

1.1 INTRODUCTION

The power sector has been the major sector of Indian economy, which has witnessed major reforms ever since started in 1991. Power is a critical infrastructure which contributes to economic growth. To step up the present economic growth, the Government of India has an ambitious mission of **'Power for all by 2012'**. This mission would require that our installed generation capacity should be at least 2, 00,000 MW by 2012 from the present level of 1, 45,587 MW to provide over 1000 units of per capita electricity .Generating capacity in the country which was only 1362 MW at the time of indendence has increased to 145 GW today. Despite rapid increase in population over a period of time, per capita consumption has increased from 15 KWh to 672 KWh per year. The power supply position is characterized by shortages both in terms of demand met during peak time and overall energy supply. The peaking shortage is much more in every region and it is about 12% on all India basis. The country's transmission perspective plan for tenth and eleventh plan focuses on the creation of a National Grid in a phased manner, by adding over 60,000 CKM of Transmission network by 2012.

Prior to independence the supply of electricity was restricted to a few towns in the country. Most of the power supply was through local generation which was distributed though radial mode of distribution. The Electricity (Supply) Act, 1948 however mandated extension of distribution network to rural areas through State Electricity Boards (SEBs) who were vertically integrated monopolistic structures.

After independence, the electricity sector was virtually nationalized by notification of the Electricity (Supply) Act, 1948. The need was felt for the State Government to step in to ensure supply of electricity **to all nooks and corners of the country, leading to genesis of state level SEBs created as an arm of the State Government to discharge its social responsibilities.**

Since their conceptualization and constitution, the SEBs (State Electricity Board) have been playing the crucial role of building up the necessary generation as well as network facilities for smooth and coordinated supply of electricity to consumers of all categories. They facilitated extension of electricity into rural areas supplying electricity to rural households and energizing pump sets, thereby helping rural economy and agriculture production.

Over a period of time, the SEBs grew into monolithic organizations with all powers of operation as well as regulations concentrated in them. Although SEBs by the very nature of their activities were commercial organizations, they could hardly run the business on commercial lines as the political masters always chose to use the State Electricity Board to sub-serve their political interests. Tariff reviews did not take place based on commercial considerations and coupled with this was the lack of motivational force in the Management of the Board that led to deterioration in the overall performance of the SEB. The unwieldy structure of the organization also bred into several inefficiencies.

By 1990s the functioning of SEBs was characterized by:

- a. High Commercial Losses:** SEBs continued to incur huge financial losses. Commercial losses without subsidies climbed up from Rs.4560 crores in 1992-93 to Rs. 25,701 crores in 2007-08. In case of some SEBs the deterioration in their financial condition was very sharp.
- b. Increase in Subsidy:** Subsidy to consumers which stood at Rs.7335 crores in 1992-93 climbed to Rs.11693 crores in 2004-05. The state power utilities continue to bleed with a higher level of gross subsidy and lower provisions from the state budgets.
- c. Widening Gap between Cost and Tariff:** Average cost of supply per unit has been increasing over the years. Cost of supply has gone up from Rs.1.10 per unit in 1991-92 to Rs.3.50 in 2001-02 due to increase in cost of fuel, power purchase, employees etc. Overall increase in tariff has not kept pace with cost of supply and at present the gap is approx between Rs 1.10 to 0.90.

d. Huge Revenue Receivables: Billing and collection efficiencies were on the decline and even when bills were submitted, tariffs were not realized. Free of charge supply to agriculture consumers gave a perverse incentive to the boards to misclassify loads and hide their inefficiencies. Revenue Arrears receivables increased from Rs.9014 crores in 1994 - 95 to Rs.24773 crores in 1999 - 2000 .By the year 1999 - 2000 the receivables as percentage of sales revenue stood at a staggering 40.4%. With huge receivables in their books SEBs started defaulting to power/equipment suppliers, banks etc. Thus, lack of sufficient investment in distribution over these years has rendered the network heavily overloaded.

The need for sustained growth of the power sector came to be a high priority during the first half of the 90's when economy was opened up. The sector was nearing bankruptcy and was incapable of meeting its huge investment needs. Since then efforts are being made to improve the health of the power sector in India to ensure that the country is able to achieve the avowed objective of poverty alleviation and raising the living standards.

After an initial attempt at increasing the capacity, the reform efforts witnessed a shift towards improvement of the distribution sector. In the process, it was felt that the restructuring of the monolithic SEBs is a *sine qua non* for attaining the desired results.

In this context it becomes clear that the distribution sector needed urgent attention if the trend of deteriorating financial health had to be reversed. The reversal would need a combination of the following key measures:

- Control of theft of electricity
- Reduction in the cost of supply through reduction in technical losses.
- Better management and lowering the cost of generation
- Payment of user charge and Tariff rationalization

Attention over the last few years has been focused on each of these measures aimed at distribution sector reform. There has been significant progress so far related to power sector reforms. Notwithstanding encouraging initial results, the task ahead is quite difficult. Momentum achieved needs to

be sustained with the requisite regulatory intervention and political consensus and will, which is being created.

The enactment of the Electricity Act, 2003 created a new paradigm for the development of power sector in the country. The monopoly of the SEBs was abolished which was created through the Electricity (Supply) Act, 1948, thus, creating a new competitive framework for the development of the power sector in the country with focus on the consumers and safeguarding of their interests by Independent Regulatory Commissions.

Comprehensive reforms of Power Sector in India started in mid 90's and have travelled considerable distance since then. Tracing the process of restructuring of SEBs vis-vis unfolding of power sector reforms is a critical exercise towards understanding the power sector.

1.2 RESTRUCTURING THE ELECTRICITY SUPPLY INDUSTRY

For the first 100 years of its commercialization, the power industry was in the hands of vertically integrated monopoly utilities. This was thought to be the only way to handle the business of electricity supply because of the following reasons:

1. Natural monopoly aspects of transmission and distribution because only one set of wires could economically serve the area;
2. Technical challenge of co-ordination between generation, transmission and consumption posed by following technical truths about electricity -
 - (a) Electricity cannot be economically stored – Its generation and consumption has to match in real time.
 - (b) Electricity travels at the speed of light – Its co-ordination cannot be left to a relatively slow moving entity like market.
 - (c) Transmission of electricity over the network is subject to a complex series of physical interactions. It follows the laws of physics and not the agreements between parties.
3. Economies of scale in generation whereby bigger and bigger plants produced lower and lower prices added to the conventional wisdom that generation was also a natural monopoly.

Theoretically, the reform of electricity industry in the rest of the world as well as India comprised the following factors;

1. Unbundling of vertically integrated utilities;
2. Setting up independent regulatory agencies;
3. Provision of non-discriminatory open access to transmission and distribution networks;
4. Phased deregulation;
5. Consumer choice.

Reforms in India are aiming to achieve the aforesaid milestones. In the process, 14 states (Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Rajasthan, U.P Uttaranchal, Tripura and West Bengal) have unbundled their SEBs, and 23 States have set up regulatory agencies. Non-discriminatory open access to transmission has become a reality with enactment of the Electricity Act, 2003 and CERC/SERC laying down regulations for the same. At present the sector is struggling to move towards phased opening up of consumer choice which is hindered by present tariff structure and severe shortages.

1.3 NEED FOR THE STUDY

Realizing that performing distribution sector is crucial to improve the power industry and quality is particularly important: customers pay not only for the physical product which they consume, but also for the security of uninterrupted power supply which they expect to receive. In this context, quality refers to frequency and voltage, continuity, reliability and other associated parameters.

Distribution sector also has the dubious image of insensitive consumer interface corruption and inefficiency at all levels although many State Regulatory Commissions have formulated regulations, initiatives, procedures and systems ensuring improved Quality of Service (QoS). The power sector reform programmes in India have duly taken note of promoting QoS and Performance as per notification of "Electricity Act, 2003" as:

Section-57 (Consumer Protection: Standards of performance of licensee) states that:

1. The Appropriate Commission may, after consultation with the licensees and persons likely to be affected, specify standards of performance of a licensee or a class of licensees.
2. If a licensee fails to meet the standards specified under sub-section (1), without prejudice to any penalty which may be imposed or prosecution be initiated, he shall be liable to pay such compensation to the person affected as may be determined by the Appropriate Commission: Provided that before determination of compensation, the concerned licensee shall be given a reasonable opportunity of being heard.
3. The compensation determined under sub-section (2) shall be paid by the concerned licensee within ninety days of such determination.

Section-58 (Different standards of performance by licensee) states that the Appropriate Commission may specify different standards under subsection (1) of section 57 for a class or classes of licensee.

Section-59 (Information with respect to levels of performance) states that:

Every licensee shall, within the period specified by the Appropriate Commission, furnish to the Commission the following information, namely:

- a. The level of performance achieved under sub-section (1) of the section 57;
- b. The number of cases in which compensation was made under sub-section (2) of section 57 and the aggregate amount of the compensation.
- c. The Appropriate Commission shall at least once in every year arrange for the publication, in such form and manner as it considers appropriate, of such of the information furnished to it under sub-section (1).

It can be seen from above that the intangible electricity showed be earmarked with tangible components to judge the level of quality and benefits being received by the end consumers. In order to judge / depict performance, the level of Quality of Service to the consumer can be broadly categorized into the operational, commercial parameters, technical and dispute resolution.

Quality of Service (QoS) can be defined as the end result of utilities planning, designing of network, operation and service management, which determines the degree of satisfaction of the consumer. It consists, mainly, of two aspects; one related to technical standards and operation of power system, and the other to support and responsiveness to consumer needs. QoS thus constitutes one of the important performance parameters of a utility and has direct bearing on safety and performance of plant and equipment, besides ensuring consumer satisfaction. Poor quality of service is also an impediment to promoting the use of energy efficient appliances. A host of reasons, including inadequate power generation, weak distribution network, and poor financial health of the State Electricity Boards, monopolistic nature of the industry, lack of consumer awareness, inadequate enforcement mechanism, can be attributed to the poor quality of power supply.

It was analyzed based on the information available in public domain – consolidated from the publications and as highlighted in the “Electricity Act 2003”, and the studies undertaken so far that the QoS parameters have not reviewed from the consumer point of view in Delhi. There is a need to highlight need for conducting in-depth performance review of the existing private distribution utilities in Delhi. Such an analysis would lead to valuable suggestions for analysing the experiences of the regulatory and legislative framework designed few years back in Delhi. It would also help better understand the issues likely to be faced by regulators and consumers in future. The restructuring in Delhi as the subject of the research as it is considered an important milestone in the reforms journey and presently is at the centre stage of the country of which the success and failure has the potential of shaping the direction of the reforms process of the power sector in the country.

1.4 OBJECTIVE OF THE RESEARCH

The research is all about learning the impact of privatization of the power sector with emphasis on power distribution sector; post reforms. It is a well known fact that power flows from top to bottom (i.e. from generation entity to distribution entity) and revenue flows exactly in the opposite direction (i.e., from the distribution entity to generation entity).

In India few states namely Orissa, Andhra Pradesh and Delhi have privatized the distribution businesses whereas many states are in the process of privatizing their power distribution business. The privatization of electricity distribution in Delhi and its impact has been studied with the following objectives which have been further outlined in the above section "need for the study".

The objective of this research is to carry out a qualitative and quantitative analysis in the light of Quality of Service (QoS) parameters before and after reforms with emphasis on Electricity Distribution.

The Broad Objectives of the research are:

1. To study the status of Indian Power Sector before and after reforms in India.
- 2a. Parameterization and measuring performance of Power distribution companies in Delhi against the identified Quality of Service parameters for operating efficiency and reliable power from the Consumer point of view during 2000-2007.
 - Technical Efficiency
 - Commercial Efficiency
 - Operational Efficiency
 - Consumer grievances initiatives
- 2b. Measuring performance of Power distribution companies in Delhi against the Quality of Service performance parameters during 2000-2007 from the consumer point of view.
3. To provide suggestions for improving the quality of Service in the power distribution from the consumer point of view.
4. To study the possibilities of replication in case of other states.

This thesis is an outcome of research to integrate applications in Power Sector to macro economic objectives. As such, the study proceeds to review the reform process Power Sector in general and in particular improvement in Quality of Service of power distribution utilities of Delhi as a consequence of the power sector reform process. Statistical works carried out in the research involve

compilation of relevant data from primary and secondary sources pertaining to Indian economy, Power Industry in India and Power Restructuring models in the world. The analysis and recommendations of the study draw heavily on the knowledge and experience of practitioners in the field. Wherever it is related to economics, the views and expressions of economists have been relied upon.

1.5 RESEARCH METHODOLOGY

To achieve the above objectives the following methodology has been followed. The study is a descriptive and diagnostic one in the sense that it attempts to explore the linkages and results of Power industry reforms with the national economy and privatization of power distribution in Delhi. The period of study has been chosen from the year 2000 to 2007. Primary as well as secondary data is used for the analysis. Primary data is based on questionnaire which includes various quality of service parameters which is provided at the end of the section (Annexure 1). The data was also collected from personal interaction with senior officials of BSES, NDPL and DERC. Secondary data was taken from the records of all the three distribution companies (i.e. BSES, NDPL and BYPL) and DERC and other published documents like Yearly Reports of Annual Revenue Requirement, Electricity General Review of Central Electricity Authority, Annual Reports of Distribution Companies and DERC etc.

1.5.1 Primary Data Details

The present study focuses on assessing the Quality of Service to the consumer satisfaction by three distribution companies namely BSES RPL, NDPL and BSES YPL among the domestic consumers across the districts of NCT of Delhi. Appropriate quantitative technique like relevant time series data, segregation has been done wherever possible, interrelationships, weighted mean, trends have been used to interpret and to assess the different parameters.

1.5.2 Target Groups

The domestic consumers across the three distribution companies of particular 'load' categories have been covered in the present study. The consumer survey was conducted across all the three distribution companies in Delhi. The study

covered a sample size of 1002 consumers across all the districts of Delhi from the jurisdiction areas of the 3 DISCOM. The total number of consumers in each DISCOM was taken from the respective divisions across each load category.

The stratification of the sample was done in the following stages:

Table 1.1: Consumer Data for DISCOMs

S.No.	DISCOM	Consumers 2007-08	
		Number	%age
1.	BYPL	975043	99.35%
2.	BRPL	1171772	98.24%
3.	NDPL	922911	97.63%

Source: DISCOM Data 2008

Stage 1

The total sample size of 1002 consumers was proportionately distributed across the 3 DISCOMs on the basis of the total number of consumers metered in each of the DISCOM given in the (Table 1.2).

Table 1.2: No. of Domestic Consumer in three DISCOMs*

DISCOM	No. of Domestic Consumers metered	% Of Sample Domestic Consumers	Sample size
BYPL	975043	30	300
BRPL	1171772	40	402
NDPL	922911	30	300
Total	3069726	100	1002

Source: DISCOM Data 2008

*only the first type SPD (Single Point Delivery) consumers are considered.

**The first type of SPD consumers are those who receive supply at 11KV and further redistributed at the LT (Low Tension 415 V) level.

***The second type of SPD consumers are those consumers who receive supply from a Franchisee contractor who were authorized by erstwhile DESU/DVB to supply electricity in their designated areas.

Stage 2

The sample size in each DISCOM was further distributed across the 4 different types of load categories (i.e. less than 2 KV, between 2-10 KV, more than 10 KV, and Single Point Delivery) in proportion to the total number of consumers in the particular load category is given in the following (Table 1.3).

Table 1.3: Load Category v/s Division data of three DISCOMs*

	No. of Domestic Consumers	Load Category				No. of Divisions
	Total	<2 K w	2-5 Kw	> 5 Kw	SPD	
BYPL	975043	591321	81584	27226	35	14
BRPL	1171772	712932	150126	85626	75	19
NDPL	922911	581950	98113	29527	32	12

Source: DISCOM Data 2008

*only the first type SPD (Single Point Delivery) consumers are considered.

**The first type of SPD consumers are those who receive supply at 11KV and further redistributed at the LT (Low Tension 415 V) level.

***The second type of SPD consumers are those consumers who receive supply from a Franchisee contractor who were authorized by erstwhile DESU/DVB to supply electricity in their designated areas.

The sample size in each DISCOM was further distributed across the 4 different types of load categories (i.e. less than 2 KV, between 2-10 KV, more than 10 KV, and Single Point Delivery) in proportion to the total number of consumers in the particular load category (Table 1.4).

Table 1.4: Data for Sample Analysis*

Load Category	No. of Consumers	% of Sample Consumers	No. of Sample Consumers
BYPL			
<2Kw	591321	77	231
2-10 Kw	81584	21	63
>10 Kw	27226	1	3
PD	35	1	3
Total	975043	100	300
BRPL			
<2Kw	712932	60	242
2-10 Kw	150126	35	140
>10 Kw	85626	4	16
SPD	75	1	4
Total	1171772	100	402
NDPL			
<2Kw	581950	83	249
2-10 Kw	98113	15	45
>10 Kw	29527	2	6
SPD	32	0	0
Total	922911	100	300

Source: DISCOM Data 2008

*only the first type SPD (Single Point Delivery) consumers are considered.

**The first type of SPD consumers are those who receive supply at 11KV and further redistributed at the LT (Low Tension 415 V) level.

***The second type of SPD consumers are those consumers who receive supply from a Franchisee contractor who were authorized by erstwhile DESU/DVB to supply electricity in their designated areas.

Stage 3

The sample size of households/ consumers in each load category was further uniformly spread across the respective number of divisions in each DISCOM. Table 1.5 gives the number of divisions in each of the 3 DISCOMs wherein the respective number of consumers was randomly distributed.

Table 1.5: Sample Distribution Pattern in DISCOMs

DISCOM	No. of Divisions	No. of Households to be Covered in Each Division			
		Load Category			
		<2Kw	2-10 Kw	>10kW	SPD
BYPL	14	16.5	4.5	.2	.2
BRPL	19	12.7	7.4	.9	.2
NDPL	12	20.8	3.8	.5	0

Source: DISCOM Data 2008

1.5.3 Data Collection

Data used in the study are from two sources: (a) secondary sources; and (b) primary sources.

- a. Secondary data are taken from published reports of:
 - i. Ministry of Power, Government of India
 - ii. Ministry of New and Renewable Sources of Energy, Government of India
 - iii. Central Electricity Regulatory Commission, Government of India
 - iv. Planning Commission
 - v. Delhi Electricity Regulatory Commission, Government of India
 - vi. Centre for Monitoring Indian Economy (CMIE)
 - vii. The Energy Research Institute (TERI)
- b. Primary sources of data used in the study are:
 - i. Power Industry's internal reports
 - ii. Interviews with leading experts on the subject and senior executives in Power industry, both public and private
 - iii. Detailed consumer survey for the three utilities (Attached –Annexure 1)

Method of random sampling has been used for collecting the primary data. The data collection was done through household contact through a structured questionnaire. The questionnaire administered for this purpose which covers the following major areas:

- Consumption type: user category
- Consumer satisfaction level: supply, voltage, billing, frequency of power cut, etc.
- Redressal mechanism: experience in complaint registration, awareness level, official interaction etc.

1.5.4 Research Tools

1. The study begins with a review of literature on the central themes of the thesis, namely:
 - (a) Power scenario in the Indian economy;
 - (b) The planned development of the country followed by economic reforms.
 - (c) Reforms in Power sector.
 - (d) International experiences of the reforms.
 - (e) Study on quality of service parameters. Besides, the study has used the following tools:
2. Relevant time series data have been compiled; segregation has been done wherever possible, interrelationships have been analyzed, trends have been seen; all these tasks have been done using appropriate statistical methods and results have been interpreted.
3. Graphics and charts have been used for presentation.
4. Post office editing and post coding, data entry was carried out using SPSS. Adequate care was taken to subsequently clean and validate the data. Thereafter, output was generated as per the requirement of the research objectives.
5. Stratified random sampling is used to select the consumers from the entire geographical coverage, power load types and consumption pattern of the three Distribution Companies. At present Power is made available to the

residents of NCT of Delhi across all districts through the services of the following Distribution Companies:

- (a) BSES: Rajdhani Power Limited
- (b) BSES: Yamuna Power Limited
- (c) NDPL: North Delhi Power Limited

Hence the present study covers all the three Distribution Companies. The satisfaction of the consumer has been assessed by recording responses on a 5 point scale.

- Not at all satisfied
- Not satisfied
- Somewhat satisfied
- Satisfied
- Very satisfied

1.6 SIGNIFICANT CONTRIBUTION OF THE STUDY

The following are some of the significant contributions emanating from the research work.

The study is a descriptive and diagnostic one in the sense that it attempts to explore the linkages and results of Power industry reforms with the national economy and privatization of power distribution in Delhi. The method adopted is descriptive type, as it chronicles the development in Power industry during last sixty years and economic reform process of last eighteen years. The study is analytical to the extent the power distribution privatization and its linkage with the economy have been deciphered and their interrelationships have been brought out. The study measures the impact of policies on various segments of the economy in a micro/macro economic framework. The study also attempts to test to validate the course, direction and measures of reforms in Power Sector.

The method adopted in this study is applicable for a sectoral strategy (i.e., for Power sector), within the emerging market condition (from monopolistic market gravitating towards competitive market), under an overall policy

regime (transformation of a public sector domination to private participation, under democratic framework-PPA model).

Another significant feature of this study is its problem solving approach. Problems have been identified in terms of macro economic indicators like reduction in AT&C losses, meeting the power requirements, QoS etc. These problems have been analyzed and solutions have been attempted through multi-pronged approaches. The study has futuristic outlook and reformist approach. Emerging business environment, coupled with the trend in heightened customer awareness and expectations have been factored in the tenor of the study. The methods adopted in this study are: review of economic history, environment scanning, competition management and customer relationship management.

The comparative analysis was based on the pre and post Electricity Act 2003. The level of AT&C loss reductions was the bidding parameter that was used by GNCTD in its privatization of electricity distribution. Delhi's restructuring scheme hinges critically on DISCOMs achievement of AT&C loss reduction targets.

This research further examines the impact of the power Industry reforms by: a) the changes that occurred in policy with an international perspective and b) the changes that happened on improvement of Quality of Service with power distribution reforms in Delhi.

1.7 ORGANIZATION OF THIS THESIS

Brief outlines of different chapters are given below:

Chapter 1 contains a brief introduction to the power Industry to put the problems and investigations in proper perspective. It also provides a brief introduction to the study, motivation for the research, objectives of the research and an outline of organization of this research work with a chapter wise summary.

Chapter 2 contains an overview - a selected review of literature in the light of the need and objectives of this research.

Chapter 3 attempts to place Power Industry on the backdrop of energy sector and country's macro economy, by analyzing linkages between Power Industry growth, reform and restructuring process. This chapter throws up some critical issues of Power Industry, while making review of literature on the subject. The chapter outlines the demand supply balances in Power Sector. This chapter also brings out the import dependence of Indian Power industry and the issue of energy security.

Chapter 4 is a treatise on India's economic development with reference to power sector and reflects on the chronicles of the reforms undertaken in Power sector by a historical sequence. This chapter traces the evolution of reforms; by means of tracking the policy announcements and developments on various fronts in Power Industry.

Chapter 5 examines the impact of Power Sector reforms on some significant aspects of the power distribution reforms in Delhi. To provide a spectrum of Power Sector distribution reforms objectives, need and restructuring process in Delhi before and after restructuring. It also analyzes the restructuring process of Delhi Vidyut Board and lessons learnt from the privatization of distribution in particular.

Chapter 6 outlines medium term outlook and challenges for power industry in the international perspective mainly with reference to UK and Chile .It discusses the lessons learnt and recommends action plan to take the reform process further both at (macro) economy level and at (micro) enterprise level in India.

Chapter 7 the chapter attempts to provide a spectrum of power sector QoS and performane issues in India's power sector its objectives need and process. Also examines how much power sector reforms have supported the improvement in QoS on technical, commercial and operational parameters. This chapter would explore the alignment in the reform process in power distribution with that in the mainstream economy.

Chapter 8 contains major findings and significant contributions of the research duly as per the identified parameters summarized followed by the set of

recommendations. The thesis finally ends with the limitations of the study and suggestions for further research.

1.8 CONCLUSION

Chapter 9 outlines the medium term outlook and challenges for power industry and recommends action plan to take the reform process further both at (macro) economy level and at (micro) enterprise level. The study at the end comes to take a view about the appropriateness of the direction, course and efficiency of the reforms in power industry. It then goes on to lay down some recommendations for carrying the reform process further in the power sector.