Fives Coil Babcock	France	complete cement plant technology
Hammer Mills Inc.	U.S.A.	crushers
Mitsubishi Mining and Cement Co.	Japan	pre-calcinor technology
Lurgi GmbH	Germany	electrostatic precipitators
ACC-Babcock	U.K.	steam boiler technology

Source: Company reports and staff interviews, September 1992.

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Licensing. Licensing manufacturing technology is the preferred market entry strategy in India, assuming no foreign equity capital is involved. The U.S. leads all other foreign countries in Indian licensing arrangements, having signed some 2,500 arrangements during 1991.

Licensing involves an agreement of a limited duration under which a foreign firm sells its technology and know-how for an initial lump sum payment and collects royalties based on subsequent sales. Technology licensing arrangements usually involve a combination of patents, manufacturing know-how, technical advice, engineering services, plant construction, and assistance in the purchase of plant equipment. Indian companies are seeking partnerships with U.S. manufacturers and technology/service companies. According to Sanjeev Jain, General Electric's deputy director for India, "licensing technology to an Indian company is a good way to enter into the Indian market."

The central government must approve foreign-domestic collaborations, including licensing arrangements. India's strategy has been to promote domestic industrial development by restricting the alternatives to licensing (such as direct imports and foreign direct investment). Approval is contingent on such factors as existing domestic availability of the technology in question, export potential, and foreign exchange requirements.

Rapid changes in technology and a more pressing need for sophisticated equipment have led to an increase in foreign collaborations, with licensing arrangements continuing to be the preferred approach. This acceleration appears to result from private and state-owned companies being directly exposed to major foreign firms that wish to enter the Indian market and Indian companies that hope to expand their product lines, develop export markets by acquiring technology, and remain competitive in a crowded domestic market. The government has considerable discretion in approving licensing arrangements; high-technology agreements in priority sectors (e.g., power plant equipment, software development and specialized services) usually receive approval.

The government is attempting to improve and expedite the often long and bureaucratic approval process for foreign direct investments and licensees. In July 1991, the Finance Ministry announced that it will automatically approve direct foreign investments and technology agreements related to high-priority industries that lie within "certain parameters." In the power sector, these include collaborations designed to produce or improve the performance of:

- ☐ boilers and steam generating plants
- ☐ selected prime movers
  - -- renewable energy systems
  - -- gas/hydro/steam turbines up to 60 MW
- ☐ equipment for the transmission and distribution of electricity, including power and distribution transformers, power relays, HT-switch gear synchronous condensers
- ☐ generating sets based on internal combustion engines.

Approval is still required, however, and some restrictions do apply. For example, lump sum payments over $350,000 and royalty payments for domestic sales over 5 percent and for exports over 8 percent disqualify firms from "automatic" approval. Other industries not on the above list will be approved under the same guidelines, but only if no foreign exchange is required for any payments.

Licensing arrangements appear to be on the rise in the Indian power sector owing to the great demand for new technology. Many of the licenses in which BHEL had been a participant are expired or nearly expired. U.S. power technology is needed more than ever before to develop environmentally sound coal-fired power plants, achieve greater fuel conversion efficiencies, and rehabilitate older plants. The need to develop reliable, high-efficiency combustion turbines for natural gas-fired combined cycle plants is one example.

The licensing approach is not expected to lose its advantages over direct imports of equipment, despite a trend toward more liberalized trade. The competitive costs of production in India (such as lower labor costs) will continue to favor domestic manufacture, especially for conventional power boilers and increasingly for combustion turbines as well.

Joint Ventures. Joint ventures are another possible strategy for entering Indian markets. This approach represents 15 to 20 percent of all approved foreign collaborations. A foreign firm may receive lump sum and royalty payments for technology transfer as well as dividend transfers. These ventures usually involve the sale of equipment and components followed by training during the start-up phase.

India

In the past, the GOI restricted foreign direct investment to some 40 percent of equity, which meant in practice that joint ventures were the only foreign direct investment option in India. The government's traditional point of view has been that the less foreign equity is involved in a venture, the better. Only investments accompanied by technology transfer were approved. However, opportunities exist for specific services as well. A director at a major Indian boiler maker confirms that "the market offers U.S. suppliers niche opportunities in areas such as boiler life extension and O&M services."

These past restrictions have been greatly revised and relaxed. The requirement that foreign technology agreements accompany such investments is now removed. In high-priority industries requiring large investments and advanced technology, direct foreign investment of up to 51 percent equity is allowed (pertinent power sector industries are listed under the licensing discussion above). However, approval requires that foreign equity cover any applicable the foreign exchange requirement for imports of capital goods. The Reserve Bank of India, the country's central bank, monitors such arrangements to ensure that export earnings balance dividend payment outflows.

The power sector is a special case. The government will negotiate at a high level with large foreign firms interested in investing in India if this will would provide access to foreign technology, capital and world markets. The investment programs of these large firms will be considered in totality, free from pre-determined parameters or procedures. Here, 100 percent foreign ownership is allowed.

Direct Sales of Technology. As part of the revised industrial policy, a ceiling of 110 percent is imposed on basic tariff rates, down from a previous 150 percent. India's government has committed to further reductions in tariffs as part of current General Agreement on Trade and Technology (GATT) negotiations. Tariffs remain high despite this new ceiling, especially for domestically produced goods (which are a government priority). However, power generation equipment tariffs have been brought down further to around 30 percent, and are eliminated for foreign private power projects and applications at key industries.

Intellectual Property Protection

India has a reputation for poor intellectual property rights protection, especially for patents. This is not because laws do not exist, but because they are rarely complied with and are poorly enforced. Enforcement through the Indian legal system is time consuming and often difficult to resolve. Many foreign firms consider Indian patent protection inadequate and weak in its implementation.

- ☐ The following protection is granted under Indian law: U.S. nationals have the right to *patent protection* on the same basis accorded to citizens of India. Indian policy guidelines normally limit recurring royalty payments (including patent use payments) to 5 to 8 percent of the selling price. Patent protection is governed by the Indian Patent Act of 1970. Patents are usually granted for 14 years, with the exception of some products, e.g., pharmaceuticals, which are granted protection for only 7 years. Power generation equipment is subject to the 14-year provision.

- ☐ Although *trademarks and brand names* receive legal protection, the Indian Government rarely approves them if they are foreign. This is justified on the grounds that they represent a reputation monopoly and, unlike patents, offer no technology. Some exceptions do apply. Indian firms frequently use hybrid brand names, part Indian, part foreign, such as ACC-Babcock Limited.

- ☐ Rights to *know-how* may be licensed alone or linked to a patent or trademark. However, the GOI does not normally allow separate payment for patent or trademark rights.

It would appear that the GOI will have to modify the current situation and enforce patent infringement in the near term if it is to achieve the level of direct foreign investment and technology transfer it wishes to attain during the 1990s. In 1991, it took a step in that direction by agreeing to include intellectual property rights under the GATT now under negotiation. The U.S. Government has made such protection a key element of any forthcoming agreement. U.S. firms will nevertheless be advised to explore this issue in detail before entering into a collaborative agreement in India.

Source: U.S. Department of Commerce, Washington, DC.

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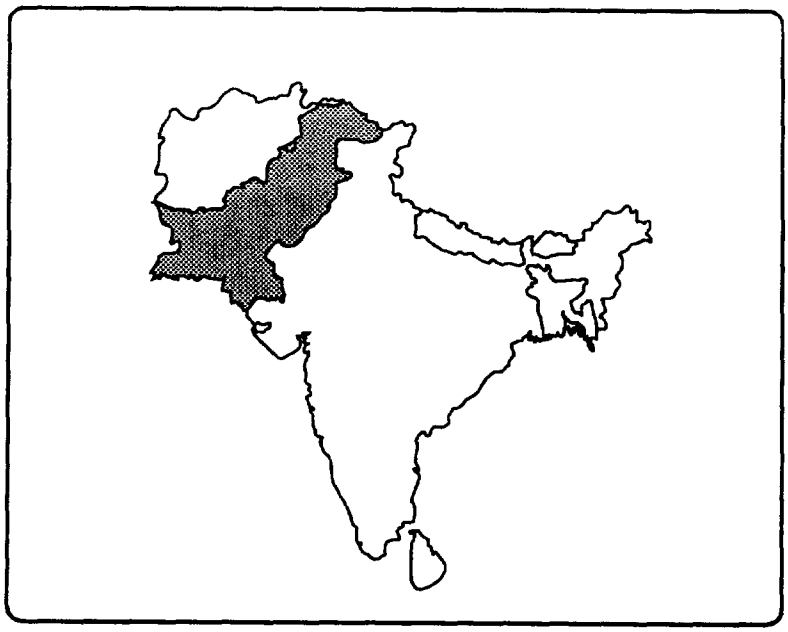


Pakistan

Pakistan's economy has experienced sustained economic growth rates over most of the 1980s, which have continued in the 1990s, especially in the industrial and export sectors. However, despite impressive economic growth, the country continues to suffer from large government budget deficits and chronic balance of payments problems. While Pakistan has an ample endowment of energy resources (hydro, wind, solar, and some coal), it has always depended heavily on imported oil to meet its energy needs.

In the energy sector, the country's long-term plan is to accelerate domestic energy resource development, increase energy-related investments, encourage energy conservation, and reform its energy and utility institutions. Bilateral donors and multilateral development banks are active in helping Pakistan achieve its energy goals.

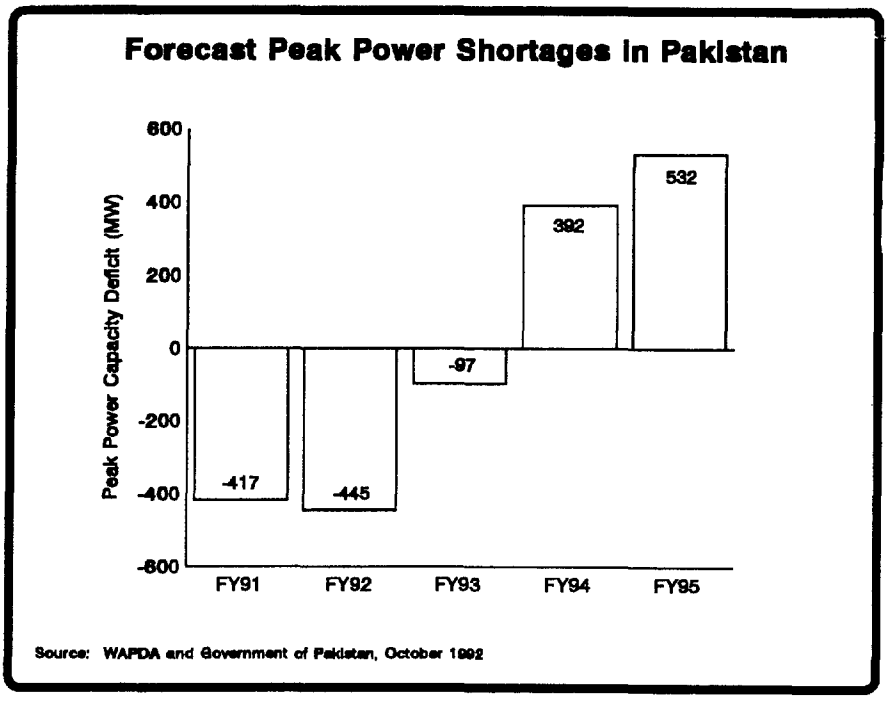
Pakistan was one of the first developing nations to promote private power development. By the end of 1998, Pakistan hopes to have added almost 4,000 MW of private power capacity, representing about 30 percent of its new capacity additions.

Pakistan imports nearly all of its utility-scale power generation equipment. It is estimated that over the next five years, power generation equipment worth almost US $4.6 billion will be imported. Pakistan will continue to rely heavily on export credits, and bilateral and multilateral aid to finance its power generation imports. Sales of equipment, therefore, will likely continue to be awarded to those countries that offer financing arrangements. Historically, the United States has claimed about 10 percent of this market.

Pakistan

Power Sector Overview

Power demand in Pakistan has grown between 9 and 10 percent annually over the past decade, with peak demand growing even faster. Because power supply has not kept up with demand, the country suffers from power shortages on the order of 25 to 30 percent of required peak capacity. These shortages are worst during the dry season (December to May), especially during the months of April and May, when Pakistan's hydroelectric output is often at its lowest. During the summer months, cooling loads put additional demands on the system at a time when the hot temperatures reduce the output of Pakistan's turbine-based power systems. For Karachi, Pakistan's largest city, and Islamabad, its capital, "load shedding" and brownouts are a common occurrence during the dry season.[1] The impact of power outages on the Pakistani economy is high: one estimate places these losses at $500 million per year in lost production.



[1] The Karachi metropolitan area has been spared of some of the worst load shedding. But due to delays in the city's utility construction program, extensive load shedding is expected during FY 1993. Cooling loads can be as high as 1,200 MW and strike during summer months when turbines are operating well below their rated power output.

Pakistan's total utility power generation capacity at the end of 1991 was about 9,209 MW, which is very small for a country of some 109 million inhabitants.[2] Pakistan's largest utility, the Water and Power Development Authority (WAPDA), accounted for about 7,147 MW (78 percent) of utility generation; the Karachi Electricity Supply Corporation (KESC) accounted for about 1,905 MW (21 percent); and the Karachi Nuclear Utility Plant (KANUP) 157 MW (under 2 percent). Of this utility-based capacity, about 32 percent is derived from hydroelectric projects, 40 percent from oil or gas-fired steam plants, 22 percent from combustion turbines, 4.5 percent from combined cycle plants, and 1.5 percent from a nuclear power plant in Karachi. To supplement its utility generation, the country has industrial cogeneration and captive power production of about 1,500 MW.

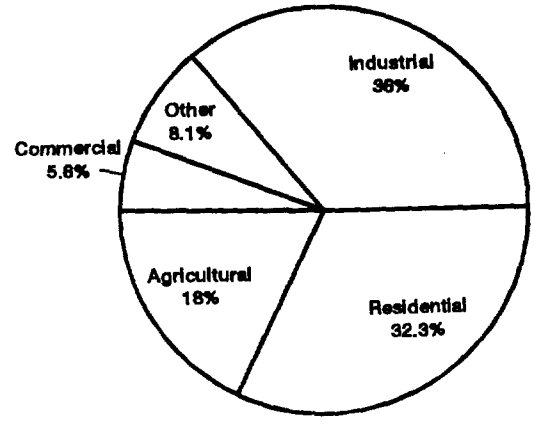
Pakistan's total demand for electric power capacity is expected to continue growing and will reach nearly 18,910 MW by the end of this century, leading to a doubling of demand in the 1990s. Experts predict that Pakistan will require electricity sector investments of $1.5 to $2.5 billion annually just to keep pace with rising demand.

Industry accounts for most of Pakistan's electricity consumption, followed by the residential sector.

Pakistan's transmission and distribution system is very large. The size of the system is partly the result of having to link seasonal, hydroelectric resources in the north to thermal capacity in the south in order to improve the reliability of the system as a whole. The grid consists of over 23,000 km of transmission lines ranging from 60 kV to 500 kV, the longest contiguous transmission system in Asia. (Only 7.5 million customers are currently connected to the system, however.)

The country's losses in transmission and distribution are very high. For

Electricity End-Use Consumption in Pakistan, 1992-1992:
Share of Total Generation



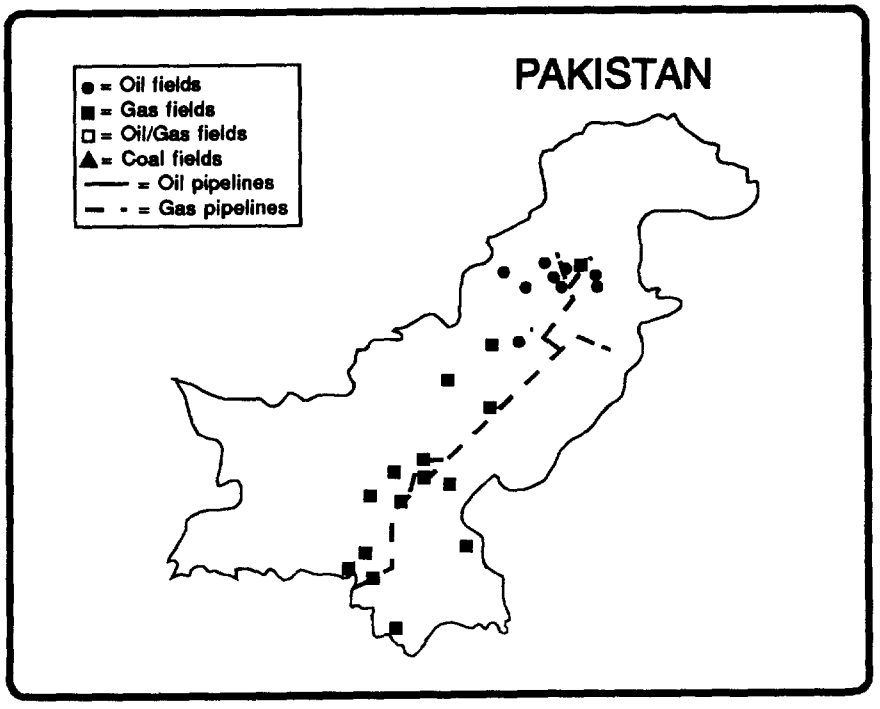
Source: WAPDA, Planning Department,

[2] Mexico, for example, has installed some 26,000 MW of electric generating capacity serving some 85 million people.

WAPDA and KESC, these losses are currently on the order of 20 and 26 percent, respectively. The Government of Pakistan is addressing these problems with loss reduction programs that aim to reduce current loss levels to around 18.5 percent by 1998.

Resources

Pakistan is an oil importing nation that is trying to attain greater energy self-sufficiency by overcoming some of the institutional, financial, and political hurdles that have left its energy resources under-developed. These resources consist of hydropower (abundant), natural gas (moderate supplies), oil (relatively few supplies), coal (relatively few supplies) and alternative resources including biomass, wind and solar (relatively abundant). None of these resources is well developed.



Pakistan's Fifth and Sixth Five-Year Plans (FY 1979-FY 1988) missed their targets for domestic energy resource development. Pakistan fell short of its goals because of constraints in implementation and in project financing. Efforts to attract private risk capital (from abroad) have been slow, partly because of the high perceived risks of doing business in Pakistan. In addition, this country has had particular difficulty in obtaining some of the provincial/central government compromises necessary to move hydropower projects out of the feasibility stage.

Hydropower. Like India, Pakistan presses up against the highest mountain ranges in the World. Snow melt from the Himalayas offers substantial opportunities for hydropower development. Pakistan's potential for large hydro alone is estimated at between 30,000 and 40,000 MW. Using the more conservative 30,000 MW figure, Pakistan has developed less than 10 percent (2,900 MW) of this potential resource. Projects currently under development in the 1990s will contribute another 6 percent (1,928 MW) of the total potential.

This pace of development is not nearly as rapid as it could be, not only because of the long lead times that hydro projects typically require but also because of provincial/federal-government conflicts over the distribution of benefits from hydro projects (chiefly in terms of revenues from sales) and the country's seeming inability to adequately address environmental impacts (such as rising water tables and consequent increased salinity). The permanent deferral of the huge Kalabagh Dam, a 2,400 MW project, is the result of some of these contentious issues.

Pakistan is now considering importing hydroelectricity from Central Asia. Talks on this matter with Tadjikistan, for example, are fairly advanced. Because of political and geographical difficulties, Central Asian hydropower is unlikely to be a bargain.

Natural Gas. Pakistan's proven natural gas reserves are estimated at about 22.6 trillion cubic feet (tcf). Annual natural gas production has grown from 235 billion cubic feet (bcf) in 1981 to nearly 519 bcf in 1991.[3] Most Pakistani gas fields lie on-shore in southern Baluchistan, a province in western Pakistan bordering Afghanistan and Iran.

Pakistan is trying to boost its gas production to meet growing demand and to compensate for the depletion of some of the country's most productive gas fields. The Sui

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[3] British Petroleum, *Statistical Review of World Energy*, June 1992.

gas field, for example, is Pakistan's largest source of natural gas and is already more than 55 percent depleted. Promising new finds both on and offshore in Baluchistan could improve the gas supply situation, but the government is not waiting to find out: it is actively exploring possibilities for natural gas imports from neighboring countries.

Pakistan is considering importing gas from Qatar[4] and Iran, and more recently, from the newly independent Central Asian Republics. An ambitious pipeline construction project connecting Pakistan directly to Qatar is currently under consideration. If approved, it would be undertaken by the private sector with some World Bank funding and would represent Pakistan's biggest-ever energy project. The project would eliminate many of the gas-supply bottlenecks in Pakistan, and the government hopes it will be in place by the mid-1990s.

Oil. Pakistan's crude oil reserves have shot up in recent years, but production considerably lags demand. Its proven recoverable petroleum reserves at the beginning of 1991 were about 119 million barrels of crude oil, although these estimates vary considerably depending on the source of information.

Pakistan is an oil importer whose imports met only 26 percent of its crude and refined-product requirements in 1991. Although the country has successfully boosted the domestic production of crude from 3.65 million barrels in 1980 to 22 million barrels in 1991, there is concern that the growth of oil consumption in Pakistan in the 1990s is picking up too quickly, threatening to negate some of the gains in self-sufficiency that were achieved in the 1980s.

Petroleum consumption in the electric power sector, for example, is on the rise, having jumped 60.6 percent in the 1980s. Today, about 40 percent of installed generating capacity is oil-fired (or dual oil/gas-fired). A substantial share of the fuel oil is imported: Pakistan imports about 45 percent of its heating oil, kerosene, and diesel fuel, primarily from Gulf states.

Pakistan's refined capacity is limited to about 60 percent of domestic needs. This requires substantial volumes of petroleum product imports every year (33.7 million barrels in 1991). Partly in response to price surges during and after the Iraqi invasion of Kuwait, the

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[4] Private sector interests submitted to the World Bank a proposal for loan assistance to build a pipeline connecting Qatar's gas resources to Pakistan.

Government of Pakistan (GOP) has accelerated its plans to build additional refinery capacity with projects in Port Qasim, Multan, and Badin.

To control the impact of oil on the country's balance of payments (a $1.6 billion hit in 1991), Pakistan is trying to boost production by engaging private sector companies in exploration, drilling and extraction. The principal foreign operators in Pakistan include BP Exploration, Albion International Resources, and local subsidiaries of Texaco, Amoco, Occidental and UNOCAL. Many firms have concessions for exploration, and some important finds near the capital of Islamabad were announced in the summer of 1991.

Coal. Pakistan's coal and lignite deposits are estimated at about 900 million tons, of which 175 million are proven and recoverable. Domestic coal resources are considered to be low quality because of their high ash and sulfur contents. The GOP has neglected coal resource recovery, and Pakistan's limited use of coal is the result (around 268,000 tons in 1991). This supply is primarily used by the brick industry, while imported coal is used by the steel industry. The utility industry uses very little coal. Recently, coal has been found in the Thar Desert, but commercial production is unlikely in the near future.

A number of factors account for the underutilization of coal in Pakistan. One of the principal of these is the government's pricing policies before 1985 when oil and gas prices were kept low. With pricing reforms, coal is now competitive in terms of thermal capacity, but problems remain. One of these is a market problem. Today, the economy is designed to run on other fuels than coal because coal has not been readily available. This slack demand has partly contributed to a further lack of interest in developing coal resources.

The GOP has also traditionally discouraged private sector exploration and mining. Various laws and regulations discouraged private investors and the Pakistan Mineral Development Corporation (PMDC), a government-owned enterprise, has not always favored private exploration. Present trends suggest that it will take Pakistan considerable time before its coal production is substantially stepped up.

Alternative Fuels. Although fuelwood and agricultural and animal waste provide a major share of Pakistan's energy needs in rural areas, their contribution to rural energy could decline 20 percent over the 1990s simply because of the depletion of forests. Although wind, solar and micro hydro resources appear to be fairly abundant in some regions of the country, Pakistan does not have an aggressive program to develop them.

Government Institutions

Pakistan has no private utilities at this time. Two public sector enterprises carry out almost all of Pakistan's electric power generation and transmission functions: the Water and Power Development Authority (WAPDA) and the Karachi Electricity Supply Corporation (KESC). WAPDA, the dominant national electric utility, is responsible for four-fifths of all power produced in Pakistan. KESC, a partially "privatized" firm,[5] supplies metropolitan Karachi and the surrounding industrial areas. The Karachi Nuclear Utility Plant (KANUP) is a small nuclear utility (157 MW) that sells its output directly to KESC. In about three years, a fourth utility, HUBCO (Hub Power Company), may become Pakistan's first private utility. It will responsible for managing Pakistan's first private power project -- the 1,292 MW Hub River complex. In addition to these power companies, new government organizations have been established to facilitate private power project development.

Water and Power Development Authority (WAPDA)

WAPDA remains the institutional underpinning of the Pakistani electric power sector. Besides the generation, transmission, and distribution of power, WAPDA's responsibilities include irrigation, water supply, and drainage; water-logging, salinity, and flood control; and internal navigation of Pakistan's rivers. It is the largest civil organization in the country and employs more than 153,000 persons, of which only some 5,500 are professionals.

Administratively, WAPDA is divided into three branches, or "Wings" -- Power, Water, and Finance -- each of which is headed by a member who reports directly to the chairman of the Authority. The Power Wing is largest in terms of revenues, budget, and staff, accounting for about 84 percent of WAPDA's total workforce. The Power Wing has two managing directors, one for transmission and grid stations and the other for distribution issues. The head of distribution has seven general managers who head the departments of planning, engineering and standards, administration, finance, operations, purchasing and inventory control, and management and customer services. The General Manager (Operations) has eight Area Electricity Boards under him that consist of officials from WAPDA as well as other public organizations. Similarly, each area has its own chief engineer who oversees the planning, development, construction, and operation of various power projects.

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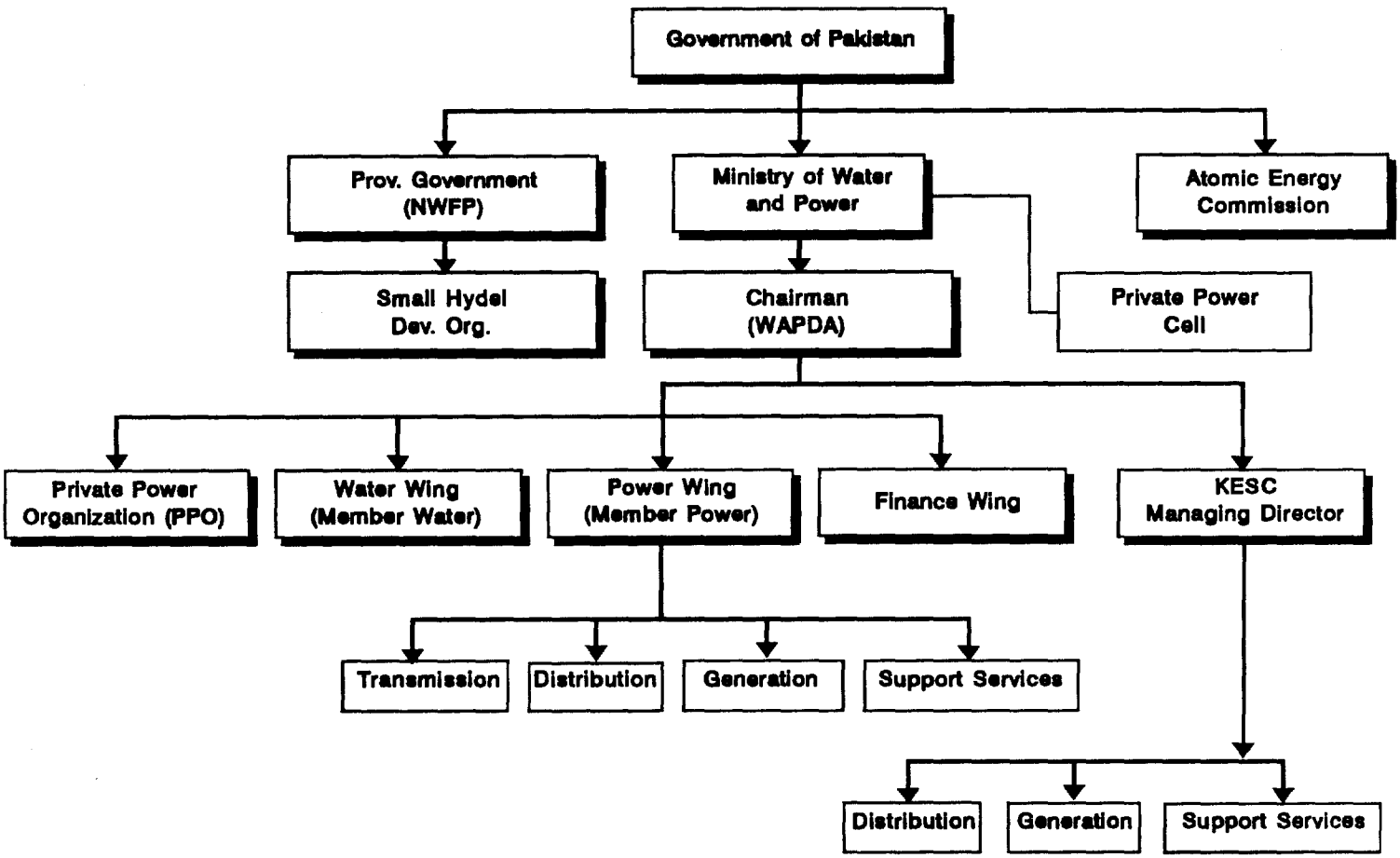
[5] About 7 percent of KESC's stock is publicly traded on the Pakistani stock exchange.

Organizational Structure: Pakistan's Power Sector



Funding for WAPDA comes from federal and provincial government grants and loans, sales of WAPDA bonds issued by the government, loans from other sources obtained under government sanction, grants and loans from international donor agencies as approved by the government, power sales, and other government revenues. WAPDA also pays for a portion of its own budgetary requirements out of its revenues, which the government pre-determines each year.

The WAPDA Annual Development Program for 1989-90 called for expenditure of $819 million, the power sector's share of which was some $720 million, or 87.9 percent of

the total. This includes a foreign loan component of $331 million and a self-financed component of $268 million. WAPDA typically recovers only 40 percent of its costs through tariffs; the rest comes from loans or central government subsidies.

Government Institutions in Private Power

In November 1985, the GOI established a Private Power Cell (PPC) in Islamabad that is under the jurisdiction of the Directorate General of the Ministry of Water and Power. The government established this agency to promote, evaluate, and negotiate private sector investments in the electric power sector. PPC reviews private power feasibility studies and negotiates the principal agreements, tariffs, and implementation timetables for all private power investments (in collaboration with WAPDA). It also acts as a one-stop shop for obtaining information pertinent to developing a private power project.

Pakistan's National Development Finance Corporation (a national development bank based in Karachi) established a special unit in 1988 to oversee the newly established Private Sector Energy Development Fund (PSEDF). PSEDF is a multilateral fund that provides co-financing for private power projects (see box on the next page). This unit, called the Private Energy Division or PED, reviews the technical and financial viability of projects and administers the PSEDF.

WAPDA also has a private-sector component. Called the WAPDA Power Privatization Organization (WPPO), this unit is based in Lahore and is responsible for negotiating and administering various power purchase agreements. The WPPO works in cooperation with the PPC because power purchase agreements are with WAPDA, not the federal government. (On a case-by-case basis, the government will guarantee WAPDA's power-purchase agreements.)

Private Participation in Power Generation

Pakistan is the first country in South Asia to promote private projects. Starting in 1985, the government began to develop the necessary framework and to grapple with the numerous institutional issues that are involved. Private power is now considered an essential strategy for meeting projected electricity demand in Pakistan. At present, the private sector can establish power plants with as little as a 20 percent equity commitment from the developer. The plant can be fueled by fuel oil, coal, low-calorific gas, or hydropower.

The PSEDF: Multilateral Funds for Private Power

The World Bank and other lenders are supporting Pakistan in attracting private capital to the power sector. The Private Sector Energy Development Fund (PSEDF), an innovative fund designed to give private power developers in Pakistan greater access to capital and some diminution of risk, is a key element in the Pakistan Government/World Bank strategy to promote private power.

The fund, operated under sovereign guarantee by Pakistan's National Development Finance Corporation (NDFC), provides loans at Pakistan's prevailing market rates on a fixed basis. These resources are attractive because financing can cover up to 30 percent of total project costs with up to 23 years' maturity and up to 8 years' grace period. Debt obligations arising from PSEDF lending are subordinated to commercial banks and export credit. Japan, the U.S., the U.K. and Italy are just a few of the co-financiers that have contributed to the fund, a resource which runs in the hundreds of millions of dollars.

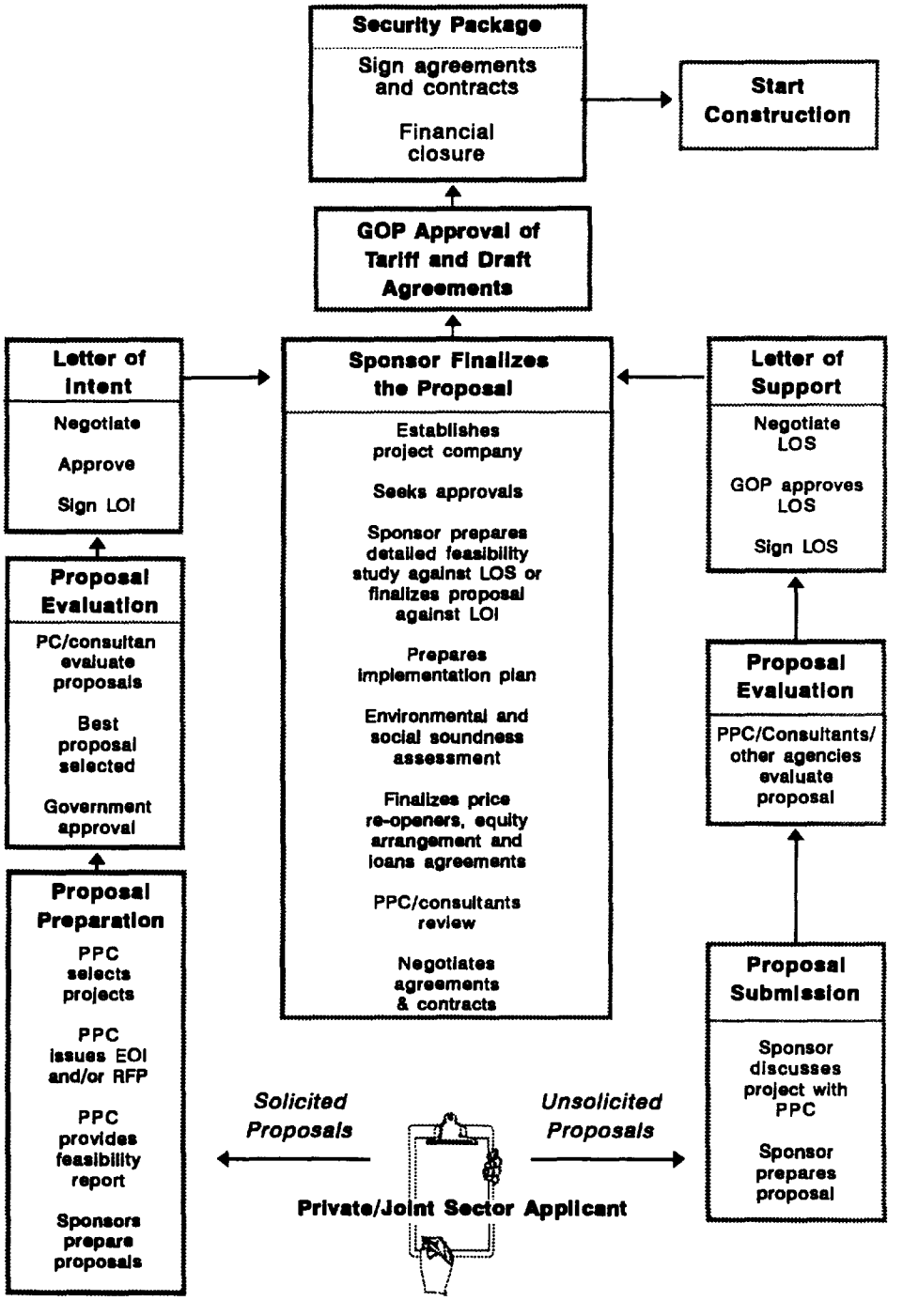
The Hub River Project, discussed earlier, shows how important the PSEDF can be in helping projects go forward in Pakistan. The PSEDF provides up to 30 percent of total project costs, or in Hub's case, about $350 million.

Other projects being considered include 525 MW units in northeastern and southern Baluchistan, a 135 MW gas-fired plant in southern Punjab, a 350 MW oil-fired plant near Karachi, two domestic coal projects (300 MW), and a proposed 100 MW low quality gas-fired combined cycle plant. However, the PSEDF will need replenishment if it were to provide funding for these projects.

A new pool of funds now exists for financing private projects. With support from international donor agencies such as the World Bank, the government has established the Private Sector Energy Development Fund (PSEDF) to provide about $600 million for financing some 2,000 MW of private power (box above). This and other incentives, such as guaranteed power purchases and fuel supplies, tariff indexation against inflation

Pakistan

Typical Project Stages



and devaluation, and favorable tax and other credit arrangements, have elicited private sector interest.

Various private power joint ventures have been approved, of which the Hub River project is the largest and most prominent. This ambitious project, which has taken over five years to negotiate, is a pioneering effort (see box).

Hub River and the Shariat Law:
How Risky is Private Power Development in Pakistan?

The story of private power in Pakistan is the story of Hub River, a project which could make or break large-scale private power in Pakistan. The complex $1.8 billion deal appears to have come to fruition after almost five years of intense negotiations.

No obstacle to closure has been greater than the Shariat Law, a newly resuscitated Islamic law that prohibits charging interest rates. This law is now before the country's Supreme Court for approval. If approved, this unforeseen wrinkle in private power financing could stop development.

There are, however, ways around the Shariat restrictions. Returns on investment are allowed, for example; interest rates *per se* are not. For this reason, commercial bankers are more concerned with the issue than equity investors, for example.

In the meantime, the World Bank has stepped in to bring down the added risks that the Shariat poses to the project. The Bank has developed an innovative component called "enhanced co-financing," which covers half of the commercial bank exposure on the down side of the Shariat and other sovereign risks of major concern to investors and lenders.

Pakistan

Several substantial risks remain for private power participants in Pakistan. Of these, the prospect of the Pakistani Supreme Court upholding the country's Shariat (Islamic) Law, which forbids transactions using interest rates, presents one of the greatest project risks to developers (see box). (This is the reason for some recent negotiating delays on the part of Japanese financiers.) Another risk arises from the lack of law and order in some parts of the countryside. Further, the usual foreign exchange rate risks associated with developing countries certainly apply in Pakistan. Among these, devaluation of the currency, timely repatriation of earnings, and currency convertability are of concern. Pakistan does offer foreign exchange insurance that can be purchased by project developers, but it may not be adequate to address this risk.

These risks have been addressed in the government's "security package" which is designed to reduce these perceived and real risks. This package, which is subject to negotiation on a case-by-case basis, will provide better management of sovereign risk, non-payment from WAPDA, protection against changes in taxes and duties, indexation of the power purchase price to protect against inflation in specified costs, indexation to protect against devaluation, guaranteed convertability, guaranteed power purchase agreements, and guaranteed fuel delivery if provided by a government-owned entity. Developers and project financiers will, of course, want to examine this package carefully.

Current Situation

Pakistan's current policies seek to meet the investment requirements and consolidating the gains made in the development of private power projects. This will mean continuing to attract private capital into the power sector. The Pakistani Government is focusing on:

- ☐ implementing rapid thermal and hydroelectric capacity additions
- ☐ continuing the increased role of private power participation
- ☐ developing indigenous fuel supply and improving the distribution network
- ☐ promoting industrial cogeneration.

Pakistan's electric power expansion plans, though ambitious, are underfunded. Government financial sources are not sufficient to meet the requirements of building nearly 10,000 MW of new electric generating capacity by 2000, the governments' stated goal. These additions would greatly alleviate the peak power shortages faced by most regions of the country.

The public sector will provide the majority of the investment required, according to the Eighth Five-Year Plan (1993-1998). The Plan estimates that power generation equipment and related services during the same period will amount to nearly $10.6 billion. The government has slated almost 74 percent of spending to be for thermal power generation, with the remaining 24 percent on hydro schemes. This action is in part due to the incessant power shortage. As before, the multilateral banks, bilateral agencies and private capital flows are expected to contribute significantly to the Eighth Plan.

The Pakistani power sector faces many challenges. Like India, it also suffers from subsidized power tariffs, especially in the agricultural sector. Low thermal plant load factors, poor site selection for plants, high transmission and distribution losses (technical and theft), unbalanced investment (skewed in favor of new generation capacity at the expense of O&M, transmission, distribution and rehabilitation), inefficient bill collection, and aggressive rural electrification schemes also present problems to the country.

Similarly, KESC's thermal generation capacity is being augmented by 420 MW in additional units at its Bin Qasim thermal station, a 70 percent increase. In the Eighth Five-Year Plan (1993-1998), the total national power generation capacity is projected to rise to 16,735 MW, with 12,908 MW and 2,535 MW coming from WAPDA and KESC, respectively, and 1,292 MW of private power.

In addition to some of these thermal project, long-term plans in hydro have included the construction of 2,400 MW and 4,500 MW hydroelectric dams at Kalabagh and Basha, respectively, and the subsequent expansion of Tarbela's capacity by 1,200 MW. (Tarbela is Pakistan's largest hydroelectric installation.) Other major sites identified for hydroelectric generation include Dassu (2,700 MW), Thakot (2,400 MW), and Ghazi-Ghariala (1,600 MW).

Some of these hydro projects may never materialize because of the numerous obstacles discussed earlier. The development of other hydroelectric projects on the Indus River is expected to take at least 8 to 10 years, with the exception of the Chashma and Ghazi Ghariala projects, which are expected to come on line by 1998.

The Government of Pakistan and the World Bank are currently developing projects to improve and accelerate the development of indigenous hydrocarbons, utilizing private funding resources to the maximum extent possible. Other objectives include improving the commercial orientation of SNGC and OGDC public sector enterprises. These proposed

institutional improvements are expected to pave the way for an increased private sector role in the power sector.

Projects such as the Dhodak-Kot Addu pipeline, which would carry about 45 MMcfd of natural gas and the Qadirpur gas pipeline for WAPDA'a Kot Addu power station, would greatly assist in the rapid substitution of imported high-speed diesel. The World Bank is also financing WAPDA's conversion of Kot Addu's combustion turbines to use natural gas.

Besides the construction of new, private power projects, the GOP hopes to sell off some of WAPDA's generation and transmission assets, a move that is under the purview of the government's Privatization Commission. The result is a plan that calls for WAPDA's gradual privatization in four phases (1991-92, 1992-94, and 1994-96, with 1996 to be determined). One draft of the Plan called for first privatizing the Jamshoro thermal power plant (880 MW), followed by the privatization of electricity distribution operations in the Faisalabad region. Other reports suggest that WAPDA's thermal capacity could be privatized in one fell swoop. The magnitude of such a privatization would be large: in 1990, WAPDA's fixed and total assets amounted to $4,170 million and $5,035 million, respectively.

New laws now permit private captive generation. Pakistan's 56 or so industrial estates (industrial parks) are prime candidates for self-generation. Some 16 of these already produce their own power, and 29 of the remainder are linked to natural gas, which could be used to fuel small power installations. The textile industry is leading the way in captive power generation using heavy duty diesel generator sets.

External Assistance to the Power Sector

International donor agencies, both multilateral and bilateral, play an important role in the Pakistani power sector, with multilateral banks being pre-eminent. Funding from all major sources from 1990 to 1992 amounted to nearly $539 million for the entire power sector. Lending for power generation equipment amounted to some $367 million, or almost 68 percent of total lending.

External multilateral and bilateral support for the development of Pakistan's power sector has played a significant role in the historic development of the sector. During the 1990 to 1992 period, bilateral flows leading to the installation of power-generation equipment amounted to some $401 million.

The World Bank. The World Bank is the largest lender to Pakistan and also has the ability to attract private capital by reducing investor risks. For example, through the World Bank's "enhanced co-financing (ECO)" in which 50 percent of commercial bank exposure is guaranteed; and through support to the Private Power Energy Development Fund (PSEDF) discussed earlier, the Bank is easing the way for private investment in Pakistan's power sector. (Although the Bank's International Finance Corporation (IFC) has not yet been involved in Pakistani private power, it may well be in the future.)

Multilateral Assistance to Pakistan for the Power Sector - FY 1990/91-1992/93, ($ million)

Source	T&D	Hydro	Steam Turbine	Gas Turbine/ Comb. Cycle	Total Commitment
World Bank	72	0	190	28	290
Asian Development Bank	86	77	16	51	230
International Dev. Association	8	0	0	0	8
European Community	6	0	0	0	6
UN Development Programme	0	5	0	0	5
Total	172	82	206	79	539

Source: The World Bank, Asian Development Bank, European Community, and United Nations Development Programme, October 1992.

Germany and Japan. Among the 14 countries providing foreign aid, Germany's contribution of nearly $140 million went towards the installation of a hydro turbine and combustion turbines for a combined cycle plant. Overall, German aid commitments are expected to be similar in magnitude to World Bank project loans during FY 1990-1993. The following table shows these figures broken out in detail by country and by power generation equipment.

German and Japanese aid correlates weil with their important market presence in Pakistan's power sector. Both countries have closed some important deals such as the 300 MW combined cycle addition at Guddu (a deal worth $120 million), the 450 MW combined

cycle gas and steam plant for WAPDA at Kot Addu in Punjab (also supplied by Germany), and the 250 MW Jamshoro 1 steam plant (financed with a Japanese $141 million soft loan).

Bilateral Assistance to Pakistan for the Power Sector - FY 1990/91-1992/93
($ million)

Source	T&D	Hydro	Steam Turbine	Gas Turbine/ Comb. Cycle	Total Commitment
Germany	83	34	0	106	223
Japan	84	0	28	0	112
Russia	0	0	107	0	107
Canada	7	24	19	0	50
China	0	0	45	0	45
USA	25	0	2	0	27
France	4	10	0	1	15
UK	0	0	0	13	13
Other*	11	6	0	6	23
Total	214	74	201	126	615

* Other includes Belgium, Czechoslovakia, Italy, Norway, Switzerland and Sweden.

Source: Government of Pakistan, October 1992.

United States. The U.S. has not captured a major electric power sale in Pakistan since 1986. This may be in part attributed to an end to U.S. bilateral aid to Pakistan. In 1990, Congress found Pakistan to be in non-compliance with U.S. nuclear non-proliferation legislation governing foreign aid disbursements. As a result, further U.S. assistance to Pakistan has been suspended.

This contrasts markedly with the 1980s when U.S. aid flows had been substantial in an attempt to buttress its efforts against the Soviet invasion of Afghanistan and to help Pakistan cope with a huge influx of Afghan refugees. Power sector assistance in the 1980s

included financing for the 450 MW combined cycle Guddu power station, energy efficiency, and institutional developments relating to private power development. General Electric provided the gas turbines, steam generator systems, turnkey engineering services and construction supervision for this plant.

The U.S. has also played an important role in laying some of the institutional groundwork for private power in Pakistan. USAID has provided assistance to the Government of Pakistan in designing and evaluating private power proposals such as the Hub River project. This support continues in order to honor past commitments, but no new funding has been made available to Pakistan. However, the U.S. is succeeding in transferring needed skills which the GOP will need for private power to move forward.

Environmental Considerations

As in many developing countries, environmental considerations are becoming more and more important in Pakistan. For example, one reason for moving Pakistan's largest proposed private power development project to Hub River in Baluchistan was to avoid further polluting Karachi, a megalopolis with serious air pollution problems. Karachi was, however, the original site for a 600 MW component of the 1,300 MW oil-fired project.

Hub River and any other private and public projects with World Bank participation routinely require compliance with the Bank's environmental standards. (The reporting requirements for private developers are discussed in the following box.)

An increase in oil-fired capacity may contribute to increased levels of power plant emissions. (Oil-fired capacity is projected to grow to a 45 percent share of total capacity by 2000.) Fuel oil in Pakistan is highly polluting as a result of its 3.5 to 4 percent sulfur content. Oil-fired plants are concentrated in the Jamshoro area, with another 300 MW scheduled for Bin Qasim. Hub River, nearly 1,300 MW, will also be oil-fired, and Muzaffargarh will have a 630 MW oil-fired plant by 1994. According to recent reports, many of these plants do not have provisions for desulfurization (the installation of scrubbers).

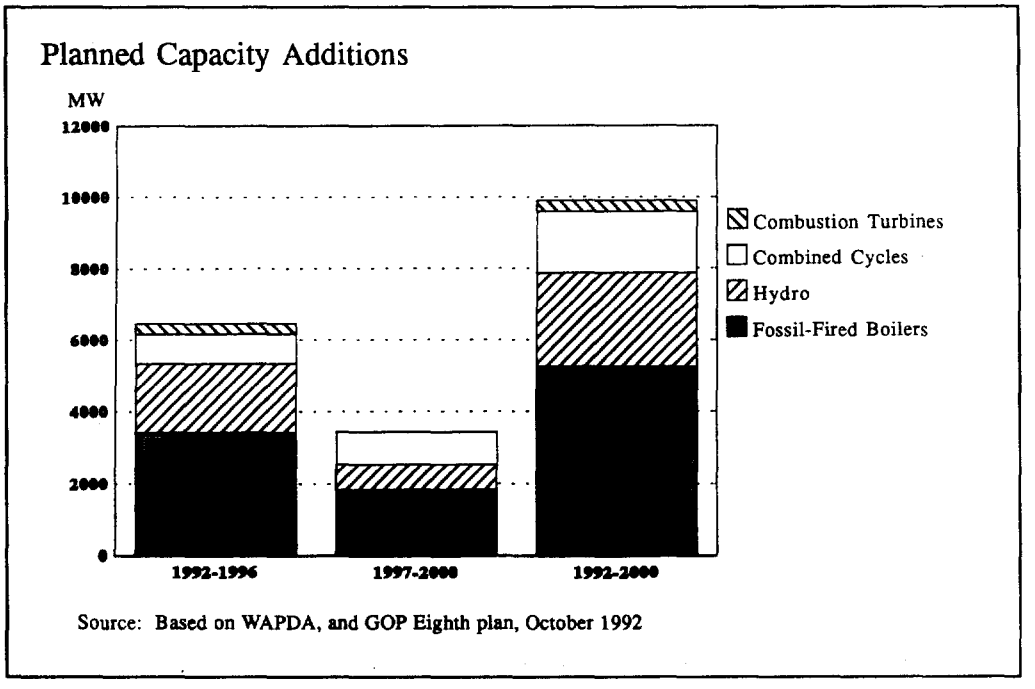
Environmental Regulations for Private Power Developers in Pakistan

Private power developers must complete an "Environmental and Social Soundness Assessment." This assessment requires:

1. a description of the affected environment
2. a description of the proposed project
3. an analysis of impacts including the collection of at least one year of regionally representative meteorological baseline data, the collection of on-site water quality data, an analysis of potential socio-economic impacts of the proposed project, an analysis of required resettlement of local inhabitants, and a review of the handling of hazardous materials during construction (PCBs are prohibited)
4. a mitigation plan (where resettlement is involved, this must include a resettlement plan)
5. an evaluation of the mitigation plan in terms of cost, duration, and other factors
6. the development of a monitoring plan to assure continued environmental compliance.

Power Sector Market Assessment

During the 1992-1996 period, 6,465 MW of new electric power generation capacity are likely to be added in Pakistan. These additions consist of 3,412 MW of fossil-fired boilers (53 percent), 1,928 MW of hydro units (30 percent), 825 MW of natural gas-fired combined cycle units, and 300 MW of combustion turbine peakers (together 17 percent). During this time period there, are no generating units scheduled for retirement.



Several of these projects are currently under various stages of planning and implementation. These include the 1,728 MW hydroelectric capacity expansion projects at Tarbela and Mangla dams, 630 MW of oil-fired units at Muzaffargarh, 150 MW of coal-fired fluidized bed combustion boiler units at Lakhra, 80 MW of natural gas-fired combined cycle plants at Faisalabad and Kotri, and a 415 MW block extension at Guddu station. These additions would raise WAPDA's electric power generation capacity to almost 10,200 MW by June 1993. Further thermal plant addition will increase WAPDA'a capacity to nearly 12,900 MW by the end of the Eighth Plan (1998).

Similarly, KESC's thermal generation capacity is being augmented by a 420 MW fossil-fired boiler unit addition to its Bin Qasim thermal station. KESC's long-term plans include the construction of 2,400 MW and 4,500 MW hydroelectric dams at Kalabagh and Basha, and the expansion of Tarbela's capacity by 1,200 MW subsequently. Other major sites identified for hydroelectric generation include the potential to develop 5,500 MW at Dasu, 2,400 MW at Thakot, and 1,000 MW at Ghazi-Ghariala. KESC plans to own close to 2,535 MW of electric generating capacity by the end of the Eighth Plan (1998).

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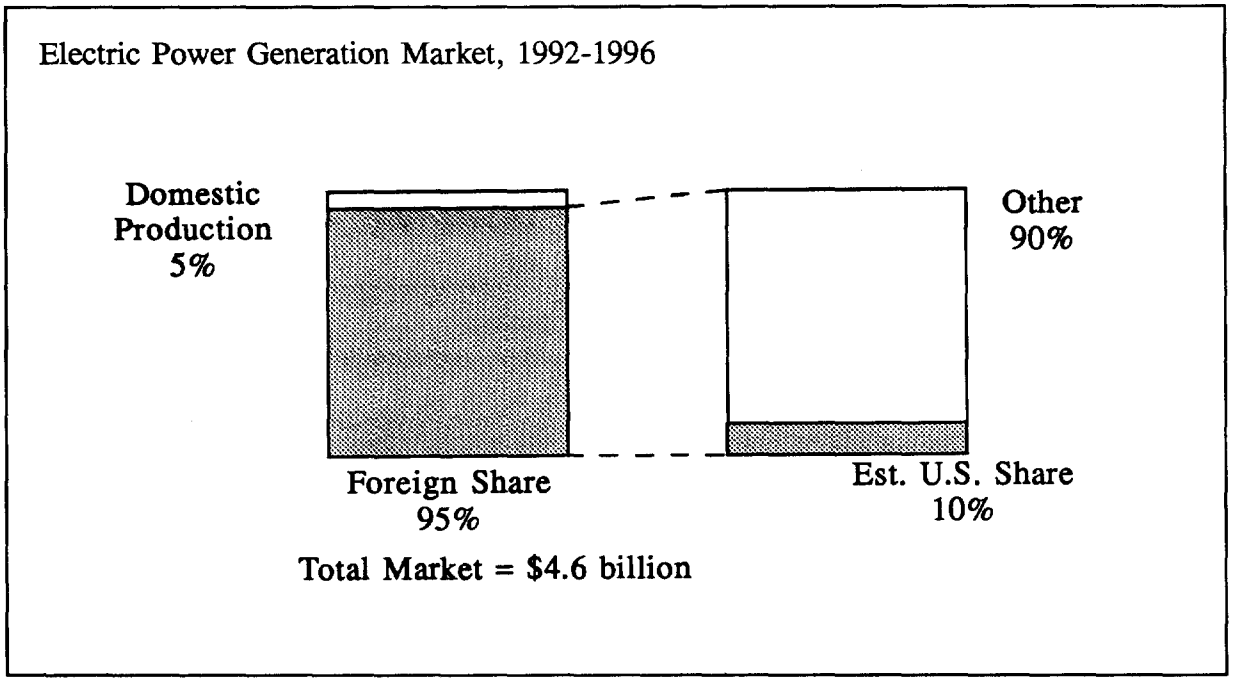
While a great deal of preparatory work has already been completed for the Kalabagh Dam, the project is not in the active construction phase as some aspects of the inter-provincial agreements relating to damages associated with rising water levels and the distribution of revenues and benefits remain unresolved. The development of other hydroelectric projects on the Indus river is expected to take another 8 to 10 years, with the exception of the Chashma and Ghazi Ghariala projects, which are expected to come on-line by late 1998. In the short term, the country will continue to face power shortages of the order of 5 percent or more of the available installed capacity and must rely mainly on the rapid additions in dual oil/gas-fired combined cycle power plants.

For the period 1989-1992, the Pakistani power generation equipment market has averaged at $536 million per year, with hydroelectric units accounting for 8 percent, and thermal for 92 percent of total investment. The investment in thermal plants has been 37 percent for steam, 22 percent for gas turbines, 7 percent for coal, and 16 percent for combined cycle power plants. Investments are projected to increase from $540 million in 1993 to about $2.3 billion in 1995. The sharp rise in investments in the power generation sector is due to major capacity additions in steam plants including the Hub River project and large-scale hydro projects such as Chashma and Ghazi Ghariala dam projects.

Pakistan imports most of its utility-scale power generation equipment. This trend is not expected to change in the near future: a 95 percent share of the estimated $4.6 billion Pakistani power generation and equipment market anticipated through 1996 will be imported.

Strong ties with European suppliers and emerging relationships with Chinese and Japanese firms imply that U.S. firms will have to compete intensely for orders (the U.S. can expect to hold a 10 percent market share -- about $437 million -- of the foreign market. It is worth noting that at present Pakistan does not have a single major equipment order under contract with a U.S. firm. However, U.S.-based consulting engineers, K&M Engineering and Consulting, Inc., is participating in the 1,300 MW Hub River private power project. Further, U.S. firms have been active in developing work from WAPDA in the areas of regulatory analysis, privatization and management consulting through the World Bank and USAID.



Domestic Competition

The ability of Pakistani industry to manufacture power generation equipment is limited. The country's manufacturing capability consists of high-pressure boilers and components for hydroelectric turbine units. The Heavy Machinery Complex (HMC) headquartered near Islamabad produces power boiler and hydro turbine components. HMC was formed in 1971 as a subsidiary of the government-owned State Engineering Corporation, which owns the majority of Pakistani heavy manufacturing industry. HMC also produces equipment that serves the sugar, cement, railways, and road construction industries. In recent years, HMC's capacity utilization has been low, ranging from 40 to 60 percent of total capacity. HMC employs approximately 175 engineers, 3,000 technicians and semi-skilled workers, and 75 management support staff. The firm's annual sales revenue is estimated at $50 million.

HMC entered into the Pakistani power generation equipment market during the Sixth Plan (1983-1987) by signing a collaborative agreement with Deutsche Babcock (Germany) and Sulzer Escherwyss (Switzerland) for the manufacture of boilers and components, and the

fabrication of smaller hydro turbine components, respectively. The following exhibit summarizes HMC's power generation equipment manufacturing in progress:

Summary of HMC's Current Order Book

Project/Client	Equipment Supplied	Approximate Value
Bin Qasim thermal Power station, Units 3,4 for WAPDA	convection tube banks, superheater, reheater, economizer coils and headers	20 percent of total project
Miscellaneous projects* for Northern Area Public Works Department	250 to 500 kVA generator units for 32 mini hydel schemes	not available
WAPDA	4x1 MW Pelton type turbine and components such as penstocks, sliding gates, crane and transformers	$1.5 million or about 65 percent local content

Note: * HMC, in collaboration with Biwater Limited (U.K.), was awarded a contract to supply 32 mini hydel schemes in the northern region.

Source: Staff interviews with HMC, Islamabad, October 1992.

HMC is planning to gradually increase its share of manufacturing through foreign technology transfer and training. HMC is acting as engineers and subcontractors for WAPDA's Bin Quasim Unit 5, which is being built by Marubeni (Japan), who also built Unit 1. Similar progress in capability is planned for the hydroelectric portion of HMC's business. Within two to three years, HMC plans to begin production of major hydro turbine components such as spiral casings, inlet pipe and draft tubes, expansion joints, head covers and wicket gates.

HMC executives are optimistic about the possibility of participating in the larger thermal and hydro projects in the future. HMC claims that customers such as WAPDA, KESC and private power developers would greatly benefit from local production of power

boilers, spares and engineering from a standardized design. Further savings to the power sector could be achieved in foreign exchange savings. However, issues such as performance guarantees, financing, investment in technology license and plant and delivery times are yet unresolved.

The exhibit on the next page provides an historical overview of the power generation equipment market for Pakistan for the 1987 to 1992 time period. It can be seen that European and Chinese suppliers enjoy a predominant position in the market. Each of these projects -- with the exception of the 2x100 MW combined cycle conversion for the Kot Addu station and the 2x40 combined cycle Kotri project -- were financed by foreign export credit agency programs. The Kot Addu and Kotri projects are funded by the World Bank and the Asian Development Bank, respectively.

WAPDA's giant 1,500 MW combined cycle Kot Addu station will be composed of mostly European-made combustion turbine and generator equipment. Italian made Fiat-GIE turbines under supplier credit arranged by the Italian government were contracted for in 1987. Following this delivery, Siemens-KWU and Alsthom combustion turbine equipment, supported by German and French supplier credit, were selected to provide the remainder of the equipment. General Electric bid unsuccessfully for the combined cycle expansion of the 450 MW Guddu power station, having supplied the earlier units under USAID assistance and loans from the Asian Development Bank.

On the private power development side, the signs for possible U.S. power generation equipment are not encouraging. The Hub station, Pakistan's first private wholesale electric power project nearing finalization, will comprise almost 1,300 MW of conventional oil-fired steam boiler generating units. The turnkey construction contract will be executed by a consortium made up of Mitsui & Co. (Japan), Ansaldo GIE (Italy), IHI (Japan) and Camperon Bernard (France). As export credit agencies are involved, the boiler and turbine generator sets will probably be supplied by Japanese, Italian and British companies. For the 135 MW Kabirwala power plant, a U.S. manufacturer (Westinghouse Electric) will supply the turbine generators.

Historical Overview of Selected Electric Generation Projects Undertaken in Pakistan

Project/Major Equipment	Commissi-oning Date	Major Supplier	Country of Origin	Approx. Equipment Value (Million)
3x210 MW M. Garh thermal power plant	1987	TPE	USSR	$250
4x100 MW gas turbines for Kot Addu station, Units 1 thru 4	1987	Fiat-GIE Siemens KWU	Italy Germany	$110
3x210 MW thermal Jamshoro power plant	1990-91	CMEC	China	$230
2x210 MW thermal Bin Qasim 4-5 power plant	1990-91	Ansaldo	Italy	$180
3x50 MW thermal Lakhra power plant	1992-93	Dong Fang	China	$70
4x100 MW gas turbines for Kot Addu Units 5 thru 8 and 2x100 MW combined cycle conversion	1988-89 under dev.	Alsthom	France	$93 & $135
2x100 MW combined cycle conversion of Kot Addu Units 1 thru 4 power plant	under dev.	ABB	Germany	$96
2x100 MW gas turbines and 100 MW steam turbine for combined cycle expansion for Kot Addu power plant	under dev.	Siemens KWU	Germany	$264
3 steam turbines (2x210 MW + 300 MW) for thermal M. Garh power plant	under dev.	CMEC	China	$255
2x100 MW gas turbines + 100 MW steam turbine for combined cycle expansion for Guddu power plant	under dev.	Siemens KWU	Germany	$160
2x40 MW steam turbines for combined cycle conversion at Kotri-Faisalabad power plant	under dev.	HPEEC	China	$70

Source: Based on WAPDA, trade publications, and industry estimates. Information on US$ value of equipment was made available for this study by WAPDA, October 1992.

Players in the Market: The Case of Hub

Some of the key players in Pakistan private power Hub Project are:

- ☐ The Government of Pakistan (Secretary of Power, WAPDA, Pakistan State Oil Company, and the National Development Finance Corporation)
- ☐ The World Bank (Asia operations; the International Finance Corporation is just beginning to enter the picture)
- ☐ Xenel Industries of Saudi Arabia (the lead developer of the Hub River Power Group or HUBCO (tied into the fuel supply contract for Gulf oil imports)
- ☐ Mitsui and Company of Japan (the most important developer after Xenel)
- ☐ British Electricity International of the U.K. (responsible for O&M)
- ☐ K&M Engineering of the U.S. (overall project manager and technical consultant)
- ☐ Various commercial banks (Citibank of the U.K. is the lead; Union Bank of Switzerland, Credit Lyonnais of France, Mitsui Bank of Japan, and Bank of Tokyo)
- ☐ European and Japanese equipment and services vendors (Mitsui, an equity partner, is also the lead contractor; Ansaldo of Italy will provide turbines and overall engineering; Ishikawajima-Harima Heavy Industries of Japan will furnish oil-fired boilers; and Campenon Bernard of France civil works and construction).

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Market Overview of Selected Private Sector Power Proposals

Project	Developer Team	Project Status	Country of Origin	Approx. Project Value
4x323 MW oil-fired Hub River power plant	Xenel, Mitsui, IHI, K&M Engineering, BEI	Loan appraisal in progress	Saudi Arabia, Japan, U.S.	$1,800 million
2x350 MW oil-fired Port Qasim (eventually at Hub) power plant	Fauji Foundation, Babcock & Wilcox, Can-American Holdings	Feasibility study in progress	Pakistan, U.K., UAE	$453 million
4x210 MW oil-fired Jamshoro power plant	Fateh Group	Feasibility study in progress	Pakistan	$883 million
415 MW gas-fired combined cycle Uch power plant	Tenaska Inc., Hawkins Oil & Gas Co., and California Energy Co.	Feasibility study in progress	U.S.	$432 million
525 MW gas/oil-fired combined cycle Uch II power plant	Power Development Co. Ltd., Energy Resources International Inc., Gibb & Hil Inc., Daelim	Feasibility study in progress	Pakistan, U.S.	$608 million
2x40 MW coal-fired Kalar Kahar Salt Range power plant	Inter Redec Group, Intrag Inc.	Letter of Intent or support issued	U.S.	$80 million
135 MW oil/gas-fired combined cycle Tehsil Kabirwala power plant	Intrag Inc., O'Brien Environmental Energy Inc.	Letter of Intent or support issued	U.S.	$164 million
6x600 MW coal-fired Gadani power plant	Shawinigan Integ	Feasibility study in progress	Canada	$1,160 million

Source: National Development Finance Corporation, Private Sector Power Projects, Karachi, Pakistan, RCG/Hagler, Bailly, Inc. Islamabad, Pakistan and compilation of trade literature, October 1992.

Of the nearly 22 projects being monitored by the National Development Finance Corporation,[6] at least five projects are being proposed by U.S. private power developers. Four of these five projects could include U.S.-made power generation equipment.

The first is the 415 MW dual oil/gas-fired combustion turbines project proposed by U.S. developers Tanaska Inc. and Hawkins, Inc. The feasibility study for this project will be completed by the end of 1992, with the financing expected to be concluded by the end of 1993. This project is likely to utilize the mixed credit facility of the US Exim Bank that was provided in FY 1991. The second is the 525 MW Uch II project in Baluchistan, which is also firmly being proposed with U.S. equipment -- six General Electric frame 9 series combustion turbines to be fired with natural gas and oil. The other proposals include the 80 MW coal-fired Kalabar Kahar Salt plant and the 105 MW combined cycle power plant at Tehsil Kabirwala.

Other prominent U.S. manufacturers active in Pakistan include U.S. diesel engine and gas engine generator makers such as Caterpillar and Waukesha. These firms are well represented in the 100 to 2,000 kW self-generation market. Both firms have been active in the market through local representatives who have developed a strong sales and service network. A USAID-sponsored loan program assisted both companies in consolidating their position in the market. The loan program provided financing for small and medium-sized industrial enterprises for the purchase of U.S.-built generator sets.

The following observations can be made based on the market assessment and discussions held with representatives of foreign companies operating in Pakistan.

Summary of Major Pakistani Power Sector Trends

Equipment Trends	▸ large steam turbine systems and combined cycle power plants are the primary focus of the market. ▸ In the long-term, hydro turbines and associated equipment markets will develop.

[6] NDFC is currently being assisted by USAID in evaluating private power/energy proposals.

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Market Players	▸ At present, European firms are dominant in gas turbine and combined cycle plants. Chinese and Russian firms have monopolized the large steam turbine market. ▸ U.S. and Japanese suppliers currently hold a negligible market share. ▸ The U.S. could play a major role in the market given that there are five projects under development by U.S private power developers, one of which has access to US Exim Bank financing.
Market Drivers	▸ For the 1987 to 1992 period, about 65 percent of all power generation equipment purchases have been arranged under European, Chinese and Russian equipment supplier credit. The multilateral development bank contribution represents the remaining 35 percent of the market. The European market share will remain steady, but Chinese suppliers, CMEC and Dong Fang are expected to eat into the Russian market share. ▸ Private power developers will influence the market towards the procurement of high-efficiency equipment. These machines may well be funded by export credit agencies, including the US Exim Bank, which has issued a commitment to the Ministry of Finance to assist Pakistani power projects.
Technology Trends	▸ WAPDA and KESC convey a preference for gas fired-combined cycle units. ▸ Chinese firms have clearly demonstrated a vast improvement in steam turbine generator technology. Observers believe that CMEC plant performance is comparable to U.S. and European suppliers.

Market Entry Strategy

Foreign direct investment in Pakistan totals approximately $300 million. Pakistani laws provide foreign investors with repatriation, national treatment, and other protection. The GOP also actively promotes foreign investment by offering various tax incentives, expedited approval processes, export processing zones, and other incentives. There are no restrictions on the share of foreign equity ownerships in most investments. However, bureaucratic obstacles still remain in Pakistan, and are considered to be a curb on the level of new investment. Further, little, if any, of the U.S. investment in Pakistan is in the power generation equipment and services area.

The government of Prime Minister Nawaz Sharif is committed to economic reforms, including the privatization of up to 115 public industrial enterprises, financial institutions and key utilities. Not only does this present opportunities for foreign investors, but it is also expected to cut down the amount of bureaucratic red tape typically encountered in doing business in general in Pakistan.

The only major foreign licensees in Pakistan's power generation sector are Germany's Deutsche Babcock and Switzerland's Sulzer Escherwyss for the manufacture of power boilers and hydro equipment. U.S. companies such as General Electric, Caterpillar and Waukesha are not involved in licensing, but have entered the market through distributors and direct export sales. Market entry strategies for the power generation market are not likely to focus on foreign direct investment or the licensing of technologies, but on how to capture direct export sales of equipment.

Export sales, directly or through distributors, represent the best market entry strategy for the power generation market in Pakistan. Many direct sales are linked to bilateral grants and loans, export credit availability, and competitive bidding under World Bank and Asian Development Bank-funded investments.

Countries with foreign assistance grants tied to power generation projects will have an edge over countries with no tied aid programs. Over the next five years, OECD countries have agreed to begin phasing out tied aid programs. Since the United States has never been one of the more aggressive countries in the tied-aid game, the phasing out of tied aid may level the playing field for U.S. equipment suppliers relative to their European competition. This could improve U.S. competitiveness in Pakistan.

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The record of U.S. equipment sales under multilateral development bank international competitive bids has not been very good. Many observers believe that U.S. companies have more work to do in the area of developing local sales forces, customer relations, and other actions that demonstrate a long-term interest in the Pakistani market.

Teaming with or selling to private power developers offers a market entry point for many U.S. power generation equipment suppliers. Future private power projects in Pakistan will serve as potential markets for U.S. equipment and services.

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