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INDIA'S POWER SECTOR : A STUDY

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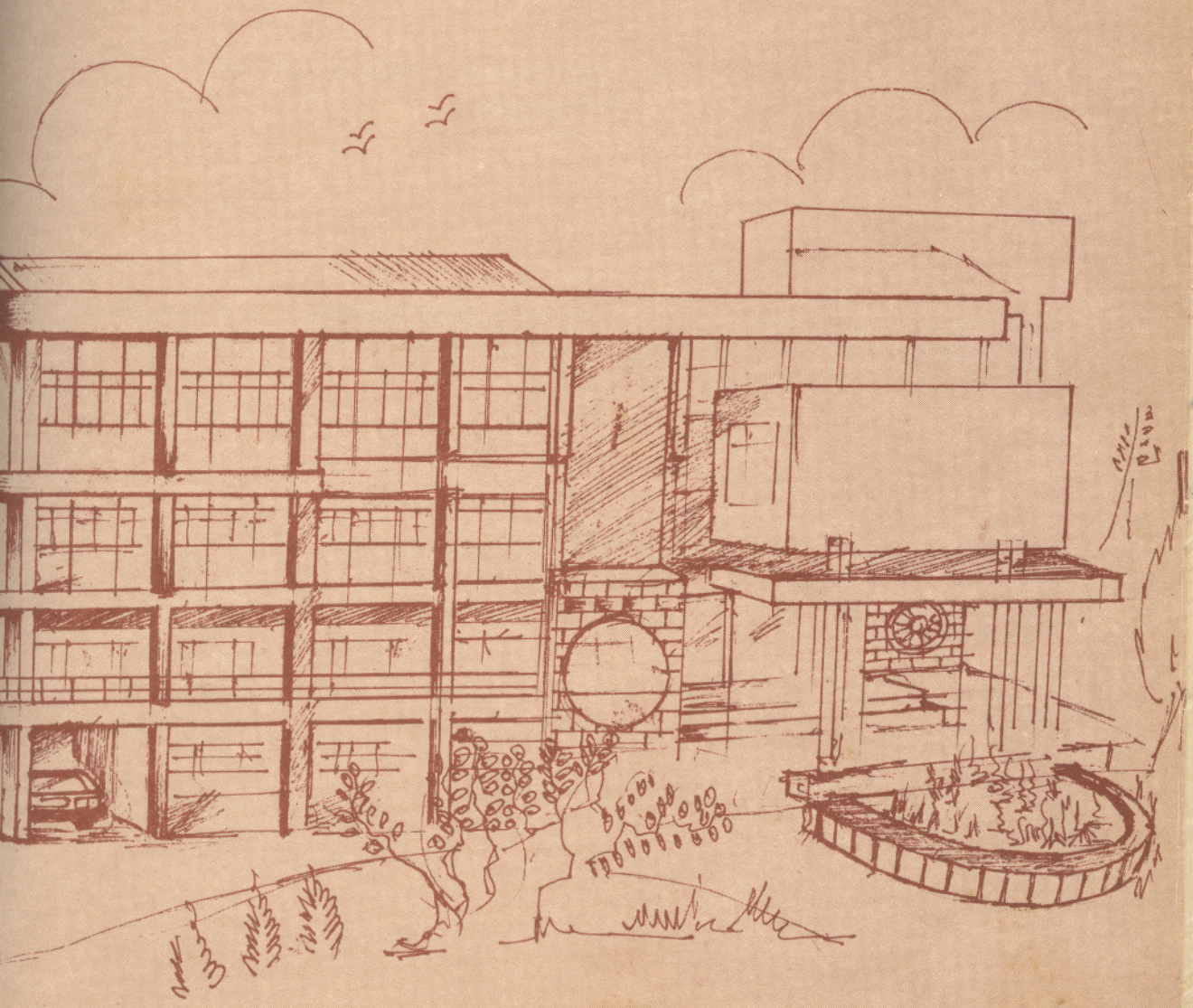

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INDIA'S POWER SECTOR : A STUDY

INTRODUCTION

After India's independence, government decided to reserve power generation and distribution exclusively for the public sector. The reason for this was that the generation of power was dismally low at 1369 MW. The public sector was successful in increasing the power generation capacity of the country 50 folds to 69000 MW by the end of year 1992. Also the rural electrification target was met to an extent of 85%. Apart from that the regional and state grids were set up.

However India's power sector has moved from one of surplus in 1960s and 1970s to one of shortage, with the prospect of shortages destined to become even larger in the near future. Per capita electricity consumption in the country is only around 310 kWh compared to 3000 kWh in some of the East Asian countries and over 13000 kWh in the US. The following considerations were identified as the primary causes of the problem:

- the unplanned development of transmission lines and system
- Unremunerative rates at which the power was made available to agriculture and domestic consumers. According to Economic Survey : 1996-97, the gross subsidy to agriculture is Rs 17,285 crore and to domestic consumers is Rs 4295 crore in 1997-98 (Annual Plan Projections). This leads to the current problem of cross subsidization, which can not be solved without drastic political implications.
- Lesser attention to the renovation and modernization of the plants and distribution system.

This along with the whopping increase in the demand for the power to keep up the pace with the growth in the economy led India to a situation were government found no alternative but to open power generation and transmission to the private sector.

In 1992, the Central Electricity Authority estimated that the country as a whole had a peaking shortage of 17.7% and the energy shortage of 8.5%. This was coupled with the problems of uneven demand supply gaps in different regions of the country. Whereas in North and Northeast the shortages were close to the national average, in South there was an energy shortage of 12.5% and peaking shortage of 21.8%. East was still worse with an energy shortage of 21.65% and the peaking shortage of 32.4%. Only West was in a comfortable position with corresponding figures of 0.2% and 7.6%.

Changes in Government Policy:

With the backdrop of power shortage and paucity of funds with the government, the GOI formulated a policy in 1992 to encourage private sector participation of the private sector in electricity generation. The salient features of these policies were :

- Debt: Equity ratio permitted upto 4:1
- Return on Equity of 16%, and an additional 0.7% return on equity for every percentage point by which the plant load factor (PLF) exceeded 68.5%
- Promoter's contribution of a minimum of 11%
- In projects promoted by foreigners, not more than 40% of the project cost can be funded by India Financial Institutions.

In 1993, the government allowed private power-generating companies to own and develop captive coal mines. This was to augment capacity and ensure reliability both on account of quality and delivery schedules.

In 1994, the Government of India has made the following policies changes:

- Capitalization of interest during construction was allowed
- 100% equity participation by foreign agencies was allowed
- Five-year tax holiday for new power projects.

In 1995, the government set up a National Power Tariff Board at the center and Regional Power tariff Boards in Delhi, Bombay, Calcutta and Shillong. The main function of the National Power Tariff Board is to evolve board principles and guidelines to ensure uniform approach by all regional boards in the matter of fixation of tariff for inter-state and inter-regional exchange of power. The Government of India also decided to extend counter-guarantees to the eight fast track Independent Power Projects.

The government agenda for the power sector, announced in the last week of August' 1996 adds clarity to the picture. Decentralization of power, greater autonomy to the states and streamlining of the approval procedures form the crux of these reforms. The decisions include:

- High ceiling for projects which has to come to CEA for mandatory techno-economic clearances, the CEA has now been given the responsibility for super projects. Only with all investments upto Rs 40,000 millions being cleared by the state government directly.
- Incentive for captive power generation plants primarily based on alternative fuels like natural gas and furnace oil.
- Changes in the Electricity Act are being considered to enable the restructuring of SEBs. Routes being considered include unbundling of SEBs into separate companies in order to make them commercially viable.

- A model power purchase agreement is expected to be announced in order to standardize the commercial agreements signed between the SEBs and the private power developers.
- In view of large number of SEBs being unable to meet the minimum 3% Rate of Return on their assets, the planning commission has impressed upon the state governments to revise their tariff rates and introduce a more rational structure by December. Proposals for applying a uniform agricultural tariff are being discussed.

TABLE 1

Indian Energy Scenario

Current Energy Generation for 1997		410.97 Billion kWh
Projected Demand by 2000 AD		502,254 million kWh
Sectoral Energy Consumption from Public Utility		
	1995-96	2001-02
Industry	40.31%	39%
Commercial & Miscellaneous Sector	13.28%	13.38%
Irrigation	27.04%	24.1%
Domestic	19.37%	23.52%

Source: CMIE, September 1996.

Financing Requirements:

To sustain a 6% growth of GDP, power generation would have to increase by 10% per annum. The 14th Electric Power Survey of India projects the peak demand for the year 2010 to be 172262 MW. For meeting this demand India has to add 100000 MW installed capacity in the next fifteen years - a stupendous 6500 MW each year.

Based on the capacity needs assessed by the Power Development Plan, the total investment requirements over the next 10 years period i.e. from 1996-97 to 2005-06 should be of the order of Rs 624 billion as per Rakesh Mohan Committee estimates.

Risk of Power Projects

Another important agenda for the lack of interest shown by the Independent Power Producers is the lack of risk sharing and risk mitigation process in power projects. Important agreements like completion guarantees; working capital maintenance /cash deficiency agreements; contractor's bonds ; licenses and concessions ; and host government support are lacking or else not developed. Thus, adequate hedging of risks cannot be done and the returns do not commensurate the risks being borne.

Fuel Source Mix

TABLE 2

Percentage of Power Generation by Different Sources

Thermal	**74%**
Hydel	**24%**
Nuclear	**2%**

Source: Economic Survey: 1996-97

A. Thermal Power

Thermal sources are coal or gas, which accounts for bulk of the total generated power. Ideally, coal based plants should be used for base energy load and gas based plants for meeting the peak load requirements. The average cost of setting up 1 MW of thermal capacity is Rs 3.5 crores.

Coal:

The low calorific value and high ash content of Indian coal are the main problems. This requires blending of Indian coal with imported coal. It takes 5 years to set up a combined cycle plant using coal as a fuel while only 2-3 years for a plant of identical capacity using either gas or liquid as fuel. Also, major coal reserves are located in East India. Thus transportation is a problem as sufficient number of railway wagons is not available and also the distances are too large. This adds to the transportation costs and requires large inventory to be maintained.

Gas:

Gas based power plants have a short gestation period of 3-4 years and use a relatively non-polluting source of fuel. Paradoxically, while we don't have enough gas to meet the demand for power and other industries, the rate of flaring of natural gas has gone up from 6 percent to 10 percent in the past 5 years. The reason for this is the lack of storage and transportation i.e. pipelines facilities. Also, the Kelkar committee recommendations, which will result in increase in gas prices by over 30 percent, have resulted in poor investment in gas based power plants. This has led to gas based units switching over to liquid fuel, naphtha.

Naphtha:

The current production of naphtha is about 6 million tonnes per annum while the demand is only 3.7 million tpa. Thus most of the production is exported sometimes even at a price lower than the domestic market price. As a short-term measure, the government has announced the liquid fuel policy, which permits use of certain hydrocarbon fuels for power generation subject to the project meeting certain locational criterion. This is because naphtha is an excellent raw material for the petrochemical industry and thus the government does not wish its wastage as fuel.

Also, while the calorific value of naphtha is higher than gas, the latter is preferred because 5-6 percent naphtha remains unburnt and goes waste while gas can be burnt fully. Moreover, if naphtha is used as fuel, a treatment plant has to be set up to keep emission of poisonous gases like sulfur oxide within permissible limits, thereby increasing the capital costs. Thirdly, naphtha has to be burnt with steam in boiler (gas can be burnt directly) resulting in lower PLF than gas based plant as part of waste heat is used to burn steam with naphtha.

B. Hydel Power

Hydel power is the cheapest form of energy. It is also renewable fuel and creates irrigation potential. The share of hydel power has declined over a period of time. The absence of adequate hydroelectric capacity means that some of the thermal stations are forced to perform the role of peaking units, which means they are utilized less optimally. Ideally, hydel stations are utilized for peaking and thermal for the base energy load. This is because hydel stations can utilize large quantities of feedstock - water, to generate the

large quantity of power required for meeting peak load, thermal stations which burn coal or gas would cost a lot more to do so. However, the absence of such an optimal mix in the Indian context means that we have to make do with lower utilization of our thermal capacity. Thus we have to provide for a larger investment on the capacity for same energy generation.

However, development of hydel station is beset with problems such as land acquisition and inadequate funds. But the major problem relates to environmental issues, as the setting up of a hydel power plant often involves displacement of people and submerging of forests. Thus in India, it takes an average of 21 years to set up a hydel plant compared to world average of 3 years. Sardar Sarovar Narmada Project and the Tehri Dam Project are the cases in point.

The average costs of setting up hydel power capacity are higher than that for thermal plants, at around Rs 4.5 - 5 crores per MW. This does not take into account variations due to land acquisition costs, rehabilitation costs, etc.

C. Nuclear Power

The nuclear power programme has not been very successful in India. The eight operating reactors are running at less than 40 percent of capacity and account for only 2 percent of total power generation capacity.

The costs of nuclear power against thermal power are difficult to calculate. This is because it is dependent on four factors: the cost of capital, of operations and maintenance, of fuel and the decommissioning costs at the end of plant's life. All these figures are largely dictated by the safety standards imposed by the government and the

route adopted to obtain the fuel. Rough estimates indicate the cost of power per kilowatt-hour for a nuclear plant is not significantly different from a thermal power plant. The nuclear power programme is however beset with problems. High capital costs, long construction periods and poor performance of generated power have led the government to favor thermal plants over nuclear. Moreover, isolation of India over the Nuclear Non Proliferation Treaty has made it impossible for India to import key components for the nuclear plants. The substandard quality of the alternative indigenous equipment has resulted in a poor capacity factor. The ratio of energy produced by a power plant to the maximum it could have produced is 45 percent compared to 90 percent in USA and 70 percent in Japan. Also, since India has only marginal Uranium deposits, it is largely dependent on imports as the main fuel of nuclear plants. This is subjected to extensive international controls, given the sensitive nature of its dual use as a raw material for military purposes.

Issues in Power Sector

Economic Problems of State Electricity Boards

The critical problem area in the power sector continues to be the poor performance of state electricity boards (SEBs) which generate and distribute power, set tariff and collect revenues. Despite liberalization, around 63 percent of the total installed capacity are still in the state sector and SEBs have the monopoly in transmission and distribution. According to the Economic Survey: 1996-97, the commercial losses of the SEBs in absolute terms rose to Rs 10491 Crores (Revised Estimates) in 1996--97 as compared with Rs 4117 crores in 1991-92. The losses are projected to be 9959 crores in the 1997-

charged to agriculture and domestic sectors and transmission and distribution losses.

Differential Power tariff structure

According to CMIE (September 1996) report on India's Energy Sector, the difference between the average cost of generation and supply, and the average realization from the agricultural sector is widening. Tamil Nadu and Karnataka SEB supplies power free to the farmers. In Haryana as against the cost of 130 paise per kWh, unit power is available at 21 paise per kWh. That apart, pilferage and theft of power are rampant in many states. As a matter of fact, the SEBs are required to earn a minimum rate of return of 3% on their fixed assets, after fully meeting the fixed and operating costs and interest and tax liability. Instead, according to Economic Survey 1996-97, SEBs together showed a rate of return of negative 17.7% in 1996-97. If however, the SEBs were to earn a minimum stipulated three percent rate of return; they would have been in a position to generate an additional revenue of Rs 12269 crores in 1996-97. And if a flat rate of 50 paise per kWh were charged in the agricultural sector, it would have resulted in an additional increase of Rs 2432 crores in 1996-97.

Problems in the Distribution System

The country lost an estimated revenue of Rs 5000 crores between 1990-91 and 1992-93 due to transmission and distribution losses nearly Rs 1700 crores every year. All India T&D losses have been on the rise from 17.6% in 1970-71 to 20.6% in 1980-81 and are estimated to be in vicinity of 22-23% at present (the globally accepted figure is less than 10%).

The present day distribution system has grown to its present shape with small power stations and substations, which had been set up in various towns to feed mostly domestic and commercial loads. The extension has been done in an adhoc manner form time to time to cater to the immediate load demand. This unplanned expansion of the distribution system has been the primary cause of the high-energy losses. The main problems of existing system are;

- Frequent over loading of distribution transformers
- High losses in the distribution system
- Large voltage variation that often results in the damage to costly electronic equipment and domestic appliances
- Consumer dissatisfaction due to erratic power supply
- Theft of electricity through meter tampering and direct tapping of electricity at low tension points

The main reasons for the high degree of T&D losses in the Indian distribution system are as follows:

- Lack of adequate investment in the system. After growing at about 20% per annum between 1950 and 1970, T&D lines grew only by 8% in the 80s and at a miserly 1% in early 90s. The Rajadhyaksha Committee on power in 1980 had urged that T&D including rural electrification, should receive about 50% of the total allocation of the power sector, but the Eighth Plan accords only 28%. When the investments are not commensurate with the growth of the installed capacity, it leads to unreliable supply conditions and extremely high voltage fluctuations. According to Economic Survey : 1996-97, T&D losses stood at 20.9% in 1994-95.

losses.

- Large scale of rural electrification programme without strengthening the backup transmission and subtransmission system.
- Low quality of construction and inadequate maintenance of equipment.
- Pilferage and theft of electricity through direct tapping/unauthorized connections and tampering of the electricity meters.

Sanctioning projects on the basis of negotiations

When the new power policy was declared in 1991, the MoU route, whereby the Independent Power Producers (IPPs) entered into an agreement with the SEB, was the means of setting up a project. Till now the projects were awarded to the private promoters based on the negotiations between SEB and IPP. Due to acute shortage of power in India; the bargaining power of the electricity board is weaken. This is invariably resulting in higher costs of the projects. The Power Purchase Agreement (PPA) - the legal form of commercial arrangement between the buyer and the seller of power and the compensation in the event of a breach of contract - has been the most contentious issue. As many as 12 writ petitions were filed all of them challenging the deal on the grounds of non-transparency. The problem that still prevails is that neither the SEBs nor the Government has the requisite expertise or the knowledge base required for floating a tender and evaluating the bids.

Long and frustrating licensing procedures

The Government had earlier announced the clearance of power projects to be a single window clearance in order to attract the foreign investors who were wary of the

procedures prevailing in the country. However, private projects promised single window clearance actually need upto 92 clearances dealing with 27 ministries as reported by a World Bank study. Apart from collecting clearances from various state departments and the CEA, a project generally needs clearances from the ministries of Power, Railways, Finance, Environment, Forests, Natural gas, Petroleum, Shipping, and Transport. Other entities can be Water Commission, the directorate general of Civil Aviation, RBI and so on.

High cost of Repairs and Maintenance

In case of nuclear power is the problem of spare parts which leads to delays in maintenance and high cost over-runs. This is attributed to the fact that India has not joined NPT (Nuclear Non Proliferation Treaty) and is thus deprived of the crucial delivery of the spare parts.

Risk Sharing and Risk Mitigation in Power Projects

Proper risk sharing and risk mitigation mechanism should be available for the development of private power projects. Some of the important agreements and mechanisms involved in risk mitigation in the power projects are as follows:

- *Completion guarantees*

  In the case of power projects, the risk of the project not succeeding from a technological point of view are greatest till the completion of the physical facilities and productive capacity to ensure a reasonable flow of production and receivables. This is because of; long construction period resulting in longer time lag to profitable operation and capitalization of interest during construction phase.

Thus, operation phase will be a lower risk/low cost compared to high risk/high cost construction phase.

The simplest way to reduce is to have more than one project sponsors, on a several or joint and several basis, to undertake to ensure that the project completion is achieved by a certain date, with a clear undertaking to repay the loan if it is not.

- *Working capital maintenance/cash deficiency agreements*

In many ways maintenance and deficiency payment agreements provide comfort similar to a completion guarantee, except that they might remain in place beyond the completion date. In essence, such an agreement provides that the shareholders or sponsors of the Project Company undertake with the lenders - that the Project Company will always have sufficient funds to complete and operate the project or, alternatively to satisfy certain specific financial ratios that might have been negotiated. The sponsors of the company ensure this by subscribing for shares or by providing loan capital (usually on a subordinated basis).

A claim for breach of an agreement of this nature involves the lenders having to prove actual financial loss and the lenders would have an obligation to mitigate that loss. In order to prove loss it might also be necessary first to enforce security and exhaust any other remedies that the lenders might have against the borrower or other project sponsors.

- *Contractor's bonds*

In construction of power projects, sponsors and lending banks are concerned to secure the performance of contractors, sub-contractors, and suppliers by requiring bonds from banks or surety companies. The bonds usually constitute unconditional on-demand payment obligations in favor of the Project Company either in the form of a bond, guarantee or standby letter of credit. Lenders take assignments of the bonds to ensure that calls on them result in payments being made to accounts controlled by the lenders, and to ensure that - if need be - the lenders themselves can make demand for payment.

- *Host government support*

In the case of power projects, the host government is closely involved in all stages of the planning, financing, construction and operation of the project. In such cases, the project sponsors and lenders look to the host government to provide contribution to the success of the project. The parties might also seek assurances that the host government will not take steps that will jeopardize the technical or economic feasibility of the project or the ability of the sponsors - and the lenders - to make the desired returns on their investment. This negative aspect of host government support involves a consideration of the political risks attaching to that country - the prospects of expropriation, nationalization, and restrictions on repatriation of dividends and profits.

- *Licenses and concessions*

In many cases, the rights to establish develop and operate a project are founded on a license or concession from the government of the country in which the project is to be situated. The license or concession will frequently be issued

under regulations which give the host government widely stated rights to revoke if certain events occur. Further, there is the risk to the lenders, where co-ventures are involved, that the license are capable of being revoked not merely through any act or omission of the borrower with which the particular lender is concerned but also through an act or omission of any other member of the consortium. There is also the risk that default in relation to another unrelated; development in the license area might put the license in jeopardy even though the particular project that the lenders are financing is running smoothly. Additionally, the license might impose substantial obligations on the licensee, which must be performed by set dates, under threat of forfeiture or revocation.

Lenders might look for comfort on a variety of issues, including the host government's approval of the financing and the host government's approval of any plans for development and operation of the project. The government may have to assure that it will not impose direct or indirect restrictions in production, which would have material adverse effect on the projected cash flow. Whether the lenders are permitted to take a security interest in the license or concession and, if so, whether that security are enforceable without the need for further consents or approvals and; the terms upon which any new license are granted in the event that the original license is revoked.

SUGGESTIONS

- **Structural Reforms**

◊ The government needs to undertake several reforms aimed at long term restructuring of the power sector. These should be based on the objectives of obtaining efficiency by bringing in smaller entities, promoting competition, restraining monopolistic features and promoting modern management practices. Also, the role of the government should be of a policy maker and a watchdog rather than of an actual player in the market. Some of the steps that can be undertaken in this direction are;

◊ Separation of generation, transmission and distribution functions of the SEBs into separate entities. The individual functional entities can be later allowed to go in for joint ventures with private/foreign partners to infuse much needed capital and technical expertise.

◊ Private parties should be allowed entry into the distribution of power in the context of large quantum of funds requirements and cash starved state of most of the SEBs.

◊ Autonomous, decentralized regulatory bodies should be established to

* Protect the interests of consumers from a service with strong monopolistic features

* Protect the interests of investors who need to be encouraged to commit large sums of money to the sector

* Balance these potentially conflicting interests on the basis of socially equitable and economically sound principles.

Public Sector Undertakings in the power sector and State Electricity Boards should be given more autonomy in day to day operations and more professional management should be brought for running these entities.

♦ **Risk Mitigation Mechanisms:**

Clear-cut demarcation of project risks and allotment to different stakeholders is an integral factor for commercialization of infrastructure projects. The finance ministry has imposed three conditions on the fast track projects awaiting counter guarantees. These are :

- Reduction in deemed generation to 80% and reduction in the rate of incentive to 0.5% over the 68.5% plant load factor.
- Introduction of *force majeure* clause which has been divided into direct political *force majeure* wherein the fixed cost would be paid to the company and non-political *force majeure* wherein nothing would be paid.
- Introduction of stringent penalties for wrong declaration of capacity and the multi-matrix *force majeure, which* would include governmental and non-governmental *force majeure* and direct and non-direct *force majeure.*

As a result, the private investor may find such guarantees more credible. This supplemented by Contingent Valuation Funds for providing additional backups to infrastructure projects guarantees be set up at both central and state levels may added more faith in the system.

♦ **Employment of Competitive bidding method**

Competitive bidding is the simplest of all methods to select a prospective investor. The closed competitive bidding where the project goes to the tender that has the lowest cost is

being viewed with suspicion particularly in light of telecom licensing. Two stage competitive bidding is the preferred route since it is transparent and results in lower costs though there is enough argument that negotiated bidding is superior. Two-stage competitive bidding broadly involves the following steps. In the first stage based on the bids submitted pre-qualification of the bidder takes place. In this stage a number of potential players are selected so that further negotiations can be done. In the second stage considerable negotiations are conducted with the IPP based on the groundwork being carried out by the regulating agencies before signing the PPA. Thus SEB that invites the bids have first got to prepare the project profile, obtaining fuel linkages and site clearances, preparing necessary bid documentation. This means that the SEB has to bear a part of the development cost. The drawback being the bidding process is time consuming. According to TERI Newswire (1-15 January 1998), the GOI has projected 40 307 MW of capacity addition during the Ninth Plan. So far, about 2317 MW of capacity has been added by the private sector. Hence the GOI has shifted its focus on 'negotiated bidding'. A committee headed by P. N. Bhagwati has been set up to examine proposals. But, in the longer run, two stage competitive bidding mechanism is the preferred route.

In this context, further lessons can be drawn from the Philippine experience. The government of Philippines had opened bids for all potential power projects identified by the National Power Corporation (NPC), a government body. Since there was limited data on the projects and few useful parameters for the formulation of bids, it was decided to provide feasibility studies on many sites in order to attract bids. These reports were prepared by internationally renowned engineers hired by the NPC and contained detailed

information on topography, hydrography and sub-surface studies besides detailed planning and costing. This proved to be very helpful in attracting bids from multinational companies despite a politically unstable situation prevailing in the country at that time.

- **Suggestions for a model Power Purchase Agreement**

The Power Purchase Agreement is one of the most important documents because of several reasons. Foreign companies do non-recourse financing, as opposed to balance sheet financing in the case of most Indian companies. Thus, for the lenders, the prime concern is not the financial health of the company but the revenue stream of the project itself. The PPA guarantees this revenue stream.

Therefore, a comprehensive document is needed that is bankable and allots risk with the agency which can control it, failing which it lays down the course of action to be taken and the fundamental principles for the negotiations process. Some of the suggestions are as follows.

Currently, the PPAs offer an extremely high 16 percent return along with the 0.7 percent incremental return over the 68.5 percent Plant Load Factor (PLF). While, this limit can be considered good for thermal plants, a PLF of 90 percent is easily achievable for gas based ones. This may result in consumers paying more as power companies book abnormal profits. A revised PPA should therefore need to put down different standards for all kinds of power plants with a cap on incremental returns. Capital cost is another important issue. The IPPs vary rarely go in for competitive bidding and generally the engineering, procurement and construction contractor is the stakeholder in the projects who also bears the construction risk. The project cost is therefore higher than if the SEB

was setting up the plant. This results in overstreched negotiations between the SEBs and the promoters over the increased capital costs. The model PPA should thus contain a fair formula for the calculation of the capital costs. Also the costs, as well as the revenues should be indexed to inflation. Another, safeguard will be to have contracts under the build-own-operate basis rather than on the build-operate-transfer basis. Different incentives payments for peak, off-peak and standard settlement periods. The model PPA should also contain separation of Indian political events and *force majeure* events.

- **Site Allocation**

As an alternative to the existing bidding for the site process, a permit application process can be followed. Under this method, the prospective developers apply for the exclusive right to prepare studies and apply for a power purchase agreement for a defined project. If granted this right under the permit system, the developer would be required to complete the prescribed investigations and negotiations on a specified schedule, resulting in a PPA at the end of the process. If the developer is does not perform during the permit period, the permit can be revoked. In case more than one developer is interested in a particular site, the selection of developer can be done on a first-come-first-serve basis or on qualifications.

- **Improving the Plant Load Factor (Capacity Utilization):**

The current shortage of power can be met in the short term partly through better utilization of existing capacity in the power plants. Some of the steps that can be taken in this context are:

- Improve the capacity of old-run-down stations through renovation and modernization. This step can add upto 5000 MW of energy. The SEBs can raise resources for this programme through sale of non-profitable assets and can even invite private sector participation through either outright sale or leasing of power plants.
- Efficient demand management can be influenced to a large extent by removal of subsidies to certain categories and have a realistic tariff structure. Unauthorized tapping in rural areas can be best tackled by involving local agencies in the distribution.
- Improving usage efficiencies through periodic maintenance and renovation. It has been observed that the equipment and replacement supplies are often sub-standard and result in frequent breakdowns. Steps should be undertaken to check such malpractice on the part of employees.

♦ **Tariff Reforms:**

- The financial position of SEBs needs to be improved to make them profitable in the short term and self-sufficient in the long run.
- Transition- cost based pricing for each consumer segment in a phased manner. A net ten percent increase in average tariff per annum can be undertaken till the target levels have been reached.
- Provision of metering at the consumer end or at an intermediate distribution point should be provided for rural or remote areas. In the latter case, the intermediary agency the local administrative unit like the Panchayat will pay for the metered

supply and for reasonable apportioning the charges to the consumers and its recovery.

- Identifying institutional means to administer subsidies to target groups of consumers. This can be done through provisions in the state budgets or through direct payment to the main distributor (SEB or private).
- State-level regulatory Agencies to cover consumer tariffs and Central Regulatory Authority to administer bulk generation and inter-state transmission tariffs.

♦ **Reducing Transmission & Distribution losses:**

Steps for lowering of Transmission & Distribution losses should be an area of priority because there exists sufficient scope to bring them down to less than 15 percent form the current average level of 21 to 22 percent. It has been calculated that even a one percent reduction in T&D losses will imply a saving of Rs 500 crore for the SEBs and bring about a total annual savings of more than Rs 5000 crores. This is sufficient to wipe out the commercial losses incurred by the SEBs currently and turn them financially viable through the rationalization of power tariff structure. The additional resources so generated will help in ploughing back to establish new power capacities. Some specific suggestions for reducing the T&D losses are as follows.

◊ Investment in transmission sector as a percentage of generation should be increased to 50 percent from 28 percent presently.

◊ Reducing the length of low voltage transmission lines i.e. less than 1.1 kV by relocation of distribution substations or installation of additional substations. Also, conversion of low transmission lines to 11 kV lines where posssible.

◊ Use of modern equipment and standardization of construction practices and operation and maintenance procedures

◊ Adoption of distribution automation techniques for quick identification of system faults and effective and efficient restoration of supply

◊ Prompt calibration and replacement of incorrect meters and installation of tamper proof meter boxes

◊ Carrying out mass publicity through various media highlighting the penalties for pilferage activities and enlightening the consumers in this regard

◊ Regional grids should be strengthened by providing missing links and inter-regional ties for adequate exchange of electric power capacity between different regions. With the installation of inter-regional links, the additional energy generated will be about 6500-6700 MW through improved hydrothermal mix of the combined regions.

♦ **Small Power Projects: Short-term Alternative**

Small power projects with short question period could be a viable alternative in the short term for reducing the power shortage. The small power plants offer several advantages over their bigger counterparts. While the mega plants take anywhere between 3-4 years in being set up, the smaller plants can be set up within a period of 18-24 months. The time thus saved allows the smaller plants to be completed at lower cost owing to savings in pre-operative expenses. The cost per megawatt of a small power plant is around Rs 3 crores as compared to Rs 4 crores for the larger plants (Table 3). Moreover, these plants can be set up close to the load centers, thus minimizing the T&D losses. Also having a small set of customers would help them in managing their receivables.

TABLE 3

COMPARISON BETWEEN PRIVATE POWER PROJECTS

PROJECT	CAPACITY (MWs)	COST (Rs)	COST/MW (Rs/MW)
Bhadrawati	1072	4631	4.3
Visakhapatnam	1040	4318	4.1
Bina	1000	4000	4.0
Korba (East)	1000	4000	4.0
Kumta Barge	100	297	2.97
Haryana	100	300	3.0
Malpe Barge	150	400	2.7

Source : CIME, September' 1996.

On 8 October 1995, the Andhra government announced a new power policy for mini plants to ensure an additional generation capacity of 2,000 MW. The Gujarat government in its new policy on power has allowed the private parties to set up 60 MW of captive power plants without prior permission.

♦ **Captive Power Plants: Viable Alternative in Short-term**

The power shortage in the short them can be effective controlled by buying excess power from captive power plants. The total installed capacity of captive power plants was 10,150 MW in 1994-95 against total power generation capacity of 83,000 MW. Also, they could be allowed to sell it to third party customers through the state grid against payment of predetermined wheeling charges. A similar methodology has been followed in Orissa which with 12 captive thermal power plants with installed capacity of 1315.65

MW and another 100 standby diesel generations with installed capacity of 210 MW has allowed sale of excess power directly to third parties since 1993. The government has prescribed from the captive producers wheeling charge at the rate equal to what Grid Corporation of Orissa (GRIDCO) has been charging.

Similarly, the Madhya Pradesh State government announced a new captive power policy to encourage the major power consumers to produce power in surplus of their requirements and sell the same either to the Madhya Pradesh Electricity Board (MPEB) or to a third party. To make the option economically viable, the state government proposes to offer an attractive price for the surplus power generated by them.

CONCLUSION

Thus, looking at the status of Power Sector in India, the need for action need not be highlighted. A strategy where all factors were integrated into short term and long term polices is the need of the hour. Power as one of the critical input has to light up the economic growth and prosperity of India.

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