POWER SECTOR REFORMS IN DELHI

An enquiry into outcome of reforms, claims of power sufficiency and the road ahead

Submitted to

Centre for Civil Society

By

Paras Malhotra & Shivraj Singh Negi

Working Paper No 228

Summer Research Internship 2009

Abstract

Delhi has to be power-sufficient if it wants to be a world class capital city. It also has to achieve this in a cost-effective and sustainable manner. The power reforms of 2003 were the first step in this direction. As a result of those reforms private participation was introduced in distribution for the first time in Delhi. The reforms have largely succeeded in cutting down the AT&C losses, reducing the financial burden of exchequer, and in increasing the amount of metered power. However, the generation capacity has remained stagnant. Delhi's model of power reform has been unique, and has largely escaped unscathed from the bitter experiences of power reforms introduced in Orissa. The success of these reforms enabled the government to make claims of power self-sufficiency by 2010.

Supply surplus is the pre-condition to the next stage of reforms, which can be achieved by being more energy efficient and revving up the power generation capacity. Since setting up power plants in Delhi is uneconomic, Delhi has to do this by long term PPAs and investing in generation capacity in other states.

The purposes of the paper were to demystify power reforms, look at the outcome of these reforms in generation sector, and verify the government's claims about power sufficiency by 2010 and to suggest future direction of the second stage of reforms.

In order to fulfill the purpose of the paper, we studied available literature on the issue and interviewed responsible officials associated with the regulatory bodies.

The outcome of the paper indicates that Delhi will be power sufficient only if the planned power plants are commissioned in time and demand is curbed by energy efficiency measures; The government has no specific policy initiative to make Delhi more energy efficient; for proper initiation of the second stage of reforms the supply demand gap has to be eliminated and there should be more pressure on the entire system to raise overall level of customer satisfaction.

Foreword

This paper is a result of research work done over a period of a month. The research focused specifically on Delhi and its experiences with privatization in the Power sector. Most of the time in research was spent interacting with people who have worked in the entities which existed before and which came after privatization.

We would like to thank our research guide Dr. Partha J Shah, for giving us directions and guidelines throughout the period of the research paper. We would also like to thank CCS (Centre for Civil Society) for giving us an opportunity to write this research paper.

We would like to give special thanks to Shri. Amrendra K. Tewary, Secretary, DERC for providing us with crucial inputs, suggestions and an overall insight into the functioning of the Delhi's power sector.

We would also like to express our gratitude to Mr. K K Verma, Deputy Director (Engineering) DERC and Prof. Sudheer Chella Rajan IIT Madras for taking out valuable time out of their busy schedules and giving us data and other relevant inputs.

All mistakes, however, will remain our responsibility.

New Delhi, June 2009

Paras Malhotra
Shivraj Singh Negi

Contents

1. Introduction

In this chapter we will give a general background of the background and development of our field of research. We will also identify the main problem and the purpose of the research. We will also limitations of the research. We will present our research questions and hypotheses. We will close the chapter by an outline and a short summary.

1.1 Background

Delhi's power demand has been increased continuously and the dependence on the power from outside has been increasing simultaneously. Though, the power corporations have earned sufficient surpluses during the winter season when Delhi has power-surplus, the summer peaks are way high above the total arranged capacity which leads to load shedding. Power reforms were introduced to improve the efficiency of the system and to rationalize tariffs and financial health of the sector. The reforms witnessed severe hiccups in the beginning. But the initial opposition to the reforms finally seems to be withering away, even as we witness lesser power cuts, and more confidant claims of power sufficiency by Delhi Govt[1].

1.2 Problem

The major problem is demand and supply gap in the present phase due to growing demand. Delhi's demand can go up to 7000 MW by 2010[2], or even more. Being power surplus is a pre-condition for the next steps in privatization because otherwise there will be no takers for the govt. proposal. Delhi needs privatization to reduce the rates for the consumers and this can only be done by generating more power. Introducing more competition in the distribution will raise the costs for discoms, diluting their profits without reducing the price. This is because, the price of electricity being regulated, discoms cannot increase the price as they want, while they will be forced to purchase costly electricity from different sources, to avoid power-cuts.

So next step in privatization should be introduction of private players into generation of power but pre condition to this is a sound distribution system where AT&C losses are minimized.

1.3 Purpose

The purpose of the paper was to understand the broad changes that have taken place in the sector after the reforms, understand the reasons behind confident claims of power sufficiency in future and find out their validity, and to suggest what should be the next steps in the overall process of privatization which will lead to a betterment of services provided to the end users.

1.4 Limitations

Due to the limited time and vastness of the power sector in general, the paper focuses only on the changes in the generation area of the market. To understand the actual impact of reforms on the power sector, we should look into generation, transmission and distribution and understand the relationships, interactions and activities of the new players and entities. But our focus will be changes in generation and we will try generating insights into the processes involved in overall working of the public-private setup.

1.5 Research questions

1. Since each of them has different demand projections, what are the parameters over which demand is projected for the next years by different authorities like NRLDC, DPC, CEA and DERC etc?
2. Where and how are power projects being planned, and what will be the addition in capacity when they are commissioned?
3. What is the time lag in allocation of funds and implementation of each of these projects?
4. What percentage of power is generated outside state?

5. What are the inter-relationships between the different bodies present in the power sector?
6. What is the nature and degree of privatization and regulation in the sector?
7. What is the current generation capacity of different power plants supplying power to Delhi?
8. Why was only Distribution privatized?
9. Why is Delhi not setting up its own power plants?

1.6 Hypothesis

Hypotheses are connected to the research questions. Some of these hypotheses were developed during the initial investigation into power sector reforms.

H_1: Delhi will be self-sufficient in terms of power till 2010-11.

H_2: Power reforms have induced a competitive environment for DISCOMs.

H_3: Power reforms have increased the efficiency of the sector.

H_4: A Fabian approach has been used to implement the reforms.

1.7 Abbreviations

AT&C	Aggregate Technical and Commercial
APDRP	Accelerated Power Development and Reform Programme
BRPL	BSES Rajghat Power Limited
BSES	Bombay Suburban Electricity Supply
BTPS	Badarpur Thermal Power Station
BYPL	BSES Yamuna Power Limited
CEA	Central Electricity Authority
CPRI	Central Power Research Institute
DERC	Delhi Electricity Regulatory Authority
DISCOM	Distribution Company
DPC	Delhi Power Corporation
DTL	Delhi Transco Limited
DVB	Delhi Vidyut Board
GENCO	Generation Company
GNCTD	Government of National Capital Territory of Delhi
GRIHA	Green Rating for Integrated Habitat Assessment
LEED	Leadership in Energy and Environmental Design
MES	Military Engineering Services

MU	Million Units
MW	Mega Watt (1 Million watts)
NCR	National Capital Region
NDMC	New Delhi Municipal Corporation
NDPL	New Delhi Power Limited
NRLDC	North Region Load Dispatch Centre
NRPC	North Region Power Committee
NTPC	National Thermal Power Corporation
PLF	Plant Load Factor
PXIL	Power Exchange of India Limited
SLDC	State Load Dispatch Centre
THDC	Tehri Hydro Development Corporation
UI	Unscheduled Interchange

1.8 Outline of the document

Chapter 3: Chapter 3 introduces the Electricity Reforms Act 2003. It explains it's various aspects related to generation, transmission and distribution. It also explains the role of various agencies which were born out of the reform process. Also their inter-relationships are explained through a chart.

Chapter 4: It explains the various procedures and processes related to procurement of power, tariff structure and subsidies.

Chapter 5: It gives an insight into supply and demand projections made by the government and different agencies. It also lists the different factors which determine these projections, and draws certain inferences.

Chapter 6: This chapter explores the road after reforms. It lists certain suggestions which should be government's priority in the next stage of reforms.

Chapter 7: This chapter concludes the document with some observations, suggestions and conclusions. We also present certain topics which require further research.

1.9 Short Summary

Power reforms in Delhi were introduced with an aim to reduce the inefficiencies of the system. Taking lessons from the power reforms worldwide, where power reforms were followed by huge price rises, Indian reforms have progressed slowly, and have taken care to

buffer the impact of privatization on energy prices. The reforms model is also innovative as discoms were privatized first, and simultaneously licensing requirements were eased for gencos and the transmission continued to remain in govt. hands. The discoms were not left free to charge prices, but their tariff structure was highly regulated by an autonomous body which also ensured that discoms continue to get sufficient returns on their investments. The new procedures and processes related to power procurement, tariff structure and subsidies are innovative and more efficient than before. The supply demand projections made by government confirm that Delhi will be power sufficient, partly due to long term PPAs, by 2012 C.E. The next stage of reform process should focus on making the system more efficient and more consumer friendly. The demand should be curbed by implementing more efficient metering technologies and encouraging power saving practices. The supply should be increased by more power projects. This will reduce the demand-supply gap as soon as possible, and ease the transition to next stage of reforms. Moreover, we need more research to know how an integrated Energy Efficiency Policy will help in this transition.

2. Method

In this chapter we have discussed and explained the method used in order to fulfill the purpose of the research. Further we will also explain how we collected the primary and secondary data.

2.1 Methodology

The methodology involves the following steps in chronological order:-

- Focusing on the specific issues.
- Data collection.
- Data interpretation.
- Identification of trends and problems.
- Finding out the solutions.

2.2 Research Philosophy

Knowledge is processed differently by different people. We have adopted a positivist approach and tried to keep our observations structured and quantifiable.

2.3 Research Approach

The research approach is largely inductive, though in the initial stage a lot of secondary data was collected to form a sound theoretical framework to understand different dimensions of the reforms.

We have collected data, and analyzed it for the purpose of our paper. We developed three hypotheses and checked them with further data and with inputs from our interaction with different stakeholders.

2.4 Data

2.4.1 Primary Data

The primary data has been collected by interviewing officials, collecting information from them and using our interpretations carved out from this data. Data was also collected from newspaper articles, from meetings with officials and NGOs and from PILs.

2.4.2 Secondary Data

The reports by various government departments, government budgets, government manifestos, reports made by NGOs and research institutions have been referred to.

2.4.3 Criticism

It is important to verify the suitability of the data that has been collected. Most of the data collected was provided by state government organizations and some central agencies.

We noticed certain discrepancies in the data provided by the central govt. authorities, while finding the data with the state government organizations more reliable. It was more credible as it included the reduction in AT&C loses and also the increase in plant load factor.

We were also uncertain about some projections given by central organizations, as we are not very sure if those parameters were made using the same parameters as we have mentioned in our papers.

2.5 Summary

We have adopted positivist approach, keeping our data and observations quantifiable, relied on secondary research available, and relied largely on data provided by the govt. to draw our conclusions. Primary data was collected by interactions with govt. officials, while secondary data was collected from various research journals.

3. Electricity Reforms 2003

The section explains the Electricity Act, 2003. It touches upon some of the topics and mentions the various entities which came into being due to the Act. It also deals with how these are inter-related. It covers the generation, transmission and distribution aspects of the entities involved.

3.1 Electricity Act, 2003

The Electricity Act of 2003[3] has addressed three key issues:-

1. Payment risk from sale of electricity.

2. Tariff rationalization.

3. Open Access.

Key features of Electricity Act, 2003

1. It split state utilities into autonomous entities.
2. It has directed to setup autonomous electricity commissions.
3. Setting up independent organisations legally binded to control national supply at national level.

Generation	Transmission	Distribution
1. Licences are only required to setup the hydel plants. 2. Generation from waste and renewable sources encouraged.	1. Different agencies for energy trading. 2. Privatisaton in this sector allowed. 3. Power trading given in hands of unbundled regulatory authorities which are further supervised by autonomous national agencies.	1. Consumers given freedom to choose their own suppliers. 2. Regulatory bosies to decide power structure. 3. Reduction of subsidies and cross-subsidies. 4. Stress on reduction of AT&C losses. 5. Stress on anti-theft and accurate electricity connections.

3.1.1 Generation

The generation in Delhi has been in hands of government since the independence and the privatization has only taken place only in the 2001. Even, then, the private companies have not setup any power plants in Delhi because of three **constraints**:-

1. Gas supplies are short and the supply of large quantities of gas required for power generation will need new pipelines, which will increase the costs.

2. Thermal generation form coal is also not practical as, coal has to be hauled from faraway reserves, and this transportation is costly, sometimes the cost of transportation being more than the value of coal hauled.

3. Any large thermal power plant in the NCR region will contribute to the air pollution levels.

The main power generating corporations are:-

1. IPGCL (Indraprastha Power Generating Co. Ltd.)

2. PPCL (Pragati Power Co. Ltd.)

3. Badarpur Thermal Power Station. (BTPS)

All of them are government owned companies.

The following is the list of the Power plants that account for Power generation by Delhi domestically:-

Company	Power Plant	Type	Installed	PLF
IPGCL	Rajghat Power House	Thermal-C	135 MW	53.69%
IPGCL	Indraprastha Power Station	Thermal-C	247.5 MW	43.92%
IPGCL	I.P.Gas Turbine Power Station	Thermal-G	282 MW	67.36%
PPCL	Pragati Power	Thermal-G	330 MW	91.53%

	Station			
Dedicated Power plant for Delhi	Badarpur Thermal Power Plant	Thermal-G	720 MW	93.6%

PLF = Actual generation capacity/ Total installed capacity.

Average PLF = 67.81% in 2006-07 published in Economic Survey of Delhi 2007-08.

For BTPS PLF, Source: CEA.

3.1.2 Transmission

Transmission was earlier handled by DVB only and the focus on transmission losses was very less. Delhi Transco Limited is the sole company responsible for transmission after the Act. There are strong economic reasons for continuing public ownership of transmission. Competition in transmission should mean better transmission efficiency, and it should be transferred to end user in form of lower prices. But the competing companies will have to invest in the transmission network to improve transmission efficiency.

Since the amount of investments required are high, and transmission entities get a fixed amount irrespective of transmission efficiency, they have no incentive to really invest and improve the network. They will continue to operate the same network, without improving the efficiency.

The unbundling of DVB into DTL has increased the efficiency of transmission network[4] and the AT&C losses have reduced to 29.82% from 52 % before reforms.

3.1.3 Distribution

Earlier DVB was responsible for all the distribution and the AT&C losses were 52% in 2000 and after privatization, the AT&C losses have reduced to 29.82%[5]. The present distribution companies are:-

1. NDPL

2. BRPL

3. BYPL

4. MES

5. NDMC

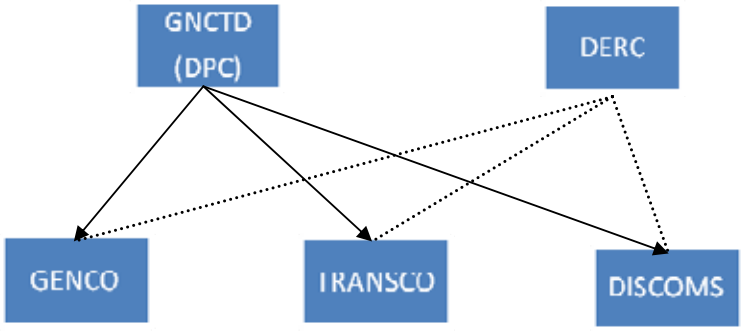
NDPL, BRPL and BYPL are privatized companies in which govt. has minority stake. The distribution network has decreased AT&C losses to nearly 30% in 2007-08 from as high as 61.89% in case of BYPL 2002-03[6].

3.2 Role of each agency

AGENCY	ROLE
GNCTD	It has stakes in all the companies through which it keeps its terms but not directly interfering with the autonomous companies. It appoints the entire decision making management in the bodies in consultation with the companies. It gives the subsidy to the end customers either by giving cash transfers to Discoms or by lower connection costs.
Delhi Power Company	It is the holding company which is a 100% govt. subsidiary. It has share-holdings in BYPL, BRPL, NDPL, PPCL, and IPGCL.
DERC	It is the regulatory body and sets the tariff for different companies for transmission facilities and the general public also. It is also responsible for the distribution and transmission licenses. It regulates the procedures and interlinks different bodies. It also looks after the grievances of affected people.
IPGCL and PPCL	The aim of GENCOS is to generate electricity and intimate the capacity available in advance so that the GNCTD and DERC can avail power from outside in advance. The two generation companies have

	different DISCOMS as clients.
Delhi Transco Limited	It is responsible for transmission of power at 220 KV and 400 KV Level besides up-gradation, operation and maintenance of EHV Network. It also monitors demand and gets directions from the regulatory body regarding transmission policies. It is a 100% govt. subsidiary. The State Load Dispatch Centre (SLDC) is a subsidiary of DTL.
NDPL	It is a joint Venture between Tata Power and GNCTD. It is responsible for distribution of 1180 MW in North and north-western parts of Delhi. It is responsible for reduction of a part of AT&C losses and new connections are sold by it only. It draws power from Transco and distributes at 11 KV and 44 KV lines
BSES	BSES operates in form of two companies: BRPL and BYPL. BRPL distributes power in South and West zones and BYPL distributes in North-East, South-East and Central zones. They are responsible for controlling and reducing the power theft which varies from less than 30% to 80% (areas in Nizamuddin) in some areas.
NDMC	It distributes power in territories under its jurisdiction, which mainly include the area comprising the territory that has been described as Lutyen's Delhi and which has historically come to be regarded as the seat of central authority in Union of India.
MES	It is responsible for distribution of power in Delhi's cantonment areas.

3.3 Organization chart



Legends

Regulatory relationship.

Asset Line.

The liabilities of different companies in generation, transmission and distribution are in the hands of the DPC whereas the govt. holds some percentage in terms of assets in these companies[7]. DERC also acts as consulting body on important policy matters to GNCTD[8].

4. Procedures and Programmes

The section explains the basic processes involved in power procurement and the efficient functioning of the setup. After privatization, govt. could economically benefit the society in three ways: Tariff Structure, Rural Power Scheme and Subsidies. The subsidies and cross subsidies are functional in the tariff structure itself.

4.1 Procurement of Power

The power can be procured by three ways based on time factor:-

1. Power Procurement Agreement (PPA) long term – The govt. signs a long term PPA with Gencos in different states and these pacts are based on fixed and variable charges. The fixed charges (machine, salary, etc.) cost the end consumer Rs. 24/KW/month and the variable cost covers the fuel costs[9]. This is called double tariff structure.

2. PPA short term – Short term agreements include fixed and variable charges and is done by govt. with different states and different companies to cover anticipated peak demand scenarios.

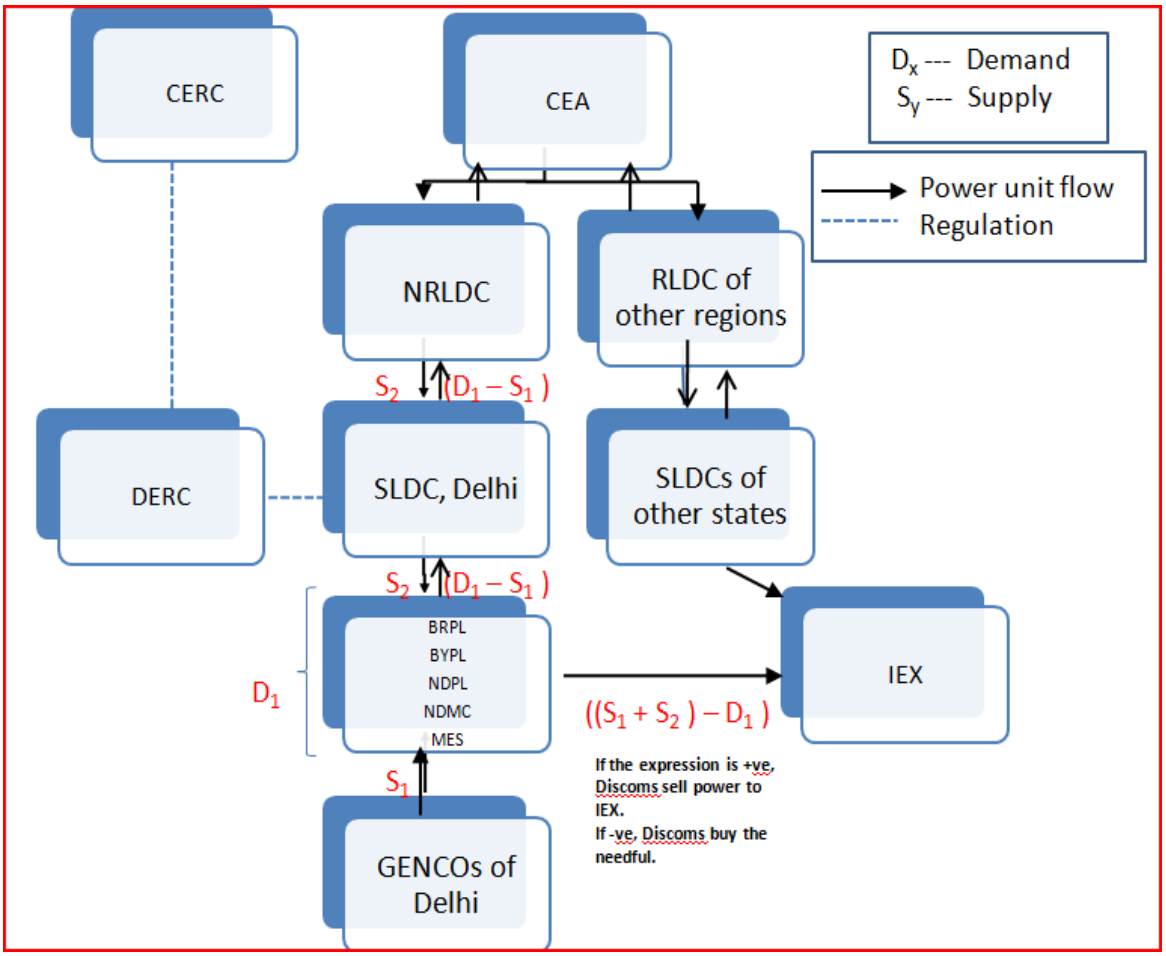
3. Unscheduled Power –When the demand exceeds the power obtained from short and long term PPA, the DISCOMS procure it through IEX or PXIL at UI rate which can even go up to Rs.14/unit[10].

The power demand is scheduled by DISCOMs into 96 slots of fifteen minute intervals a day in advance and informs SLDC (State Load Dispatch Centre), a part of Delhi Transco Limited. SLDC intimates this schedule to the NRLDC. It prepares the same demand schedule for entire northern region and further intimates CEA. The CEA is supplied a similar supply scheduled by different gencos and then it prepares the demand supply match for all regions and lets other states know the surplus/deficit. This supply is distributed in a similar manner, keeping the demand-supply gap to a minimum, from CEA.

In this way, the power is regulated by the Central Power agencies through grid systems.

The figure shows the power flow chart between nodal agencies and the Discoms. The supply-demand flow chart is divided into three stages:-

1. The supply from Delhi Gencos is S_2 which meets the initial demand D_1 by the Discoms.
2. The rest of demand i.e. ($D_1 - S_1$) has to be met from central grid. The supply S_2 given from Central Grid meets the rest part of the demand.
3. If S_2 is insufficient, the Discoms can purchase the power from IEX. If more than sufficient, they can sell the residuary power at IEX. Power sold/bought at IEX is at UI rate always.



4.2 Tariff Structure

The tariff structure is made by DERC and has various slabs which infuse demand in lower strata of society and curb it at the higher end. A new tariff structure released this year reaffirms this trend.

The current tariff structure is shown in the Annexure.

4.3 Subsidies

Delhi Govt. gives power subsidy to agricultural consumers and the consumers which consume less than 150 units of power. It has been decided to give the subsidies at Re.1 per unit in both peak and non-peak seasons[11].

The cross- subsidy, i.e. different industrial and residential rates per unit, is also in place thereby stressing the industrial users. So, DERC has decided to reduce this cross-subsidy slowly and level the two rates.

4.3.1 Rural Power Scheme

To attract private investments in generation and distribution in villages, tax exemptions are offered to these investors. In rural areas, Rural Electrification Corporation, under the Rajiv Gandhi Grameen Vidyutikaran Yojana, is responsible for helping setup small power plants. This central scheme is being implemented with the Delhi govt. authorities. According to 2001 census, the number of un-electrified rural households stand at 24580 i.e. 14.5% of rural household. In Delhi, the rural population account for 7% of the population which is not significant. These areas are distributed over Delhi and inducing rural power scheme to setup an independent power plant for these areas seems economically infeasible at the moment.

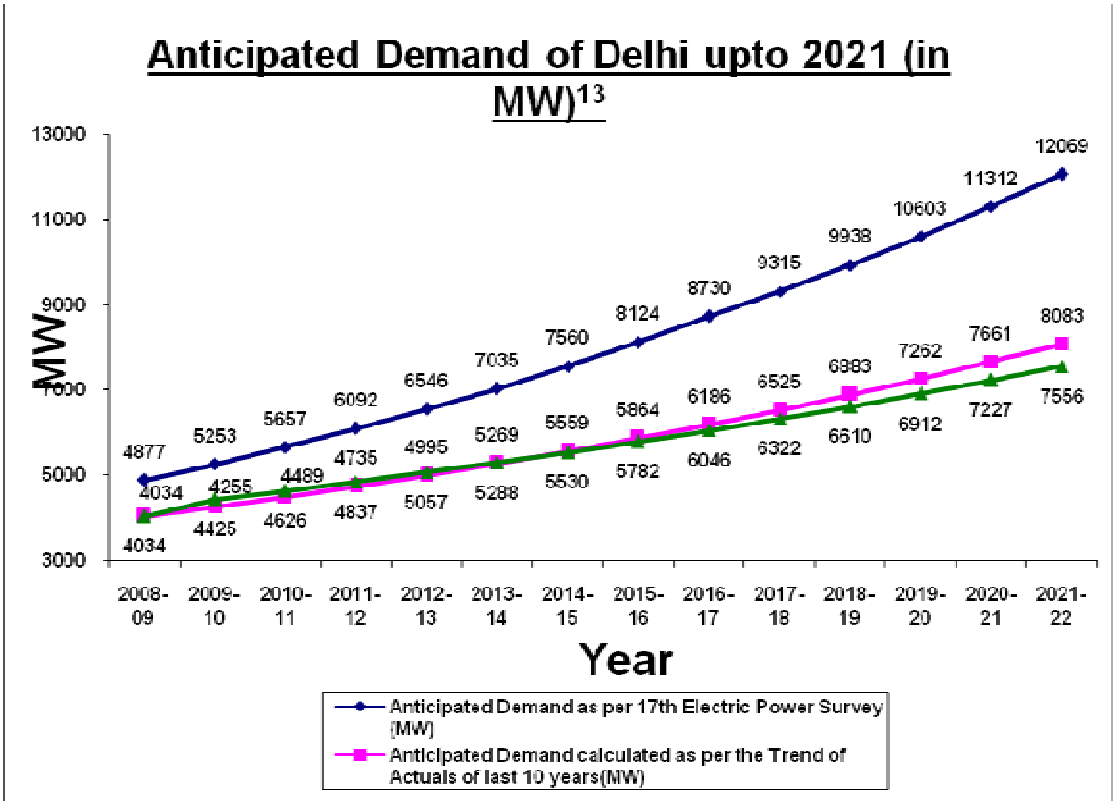
Table 5.1: Typology of Electricity Subsidies[12]					
		TARGETTED SUBSIDIES			
			EXPLICIT TARGETTING		
	UNTARGETTED SUBSIDIES	**IMPLICIT TARGETTING**	SELF SELECTION: QUANTITY TARGETTING	SELF SELECTION: SERVICE LEVEL TARGETTING	ADMINISTRATIVE SELECTION
CONSUMPTION SUBSIDIES	*No across the board price subsidies:* Subsidies are available for only few Consumers.	*Tolerating Illegal connections*: Benefits those with illegal connections.	*Increasing Block Tariffs* Tariffs vary with the connection load. Benefit users with lower load. *Volume differentiated tariffs.* Tariffs vary with amount consumed. Benefits user with low consumption.		*No provision of "Social tariffs". No such subsidies.* *No Merit discounts and discounts. No such subsidies.*
CONNECTION SUBSIDIES	*No financing scheme for financing new connections, except those classified as poor*				*Social Connections:* Households classified as Poor benefit from this.

5. Demand and Supply

The section reveals the statistics and explains the demand trends of Delhi's power consumption. This section uses the demand and supply projections to draw the conclusion towards the end of the paper.

5.1 Demand projections

Demand projections are done by various agencies – NRLDC, SLDC and CEA and based on that, supply side decisions shape the power security of Delhi. The demand trends are analyzed and then investments decisions are made to setup new power plants in the region or to use those investments to improve grid efficiency.

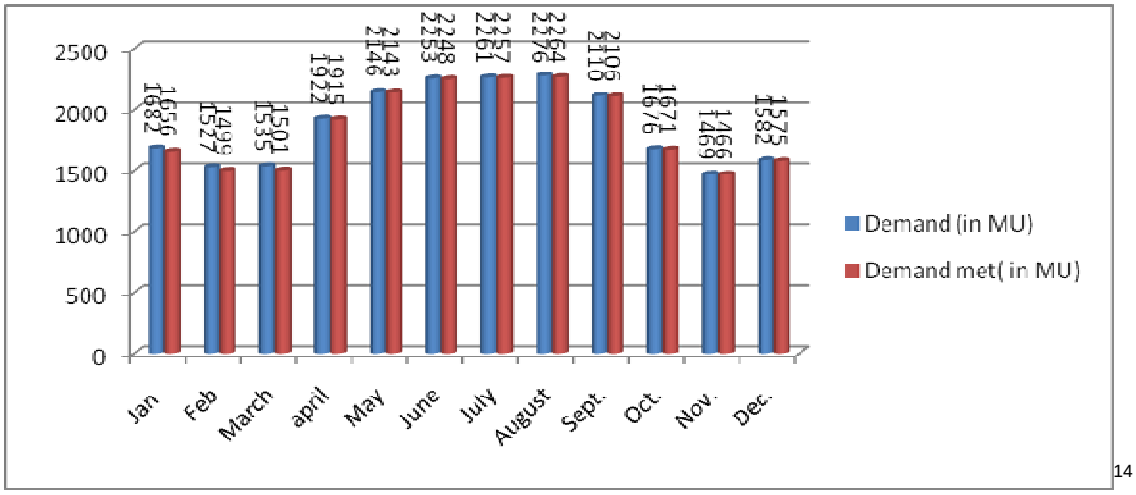


Demand has been projected by three agencies CEA, DTL and NRDC till 2022-23. Though, the projections are highest by CEA and lowest by NRPC. They have taken different annual average growth rate of electricity demand. The NRPC takes average rate at 4.5% from

2010-11 onwards, CEA's average rate is 7.26% till 2016-17 and 6.69% till 2021-22 and DTL projects at an average rate of 4.56% from 2009-10.

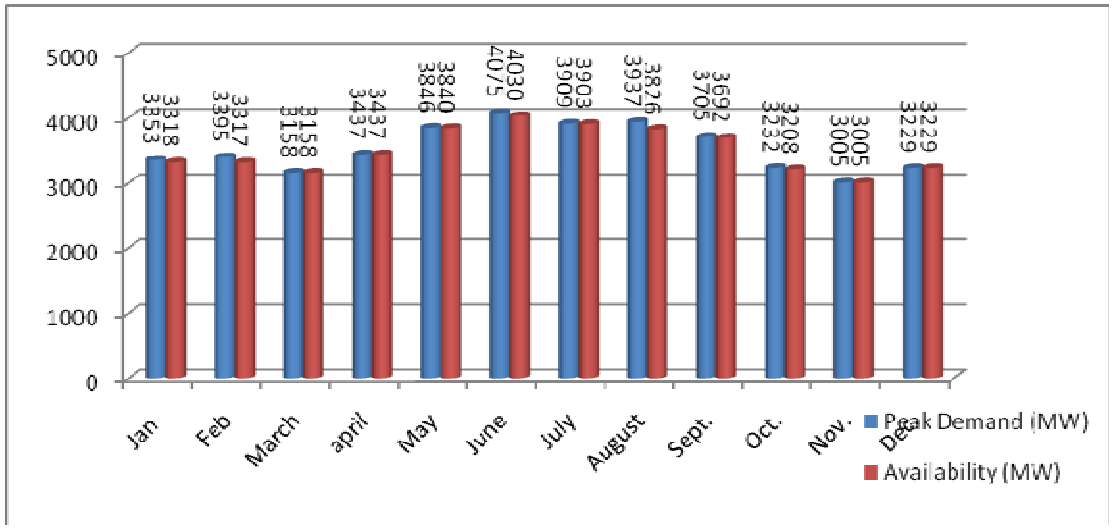
5.1.1 Demand pattern in different seasons

The figure shows the month-wise demand in MUs. Most of this power was procured from Central Grid System through CEA.



14

The figure reveals the maximum deficit of 111 MW in the month of August showing peak variations.



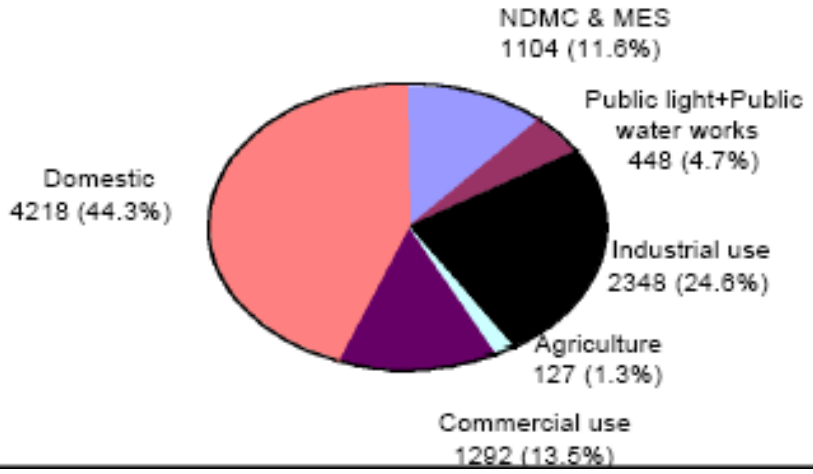
15

The seasonal pattern is a typical bell-shaped curve showing peak variations in summer months. But most of the demand met is due to central grid system and not due to Delhi's own power plants.

5.1.2 Demand distribution

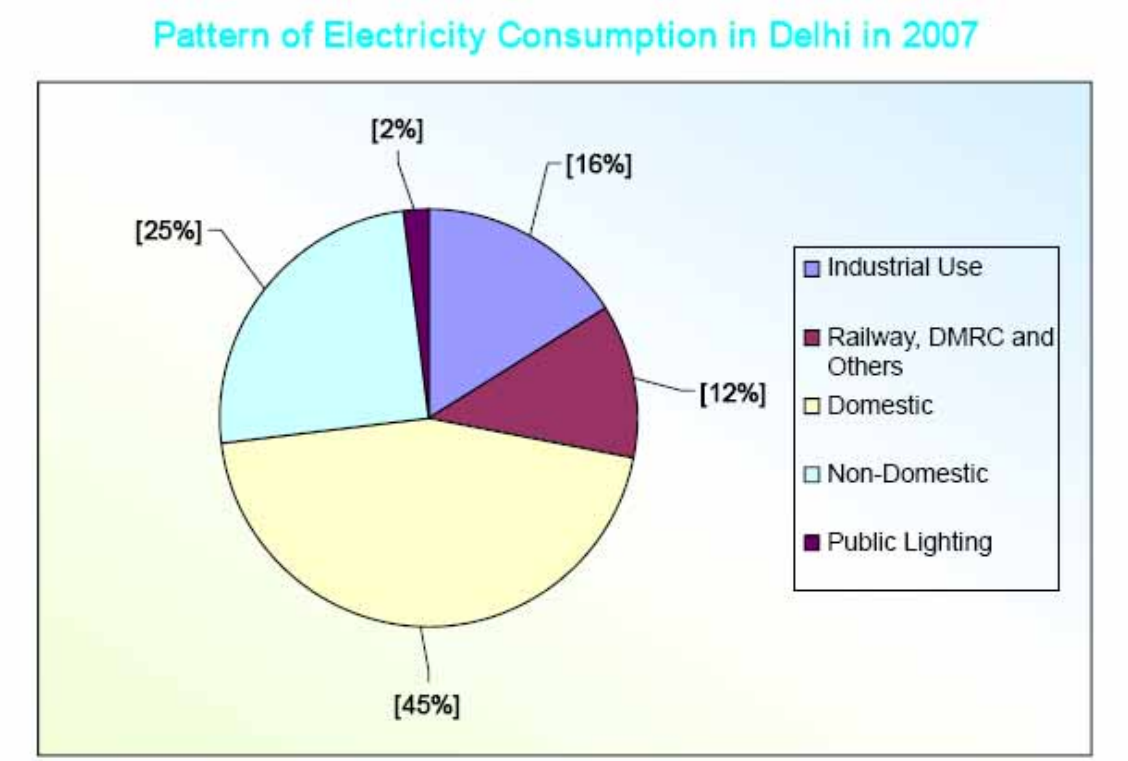
The per capita electricity consumption is 1,265 KWh, highest in the nation. The demand distribution pattern is shown in the following charts for the year 2001 and 2007:-

PATTERN OF ELECTRICITY CONSUMPTION IN DELHI IN 2000-01 (MILLION UNITS)



[16]

The large part of power share is consumed by the domestic and non-domestic connections. Though, the housing share is increasing at a better rate than any other connection and is expected to increase more.



16

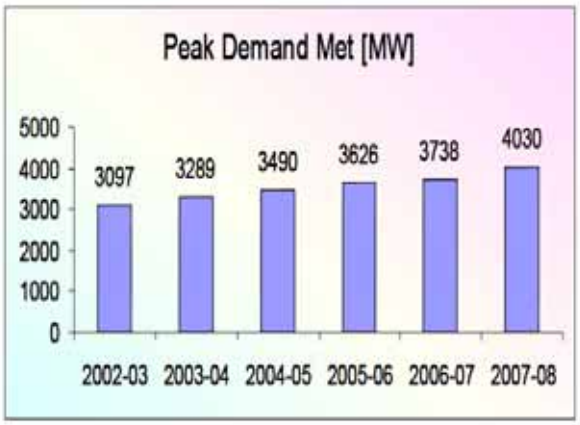
5.2 Method of projection

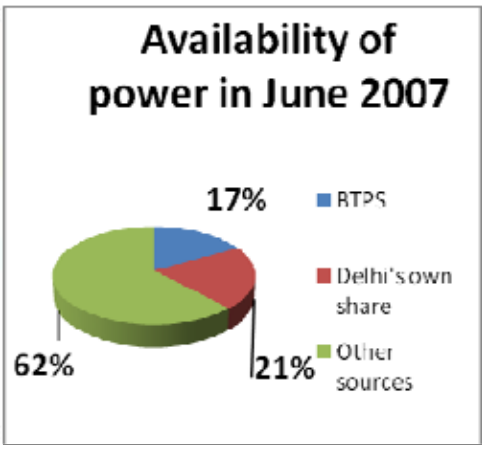
There can be various parameters used to forecast power demand:

1. Statistical data from previous years.
2. Economic growth projections (GDP)
3. Industrial growth (IIP)
4. Climate projections for the year
5. Population growth.

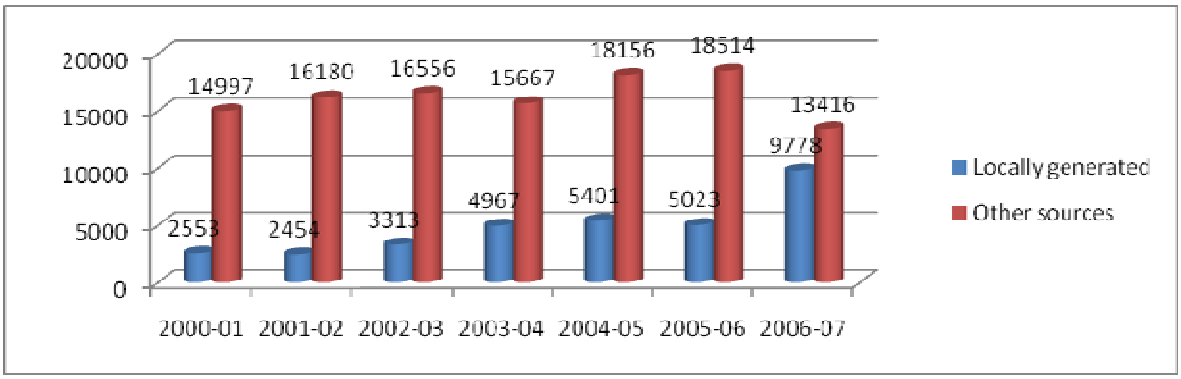
5.3 Supply projections

The supply projections are based on the maximum power made available from existing power plants and upcoming power plants in the future. Supply projections also take power received from power purchase agreements into account. Based on these figures, supply projections are made and demand and supply gap projected. The present situation is presented in the figure below, where most of the share of our power is drawn from central grid[17] i.e. more dependence on central grid. Delhi imports large amount of power for its use.





The govt. has very limited generation capacity of its own i.e. 1699 MW installed capacity, most of the power is procured from central grid and some of it from power exchanges.



Source: Economic Survey of Delhi, 2007-08, Chapter-11.

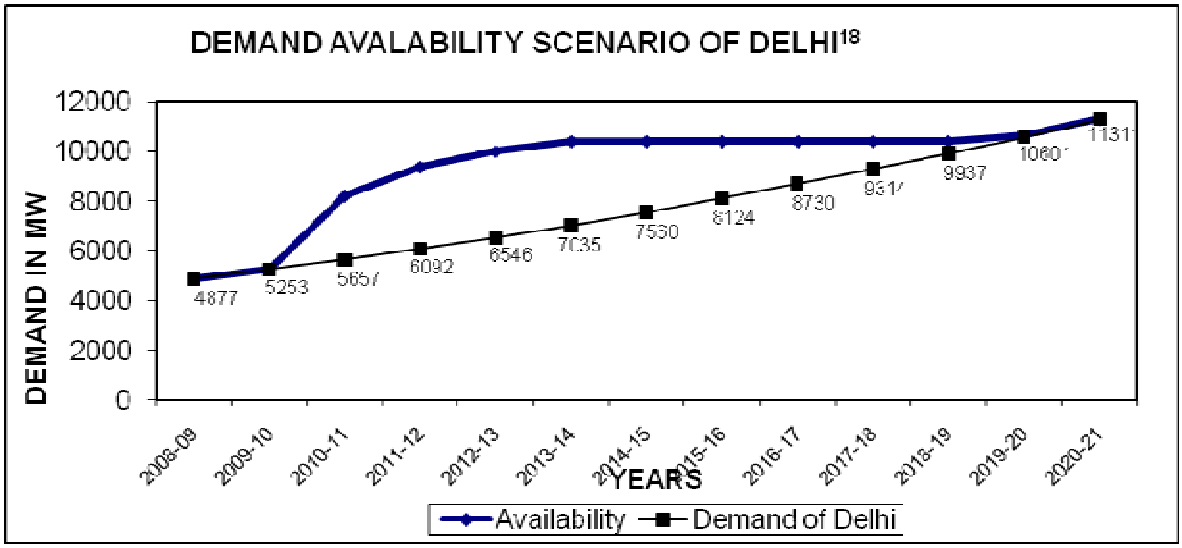
The above figure shows 4030 MW capacity met in 2007-08. The Delhi's own power generation installed capacity is 1699 MW and the average plant load factor is 67.8% as compared to national average of 76.8% in 2006-07. The Indraprastha Power Station has an average load factor of 43.92% because its closure date has already passed but still it has not been out-phased, due to lack of other power production alternatives. Same is the case with other power stations which are running beyond their design life.

Due to induction of BTPS into the generation cycle of Delhi government, there will be a surge in domestic generation capacity of Delhi.

5.4 Method of Projections: Supply

Supply Projections are made based on these factors:

1) Power available from long-term PPAs.
2) Power available from New-upcoming plants where Delhi has a stake.
3) Power made available due to efficiency gains expected from grid, and the supply network.
4) Power available from Delhi's own power plants.
5) Surplus power that can be arranged from the grid.



5.5 Inferences

- The demand has grown and many times exceeded the supply in recent years. The major problem is that supply is still short in peak months. The load shedding is done in many areas and the DISCOMs exert a lot of pressure on the regulatory body to increase the price because of rising prices at which they buy electricity which is due to higher demand and less supplies.
- The trend seen in the recent years has shown that govt.'s dependence on Central grid system is increasing rather than decreasing. Rather, Delhi was slow in initializing many turn-key projects. But now most of them are in place and the date of commissioning is near 2010-11. This suggests lower dependence on Central Power grid

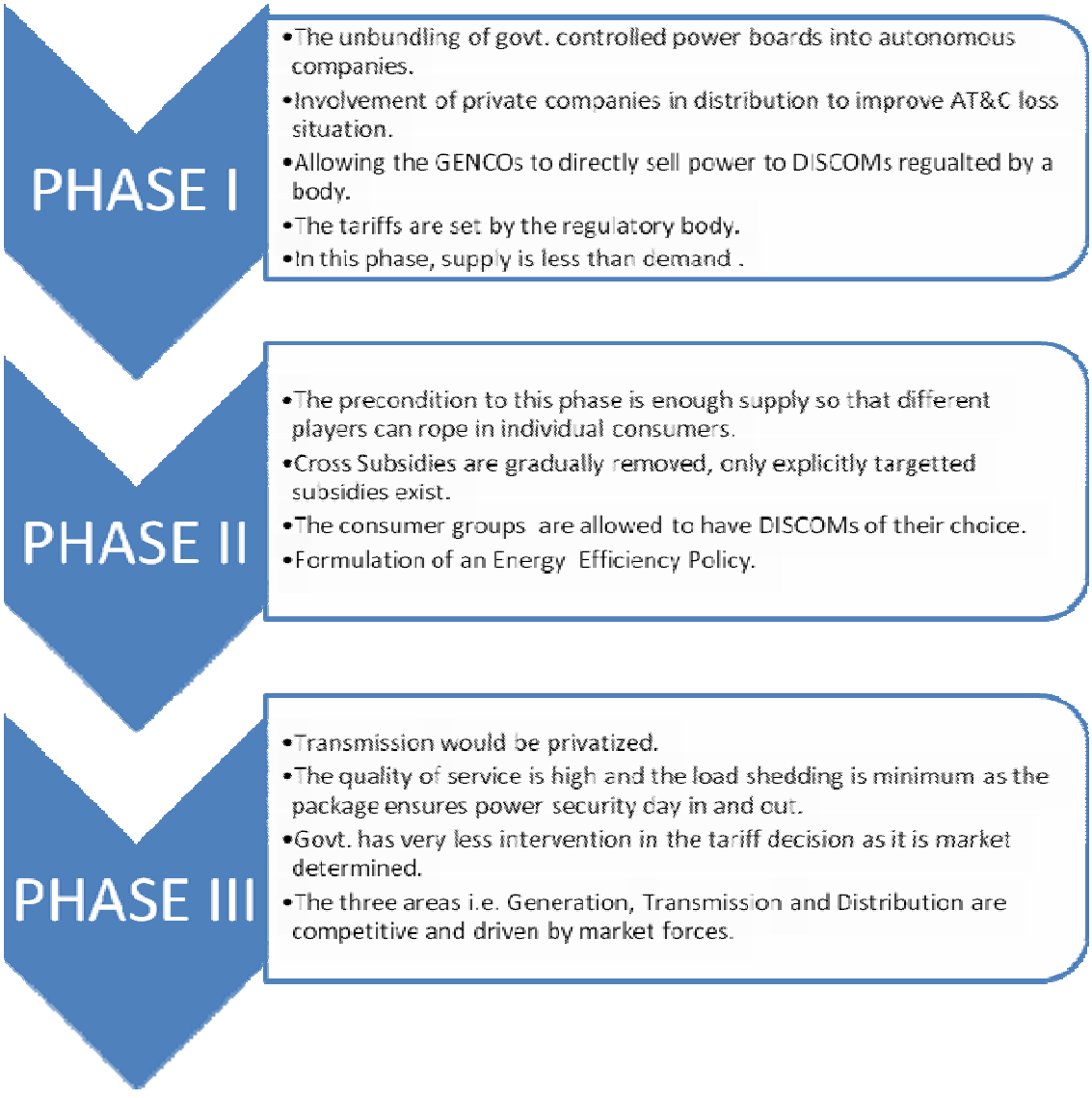
and more self-sufficiency. Also, the prices can rise because of the high UI rate in peak seasons. The cheaper electricity can only be ensured by more supply, otherwise the limitedly privatization would not help.

- Based on these factors and the supply projections made by the different agencies, Delhi will be power sufficient by 2011, and will have a power surplus as well in peak time. The rider to this is that only if the current projects are completed in time and the existing PPAs are maintained.
- Though Delhi's own capacity will start increasing only from 2009 end when 108MW NDPL's Rithala Plant will add to the capacity. It will also see phasing out of Indraprastha Plant's old generation units.

6. The Road after the Reforms

The reforms introduced in Electricity Act, 2003 acted as the first step for the privatization in the Delhi power sector. The next phases have been introduced in this section and the consumer satisfaction has been stressed through privatization. It has taken into consideration the steps needed to move the reforms to next phase. The section deals with how energy efficiency can change the present scenario.

6.1 Next steps in privatization



Three phases in the power reforms have been identified which can act as the directions for framing future govt. policy. These can be seen in the following figure.

Delhi's reform process is in the first phase, though foundations of second phase have been laid like the freedom given to consumer groups to choose their own supplier. Though no private company has taken this up as the tariff is still regulated by DERC and the supply-demand gap is still prevalent. The power is purchased by the DISCOMs from the GENCOs but the tariff is set by the DERC. That is why the market is still regulated and needs to be till the supply demand deficit gets fulfilled by up-coming power projects.

6.2 Raising customer satisfaction

The system as a whole needs to be made more accountable for power security and the quality of power. The present system has shown a significant improvement in terms of AT&C losses and connection services. Increasing the benchmarks will call for better services. This can be done by putting more pressure on the system as a whole irrespective of public and private inter-relationship.

The following customer concerns should be addressed:-

a) The quality of service needs to monitored i.e. fluctuations in power supply, power outages should be banned and if any intimated in advance, etc.

b) A citizen charter should be followed by the Discoms.

c) New energy efficiency measures need to be promoted by Discoms.

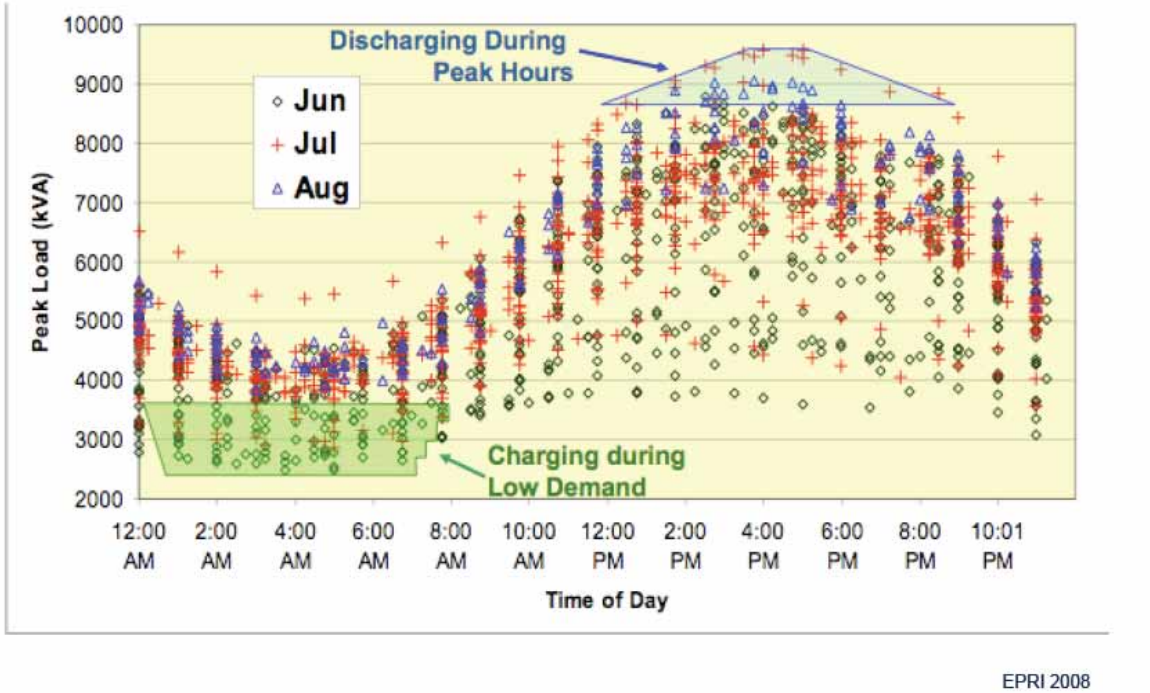
The overall customer satisfaction level has to be raised. Though the recent A C Nielsen[19] consumer survey done on the behalf of DERC indicates that the overall customer satisfaction is on rise, but still it is still short of what it should have been as a result of reforms. Customers have expressed a "high degree of satisfaction" about stable voltage, regular visits

by meter readers and regular receipt of bills. The unscheduled power cuts are still an area of concern. It is expected that they will reduce once the supply situation improves.

For the smooth functioning of the system, it is very necessary that supply should exceed demand. This can be achieved both by supply and demand side management.

6.3 Energy Efficiency

The energy efficiency has a lead role to play if the peak outages have to be controlled and Delhi made sufficient in terms of power. The lead role has to be taken by govt. in terms of policy measures and Discoms in terms of implementation. The recommendations have been given in Chapter-8 of the paper. The charging of system at low demand and discharging at peak times is a solution to the inefficiency which has become inherent in the generation plants due to fluctuating demand. This inefficiency leads to wastage of fuel and may even increase the generation costs.



The above graph[20] shows hourly variation in power consumption for every day over a period of three months. If the system can be recharged during the off-peak hours, it can be discharged during peak-hours and thus the demand can be managed.

Currently, THDC has adopted a method where they discharge the water from reservoir during peak demand hours, while the same water is pumped up into the reservoir during off-peak hours when there is a power surplus. This way, the generation system acts as a storage unit as well, discharging during peak hours while recharging during the off-peak hours.

Time of day metering is another novel method of distributing the supply throughout the entire day, instead of concentrating it during few hours of a day. The customers are charged more for consumption during peak hours, while off-peak consumption is charged less. This gives customers the incentive to use some equipment like washing machines etc during off-peak hours, and thus distribute the overall variation in demand over the day.

7. Observations and Conclusions

The section explains the present observed situation and its effects in the long run. Also, many new paradigms will be touched to ensure an accountable system both for future power security and better quality.

7.1 Hypothesis testing

H_1: Delhi will be self-sufficient in terms of power by 2010-11.

C_1: Delhi will be sufficient only after 2011. The term self-sufficiency means that supply from power plants will meet the demand in Delhi, which cannot happen at all. Power from long term PPAs and from the UIs and short term PPAs will be needed to achieve sufficiency in power sector. Since the power from short term PPAs and IEX is expensive, this will slow down the pace of reforms as market forces cannot operate freely in such scenario. They cannot buy expensive power and sell it at regulated rate for long. Self-sufficiency can be achieved only after Delhi gets its share of power from Damodar Valley Project i.e. 2300 MW. Only after the commissioning of the plant can Delhi become power sufficient.

H_2: Power reforms have induced a competitive environment for DISCOMs.

C_2: The hypothesis has been proved wrong because the setup in phase I is regulated to keep the prices at affordable level for the end consumer. Though the govt. ensures that the Discoms get a 16% return, there is no competition dimension in the power environment. The only competition they face is when they sell excess power in open market. But that has no effect on reduction of prices at retail level.

H_3: Power reforms have increased the efficiency of the system.

C_3: Definitely, the Discoms have reduced their AT&C losses remarkably. But the actual efficiency has not been passed to the consumer yet because of the demand and supply gap.

The AT&C losses have reduced below the national average of nearly 30% but still some areas have theft and commercial losses that go up to 80%. The level of 15% seems difficult because they have been able to reduce AT&C from 46.3% to 30.4% in a little more than five years.

H_4: A Fabian approach has been used to implement the reforms.

C_4: A Fabian approach is when one proceeds very slowly but firmly, and chips away the opposition one by one. The success of the strategy lies in using time to wear out any opposition or roadblocks. The hypothesis holds true because the reform process which is still in Phase I has been highly and rightly regulated. Delhi has not gone for an all out reform, but slowly, stepwise, staggered reforms, which have gone ahead in spite of heavy opposition from different vicious interests.

7.2 Conclusions

- Since introduction of private DISCOMs, the electricity rates have not reduced as promised. The sole reason for this is demand and supply gap.
- The generation capacity will increase considerably to make Delhi power-sufficient.
- The AT&C losses have reduced considerably but net AT&C losses still stand nearby 30%.
- Delhi's own generation capacity can never match its supply. Hence, it needs the long-term PPAs in future too.
- Transmission sector's privatization is infeasible in small grids as the investment costs are huge in lieu of the constant and low transmission costs.
- The phase I of reforms needs to be highly regulated in order to prevent the customer from high prices due to the demand and supply gap.
- The next phase's pre-condition is supply exceeding the demand.

- Delhi's model of privatization is successful model for areas with more than 90% urban population and less agricultural connections. Here the major user will be the domestic ones followed by industrial or non-domestic. Service should aim to achieve a high level of customer satisfaction.
- Energy Efficiency has not been introduced by the Discoms at the consumer end.
- Both supply side and demand side management are needed to achieve a power surplus scenario.
- An energy efficiency policy is needed for demand side management.

7.3 Recommendations

- **The power plants' commissioning should be monitored closely as the supply surplus is a solution to the price problems and will lead to sufficiency.**
- **The revving up of demand from the households at lower income level is necessary as power consumption is seen as a vital factor for Human Development Index.**
- **The Demand Side Management is also necessary to curb the peak demands. No policy or practices curbing the peak demand to lower levels are in place. There are many technical and policy measures which can curb demand of large users.**
- **The entire system should be pressurized to deliver better customer experience. There should be a citizen charter on quality of service being delivered, and it should lay down the exact parameters of service provided by the discoms. The charter should also have angry efficiency targets to be achieved by discoms.**

- **New measures on efficiency will help move the Delhi to next phase of privatization as pressure will reduce on Discom end since no unscheduled power will have to be drawn at peak time. These should include:-**

1. **Necessary energy audits for all industrial and govt. buildings.**
2. **Allowing private companies to enter Energy Services Business by allowing ESCOs (Energy Services Companies) to Audit and consult on energy consumption matters.**
3. **New buildings have to follow a set of standards may it be LEED or GRIHA standards.**
4. **Net metering should be introduced by the Discoms to rev up the information standards. This should at least be mandatory for new industrial connections.**
5. **An Energy Efficiency Policy (EEP) should be designed to rev up these measures. It should have following salient features:**

i. **Legislative measures:** Formulating a policy which outlines the energy efficiency targets and measures which will be taken to realize those targets. A written policy will give these measures support of law, and will make various provisions enforceable.

ii. **Administrative measures:** Setting up of an autonomous body to recommend and monitor the implementation of various energy efficiency measures, especially by large consumers of energy.

iii. **Fiscal Initiatives:** Changing the economic policies to incentivize the adoption of more energy efficient technologies and to reduce the cost of their adoption. Increase in energy efficiency should not cause an increase in energy consumption, which may actually offset any savings. So measures have to be in place in order to reduce this 'rebound effect' to minimum.

iv. **Civil Initiatives:** Making energy efficiency targets a necessary part of various organizations which are large users of energy, and also, introducing it into the citizen charters of discoms in Delhi. Popularizing the adoption of energy efficient technologies and raising the overall awareness level on this issue.

8. Endnotes

1. Congress Manifesto: Assembly Elections, 2008. Source: ttp://dpcc.co.in/dpcc.php
2. Anticipated Demand as per the 17th Electric Power Survey.
3. Indian Power Sector – Emerging challenges to growth by Sandeep Kumar, Anurag Khetan and Bishal Thapa, ICF Consulting.
4. Economic Survey of Delhi 2007-08.
5. Economic Survey of Delhi 2007-08.
6. Economic Survey of Delhi 2007-08.
7. Electricity Act, 2003.
8. Electricity Act, 2003.
9. As told by Mr. K. K. Verma, Joint Director (Engineering) DERC.
10. Annual Report. NRPC, 2007-08.
11. Electricity Tariff Structure in Delhi, 2009.
12. Chapter Two, Kristin Komives, Vivien Foster, Jonathan Halpern and Quentin Wodon. Water, Electricity and the Poor: Who Benefits from Utility Subsidies. World Bank, 2005.
13. Data collected from Delhi Transco Limited.
14. NRPC Annual Report, 2007-08.
15. NRPC Annual Report, 2007-08.
16. Economic Survey of Delhi 2000-01 and 2007-08.

17. Economic Survey of Delhi 2007-08.

18. Data collected from Delhi Transco Limited.

19. http://www.indianexpress.com/news/derc-survey-sheds-light-on-power-complaints-down-powercuts-still-on/477544/

20. Prof. SC Rajan's presentation on 'Energy for Sustainable Development' during Indo-German workshop on sustainability at IIT Madras.

21.

9. References

Antonette D'Sa, K. V. Narasimha Murthy, Amulya K. N. Reddy. "India's Power Sector Liberalisation:

An Overview." *Economic and Political Weekly*, June 5, 1999: 1427-1434.

CERC. *MONTHLY REPORT ON SHORT-TERM TRANSACTIONS OF ELECTRICITY.* New Delhi: CERC, March 2009.

Daniel Bouille, Hilda Dubrovsky, Crescencia Maurer. *Reform of the Electric Power Sector In Developing.* Project Report, World Resources Institute, March 2001.

"Economic Survey of Delhi ." New Delhi, 2008-09.

Godbole, Madhav. "Power Sector Reforms: If Wishes Were Horses." *Economic and Political Weekly*, Feb. 16-22, 2002: 621-626.

John Vickers, George Yarrow, Jean-Charles Rochet, Anthony Venables. "The British Electricity Experiment." *Economic Policy*, April 1991: 187-232.

Kale, Sunila S. "Current Reforms: The Politics of Policy Change in India's Electricity Sector." *Pacific Affairs*, Fall 2004: 467-491.

Kristin Komives, Vivien Foster, Jonathan Halpern and Quentin Wodon. *Water, Electricity and the Poor: Who Benefits from Utility Subsidies.* World Bank, 2005.

Limited, Delhi Transco. "Annual Report." New Delhi, 2007-08.

Navroz K Dubhash, Sudhir Chella Rajan. "Power Politics : Process of Power Sector Reform in India." *Economic and Political Weekly*, September 1, 2001: 3367 to 3390.

NRPC. *Annual Report.* NRPC, 2007-08.

Reddy, Amulya K. N. "California Energy Crisis and Its Lessons for Power Sector Reform in India." *Economic and Political Weekly*, May 5, 2001: 1533-1540.

Sant, Girish. "Power Sector: Regulation, Governance and role of Civil Society." *Prayas, Energy Group.* Chennai: Prayas. Powerpoint presentation.

Upadhyay, Anil K. "Power Sector Reforms: Indian Experience and Global Trends." *Economic and Political Weekly*, Mar. 18-24, 2000: 1023-1028.

10. Annexure

10.1 Map showing respective areas of operation of Discoms.

10.2 Tariff Structure

	Category	Fixed/Demand Charges [1]	Energy Charges (Apr-Sept)	Energy Charges (Oct-Mar)
1	**Domestic**			
1.1	**JJ Clusters**	175 Rs/month		
1.2	**Domestic Lighting/ Fan and Power**			
	Upto 2 kW Load			
	0-200 units	24 Rs/month	245 P/kWh	
	201-400 units	24 Rs/month	395 P/kWh	
	Above 400units	24 Rs/month	465 P/kWh	
	2 to 5 kW Load			
	0-200 units	60 Rs/month	245 P/kWh	
	201-400 units	60 Rs/month	395 P/kWh	
	Above 400units	60 Rs/month	465 P/kWh	
	Above 5 kW Load			
	0-200 units	12 Rs/kW/month	245 P/kWh	
	201-400 units	12 Rs/kW/month	395 P/kWh	
	Above 400units	12 Rs/kW/month	465 P/kWh	
1.3	**Domestic Lighting/Fan and Power on 11kV single delivery point for CGHS and other similar group housing complexes** [2]			
	First 44.4%	12 Rs/kW/month	245 P/kWh	
	Next 44.4%	12 Rs/kW/month	395 P/kWh	
	Next 11.2%	12 Rs/kW/month	465 P/kWh	
1.4	**Domestic Lighting/ Fan and Power Connections in Left Out Pockets and Villages, both Electrified and Un-electrified for plot sizes**			
	Upto 50 sq yards	264 Rs/month		
	Between 51-100 sq yards	384 Rs/month		
	Between 101-150 sq yards	504 Rs/month		
	Between 151-200 sq yards	699 Rs/month		
	More than 200 sq yds. only through installation of meters by licensee	As applicable for relevant category	As applicable for relevant category	As applicable for relevant category
2	**Non-Domestic**			
2.1.1	**Non-Domestic (Low Tension): NDLT-I**			
	Up to 10 kW	50 Rs/kW/month	540 P/kWh	
	> 10 kW to 100 kW	50 Rs/kW/month	492 P/kVAh	
2.1.2	**Non-Domestic Light/ Power on 11 kV Single Delivery Point for Commercial Complexes-NDLT-II**	50 Rs/kW/month	492 P/kVAh [3]	
2.2	**Mixed Load (High tension) >100 kW – MLHT**			
	Supply on 33 kV and above	150 Rs/kVA/month	495 P/kVAh [4]	

10.3 Anticipated Power Supply Position of Delhi upto 2020-21

(AS ON 12-03-2009)

All Figures are in MW & at Delhi Periphery

NAME OF THE SOURCE	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Availability of Power														
I.P., RPH & G.T.	450	450	350	350	350	350	350	350	350	350	350	350	350	350
Pragati	300	300	300	300	300	300	300	300	300	300	300	300	300	300
BTPS	630	630	630	380	380	380	380	380	380	380	380	380	380	380
Availability within Delhi (1)+(2)+(3)	1380	1380	1280	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030
Basic Allocation from existing Central Sector Generating Stations	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013
Expected allocation from Unallocated quota of Central Sector Generating Stns	240	240	0	0	0	0	0	0	0	0	0	0	0	0
Total A.2	2253	2253	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013
Upcoming Projects Within Delhi														
NDPL Gas Based Rithala Project	0	108	108	108	108	108	108	108	108	108	108	108	108	109
Pragati Phase-II (Bawana Project)	0	0	987	987	987	987	987	987	987	987	987	987	987	987
Pragati Phase-III (Bamnauli Project)	0	0	0	0	715	715	715	715	715	715	715	715	715	716
Total (A.3)	0	108	1095	1095	1810	1810	1810	1810	1810	1810	1810	1810	1810	1812
Upcoming Projects outside Delhi & BTPS														
Kahalgaon Stage-II (NTPC)	81	81	81	81	81	81	81	81	81	81	81	81	81	81
Damodar Valley project (DVC)	92	736	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
RAPP V & VI	55	55	55	55	50	50	50	50	50	50	50	50	50	50
Sewa – II HEP (NHPC)	0	10	10	10	10	10	10	10	10	10	10	10	10	10
Dadri (Th.) Stage -II Unit- I & II (NTPC)	0	380	760	760	760	760	760	760	760	760	760	760	760	760
Koteshwar (SJVNL)	0	0	29	29	38	38	38	38	38	38	38	38	38	38
Aravali Project in Haryana	0	0	650	650	650	650	650	650	650	650	650	650	650	650
Parbati HEP-III	0	0	42	42	42	42	42	42	42	42	42	42	42	42
Uri – II	0	0	19	19	19	19	19	19	19	19	19	19	19	19
Chamera - III (NHPC)	0	0	37	37	37	37	37	37	37	37	37	37	37	37
Koldam HEP (NTPC)	0	0	0	75	75	75	75	75	75	75	75	75	75	75
Barh (NTPC)	0	0	0	132	132	132	132	132	132	132	132	132	132	132
Parbati HEP-II	0	0	0	0	65	65	65	65	65	65	65	65	65	65
North Karanpura (NTPC)	0	0	0	128	128	128	128	128	128	128	128	128	128	128
Rampur HEP	0	0	0	43	570	570	570	570	570	570	570	570	570	570
Sasan Ultra Mega project	0	0	0	121	121	370	370	370	370	370	370	370	370	370
DISCOM Arrangement from Maithon Power Project (DVC) **	0	0	0	284	276	276	276	276	276	276	276	276	276	276
Tehri Pump Storage (THDC)	0	0	0	0	43	43	43	43	43	43	43	43	43	43
Jharkhand Ultra Mega project (Tilaiya)	0	0	0	0	0	125	125	125	125	125	125	125	125	125
Sub-Total of A.4	**228**	**1262**	**3983**	**4767**	**5397**	**5771**	**5771**	**5771**	**5771**	**5771**	**5771**	**5771**	**5771**	**5771**
Total availability (A.1)+(A.2)+(A.3)+(A.4)	3861	5003	8371	8905	10250	10624	10624	10624	10624	10624	10624	10624	10624	10626

Total Availability at 90% of A.5	**3475**	**4503**	**7534**	**8014**	**9225**	**9562**	**9562**	**9562**	**9562**	**9562**	**9562**	**9562**	**9562**	**9563**
Demand of Delhi (Year wise estimations upto 2011-12 and considering a growth factor of 7.46% for the period 2012-13 to 2017-18 and 6.69% thereafter as per the 17th EPS Report of CEA)	4877	5253	5657	6092	6546	7035	7560	8124	8730	9315	9938	10603	11312	12069
Availability through Bi-lateral arrangements from different sources such as HP, MP, WBSEB, Orrisa, etc.	1450	750	0	0	0	0	0	0	0	0	400	1050	1800	2550
Total Availibility with Bilaterals (A.6) + (A.8)	4925	5253	7534	8014	9225	9562	9562	9562	9562	9562	9962	10612	11362	12113
Shortfall (-) / Surplus (+) with Bilaterals (A.9) - (A.7)	48	0	1877	1922	2679	2527	2002	1438	832	247	23	9	49	44