CHAPTER- 1

INTRODUCTION

Since the inception of planned economic development strategy in India in 1951, public sector has occupied a crucial place in the Indian economy. Public sector came into existence with an objective to establish basic and heavy industries, which are mother industries, for accelerated industrialisation of the economy. The public sector undertakings, which provide basic services essential for economic development and to the daily life of a person such as telecommunication, transport, electricity etc. are traditionally known as public utilities. The public utilities were inherently natural monopolies in which the nature of the service was such that over a considerable geographical area they can function optimally only under conditions of monopoly. This was mainly because at the present stage of technological development large indivisibility characterises investment in these utilities. Broadly speaking in India till now, the public utilities enjoyed the highest degree of monopoly power as private entry was barred in these industries because of scarcity of resources and to ensure their utilisation in most efficient way in the economy as a whole. Energy played a significant role in accelerating development of the economy as it was a key infrastructure component. In
the process of economic development and growth, various economies were critically dependent on energy resources. Among the various energy resources, electricity was 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. A sound pricing policy in electricity becomes a powerful instrument to realise the socio-economic objectives with which electricity utilities have been brought into existence. A sound pricing policy in utilities is expected to have three main objectives: (a) to ensure efficient allocation of resources in the power sector; (b) fair distribution of costs among the consumers; and (c) accrual of a certain minimum returns on the capital invested.

As far as the first objective is concerned, most of the public enterprise economics has been theorised on the criterion that the pricing and investment policies of the public enterprise should lead to an efficient allocation of resources in the economy. The allocation of resources means a particular distribution of inputs (resources) among various commodities/services in the production process and a distribution of these commodities/services among various consumers in the exchange process. Paretian efficient allocation means that no redistribution of inputs can increase the output of any product without decreasing the
output of at least one commodity and also that, given a particular distribution of income, no redistribution of commodities among the consumers can improve social welfare without decreasing the welfare of at least one person. This criteria of allocative efficiency is status quoish. This objective has a bearing on the problem of efficient allocation of resources, which is very important particularly in developing countries in view of shortage of capital and the need to conserve investable resources.

The efficiency principle seeks to ensure the regulation of prices in such a manner that the allocation of the society's resources in the energy sector fully reflect their cost to the society. It would also indicate price signal to consumers for using or saving resources.

The second objective regarding fair distribution of costs implies that as far as possible each buyer should pay the cost of service provided to him. However, we may take into account capacity to pay as well as willingness to pay of the consumers because the distribution of the resources (income) is not equal in the economy. In this case if the policy of subsidisation is to be adopted for equitable distribution of cost among different categories of consumers then such subsidies should be quantified and based on sound socio-economic principles.
The third objective is significant for obtaining financial viability of the utilities that is just normal profit, which helps in mobilising internal resources for further expansion of the utilities, so that continuity and quality of service can be ensured and future investment requirements are also taken care of.

In general equilibrium framework, economic theory states that in a competitive market, to ensure efficient allocation of resources in the economy marginal cost based pricing policy may be applied. But it is fruitful only when all the sectors of the economy apply this principle in price determination. However, due to market imperfections it is not possible to apply marginal cost approach in actual practice. Then the question of second best principle arises.

Hence, the central government made some provisions in the Electricity (Supply) Act 1948 regarding tariff setting in electricity utilities. According to the provision 59 of the Act, 1948, the tariffs were to be determined on cost plus basis to make the power utilities financially viable. The utilities were expected to earn at least 3 percent Rate of Return (RoR) on average capital base. However, it has been reported that in most of the power utilities tariffs have been determined arbitrarily on

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1 The Electricity (Supply) Act, 1948, pp. 47-48
populist considerations without economic rationality, which was necessary to ensure recovery of full financial cost during a year. It needs to be noted that pricing policy is one of the crucial factors responsible for worsening financial viability of the utilities year after year. Moreover, it has also been observed that state governments are withdrawing budgetary support from the power sector.

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 w.e.f. 1\textsuperscript{st} April 1985\textsuperscript{2}. But most of the State Electricity Boards have reported to have failed to meet this statutory requirement and continue with an arbitrary and uneconomic pricing policy. In order to improve the profitability and financial viability of SEBs, there is a need to tackle the key issues such as tariff rationalisation, curbing of T & D losses, reducing gap between cost of supply and revenue/unit of electricity sold. Thus, the restoration of financial health of SEBs along with improvement in their operational performance continue to remain critical issue in the power sector.

\textsuperscript{2} The Electricity (Supply) Act, 1948, amended, pp.28-29
Since 1991, the reforms process was initiated in Indian economy primarily due to deepening financial and foreign exchange crisis and on the insistence of international financial institutions like IMF and World Bank. In the public sector, power sector has been the first sector where reforms process has been initiated since early 1990s. Orrisa was the first state, which undertook power sector reforms process in 1996. Thereafter, other states also initiated reforms in power sector one after the other implementing the provisions of Electricity Act, 1998. However, now a more comprehensive law, the Electricity Act 2003 has been passed by the Parliament and implemented with effect from 10th July 2003, which superseded all earlier Acts. Earlier the power undertakings were operated as vertically integrated systems, which functioned just like a governmental department without commercial outlook. To ensure transparency & accountability in their 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 provided for 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 alongwith the financial viability of the utilities. It was expected to ensure that electricity utilities follow sound economic principles in pricing policy, function efficiently ensuring transparency in their decision-making and protecting the genuine interests of all the stakeholders.

Significance of the Study

Electricity has influenced every aspect of human life significantly. Therefore, availability of electricity at reasonable prices to consumers is critical. Irrational pricing policy in electricity systems was one of important factor responsible for initiating reforms in the power sector. It is pertinent to analyse the impact of reforms process on the performance of the power systems in relation to pricing policy. Therefore, it is insightful to analyse 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 especially in relation to the pricing policy. The comparison in performance of three power system that were at different stages of reforms may be quite meaningful and interesting for policy implications. Till now very few studies analysing the experience of reforms process in the power sector has been conducted. The present study is expected to bridge this gap.
Objectives of the Study

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

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.
Methodology and Data Base

There are 19 state owned power utilities in our country as on March 31, 2002. It was not possible to cover all the power utilities in the present study. Therefore, only three utilities have been chosen for the purpose of the study. The present status of reforms is not same across the states of the country. The progress of reforms process in terms of unbundling, corporatisation, privatisation and regulation differs from one state to another. Some states have created only State Electricity Regulatory Commissions (SERCs) without doing any unbundling and corporatisation of the State Electricity Boards (SEBs). These states are Maharashtra, Punjab, Madhaya Pradesh and Himachal Pradesh etc. Some states have unbundled the State Electricity Boards (SEBs) into separate corporations responsible for electricity generation, transmission and distribution and have also created State Level Electricity Regulatory Commission (SERC) but have not privatised the distribution business. This includes Haryana, Andhra Pradesh, Uttar Pradesh, Rajasthan, and Gujarat etc. While the other states unbundled the State Electricity Boards into generation, transmission and distribution corporations and privatised the distribution business also. These states are Orissa and Delhi. Therefore, we have selected Punjab, Haryana and Delhi one state from
each type of reforms model available in the power sector according to our convenience in accessing the required data and other relevant information.

In order to examine the relation between cost of power supply and tariff, we propose to analyse average cost of power supply and average revenue realised from different consumer categories. Due to non-availability of data regarding category-wise cost of supply, average cost of the system has been taken into account for this exercise. In fact, none of the three power undertakings operationalised category-wise cost of supply in tariff determination till now. The whole exercise may be cast in terms of pre and post-reforms periods. The average revenue per unit of electricity supplied to each category may be computed and compared with the average cost of supplying power. It may help us in finding the rationality behind the pricing policy and to determine the extent to which electricity sale involves subsidisation or cross subsidisation.

To appreciate the financial performance of the power systems we may compare the total cost of power supply with total revenue realized from consumers’ categories. It may help us to find out the extent to which electricity sale involves profit earning or losses.
To evolve the suitable criterion for electricity tariff design, which could be operationalised in the power systems, we propose to estimate Cost of Supply for different categories of consumers.

To analyse the electricity consumption pattern we may divide consumers in five broad categories - Domestic, Commercial, Industrial, Agricultural and Others and examine their shares in total electricity sale.

To examine the elasticity of electricity consumption we will make regression analysis and estimate the parameters by using Ordinary Least Square (OLS) method. We may estimate the output elasticity w.r.t. electricity consumed for different categories by using double log function. To meet this objective we may regress the electricity consumed by domestic consumers on the Gross State Domestic Product (taking all activities together). The electricity consumed by commercial sector will be regressed on the contribution of the tertiary sector in the Gross State Domestic Product. Similarly the electricity consumption made by the industrial sector may be regressed on the contribution of the secondary sector, whereas the agriculture consumption will be regressed on the contribution of the primary sector in the Gross State Domestic Product. For the economy as a whole we may regress the total electricity consumption on the Gross State Domestic Product.
Lastly, to determine the significance of power system in the development of the economy a relationship between electricity consumption and Gross State Domestic Product at aggregate as well as at the sectoral levels may be examined. We will select the state Punjab for this purpose mainly because it has the highest per capita electricity consumption in the country. Having relatively higher share of the hydel capacity in total generating capacity, better technical performance of thermal plants and lower level of Transmission and Distribution losses, the availability of power in Punjab is more than Haryana and Delhi. To meet this objective we may use four alternate models and estimate regression parameters by using Ordinary Least Square method. Specification of the models is as follows:

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\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*}
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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 auto-correlation has been assumed.
to exist and Prais-winsten method is used as a solution to the problem of auto correlation. All the four models have been estimated for the state economy, industrial and agricultural sectors separately.

**Information & Data Base**

The present study has been based on secondary data that are collected from various sources. The main sources for the secondary data are Commercial Directorate of Central Electricity Authority, New Delhi, Administration Reports & Statement of Accounts of the State Power Utilities, Central & State Electricity Regulatory Commissions, Planning Commission, Ministry of Power, Annual Report on the Working of SEBs & EDs (various issues), Experts Committee Reports Tata Energy Research Institute (TERI), New Delhi (various publications), World Bank Document Centre, New Delhi, Economic Survey (various issues) and Statistical Abstract of India, Punjab and Haryana (various issues).

**Limitation of the study:**

This study has used the information available in the documents of PSERC, HERC & DERC as well as utilities and official reports as a main data source. However, it has been realised that this source is 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 utilities, it could help little.

Chapterisation Scheme

The thesis runs into eight chapters. The Chapter 1 is the introduction, which includes significance, objectives, methodology & data base and limitations of the study. The Chapter 2 is devoted to the Review of Literature. In Chapter 3 the performance of the Punjab Power System has been evaluated. We have examined the physical, technical & financial performance and reforms process made by the Punjab State Electricity Board. The performance has been measured taking into account some parameters, which have direct or indirect relation with the pricing policy. The Chapter 4 evaluates the performance of the Power System in Haryana State on the basis of same parameters. Similarly, Chapter 5 is devoted to the analysis of the performance of Power System in Delhi State. The Chapter 6 highlights the comparative analysis of the three Power Systems on the basis of some selected parameters. The Chapter 7 highlights the interaction between the economy and electricity. The Chapter 8 is devoted to the summary and main findings of the study.