CHAPTER - 8

SUMMARY AND CONCLUSION

In the process of economic development and growth, various economies are critically dependent on energy resources. Among the various energy resources, electricity is the most preferred form of energy. Electricity has become a basic requirement for life and access to it at reasonable and affordable price is critical to the development process. Therefore, a sound pricing policy in electricity becomes a powerful instrument to realise the socio-economic objectives with which a public utility has been brought into existence.

The central government made some provisions in the Electricity (Supply) Act 1948 regarding tariff setting in electricity systems. According to the sections 59 of the Act, 1948, the tariff was to be determined on cost plus basis to make the power systems financially viable. The systems were expected to earn at least 3 percent Rate of Return (RoR) on average capital base. However, in most of the power systems tariffs have been determined without economic rationality, which was necessary to ensure recovery of full financial cost during a year. Therefore, the financial position of the systems have been worsening from year to year due to irrational tariffs alongwith,
management inefficiencies in the system and withdrawal of budgetary support by the state governments to meet the revenue gap.

As the government of India was not satisfied with the financial performance of the State Electricity Boards (SEBs), it made a 3 percent Rate of Return (RoR) on the average capital base an obligatory RoR for the SEBs by amending the Section 59 of the Act (1948) w.e.f. 1st April 1985. But most of the State Electricity Boards have failed to meet even this statutory requirement due to arbitrary and uneconomic pricing policy of the SEBs.

In order to improve the profitability and financial viability of SEBs we need to tackle the key issues such as tariff rationalisation, curbing of high T & D losses, reducing the gap between average cost of supply and average revenue realised from the consumers. Thus, the restoration of financial health of SEBs and the improvement in their operational performance continue to remain critical issues in the power sector.

Since 1991 the reforms process was initiated in Indian economy primarily due to deepening financial and foreign exchange crisis and on the directions of international financial institutions. In the public sector, power sector has been in the limelight of the reforms process. Orrisa was
the first state, which initiated power sector reforms process in 1996. Thereafter, other states also initiated reforms in power sector one by one implementing the provisions of Electricity Act, 1998. However, now a more comprehensive law, the Electricity Act 2003 has been passed by Parliament and implemented with effect from 10th July, 2003, which superseded earlier Act. Earlier the power undertakings were operated as vertically integrated systems, which functioned just like a government department without commercial outlook in their functioning. To ensure transparency & accountability in the functioning and to insulate power systems from political interference in day to day functioning, the State Electricity Boards were called up on to restructure the existing system. The reforms have envisaged establishment of Independent Regulatory Commissions, which constitute a key component of the new institutional structure. The Regulatory Commissions were being formed with a view to ensure that the power sector was able to meet the stated goals of supplying good quality of electricity at reasonable tariffs to the consumers along with the financial viability of the systems. It was expected to ensure that electricity undertakings follow sound economic principles in tariff determination, function efficiently ensuring
transparency in their decision-making and protecting the genuine interests of all the stakeholders.

Therefore, it has been desirable to examine the performance of the power systems in the pre-reforms and post-reforms scenario to examine the extent to which the reforms process has achieved its stated goals, particularly in relation to the pricing policy. In this study three electricity systems selected for indepth study have undertaken three different types of restructuring models which were at various stages of implementation. In the power system of Punjab state Regulatory Commission has been established but the Board continued to function as vertically integrated system. Whereas in Haryana power system has been unbundled into separate corporations responsible for power generation, transmission and distribution. The distribution business has been handed over to two state owned distribution companies. In case of Delhi state, the power system has been unbundled into separate corporations, which were handed over to private companies. The analysis of comparison in performance of three power systems that have different status of reforms has been quite meaningful and interesting for policy implication. Till now, very few studies analysing the experience of reforms process in the power sector have been conducted. The present study was expected to bridge this gap.
Objectives of the Study

The broad objective of the study was to evaluate the impact of power sector reforms on technical and financial performance of the electricity undertakings. To accomplish this objective the subsidiary goals of the present study were:

1. To examine the relation between cost of supply and pricing of electricity to various categories of consumers before and after the power sector reforms.

2. To study the impact of pricing policy on the financial performance of the selected power systems.

3. To evolve suitable criterion for determining the prices in electricity undertaking.

4. To analyse electricity consumption pattern among various categories of consumers in relation to prevailing pricing policy.

5. To estimate elasticity of electricity consumption for various consumer-categories.

6. To analyse interaction between the economy and electricity consumed.
Methodology and Data Base

There were 19 state owned power systems in our country as on 31 March, 2002. It was not possible to cover all the power systems in the present study. Therefore, only three systems have been chosen for the purpose of the study. The present status of reforms was not uniform across the states of the country. Various states were at different stages in the implement of power sector reforms as envisaged in the Electricity Act, 2003. Some states have created only State Electricity Regulatory Commissions (SERCs) without doing any unbundling and corporatisation of the SEB. These states were Maharashtra, Punjab, Madhya Pradesh and Himachal Pradesh etc. Some states have unbundled the State Electricity Boards (SEBs) into separate corporations and also created State Level Electricity Regulatory Commission (SERC) but did not privatise the distribution business. These included Haryana, Andhra Pradesh, Uttar Pradesh, Rajasthan, and Gujarat etc. While the others unbundled the State Electricity Boards into generation, transmission and distribution corporations and privatised the distribution business also. These states were Orissa and Delhi. Therefore, we have selected one state, Punjab, Haryana and Delhi from each type of reform model available in the power sector.
In order to analyse the relation between cost of power supply and tariff, we examined the average cost of power supply and average revenue realised from different categories of consumer. Due to non-availability of data regarding category-wise cost of supply, average cost of the system was taken into account for this exercise. In fact, none of the three power systems operationalised the category-wise cost of supply in tariff determination up till 31 March 2005. The whole exercise has been carried out in terms of pre-reforms and post-reforms periods. The average revenue per unit of energy supplied to each category has been computed and compared with the average cost of supplying power. It helped us in finding the rationality behind the pricing policy and to determine the extent to which energy sale involves subsidisation or cross subsidisation.

To appreciate the financial performance of the power systems we compared the total cost of power supply with total revenue realised from each consumer category. It helped us to find out the extent to which electricity sale involves profit earning or losses.

To evolve a suitable criterion for electricity tariff design, which could be operationalised in the power systems, we have estimated Cost of Supply for different categories of consumers. Due to limitation of data this exercise has been undertaken only for Haryana state.
To analyse the electricity consumption pattern we have divided consumers in five broad categories - Domestic, Commercial, Industrial, Agricultural and Others and examined changing profile of their shares in total consumption.

To estimate the elasticity of electricity consumed we undertook regression analysis and estimated the parameters in four alternative specifications of a model by using Ordinary Least Squares method. We estimated the output elasticity w.r.t. electricity consumed for different categories of consumers by using double log function. To achieve this objective we regressed the electricity consumed by domestic consumers on the Gross State Domestic Product (taking all activities together). The electricity consumed by commercial sector was regressed on the contribution of the tertiary sector in the Gross State Domestic Product. Similarly the electricity consumed by the industrial sector was regressed on the contribution of the secondary sector, whereas the agriculture consumption was regressed on the contribution of primary sector in the Gross State Domestic Product. For the economy as a whole we regressed the total electricity consumption on the Gross State Domestic Product.

Lastly, to determine the significance of power system in the development of economy the relationship between electricity
consumption and Gross State Domestic Product at aggregate as well as at the sectoral levels have been examined. We selected the Punjab state for this exercise mainly because Punjab state has the highest per capita electricity consumption in the country. Having relatively higher amount of hydel capacity in total generation capacity, better performance of thermal plants and lower level of T&D losses, the availability of power in Punjab has been relatively more than Haryana & Delhi. Specification of the models was as follows:

\[
\begin{align*}
M-1 \quad \log Y &= A + B \log X \\
M-2 \quad \log Y &= A + B X \\
M-3 \quad Y &= A + B \log X \\
M-4 \quad Y &= A + B X
\end{align*}
\]

In the models, \( Y \) denotes the consumption of electricity measured in crores of units (Kwh) and \( X \) denotes output measured in crores of rupees. As the time series data for the period 1993-94 to 2003-04 has been used for estimation, a first order autocorrelation has been assumed to exist and Prais- winsten method has been used as a solution to the problem of auto correlation. All the four models have been estimated for the state economy, industrial & agricultural sectors separately.
Information & Data Base

The present study was based on secondary data that was collected from various sources. The main sources for the secondary data were Commercial Directorate of the Central Electricity Authority, New Delhi, Administration Reports as well as Statement of Accounts of the State Power Systems (various years), Central & State Electricity Regulatory Commissions, the Planning Commission, Annual Reports on the Working of SEBs & EDs, the Tata Energy Research Institute, Delhi (various publications), the World Bank Document Centre, Delhi, Economic Survey (various issues). Five-Year Plan documents, Statistical Abstract of India, Haryana and Punjab (various issues).

Limitation of the study:

This study has used the information available in the documents of PSERC, HERC & DERC as well as power companies and official other reports as a main data source. However, it had realised that this source was unreliable and inadequate. Attempts were made to refine the available information and bridge the information gaps. But due to lack of adequate metering and proper information base with the systems, it could help little.
Main Findings of the Study

The electric power has been playing a significant role in the economic development of the state of Punjab. Electricity based tube-wells played a key role for making water available for irrigation to bring about green revolution in the state. The Punjab State Electricity Board (PSEB) which controls the Punjab Electric Power System was constituted under Section 5 (1) of the Electricity (Supply) Act, 1948, on February 1, 1959. Subsequently, the erstwhile state of Punjab was reorganized under the States Reorganisation Act, 1966, and the Electricity Board in its present form came into existence with effect from May 2, 1967. Power Sector reforms were initiated in Punjab State in 1999 with the establishment of the Electricity Regulatory Commission. Due to strong opposition of the employees the reforms process got delayed in the state. Since the Regulatory Commission started its functioning in 2001. The main characteristic of the power system in Punjab was that it was working as integrated system even in post-reforms scenario.

Haryana State came into existence with the reorganisation of the State of Punjab as on November 1, 1966. Haryana State Electricity Board (HSEB) was created in May 1967 by bifurcating Punjab State Electricity Board (PSEB) under the provisions of the Electricity (Supply) Act 1948.
HSEB was incorporated as an integrated system to discharge the generation, transmission and distribution functions in the State. The reforms process in power sector in the state was legally started in 1997. The erstwhile HSEB has been unbundled into four independent corporations in August 1998. After reorganisation, Haryana Power Generation Corporation Limited (HPGCL) was solely responsible for generating electricity from the state’s owned power plants. Haryana Vidyut Prasaran Nigam Limited (HVPNL) was incorporated for running the Transmission & Bulk Supply (T&BS) business of power sector in the state. It purchased electricity from the various sources, including HPGCL & other external sources and sold all the available energy to distribution companies. Uttar Haryana Bijli Vitran Nigam Limited (UHBVN) and Dakshin Haryana Bijli Vitran Nigam Limited (DHBVN) are constituted for running the Distribution and Retail Supply business in the state for the northern and southern regions respectively.

On the eve of independence the Delhi Central Electric Power Authority (DCEPA) was catering to electricity supply in Delhi. The DCEPA was taken over by the Delhi State Electricity Board (DSEB) in 1951, which was constituted under the Electricity (Supply) Act 1948. DSEB was reconstituted in 1958 and Delhi Electricity Supply
Undertaking (DESU) came into existence, which was once again converted into Delhi Vidyut Board (DVB) in 1997. Reforms process in Delhi started with the existence of Delhi Electricity Regulatory Commission (DERC) in March 1999. The Commission became operational with effect from 10th December 1999. In pursuance of the Reform Act 1998, the Delhi Vidyut Board was reconstituted in July 2002 as under: (a) the generation functions were to be vested in Indraprastha Power Generation Company Ltd, (GENCO), which is also known as a holding company; (b) the functions of Transmission & Bulk Supply were vested in Delhi Power Supply Company Ltd (TRANCO); and (c) the distribution related functions were assigned to three distribution companies BSES Yamuna Power Limited (BYPL), BSES Rajdhani Power Limited (BRPL) and North Delhi Power Limited (NDPL). Two of the three distribution companies, namely BYPL & BRPL, have been handed over to Bombay Sub-urban Electricity Supply (BSES) owned by Reliance group and the other one NDPL to Tata Power. The whole geographical area of Delhi was divided into three zones namely North & North-West, Central-East, and South-West. The distribution company NDPL has the responsibility to distribute power in North & North-West
Delhi whereas the regions of Central-East and South-West of Delhi have been allotted to BYPL and BRPL respectively.

It has been found that all the three systems did not own any significant share of natural resources like coal or petroleum with given state of technology and skilled manpower. Therefore, state governments in the three states played a significant role in developing their power sector through allocating a noticeable proportion of the plan expenditure to it (Table 6.1). Hence, the generating capacity as well as transmission & distribution network in the states grew at an impressive rate. Despite that, the systems failed to meet the power requirements in the states, it was evident from the fact that the growth rates of simultaneous maximum demand was higher than the growth rates of power generating capacity. In case of Punjab the growth rate for simultaneous maximum demand was 7.22 percent for the period 1980-81 to 2003-04, whereas the growth rates for installed capacity was 5.80 percent during the same period (Table 3.3). During the corresponding period of time, these growth rates were estimated as 5.48 percent & 4.71 percent for Haryana (Table 4.3) and 8.02 percent & 3.43 percent for Delhi (Table 5.3) respectively. It was also observed that operational efficiency of thermal power plants was not that satisfactory in the states (Table 6.3). It was noted that official
estimates of T&D losses were high in all the states. In the post reforms period the level of T&D losses particularly in Haryana and Delhi increased significantly. As on 31\textsuperscript{st} March 2004 the level of T&D losses was 45.61 percent for Haryana and 47.54 percent for Delhi. Whereas in case of Punjab T&D losses were estimated in the range of 20 percent to 30 percent during the whole period under consideration. However, these estimates were only intelligent guess not the actual because a significant proportion of the total energy sale was unmetered. Without proper metering it was not possible to estimate precise level of electricity consumption and T&D losses. The analysis of technical efficiency has highlighted that Punjab state was performing better in comparison to power systems in Haryana as well as Delhi (Table 6.3 & 6.4). The technical efficiency in power system of Punjab state was improving but it was still not satisfactory.

Operational as well as management inefficiencies have its implications for the pricing policy in the systems because cost plus approach was used for tariff determination in these power systems. In cost plus approach level of efficiency of the power system has been playing a crucial role in affecting the components of the cost of supply, which were reflected in tariff. In case of high level of operational as well
as management inefficiencies, the electricity consumers were overburdened through increased tariffs unnecessarily. Simultaneously, tariff structure in the systems affected the pattern of electricity consumption in the states. It was noticed that electricity consumption for domestic & agriculture consumers increased at a noticeable rate, while industrial demand for electricity did not grow at the same pace particularly in Haryana and Delhi (Table 6.5). The existing pricing policy may partially be responsible for the same because it consisted the elements of subsidisation/cross subsidisation. Power supply to domestic and agriculture consumers was highly subsidised while commercial & industrial supply was overcharged without providing any rationality and justification. Consequently, subsidised categories consumed power inefficiently, which in turn, created power shortage in the states along with negative impact on environmental conditions. Simultaneously, due to non-availability of quality power at reasonable prices along with uncertain power cuts the competitiveness of industrial sector may also be adversely affected. Hence, to run the production process smoothly the industrialist fell back more and more upon captive plants.

The financial performance of the systems was also not found satisfactory. During the pre-reforms period cost recovery ratio was found
low in all the systems (Table 6.6). But in post-reforms period it was improving particularly in Punjab and Delhi. As on 31st March 2004, it turned out to be 94.70 percent for Delhi, 86.62 percent for Punjab and 64.78 percent for Haryana. Non-recovery of cost through tariff has deteriorated the financial viability of the systems. It is pertinent to note that there was a wide gap between the average cost of supply and tariff rates in all the three states. There was not a single year in which average revenue realised remained higher than average cost of supply in all the systems. Therefore, tariff rates did not keep pace with the average cost of supply. It was also observed that the tariff rates vary significantly across the categories of consumers (Table 6.7). It implied that tariff rates did not have any systematic relationship with the cost of supply. Socio-economic and political considerations appear to have played crucial role in the determination of tariff rates. Simultaneously, lack of commercial outlook in the functioning was also appeared. Due to provision of subsidisation, the amount of gross subsidy increased many fold in all the systems (Table 3.6, Table 4.6 and Table 5.6).

Rationalisation of tariffs and subsidies was necessary for providing reliable quality of power at reasonable and affordable prices to consumers. Tariff must reflect cost of supply. If the power was supplied
at subsidised rates to some consumer categories on the direction of the Government on some justified grounds, the government must reimbursed the full amount of subsidy to the power companies from general exchequer so as heavy tariff hike must be avoided. However, in actual practice the state governments have not provided full subvention to the power systems. Moreover, political interference in the functioning, particularly in tariff determination process of the systems was clearly appeared from the very fact that subsidised power supply without providing any justification to some consumer categories was continued. It was also necessary for the state governments to involve and adopt a fair and transparent policy for rationalisation of subsidies. Such an arbitrary interference has made the management and administration frustrated with having little motivation or desire to improve administration or technical efficiency of the system.

Furthermore, the analysis of the power sector reforms process in the states revealed that in pre-reforms period the power systems were operated just like a government department, they did not collect even essential commercial and technical data regarding various parameters. After constituting Electricity Regulatory Commissions in the states, the systems have been compelled to compile required data for Annual
Revenue Requirement filings. However, the systems were yet to develop proper data management system, which will have complete information with transparency in the power systems.

One of the important aspects of the reforms process was its emphasis that there should be no political or governmental interference in the day-to-day working of the systems. It was believed that an important work of the Commissions, in the reforms scenario, was to insulate the power sector from the political interference. It has also been pointed out that the root cause of the crisis engulfing the power sector was the pervasive politicisation of most decisions affecting the operations & expansion and the resulting lack of commercial outlook in their functioning. The subsidies were spiraling up because of the non-accountable political interference in the functioning of the systems. Therefore, there was no significant improvement in the financial viabilities of the systems in Haryana and Delhi. However, financial performance of power system in Punjab was improving in the post-reforms period but the pace was slow.

Another critical factor was lack of transparency and accountability in the operations of the power systems. To ensure the efficient functioning of the systems its operation must be transparent and
accountable. From economic point of view it was the efficiency that matter not the ownership. If the vertically integrated power system could achieve a desirable level of efficiency, there would be no reason to insist on corporatisation/ privatisation.

The main challenges for the power systems were recognised as ensuring financial viability, autonomous working, commercial outlook in the functioning, professional & fixed tenure of management, 100 percent metering and reduction of line losses and control of theft. A proper metering system was the backbone of electricity business. In the absence of proper metering system it would not be possible to know the precise estimates of electricity consumption and T&D losses. Upto now, the reforms process has not yielded the desired results. In case of Punjab power system the technical as well as financial performance was improving but the pace was slow. Whereas, in Haryana there was hardly any improvement in the performance of the power companies. The reforms process in Delhi state was in premature stage, so it would be difficult to comment on the impact of reforms on the performance of the power system.

It may be argued that mere policy directions cannot improve the performance without ensuring accountability, transparency and autonomy
in the system, particularly in decision-making process. Therefore, there was an urgent need for functional reforms in the power systems rather than structural reforms. The functions of the electricity system be divided into three separate units responsible for power generation, transmission and distribution. Each unit should be operated on sound commercial principles. For this we should learn from the French model.

We have also made a methodological exercise to formulate Cost of Supply (CoS) model for power systems. Due to non availability of required data this exercise was made for Haryana power system. The estimation of CoS has been done taking into account some crucial indicators, such Consumer Base, Connected Load and Energy Sale. Per unit CoS was found as 371.97 paise for the system as a whole. The CoS turned out to be 461.26 paise for Domestic, 392.21 paise for Commercial, 343.51 paise for Industrial, 344.77 paise for Agricultural and 334.92 paise for Others. It needs to be noted that the highest CoS (461.26 paise/unit) was found for domestic consumers, it may be due to the highest shares in Connected Load as well as in Consumer Base. Moreover, out of total electricity sale about 22 percent was consumed by domestic consumers.
The results of the interaction between the electricity consumption and the state economy have highlighted that for the state economy as a whole all the estimated parameters were significant at 5 percent level of significance. The elasticity of electricity consumed with respect to output was greater than unity in all the models. Estimates of elasticity vary between 1.050 and 1.084, which implied that one percent increase in output of the economy would lead to increase in electricity consumption between 1.050 percent and 1.084 percent. For industrial sector, the estimates were significant at a 5 percent level of significance in all the models. The estimates of elasticity were not uniform across the models and varied from 0.843 to 0.883. In case of agricultural sector, all the models gave estimates of parameter, which were not significant at 5 percent level of significance but were significant at 10 percent level of significance. The estimates of elasticity coefficient for agriculture sector varied between 1.074 and 1.153 and it was appeared to be quite reasonable because the intensity of electricity use in agriculture may be increasing due to mechanisation and energisation for agricultural operations such as irrigation, thrashing etc. This implied that one percent increase in the agricultural output was expected to raise the demand for electricity more than 1 percent. However, it was noted that in agriculture
about 50 percent power supply was unmetered. The estimation of electricity consumption was only guesswork. In this situation, the results of interaction between agriculture sector and electricity consumed by the agriculture sector has indicated just reflection of association between the two not the exact ones. In the wake of insufficient data, it was not possible to estimate exact relationship between the variables. The analysis has brought out that there was close relationship between electricity consumed and output of the economy as a whole as well as industrial sector. However, the relationship was also existed between electricity consumed and output in agriculture sector but was not to the extent of economy and industrial sector. It implied that the changes in output of economy and industrial sector have influenced the electricity consumption more intensively than agriculture sector.

We have also estimated income elasticity of electricity consumed for different consumer categories by using double log function. The highest degree of elasticity (2.034) was found in the category of domestic consumers, while the lowest (.883) was found for industrial consumers. More or less, it may be pointed out that the level of income has significant influence on the electricity consumption in all the categories.
In nut shell, it may be pointed out that all the three power systems have adopted cost plus approach in tariff determination. Un-accountable political interference in the functioning, particularly in tariff determination was continued even in post-reforms period in all the systems. There was hardly any improvement in the financial viability of the systems particularly in Haryana and Delhi. The power system in Punjab was improving but the pace was slow. Therefore, the reforms process has not yielded the desired results. This very fact was also highlighted by an Expert Committee constituted by the Government of Punjab. The Expert Committee has pointed out that power sector reforms in eight states have failed miserably and have led to burden on public in the form of increased tariff & enhanced cash subsidy without any improvement in quality of service (Haldea Committee Report, 2003).

In the pre-reforms period all the three systems worked just like a government department. However, in post-reforms period the Regulatory Commissions have put some pressure on the systems to compile necessary information with themselves and made it available to the Commission as well as public. The Commissions have tried to ensure transparency in the functioning of the systems through holding public hearings, which may be considered a forwarding step to ensure
accountability. It has also been realised that there was a close association between the economy and electricity consumption. Therefore, the tariff should be determined on the basis of category-wise cost of supply. The tariffs were required to be rationalised. If the government wants to supply power to any consumer category at subsidised rates then the amount of subsidy be calculated accurately & in a transparent manner and the systems be compensated by the government for the loss occurred in the systems on account of government directed policies, out of general exchequer. Further, serious efforts were to be made to reduce operational as well as management inefficiencies. It was the efficiency that matter not the ownership. 100 percent metering was must to estimate category-wise electricity consumption and level of T&D losses. The systems should emphasis on functional reforms rather structural reforms. The functions of the systems as electricity generation, transmission and distribution be separated into separate units responsible for power generation, transmission & distribution and each unit must run on commercial principles.