Performance of Indian power sector during a decade under restructuring: a critique

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Abstract

The Indian power sector has been facing serious functional problems during the past few decades. In order to re-vitalise the sector and to improve its techno-economic performance, Government of India has initiated restructuring process in 1991. This paper reviews the performance of the Indian power sector in the last decade (1991-2001), while undergoing the restructuring process. The study also examines how far the restructuring process during this period has been effective in realising its set objectives and benefited the social development of the Nation. A critical evaluation of the methodology and steps so far adopted for the restructuring process and a few suggestions for re-framing the future course of reforms also have been proposed in this paper.

Keywords: Power sector restructuring; Indian power sector; Performance evaluation of power sector

1. Introduction

Though the Indian power sector has achieved substantial growth during the post-independence era, the sector has been ailing from serious functional problems during the past few decades. The power sector annually avails a substantial share of the outlay of the national economic plan (about 13-18\%), but most of the State Electricity Boards (SEBs) in India have been striving under resource crunches and operating at huge commercial losses. Consequently, the electricity services provided to the consumers by these SEBs—both in terms of quality and quantity—are 'poor'.

The supply-demand gap of electricity in India is consistently widening over years and most of the States in India are facing heavy electricity shortage. Typical for most of the developing countries, the power 'crisis' in India also had been identified to be arisen out of serious inadequacies in the structure and performance of the power sector. Functional inefficiency of Government owned SEBs, non-rationality at all phases of trading of energy (including tariff setting, metering, billing and revenue collection), inability of the utilities to mobilise adequate resources for capacity expansion and modernisation, etc.; have been cited as the major reasons for the crisis (Baijal, 1999; Planning Commission, 2001a, b; Parikh and Radhakrishna, 2002).

Basic and radical restructuring of the power sector had become imperative to improve the consumer services and also even for the sustenance of the power sector itself avoiding a shatter. It was under these circumstances, Government of India, in the year 1991 decided to appropriately restructure the Indian power sector in a phased manner. The prime objective of the reform process was to transit the power sector into a technically efficient and commercially profitable energy—trading sector. The Government of India as well as the State Governments have taken various steps during the past decade for implementing the restructuring process through legislative and administrative measures.

Thus commenced in 1991, the Indian power sector has undergone quite a lot process of reforms during the past ten years. Following a full decade of reforms, the objective of this study is to examine the performance of the Indian power sector during the period from 1991 to 2001 and to review how far the restructuring processes
have been effective in realising their set goals. As improved energy services have vital roles in the improvement of social conditions, how far the power sector reforms during the past decade have also been effective as a welfare measure for social development in India? A brief evaluation of this issue is also attempted in this study.

This paper is divided into ten sections. After this introduction, Section 2 provides a brief literature review and discusses the theoretical background of performance evaluation studies. After narrating the pre-reform profile of Indian power sector in Section 3, Section 4 discusses the objectives and salient features of the reform process initiated in the Indian power sector. Section 5 briefly the techno-commercial indicators selected in this study for performance evaluation. Section 6 is devoted for the review of the performance of the Indian power sector during the period 1991-2001. This is attempted in four sub-sections. Sections 6.1 and 6.2 evaluate the technical and economic performance of the sector, respectively. Section 6.3 examines the role of private sector participation during this period in improving the resource mobilisation in the power sector.

In order to understand the specific impacts of the power sector reforms at micro level, the performance of the power sector in five selected Indian States undergoing reforms have been attempted in Section 6.4. The role of electricity regulatory commissions—the main by-product of the power sector reform process in India—is briefly reviewed in Section 7. Section 8 provides a general assessment of the performance of the power sector in the last decade while undergoing the reform process. A critical evaluation of the methodology and steps adopted for restructuring process in India and their impacts at large are also discussed in this section. A few suggestions for re-framing the future reform strategy is depicted in Section 9. Concluding in Section 10, the authors affirm the need for a holistic review of the present reform process to make it more appropriate and effective in Indian scenario.

2. Literature on utility performance under restructuring

During the past decade, utility restructuring have been taken up by countries worldwide and the reform process are at various stages now. While most of these countries are deriving successful results, restructuring efforts in a few countries (like California) had ended up in unmitigated disaster. During this period, quite a good number of studies have attempted to review the degree of success of the reform process in various countries. All these studies analyse the performance on the basis of actual data over a selected period and in some cases depend on the simulated data of historic trend (Pollitt, 1997).

Most of the earlier studies measured the success of restructuring either by comparing the energy prices (Yarrow, 1992) or by making general efficiency comparisons (Burns and Weyman-Jones, 1994). A few subsequent studies reviewed the macro economic linkages of energy and the consumer price benefits aroused out of restructuring (Chisari et al., 1999; Antonio et al., 2001). However, these empirical studies do not take into account of the country specific issues like income distribution or environmental impacts. In a more comprehensive approach, one study evaluates the influence of regulatory reforms in 19 OECD countries with the aid of a set of regulatory indicators (Faye Steiner, 2000). This study also explores the relative efficiency of different reform strategies employed in these countries. A few studies, of late, measure the success of regulatory reforms on the scales of ‘public good’ (Cecilia Ugaz, 2001; Maximo and Alberto, 2001; Preetum and Pollitt, 2000; Kristin et al., 2001; Chisari et al., 2001). Most of these studies conceptualise the objective of restructuring process as a welfare measure and some even underline that success of power sector reforms (especially in developing countries) shall be meaningfully evaluated by measuring their ability in benefiting the majority of (economically weaker section of) population (Berket et al., 2002; Karekezi and Majoro, 2002).

A few studies related to the restructuring process taking place in India have been published in the past (Dubash and Rajan, 2001; Ruet, 2002; Godbole, 2002a, b,c; Reddy, 2000, 2001, 2002). Though these studies do not provide a comprehensive evaluation on techno-commercial performance of power sector undergoing restructuring, they focus and review various aspects of the reform process like utility privatisations, regulatory commissions, economic impacts etc. This present study is an effort to comprehensively examine the past performance of the Indian power sector under reforms, covering both technical and economic spheres.

3. Indian power sector in 1990: a pre-reform profile

Commencing with a meager installed capacity of 1300MW during the year of national independence in 1947, the Indian power sector has made substantial growth over decades. By the year 1990 the installed capacity grew to the tune of 75000 MW and the total electricity sale was about 289,440 million units. Major portion of the transactions related to the trading of electricity in the country, including generation, transmission and distribution, power delivery and revenue realisation have been carried out at State level by 19 State owned Electricity Boards (SEBs) and also six Electricity Departments of the Governments in a few States. The functional structure of the SEBs was vertically integrated, and the control—not only in matters of policy but on day-to-day affairs also—
were basically resting with the energy ministries of the State Governments. In general, the technical performances of these SEBs were not satisfactory. The T&D losses recorded during the year 1991 was about 22.90%. Thermal power stations were operating at very low efficiency and with average Plant Load Factor (PLF) of only 53.90%. The generating capacity additions were totally inadequate to meet the growing demand requirements and consequently the deficits in electrical energy and peak-power requirement experienced during the year 1990-91 were 7.7% and 18.8%, respectively.

### Selected indicators of Indian Power Sector, 1990-91

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed capacity</td>
<td>74,698 MW</td>
</tr>
<tr>
<td>Hydro-thermal ratio</td>
<td>21.71</td>
</tr>
<tr>
<td>Gross annual generation</td>
<td>289,440 million kWh</td>
</tr>
<tr>
<td>Energy deficit</td>
<td>7.7%</td>
</tr>
<tr>
<td>Peak power deficit</td>
<td>18.8%</td>
</tr>
<tr>
<td>Percapita consumption</td>
<td>271 kWh</td>
</tr>
<tr>
<td>T&amp;D losses</td>
<td>22.9%</td>
</tr>
<tr>
<td>Plant load factor of thermal stations</td>
<td>53.9%</td>
</tr>
<tr>
<td>Annual commercial loss of 40,210 million rupees SEBs</td>
<td>22.9%</td>
</tr>
<tr>
<td>Average production cost of 108.58 paise/kWh electricity</td>
<td>22.9%</td>
</tr>
<tr>
<td>Average tariff</td>
<td>81.80 paise/kWh</td>
</tr>
</tbody>
</table>

Note: One Indian Rupee = 100 Paise = 0.02 US$ in 2003.

The efforts to restructure the power sector in India formally commenced in 1991. The prime reasons which prompted the Government to initiate such a reform process were: (i) the ever-widening gap between the demand and availability of electricity, (ii) the poor technical and financial performance of the State Electricity Boards and (iii) inability of the Central and State Governments to finance and mobilise resources for generation capacity expansion projects, making third party investment in power sector imperative.

The initial step in this direction has been the amendment of legislation governing the electricity sector in 1991. This allowed private sector participation in power generation and also permitted foreign companies to build up power projects in India and sell the power to SEBs. The National Development Council set up in 1993 was the first official body to steer the reform process. This was followed by various national level conferences of State Chief Ministers during the years 1996, 1998, 2000 and 2001. Comprehensive reforms of legislation including Electricity Regulatory Commission Act (1998) and electricity bill (2001) also followed. Central Electricity Regulatory Commission (CERC, formed on 26 April 1999) as well as State Electricity Regulatory Commissions (SERCs) subsequently set up in 15 States are already functioning. Most of the States have initiated reform process and some have made substantial progress in restructuring of the power sector.

The salient features of the restructuring process of Indian power sector can be summarised as follows:

(i) Unbundling of vertically integrated SEBs into different companies, segregating along their different functional lines viz. generation, transmission and distribution. This was expected to bring greater operational efficiency in all the three functional areas.

(ii) Allowing private investment (from both national and foreign investors) in all spheres of electricity industry, mainly in generation sector. This was anticipated to improve resource mobilisation in the generation sector and also attract Independent Power Producers (IPP). It was also expected that the shortfall in generation capacity could be reduced by this way and would relieve SEBs from financial crunches. Resultant competition in generation and retail marketing of electricity was intended to fetch improved consumer service, reduced retail prices and better functional efficiency.

(iii) Steps to rationalise the tariff, effort to reduce the commercial losses, promote fair competition and to ensure transparency in all activities related to the trade of electricity. For this purpose independent electricity regulatory commissions at Centre and State levels were proposed to be set up.

The Indian Electricity Act 2003 recently enacted by the Indian Parliament embodies the above features of reform steps carried out during the past decades.
(Ministry of Power, 2003). As depicted in the preamble of this Act, the basic guiding principles and objectives of the restructuring were to

- take measures conducive to the development of electricity in India;
- to ensure reasonable price of electricity;
- to promote free and fair competition so as to achieve greater operational and economic efficiency and
- to establish independent and transparent electricity trade regulations through establishing regulatory commissions.

Section 5 provides review of the performance of the power sector during the last decade while undergoing the process of reforms and evaluates how far it was successful in achieving the set goals of reforms.

5. Selection of performance indicators

A number of indicators—categorised under technical and economic indicators—have been defined in recent studies monitoring the performance of the power sector (World Bank, 1995). The selection of a particular set of indicators depends on the objective of the evaluation. As this study intends to evaluate the success of restructuring process in India and also attempts to assess the social benefits that could be accrued out of restructuring, a set of techno-commercial indicators that are felt capable of revealing these aspects has been selected for this study. Details and brief statistics of the indicators selected for review are shown in Table 1. The data for this analysis have been adopted from the published annual reports of the Planning Commission of Government of India, UNDP, the energy directory published by Tata Energy Research Institute and from the Census Department (Planning Commission, 2002; UNDP, 2002; TEDDY, 2002; Census, 2001).

5.1. Technical indicators

The energy deficit and peak power shortages are two key technical indicators selected to provide an overall indication of the power supply position in India during the period of review. These indicators are based on the assessments provided by the Central Electricity Authority (1995) in the 15th power survey. Similarly the targeted capacity addition in power generation as per the national plans as well as a comparison of these targets with the actual realisation during this period are intended to provide a measure of the effectiveness of the project planning and implementation during the period of restructuring. Another indicator adapted in this study is the national per capita consumption of

Table 1
Statistics of techno-economic indicators

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Period</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
<th>Coefficient of variation</th>
</tr>
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<tbody>
<tr>
<td>Technical indicators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy deficit (percentage)</td>
<td>11</td>
<td>1991-2001</td>
<td>5.9</td>
<td>11.5</td>
<td>7.9</td>
<td>1.52</td>
<td>0.19</td>
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<tr>
<td>Peak power deficit (percentage)</td>
<td>11</td>
<td>1991-2001</td>
<td>11.3</td>
<td>20.5</td>
<td>15.7</td>
<td>3.19</td>
<td>0.20</td>
</tr>
<tr>
<td>Addition of installed capacity—hydro (MW)</td>
<td>5</td>
<td>1997/98-2001/02</td>
<td>233</td>
<td>1371.5</td>
<td>907.6</td>
<td>496.4</td>
<td>0.55</td>
</tr>
<tr>
<td>Addition of installed capacity—thermal (MW)</td>
<td>5</td>
<td>1997/98-2001/02</td>
<td>2009</td>
<td>3699.5</td>
<td>2719.4</td>
<td>677.8</td>
<td>0.25</td>
</tr>
<tr>
<td>Addition of installed capacity—nuclear (MW)</td>
<td>5</td>
<td>1997/98-2001/02</td>
<td>0</td>
<td>440</td>
<td>176</td>
<td>240.9</td>
<td>1.37</td>
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<tr>
<td>Addition of installed capacity—total (MW)</td>
<td>5</td>
<td>1997/98-2001/02</td>
<td>3115.2</td>
<td>4532.5</td>
<td>3803</td>
<td>6204</td>
<td>0.16</td>
</tr>
<tr>
<td>Addition of installed capacity from private sector (MW)</td>
<td>5</td>
<td>1997/98-2001/02</td>
<td>588</td>
<td>1575</td>
<td>1012.2</td>
<td>387.0</td>
<td>0.38</td>
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<tr>
<td>Percapita consumption of electricity (kWh)</td>
<td>9</td>
<td>1991/92-1999/00</td>
<td>229</td>
<td>359.6</td>
<td>314.8</td>
<td>44.9</td>
<td>0.14</td>
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<td>T&amp;D losses as % of availability</td>
<td>11</td>
<td>1991-2001</td>
<td>21.1</td>
<td>31.4</td>
<td>24.9</td>
<td>3.6</td>
<td>0.14</td>
</tr>
<tr>
<td>Auxiliary consumption as % of availability</td>
<td>11</td>
<td>1991-2001</td>
<td>6.6</td>
<td>7.3</td>
<td>7.1</td>
<td>0.20</td>
<td>0.03</td>
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<td>Plant availability (thermal)</td>
<td>10</td>
<td>1991/92-2000/01</td>
<td>72.8</td>
<td>80.5</td>
<td>77.8</td>
<td>2.5</td>
<td>0.03</td>
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<tr>
<td>Plant load factor (PLF) (thermal)</td>
<td>11</td>
<td>1991/92-2001/02</td>
<td>55.3</td>
<td>69.9</td>
<td>63.3</td>
<td>4.6</td>
<td>0.07</td>
</tr>
<tr>
<td>Forced outage ratio (thermal)</td>
<td>10</td>
<td>1991/92-2000/01</td>
<td>11.9</td>
<td>16.19</td>
<td>13.4</td>
<td>1.4</td>
<td>0.11</td>
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<tr>
<td>PLF of State owned thermal stations</td>
<td>10</td>
<td>1992/93-2001/02</td>
<td>54.1</td>
<td>67</td>
<td>60.2</td>
<td>4.4</td>
<td>0.07</td>
</tr>
<tr>
<td>PLF of Centre owned thermal stations</td>
<td>10</td>
<td>1992/93-2001/02</td>
<td>62.7</td>
<td>74.3</td>
<td>70.8</td>
<td>3.4</td>
<td>0.05</td>
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<tr>
<td>PLF of Private owned thermal stations</td>
<td>10</td>
<td>1992/93-2001/02</td>
<td>57</td>
<td>74.7</td>
<td>68.1</td>
<td>5.9</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Economic indicators

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Period</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
<th>Coefficient of variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average production cost (Paise/kWh)</td>
<td>11</td>
<td>1991/92-2001/02</td>
<td>21.2</td>
<td>349.9</td>
<td>221.2</td>
<td>82.3</td>
<td>0.37</td>
</tr>
<tr>
<td>Average tariff (Paise/kWh)</td>
<td>11</td>
<td>1991/92-2001/02</td>
<td>89.1</td>
<td>239.9</td>
<td>162.2</td>
<td>50.5</td>
<td>0.31</td>
</tr>
<tr>
<td>Average cost recovery as % of production cost</td>
<td>11</td>
<td>1991/92-2001/02</td>
<td>67.8</td>
<td>82.2</td>
<td>74.8</td>
<td>4.9</td>
<td>0.07</td>
</tr>
<tr>
<td>% rate of return without subsidy</td>
<td>10</td>
<td>1992/93-2001/02</td>
<td>-3.3</td>
<td>-2.2</td>
<td>-1.45</td>
<td>10.6</td>
<td>0.72</td>
</tr>
<tr>
<td>% rate of return with subsidy</td>
<td>10</td>
<td>1992/93-2001/02</td>
<td>-4.4</td>
<td>-12.3</td>
<td>-2.57</td>
<td>13.0</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Sources: (1) Annual report (2001-02) on the working of the State Electricity Boards and Electricity Departments, Planning Commission, Government of India, May 2002. (2) TERI energy data directory and year books (TEDDY 1996/97 and 2001/02), Tata Energy Research Institute, New Delhi.
electricity. Growth in per capita consumption does not represent the true growth of power sector. However, a comparison of this indicator with that of other similar developing countries as well as an analysis of the structural changes occurred in consumption by various sectors is attempted in this study. This is expected to provide a meaningful indication of the social benefits provided by reforms during this period.

Regarding the operational performance indices, two common indicators—T&D losses and auxiliary consumption rate of power stations—are selected. The variation of these indices over the period of review are intended to reveal how far the technical measure adapted during the reform process have been effective to bring down the high level of technical losses of Indian power sector. The operational efficiency of thermal power stations in India has been identified to be very poor. In order to evaluate the improvement in the performance of thermal stations, three indicators viz: plant availability factor, PLF and forced outage ratio have been selected. These indices in respect of thermal stations falling under three separate categories of ownership (Central owned, State owned and private sector stations) have been reviewed separately. No suitable indicators could be identified at national level to comprehensively represent the quality of power—in terms of various parameters like voltage and frequency as well as in respect of the service quality like outages and load shedding. Hence, review on the quality factor is not attempted in this study.

5.2. Economic indicators

The financial ill health of the utility companies has been the most critical factor impeding the growth of Indian power sector. Hence, the economic indicators selected are required to reveal the financial progress of the sector. The average production costs of electricity and average tariff are the two indicators selected for review. These indicators provide cost-revenue comparison and show how far the periodic tariff revisions were effective in realizing the actual production cost. Similarly the structural components involved in the unit cost of electricity and their periodic changes also have been studied to reveal the progress of power sector.


The performance of the Indian power sector both on technical and commercial terms during the period 1991-2001 is discussed in this section.

6.1. Technical performance

The percentage deficit of electrical energy during 1990-91 was 7.7%. However, in spite of the efforts, the power situation continued to be grim throughout the last decade and as shown in Fig. 1, by the year 2001-02 the energy deficit still remained at the level 7.5%. In fact, it went up to digits as high as 11.5% during some years in this period. The case of peak power demand is also not different. The power shortage of 18.8% during peak hours in 1990 did not come down, but continued throughout the decade within a steady range of 12-14%. This sizeable percentage deficit of both energy and peak power indicates that the capacity additions during this period was inadequate to bridge the supply-demand gap.

The generation expansion programs during this decade suffered substantial slippage from targets. The slippage in the eighth National Five-Year Plan period (1992-97) was about 46.3%. During the period of the ninth plan (1997-2002) this has further increased to 52.75% and the capacity additions during this period were only to the tune of 19015 MW against the target of 40245 MW. As shown in Table 2 it can be seen that except in nuclear plants—where capacity addition was meager—the target of realising power projects in both thermal and hydroelectric sectors suffered substantial slippage. It is significant to mention that the contribution for capacity additions during the ninth plan period from Central, State and Private sector power projects were, respectively, 4504, 9450 and 5061 MW only (which are respectively, 37.8%, 87.9% and 28.8% of the targeted capacity expansions from these sectors). The reasons for such glaring disappointment in contribution, especially from private sector, will be discussed later in this paper.

Regarding the per capita consumption of electricity also, it can be seen that the growth rate achieved during the last decade is not promising. The per capita consumption, which was 268 kWh in 1991-92 indicated only a low average annual growth rate of 3.57% during this period and by the end of the decade it, was 354.75 kWh only. As shown in Table 3, according to the

UN development report 2002, this per capita consumption and growth rate of consumption are far below compared to other countries (coming under the group of comparable nations with medium level of human development indices) (UNDP, 2002).

Referring to the structural composition of electricity consumption by various sectors shown in Fig. 2, it can be seen that the percentage share of residential sector increased from 17% to 25% during this period. However, the share of electricity consumption for agriculture (upon which the majority of the Indian populations depend) remained unchanged at about 26% through out this period. Hence, the mere marginal increase in per capita consumption does not unequivocally establish a true contribution of electricity sector in the improvement of the quality of life of the majority of Indian population.

The efforts to bring down various technical losses deterring the performance also could not be effective during this period as depicted in Table 4. The T&D losses which were about 22.83% in 1991-92 though remained steady for a few years, indicated the trend of increase and according to the latest figures it is about...
27.8% (2001-02). Similarly the auxiliary consumption of thermal power stations also could not be brought down and still remain steady at a level of about 7%. Another item among the poor technical performance of the Indian power sector has been the low PLF of thermal stations. From Table 5, it can be seen that there has been an indication in the improvement of the average PLF during the last decade.

A closer look of Table 6 reveal that the total increase in PLF is solely on account of the improved PLF of private and Centre owned thermal stations and the poor performance of State owned thermal stations still continue. For example in 2001-02 the average PLF of thermal stations owned by certain States like Uttar Pradesh (59.07%), Delhi (45.20%), Bihar (14.50%), Assam (16.80%) were substantially low whereas the average PLF of thermal stations of Centre owned National Thermal Power Corporation (80.10%) and private owned plants like BSES (86.50%), Ahmedabad Electricity Company (AEC) (82.30%) were remarkably excellent (Planning Commission, 2002). Also as shown in Table 5, though the PLF has increased, the gap between the plant availability and PLF still continues. This is on account of the sub-optimal utilisation of plants during off-peaks (due to reduced demands in certain regions) and also due to the inadequacy of regional transmission grids to transfer surplus power to regions of shortage. Similarly as shown in Table 5 the forced outage ratio of the thermal stations also did not improve from the range of 12% to 15% during this period.

6.2. Economic performance

Similar to most of the developing countries, the GDP—electricity elasticity during the five decades after independence (1947-97) was significantly above unity. However during recent years, it has come down and is at present around unity. As shown in Table 7, though the power sector received significant shares in all national financial plans (13-18%), the contribution of this sector in GDP was meager (about 2% only). The growth of power sector has not kept pace with the economic growth of the country. On the contrary, the poor performance of the power sector has been a serious hurdle in the economic progress of the nation. As shown in Fig. 3, the total commercial loss of the State owned utility companies has been piling up year by year and during the year 2001-02 alone, these losses were as high as 6144 millions of US dollars.
Referring to Table 8, the unit cost of production of electricity, which was 112.20 paise in 1991-92, indicated an average annual increase of about 11.8% and is about 349.9 paise per unit in 2001-02. But the average revenue realised through electricity tariff which was 89.06 paise in 1991-92 increased to only 239.9 paise in 2001-02, still maintaining a deficit of about 9.5% annually from the actual unit cost of production. The average tariff throughout the decade was totally inadequate to cover even the production cost of energy and this further aggravated the ill health of SEBs.

On analysing the components involved in the unit cost of production of electricity for a few years in the past, as shown in Table 9, the percentage share of all components except power purchase cost showed a declining trend. The share of power purchase cost of SEBs (from the generating companies owned by Central Government and private power producers) has undergone exorbitant increase during the past decade. This percentage increase is more during the period from 1996 to 1997 wherein the reforms in the generation sector were initiated vigorously and a few new generating companies—mostly based on naphtha and diesel—were set up.

The SEBs facing serious inadequacy of in-house generations (of low cost power) were forced to import power from the new generating companies at higher cost to reduce power shortages. This posed additional burden on the already poor financial set up of most of the SEBs. At least in some States it lead to the vicious paradox that even though the Central and private owned generating stations in those States were operating below their rated capacity, SEBs running in the same States at huge losses could not find enough funds to purchase power and utilise the spare generating capacity to reduce the shortage of power. To site an example, Kerala—one of the southern most States of India—was suffering from serious power shortages during the past few years whereas the National Thermal Power Corporation (NTPC) was ready to provide power from their thermal station operating within the State itself. But this SEB could not purchase costlier naphtha-based power from this NTPC station. Ultimately the State was plunged into severe power cuts and load shedding.

The dismal financial performance of the SEBs will be more discernible while reviewing the rate of return. As shown in Fig. 4, the rate of return of the SEBs has sharply declined from -12.7% (1992-93) to -44.1%
6.3. Private sector participation

Having seen the dismal technical and financial performance of the power sector in the last decade, now the review is focussed on the success of the private sector participation, which was one of the chief aims of restructuring. It can be seen that there was terrible shortfall in the capacity addition expected from private sector. Against a target of 2810 MW in the eighth National Plan (1992-97) the achievement was only 1430 MW and against a targeted capacity addition of 17588.5 MW from private sector in the ninth plan (1997-2002) the actual realisation was only 5061 only indicating a shortfall of 71.2%. As shown in Fig. 5, though the average capacity addition targeted per year during the ninth plan period was about 3517 MW, the actual achievement in all the 5 years were far below this expectation. The poor financial situation of the SEBs and their inability for ensuring payment security for the power purchase are the main reasons for the poor participation of private sector.

6.4. Performance of ‘reformed’ states

All the 27 States in India have initiated restructuring process of their SEBs and these are at various stages of implementation. Twenty States have already signed memorandum of understanding with the Ministry of power of Government of India to implement reforms at distribution sector in a time bound manner. Orissa, Haryana, Uttar Pradesh (UP), Andhra Pradesh (AP) and Karnataka were the first five Indian States that initiated restructuring process and vigorously implemented various steps during this period. Referring to Table 10, it can be seen that even after a full decade of restructuring all these States are still facing deficit, both in energy and peak generation capacity. In the case of AP, the level of energy deficit as well as the peak power shortage has increased. On reviewing the T&D losses of these States (Table 11), T&D losses in Orissa still continues to be at alarming levels as high as 49%.

The World Bank’s staff appraisal report on Orissa, before commencing of the reforms, has targeted a reduction of T&D losses to the level of 25% by the year 2001 but this has not been realised at all (SAR, 1996). The picture of Haryana, UP, AP and Karnataka are also not different. In the case of these States, the losses showed an increasing trend and are currently above 30%. In AP and Karnataka the percentage of T&D losses have shown about two-fold increase while undergoing restructuring. Regarding the growth in percapita consumption of electricity, as shown in Table 12, the rates in these States except that of AP have not indicated any substantial improvement above the national average growth rate of 3.5%. UP recorded a very poor average growth rate of 0.66%.
Table 11
T&D losses of selected Indian States (1995-96 to 2001-02)

<table>
<thead>
<tr>
<th>State</th>
<th>T&amp;D Losses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orissa</td>
<td>46.9</td>
</tr>
<tr>
<td>Haryana</td>
<td>31.4</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>22.8</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>18.9</td>
</tr>
<tr>
<td>Karnataka</td>
<td>18.5</td>
</tr>
</tbody>
</table>


*a Data not available.

Table 12
Percapita electricity consumption of selected States (1990-91 to 1999-2000)

<table>
<thead>
<tr>
<th>State</th>
<th>Percapita consumption of electricity (kWh)</th>
<th>% decadal growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orissa</td>
<td>271</td>
<td>295</td>
</tr>
<tr>
<td>Haryana</td>
<td>400</td>
<td>455</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>166</td>
<td>174</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>245</td>
<td>191</td>
</tr>
<tr>
<td>Karnataka</td>
<td>296</td>
<td>296</td>
</tr>
</tbody>
</table>

Sources: (1) Annual report (2001-02) on the working of the State Electricity Boards and Electricity Departments, Planning Commission, Government of India, May 2002. (2) TERI energy data directory and year books (TEDDY 1996/97 and 2001/02), Tata Energy Research Institute, New Delhi.

Table 13
Electricity tariff in selected States: (1991-92 to 2000-01)

<table>
<thead>
<tr>
<th>State</th>
<th>Electricity tariff (Paise/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orissa</td>
<td>65.1</td>
</tr>
<tr>
<td>Haryana</td>
<td>66.3</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>79.7</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>83.3</td>
</tr>
<tr>
<td>Karnataka</td>
<td>82.4</td>
</tr>
</tbody>
</table>

Sources: (1) Annual report (2001-02) on the working of the State Electricity Boards and Electricity Departments, Planning Commission, Government of India, May 2002. (2) TERI energy data directory and year books (TEDDY 1996/97 and 2001/02), Tata Energy Research Institute, New Delhi.

All the above five States implemented heavy tariff revisions during the course of restructuring. The average of annual percentage tariff increase from 1991-92 to 2000-01 in Orissa, Haryana, UP, AP and Karnataka were 17.24%, 13.39%, 13.97%, 10.88% and 11.37%, respectively, as depicted in Table 13. It may be noted that the national annual average increase of tariff during this period was about 10% only. Paradoxically, in spite of the tariff revisions, the commercial rate of return of power sector in these States are still at huge negative figures as depicted in Table 14. In short, the financial situation of SEBs of these States has substantially deteriorated during this period.

7. Role of regulatory commissions

The broad objectives of setting up regulatory commission (as reiterated in the introduction of The Electricity Act 2003) are to
(i) regulate tariff and trade margin;
(ii) issue licenses;
Table 14
Rate of return of SEBs without subsidy (1992-93 to 2001-02)

<table>
<thead>
<tr>
<th>State</th>
<th>% rate of return (without subsidy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haryana</td>
<td>-26.1</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>-16.7</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>-0.2</td>
</tr>
<tr>
<td>Karnataka</td>
<td>-2.0</td>
</tr>
</tbody>
</table>

Source: Annual report (2001-02) on the working of the State Electricity Boards and Electricity Departments, Planning Commission, Government of India, May 2002 and TERI energy data directory and year books (TEDDY 1996/97 and 2001/02), Tata Energy Research Institute, New Delhi.

(iii) promote competition and economy;
(iv) develop appropriate policies for environmental regulations;
(v) frame guidelines in the matters related to electricity tariff;
(vi) adjudicate disputes in matters of electricity trades.

In addition to the CERC at national level, most of the Indian States have already constituted SERCs and commenced their functions. From a public consumer point of view, the present role of ERCs has been seriously limited to mere bodies enacting periodic tariff revision orders, which was earlier being performed by the SEBs in consultation with the respective State Governments. Probably the only qualitative difference in the role is that if earlier tariff revisions effected by SEBs/Government were guided by social and political considerations also, now they are most likely to be taken in the interest of the major stakeholders of the power sector. Members of the ERCs are expected to be eminent personalities having expertise in the techno-economic aspects of the power trading. But the present framework of the ERCs neither demands nor permits them to function as true independent regulatory bodies that could ultimately provide benefit to the greater need of the society at large.

Another limitation experienced by ERCs in their current functioning is their narrow field of jurisdiction. The present jurisdiction of ERCs are limited to power sector only and they have no say in the matters related to the basic energy sources like petrol, coal, naphtha or CNG. While the availability and price setting of these energy sources have considerable bearing in the policy matters of electricity sector, this limitation of jurisdiction of ERCs seriously hamper their effective functioning. Further, regarding the improvement of quality and reliability of power delivered to the customers also, the ERCs could so far contribute little. In short, the present structure of ERCs have not enabled them to act as a body with multi-dimensional functions and also to assume the role of a true guide for the overall development of power sector, but only provided that of a quasi-judicial setup for periodic tariff revisions.

8. General assessment and evaluation

From the above overview it is apparent that the technical and financial performance of power sector in the past decade have not been successful in realising the positive results of restructuring, particularly in respect of the following:

1. To improve the operational efficiency and reduce losses.
2. To re-mould the power sector as an economically profitable one.
3. To increase private sector participation so as to improve resource mobilisation.
4. To reduce supply-demand gap.
5. To improve free trade of electricity regulated through ERCs.

While evaluating the general performance indices of the power sector of India in general and that of certain restructured States in particular, it is obvious that the major set objectives could not be realised.

As per the Indian Census 2001, out of the total population of 1027 million, about 742 million live in rural areas and their predominant income is from agriculture (Census, 2001). It can be seen that in 1991, out of 587,258 inhabitable Indian villages, electricity was accessible to 487,200 covering about 82.96% only. However, looking at the scenario in 2001, power has been extended to 508,701 villages (out of 638,691 villages) covering about 79.55%. It is obvious that the thrust given on rural electrification schemes is retarding during the course of restructuring and does not commensurate with the demographic transitions of the nation.

Similarly while reviewing the share of electricity provided for agriculture, it can be seen that this also has retarded slightly from 29.90% in 1992-93 to 28.78%...
in 2001-02. In the States of Orissa and Haryana, it has substantially reduced from 5.60% to 1.81% and 27.20% to 19.61%, respectively, during the above period. This discerns the shift in focussing of distribution priorities of electricity. Though this may marginally aid to improve the financial health of SEBs (due to the decreased liability on agricultural subsidy), this will significantly affect the agrarian base of the economy and thereby the common welfare of the majority of population.

In a recent study analysing the impacts of the electricity reforms in the rural development of Orissa, it was revealed that during the restructuring period the rural electrification programs also suffered serious setbacks (Panda, 2002). This study also revealed that the agricultural sector suffered the maximum with low growth in lift irrigation, energy availability to pump sets, etc. According to the study the power sector restructuring in Orissa could not succeed in improving the power quality or even in effectively realising the revenue of electricity through retail billing.

If we look at the development of renewable sources for power generation, the performance in the past decade was not promising. The total capacity of renewable energy that could contribute to power generation was about 3165 MW only, less than 3% of the total installed capacity (TEDDY, 2002). Though the wind energy potential of India is estimated to be about 45,000 MW, we could tap only 1507.46 MW till date which forms only 1.44% of the total installed capacity. The wind power development during the eighth and ninth national plan was 312.3 and 1195.16 MW only. The apathy shown towards development of renewable sources of power may have two implications in Indian scenario.

1. The feasibility of providing power to about 18,000 non-electrified remote villages (where power supply from conventional grid is hardly possible) will diminish.
2. The development program aiming a sustainable and environment friendly power generation will get setbacks.

Here, it is worth while to mention that the Indian experience of power sector reforms which do not benefit the rural poor as it was expected, is not unique. A few recent studies—on the impact of power sector reforms initiated during the same period in African continent—report that the restructuring could not fetch any positive benefits to the rural poor in these countries also (Karekezi and Kimani, 2002; Pineau, 2002).

Though the tariff underwent consistent and exorbitant increases, it could not improve the economy of the SEBs. The quality and availability of the power also could not be improved during this period. The social objectives of the power sector also remained out of focus in the restructuring process. The study-report on the non-performance of Orissa model inferred that serious flaws exist in the objectives, methodology and implementation of present restructuring (Department of Energy, 2001). It is appropriate that a comprehensive review on the footing of the restructuring and the impacts made so far be done before chalk out further steps.

The need aspect of a restructuring of the Indian power sector, at the time when it was initiated a decade back, was beyond any debate. Retaining the status quo would have definitely lead to a shattering of the sector. However, the following features contribute to the non-delivery of positive results as expected.

1. The pre-conceived notion that private sector participation is unavoidable for the growth of the sector provided a wrong footing. The need for resource mobilisation ultimately turned up to an agenda of privatisation. A simultaneous contribution from co-operative sectors or joint venture investment also could have been sought for resource mobilisation. The successful episodes of co-operative movement in milk production and marketing in Gujarat State and various industrial and banking sectors in Kerala State are promising examples for this proposition.
2. The initial part of the restructuring concentrated at the generation expansion programs. Considering the fact that the Indian power sector feeds a very large number of consumers (113.66 million as on 31 March 2002), the distribution sector should have been given an equal or more thrust for efficiency improvement measures. In fact, many of the regional studies brought out the potential of substantial energy savings (and thereby reducing generation expansion) by adopting DSM techniques, which implies that it is appropriate to start restructuring from distribution side rather than from generation sector (Reddy and Sumithra, 1997; Sharma et al., 2001).
3. The failure to conceive the unique nature of the electricity industry, which qualitatively differentiates it from other sectors, is perhaps one reason for the lack of results. While unbundling the three major functions namely generation, transmission and distribution, it should be essentially preconceived how these three interdependent functions would be effectively operating in harmony, after unbundling. The vertically integrated structure of SEBs, however less efficient, was rugged and capable of dealing with multi-faced functions including rural electrification, extending power to remote areas etc. Once unbundled, there should be more clarity in identifying the agencies responsible for implementation of all these functions. Lack of perception in this matter may defeat the efficiency improvement programs.
4. During the pre-reform period, Integrated Resource Planning (IRP) was considered essential for the
overall development of the sector. The focus on a narrow band of electricity planning (without visualising the energy sector as a whole) would not strengthen the process. The unanticipated market fluctuation in the cost of hydrocarbons like naphtha and its consequent impacts in the power industry is an example for this.

5. The welfare and social objectives were not given required prominence in the restructuring aims. As about half of the Indian population is yet to have access to electricity, it is essential to visualise this role of the power sector also while initiating restructuring. Treating this sector as an industry with sole aims of efficiency and profit will deter the social development process.

6. The restructuring proposals were more based on economic and efficiency standards, not with enough thrust for the equity and environmental aspects. Hence from the sustainability point of view also the reform process lack adequate footing.

7. The present tailor-made structure of the ERC is not appropriate for Indian power sector. A 'true' competitive market only requires a regulatory framework of the present form. But such a competitive market is far from reality in India. Hence the ERCs now have the role of tariff revising bodies. An energy board, with a broader outlook on various technocommercial matters related to energy with jurisdiction on all segments of energy (not restricting to electricity alone) would be appropriate.

It is essential that along with betterment of technocommercial efficiency of power sector and improving the consumer choice for better reliability, the reform should encompass the broader objective of providing access to electricity to the major portion of the population of India and to increase the affordability of this energy form by the weaker section of the society.

9. Future of reforms

Having experienced that the performance of the Indian power sector during the past decade of reforms has not fetched the positive results as expected, it may be appropriate to have thoughts regarding the future trajectory of reforms. It has been wisely advised that rather than going for drastic steps of restructuring which may land up in serious after-effects that are hard to bear, small 'reversible paths' with greater clarity of objectives are ideal for Indian situations (Reddy, 2001, 2002). Looking back on the continued poor performance of the power sector during the last decade and the valuable experience gained from the shortfalls in the restructuring models (implemented in a few Indian States), the following suggestions shall be worth considered while continuing future course of reforms.

1. The objectives and guiding principles of restructuring shall be framed taking into consideration the social objectives and restated with greater clarity.

2. The preconceived notion that 'the vertically integrated structure of SEBs are the root cause for the inefficiency and hence to be unbundled' shall be reviewed. The experience with unbundled utilities so far does not substantiate this. Hence rather than unbundling, efficiency improvement measures shall be the objective.

3. It may not be always true that privatisation will fetch market efficiency and improve competition. Some countries (like Norway) have very efficient and competitive electricity market without privatisation. Better public participation through co-operative sector can be a strong alternative.

4. Along with efficiency and economy the basic objectives of access and affordability of electricity, especially to the weaker section of the public should also be given equal thrust.

5. While effecting tariff increase to cover the operational inefficiency it should be ensured that such increases are carried out on a rational social base and simultaneously fulfilling the long-term objective of enhancing the efficiency.

6. Rather than a power sector restructuring policy it will be effective to have a comprehensive energy policy on the basis of integrated resource planning.

7. Along with capacity addition at generation side, energy conservation efforts through demand side management (DSM) measures shall also be taken up.

8. The present role of ERCs shall be redefined and assigned with improved functions as an effective body catalysing the development of power sector.

9. Steady incremental steps of reforms with forethought will be more appropriate than highly accelerated development programs.

10. It is essential to identify the 'real' crisis of the sector so as to arrive at 'real' prescriptions. In the long run, adhoc programs will not bring any benefit to the consumers, power sector or the society as a whole.

10. Conclusions

The power sector restructuring process initiated during 1991 has not succeeded in improving technical efficiency or in improving financial position of the power sector. Also it could not reduce the losses or improve customer satisfaction. The social objectives of the power sector also could not be fulfilled effectively in the reform process. It is appropriate that serious review be made on
the past performance of the power sector and effective steps taken. Learning from the past decade's experience of reforms, an integrated approach to redefine the objectives and methodologies are imperative to realise development. This approach can only ensure reliable and affordable electricity with greater accessibility for the Indian population.

References


Godbole, M., 2002c. Electricity regulatory commissions, the jury is still out. Economic and Political Weekly, June 8, pp. 2195-2200.


