CHAPTER - 4

PROBLEMS FACED IN GENERATING, TRANSMITTING AND DISTRIBUTING ENERGY
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CHAPTER 4

PROBLEMS FACED IN GENERATING, TRANSMITTING
AND DISTRIBUTING ENERGY

4.1 History of Power Generation

Although commercial electric power generation in India is over a century old, substantial efforts to develop power began only after independence. Approximately 80% of India's power supply was met by private companies and local authorities, at that time. It was limited to urban areas. After independence, the licences of these companies expired and they were taken over by State Electricity Boards (SEBs), which were created under the Electricity (Supply) Act, 1948, with the exception of Bombay, Calcutta, Ahmedabad and Surat.

When the first five-year plan was adopted in 1951, power generation was recognised as a major input for economic development and was accorded high priority. In successive Five-Year Plans, power sector outlays have been amongst the highest. In the early 1960s, a need was felt to integrate the state grids into regional grids, because some of the states had inadequate resources for generating power.

Regional Electricity Boards (REBs) were created by a government resolution in the mid-1960s to integrate regions into one grid. Since all the coal supplies came from the eastern states and all hydel sites were located
in the north and the north-east, it was decided to integrate the entire country into one grid and a power grid was created in the late 1980s.

In the mid-1990s, Regional Load Dispatch Centres (RLDCs) were transferred to the power grid and the REBs continued to oversee the functioning of RLDCs. With the creation of the power grid and investment in inter-state and inter-regional lines, it became possible to think and plan for an improved integrated national transmission network.

4.2 Private Sector in Power Generation

It was evident by the beginning of the Eighth Plan that the government could no longer finance the increasing capacity requirements of the power sector. As a result, the government formulated a policy in 1991 to encourage investment by the private sector in generation. The policy permitted 100 per cent foreign owned companies to set up power projects, without any export obligations. Since the policy was based on negotiations to determine tariffs, the initial projects were marked by high rates. However the realisation soon dawned that not many generation projects could come up by this route unless the sector was restructured and unbundled. And unbundling could not efficiently take place unless regulators were appointed first. After discussion in different fora over years, the central government issued an ordinance, which was later converted into an Act in 1998, to enable the appointment of regulators at the national and state level. By another amendment of the Electricity Act, transmission was recognised as a distinct activity. This separation permitted the setting up of privately funded transmission
lines within the control, supervision and operation of the national and state transmission utilities. The Central Regulatory Commission was set up soon after the enactment of the Electricity Regulatory Commission Act 1998. Such commissions had already been set up in Orissa and Haryana in 1996 and 1998 respectively under state legislations. Subsequent to the enactment of the central Act, a large number of states have gone ahead with the setting up of Regulatory Commissions. With the concurrence of the central government, Andhra Pradesh passed a separate Regulatory and Restructuring Act, in line with the Orissa and Haryana Acts. There is need for other states also to pass such restructuring acts.

So far, reform and restructuring measures introduced in India comprise the setting up of a regulatory body, unbundling of the system into generation, transmission and distribution and the setting up of a framework to break up these into smaller entities to facilitate the entry of private capital. The process of liberalisation, the new power policies as well as the participation of the private sector have entirely reshaped the power industry in the country.

The emerging competition from independent power producers, stringent environmental regulations, uncertainties in fuel linkages, resource constraints, restructuring of reforms in the power sector are all crucial and interrelated factors that impact on business decisions. These fundamental changes have necessitated a fresh look at how business is conducted. Thus the years ahead will witness a very different scenario with changing pattern
of ownership and assets, the norms of project implementation, plant availability and reliability and operations to match international standards.

The main issue confronting private participation is providing government guarantee, which depends on the state of finances of the State Electricity Board. Some of the other issues are:

1. Karnataka has decided not to extend escrow cover to independent power projects, in tune with the recommendations of the Deepak Parekh panel. The committee suggested in February 2000 that providing escrow would be unwise and the Government of Karnataka as owner of KPTCL, (the Karnataka Power Transmission Limited) should not provide escrow cover to any IPP. The cabinet which reviewed the report took note of the precarious financial position of the SEB and endorsed the view of the seven-member expert panel.

2. It was also decided that only least-cost PPAs would be encouraged and IPPs would have to process without the dedicated escrow stream of payment. The least cost tariff approach will allow the SEB to get the cheapest source of power from various power projects thereby putting minimal amount of strain on the existing financial position of the Board.

3. The power projects which are expected to make the merit list of those with the cheapest tariffs include, Rayalseema (27.8 MW) with a tariff rate of 2.96 per unit, the Tatas (81.3 mw) with a tariff rate of Rs. 3.39 per unit, Bidadi (200 MW) at around Rs. 3.30 – 3.40 per unit and Aatria (200.4 MW) at Rs. 3.60 per unit. The CRISIL report states that the SEB can
have 500 mw of escrowable capacity if there is continuous subsidy from
the state government over a period of seven years totalling around Rs.
8,000 crore.

4. The same terms would apply to the 100 MW Mangalore Power Co. which
the CLP power international is hoping to push ahead along with the Tata
Electric Co. There are 22 IPPs in the state in various stages of progress.
Escrow has been signed for Tannirbhavi (barge-mounted), Arit and Ray-
alaseema projects. Ten are yet to sign PPAs.

5. The panel has noted that industrial use of power has been declining. It
would not be sustainable to pursue costly proposals to prop agricultural
consumption alone. Instead, the panel has said the leaks should be
plugged, requirement should be moderated and tariffs rationalised.

4.3 Convergence

The quantum progress in technology made the world over has also
impacted the power sector. One of the most interesting developments in the
sector has been convergence. Integration of telecommunication activities
with electricity transmission and distribution is emerging as a global phe-
nomenon. The transmission system covers the entire country and depend-
ing on the extent of electrification, the wires reach every house. This pro-
vides an enormous right of way to link the country with optic fibre to create a
backbone for telecommunication and other multimedia services. A number
of companies have jumped into the fray with the notable ones being Power
Grid and BSES. Power Grid has plans to enter into National Long Distance
NLD) telephony as well as international telephony. BSES, an ISP in Mumbai, plans to link the country with a fibre optic network for transferring data by companies.

4.4 Constraints in Hydro Development

Kamataka being heavily dependent upon hydel power, it is but natural to begin the discussion with the constraints that the State’s hydro development faces.

The major constraints which have affected hydro development in general are the following and Kamataka can be no exception:

- Resource Crunch and deficiencies in providing long term financing.
- Difficult investigation
- Tariff related issues like low IRR as compared to thermal projects and machine availability.
- Environmental issues.
- Delay in land acquisition.
- Resettlement and rehabilitation of project-affected people.
- Inter-state problems
- Law and order problems in militant infested areas.
- Dearth of good contractors and poor contract management.

Recently the government has announced the policy on hydro development, wherein some of the above concerns have been addressed. It would be worthwhile to look at the essential aspects of hydro policy with reference to above constraints.
4.5 Major Issues in Policy for Hydro Power Development

Funding of the Hydro Projects

The resource crunch, which is generally applicable to all developmental activities, has perhaps hit the hydropower sector the hardest. It has been proposed in the policy to provide full budgetary support to Central Sector projects, which are under construction and new projects to be taken up in the IX plan. In respect of state sector projects, mechanisms like earmarking of funds in plan allocation, supplementary funding for projects where more than 50% expenditure has been already incurred and intensive monitoring have been envisaged.

It is also proposed to create a dedicated fund called "National Power Development Fund" by levy of a cess of 10 paise per unit. It is expected to realise approximately Rs. 3,000 crores per annum. The proceeds of this cess would be shared between State Governments and Central Government in the ratio of 2:1.

4.6 Emphasis on Survey and Investigation

Investigation of hydro project is the backbone of project planning and development. In several projects the time and cost overrun had been due to geological surprises. Lack of fund and outdated technology are the major reasons for inadequate investigations. Hydro policy proposes to provide funding support from the Power Development Fund for the purpose of carrying out survey and investigation and prepare bankable Detailed Project Reports (DPRs) by Central PSUs as well as SEBs.
4.7 Tariff Related Issues

Private developers have been voicing their concern about low IRR resulting from hydropower projects on account of their long gestation period. The policy envisages rationalising existing hydro tariff norms. In this direction it would:

- Allow a premium on sale rate of peak power.
- Allow sale rate of secondary energy at the same rate as that of primary energy.
- Allow reduction in normative machine availability factor from 90% to 85%

4.8 Geological Surprises

The unexpected but unavoidable increase in quantities, introduction of new items and consequent increase in cost due to geological surprises cannot be anticipated and provided for while preparing DPR. For example, the developer may run into hostile terrain which may prove rather difficult to get over. A spring may hamper the developer's progress. A hardened rock may hamper the developer's progress. In such cases, the developer will have to deploy appropriate additional machinery and manpower to plug the spring or clear the rock. These measures, though remediable, result in time and cost overruns for the developer. The loss incurred by the developer will have to be made good by the government because these expenses were not foreseen at the time the cost of the contract was estimated and finalised. In case of such geological surprises during execution of work, the policy allows the developer to submit his proposal for enhanced cost to government. For
this purpose Expert Committees at state-level would evaluate and recommend increase in cost up to a certain percentage and beyond this, the Expert Committee at central-level would examine and make recommendations.

4.9 Delay in Land Acquisition, Resettlement and Rehabilitation and Catchment Area Development

Many projects have suffered time and cost overruns on account of problems relating to land acquisition and resettlement and rehabilitation of project-affected persons. For example, Ranjit Sagar (Thein) Dam in Punjab suffered a delay of 5 years and the commencement of Doyang Project in Nagaland was delayed by 2 years on account of land acquisition problems. The demands for employment in lieu of land, land for land at the places of landowner’s choice etc, have resulted in delays at various projects. The policy proposes to insulate developers from such problems. These issues would be addressed and settled by State Government. State Governments may form authorities for these purposes including Catchment Area Development. The Project Developer will not be involved in execution and implementation of works by these authorities but will be required to contribute funds and the cost incurred by developer to these activities will be allowed to be passed through tariff.

4.10 Inter State Aspects

Many mega hydropower projects aggregating 6,300 MW capacity are dormant due to inter-state issues involved between riparian states. CEA has cleared schemes of 500 MW. Schemes of 800 MW are under examination and schemes of 5,000 MW have been returned to States for resolution of
disputes. Out of above, 6,300 MW projects aggregating 3,900 MW are located in southern region out of which 1,760 MW is in the Cauvery river basin.

The Policy recognises the need to evolve an approach to ensure that available potential is utilised without prejudice to the rights of the riparian states as determined by award of tribunal/agreements. Preference is to be given to simple run-of-the-river schemes not involving major storage or consumptive use. It has been proposed by some of the authorities that such projects can be got executed by neutral agencies like NHPC.

4.11 Reduction of Transmission and Distribution Losses

The protected, license-permit, cost-plus Indian economy has been riddled with inefficiencies, not only in the manufacturing conversion process, but perhaps even more in logistics of storage, transportation and delivery. Power transmission losses have been high due to genuine technical loss, leakage, theft etc. To reduce the said losses, government can:

- Allocate more investment in transmission lines, to reduce the imbalance with generation.
- Make more investment in load frequency control systems, metering, etc for correct billing, transfer price, etc.
- Follow up on collection of dues and claims.

4.12 Installed Capacity in India

The present installed capacity in India is of the order of 94,000 MW. The peak demand for power is estimated to increase to 1,76,647 MW by
2011-12 which means that the installed capacity developed in the past 50 years will have to be doubled in another 10 years. It gives clear picture of the task ahead for power developers in the country.

4.13 Installed Capacity in Karnataka

The situation is similar in Karnataka also. The present installed capacity in Karnataka is of the order of 5,300 MW including share from the central sector with an annual energy capability of about 26,000 million units (71 million units/day). Studies show that the demand would increase to about 9,500 MW by 2011-12 which means that the capacity of grid developed in the post-independent 50 years will have to be doubled in another 10 years. Therefore, obviously, this poses many more challenges to the power sector in Karnataka.

4.14 Challenges in Power Sector in Karnataka

The following are the challenges that Karnataka’s power sector faces:

- Mobilisation of resources in Karnataka’s power sector
- Improvement in efficiency of operations
- Improvement in metering and revenue collection
- Compensation to KPTCL for offering subsidies
- Choice of appropriate fuel – least cost fuel

4.15 Mobilisation of Resources

- Finances of the order of Rs 20,000 crores for generation and an equal amount for transmission and distribution are required to be mobilised to establish additional 5,000 MW in next 10 years.
- Finances are required to be raised through non-resource financing from financial institutions/banks in the absence of ESCROW from State utility.
- The state electricity organisations in most of the states in India including Karnataka are facing financial crunch due to various reasons like, delayed projects, inadequate transmission and distribution facilities, inadequate transmission and distribution facilities, inadequate operational efficiency, subsiding certain sectors, low revenue collection, etc.

4.16 Response from the Government

In line with the Common Minimum Action Plan of the central government, reforms have been initiated in Karnataka also. The main areas are:

- Private sector participation in power generation.
- Corporatisation of the State Electricity Board and subsequent privatisation of distribution.
- Formation of the Electricity Regulatory Commission.

4.17 Private Sector Participation in Power Generation

The 260 MW project at Bellary by Jindal Tractebel which is in operation is the only success story in Karnataka apart from small and mini hydel and wind stations operated by private sector.

4.18 Energy Conservation Measures

Energy saved is energy generated. The Government of India recognises that energy conservation is one of the crying needs of the day, and based on policies suggested by the Central government, a number of state governments have made energy auditing mandatory for undertakings which
consume more than a specified amount of power. What may be termed a 'systems approach' to energy audit, wherein energy audit is examined as a part of the entire energy management systems as a whole is vital, as a result.

Any management programme, whether energy, quality or environment, is best implemented if a systematic procedure is followed. The steps, which are normally considered essential, are:

- Have a well-defined policy, originating at the topmost level and percolating throughout the organisation down to the lowest level.
- Formulate and document well defined procedures that are to be followed.
- Clearly define and assign responsibilities, and ensure that adequate authority is delegated.
- Have a person in overall charge of implementation. In the case of quality management, this person is known as the Management Representative. In the case of energy management, he could be designated ‘Energy Manager’.
- Arrange proper training at all levels.
- Periodic internal audits, followed by regular external audits, will ensure that the plan envisaged is followed. External audits are now mandatory in certain types of undertakings.
- A fully operational MIS will ensure that top management is kept apprised of all developments on this front, and that appropriate corrective and preventive action is taken at the correct time.
Audit implies checking to ensure that what is actually being done conforms to predetermined and established standards. In the case of financial audit there are established accounting practices, embodied in International Accounting Standards, against which the checking of prevalent practice is done. In the case of quality control, there are procedures laid down as per international standards like the ISO 9000 series against which the audit is done. In the case of energy, there are no such international standards, Hence, for every organisation, a set of standards must be formulated by the Management. This is one of the most important jobs of the Energy Manager, forming, as it were, the starting point of this work.

The following job description of an Energy Manager, based on recommendations of the Government of India, shows how the procedures for energy management could be formulated:

4.19 Energy Data Collection and Analysis

- Maintain records of all energy and water consumption in the Plant.
- Check the readings of all the meters and sub meters on a regular basis.
- Specify additional meters required to provide additional monitoring capability.
- Develop indices for specific energy consumption relative to production and maintain these indices on a monthly basis for all major production centres.
- Set performance standards for efficient operation of machinery and facility.
4.20 Energy Purchasing Supervision

- Review all monthly utility and fuel bills, ensure billing is proper and that the optimum tariff is applied in all cases.
- Investigate and recommend fuel-switching opportunities where a cost advantage to the company is possible.
- Develop contingency plans to implement in the event of supply interruptions or shortages.
- Work with individual departments to prepare regular energy budgets.

4.21 Energy Conservation Project Evaluation

- Develop energy conservation ideas and projects, working with in-house staff, equipment vendors and outside consultants.
- Summarise and evaluate possible energy saving projects according to the company's financial planning requirements.
- Perform economic analysis to permit management evaluation of the projects.
- Obtain management commitment of funds to implement conservation projects. Re-evaluate possible projects as the company operations change or grow; evaluate energy efficiency of new construction; building expansion or new equipment purchases.

4.22 Energy Project Implementation

- Initiate equipment maintenance programmes for energy saving.
- Supervise the implementation of conservation projects, including specification of equipment, requests for quotation, evaluation of offers, ordering
of material, construction, installation, operator training, start-up and final acceptance.

4.23 Communications and Public Relations

- Prepare monthly reports to management, summarising monthly energy costs and consumption as well as specific energy consumption.
- Communicate with all production and support departments, so that all can participate in the energy management programme.
- Develop an awareness programme within the company to encourage active participation by all employees in energy saving activities.
- Develop training programmes to upgrade knowledge and skills of all levels of employees in energy saving matters.
- Publicise the company commitment to energy conservation where appropriate, providing information for press releases and internal notices, presenting papers in professional conferences, entering the company in energy award programmes.

A typical preliminary audit programme would consist of the following steps:

- Make out a flow chart of the production process.
- Ascertain from where the energy inputs are derived, viz. electricity, solid fuel, petroleum products or any other.
- Collect data regarding production (output), total energy consumed in various categories, cost of the different types of energy inputs, etc, on a monthly basis.
- Calculate the specific energy consumption for the various production centres on a product wise basis.
- Draw graphs showing the energy - production relationships.
- From the data collected over a number of years establish norms of energy consumption for different levels of production.
- Compare current figures against the standards calculated as above.
- Analyse the data and try to account for anomalies or discrepancies, if any.
- Decide upon preventive measures to ensure that such discrepancies do not occur in future.
- Convey the findings to the top management and arrange review meet-

4.24 Marginal Energy Consumption

Energy is consumed not only during the production process but also when there is no production. For example, the lighting, air conditioning and water supply loads are independent of output, and are more or less constant throughout the year. The concept of marginal energy consumption therefore assumes importance in this connection. Marginal energy consumption may be defined as the increase in energy consumption for an extra unit of production. This can be regarded as the variable component of total energy consumed, whereas the other components together may be termed as the fixed energy consumption.

To achieve control it is usually necessary to set standards for both fixed as well as marginal energy consumption. These standards may be set by:
a) Calculation

b) Statistical averages derived from previous years' figures.

c) Ascertaining industry standards using other well-run industries as benchmarks.

After the standards have been set, the procedure of audit implies checking the actual figures obtained against these standards and making out an analysis of the variances, trying to find out the reasons for any differences. Once these reasons have been established, it will be found in most cases that preventive measures will automatically be thrown up.

4.25 Other Issues Emphasised in the Policy

- Basin-wise development of hydro potential
- Advance action for capacity addition in X plan beyond.
- Renovation, modernisation and up-rating
- Promoting small and mini hydel schemes
- Simplified procedure for transfer of clearances
- Promotion of hydel projects through joint venture
- Selection of developer and Techno Economic Clearance
- Evacuation and sale of power.

4.26 Impediments in Project Implementation

Administrative clearance has been an impediment in the implementation of projects. Such bottlenecks, wherever they exist, need to be removed in order to expedite project completion. Besides promoting conventional power projects, the "Private Power Policy" addresses other possibilities of
amending power generation through improved productivity and efficiency such as captive and co-generation plants, and renovation and modernisation. The Government of India has also made competitive bidding mandatory for the development of new power projects. The major task of the power sector will therefore, be to ensure that the anticipated demand is met adequately and in a reliable and cost-effective manner.

4.27 Power Sector Concerns

The following summarise the concerns of the power sector:

**Unacceptably high level of T & D Losses**

- T&D Losses 26% During 1998-99 (Source: MOP Annual report 2000-01)

- Maximum T&D Losses in Delhi State (45-50%) (Source: CEA Publication)

- Minimum T&D Losses in Maharashtra, Tamilnadu, Bihar (15 - 1%) (Source: CEA)

- Theft estimated to cost over Rs 20,000 crores annually, across the country.

- Reducing T & D losses account for 14,000 MW (Approx.) (Source – ICICI Report)

**Fast Rate of Obsolescence OF Existing Generating Capacity**

- Effective R & M, would account for 10,000 MW (approx.) (Source – ICICI REPORT)

- Public Sector utilities operating at a lower PLF than private sector energy provider.
4.28 Financial Crunch

- SEB's owing huge financial liabilities (to the tune of Rs.400 Billion) to Central Utilities.

- Poor response from private sector in energy sector especially hydro sector.

To achieve affordable and quality power to consumers the following needs to be done:

- Reorganise electricity industry on commercial principles.

- Create a healthy relationship among generation, transmission and distribution entities.

- Reforms should start from distribution end for better revenue realisation.

- Efficient tariff policy, where grid defaulters should be punished.

- Enhancing incentives and competition in supply wherever feasible.

4.29 Investment in the Energy Sector

As per the system studies carried out by power engineers, the ideal hydro-thermal mix is 40:60. We cannot afford to operate thermal plants to cope with peak demand and again back them down during off-peak hours. The task ahead is challenging and difficult but it can be made possible through sustained efforts, sincere and practical approach.

Private participation is imperative for the future growth of the sector. It is no surprise that the demand for power in Karnataka is far outpacing supply resulting in a perennial shortage of electric power. The government has also
come to terms with the fact that the country cannot depend on Government resources alone to achieve a phenomenal growth in the power sector. The big-push has to come in the form of private investments.

The privatisation of the power sector is a recent, but internationally widespread trend that has placed greater reliance on market forces and less dependence on government in the allocation of resources. The privatisation of the power sector has been made possible after recognising the fact that this sector should be separated into generation, transmission and distribution and in turn each of these sectors should be broken into several companies.

Monetary restraints and debt-placed pressures to reduce government expenditures and provide for better service to the people has made it imperative to introduce private capital in the power sector, which if properly structured and implemented can lead to several advantages. Further, privatisation and policy restructuring would assist the power industry to gear up and meet the present and future needs.