CHAPTER 2

POWER SECTOR SCENARIO
2.1 **ECONOMIC GROWTH & ELECTRICITY:**

Electricity is the most important infrastructural input in the development and growth of economy. Any economic activity, be it agriculture, industry, commerce, trade or service sector, all require, for their growth and expansion, the input of electricity. Consumption of energy, and more particularly of electricity, is recognised world over, as the most important index of the extent of advancement of the country and of the standard of living of people.

While the official statement on shortages indicates an average energy shortage of the order of 7 to 8% and peaking shortage of the order of 13 to 14%, the actual shortages both in terms of average energy and peaking are much higher. For 9% growth of economy, growth in the electricity production and consumption will have to be at least of the same order, if not more. During 70’s and 80’s, power sector did achieve a growth of about 7 to 8%. This however, slowed down during 90’s. During 5th Plan period capacity addition was of the order of 10202 MW, during 6th Plan – 14226 MW, during 7th Plan (1985-1990) 21400 MW which declined to 16923 MW during 8th Plan (1992-1997).
To support 9% economic growth target, capacity addition in the Power sector will have to be of the order of at least 10000 MW every year in the next 5 years and 11000-12000 MW every year in the subsequent five years. Obviously, this will require mammoth efforts and massive preparations. Policy initiatives, commensurate systems and procedures and suitable monitoring mechanism will all have to be put in place to meet this challenge.

2.2 DEVELOPMENT OF ELECTRICITY INDUSTRY IN LAST 50 YEARS:

Electricity industry has developed mainly through State controlled instruments. Until 1975 the development of the industry was mostly through State Electricity Boards / Electricity Departments controlled by respective State Governments. In 1975 the Electricity (Supply) Act, 1948 was amended to provide for intervention of Central Government in the development of power generation facilities. According to this amendment, National Thermal Power Corporation (NTPC) and National Hydro-Electric Power Corporation (NHPC) were set up to develop power generation projects. Electricity is in the concurrent list in the Constitution of India. Both Central and State Governments have their roles to play. Lesser involvement of the Central Government in the development of the electricity industry have obviously adversely affected the sector. Perhaps, if this industry had been planned, executed and developed, through last 50 years, with predominantly direct intervention of Central Government the state of this industry could have been different. As stated earlier this is the most crucial
sector of the economy. Its inadequate performance directly affects all other sectors. A partial correction in the situation was attempted through Central Government in 1975 started being felt very early in the 80’s. In retrospect, we can clearly visualise what would have happened to this sector if organisations like NTPC, NHPC, Power Grid on the basis of the amendments of 1975 and 1991 in Electricity Supply Act were not to influence the development of the sector the way they did. Perhaps the crisis like situation in the industry facing today would have been witnessed much earlier and with much stronger and serious adverse implications.

a. Capacity additions in thermal, hydro and nuclear are given in the following table.

<table>
<thead>
<tr>
<th>Year</th>
<th>Thermal (MW)</th>
<th>Hydro (MW)</th>
<th>Nuclear (MW)</th>
<th>Total (MW)</th>
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</thead>
<tbody>
<tr>
<td>1950</td>
<td>1153</td>
<td>559</td>
<td>-</td>
<td>1712</td>
</tr>
<tr>
<td>1960</td>
<td>2736</td>
<td>1417</td>
<td>-</td>
<td>4653</td>
</tr>
<tr>
<td>1970</td>
<td>7906</td>
<td>6383</td>
<td>420</td>
<td>14709</td>
</tr>
<tr>
<td>1980</td>
<td>17562</td>
<td>11791</td>
<td>860</td>
<td>30213</td>
</tr>
<tr>
<td>1990</td>
<td>45768</td>
<td>18753</td>
<td>1565</td>
<td>66086</td>
</tr>
<tr>
<td>2001</td>
<td>73274</td>
<td>25574</td>
<td>2860</td>
<td>101708*</td>
</tr>
</tbody>
</table>

*plus 1426 MW (Wind)

From the above table it can be seen that growth till 1990 witnessed a pattern of doubling the capacity in every decade except in the
decade of 90's. The pace of expansion declined sharply in last 10 years.

b. Required development of high voltage transmission system did suffer in early years. However, during 80’s, when NTPC also had the jurisdiction of creation HV transmission system along with their super thermal power stations, transmission side of this industry got a boost because of direct involvement of Central Government. Subsequently Power Grid Corporation of India was formed out of NTPC, and from 1992 this organisation has further added significantly toward creation of HV transmission system and development of national grid. HV transmission system in the country consists of the following:

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Length (km)</th>
<th>Capacity (MVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 KV</td>
<td>48625</td>
<td>57360</td>
</tr>
<tr>
<td>220 KV</td>
<td>95963</td>
<td>115248</td>
</tr>
<tr>
<td>800 KV</td>
<td>1155</td>
<td></td>
</tr>
<tr>
<td>HVDC</td>
<td>3601</td>
<td>2000</td>
</tr>
</tbody>
</table>

HVDC lines

3. Before emergence of central sector in power generation the performance of the power station in terms of average Plant Load Factor (PLF) was rather low. In 1985 it was as low as 46%, went up to 60% by 1995, and in the last 5 year it has consistently improved.
d. Rural electrification programmes were taken up by various SEBs. Rural Electrification Corporation of India under MOP funded substantially these programmes.

2.3 **ROLE OF PRIVATE SECTOR:**

Role of private sector in Indian electricity industry has been rather limited. On the generation side, the private sector accounts for less than 10% with the balance 90% being contributed by the State, (Central Sector 30%, and State Sector 60%). On the distribution side of electricity the picture is even more unbalanced, with hardly 3% contributed by private sector and 97% under the jurisdiction of State Electricity Boards. Perhaps a larger role from the private sector world have also made a difference in the performance of this industry.

In 1991 when the Government of India (GOI) carried out a radical restructuring of its economic policy which aimed at liberalising the industry, trade and business, removing / reducing system of license and permits and gradually reducing the role of Government. In industry and trade, the Ministry of Power (MOP), GOI also came out with policy initiatives for the electricity sector which aimed at enlarging the role of private sector in creating power generation capacity. The Electricity (Supply) Act was amended in 1991 and it was followed by a comprehensive guideline on private sector participation in power generation. The Policy provided attractive returns on investment, 100% equity participation from foreign companies, incentives for higher levels of performance, tax exemption, etc.
The policy initiatives were received with overwhelming response. More than 200 MOU’s were signed in different states by both national and international companies to set up power projects. These MOU’s would have meant an additional capacity of about 60,000 MW. It appeared that the main problem of the power sector, that is the shortage, would vanish. Unfortunately, however, during the 10 year period after announcement of this policy not even 10,000 MW has been added or is in the process of being added.

The private power policy and other initiatives received a setback and met with very limited success mainly on account of the following:

a. Commensurate procedures to support these far reaching initiatives were not put in place, thus requiring considerable amount of time for securing various sanctions, clearances and permissions.

b. Commensurate fuel arrangement and procedures for getting confirmation were totally inadequate. It is relevant to mention that Ministry of Coal, Government of India is still to come out with its policy on long term coal development programmes through private sector involvement. Captive coal mining policy had limited starts because of a number of reasons.

c. Financial closure exercises for new power projects became nightmarish. In view of almost bankrupt state-of-affairs of the SEBs, which are to be the buyers of electricity from these additional generation facilities, lenders’ concerns and reservation on funding these projects made these projects non-starters.
While all the above three reasons as important, but the one having the maximum adverse effect, leading to the dismal failure of the private power policy, has been the poor financial health of the SEBs, which have failed to provide any type of payment comfort to investors. Developers were in queue, lenders were assured to support in a big way, Central Electricity Authority, in spite of criticism against them, cleared projects aggregating to 30,000 MW of capacity. But most of these projects have not happened because the beneficiary SEBs could not substantiate that they would be able to make payment for the electricity that would be supplied to them. GOI policy need not be criticised – in fact, they did a job in formulating, revising, amending and clarifying various policies. CEA need not be blamed – they did clear a large number of projects. Lending institutions need not blamed – they did many financial closures for projects, in many cases going out of the way. The blame should squarely lie on the poor financial health of the sector.

Many of us did point that it was not the generation end of this industry but it was the distribution end of the industry which needed to be tackled and reformed first. By beginning 1990 power industry professionals knew that NTPC and Central organisations were facing tremendous problems in getting their bills paid by SEBs. Larger amount of electricity generated and sold by NTPC made the financial position of SEB’s even worse. The writing on the wall was quite clear – if they were unable to pay to NTPC, NHPC, Railways, Coal India, etc. how would they be able to pay to the private power producers.
In spite of this it has taken almost 10 years to recognise that it is the distribution reform which is required first and not private power policy in generation. If the first had happened and happened well, the second would happen automatically. The silver lining is the growing realisation and recognition of need reform and restructuring of this sector.

2.4 PRESENT STATUS:

The present status of the power sector is far from being satisfactory. As a matter of fact, its financial health is deteriorating. The following facts highlights the status of the industry.

There is a serious mismatch between demand and supply. The capacity build-up is sufficient only for the off-peak requirement. As a result of this the most of the thermal power stations run to their total capacity even during off peak hours (only in eastern region the capacity build-up is in excess of demand and that too because of very weak transmission and distribution infrastructure which is not able to absorb the power that the system is capable to deliver). Substantial investments are therefore needed to almost double the capacity in a period of 10 years.

State Electricity Boards, barring a few exceptions, have not done enough to keep their distribution system toned up through strengthening of the distribution network to provide reliable power supply. Because of poor financial health over the years, there is a huge backlog of investments
required for augmenting and strengthening the distribution system. As a result, while part of the problem of reliability and quality of power supply is attributable to demand and supply mismatch, a substantial part of the problem is attributable to poor distribution system.

There is enormous loss of electricity in transmission and distribution. Because of bad distribution network, technical loss is of 12 to 15% and more than this is the loss on account of theft, Poor metering, inadequate meter reading, etc. Inmost of the SEBs technical and commercial losses put together are of the order of over 40%. For last several decades Electricity Boards have been wrongly reporting distribution loss figures to be in the range of 18-22% and have been conveniently identifying the theft of electricity as agricultural consumption, which is largely unmetered.

Because of political compulsions there have been an attempt in the past to provide an appropriate retail tariff structure. Huge T&D losses coupled with totally improper tariff structure have led to substantial gaps between cost of supply and tariff and much more so between cost of supply and revenue. What is disheartening is that on these parameters also the deterioration in last 10 years (the period during which several policy initiatives have been taken), the situation has worsened. The table below gives the annual loss of Electricity Boards during last 10 years.
<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Loss Rs. Crores</th>
<th>ROR With Subsidy</th>
<th>Without Subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991-92</td>
<td>3083</td>
<td>-7.6%</td>
<td>-12.7%</td>
</tr>
<tr>
<td>1997-98</td>
<td>13962</td>
<td>-11.8%</td>
<td>-22.9%</td>
</tr>
<tr>
<td>2000-01</td>
<td>26103</td>
<td>-27.6%</td>
<td>-35.1%</td>
</tr>
</tbody>
</table>

In 1991-92 the average tariff was servicing about 84% of the cost on supply. This has gone down to 69% in the year 2000-01.

A large number of Electricity Boards are not able to cope with the requirement of working capital, let alone creating resources for augmentation, expansion and growth of the distribution system.

SEB's under the control of State Government have become an instrument of political patronage. Subsidised or free Electricity Supply to large group of consumers, interference in day to day operations of the working of the Boards, including in postings, transfers, constraints to the Board Management in regulation of disconnecting of power supply to defaulting consumers and their inability to enforce discipline and work culture among the staff have been the obvious outcome of controls of Electricity Boards through political system at the State level.

As a result of the above major problems, the biggest sufferers have been the paying consumers in terms of reliability and quality of supply of power and the service they deserve to be provided by utilities.
Voltage profile, range of frequency of operations, disruptions of power supply, its restoration, promptness to respond to consumer complaints, establishment of new connections – have all suffered in view of the totally non-commercial work culture among most of the electricity utilities.

2.5 NEW REGULATORY FRAMEWORK:

It is in the above background that when India's private power policy, formulated in 1991 and refined from time to time during 1992-97, received rather lukewarm response in terms of effective action, it was felt that sectoral reform was a must to provide the right framework for investment to flow in. It was also recognised that perhaps distribution is the right end from where the policy initiatives should have begun rather than from the generation end of the business. It was also realised that unless commercial aspects of this industry were set right, other policy initiatives may not be in a position to deliver.

De-politicisation of tariff formulation and proper regulation of utilities was considered to be one of the first few essential requirements to set things in order. Accordingly in May 1998 Electricity Regulatory Commission Act was passed by the Indian Parliament. The Act provides for Central Electricity Regulatory Commission at the GOI level and State Regulatory Commissions for each of the States. In the 50 years of history of power industry this was one of the most important historic intervention with a powerful potential to free the electricity industry from political imperatives
and compulsions, more particularly in respect of issues like tariff structure and the functioning of the industry.

The real issues relate to improving reliability of power supply for which shortages have to be tackled, system network and other infrastructure will have to be strengthened, good work culture will have to be established, and theft of electricity will have to be curbed and penalised.

The industry needs huge investments and therefore, investor friendly initiatives will have to be introduced. Somehow the experience of past does not demonstrate this concern. Confidence of investors will have to be enhanced by reducing the degree of regulatory uncertainty.

A lot of hope has been pinned on these regulatory institutions. The industry is in financial sickness. Power industry has not been taken as a preferred destination by the capital market, investors and developers. They have option to decide out of many other investment opportunities. Development orientation is needed on the part of the regulators. Regulatory requirement of Indian electricity is distinctly different from regulatory requirement in countries where the industry is fully stabilised, shortages are little, requirement of additions to capacity is of a marginal nature. In India investments are needed for almost every aspect of electricity industry and that too for almost than doubling the present infrastructure in each of the segments.
Consumers and public at large will need to be conveyed a clear message that it costs to produce and supply power, and unless they pay properly and adequately, industry will be unable to survive, grow and in turn will be totally unable to provide service to them.

2.6 REFORM AND RESTRUCTURING OF ELECTRICITY INDUSTRY IN ORISSA:

Orissa was the first State in the country which took the historic initiative to reform and restructure its power industry. Even before the central legislation viz., Electricity Regulatory Commission Act was passed in 1998, Orissa had already legislated Orissa Electricity Reform Act 1996. In pursuance of this Act it restructured its Electricity Board into Generation Companies, Transmission Company and Distribution Companies so as to establish accountability of operations of each one of this. In 1996 it also put in place the Orissa Electricity Regulatory Commission.

The distribution Business was restructured into four Distribution Companies which were subsequently privatised in April 1999 by disinvestment of 51% equity to private utilities. This exercise was highly ambitious in the sense that the privatisation covered the entire State including urban and rural areas in one stroke.

Some of the visible benefits of the reform are given below:
a. Tariff fixation has been depoliticised, to the extent that Government role is not there. Political pressures of course is there, but this may be the problem of transition period.

b. The Regulatory Commission has established consumer service benchmarks which utilities have to follow.

c. Political interference in the day to day operations of the utilities is almost negligible.

d. There have been extensive efforts on metering and meter reading, resulting in loss level coming low from 50% to around 40%.

e. Reliability of supply has definitely improved.

f. Though the companies have not been turned around, but financial losses have reduced.

g. For the rural areas an innovative exercise of micro privatisation involving Panchayats has been launched and there is a possibility that through the system of franchisee the rural electricity supply could be managed better.

It is clear that 40 to 50 year of accumulated problems would need to have a reasonable gestation to be solved. Radical changes have to be brought about with the same set up of officers and staff and therefore,
efforts toward making substantial improvement in work culture will need considerable amount of work for changing the mind set of employees as also the mind set of the public representatives, press, media and consumers at large. If in a period of 5 years or so substantially visible improvements are brought about, it would definitely be a gain for the industry which has, in the past witnessed only deterioration over a long period of time.

2.7 RECENT INITIATIVES OF THE MINISTRY OF POWER, GOVERNMENT OF INDIA:

The MOP, GOI has taken a number of important initiatives in the recent past. They have come out with a blueprint for power sector development which provides for six level intervention strategy. i) National level – covering policy and legal framework, ii) State level – covering tariff fixation, un-bundling and subsidies, iii) States Electricity Boards level – covering restructuring, accounting and MIS, iv) Distribution circle level – covering outage reduction reliability accountability, v) feeder level – coveting reliability, voltage stabilisation, metering HT/ LT ratio correction and vi) Consumer level – covering metering, billing and consumer satisfaction.

For the first time substantial budget allocation had been made to strengthen the distribution system by identifying specific circles for short term, medium term and long term improvement – technical as commercial improvements. These schemes are to be funded through Accelerated Power Development Programme (APDP) of the GOI. Appropriate monitoring
mechanism has been put in place by the MOP to derive the best possible advantage from this scheme. This initiative holds a lot of promise for bringing about reform at the distribution level.

The MOP, GOI have also started the system of signing Agreements with the State Government according to which funding will be available by way of soft loan and grant to States which agree to milestone based improvement and reform programmes. Electricity being in the concurrent list, this type of intervention by the MOP, which will inspire and motivate states to take important steps towards restructuring and reform, would definitely go a long way.

The MOP, GOI is also supporting and encouraging Renovation and Modernisation (R&M) of old power stations to generate additional power in short term and medium term. It is well established that investment required for (R&M) to create additional MW capacity is significantly less than the resources required for creating altogether new power capacity. These are well tested measures and have contributed toward overall improvement in the Plant Load Factors of power stations in the country. There is definitely scope for making substantial improvement in a large number of power stations which need R&M inputs. This step will further enhance the availability and Plant Load Factor.

The MOP has also prepared a ranking study of about 400 hydro-electric schemes. In the last 20 years the proportion of hydro capacity has diminished from 41% in 1979 to 29% in 1990 and further to less than 25% in 2001. There is a hydro potential of the order of 1,50,000 MW and there is
a need to give appropriate emphasis on hydro-electric development so as to set right the distortion which has taken place in the thermal – hydro proportion. The initiative needs concrete actions by various concerned agencies so as to change the situation in next 10 to 12 years.

Electricity Bill 2003 is perhaps the important initiative of the MOP, GOI. The industry has worked in according with the two important legislations Electricity Act, 1910 and Electricity (Supply) Act 1948 together with the recently enacted Regulatory Commission Act, 1998. Electricity Bill 2003 is an important step in integrating all these three legislations. The main feature of the Bill are a) Electricity generation free in licensing, b) setting up of Regulatory Commission is mandatory with the role of granting license for transmission and distribution, tariff setting, promotion of competition and efficiency, dispute resolution, etc., c) CEA role has been redefined d) All supplies are to be metered, e) Progressive reduction of cross subsidy, f) Stringent penalties against theft of electricity, g) Re-organisation of State Electricity Boards

The steps that have been taken now to bring about reform and restructuring in the sector are the steps which were needed to be taken in 1991-92. The results of these should have been available now in abundant measures. The industry would have been will prepared not only to cope with but also to effectively service huge capital investments needed for generation projects, transmission projects and distribution activities. Commercial health, on the basis of this action would have improved substantially.
Obviously distribution reforms including restructuring of tariff, removal of imbalances, elimination of gaps between cost of supply and revenue would strengthen the industry commercially and financially. There will, however, be an inevitable gestation period of 5 to 10 years depending on the pace of reform, restructuring and actions on other initiatives. During this period electricity being a infrastructure, the Government role will have continue in a big way. Private sector investment would flow only when commercial and financial health of this sector comes to a reasonably satisfactory level. Perhaps it was not a correct strategy that the Government role started diminishing right from 1991-92. In the next 5 to 10 years Government role will need to continue with appropriate emphasis and budgetary support which of course should be linked to seriousness of implementation of reform measures. Once the sector become commercially viable, external investments would be easy to obtain in comparatively less expensive ways.

It needs to be noted that generation projects have a minimum gestation period of some years. Unless and until financial markets, both domestic and international, develop greater faith in the commercial viability of this sector in the very near future, the country is likely to face power crisis in the coming years.

The objective of reforms is to bring in commercial viability in the power supply industry so as to ensure power supply of demand to all consumers at reasonable prices. The main features of the reforms strategy involve:

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(i) A credible independent Regulatory Commission is now a primary requisite for generating confidence for private investment on a significant scale.

(ii) Full audit of energy flow at all levels so as to accurately identify where energy is being consumed or lost. This would require at all substations and feeders.

(iii) Effective elimination of power thefts. All consumers of power need to be metered in a time-bound programme.

(iv) Tariffs which provide for commercial viability. The State Government would need to provide explicit subsidies for target groups as cross subsidy beyond a point is not sustainable. A situation where the industrial tariff becomes so high that Indian industry becomes non-competitive in the new environment of globalization, or finds captive generation cheaper needs to be avoided. Already in some States, there is a situation of stagnant industrial demand which is a matter of serious concern.

(v) Design and implementation of cost-effective investment for improving the sub-transmission and distribution network to reduce avoidable technical losses.
2.8 OPPORTUNITIES IN DISTRIBUTION SECTOR:

The important features of these emerging opportunities in distribution sector are – (a) they are ongoing businesses earning revenues, (b) prevailing high distribution losses provide ample opportunities for improvement thereby enhancing revenue and bottomline, (c) assets being old, the cost of acquisition would be comparatively inexpensive, (d) since the distribution system network is weak, there would be scope for capital investments which in turn will be entitled for additional revenue and profit. These corporatised and privatised distribution companies would provide a much higher level of confidence to the investors and developers in new power generation projects and transmission projects.

2.9 LESSONS FOR THE FUTURE

Orissa Electricity Reform, and particularly the privatisation of distribution, was the first ever such exercise undertaken in the country. This exercise has thrown up a number of issues based on the experience which would definitely be relevant for any reform proposed to be taken up anywhere in the country. Therefore, lessons drawn from Orissa, as given below, need to be given serious consideration:
i. TAKING up privatisation of distribution of the whole State in one go would, perhaps, be too optimistic an approach and too unrealistic a target to succeed.

ii. Orissa model covering rural and urban area together and geographically structuring Distribution Companies on the basic of this approach may create enormous amount of difficulty in respect of issues like extension of rural electrification and dispensation of subsidy in rural areas. Dispensation of subsidy through private sector route creates enormous difficulty of administering it and on the matter of transparency.

iii. No one single model of restructuring may be valid and relevant for all the State nor the same model would be applicable in the entire state. It also needs to be recognised that private sector in distribution, considering the number of players available in the country, could only increase gradually and not on a large scale.

iv. In any State, therefore, privatisation could begin from areas of concentrated loads and could gradually expand. It needs to be mentioned that in most State major amount of financial loss in distribution business is from areas having concentrated loads. This needs to be set right first.
v. Too optimistic evaluation of assets leads to serious problems of financial engineering and creates avoidable problem of tariff shock, and hence upvaluation needs to be avoided.

vi. Substantial amount of work is required to be done for preparation of authentic information memorandum, receivables, quality of receivables, liabilities, pension, PF, etc.

vii. Compilation of assets record giving the exact status / conditions of various assets is a must. Same applies to inventory in stores.

viii. Bases line on performance parameters such as transmission and distribution loss, bill collection percentage need to be determined carefully so that they could be relied upon. These is a case to review T&D loss approach. Technical & Commercial loss together, which will include collection inefficiency, will be a better parameter.

ix. We may redefine distribution loss in a way which will reflect the gap between input power and power for which the collection in made rather than the gap between input and billed power.

x. Regulatory Approach:
• Determination of improvement targets by Regulatory Commission also needs to be done on a realistic / achievable basis

• A five years perspective of tariff together with the efficiency gains would lead to predictability for all stakeholders.

• A reliable determination of revenue gap during the transition period and making suitable financial support arrangement, may be necessary.

• Entire receivables could be treated as assets of erstwhile SEB with a stipulation that the new Distribution Company will make all efforts to collect these receivables as an agent.

xi. Due diligence of various liabilities those from accumulation of leave, leave encashment, gratuity, provident fund, pensions etc., needs to be done systematically and requires a pragmatic approach.

xii. Proper arrangement for payment of bill in respect of supply of electricity to Government Department / undertaking.
xi. A streamlined method of release of World Bank Fund or such other fund in respect of capital works will lead to speedy implementation of T&D strengthening schemes.

xii. A clear-cut plan and procedure on rural electrification, capital and revenue subsidy and its method of payment would ensure that rural electrification programmes do not suffer.

xiii. The agency taking over from electricity boards should have some freedom to screen out a specified number of employees and managers.

xiv. It needs to be recognised that problems of distribution, whether technical, commercial or financial have accumulated over 50 years. These would be at least 5 years of gestation when these companies would be in serious financial difficulties. Expectations from privatisation, however, have to be moderated. Hand holding assistance during this period would be must for a better future. Modality of such hand holding has to be worked out.

xv. Process of communication has to be systematic and comprehensive right from the stage when preparation for privatisation starts and through the period of transition of 4 to 5 years after privatisation.
xviii. Unrealistic expectation from consumers, public, political system and the Press might lead to wrong conclusions that such initiatives do not deliver.

xix. Various consultants and agencies preparing Information Memorandum and legal documents should be appointed with a clear brief that they need to take care of the interests of all the stakeholders and not only of the disinvesting Electricity Boards. The objective should be that balanced documentations emerge taking care of the rights and interests of all the stakeholders.

2.10 OPTIMUM UTILISATION STRATEGIES FOR EXISTING POWER PLANTS

Power in a highly capital intensive industry. Even the conventional power generation facilities which are comparatively less expensive (in terms of capital) as compared to non-conventional source of power generation, require substantial amount of capital. It is, therefore, a national responsibility and more particularly the responsibility of all power professionals, to ensure that power plants are operated at the optimum level of their capacity and efficiency. High availability of plants and machinery through adoption of proper operation and maintenance practices would facilitate such optimum utilisation. In a number of highly developed countries where the installed capacity is far in excess of requirements, the
capacity utilisation may not be a relevant consideration. However in Indian power industry which is characterised by shortages and serious mismatches between demand and supply, particularly the shortages during peak hours, maximising the capacity utilisation is imperative.

It is highly gratifying that Indian power industry has been able to engineer, construct and operate large capacity super thermal power plants with a high degree of availability and Plant Load Factor (PLF). In some of the power stations, the availability is as high as 90% and PLF is between 85-90%. The industry has been able to incorporate and assimilate the best of technology and the best of operating practices leading to such National Thermal Power Corporation Ltd. (NTPC) but also a large number of power stations operated by Electricity Boards and other utilities are demonstration such satisfying results. In fact, in the last 15 years, the performance of the power stations as a whole in the country has improved from a PLF of 48.3% in 1982-82 to 64.4% in 1996-97. The performance improvements during the 90s have been even more remarkable.

<table>
<thead>
<tr>
<th>Year</th>
<th>PLF (%)</th>
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<tbody>
<tr>
<td>1990-91</td>
<td>52.3</td>
</tr>
<tr>
<td>1991-92</td>
<td>55.3</td>
</tr>
<tr>
<td>1992-93</td>
<td>57.1</td>
</tr>
<tr>
<td>1993-94</td>
<td>61.0</td>
</tr>
<tr>
<td>1994-95</td>
<td>60.0</td>
</tr>
<tr>
<td>1995-96</td>
<td>63.0</td>
</tr>
<tr>
<td>1996-97</td>
<td>64.4</td>
</tr>
</tbody>
</table>
It is definitely possible to further improve the national average PLE. A 10% improvement in generation in the existing power plant, may lead to an average PLF of over 70% - a target with is realistic and achievable. This will also mean substantial relief in mitigation of the shortages.

2.11 STEPS TO IMPROVE CAPACITY UTILISATION OF POWER PLANTS

2.11.1 BETTER O&M PRACTICES AND WORK CULTURE

Quite often, it is brought out that substantial improvement in capacity utilisation (PLF) would necessarily require large capital investment for Renovation and Modernisation (R&M). While it may be true in a number of cases, it is also a fact that a large number of power stations can be operated at higher levels of availability and PLF without any significant capital investment for such R&M works. The following two cases can be briefly mentioned to make the point:

a. The Management of the Badarpur Thermal Power Plant was handed over to NTPC in 1978-79 when the performance of the station was about 30% PLF. The first stage of the power station consisting of 3 units of 100MW each had been commissioned during the period 1967 to 1970. After the take over of management several steps were taken,
including short-term, intermediate-term and long-term programmes, to improve the working of the power station. In a period of three years without any significant capital investment for R&M, the PLF was improved to about 60%. Improvement to above 50% was bought out within two years and to about 45% in one year. Further improvement did need capital investment of short-term and long-term nature. With R&M phase - I, it was possible to further improve the PLF and by the year 1992-93 this power station came in line with other power station of NTPC generating at over 72% PLF.

b. The case of Unchahar Power Station is even more relevant to make the point that proper operation and management practices and right work culture will definitely fied to higher capacity utilisation even without capital investment. Unchahar Power Station - 2 x 210 MW (in up State) was taken over by NTPC in February, 1992. During year 1991 the PLF of this station was 12.85%. After commissioning of this power station (first unit in November, 1988 and 2nd Unit in March, 19989) both the units of this power station had never been operated together. Within 7 days of takeover both the unit was operated together. Within 100 days, the availability improved from 27% for the period March 1991 – February 1992 to over 58% and PLF for the same period from 18% to 48%.
In this power station on account of various steps to streamline R&M practices the PLF improved to over 60% within six month and over 70% in 12 months after the take over. The availability PLF and a specific oil consumption during 1992 and 1993 as compared to the pre-take over year of 1991 is given below:

<table>
<thead>
<tr>
<th>Year</th>
<th>Availability (%)</th>
<th>PLF (%)</th>
<th>Specific Oil Consumption ML/KWH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>19.37</td>
<td>12.85</td>
<td>23.28</td>
</tr>
<tr>
<td>1992</td>
<td>59.39</td>
<td>43.91</td>
<td>10.29</td>
</tr>
<tr>
<td>1993</td>
<td>80.79</td>
<td>71.08</td>
<td>03.01</td>
</tr>
</tbody>
</table>

2.11.2 RENOVATION AND MODERNISATION

R & M for old power stations must be paid due attention to get the best output from these plants. It has been recognised that it would be possible to create the additional generation capability at much cheaper cost.
by way of R&M than by creating an all together new capacity. The following suggestions need consideration:

a. Power Finance Corporation could be the main funding agency for this work. For R&M works there should be more relaxed criteria for providing than for new power project.

b. All such power station which have lower PLF need to be brought into focus. BHEL and NTPC could combine their efforts to provide necessary consultancy and R&M inputs.

c. Wherever major funding requirements exit in view of the power station being very old, SEBs could consider selling such a power station so that the private agency could be asked to invest substantial capital for R&M.

d. A variation of the above model could be a joint venture between SEB and another organisation for the same assignment.

e. As an alternative, the concept of lease rehabilitate, operate & transfer (LROT) could also be considered. Agencies could be selected on the basis of pre-determined criteria.

f. Long-term management contract could be yet another option. This would, however, succeed only if the mechanism is evolved
to make the employees accountable and under control to the agency entrusted with the management.

2.12 MANAGEMENT OF MAINTENANCE OF LARGE SIZE THERMAL POWER STATION

In the context of Indian power sector which is characterized both by deficit in energy supply and deficit in capacity with reference to peak demand, management of power station to generate maximum power assumes great importance. In other developed countries where the capacity build up is significantly more than the peak demand, the availability of redundancy is so much that utilisation of capacity expressed in terms of Plant Load Factor (PLF) is really not an indicator of the station performance. It is the Availability Factor which reflects its performance. This situation of shortage is likely to continue in our country for some more time and till then maximum generation to maximise PLF would continue to be looked upon as the most important performance parameter.

2.12.1 NTPC’S PERFORMANCE VIS-A-VIS NATIONAL AVERAGE

NTPC has established in itself in the field of Project Management by commissioning successfully most of its 200 MW and 500 MW sets ahead of schedule. Except for a few examples here and there NTPC’s Project Management performance is virtually unmatched not only within India but also internationally. Performance of NTPC in respect of operation and
maintenance of power stations is remarkable. The average PLF has always been higher than the national average by 10 to 25%.

It needs to be appreciated that if a 200MW set is out of the grid for a day the loss of power at today’s rate is equivalent to over Rs.20 lakhs of revenue loss and the corresponding figure, if a 500MW set is down for a day, is over Rs. 50 lakhs of revenue loss with consequential effect on and loss from all the industrial and economic availability of systems or sub-systems which leads to reduction in generation of power in such large capacity sets has a tremendous impact in terms of revenue loss and consequential.

Management of large size power stations, therefore, has to be viewed in the context of above presentation. Maintenance of various systems and equipments, to maximise plant availability and to maximise generation on a long-term basis, should constitute the main aims and objectives of maintenance management. The maintenance policy should include various aspects of routine preventive maintenance, breakdown maintenance, major overhauls and approach and strategy towards plant betterment. It should also include approach towards spare parts management which is an integral part of the maintenance policy.

In the year 1985, Government of India had constituted a Committee to study and make recommendations on modernisation of maintenance procedures in large thermal power stations. The Committee submitted its report in 1986 and covered many important aspects including preventive
maintenance, long-term and short-term overhauls and spare parts etc. There is a good degree of commonness between NTPC's maintenance policy and systems and the one recommended by the said Committee's report on modernisation of maintenance procedures provide very important framework for organising and managing maintenance activities.

2.12.2 CRITICAL ANALYSIS OF LOSS OF GENERATION

Analysis of loss of generation should be a regular exercise to be carried out by each station on a monthly/quarterly basis so as to identify the important factors that contribute to reduction in generation of power. Even unit of power loss is important. However, to manage effectively, within the available resources.

2.12.3 CRASHING OF SCHEDULES FOR OVERHAULS

Besides the statutory overhauls of the boiler, capital overhauls including overhaul of turbine are carried out on periodic intervals. Also overhauls are carried out for other systems/equipments such as overhaul of mills, motors, fans etc., from time to time. Normally each power station has time schedules in the form of CPM networks for these overhauls. Coupled with these time schedules are also the resources allocation in terms of manpower, materials, tools and tackles. At the time of such overhauls any other defects on the related system or equipment which are parallelly to be shutdown are also attended to. What is being suggested is that there is a need to question the time
element provided for each of the activities involved in an overhaul, more particularly those activities which are on the critical both. Such critical review should be aimed at crashing the total duration. For example, if for a boiler overhaul of 200MW, the time exercise should aim at reducing this duration to say 25 days or less. To attempt such a crashing it might be necessary to augment the overhaul schedules and continuous effort to reduce the duration of long-term; medium term and short-term overhauls should be one of the major responsibilities of the long-term maintenance-planning cell. While attempting this exercise, modular concept of replacement of a part of the system/equipment could prove to be quite effective.

2.12.4 DEVELOPMENT OF MAINTENANCE SPECIALISTS

The specialists would need to be developed at two levels viz., technicians/master technicians who could carry out all types of repairs on a particular machine/system or a group of machines. They would need to be given a combination of training inputs in India and abroad with the objective of developing them to a level of perfection on the system for which they are trained. Another level of maintenance specialists would be the engineers who would be expected not only to diagnose all types of defects and problems but also to plan and guide the repairs of the equipment. Here again the inputs can be from a variety of sources with the sole objective of developing these specialists to a high level of knowledge and specialization of system and equipment for which they are identified.
2.12.5 COMPUTERISATION OF MAINTENANCE ACTIVITIES

Maintenance of large size thermal power station requires not only forecasting of failures but also planning of the maintenance activities including resources mobilization aiming at minimum outage. With the power station ageing with time and with preventive, breakdown and overhaul maintenance activities continuously going on one set or the other, effective way of handling maintenance would warrant an integrated computerization of spares procurement, spares storage and monitoring of maintenance activities. The following types of maintenance activities could be taken up for computerization, pending addition of further activities, on a priority basis:

a) forecasting of failure of equipment based on collection and analysis of data from the concerned power station.

b) Variety of output sheet based on the analysis of networks for history cards could also be considered.

c) Development of maintenance schedule networks for large number of preventive and breakdown maintenance activities of repetitive nature. While developing these schedules, optimization of time duration could be attempted by varying the resource inputs, the total duration of schedule could be optimized.
d) Development of time schedule networks for short-term, medium-term and long-term overhauls of a piece of equipment of for the whole system. Here again by varying the resource inputs, the total duration of schedule could be optimized.

e) Monitoring of progress with reference to the networks either for the overhauls of for the other regular maintenance activities (preventive as well as breakdown). Depending on the extent of progress, slippages could be taken into account by updating networks and wherever possible by crashing so as to catch up with the ultimate schedule.

f) Maintenance activities have to be carried out on periodic basis viz., daily weekly maintenance schedule. This could be prepared through computerization and also the progress could be monitored through computers.

g) Integration of maintenance activities, particularly of medium-term and long-term nature with the spare parts management including indenting, procurement, issue etc.

These are the activities which should be taken up for computerization in the first stage. Subsequent stage of computerization could be analysis of the maintenance feedback for programmes like design changes, plant betterment etc.
The average PLF may put a power station higher than another power station, but it has also to be seen whether the range of variation on day-to-day basis and also within an hour-to-hour basis is within the desirable range or the fluctuations are too high to keep the customer happy. The good maintenance management system when properly implemented would not only lead to maximization of availability and maximization of generation but would also ensure a reliable supply of power.