POWER SECTOR REFORMS IN HARYANA: PERFORMANCE AND ITS IMPACT

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DECLARATION

I do hereby declare that the dissertation titled **"POWER SECTOR REFORMS IN HARYANA: PERFORMANCE AND ITS IMPACT"** submitted by me is a bonafide work and it has not been submitted to any other university for the award of any other degree.

(Gaurav Arya)

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Dedicated to my loving Parents

My

MAA...and PAPA...

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Abbreviations and Acronyms

ACs	Average Costs
AEGCL	Assam Electricity Generation Corporation Limited
AP	Andhra Pradesh
APDRP	Accelerated Power Development and Reform Programme
APERC	Andhra Pradesh Electricity Regulatory Commission
APGCL	Assam Power Generation Corporation Limited
APGENCO	Andhra Pradesh Generation Corporation
APSEB	Andhra Pradesh State Electricity Board
APTRANSCO	Andhra Pradesh Transmission Corporation
ARs	Average Revenues
AT&C Losses	Aggregate Technical and Commercial Losses
CAGR	Compound Annual Growth Rate
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CI	Concentration Index
CPU	Central Processing Unit
CTU	Central Transmission Unit
CV	Coefficient of Variation
DHBVNL	Dakhin Haryana Bijli Vitran Nigam Limited
DISCOMs	Distribution Companies
DPC	Dhabol Power Corporation
EHT	Extra High Tension

E & A Cost	Establishment and Administrative Cost
ERC	Electricity Regulatory Commission
ESI	Electricity Supply Industry
GENCO	Generation Corporation
GOI	Government of India
HMCE	Household Monthly Consumption Expenditure
HPGCL	Haryana Power Generation Corporation Limited
HR	Haryana
HSEB	Haryana State Electricity Board
HVPNL	Haryana VIdyut Prasarn Nigam Limited
HT	High Tension
IC	Installed Capacity
IPP	Independent Power Producers
KERC	Karnataka Electricity Regulatory Commission
KPCL	Karnataka Power Corporation Limited
KT	Karnataka
KV	Kilo Volt
KWh	Kilowatt Hour
LV	Low Voltage
LT	Low Tension
MkWh	Mega Kilowatt Hour
MSEB	Maharashtra State Electricity Board
MoP	Ministry of Power

MP	Madhya Pradesh
MU	Million Units
MV	Medium Voltage
MW	Mega Watt
NHPC	National Hydro Power Corporation
NSSO	National Sample Survey Organisation
NTPC	National Thermal Power Corporation
OERC	Orissa Electricity Regulatory Commission
OHPC	Orissa Hydro Power Corporation
O & M Cost	Operation and Maintenance Cost
OPTCL	Orissa Power Transmission Corporation Limited
OR	Orissa
OSEB	Orissa State Electricity Board
PLF	Plant Load Factor
PPA	Purchasing Power Agreement
RJ	Rajasthan
SEB	State Electricity Board
SERC	State Electricity Regulatory Commission
SLDC	State Load Dispatch Corporation
STU	State Transmission Unit
TRANSCO	Transmission Company
T & D Losses	Transmission and Distribution Losses
UHBVNL	Uttar Haryana Bijli Vitran Nigam Limited

UP	Uttar Pradesh
UPERC	Uttar Pradesh Electricity Regulatory Commission
UPJVNL	Uttar Pradesh Jal Vidyut Nigam Limited
UPPCL	Uttar Pradesh Power Corporation Limited
UPRVUNL	Uttar Pradesh Rajya Vidyut Nigam Limited

Chapter -I

INTRODUCTION

CHAPTER-1
INTRODUCTION

1.1 Introduction

Power is an important factor for the economic and social development of an economy. As India is a fast growing economy, the significance of power sector can hardly be negated. It is the main source of industrial and agricultural production. In other words, all the industrial and agricultural activities depend on power. Availability of appropriate quantity and quality of power at reasonable prices can contribute to increase productivity, growth in existing economic activities and consequently provide greater economic opportunities to people. Development of different sectors of economy is not possible without matching development of the electricity sector. In fact it has become essential ingredient for improving the quality of life and its absence is usually associated with poverty and poor quality of life. Though the Indian power sector has achieved substantial growth during the post-independence era, the sector has been ailing from serious functional problems during the past few decades.

Publicly owned power sector in developing countries are going through the reforms as part of Structural Adjustment Programme to correct the near financial bankruptcy and inefficient operation. Reforms in power sector, more objectively, involve the disintegration of various segments involved in delivering power to the final consumer along with introduction of independent regulation of the sector often followed by privatization. These steps are basically followed for achieving efficiency and reducing the financial burden of the state.

India's power sector faces huge financial losses as well as highly inefficient physical operations (Kannan and Pillai 2002, and Jha, Murthy and Sahni 1992). State electricity Boards (SEBs), the main body responsible for providing power in each state of India, is laden with organizational frictions and rigidities. These rigidities have left enough incentive for the employees of the SEBs to be inefficient (Ruet, 20001). Many are of view that political intervention even at executive level, often through informal means,

reduced accountability of system to vanishing point at various levels of the organization.

In order to rectify the situation, India launched its policy of electricity reforms in 1990 with a view to overcoming huge shortage in the availability of power and to improve the financial health of the utilities, which caused great drain to the state resources. Initially the reform meant for foreign and private capital participation in the generation segment of the industry through various high powered incentives to overcome shortages. But soon it was realized that inviting capital in this sector was not easy even with high-powered incentives until significant and meaningful reforms were undertaken (Moriss 2000, Kannan and Pillai 2002, Ruet 2001). For one group, mainly comprising policy makers and donor bodies, basic reform meant unbundling, corporatization followed by privatization and instituting independent regulatory commissions at provincial level. The other, on the basis of international experiences, argued that inefficiency in the sector might not be the result of ownership (government) or structure (vertically integrated monopoly) but arrays of perverse incentives, lack of accountability and non-enforceability of legislation (Phadke and Rajan 2003, Godbole 2003). Thus they advocated for incentive structures by changing the rules through effective regulation rather than the structure of the industry to avoid conflict of public and private interest (Phadke and Rajan 2003).

In the pre-reform period, India's electricity-supply industry was mainly owned and operated by the public sector. The power sector was totally state owned and suffered from problems like low efficiency, shortages (imbalance between demand and supply of power), enormous T & D losses, pervasive theft and many more other major drawbacks. It resulted in huge transaction cost for the economy. India's power sector, henceforth, was opened with much fanfare for the private sector in early nineties. The power sector reforms were to accelerate the generating capacity and to improve the system efficiency as well. The first reform phase began in 1991 with the introduction of Independent Power Producers (IPP) paradigm. Taking clue from industrialized nations like UK and USA and developing countries such as, Argentina, Chile, Brazil, Philippines and Pakistan, the Indian government commenced the restructuring of the Indian power sector. The reform process started with the unbundling, corporatization and privatization of

Orissa power utility. Orissa was the first state in India to implement the power sector reforms. After this initial reform process, a comprehensive Electricity Bill was drafted in 2000 following a wide consultative process. Further to a number of amendments, the bill finally sailed through the legislative process and was enacted on 10 June, 2003. It replaces the three existing legislations governing the power sector, namely Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948 and the Electricity Regulatory Commissions Act, 1998.

According to this Electricity Act (2003), the SEBs are to be restructured into separate generation, transmission and distribution entities with formation of autonomous regulatory commissions that shall be entrusted with the task of regulation of tariffs and issue of licenses. Regulatory function was taken away from the purview of the government. The Electricity Act, 2003 mandates license-free thermal generation, non-discriminatory open access of the transmission system and gradual implementation of open access in the distribution system which will pave the way for creation of power market in India.

1.2 Background

The power sector in India for long was provisioned by respective provincial governments but the policy guidelines were mostly retained by the central government. With continued worsening of the SEBs, Central government on the advice of the World Bank, created a central generation utility, the National Thermal Power Corporation (NTPC) in 1975. Over the years, NTPC has emerged as one of the efficient power utilities in the world. But the state of the SEBs did not improve. The NTPC grew out of transfers of generating plants from the SEB's and new capacity additions. SEB's also came under the waves of the overall economic reforms, initiated in early 1990s. Investment and consumption subsidies for the SEBs became the first victim of fiscal disciplining programme, as these were the major heads of fiscal expenditure. In addition, power shortage in India was a grave concern in early 1990s, when this policy was adopted. It was anticipated that inflow of private capital into this sector would help the government to spend more resources on other crucial sectors such as health and education, which have more progressive effect on

reduction of poverty and deprivation.

To accommodate private capital, generation sector was liberalized. The Independent Power Producers (IPP) could establish their own plants with 100 percent foreign capital and sell the power to the SEBs through power purchase agreements (PPA). This was more like a bilateral monopoly bargain. But to avoid the delays in bargain and induce the investors, basic incentives of the contract were spelt out by the central government, which had to be followed by the SEBs. One of the first and most controversial PPA signed was between the Maharashtra State Electricity Board (MSEB) and the Dhabol Power Corporation (DPC), an Indian subsidiary of a US based multinational energy major, Enron. This PPA turned out to be a major failure as the MSEB started incurring losses just because of the power purchase bills it received from the DPC. Along with it, other PPA also had similar effects on the other SEBs. As a result, it was realized that power sector requires comprehensive reforms. The major thrust of the reform was now towards making distribution sector more efficient. This became the concern of the policy makers because various weaknesses in the distribution sector posed threat to the financial viability of the SEBs. Lack of response by private sector to the generation sector was attributed to the state of the SEBs. It was thought that SEBs would not be able to pay the power purchase bills of IPPs. Therefore the steering of the power sector reform got diverted to the distribution segment of the ESI (Electricity Supply Industry). The SEBs in general faced the problem of high transmission and distribution losses, low collection efficiency, pervasive theft, and lack of employee motivation, political intervention to keep the prices low for political mileage and to continue the supply even after the default of payment of electricity bills.

Haryana was the second state in India to undertake power sector reforms. With the introduction of the reform in Haryana, the usual European and Latin American style unbundling started. The vertical segments of the ESI were separated in different companies and the operation of the ESI was to take place through a contractual obligation. Three different segments of power sector are:

- Generation
- Transmission
- Distribution and supply

This whole process of disintegration is often termed as unbundling also. This is one of the landmark changes in the history of the power sector organization and co-ordination. This reform was carried out based on the success of the UK model. One of the advantages of such model is that after unbundling, it becomes possible to introduce competition in the potentially competitive businesses like generation and supply. But on the other hand, it adds to cost also (Joskow 2002), i.e., the increased transaction cost of the contractual obligation required now was non-existent when the whole ESI was under an integrated monopolist.

1.3 Review of Literature

The Electricity Reforms in 1990s and Electricity Act, 2003 are the landmark developments in the history of electricity policy in India. These policy changes have altered the organization and governance in the sector. The erstwhile SEBs has undergone visible changes, with an independent regulator given the broad powers to issue licenses and set tariffs. Though, the structure and the regulatory framework of the electricity sector has been dealt with extensively in the literature, the study related to the impact of the reform process are relatively few. The present study tries to fill the void through an empirical analysis of performance of Haryana Power sector after the reforms and the impact of reforms broadly on household consumers in Haryana. In this section, we provide a brief review of the studies undertaken in the context of power sector.

a) Regulation and Restructuring of the Power Sector

Effective Regulation of any entity is necessary for both investor's confidence and consumer's protection. The primary purpose of a well-designed regulatory system is to protect consumers from monopoly abuse, while providing investors with protection from arbitrary political action and incentives to promote efficient operation and investment (Laffont and Tirole 1993). The main reason of regulating the public utilities is to make them cost effective (H. Demsetz, 1968).

In context of power sector a good regulation can benefit the public interest in matters of technical, economic, social and environmental complexity. But the quality of decisions

taken will always depend on the quality of decision makers and on the extent of public awareness and active participation of public. Key factors in formulating a regulatory framework in India that will serve the country's long-term interest are; (1) the establishment of a system of public hearing and information-sharing before contracts are signed; (2) institutionalized mechanisms to safeguard the public and environmental interest; (3) a personnel selection process that ensures a diversity of views and attracts personal trained in policy analysis options; and (4) a commitment to capacity-building that will enable public interest organization, who can represent environmental and small consumer concerns, to participate fully and actively with the other interests in society to help India move toward a sustainable energy future (Byrne John and Chandrasekhar Govindrajalu, 1997).

In case of Britain the principles of private ownership, competitive markets and independent regulation have worked well and the British electricity industry has become more efficient and innovative. Electricity industry's environmental record has improved. But in some respects the circumstances of each developing country are different from Britain and from each other infect. The same principles of public policy, therefore, will not be applicable in every country. However, this problem can be overcome by appropriate modifications in the circumstances of each case, then similar policy mix of privatization, competition and independent regulation can be adopted in developing countries also (World Bank, 2000).

According to Sarma E A S, 2007[1], the effective regulation is most mandatory for the efficient reform process of power sector. In India during the 1980's increasing political interference in tariff setting eroded the financial health of the public sector utilities. So the crucial requirement for good regulation is the independence of the regulator from political interference and regulatory laws itself needs to be constantly reviewed and adapted to safeguard the interests of the consumers.

Regulation of power sector is contingent on the effective restructuring of the sector.

[1] Sarma E A S (2007), "Regulating Electricity in India" *Economic and Political Weekly*, Reviews, pp. 3375-3377

Lessons learned from the global reforms in the power sector are a ready reckoned to us. Accordingly, the government is not to play hands off approach, but has to function as a policy maker for the effective regulation of the power sector. Unbundling of power industry is a three pronged strategy; separate generation, transmission and distribution units. A regulatory commission that shall regulate a wholesale electricity market with more transparency, tariff revision and qualitative supply is to be formed at both national and state levels (Baijal Pradip, 1999).

The funding and methodology for the reform of power sectors were suggested by the World Bank. Restructuring of power sector was based on the four models given by the World Bank which can be implemented according to the situation and parameters of a particular country. The four models[2] are as follows:

Model 1. (Monopoly) This is an integrated monopoly with no competing generating or distribution companies in an area. Customers buy from the monopoly company.
Model 2. (Purchasing agency) allows a single buyer or purchasing agency to encourage competition between generators by choosing its sources of electricity from a number of different electricity producers. The agency on-sells electricity to distribution companies and large power users without competition from other suppliers.
Model 3. (Wholesale competition) allows distribution companies to purchase electricity directly from generators they choose, transmit this electricity under open access arrangements over the transmission system to their service area, and deliver it over their local grids to their customers, which brings competition into the wholesale supply market but not the retail power market.
Model 4. (Retail competition) allows all customers to choose their electricity supplier, which implies full retail competition, under open access for suppliers to the transmission and distribution systems.

Mostly countries including India adopted the second model which was the single buyer model for restructuring the industry. It was thought very comfortable in prospective of

[2] World Bank (1995), "*Power Sector Reform in Developing Countries and the Role of the World Bank*", Industry and Energy Department, World Bank, Occasional Paper No. 9

developing countries but it has many short comings. The single buyer model has many major disadvantages, particularly in countries with weak government and low payment discipline:

First, the single buyer model responds poorly when electricity demand falls short of projections. Under single buyer model, however, wholesale electricity prices rise because take-or-pay quotas must be spread over a shrinking volume of electricity purchases. When these high prices cannot be passed on to final consumers, taxpayers must bear the losses.

Second, the single buyer model hampers the development of cross-border electricity trade by leaving it to the single buyer, a state-owned company without a strong profit motive.

Third, the single-buyer model weakens the incentives for distributers to collect payments from customers.

Fourth, the single buyer model makes it so easy for government to intervene in the dispatch of generators and the allocation of cash proceeds among them that few are able to resist the temptation.

Lastly, the single buyer model increases the likelihood that, under pressure from vested interests, governments will indefinitely delay the next step toward fully liberalized electricity markets (World Bank, 2000).

In India the process of involvement of private sector in the power sector is working on since the 1990's just after the economic reforms but no benefits can be achieved without the effective restructuring of the sector. There are many unresolved issues which cannot be fulfilled by just involvement of private sector participation, so there is need of effective regulation and restructuring of power sector before involving private sector investment (Madhav Godbole, 1998).

According to Srivastava A. and M. Shahidehpour[3], restructuring process for Indian power sector in India should be done in three phases. In first phase, the Indian government should establish an appropriate background needed for restructuring, which involves

[3] Srivastava A., M. Shahidehpour (2002), "Restructuring Choices for the Indian Power Sector", *IEEE Power Engineering Review*

bridging the gap between power demand and generation decentralizing the planning process, increasing the number of transmission lines, and increasing the tariffs gradually. In second phase, the direct government control should be reduced, SEBs should be unbundled, and an independent regulator should be established. In the third phase, the privatization and commercialization of newly formed entities should be considered, and a free electricity market should be established. These suggested steps for restructuring are to be implemented in a time bound manner. Studies say that, India should implement the reform process in power sector keeping in mind experience from the successful reforms in other countries and from domestic market (Dubash Navroz k, Daljit Singh, 2005).

b) Power Sector Reforms in India- Lessons learned from the international and domestic experiences

The power sector reforms, though, have been considered to have started in 1990s, but had already been started way back in Chile in 1970s. The power sector reforms in Chile took place in three stages from new legislation to privatization and gave three lessons that competition to the whole sale market in generation and distribution, investment in generation capacity left to market forces and incentive regulator service to provide market distributer. Thereafter, in 1990s, reforms were initiated in Britain, U.S., Eastern Europe, Middle East and other developed and developing countries. India was also pioneer state who reformed its power sector in mid of 1990's (John E. Besant-Jones, 2004).

California was the state where this reform process failed and many lessons could be learnt. The major lessons from the crisis are (Amulya K N Reddy):

1. A careful comparison of the costs and benefits of the old regulated system and the new regulated system is essential before dismantling the old and ushering in the new.
2. If it is decided to replace a cost-plus price regime with market-driven prices, then it must be realized that only a market is not sufficient.
3. The case for unbundling the power sector must not be made merely on economic grounds; the restructuring must also be justified convincing on technical grounds.

4. The affordability of retail electricity prices to consumers is necessary condition for the success of restructuring, but it is not sufficient condition.
5. The unique character of electricity is such that a strong role for the state and for regulation is essential.
6. Compared to increasing capacity by building new power plants, energy conservation measures provide the quick way out of the crisis.
7. It is unwise to go ahead with restructuring/reform without specifying the criteria by which the success/failure of restructuring/reform process will be judged.

According to Paul Joskow[4], 2008, structural, regulatory and market reforms have been applied to electricity sectors in many countries around the world. There have been observed a significance performance improvement in some countries due to the reforms process, especially in countries where the performance of state-owned monopolies were poor. Privatization combined with performance based regulation (PBR) mechanisms to regulated distribution companies has generally yielded significant cost reductions without reducing service quality. Wholesale markets have also stimulated improved performance from existing generators and helped to mobilize significant investments in new generating capacity in several countries. But the California electricity crisis, electricity crisis in Brazil, Chile, Ontario, increase in wholesale electricity prices driven by unexpected increase in natural gas prices and the price of CO2 emissions permits, have made electricity reforms more cautious.

Taking clues from the international experiences power sector reforms in India initiated in 1990's because the power sector was facing with a lot of physical and financial problems like T&D losses were very high, excess political influence, low PLF, high commercial losses and many other bottlenecks. Orissa was the first state who reformed its power industry then the second one was Haryana and after that a series of reforms got started in Indian states. With enactment of reform act, central and state regulatory commission set up to take care of the reform process at central as well as state level (Harbans L. Bajaj

[4] Joskow Paul (2008), "Lessons Learned from Electricity Market Liberalisation", *The Energy Journal*, IAEE

and Deepak Sharma, 2007).

As Orissa was the first state in India and also in South Asia to implement a comprehensive power sector reform program. Lesson learned from Orissa is that, the restructuring depends mainly on three factors (1) contextual factors, (2) trigger factors and (3) facilitating factors. Contextual factors are those that form primary drivers for initiating reform such as poor performance of the utility, conditionality's of lending agencies. Trigger factors are those which create a compelling necessity to undergo restructuring for example the inability of the government to continue to financially support the utility. Facilitating factors are those factors, which act as a catalyst and create a favorable environment for implementation of reform (A. Thillai Rajan, 2000).

Many states got their power sector reformed and unbundled after the enactment of 1990's reform act. Tamil Nadu was one of the states who reformed because power sector in Tamil Nadu was inefficient at the generation and distribution stages with low plant load factors and high transmission and distribution losses. So the reform targeted to make the provision of electric power in the state profitable without tariff reform. The primary advantage of this method is that by deregulating to open competition, the industry functions at much higher levels of efficiency (Nakul Correa, 1999).

In Andhra Pradesh the condition was different before the reform process. Andhra Pradesh was the only state in 1970-90 which was in very profitable condition but the period of 1990-96 against the profitability, generation capacity was deteriorating, tariffs were not revised and the gap between revenue collection and revenue required suddenly widened and Andhra Pradesh State Electricity Board (APSEB) started incurring losses. During 1991-96 the consumption pattern also changed further in 'favour' of the subsidized sectors like agriculture and domestic, while the share of subsidized industries was on decline. So the reform was the essential need for power sector industry of Andhra Pradesh, and as expected after the reform process the condition of Andhra Pradesh power industry again started improving (T.L. Sankar, 2003).

Many attempts have been made to measure the physical and financial performance of the

power sector considering the significant aspects of inefficiency costs involved in SEB's functioning. In physical performance factors are included growth of installed capacity, growth of energy generation, and some technical performance indicators like- forced outage rate, load factor, T&D losses as percentage of electricity available and growth of energy sales. For measuring financial position cost structure of SEB's, customer category wise average tariff, average cost and revenue of SEB's have been taken (K P Kannan and N Vijayamohan Pillai, 2001)

Up to 2000 seven states got reformed their power sector namely, Orissa, Haryana, Andhra Pradesh, Uttar Pradesh, Karnataka, Rajasthan and Delhi, but the reform was not in right direction because it was neither perceived as people friendly nor was able to attract the much needed private capital in the power sector. Unlike the west where competition in generation and supply is the engine for efficiency gains tariff reduction, the Orissa model (single buyer model) relies on an interconnected chain of monopolies where competition is conspicuous by its absence (Haldea Gajendra, 2001).

As discussed earlier power sector reform in India was initiated mainly for removing physical and financial problems of the sector. The sector was suffering from huge T & D losses which are caused by high T&D network lines and electricity theft as electricity theft is one of the main drivers of high T&D losses. In India and for states like Punjab and Haryana the condition is very pathetic. The poor performance of Haryana is due to lack of supply and low resources availability, low cost recovery (due to political and domestic factors) was the drivers for reforming the state power utility. In Punjab excess political influence on tariff regime by providing free supply to agriculture added very high cost in power sector. But even then there exists a lot of power theft problem in Haryana and Punjab (Surinder Kumar, 2004).

The main reason of huge financial losses is low tariff recovery from domestic and agriculture sector. In India before reform process agricultural and domestic sectors were charged very low prices and cross subsidies were high due to economical and political reasons. So the main focus of reform was to reduce this cross subsidization. In the study

done by Ahluwalia Sanjeev[5] same policy prescription have given for four states Orissa, Maharashtra, and Andhra Pradesh and UP that objective of the reform process was to let down subsidy. But even after the reform provision of subsidy has not removed in case of agriculture.

The commercial losses were going high and low investment capacity of power sector were major influential factors to attract private sector in the power. But in the initial phase of reform participation of private sector was negligible and capacity addition was also nil to the power sector. Independent power producers (IIPs) were not efficient; SERC (state electricity regulatory commission) and central electricity regulatory commission were not cost effective as was expected. Reform focused mainly to attract private participants but current position of the sector seems that commercial losses were ignored (D'Sa Antonette, K V Narasimha Murthy and Amulya K N Reddy, 1999).

To improve further the condition of power sector and make it viable, competitive and customer friendly a new electricity act was enacted in 2003 namely 'Electricity Act, 2003' with the provision of an framework for unbundling and privatization on the one hand and introduction of wholesale competition, trading and bilateral contracts with regulatory oversight, on the other. The provisions of the Electricity Act, 2003 are intended to introduce competition in every link of the power supply chain in order to enhance efficiency and reduce costs. The act prohibits the Central and State Transmission Units from engaging in the business of trading in electricity. Further, the act mandates that CTU and STUs shall provide non-discriminatory open access to its transmission system for use by any licensee or generating company or any consumer subjects to payment of wheeling charge fixed by the concerned regulatory commissions and subject to certain conditions. The act can be a good instrument for efficient and consumer friendly if works beyond the political will (T.L. Sankar, 2004).

The act further provides windows of opportunity for independent power producers (IIPs), traders, large users and rural poor who were victims of poor quality supply because they

[5] Ahluwalia Sanjeev S. (2000), "Power Tariff Reform in India", *Economic and Political Weekly*, Vol. 35, No. 38, pp. 3407-3419

were also partly the recipients of subsidy for agricultural pumping. The act has ushered in competition by delicensing generation, by encouraging captive generation and by mandating open access. The act provides for both tracks of pricing namely, cost plus guaranteed return-based pricing as well as for competitive bids-based pricing in generation. But still there exists some issues of concern like the competitive bid route which are abused by the politicians in controlling the SEBs to promote high-cost bidders (V. Ranganathan, 2004).

But according to Anup Singh[6], 'The Electricity Act 2003' was enacted mainly to introduce open access in distribution sector, licensee free thermal generation and adoption of multiyear tariff principles. As main objective of the reform process was to enhance competition on guidelines of World Bank, but in India there is still need to improve financial position and requirement of new policy implications to attract private investment.

c) Impact of reform on different sections

The power sector reforms were took place both in developed and developing countries in 1990s with the aim of providing the qualitative and affordable supply of power to consumers. But in India the main purpose of introducing reform was to remove high physical and financial losses of state electricity boards, and removing the subsidies given to agricultural and domestic consumers. Many studies have done after the reforms in India focusing different aspects of the reform, some relevant studies related to my work have been taken here for measuring the impact of reforms.

The impact of power sector reform is positive on the many aspects at industrial level, generation side and at production level. Studies explain that reforms have not only led to the entry of private players in generation but have led to the emergence of various ownership structures, which were not present earlier. By reforms there is a shift in primary fuels used for generation from coal to gas. This changing fuel mix and technology have led to a more efficient generation in case of coal or gas plants. Due to

[6] Singh Anoop (2006), "Power Sector Reforms in India: current issues and prospects" *Energy policy*,

shifting of generation and increasing in efficiency of coal and the gas plants, but rapidly decreasing hydro generation has resulted in intensity of carbon emissions at an upward slop (P.R. Shukla, Debashish Biswas, Tirthankar Nag, Amee Yajnik, Thomas Heller and David G. Victor, 2004)

One of the objectives of power reform in India was to remove cross subsidies. But in Indian states, vested political interests impede utilities from collecting revenue. These political influences have a very high influence in on power sector. The prices of electricity determined by the political factors rather than economic or social factors. Politicians often interfere in the management of power utilities, hindering their efforts to curb power theft. As a result, in India T&D and financial losses were very high. The cross subsidization of agricultural and domestic consumers were on the high scale. So the reform process originated to curb cross subsidy, the domestic tariffs were increased after reform process but agricultural sector still holds a major part of subsidy (IEE, 2002).

According to V. Santhakumar[7], Kerala was the only state where the whole reform process was totally influenced and controlled by state politics rather than by World Bank or other international agency. The objectives for the initiation of the reform process were to increase power generation capacity in order to meet current and future demand, and to enhance efficiency of the Kerala State Electricity Board (KSEB) by retaining it in the public sector without involvement of private sector. Kerala was the only state in south India having lowest per capita consumption and in 1998 nearly 40 percent households did not have electricity connections. Domestic consumers were the main gainers of the subsidy provided by the board because agriculture and industry were consuming merely 15 percent and 30 percent of the power respectively. The whole subsidy was going to the domestic middle class but both bottom 10 percent and top 10 percent consumers in domestic sector were not getting any subsidy, means the power was subsidized mainly to non-poor. So it was the complete failure of reform process in Kerala.

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vol.34, no.16, pp.2480-2490

[7] Santhakumar V. (2003), "Impact of Distribution of Costs and Benefits of Non-Reform: Case Study of Power Sector Reforms in Kerala between 1996 and 2000, *Economic and Political Weekly*, Vol. 38, No. 2, pp. 147-154

Reforms have not much positive influence on demand and supply side of electricity; as the Orissa and Delhi were the only states where the reforms in distribution segments took place. Delhi reformed its power industry in 2003 and able to reduce a lot of problems of generation and distribution side with the involvement of private sector. 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. But in present time Delhi is facing the main problem of demand and supply mismatch due to growing demand of power in industries. So there is need of private players in the generation sector because the competition in distribution sector will raise the costs of distribution companies DISCOMs. AT&C losses have reduced but still they are at around 30 percent which is major constrained in growth of power supply and in self sufficiency of power (Paras Malhotra & Shivraj Singh Negi, 2009).

The power sector reforms took place both in developed and developing countries for providing accessible and affordable power to consumers. As countries of Africa and South Asia had very little accessibility due to lack of infrastructure. They had other bottlenecks also to provide affordable power to both rural and urban areas basically to poor; the reform was a right step in this direction. The impact of this reform is positive on many countries, the accessibility of electricity has increased but the affordable and qualitative power is still the biggest loophole. The subsidy which was thought to reduce after the reforms still contains a major part of overall funding. The cross subsidization is negatively affecting other section of consumers (John E. Beasant-Jones, 2004).

It was thought that after the energy sector reforms everybody even the poor will get the qualitative and affordable supply of power, but the reality came against the expectation. The demand for modern energy carriers such as electricity and petroleum fuels has increased and the willingness to pay for modern energy sources exists but problem is linked to reliable and qualitative supply. However, the ability to pay remains low, especially among the majority of the unserved households who are poor. Even after the reforms of energy sector rural poor are highly dependent on biomass. The users whose capacity to pay is low cannot afford to pay high prices for modern energy fuels to meet their minimum energy needs. The resultant effect of the ongoing energy sector reforms is

energy price rationalisation by phasing out subsidies and making the cost of energy fuels dearer. So it can be said that, the energy sector reforms were taken place only taking into account the financial aspect of the sector leaving behind the access and affordability of modern energy carriers in rural areas (Shrish Sinha, 2003).

In a study using data at micro level through NSSO data it was found that the monthly household income and household size have nonlinear relationship on the probability of choosing a fuel. Means after the reform process even in the urban areas the households have low capacity to purchase power and fuel supply is going dearer (M. Narsimha Rao, B. Sudhakara Reddy, 2007).

In Orissa according to the primary study of Goutam Kumar Kundu and Bidhu Bhushan Mishra[8] the involvement of private sector in power sector has benefited the power sector as a whole and consumers also got benefited. But the secondary data reveals that there is huge hike in the electricity prices in post reform period. According to author this could have been based on two reasons first is the government stopped providing subsidies and second whenever power sector is restructured, it initially incurred costs. The major achievement after the reforms is that since 2001, the tariff has remained unchanged despite the increase in fuel prices.

Present study considers all these factors and the study area has taken a particular state, Haryana which has also reformed its power sector on the footsteps of Orissa in 1998. The performance of the power sector of Haryana was very poor in terms of both physical and financial factors before reform process. The high losses both commercial and technical were major constrained before the government. Both political influences and inefficiency in the state electricity board were working behind these losses. The present study compares the physical and financial positions of Haryana power sector before and after the reforms process and measure the impact of reform process on household consumers using the micro level data of National Sample Survey Organization.

[8] Kundu Gautam Kumar and Bidhu Bhusan Mishra (2011), "Impact of reform and privatization on consumers: A case study of power sector reform in Orissa, India", *Energy Policy*, pp.3537-3549

1.4 Objectives:

(1) To study power sector reform model in India and Haryana in the light of domestic & international experiences.

(2) To compare the performance of the Haryana power sector before and after reform process.

(3) To analyze the socio-economic impact of the electricity reform on household consumers in Haryana.

(4) To make suggestions to improve the financial and technical performance of power sector.

1.5 Database and Methodology

Various secondary data sources have used for completion of this study:

Haryana State Electricity Board, Department of Economics and Statistical Analysis-Government of Haryana, Annual reports on working of state electricity boards and electricity departments-Planning Commission, Central Electricity Authority- Ministry of Power, Government of India, and Reports on the performance of state power utilities-ministry of power, Government of India. And 50^{th} and 61^{st} round of consumption expenditure survey of the National Sample Survey Organization (NSSO) conducted in 1993-94 and 2004-05.

For the above study different methodologies have used in completion of different objectives:

Objective 1 based on the theoretical aspect of different restructuring theories and experiences (domestic & international)

For analyzing and computing the performance of electricity industry simple mathematical tools and growth rates- annual & compound have used.

For measuring the impact of electricity on access to electricity and expenditure on electricity by households, we have divided the whole sample into quintiles based on their monthly total consumption expenditure (HMCE) in increasing order to have a measure of economic status of the households.

For measuring the inequality in access to electricity and affordability of electricity of consumers Concentration Index have used for access to and affordability of electricity respectively.

$$CI^{9} = \frac{2}{h} \sum_{n=1}^{N} p_n \, h_n \, Rn - 1$$

$$Rn = \sum_{i=0}^{n-1} p_i + p_n$$

$$h = \sum_{n=1}^{N} p_n \, hn$$

Where

h= average access to electricity of households

Pn= proportion of nth group population in total population

hn= access to electricity of household in nth group

Rn = relative rank of nth group where n= 1, 2, -------N

Value of Concentration Index lies between -1 and +1 or $-1 \leq CI \leq +1$

Same index have used for the affordability of electricity by the household consumers, (HMCE on electricity is taken as proxy for affordability)

[9] Kakwani Nanak, Adam Wagstaff, and Eddy van Doorslaer, (1997), "Socioeconomic inequalities in health: Measurement, computation, and statistical inference", *Journal of Econometrics*

1.6 Plan of the study

The study is divided in four core chapters. In order to develop a theoretical background for further analysis, chapter 2, explains the evolution of reform process in India and Haryana. Chapters 3 look into the lack-luster of techno-economic performance of Haryana power system in terms of the growth of the system variables, utilization trends and financial trends, in pre-reform and post reform periods. Fourth chapter assesses the impact of power sector reform on household consumers in terms of access to and affordability of electricity services according to their economic status. The last chapter concludes by enlisting major findings and with appropriate suggestions.

Chapter II

Power Sector Reforms in India: a Case study of Haryana

Chapter-2

Power Sector Reforms in India: a case study of Haryana

2.1 Introduction

Electricity is the most versatile form of energy. Its adequate supply is essential for the socio-economic development of any present day society. Electricity is a highly capital intensive product and the investment resource requirement to meet the growing electricity demand is far beyond from the means of developing countries. Multilateral institutions are lending to this sector has its own consequences. Large amounts of scarce capital resources have already been involved in the electricity supply industry. However, its financial performance has been highly unsatisfactory. Unless adequate international resources generation is ensured, the financial crises in the daily operations as well as the further expansion of electric power system cannot be resolved.

According to the Seventh Schedule of the India's Constitution, "Electricity" is a concurrent subject thereby implying that both the Parliament of India and the State Legislatures are empowered to make laws on the subject of "Electricity" - Sl. No. 38 of List-III -Concurrent List (Acharya). Thus, with Independence, the principle that both the Central Government and the States should be able to legislate on power was embodied in the constitution. Shortly after this, legislative authority was more formally divided in the Electricity Supply Act of 1948. The Act provided for the establishment of the Central Electricity Authority (CEA) and of State Electricity Boards (SEBs) which were to become the main agencies for supplying power throughout India. As the state electricity boards are the major agencies responsible for the generation, transmission and distribution of electricity in India. India's electricity supply industry (ESI) was facing numerous difficulties. Despite considerable investment and expansion of generating capacity, quality and reliability of electricity supply have deteriorated steadily.

In 1991-92 energy and capacity shortages were averaged from 9 to 18 percent of the estimated demand. India's ESI was not able to mobilise the resources required for its development. Almost all power utilities, particularly the State Electricity Boards (SEBs), were in financial distress. Commercial losses of SEBs had been increasing

around $ 1 billion per year and placed a heavy burden on the public budget (MoP, 1993). One of the main problems was that electricity had been priced below its costs, leading not only financial distress of SEBs but also to overblown demand, cross subsidies and higher generation requirement. Tariffs collected through SEBs were merely 50 to 60 per cent of long run marginal cost. The agriculture and domestic consumers were the main beneficiaries of this tariff policy. Given this fiscal situation, both central government and states acknowledged the need to raise power prices at economic and financial level.

As electricity is not a commercial commodity it is related to social benefit and development, so the price of it cannot be raised like other commodities. As according to Kahn, 1988 (chapter 3) "the user charges for basic amenities like water, power, transport, health and education are increasingly being made cost reflective which eats up greater proportion of income of the poor population, this kind of increased expenditure coupled with increasing necessity to have these services at any cost might put a significant number of erstwhile non-poor into the trap of poverty. Therefore strategy for pricing such services should be in harmony not only with economic philosophy (more specifically, marginal cost pricing) but also with prevailing social norm in which there is a re-distributive mechanism in favour of the poor section of the society. But the strict assumptions under which the marginal cost pricing yields efficient results are quite difficult for society to attain". There is need to integrate the value system prevailing in the society with economic principles to make such services financially viable that is to have an optimum combination between equity and efficiency.

To overcome the financial gap, India counted on a substantial increase in local and foreign private partition. The 1948 Electricity Act was amended in 1991, and with the introduction of the new economic policy in India since 1991, the power sector was the first public sector industry where reforms were attempted and are still in the progress. The central government also enacted the Electricity Regulatory Commission Act in 1998 to allow for setting up of the Central and State Electricity Regulatory Commissions that aimed at rationalizing the tariff structure, eliminating subsidies, and promoting private investment. As, regulation is a key factor in power sector reform,

regulatory reform needs to march in steps with sector restructuring and introduction of private sector participation.

This chapter is divided in four sections. Second section discuses evolution of power sector reforms in India and in Indian states. Third section explains the power sector reforms special reference to Haryana. And the fourth the last section concludes.

2.2 Power Sector Reforms in India

The primary reasons for electricity sector reform has however, been different for industrialized and developing countries (Joskow, 1998). The main driving force for electricity sector reform in developed countries has been to realize the efficiency gains in the generation and distribution segments that have been possible because of technological innovation. The main driving force in developing countries has been to attract private sector investment in the power sector. In countries such as India, the driving forces have been fiscal pressure, disenchantment with the performance of publicly owned utilities, and the need for new investments and modernisation. Because of these different primary reasons, the effect of reform is also different in developed and developing countries, at least in the short term. While developed countries have seen reduction in electricity tariffs, the tariffs have increased in developing countries following the reform, because of higher cost of private capital (Rajan A. Thillai, 2000).

Power sector reforms in developed countries started in 1990's but before the developed countries the reform process had already started in Latin America in 1970's by the Chile with the development of a new legislation that was introduced in 1982, and ended with the privatisation of major electricity firms between 1986 and 1989. In United States with the passage of the electricity policy act of 1992 electricity sector was opened to private sector to enhance efficiency, encourage technological innovation, and lower prices. British electricity supply industry was regulated in 1990; privatisation was primarily driven by more political motives, to "roll back the frontiers of the state" and to deliver cost improvements and hence politically attractive price reductions (John E. Beasant-Jones, 2004). By this time more than fifty countries reformed their power sector and taking clue from UK and the USA and developing countries like Argentina, Chile, Brazil, Philippines and Pakistan, the Indian

government also commenced the restructuring of the Indian power sector which commenced with the unbundling, corporatization and privatization of power sector.

2.2.1 Restructuring and Regulation of power sector in India

In many developing countries, and in particular those in Asia, the Middle East, and Africa, reform of the power sector starts from a market structure that is dominated by a state-owned national power utility with a legally endowed monopoly and a vertically integrated supply chain encompassing power generation, transmission, distribution, and customer services. The rationale for this structure is the minimization of the costs of coordination between these functions and of financing the development of power systems. Traditionally, the electric power industry has been divided along functional lines into three segments: generation, transmission and distribution. However these three functions were used to work under a single integrated company in many countries. Separating these segments into distinct commercial entities is called vertical unbundling. Horizontal unbundling, on the other hand, is breaking up a generation monopoly, and allows new entrants to power generation to compete for the custom of power distributors and users, but at the possible loss of some economies of scale. There are a lot of models of unbundling of power sector but only four models are recommended by the World Bank[1]. The four models are as follows:

Model 1. (Monopoly) this is an integrated monopoly with no competing generating or distribution companies in an area. Customers buy from the monopoly company.

Model 2. (Purchasing agency) allows a single buyer or purchasing agency to encourage competition between generators by choosing its sources of electricity from a number of different electricity producers. The agency on-sells electricity to distribution companies and large power users without competition from other suppliers.

Model 3. (Wholesale competition) allows distribution companies to purchase electricity directly from generators they choose, transmit this electricity under open access arrangements over the transmission system to their service area, and deliver it

[1]World Bank (1995), "*Power Sector Reform in Developing Countries and the Role of the World Bank*", Industry and Energy Department, World Bank, Occasional Paper No. 9

over their local grids to their customers, which brings competition into the wholesale supply market but not the retail power market.

Model 4. (Retail competition) allows all customers to choose their electricity supplier, which implies full retail competition, under open access for suppliers to the transmission and distribution systems.

According to World Bank, reform programs can be designed to progress through these models, starting from model 1 to model 2 or 3, and if possible then proceeding to model 4. Many developing countries choose model 2 or model 3. Model 2 (single buyer model) has been justified largely as a transition stage to model 3 needed to allow time for the generation and distribution sectors to develop sufficiently for the operation of a competitive wholesale electricity market. But, the main risk with the single buyer model is that government can still impose non-commercial practices on the market by manipulating the single buyer.

In India, during the late 1990s, several states embarked on reform programmes that mainly comprised of unbundling, independent regulation and privatisation beginning with the distribution assets[2]. States, which restructured their SEBs, have in general adopted a more or less similar model for the process, with a few modifications to suit their individual requirements. Orissa completed the entire restructuring exercise in one go and subsequently allowed private sector participation in the distribution segment. In other cases, initially, one or two Generating Companies (GENCOs) and a combined transmission and distribution companies were formed as successors to the SEB; and the former was, in the second stage, restructured into one transmission and two or more distribution companies. In yet a third model, the SEB itself was not dissolved, but was retained as a holding company to look after the residual and coordination functions, while forming one transmission and different distribution companies. The analysis leads to the conclusion that the second model, adopted by states like Andhra Pradesh, Haryana, Karnataka and Uttar Pradesh is more appropriate and practical, and is, therefore, recommended for adoption by the remaining states, which are mandated under the law to restructure their SEBs[3].

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[2] Government of India, (2002), "*Expert Committee on State-Specific Reforms, "Structuring of APDRP, Reform Framework and Principles of Financial Restructuring of SEBs*", Ministry of Power, New Delhi

[3] Government of India, (2006), *Study on "Impact of Restructuring of SEBs*", Ministry of Power, New Delhi

The main key of power sector reform was to set-up independent regulatory authority for the state that was going to reform its electricity supply industry. Independent regulation has been an integral feature of successful power sector reform across the world, so it was necessary to set-up a regulatory authority at central level and state level. With the enactment of the Electricity Regulatory Commissions Act, 1998, this provided for the setting up of the Central Electricity Regulatory Commission (CERC) and state level regulatory commissions (SERCs). This Act was primarily enacted to distance the government from determination and also to introduce professionalism in tariff determination through an independent agency. Central Electricity Regulatory Commission was formed on 26 April 1999 and State Electricity Regulatory Commissions (SERCs) have been set up in twenty five (25) states and are already functioning and have been notified in four (4) other states. Most of the states have initiated reform process and some have made substantial progress in restructuring of the power sector. Tariff orders have been issued by twenty (20) SERCs and thirteen (13) states have unbundled/corporatized and nine (9) are expected to follow suit shortly. The main functions of CERC include regulating tariffs of generating companies, owned or controlled by the government of India and any other generating company catering to more than one state, and also tariffs for the inter-state transmission of electricity[4].

2.2.2 Evolution of Power Sector Reforms in India

The first reform phase in India began in 1991 with the introduction of Independent Power Producers (IPP) paradigm. Government initiated reform process due to the following reasons: (i) the ever-widening gap between the demand and availability of electricity, (ii) the poor technical and financial performance of the state electricity boards and (iii) inability of the central and state governments to finance and mobilize resources for generation capacity expansion projects, making third party investment in power sector imperative. The initial step in this direction has been the amendment of legislation governing the electricity sector in 1991. The Indian Electricity Act, 1910 and the Electricity (Supply) Act, 1948 were amended to attract private investment in power generation.

[4] Harbans L. Bajaj and Deepak Sharma (2007), "Power Sector Reform in India", University of Technology, Sydney

Key features of the power sector reform policy introduced in 1991 were[5]:

- It allowed the private sector to "set up thermal projects, hydroelectric projects, and wind/solar energy projects of any size".
- It allowed the private sector to "supply and distribute energy in a specified area, (even without ownership of) a generating station";
- Foreign equity was permitted in generation companies;
- A post-tax return on equity of 16 per cent at a plant load factor (PLF) of 68.5 per cent is guaranteed, based on a two-part tariff formula, which covers both fixed and variable costs.
- Additional returns (of 10 to 12 percentage points) on equity allowed where the PLF exceeds 68.5 per cent.
- A private power generator can sell power to anyone with the permission of the concerned state government.

Considering all these recommendations of the latest amendment reform took place in Orissa in 1996 and in Haryana in 1998 under state legislation. Later on the GOI issued an ordinance which was later converted into an act in 1998 (The Electricity Regulatory Commission (ERC) Act, 1998), to enable the appointment of regulators at the national and state level. At the centre, a Central Electricity Regulatory Commission (CERC) was set up (on 24 July 1998) to deal with all state-level appeals and inter-state power flows.

In 2003 the central government introduced a new act, which stands to replace the existing three acts that governed the power sector. It replaced the 1910 Act, 1948 Act and Electricity Regulatory commission Act, 1998. The Electricity Act, 2003[67] mandates that regulatory commissions shall regulate tariff and issue of licenses and that state electricity boards (SEBs) will no longer exist in the existing form and will be restructured into separate generation, transmission and distribution entities. Regulatory function has been taken away from the purview of the government. The

[5] N. Vijaymohan Pillai (n.d.), "Power Sector Reform: Some Lessons for Kerala" Centre for Development Studies, Kerala

[6] Sankar T.L., (2004), "Electricity Act 2003: Dark Shadows over a Bright Vision", *Economic and Political Weekly*, Vol. 39, No. 8, pp. 839-844

[7] Ranganathan V., (2004), "Electricity Act- 2003: Moving to a Competitive Environment", *Economic and Political Weekly*, Vol. 39, No. 20, pp. 2001-2005

Electricity Act, 2003 mandates licensee-free thermal generation, non-discriminatory open access of the transmission system and gradual implementation of open access in the distribution system which will pave way for creation of power market in India.

2.2.3 Reforms in the Indian States

Orissa[8]

Orissa was the first state in the country to initiate reform in its electricity sector in a big way. The Orissa Electricity Reform Act came into force on 1 April 1996. The main objectives of power sector reform in Orissa were to restructure the electricity industry by bringing in improvements in generation, transmission, distribution and supply functions of electricity, increasing efficiency in economical an competitive manner, to improve the quality of service to consumer and to enhance operational efficiency and reduce losses.

Orissa Electricity Board (OSEB) was restructured and corporatized into Grid Corporation of Orissa (GRIDCO) and Orissa Hydro Power Corporation (OHPC) in April, 1996. Orissa Electricity Regulatory Corporation Commission (OERC) was established in 1996 and became functional from 1 August 1996. In November 1998, GRIDCO was transferred to four distribution companies namely, CESCO, NESCO, WESCO and SOUTHCO. Orissa Power Generation Corporation (OPGC) was privatised with disinvestment of 49 per cent stake and management control was transferred to private sector Company, in January 1999. In March, 2004, a new Public Limited Company Orissa Power Transmission Corporation Limited (OPTCL) was incorporated to carry on business of transmission; State Load Dispatch Centre (SLDC) functions of GRIDCO, and from April, 2005 OPTCL became functional.

As Orissa represents a 'single buyer model' in which all generating companies are required to sell their produce to a state owned transmission company. In the starting of the reform process the state was suffering from high AT&C losses and other technical problems like low metering, low quality of service, etc. But according to the World Bank, the financial position of the sector has improved after the reform process

[8] Rajan A. Thillai, (2000), "Power sector reform in Orissa: an ex-post analysis of the casual factors", *Energy Policy*, pp. 657-669

(World Bank, 2004). Same study done by the ministry of power concludes that AT&C losses have decreased around 18 percent for three distribution companies from 1999-00 to 2006-07 and, the three DISCOMs substantially have improved the cash collection vis-a-vis BST Bill from Rs. 760 crores in 1999-00 to 1.410 crores in 2004-05. There are improvements in technical performance also like, consumer metering which has installed over 6.5 lakh meters and quality of service has also improved.

So the overall reform process in Orissa has a positive impact on the power sector industry. But still there exist a lot of issues regarding the access to electricity and affordable supply of power to the poor and high T & D losses which exist more than 40 percent.

Haryana

Haryana was the second state after Orissa who reformed its power sector. Haryana Electricity Reforms Act, 1997 was enacted in August 1998. Power sector of Haryana was facing high physical and financial losses so the main objectives were to create financially viable electricity sector, creating an environment to attract private investment, promote competition and for providing over all development of the electricity sector in an efficient, economical and competitive manner.

HSEB was restructured into Haryana Power Generation Corporation Ltd (HPGCL) and Haryana Vidyut Prasaran Nigam Ltd (HVPNL). Subsequently, through the second transfer scheme (notified in July 1999), two distribution companies viz: (i) Uttar Haryana Bijli Vitran Nigam Ltd (UHBVNL) and (ii) Dakhshin Haryana Bijli Vitaran Nigam Ltd (DHBVNL) were incorporated by transferring distribution assets, liabilities and personnel of HVPNL to them.

Main purpose of reforming the power sector in Haryana was to reduce the high T&D losses which were around 32.39 percent in 1996-97 before the reform process but they still exists at a high level around 31.65 per cent in 2005-06. According to the report (State Power Sector Performance Rating) of Ministry of power, 2006, Haryana is in the category of the states having AT&C losses more than 50 percent. But, there is improvement in technical factors like increase in capacity addition from 863 MW in 1998 to 1,587.40 MW in 2008. Further there is improvement in plant availability and

plant load factor. But if the financial position and cross subsidy are considered than one can concludes that subsidy to agriculture sector has increased and financial position is going further down.

Andhra Pradesh

Restructuring of power sector in Andhra Pradesh started with the enactment of Andhra Pradesh Electricity Reform Act, 1998 and creation of Andhra Pradesh Power Generation Corporation (APGENCO) for generation function and Andhra Pradesh Transmission Corporation (APTRANSCO) for transmission and distribution from February, 1999. Four distribution companies (DISCOMs) were set up namely, EPDCL, NPDCL, CPDCL and SPDCL as subsidiaries of APTRANSCO.

Andhra Pradesh was most successful state of reform process. Andhra Pradesh Electricity Regulatory Commission (APERC) has played a key role in the successful implementation of power sector reforms in the state. The commission has not only come up with the regular tariff orders annually on time since 2000-01, but also notified several regulations, codes and guidelines for effective functioning of the utilities. The commission has facilitated improved performance of the utilities in both operational and customer-care matters[9]. According to report of ministry of power, there is a gradual reduction in the T&D losses on account of the regulatory control mechanism and the companies have started making profits since 2004-05. The performance gains of the power utilities have their impact on the retail tariffs, which have not increased in the last three years. In fact, there has been a reduction in the retail tariffs in respect of the subsidising categories of consumers (industrial and non-domestic commercial categories).

Uttar Pradesh

The Uttar Pradesh Electricity Regulatory Commission (UPERC) was established in September 1998 under the Electricity Regulatory Commissions Act, 1998 of the government of India, and Uttar Pradesh state electricity board was unbundled in January 2000 in to three corporations i.e. Uttar Pradesh Power Corporation Limited

[9] Raghu K., M. Thimma Reddy, N. Sree Kumar and D. Narasimha Reddy (n.d.), "Power Sector Reforms in Andhra Pradesh, India

(UPPCL), Uttar Pradesh Rajya Vidyut Nigam Limited (UPRVUNL) and Uttar Pradesh Jal Vidyut Nigam Limited (UPJVNL). The main objectives of the reform process in Uttar Pradesh were to 1) electricity to be supplied under the most efficient conditions in terms of cost and quality to support the economic development of the state, 2) to make power sector a net generator of financial resources and to protect the consumers interest. In August 2003, UPPCL was further divided into five successor companies, UPPCL was designated as the transmission company (TRANSCO) and the four distribution companies (DISCOMs). After this reform process the peak and energy deficit which were around 30 per cent and 15 percent further deteriorated to 32 percent and 20 percent respectively in 2003-04. There is some decrease in T & D losses but that is not much significant. Metering in the domestic sector has improved to 50 percent but still agriculture sector metering is negligible. So the power sector reform in Uttar Pradesh was not much significant from the very aspects of the reform process[10].

Karnataka

Power sector reforms in Karnataka began in 1997. But the actual restructuring took place in 1999-00. The objectives for restructuring were like improvement of the financial stability of the sector and increased customer satisfaction. The reform policy aimed to attract private sector investments, establishing a regulatory mechanism to promote competition, improved operational efficiency and cost reduction, and encourage energy conservation. With Karnataka Power Sector Reform Act, 1999 the Karnataka Electricity Regulatory Commission (KERC) was established with Karnataka Power Corporation Limited (KPCL). Government of Karnataka established four DISCOMs (BESCOM, HESCOM, and GESCOM & MESCOM) in June 2002. Subsequently, in 2004-05 one more distribution unit established, namely CESCOM, by carving out five districts from MESCOM, apparently based on political considerations. The reform process has some positive influence on the physical and financial performance of the sector. The installed capacity and gross generation has increased from 4386 MW and 19540 MW in 1999-00 to 6529 MW and 19822 MW in 2004-05 respectively. But this improvement is not much satisfactory. T & D losses have decreased from 37.31 percent in 1999-00 to 26.08 percent in 2004-05 but the

[10] Singh Dr. F.B. and Anita Kumari (n.d.), " Power Sector Reforms in Uttar Pradesh"

AT&C losses are still high at 35 percent in 2004-05. Karnataka was one of the states who are getting a good amount of subsidy in distribution of power due to political reasons. However, reform process was aimed to remove this subsidy regime but the subsidy to the sector is still very high and commercial losses without subsidy are around 1107 crores in 2004-05 compared to 975 crores in 1999-00. So the reform was not much successful in financial terms as hoped so.

Madhya Pradesh

Madhya Pradesh was one of the states, which had an efficient state electricity board (SEB). Madhya Pradesh has been ranked high amongst the SEBs, in terms of creating good generation capacity in the state sector, well-organised network of transmission and sub-transmission system and relatively low level of transmission and distribution losses among the SEBs. But the condition of the sector started deteriorated in 1998-99; huge gap increased between the demand and supply & increment of defaults in payment to Central Public Sector Undertakings (CPUs) and other supplies. So the Reform Act, "Madhya Pradesh Vidyut Sudhar Abhiniyam, 2000" was enacted on 20 February 2001, but in the meanwhile in November, 2000 the erstwhile state of Madhya Pradesh was bifurcated into two separate states, i.e., in Madhya Pradesh and Chhattisgarh and 33 percent of installed generating capacity was transferred to the state of Chhattisgarh. According to the reform act, in Madhya Pradesh one generation, one transmission and three distribution companies (DISCOMs) were incorporated in July 2002. The main objectives were to reduce the AT&C losses which were around 50 percent and remove other physical obstacles. The effect of the reform process was positive to some aspects the agricultural metering increased to 30 percent in 2004-05 from merely 1 percent in 1998-99. Plant load factor and plant availability have also increased. But the financial position is still pathetic the subsidy to agricultural consumers and unmetered supply is very high. Overall physical condition has improved but strong financial position still needs a long path to accomplish (MoP, 2006).

Assam

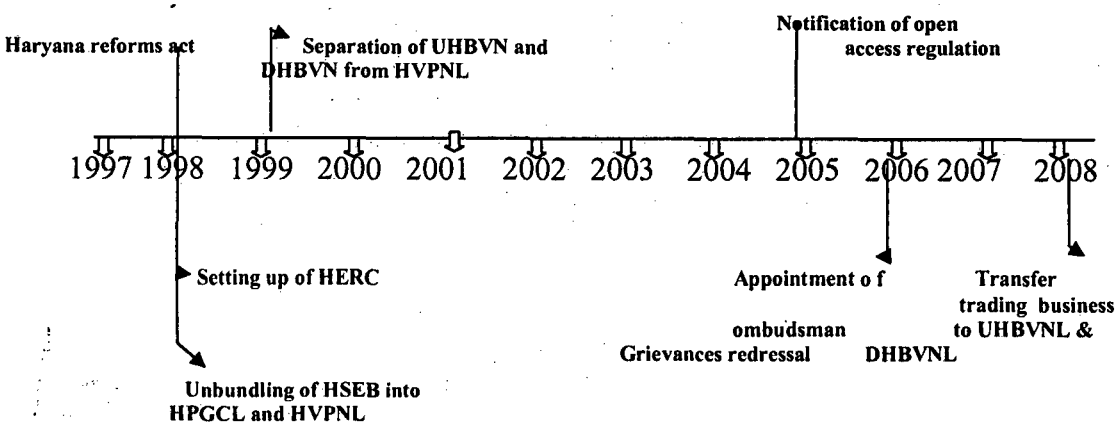
Assam State Electricity Board was restructured in September 2003 into five companies by separating the generation, transmission and distribution functions.

Assam was the first state, in which the electricity board was restructured after the enactment of the Electricity Act, 2003. Assam state electricity regulatory commission was unbundled into Assam Power Generation Corporation Limited (APGCL) for power generation, Assam Electricity Grid Corporation Limited (AEGCL) for transmission and three distribution companies Upper, Lower and Central Electricity Distribution Company Limited. The main objectives were 1) to supply adequate quantity of electricity, in an efficient manner and at a reasonable cost to all consumers in the state 2) to restore the financial viability of the power sector so that it is no longer a burden on the state exchequer and to provide a suitable environment in which private sector investment could be attracted in the power sector. The reform process has not any positive improvement on financial and physical position of the state power sector. Financial losses still capture a lot of revenue of the power industry and T & D losses are around 40-50 percent in 2004-05. So the reform process has not shown a good sign in Assam power industry till today.

2.2.4 Difference between power sector reforms opted in Haryana and in other states

The reform process which took place in India whether it as in Haryana or any other state opted the approximately similar model of restructuring. But Haryana not only contributed to the formulation of the Electricity Act in 2003 through its experience with power sector reforms but has also taken necessary action to conform GoI's dynamic policy changes. For instance, it has also specified the regulations for open access (to enhance competition), appointed an ombudsman (to address consumer grievances), and transferred the management of electricity trading from the generation company ("single buyer") to the two distribution companies ("multi-buyer") as given in figure 1.1. As one of the main objectives of reform process was to eliminate the cross-subsidisation of power through the increasing the tariffs for both the domestic as well as agricultural sector. The main change in Haryana compared to other states after the introduction of reforms was the elimination of the subsidies provided to domestic sector, other states are still subsidising their domestic sector through high cross subsidies. But the major concerns exist in Haryana is the highly subsidised agricultural sector; still have more than 60 percent unmetered supply of power.

Fig. 1.1 Timeline of Reforms in Haryana Power Sector[11]



2.3 Power Sector Reform in Haryana

Haryana is a traditionally agricultural and middle income state located in the northern part of India, with a population of 20 million. Haryana, along with neighbouring Punjab, contributed significantly to establishing India's food security during the green revolution in the 1960's. It was the first state to achieve to achieve 100 percent electrification in 1971 and boast a well developed telecommunications and transport infrastructure. Over the past decade, the sectoral composition of the economy has shifted from agriculture towards manufacturing and services sectors, fuelled by IT, real estate and infrastructure. Haryana was the pioneering states in power sector reforms and restructuring. Haryana adopted the reform model based on the study of the power sector undertaken by the World Bank in 1995-96, which had recommended comprehensive reforms of the electricity sector in the state.

2.3.1 Evolution of Power Sector Reforms in Haryana

The Haryana State Electricity Board (HSEB) was the principal body of the government responsible for power sector development in Haryana. It was constituted on 3 May 1967 under Section 5(1) of the Electricity (Supply) Act, 1948. The HSEB was vested with the responsibility of public power supply in the entire state and the

[11] World Bank, (2009), "*Haryana Power System Improvement Project*", Report No.: 47407, World Bank Document

state level related regulation of electricity supply[12]. Like the other states, Haryana was also facing with problems of power shortages, imbalance between tariffs and costs and high transmission and distribution (T and D) losses. Haryana is deficient in commercial energy resources endowment. It does not have coal or petroleum resources, and its hydropower potential is also very small. Therefore, it depends heavily on its coal based thermal power plants for which coal is transported over long distances. Haryana receives hydel power from interstate multipurpose hydro projects, namely the Bhakra Nangal project and the Beas project which Haryana shares with other states. It also purchases power from various central and other state hydro and thermal power plants to meet additional demand for electricity. HSEB found it increasingly difficult to meet the demand and provide adequate supply of electricity; the state witnessed a peak shortage of 11 percent and energy deficit of 25 percent. No generation capacity had been added within Haryana till 1990 and the state was increasingly dependent on power imported from outside sources (Surinder Kumar, 2004).

To overcome these bottlenecks, the state government decided (1993) to restructure the board and appointed consultants for power sector restructuring project study. On the basis of consultants reports (July 1995), the erstwhile board was finally restructured on 14 August 1998 under Haryana Electricity Reforms Act, 1997. The main objectives of the reforms as per the Act were:

(1) Creating financially viable electricity sector.
(2) Creating an environment to attract private investment;
(3) Promote competition; and
(4) Provide over all development of the electricity sector in an efficient, economical and competitive manner.

2.3.2 Implementation and Restructuring of Reform Programme:

Haryana State Electricity Reform Act, 1997 notified by the state government on 10 March 1998 and made effective from 14 August 1998, inter alia, provided for constitution of an Electricity Regulatory Commission. Accordingly, the Haryana

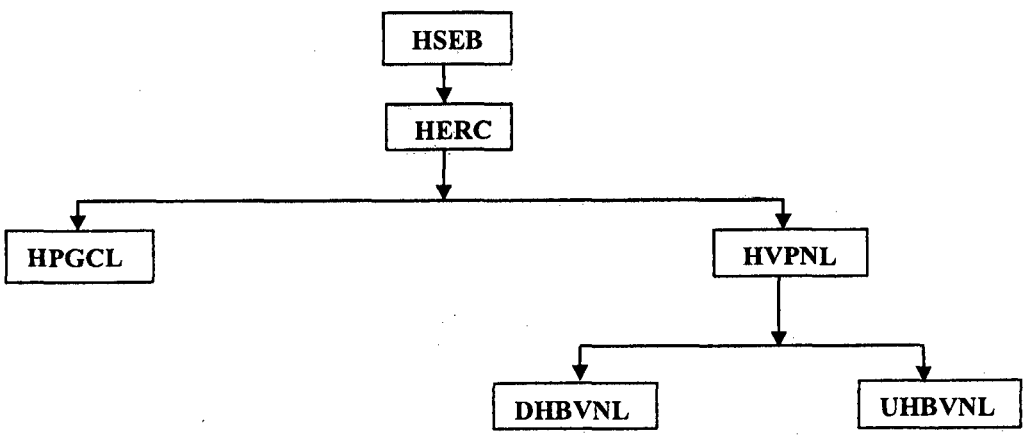
[12] Government of Haryana (n.d.), "*Power Sector Reforms and Restructuring in erstwhile Haryana State Electricity Board*", Chapter-II, Haryana Vidyut Prasaran Nigam Limited

Electricity Regulatory Commission (HERC) was constituted in August 1998. The main functions of the HERC are as under:

(1) To regulate purchase, distribution and supply of electricity, quality of service, and the tariff charges.
(2) To issue licences for power transmission, and distribution in the state.
(3) To regulate the working of licences and to promote their working in an efficient, economical and equitable manner.
(4) To act as an arbitrator or adjudicator to settle disputes arising between licences.

The erstwhile Haryana state electricity board was reorganised by framing two transfer schemes notified on 14 August 1998 and 1 July 1999. In the first transfer scheme, the generation function was transferred to HPGCL (Haryana Power Generation Corporation Limited) incorporated in March 1997 and transmission & distribution functions were transferred to HVPNL (Haryana Vidyut Prasaran Nigam Limited) incorporated in August 1997. Both the companies, wholly owned by state government, commenced their activities from 14 August 1998. In the second transfer scheme, the distribution function was transferred from HVPNL to UHBVNL (Uttar Haryana Bijli Vitaran Nigam Limited) and DHBVNL (Dakhin Haryana Bijli Vitaran Nigam Limited) both incorporated in March 1999 dividing distribution business in the state into two regions. In April 1999 HERC permitted to the HVPNL to carry on the distribution and retail supply of electricity through these two subsidiary distribution companies.

Figure 1.2: Restructuring of Assets of HSEB



2.3.3 Current status of Haryana Power Sector

Haryana is among the pioneer states in India to initiate legal, structural, regulatory and institutional reforms in the power sector in late 1990s. In 1998-99, government of Haryana unbundled the vertically integrated HSEB and corporatized the four successor companies HPGC, to undertake generation of electricity, HVPNL to undertake transmission, and UHBVN and DHBVN with the exclusive mandate over electricity distribution and retail supply in the north and south area of the state respectively. HERC was set up in 1998, as a distinct regulatory entity.

At the time of restructuring, in 1998, the capacity under HPGCL was only 863 MW, mostly thermal (65 %). The state had been facing energy deficit of 25 to 33 percent, prior to restructuring. One of the key challenges for the GENCO was to take up massive capacity addition programme in the state. After restructuring, HPGCL added around 724 MW in a period of six years. The state now has a total installed capacity of 1,587.40 MW. At present, a generating station of 600 MW capacities is under construction at Yamuna Nagar (Deen Bandhu Chhotu Ram Thermal Power Project-II). During the eleventh plan, the capacity addition target in the state is about 1,600-1,800 MW. Apart from the addition in generating capacity, there is a substantial improvement in the PLF of these stations. The average plant availability has improved from 31.96 per cent in 1998-99 to 78.11 percent in 2004-05.

Figure 1.3: Current organization of Power sector industry in Haryana

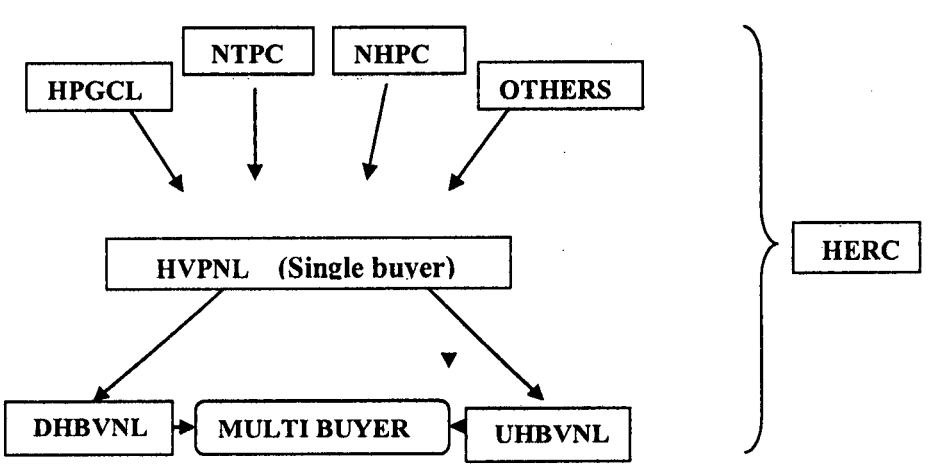


Figure 1.2 gives the current organization of power industry respectively. Haryana is one of the power deficit states; whose own power generation is not enough to fulfil

the demand of all sectors in the state. So HVPNL buys the power required by the distribution agencies in order to meet the demands for the final consumers in various sectors. The HERC supervises the activities of the companies involved in generation, transmission, and distribution. It is important to note that here that transaction of HVPNL with central transmission and generation utilities, interstate transmission and trading of electricity comes under the jurisdiction of the Central Electricity Regulatory Commission (CERC). The financial performance of the distribution sector was deteriorating even after the reform process so in June 2008 HVPNL moved from a single buyer model to a multi-buyer model; the distribution companies are now directly responsible for power procurement.

Table 1.1 explains the institutional framework of the power sector in Haryana before the reform process and after the reform process. At pre-reform time the whole of the power authority was administered by the single board, HSEB but after the reforms there is a separate unit for every distinct activity. And with the enactment of Electricity Act, 2003, the multiyear tariff regime started for the DISCOMs.

Table 2.1: The institutional framework of power sector in pre and post reform period

Activity	Pre- reform	Post Reform
1. Policy Making	Govt. of Haryana, Govt. of India	Govt. of Haryana
2. Regulation	HSEB	HERC
3. Generation	HSEB	HPGCL
4. Transmission	HSEB	HVPNL
5. Distribution and Supply	HSEB	DHBVNL, UHBVNL
6. Tariff Structure	Average Tariff	Multi Year Tariff

2.3.4 Economic and Political Dynamism

The political factors were the major hurdle in the reform process as the financial position was deteriorating day by day but government is supplying power to farmers at very low cost due to political need. Farmers constitute the largest and arguably most influential political group; consume almost 40percent of power. Earlier government was supplying electricity to agriculture and domestic consumers at highly subsidised rate, only industrial, railways and commercial were beyond the subsidy grip. But even then Haryana was one of the very states in India to charge the power supplied to farmers at an average of 50 paisa/kwh, which was the minimum level

agreed in the common minimum national action plan for power endorsed by a conference of the chief ministers at the end of 1996. Most other states either provide their farmers with free power (Punjab, Tamil Nadu) or at less than 50 paisa/kwh[13]. But charging 50 more paisa/kwh was useless for Haryana because only less than 40 percent of the framers were receiving metered supply. As mandated by the Electricity Act, the power utilities are compensated for subsidized supply to specified consumer groups, with compensation from the state budget and cross subsidies. However, without adequate metering of supply to farmers (the largest subsidized group), HERC, government of Haryana and the utilities have traditionally been unable to agree on estimates of agricultural consumption and consequently on the budget subsidy to be allocated to the utilities (World Bank, 2009).

Table 2.2 Metering of agricultural consumers in post-reform period

Total agricultural (pump set) consumers									
	DHBVNL			UHBVNL			Total		
year	no.	% metered	% unmetered	no.	% metered	% unmetered	Total no.	% metered	% unmetered
Aug-01	139433	32.9	67.1	222032	14.1	85.9	361465	21.3	78.7
Apr-02	138199	33.5	66.5	223946	15.6	84.4	362145	22.4	77.6
Apr-03	143148	37.2	62.8	227351	17.3	82.7	370499	25	75
Apr-04	149356	40.4	59.6	235753	20.5	79.5	385109	28.2	71.8
Apr-05	155961	43.4	56.6	241921	23.3	76.7	397882	31.2	68.8
Dec-05	160744	45.1	54.9	246597	24.9	75.1	407341	32.9	67.1

Source: Ministry of Power, Government of India

Even after a decade of the reform process the agricultural consumers are receiving unmetered supply of power. As given in table: 2.2, a large proportion of the agricultural (pump sets) consumers are still receiving unmetered supply of power. However the domestic consumers and commercial and industrial units are now under the metered supply. But the distribution and retail tariff have been revised only thrice in the seven years after the reform process. This is in spite of the increase in power purchase expenses of the DISCOMs. Now there is no subsidy to domestic consumers,

[13] World Bank (1997), "*Haryana Power Sector Restructuring Project in support of The Phase of the Haryana Power Sector Restructuring and Development Program*, Report No. 17234, World Bank Document

tariff for industrial and commercial categories have remained the same. Agricultural tariffs are reduced instead of being progressively increased towards the cost to serve. Now the burdens of agricultural consumers are on domestic consumers the tariff charges have increased on domestic consumers manifold. The gap between average costs (ACs) and average revenues (ARs) prevails primarily on account of agricultural consumers. Now the realisation for the domestic consumers is at 86 percent of the average cost to serve and for the rest of the categories, except the agricultural consumers, the revenue realised is around the average costs (MoP, 2006).

2.4 Conclusion

One of the important reasons for the reforms was ever worsening of the financial health of the power sector. Power sector was facing with a high T and D losses and other financial problems. This restructuring programme aimed in Haryana to restore financial viability of power utilities through involvement of private sector so that the state government is relieved of the burden of providing subsidies to cover their losses and to make the power sector a generator of net resources for the state and capable of arranging its investment requirements on its own strength. The fact is that there is negligible involvement of private sector in Haryana power industry. The principal lesson that emerges is that it is not enough to put in place a textbook model for reforms; but all reforms need a host of sufficient and totally committed champion to put them through. The power sector was unbundled a decade ago, but empowering the successor companies is still a work in process. Weak management system and limited commercialisation of the still-significant rural economy (farmers) have resulted in them continuing to depend on subsidised power from government of Haryana.

CHAPTER III

Performance of Haryana Power Sector before and after the Power Sector Reforms

Chapter- 3

Performance of Haryana Power Sector before and after the Power Sector Reforms

3.1 Introduction

The Power Sector Reforms started in India in the mid nineties. Orissa was the first state in the country to undertake power sector reforms. Adopting the similar model, thereafter, Haryana (in 1998) and many other Indian states introduced power sector reforms. The main purpose of the reform process was to improve the physical and financial position of the sector through removing cross subsidy and inviting private sector in all the three segments; generation, transmission and distribution. Orissa and Delhi (along with Noida in UP) were the only reforming states where distribution sector was also privatised. An attempt is being made to reform the distribution segment of the electricity sector in other reforming states also, namely, Karnataka, Andhra Pradesh, and Haryana. Learning from the experiences of certain states, though, reforms in the distribution segment were initiated in a number of states, it has not been as successful as it was expected (N. Pillai Vijayamohanan, (n.d.)).

The physical and financial position of the power sector did not improve; infect has deteriorated in the post reform phase. We delve into this issue and try to analyse and evaluate the physical and financial performance of the electricity sector in the state of Haryana in the pre and post power sector reform phase in this chapter. Haryana State Electricity Board (HSEB) was restructured and thereby was unbundled into generation, transmission and distribution segments under the Power Sector Reforms Act, 1997. The functioning of Haryana power system as a whole has been evaluated in terms of physical and financial performances for the SEB as a whole. Further, taking the other reforming states that have restructured their power sector on similar lines as Orissa and Haryana, such as, Andhra Pradesh, Karnataka, Uttar Pradesh, Rajasthan and Madhya Pradesh, we also try to undertake interstate comparison in order to understand the impact of power sector reforms in Haryana. The brief discussion of these sates has been already done in the previous chapter. Except for a few instances, the SEBs in India has faced financial losses ever since they were instituted. The Haryana Electricity Board was no exception to this. The worrisome

issue is that the power sector reforms did not only has an impact on the physical and financial progress of the electricity sector but due to certain populist measures, has also led to accentuation of tariff distortions. In such a case, pricing policy may give rise to unequal benefits but if operation of the utility is inefficient the nation as a whole will lose. In order to evaluate the reform process in the power sector, it would be interesting to see the level of efficiency/inefficiency in operation of the HSEB.

This chapter consists of six sections. Next section gives a picture of physical demand for electricity in Haryana and India. Third section examines the supply side in terms of physical operation of the Haryana State Electricity Board and other state electricity boards; the fourth section gives detail about the financial performance of Haryana power sector compared to all India and reformed states in pre and post reforms phase. Fifth section gives detail of the tariff structure of the Haryana power supply industry and last section concludes.

3.2 Physical Performance of the Power Sector in Haryana

Physical parameters such as, peak loads, consumer connected loads in different sectors, consumption of electricity in different sectors, consumers in different categories, growth of pump sets energised, per capita consumption of electricity are taken to evaluate the physical performance of the sector in the pre and post power sector reform phase.

3.2.1 Demand for Electricity

Peak shortage for electricity occurs in the peak hours when the demand for electricity is maximum; the main reason behind this peak load is heavy requirement of electricity in a particular time. Peak demand for electricity in Haryana was low compared to all India level in the pre-reform period. It gradually increased from 1582 MW in 1990-91 to 1814 MW in 1993-94 and to 2272 MW in 1997-98, recording growth rates of 4.67 percent in 1990-91 to 1993-94 and 5.79 percent in 1993-94 to 1997-98. Compared to all India level, the growth of the peak load was lower in Haryana. During the time period concerned, the growth of peak load was higher at an All-India level. It recorded a growth of 4.60 percent and 6.39 percent for the same time period. But after the reform process the peak load increased in Haryana with a high growth compared

to all India level. The peak load growth increased to 8.16 percent in 1998-99 to 2003-04 and 9.07 percent in 2003-04 to 2007-08 in Haryana compared to all India which registered low growth of around 3.55 percent and 8.31 percent in the same period. The reason could be high per capita consumption of electricity in Haryana compared to all India and other states.

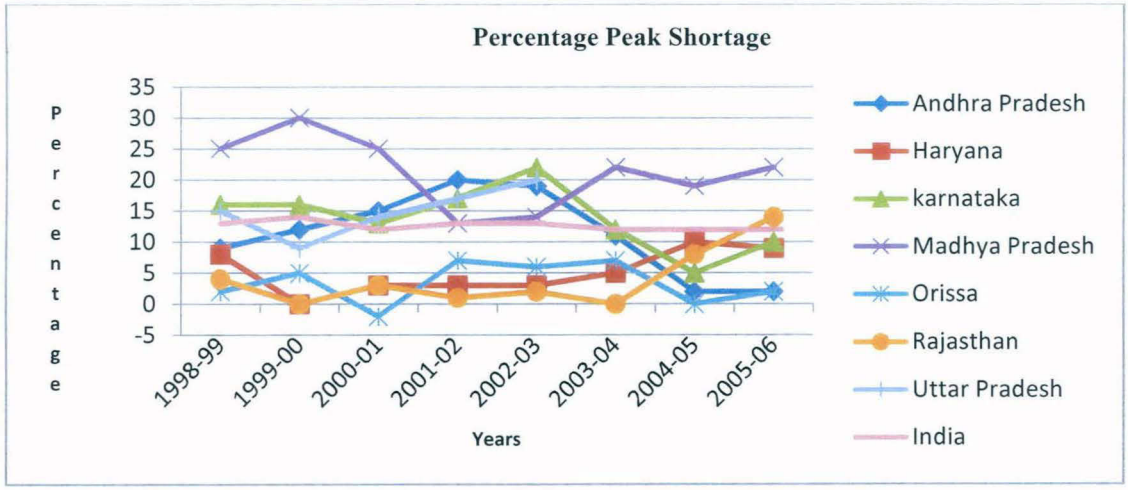
Table 3.1: Level of Growth of Peak Loads (MW)

	Haryana	India	Growth rates (%)		
Pre-Reform					
1990-91	1582	38986	1990-91 to 1993-94	4.67	4.60
1993-94	1814	44619	1993-94 to 1997-98	5.79	6.39
1997-98	2272	57167	1990-91 to 1997-98	5.31	5.62
Post- Reform					
1998-99	2215	63691	1998-99to 2003-04	8.16	3.55
2003-04	3278	75842	2003-04 to 2007-08	9.07	8.31
2007-08	5060	113059	1998-99 to 2007-08	9.61	6.58

Source: Central Electricity Authority (General Reviews)

However, in comparison to other reformed states the peak shortage in percentage terms is not very high in Haryana after the reform process. Notable among those are the two states, Andhra Pradesh and Orissa, which have considerably minimised the peak shortages in the peak time of demand.

Figure: 3.1 Percentage of Peak Shortage after Reform Process in Reformed states

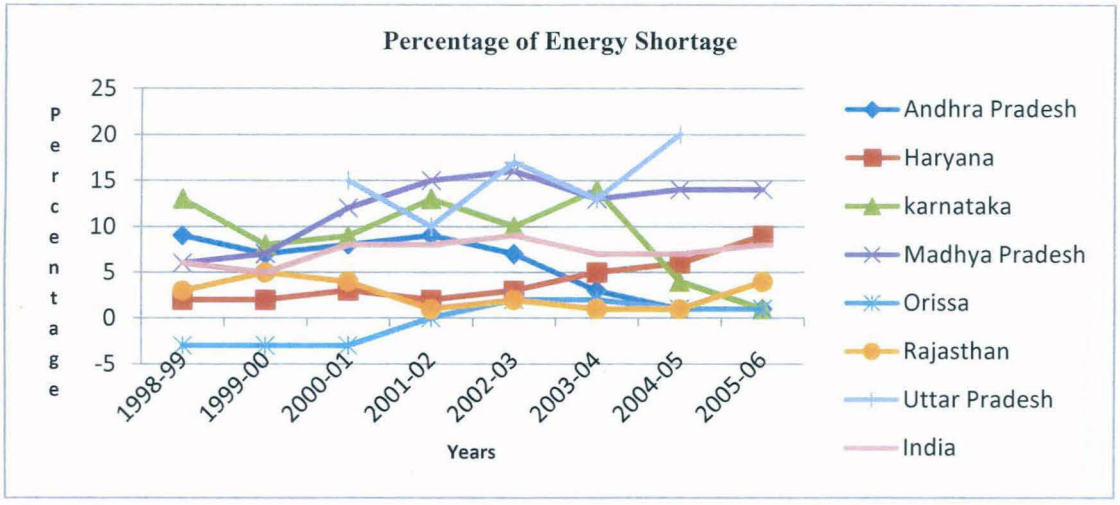


Source: Reports of Ministry of Power, Government of India

But after the reform process the overall energy shortages in Haryana has increased heavily compared to all India and other reformed states. As shown in figure-3.2 the

percentage increase in the energy shortage is 9 percent in 2005-06 which was highest for Haryana compared to other states who have unbundled their power industry except for Madhya Pradesh. Contrary to the other states, where massive energy shortages in the initial phases of reforms reduced thereafter, dissimilar pattern could be observed in Haryana. The percentage of energy shortage has increased gradually in the post power reform phase. The main reason behind this may be the high consumption of electricity in industrial and commercial sector after the reform process.

Figure: 3.2 Percentage of Energy Shortage of all unbundled states (%)



Source: Reports of Ministry of Power, Government of India

Table 3.2 describes the connected load per consumer in different categories for both the pre-reform and post-reform period. Connected load per consumer increased for all categories in both Haryana and India in pre-reform as well as in post reform period. Haryana has higher connected load per consumer across all the major categories in comparison to all India except in commercial sector. All India connected load per consumer is higher in both pre and post-reform periods than Haryana in the commercial sector. The reason behind this is the low level of commercial activities undertaken in the state as it is mainly agricultural rich states for a long time. Among the various categories of electricity consumers, despite the domestic segment accounting for the largest percentage of the consumers, the connected load per consumer is lowest both in Haryana and all India for the domestic segment. One plausible reason could be the growing energy sensitisation among the domestic consumers, who have substituted low voltage appliances for high energy consuming

devices. As a result, the connected load per consumer does not rise at a very high level.

Here one thing to note is that commercial and agricultural sectors have high connected load per consumer compared to all categories except industrial. Moreover, it increased very sharply in Haryana for the industrial sector after power sector reforms, compared to all India.

Table: 3.2 Connected Load per consumer for different categories of consumers (kWh)

Pre-Reform Period (1980-1997)						
		Total	Domestic	Commercial	Industrial	Agricultural
1980-81	Haryana	1.96	0.33	0.57	21.46	4.66
	India	1.89	0.59	0.98	21.6	3.9
1990-91	Haryana	1.84	0.55	0.72	23.17	4.69
	India	1.74	0.64	1.04	20.68	3.77
1996-97	Haryana	2.02	0.72	0.91	29.2	5.56
	India	1.97	0.85	1.41	24.57	3.99
Post-Reform Period (1998-2008)						
1998-99	Haryana	2.07	0.79	0.98	31.54	5.70
	India	1.93	0.85	1.46	25.29	4.06
2003-04	Haryana	2.72	1.00	1.33	57.68	6.34
	India	1.86	0.94	1.64	19.52	4.04
2007-08	Haryana	2.91	1.13	1.66	49.99	7.30
	India	2.03	1.00	2.13	25.07	4.18

Source: Central Electricity Authority (General Reviews)

In agriculture sector at all India level there are some declining trends but in Haryana the connected load per consumer increased significantly for agriculture in post-reform period compared to pre reform period. Increase in connected load in agriculture sector increased the financial burden on other categories as the agriculture sector still consumes maximum unmetered supply in Haryana.

The consumption of electricity in agricultural sector was very high in Haryana in pre-reform period as given in table-3.3; share of agricultural sector in total was around 45 percent, in comparison to all India level where agriculture consumes only 29 percent of total consumption. But after the reform process, the share of agricultural consumption decreased to 20.75 percent at all India level in 2007-08 compared to Haryana where share of agricultural consumption of electricity still remained high at

40.17 percent. For agricultural sector, the growth rate in electricity consumption in the post reform phase decreased drastically to 0.77 percent at an all India level. In Haryana, however, even after the reforms, the consumption in agriculture grew at 6.85 percent.

Table: 3.3 Electricity consumption (in MU) in Haryana and India (Relative Share and Growth Rates)

Pre-Reform Period							
Consumer Class		**1980-81**	**1990-91**	**1996-97**	**1980-81 to 1990-91**	**1990-91 to 1996-97**	**1980-81 to 1996-97**
Domestic	**Haryana**	185.59 (7.88)	1137.55 (18.79)	1794.14 (20.59)	19.88	7.89	15.23
	India	9246.43 (11.22)	31982.37 (16.80)	55266.77 (19.72)	13.21	9.54	11.82
Commercial	**Haryana**	67.45 (2.86)	174.9 (2.89)	288.15 (3.30)	10	8.68	9.5
	India	4681.84 (5.68)	11180.99 (5.87)	17519.38 (6.25)	9.1	7.77	8.6
Industrial	**Haryana**	1087.12 (46.17)	1745.1 (28.83)	1947.24 (22.35)	4.85	1.84	3.71
	India	48069.35 (58.35)	84208.96 (44.23)	104164.7 (37.17)	5.77	3.61	4.95
Agricultural	**Haryana**	936.02 (39.75)	2711.78 (44.81)	4089.13 (46.94)	11.22	7.09	9.65
	India	14489.03 (17.59)	50321.4 (26.43)	84018.95 (28.98)	13.26	8.92	11.61
Total	**Haryana**	2354.59	6051.37	8710.54	9.9	6.26	8.52
	India	82367.18	190357.4	280206.2	8.74	6.66	7.95
Post-Reform Period							
Consumer Class		**1998-99**	**2003-04**	**2007-08**	**1998-99 to 2003-04**	**2003-04 to 2007-08**	**1998-99 to 2007-08**
Domestic	**Haryana**	2010.72 (22.59)	2605.72 (20.17)	3476.52 (19.04)	5.32	7.47	6.27
	India	64973.14 (20.98)	89735.78 (24.86)	120918.22 (24.09)	6.67	7.74	7.15
Commercial	**Haryana**	351.12 (3.95)	656.21 (5.08)	1144.24 (6.27)	13.32	14.91	14.03
	India	19798.83 (6.39)	28201.49 (7.81)	46684.75 (9.30)	7.33	13.43	10.00
Industrial	**Haryana**	1877.05 (21.09)	3239.83 (25.08)	4989.87 (27.33)	11.53	11.40	11.48
	India	105080.42 (33.93)	124573.08 (34.51)	189424.04 (37.74)	3.46	11.05	6.77
Agricultural	**Haryana**	4039.66 (45.39)	5513.76 (42.69)	7335.37 (40.17)	6.42	7.40	6.85
	India	97195.22 (31.38)	87089.25 (24.13)	104181.7 (20.75)	-2.17	4.58	0.77
Total	**Haryana**	8899.93	12915.72	18260.5	7.73	9.04	8.31
	India	309734.05	360937.24	501977.11	3.11	8.60	5.51

Source: Central Electricity Authority (General Reviews)
Note: Figures in the bracket are the share consumption of particular category from total consumption

The domestic sector consumption which was only 7.88 percent of total consumption in 1980 increased to 19.04 percent in 2007-08 but it was lower than all India level whose share of domestic was 24.09 percent in 2007-08 with a high compound annual growth rate of 7.15 percent in post-reform period. Haryana had a very high growth rate of 15.23 percent in pre reform period in domestic sector consumption but this growth dwindled to 6.27 percent in post reform period. The commercial and industrial sectors have grown at high rates of 14.03 percent and 11.48 percent respectively but their share still lack behind the all India level. The above discussion shows that agriculture is the main culprit whose share is highest in Haryana but with a highly subsidised tariff recovery, its financial burden is shared by other sectors.

The electricity consumers in different categories in Haryana and all India are given in table 3.4, which shows that Haryana (76.52 %) had large number of domestic consumers than all India level (73.66 %) in pre-reform period. In post reform period, however, the proportion of domestic consumers to total consumers remained same, at around 77 percent. Haryana registered low growth across all the major electricity consumers compared to all India level after reform period. Among the major consumer groups, highest growth was recorded in the domestic consumers in pre-reform period and in the commercial sector in the post-reform period. The agricultural consumers increased from 0.2 million in 1980-1 to 0.45 million in 2007-08 out of total consumer base of 3.28 million and 4.27 million respectively, which is highest absolute number after domestic consumers. The industrial sector comprising of 0.038 million in 1980-1 and 0.083 million consumers in 2007-08 accounts for a very low proportion of the total.

Table: 3.4 Electricity consumers (in million) and their CAGR (%) in Haryana in different categories

		Pre-Reform Period					
Consumer Class		1980-81	1990-91	1996-97	1980-81 to 1990-91	1990-91 to 1996-97	1980-81 to 1996-97
Domestic	Haryana	0.71	1.84	2.51	10.04	5.3	8.24
	India	22.33	50.39	69.94	8.48	5.62	7.39
Commercial	Haryana	0.14	0.25	0.32	5.92	4.23	5.28
	India	4.58	8.0	10.41	5.73	4.49	5.27
Industrial	Haryana	0.038	0.068	0.077	5.8	2.18	4.43
	India	1.15	2.08	2.44	6.09	2.71	4.81
Agricultural	Haryana	0.204	0.34	0.37	5.39	1.02	3.73

	India	4.23	8.63	11.29	7.39	4.57	6.32
Total	Haryana	1.09	2.51	3.28	8.69	4.56	7.12
	India	32.57	69.63	94.94	7.89	5.3	6.91
Post-Reform Period							
Consumer Class		1998-99	2003-04	2007-08	1998-99 to 2003-04	2003-04 to 2007-08	1998-99 to 2007-08
Domestic	Haryana	2.61	2.91	3.31	2.16	3.23	2.64
	India	80.27	99.66	133.36	4.42	7.55	5.80
Commercial	Haryana	0.33	0.36	0.42	2.22	3.40	2.74
	India	11.23	15.25	17.95	6.31	4.16	5.35
Industrial	Haryana	0.073	0.068	0.083	-1.42	5.22	1.48
	India	2.55	3.38	3.87	5.82	3.44	4.76
Agricultural	Haryana	0.36	0.38	0.45	1.35	4.15	2.58
	India	11.86	12.84	15.80	1.59	5.34	3.24
Total	Haryana	3.38	3.74	4.27	2.02	3.40	2.63
	India	107.24	133.57	172.86	4.49	6.66	5.45

Source: Central Electricity Authority (General Reviews)

The pump sets energised is yet another factor explaining the high demand for electricity in rural areas. As India is the agricultural country, notwithstanding the high growth in industrial sector, the consumption of energy in rural area is still high. The growth rates of pump sets energised in Haryana is low compared to all India level in both pre-reform and post-reform periods. The consumers in Haryana are still using the diesel pump sets and a lot of pump sets have not been energised legally or they are not registered. They are getting unmetered supply of power (chapter-2, table2.2). Even though, the government of Haryana has reduced the tariff charges for agricultural consumers (pump sets) to 25 paise per unit in 2004-05, the consumers are using illegal power through different modes (MoP, 2006).

Table: 3.5 No. of Pump Sets Energised (in Lakh) and their CAGR (%)

Pre-Reform Period						
	1990-91	1993-94	1997-98	1990-91 to 1993-94	1993-94 to 1997-98	1990-91 to 1997-98
Haryana	365880	402985	409404	3.27	0.40	1.62
India	9103592	10470221	11806607	4.77	3.05	3.78
Post-Reform Period						
	1998-99	2003-04	2007-08	1998-99 to 2003-04	2003-04 to 2007-08	1998-99 to 2007-08
Haryana	410239	450617	474296	1.90	1.29	1.63
India	12216650	14115373	15350297	2.93	2.12	2.57

Source: Annual Reports of Ministry of Power, Government of India

Another factor which determines the high electricity demand is the per capita consumption of electricity. It is taken as one of the important indicator of development, it shows that state having higher per capita consumption of electricity is highly developed compared to other states. India has the lowest per capita consumption of electricity compared to developed countries and other developing countries. But Haryana is one of the few states having high per capita consumption of electricity compared to all India level and other unbundled states which have reformed their power sector. However, per capita consumption of electricity of Haryana is quite low if compared to some other highly developed states like Punjab, Gujarat and Maharashtra.

Table: 3.6 Per Capita Consumption of Electricity (in kWh)

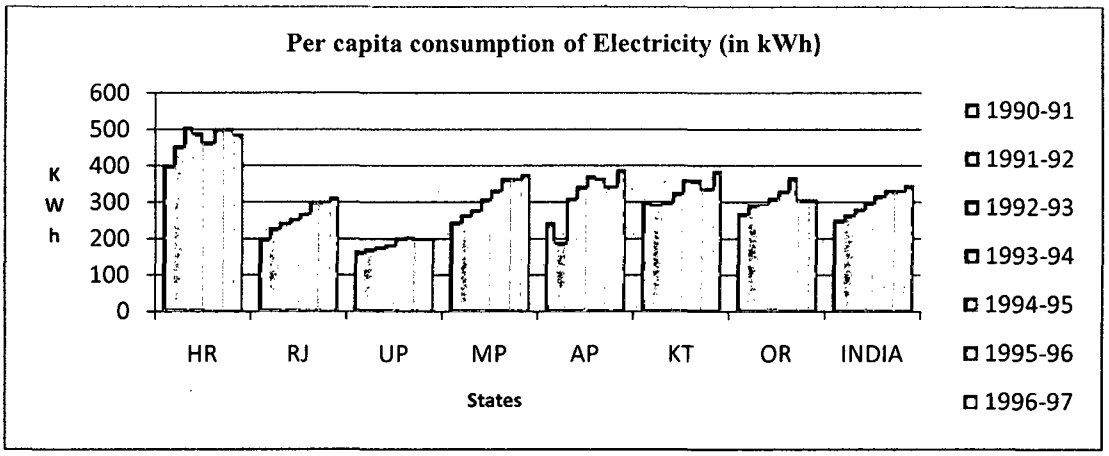
Pre-Reform Period								
States	**1990-91**	**1991-92**	**1992-93**	**1993-94**	**1994-95**	**1995-96**	**1996-97**	**1997-98**
HR	400	455	507	491	467	503	504	488.02
RJ	201	231	246	256	270	297	301	314.34
UP	166	174	179	186	204	207	197	199.53
MP	247	267	281	311	335	367	367	377.51
AP	245	191	312	345	374	368	346	391
KT	296	296	303	328	364	363	340	387.09
OR	271	295	297	313	333	370	309	308.18
India	253	268	283	299	320	336	334	348.5
Post-Reform Period								
States	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**
HR	502.41	530.2	544.31	532.9	580	618.98	658	715.16
RJ	330.28	339.51	349.54	284.71	290.9	294.08	328.09	333.68
UP	198.79	179.06	191.08	189.02	187.7	188.83	202.03	208.65
MP	398.17	353.13	294.82	273.04	278.2	283.54	308.4	344.1
AP	405.33	391	433.14	494.13	468	495.3	543.14	553.61
KT	350.64	387.09	411.74	427.76	462.8	481.73	504.69	516.67
OR	312.52	354.6	342.89	324.55	346	373.45	394.89	430.68
India	359.57	354.75	366.12	360.97	373	390.03	411.04	428.57

Source: Reports of working of State Electricity Boards (Planning Commission) and Central Electricity Authority

This higher consumption in Haryana is mainly contributed by the agricultural sector which is the dominant consumer of power in Haryana compared to other states like Gujarat and Maharashtra where industrial sector is the largest consumer. The per capita consumption of electricity for Haryana and other reformed states for pre-reform and post reform period is given in table 3.6 and for visual clarity in figures 3.3 and

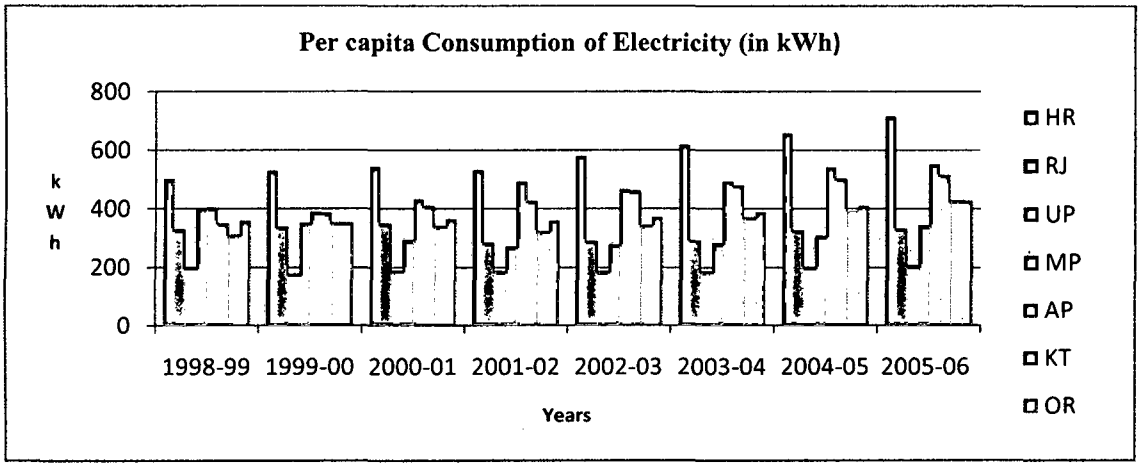
3.4. Among all the states taken and at an all India level, Haryana has the highest level of per capita consumption of electricity.

Figure: 3.3 Per capita Consumption of Electricity (in kWh) before Reform Period



Source: Reports of working of State Electricity Boards (Planning Commission)

Figure 3.4 Per capita Consumption of Electricity (in kWh) after Reform Process



Source: Central Electricity Authority (General Reviews)

3.3 Supply side of Physical Performance

In supply side, parameters have been included like, installed capacity, gross generation of electricity, availability factor of plants, plant load factor, transmission and distribution losses (T & D), distribution and transmission lines network and labour productivity through sales per labour and consumers per labours for both pre-reform and post-reform periods.

3.3.1 Generation and Installed Capacity

Haryana is acutely deficient in commercial energy resources, both renewable and non renewable. Neither does it have coal or petroleum resources, nor does it boost of adequate hydro power. Haryana shares hydro power with the other states generating power from their hydro power plants. Therefore, it depends heavily on its coal based thermal power plants for which coal is transported over long distances. Haryana receives hydro power from interstate multipurpose hydro projects, namely the Bhakra Nangal projects and the Beas projects which Haryana shares with other states. Haryana also purchases power from various central and other state hydro and thermal power plants to meet additional demand of electricity (Surinder Kumar, 2004). Table 3.7 gives the current status of share of power from different sources; hydro and thermal power. Haryana receives highest power from Bhakra and Beas multipurpose projects. It purchases power from central power producing agencies like NTPC and NHPC and other states hydro and thermal projects. In the table the current share of Haryana in total 19925.47 MW is around 2492.99 MW.

Table: 3.7 Haryana's current share in central sector & other projects (MW)

Projects	Project Capacity (MW)	Haryana's Share (MW)
BBMB	2876	875
NHPC	2972.7	329.9
NTPC Shared Project	6592.27	472.1
(Faridabad gas power project)	432	432
FARAKKA (Thermal Power in lieu of Hydro power from TALA HEP)	1600	29.76
KEHALGAON	840	66.91
TALA HYDRO	1020	14.99
NUCLEAR POWER CORP.	880	76.1
INDRAPRASTH TPS	187.5	62.5
NATHPA JHAKRI POWER CORP.	1500	65
TEHRI HYDRO	1000	43
MAGNUM	25	25
TOTAL	19925.47	2492.99

Source: Haryana Power Generation Corporation Limited (HPGCL)

The combination of thermal and hydro power mix in Haryana is given in table 3.8, which is showing that total installed capacity of Haryana did not record even marginal increase in the pre reform period from 1990-91 to 1997-98. But after the reform process there is significant increase in the installed capacity of Haryana power supply industry. The share of hydro power has decreased by the time and the share of thermal power has increased in the total installed capacity. On the generation side also the situation is same in pre reform and post reform periods.

Table : 3.8 Generation and installed capacity mix of Haryana power system (MW)

Pre-Reform Period						
	1990-91		1993-94		1997-98	
	IC (MW)	Gross Gen. (MU)	IC (MW)	Gross Gen. (MU)	IC (MW)	Gross Gen. (MU)
Thermal	911.42 (51.19)	2609.24 (37.61)	944.42 (53.05)	3154.25 (47.24)	896.4 (50.4)	3829.8 (52.2)
Hydro	883.9 (49.65)	4329.02 (62.39)	835.9 (46.95)	3522.72 (52.76)	883.9 (49.7)	3501.7 (47.8)
Total	1780.32	6938.26	1780.32	6676.97	1780.3	7331.5
Post-Reform Period						
	1998-99		2003-04		2007-08	
	IC (MW)	Gross Gen. (MU)	IC (MW)	Gross Gen. (MU)	IC (MW)	Gross Gen. (MU)
Thermal	987.58 (55.47)	3725.94 (44.88)	1106.42 (55.59)	7000.95 (64.43)	1588 (62.99)	10949.69 (75.16)
Hydro	792.74 (44.53)	4575.72 (55.12)	883.87 (44.41)	3864.42 (35.57)	938 (37.21)	3367.88 (23.12)
Total	1780.32	8301.66	1990.29	10865.37	2521	14569.13

Source: Central Electricity Authority (General Reviews)
Note: Figures in brackets are showing the share of Thermal and Hydro in Total

The growth of electricity generated and installed capacity was also poor in absolute terms in pre-reform period. The growth of installed capacity remained stagnant or shows 0 percent growth in the pre-reform period. The figure increased to 3.94 percent in the post-reform period. On the other hand growth in generation was marginal at around 0.79 percent in pre-reform period and then it sharply increased to 6.45 percent in post-reform period. The hydro generation shows the negative growth rate in both the pre-reform and post-reform periods. This shows the decrease in potential from hydro power and shifting the electricity mix towards the thermal power.

Table : 3.9 Average compound annual growth rate of installed capacity and generation in Haryana

Pre-Reform period						
	1990-91 to 1993-94		1993-94 to 1997-98		1990-91 to 1997-98	
	IC (MW)	Gen. (MU)	IC (MW)	Gen. (MU)	IC (MW)	Gen. (MU)
Hydro	-1.84	-6.64	1.41	-0.15	0.00	-2.98
Thermal	1.19	6.53	-1.30	4.97	-0.24	5.64
Total	0.00	-1.27	0.00	2.37	0.00	0.79
Post-Reform Period						
	1998-99 to 2003-04		2003-04 to 2007-08		1998-99 to 2007-08	
	IC (MW)	Gen. (MU)	IC (MW)	Gen. (MU)	IC (MW)	Gen. (MU)
Hydro	2.20	-3.32	1.50	-3.38	1.89	-3.35
Thermal	2.30	13.44	9.45	11.83	5.42	12.72
Total	2.25	5.53	6.09	7.61	3.94	6.45

Source: Central Electricity Authority (General Reviews)

Table 3.10 shows the current power supply capacity of Haryana after the reform process and name of plants and their capacity, which have commissioned till date. Before unbundling state have its own capacity at around 863 MW but after the reform process the capacity has increased to 2132.7 MW with a net addition of 1324.4 MW which is a significant increase of 150 percent. The figures show that there is positive influence of unbundling on the Haryana power supply industry.

But in comparison to other states who have also unbundled there power supply industry and all India level the growth is poor. The compound growth rate from 1995-96 to 2005-06 for Haryana is 1.56 percent which is lowest compared to all the unbundled states except Madhya Pradesh and Uttar Pradesh (because Chhattisgarh and Uttrakhand got separated in 2000 from these states respectively so the capacity reduced). So the addition to the installed capacity in post reform is not significant if compared with unbundled states.

Table: 3.10 Present Installed Capacity of HPGCL in the state

Name of Power Station	Capacity (MW) & Unit No.	Date of Commissioning	A Generation Capacity
Faridabad Thermal Power Station 110 MW (2x55 MW)	55 MW Unit-1	22-11-1974	of 1324.4 MW has been added in the state after
	55 MW Unit-3	01-04-1981	
Panipat Thermal Power Station, Panipat 1360 MW (4x110 MW + 2x210 + 2x250 MW)	110 MW Unit-2	27-03-1980	which is an increase of more than 150 percent
	110 MW Unit-3	01-11-1985	
	210 MW Unit-6	31-03-2001	
	250 MW Unit-7	29-12-2004	
	250 MW Unit-8	08-04-2005	
Deen Bandhu Chhotu Ram Thermal Power Project 600 MW (2x300 MW)	300 MW Unit-1	14-04-2008	
	300 MW Unit-2	24-06-2008	
WYC Hydro Electric Station, Yamuna Nagar 62.7 MW (6x8+2x7.2 MW+0.3 MW)	2x8 MW PH-A	1986	
	2x8 MW PH-B	1987	
	2x8 MW PH-C	1988-89	
	2x7.2 MW PH-D	2004	
Total Installed Capacity	**2132.7**		

Source: Haryana Power Generation Corporation Limited (HPGCL)

Table: 3.11 Installed Capacity (in MW) of unbundled states and their CAGR (%)

States	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	CAGR (%)
AP	5210	5765	6208	6214	6255	6756	7328	7616	7787	8072	8860	2.09
HR	1780	1780	1780	1780	1780	1990	1990	1990	1990	2546	2560	1.56
KT	3379	3385	3450	3973	4368	4465	4987	5197	5367	5935	6529	3.02
MP	3864	3873	3878	4094	4353	4373	3008	3100	3112	3324	3795	-0.90
OR	1692	1693	1693	1698	1998	2298	2298	2304	2301	2320	2345	1.82
RJ	1985	1985	1985	2235	2487	2489	3001	3077	3681	3814	3866	3.46
UP	6069	6059	6169	6085	5613	5613	4659	4626	4621	4706	4924	-1.43
India	83294	85795	89102	93294	97884	101626	105046	107877	112684	118426	124287	1.73

Source: Central Electricity Authority (General Reviews)

Same situation prevails for the generation side; here the Haryana shows the compound growth of 1.26 percent, this growth rate is lowest among all unbundled states except Madhya Pradesh and Uttar Pradesh (due to reason given before). This low growth of gross generation of electricity shows that the increase in generation capacity is not

satisfactory as it was expected. But as discussed earlier that Haryana has acute deficiency in resources, so the performance can be considered good if not excellent.

Table: 3.12 Gross Generation of Electricity (in MU) for unbundled states and their CAGR (%)

States	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	CAGR (%)
AP	18371	19959	21141	21235	24074	25853	27896	30519	29930	28823	27217	26629	30868	1.71
HR	7973	6677	7418	7262	7627	7331	8302	7969	7238	8454	9783	10865	9847	1.26
KT	12758	14344	16741	14289	11929	15929	15970	19540	19493	18878	18141	19178	19822	1.55
MP	38607	41417	38210	17599	18410	19441	20552	21812	21439	14010	15452	15802	15907	-3.29
OR	5423	5373	5765	2670	5946	5840	6358	7916	7802	9265	5882	9119	10308	2.70
RJ	8592	8529	8773	9929	10386	10853	11964	12638	13311	14161	17146	18599	20668	3.29
UP	18167	19847	21675	22827	23637	23790	24938	23598	24888	22633	22377	22836	20911	0.42
India	205550	216561	221103	235798	235359	243725	256546	268641	270788	290245	282405	304648	315365	1.50

Source: Central Electricity Authority (General Reviews)

Other important parameters that are generally used to assess the performance of generation side of the industry are the plant availability, plant load factor (PLF) and auxiliary consumption etc. The availability factor of plant is defined as unity less planned maintenance rate (PMR) less forced outage rates (FOR) i.e. availability = (1-PMR+FOR). The most common reason for poor availability is inadequate maintenance, lack of spares, inferior quality of fuel supply, labour problems etc. The availability factor is inclusive of all plants i.e. hydro and thermal.

Table: 3.13 Availability Factors of Plant (%)

States	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
AP	82.44	83.3	85.6	90.2	89	90.9	85.3	89.7	89.2	89.6	92.5	90.6	92.5
HR	69.4	61.5	59.1	62.2	68.8	70.3	65.2	80.2	72.4	67.7	80.83	69.31	78.11
MP	72	73.6	78.4	77.1	76.4	77.4	78.4	77.8	78.3	76.8	87.34	86.73	86.62
OR	59	63.6	56.7	81	84.1	83.7	88.5	90.3	87.9	79.2	89.16	87.44	89.06
India	74.69	78	76.6	77.8	79.1	78.8	78.9	78.9	79.8	79.9	81.83	81.93	82.93

Source: Central Electricity Authority (General Reviews)

The availability factor of plant for Haryana and other states has been given in table 3.13; availability of factor plant in Haryana improved significantly from 69.4 percent in 1992-93 to 78.11 percent in 2004-05. But the progress is very poor if compared at all India level and with other states, because Haryana still lags behind all Indiaaverage of 82 percent. Orissa which reformed its power sector before Haryana, had very low

plant availability around 59 percent in 1992-93, but increased significantly to 89.06 percent in 2004-05. Relatively low value of availability of plant in Haryana shows that there is a further need of proper maintenance and improvement of efficiency of plants.

The parameter to convey the extent of potential utilisation of current power system is the plant load factor. It is the ratio of the actual generation to the maximum possible generation during a given period of time (generally one year). It is one of the major determinates of technical efficiency of power supply industry of a unit. Haryana had a very low plant load factor of 49.9 percent in 1992-93 (pre-reform phase) but this technical factor increased to 69.46 percent in 2004-05 after the reform process. In pre reform phase all states had approximately same PLF. But after the reforms the increment in plant load factor for other state is very high compared to Haryana.

Table: 3.14 Plant Load factor (%) of unbundled states

States	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
AP	65	68.7	70.2	77.4	78.3	82	76.8	83.2	86.3	86.3	88.5	86.2	89.6
HR	49.9	40.5	44.7	42.82	47.7	49.2	49.24	53.24	49.7	60.8	66.44	74.91	69.46
KT	49.4	66.9	64.9	67.7	70.2	75.2	81.6	82.3	81.3	81.1	79.92	88.4	83.3
MP	52.5	56.1	58.2	58.7	62.3	66	67.2	69.4	66.7	72.2	72.2	70	71.78
OR	34.5	35.5	29	67	69.4	65.3	76.2	85.6	81.6	70.64	71.24	81.6	86.04
RJ	77	81	75.6	73.7	75.6	80.5	78.1	82.3	85	85	85	82	85
UP	50.5	50.3	43.9	47.3	49.1	48.8	48.9	49.8	57.2	59.76	58.4	57.7	57.5
India	57.1	61	60	63	64.4	64.7	64.6	67.3	69	69.97	72.34	72.96	74.82

Source: Central Electricity Authority (General Reviews)

PLF is also influenced by factors like age of the generating plants, quality of coal and its timely and adequate availability, shortcomings in energy evacuation and equipment deficiencies. These deficiencies can be considered a little bit in pre-reform phase but, after the reform process the main cause of this low plant availability and low plant load factor appear inefficiency in the power supply industry of Haryana.

3.3.2 Transmission and Distribution Lines network and T & D Losses

Once the electricity is generated it has to travel a long distance to the final point of consumption. Initially, at generation point the voltage at which electricity has to be transmitted is increased to high voltage with the help of step up transformer in alternate current. After electricity reaches near distribution point the voltage of the

power is reduced to useable for the consumers with help of step down transformers. During this process a good amount of electricity generated gets lost due to resistance and the amount of current passes through the wire. The stepping up of voltage is done mainly to minimise the losses. The electricity losses is minimum in high voltages wires compared when same amount of electricity is passes through the low voltage wires, this is called technical loss. Internationally these technical losses are very low around 6 to 10 per cent compared to a very high around 25 to 35 per cent in India. Another major reason or the non technical loss of electricity is theft (Surindar Kumar, 2004). A minor part of the commercial losses depends upon the power factor of the electronic gadgets connected to the grid. Thieving is done mainly by hooking, tampering with the meter and by bypassing the meter, takes place at distribution level of electricity. Possibility of thieving is high if the wires are not insulated. In India except few metropolitan cities insulation of wire has not done properly. So theft of power is high, where insulation has not done properly.

Table: 3.15 Transmission & Distribution losses (%) of Haryana and other reformed states

States	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
HR	27.5	26.79	26.78	25	30.8	32.39	32.77	34.04	35.33	38.28	39.82	39.22	37.65	32.07	32.11
RJ	25.8	23.07	22.71	24.85	24.65	29.29	25.88	26.42	29.41	30.33	29.76	43.06	42.61	43.74	44.68
UP	27.1	26.13	24.68	24.37	21.87	22.75	25.06	26.47	30.28	40.37	36.94	37.62	34.16	35.17	34.39
MP	18	25.82	22.52	21.78	20.75	19.27	20.59	20.94	21.05	33.67	46.07	44.55	43.31	41.44	41.3
AP	22.9	20.25	20.65	20.21	18.05	19.58	33.09	32.28	33.56	37.65	36.63	26.81	30.11	27.73	23.96
KT	20.2	19.93	19.62	19.49	19.35	19.15	18.86	19.06	30.57	37.31	34.93	33.83	24.57	23.29	26.08
OR	25.8	25.3	25.87	23.07	23.66	25.63	50.38	49.79	43.2	44.26	44.91	47.34	45.36	57.09	44.02
India	22.9	22.83	21.8	21.41	21.13	22.27	24.53	24.79	26.45	30.93	32.86	33.98	32.54	32.53	31.25

Source: Central Electricity Authority (General Reviews)

India's transmission and distribution losses are very high compared to the international level. This high T and D losses are also underreported, actually they are much higher than the observed. Here in the table 3.15 the T and D losses have been given for Haryana Electricity Board and for other electricity boards which have also reformed their power sector. Haryana shows an increase in T&D losses in initial phase of reform up to 2002-03 then there is decline in T & D losses in Haryana. Other states like Rajasthan, Madhya Pradesh, and Orissa have very high T & D losses after the reform process. But the Andhra Pradesh, Karnataka and at all India level the T & D losses are very low compared to Haryana. The current status of T & D losses in

Haryana also has a declining trend at 29.1 percent in 2007-08 but still it is behind all India average of 26 percent. These high T & D losses compared to other states shows that reform process was not much focussed towards this segment.

Various studies (Moriss 2001, Kannan and Pillai 2002, Panda 2003, World Bank 1996 etc.) have highlighted the importance of the T and D sector in their work. The following quote is an apt one to explain the neglect of T and D sector.

"*The neglect of the T and D sector especially the transmission sector, in terms of adequate investment in capacity and maintenance and the lack of the systematic T and D planning over the years are the major technical factors contributing to the high level T and D loss. Defective metering, unmetered supply and pilferage are main non technical factors. There has been over the years pronounced bias in investment in favour of augmenting generation capacity to the utter neglect of the 1:1 norm in investment in generation and T and D sectors*" (Kannan and Pillai, 2002-03).

The neglect led to the huge losses in the system. As mentioned earlier the voltage at which electricity is transferred plays an important role in determining the technical part of the loss levels. Broadly it can be verified through examining what is the length of the distribution lines per unit of the transmission wire. This ratio will speak about the implication for losses. Higher the value of the ratio higher will be the technical losses. Haryana had 46.96 Km of distribution line for each kilometre of transmission line in pre-reform period which was very high compared to all SEBs distribution and transmission line ratio. It decreased to 33.40 Km in 1996-97 but ratio increased from 19.44 to 20.88 Km at all India level in same period. This decreasing trend is continuous even in post-reform period at 23.99 Km in 2007-08 which is a sign of improvement in the transmission and distribution network of Haryana. But it is very high compared to all India level; so to make power industry of Haryana efficient further improvement is require in distribution and transmission ratio.

Table 3.16: Distribution and Transmission line length ratios

Pre-Reform Period						
	1980-81		1990-91		1996-97	
	Haryana	All SEBs	Haryana	All SEBs	Haryana	All SEBs
D/T	46.96	19.44	37.3	23.53	33.4	20.88
Post-Reform Period						
	1998-99		2003-04		2007-08	
	Haryana	All SEBs	Haryana	All SEBs	Haryana	All SEBs
D/T	36.75	20.17	29.09	18.53	23.99	18.32

Source: Central Electricity Authority (General Reviews)

Further details of transmission and distribution wire networks (voltage wise) have been given in tables 3.17 and 3.18 which reveal that Haryana along with all SEBs had low voltage T & D system. Most of the line length in transmission segment dominated by 220 kV, 132 kV and 78/66 kV lines, which are taken as low transmission line. Such kind of network low voltage lines entails more losses.

Table 3.17: Transmission lines voltage wise as percentage of total length of transmission wire (%)

Pre-Reform Period						
	1980-81		1990-91		1996-97	
Volt	Haryana	All SEBs	Haryana	All SEBs	Haryana	All SEBs
HVDC	-	-	-	-	-	-
400KV	-	1.26	-	4.26	-	0.71
230KV	-	1.63	-	2.76	-	15.45
220KV	-	24.48	16.06	27.58	23.48	2.36
132KV	57.85	37.9	46.88	36.62	44.65	31.84
110/90KV	-	11.7	-	9.77	-	33.81
78/66KV	42.15	23.04	37.07	19	31.86	15.83
Length of transmission line (Km)	2007	115031	4036	176760	4833	234048
Post-Reform Period						
	1998-99		2003-04		2007-08	
volt	Haryana	All SEBs	Haryana	All SEBs	Haryana	All SEBs
HVDC	-	0.62	-	1.81	-	1.71
400KV	-	13.39	-	16.50	-	17.30
230KV	-	2.20	-	2.05	-	2.20
220KV	19.11	29.37	29.74	29.24	36.58	28.44
132KV	47.39	30.68	40.94	29.33	36.06	28.81
110/90KV	-	8.53	-	8.20	-	7.86
78/66KV	33.49	8.53	29.32	13.33	27.36	13.26
Length of transmission line (Km)	4395	269718	5897	324881	7936	376744

Source: Central Electricity Authority (General Reviews)
Note: Dash (-) means zero (0)

The voltage wise distribution picture is clear from table 3.18 that; LV is dominating in Haryana and higher than all SEBs level but slightly decreasing by the time and MV is slightly increasing by the time. LV shows a dominant position because Haryana has fully village electrified a long back. This implies that Haryana have greater technical losses in comparison to all SEBs because household and agricultural consumers consume low voltage supply which creates greater loss.

Table 3.18: Distribution lines voltage wise as percentage of total length of distribution wire (%)

Pre-Reform Period							
		1980-81		**1990-91**		**1996-97**	
		Haryana	**All SEBs**	**Haryana**	**All SEBs**	**Haryana**	**All SEBs**
1	33kv	3.08	5.19	2.66	3.6	2.7	3.73
2	22kv	-	1.81	-	1.28	-	1.18
3	15/11kv	35.57	32.07	32.66	30.78	33.34	31.38
	MV(1+2+3)	38.64	39.07	36.28	35.66	36.03	36.29
4	6.6kv	-	0.24	-	-	-	0.09
5	3.3/2.2kv	-	0.13	-	-	-	-
6	up to 500 v	61.36	60.57	64.69	64.34	63.97	63.62
	LV(4+5+6)	61.36	60.93	64.69	64.34	63.97	63.7
	Length of distribution line (in km)	94256	2236578	150546	4159565	161439	4886770
Post-Reform Period							
		1998-99		**2003-04**		**2007-08**	
		Haryana	**All SEBs**	**Haryana**	**All SEBs**	**Haryana**	**All SEBs**
1	33kv	2.10	3.65	2.25	3.55	2.10	3.67
2	22kv	-	1.19	-	1.15	-	1.19
3	15/11kv	33.58	30.05	34.81	31.06	37.53	32.33
	MV(1+2+3)	35.68	34.89	37.07	35.77	39.63	37.19
4	6.6kv	-	-	-	-	-	-
5	3.3/2.2kv	-	-	-	-	-	-
6	up to 500 v	64.32	65.03	62.93	64.13	60.37	62.71
	LV(4+5+6)	64.32	65.03	62.93	64.13	60.37	62.71
	Length of distribution line (in km)	161504	5440688	171564	6018477	190415	6902090

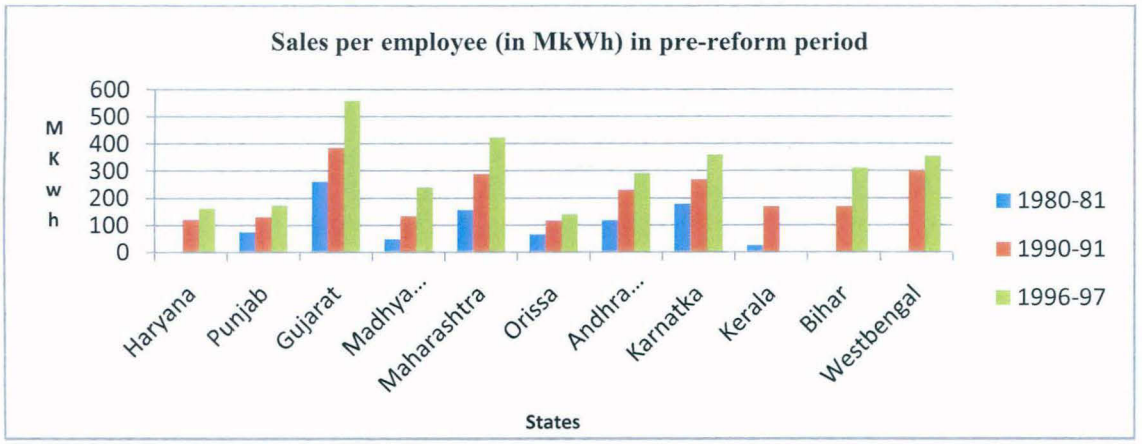
Source: Central Electricity Authority (General Reviews)

3.3.3 Labour productivity

State Electricity Boards (SEBs) in general are one of the over employed organisations in India. This results into high labour cost per unit of electricity. This is one reason why the cost of electricity is high in India. Among them Haryana State Electricity

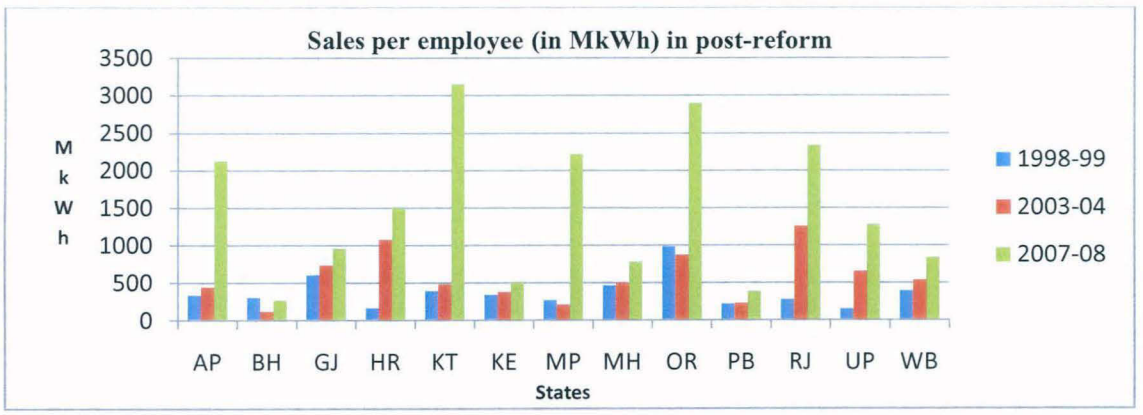
Board is still over employed. The parameters like consumers per employee and sales per employee give some subjective idea about the quality of services and productivity of labour. But there is no ideal way to measure the labour productivity so the sales per employee and consumers per employee for all major states have been taken for comparison of the labour productivity. But according to international standards, these ratios may seem to be very low depicting over manning in the utilities (Guiterrez 1993). Since there is no comparable data from all SEBs average so major states have been taken whose data are available on labour employed.

Figure: 3.5 Sales per employee in MkWh before reform process



Source: Central Electricity Authority (General Reviews)

Figure: 3.6 Sales per employee (in MkWh) in post-reform period

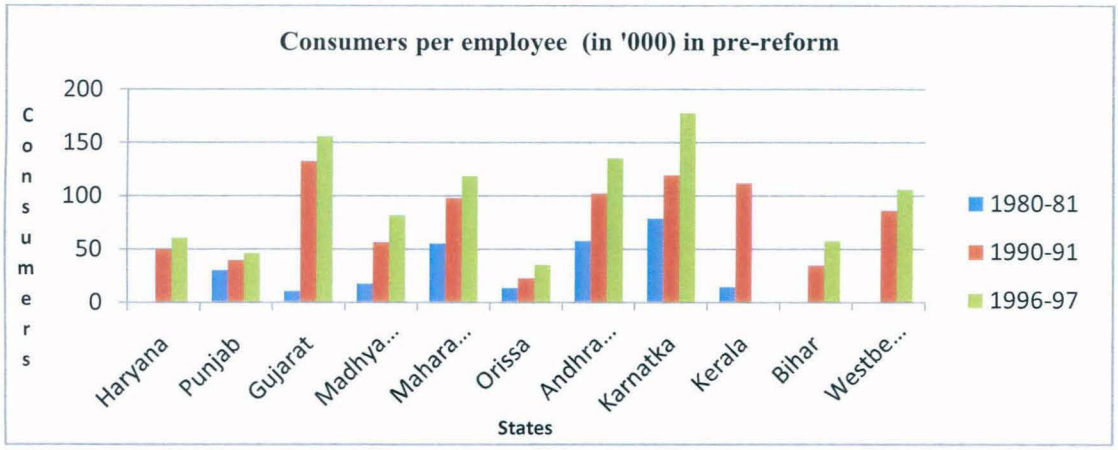


Source: Central Electricity Authority (General Reviews)

The graphs clearly show that in pre-reform period Haryana had one of the lowest sales per employee among the states listed except for 1980-81 where data is not available.

In 1996-97 it increased to 161.12 MkWh but still lowest among all the states except Orissa. Haryana had very low sales per employee than some poor states like, Bihar. This shows Haryana had too much man power in relation to energy sold. After the reforms the condition improved in Haryana but it still behind other states which have also unbundled their power sector. There may be two reasons behind this one is that Haryana is overburdened with employees even after the reform and other is Haryana has low sale of energy. But the main cause seems to be the heavy burden of over employment.

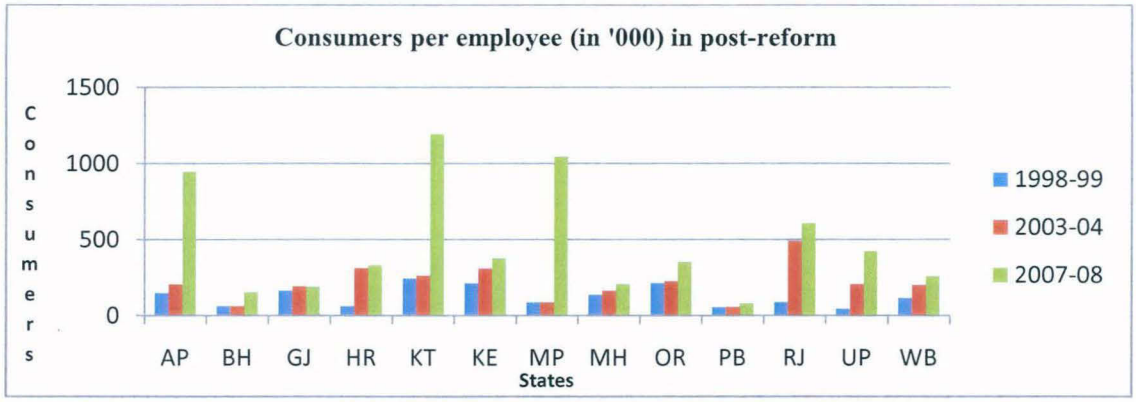
Figure: 3.7 Consumers per employee (in '000) before reform process



Source: Central Electricity Authority (General Reviews)

The number of consumers served per employee also has similar trends. Bars for all the years are very low for Haryana among the states listed in the graph. After the reform also Haryana lags behind other states as shown in figure 3.8.

Figure: 3.8 Consumers per employee (in '000) in post-reform period



Source: Central Electricity Authority (General Reviews)

Both the indicators explain that Haryana need to improve a lot. One thing to be note here is that on an average all states are experiencing steady improvements in both the parameters but the improvement is very slow in case of Haryana.

3.4 Financial Performance of the Power Sector in Haryana

Here financial position has been analysed by considering certain parameters like cost and revenue of Haryana State Electricity Boards (HSEB) and all India State Electricity Board (SEBs), cost structure of Haryana power industry, commercial and technical losses, and tariff and revenue realisation. Financial performance of any state electricity board is linked with physical performance of that board, if the physical factors are working inefficiently as in case of Haryana, then these inefficiencies necessarily lead to financial problems for the utility. So this section analyse, how the financial position existed before reform process and what happened after the reforms.

3.4.1 Cost Analysis of Power Sector in Haryana

Cost of electricity mainly depends upon the voltage at which electricity is consumed at different voltages for different purposes. In India broadly three categories of voltages or tension at which power is consumed, i.e., Low Tension (LT ranging from 200v to 400v), High Tension (HT ranging from 11kv to 33kv) and Extra High Tension (EHT, 132kv and above). Average cost of power supply at different voltages is markedly different from one another. Cost of supplying electricity at EHT is lowest while it is highest at LT. LT consumers are mainly consist of domestic, commercial and agriculture consumers, while HT consumers are from industry and for EHT consumers are from power intensive industries and railways.

Table 3.19: Average cost (AC) and average revenue (AR) realised from consumers (Paise/kWh)

		Pre-Reform Period							
		1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
AR (Paise/KWh)	HR	66.6	66.3	72.5	83.3	110.8	132.8	155.3	187.36
	India	81.8	89.1	105.4	116.7	128	139	165.33	180.33
AC (Paise/KWh)	HR	103.66	115.47	134.4	165.4	179.53	208.7	240.6	293.4
	India	108.59	116.8	128.15	149.12	163.4	179.6	215.6	239.7
AR/AC (%)	HR	64.25	57.42	53.94	50.36	61.72	63.63	64.55	63.86
	India	75.33	76.28	82.25	78.26	78.34	77.39	76.68	75.23

Source: Reports of working of State Electricity Boards (Planning Commission)

In Haryana, maximum power consumption is in domestic and agriculture sector as had already observed in the table 3.4. They are getting supply of power through Low Tension so the cost of supply is very high in Haryana and approximately similar situation exists at all India level. The cost of supply in pre-reform period was lower in the Haryana compared to all India but it increased sharply in Haryana compared to all India level by the time. The cost recovery through tariff was around 64 percent in pre-reform period as given in table 3.19 which is quite low compared to all India where the cost recovery was more than 75 percent in pre-reform phase.

After the reform process as given in table 3.20, the cost recovery through tariffs has improved marginally to 67 percent but it is still low and below the minimum requirement.

Table: 3.20 Cost recoveries through tariffs (%) after reform process

	Post-Reform Period						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
UHBVNL	65%	64%	67%	66%	59%	55%	57%
DHBVNL	65%	76%	79%	82%	75%	82%	77%
Total	65%	70%	73%	74%	66%	67%	67%

Source: UHBVNL, DHBVNL

The main reason behind this low cost recovery is low tariff charged from the agricultural consumers due to economical and political factors. And another reason behind this is the purchase of power from other sources at a high cost for short term / unscheduled interchange purchase which were 7 percent in 1999-00 increased to 9 percent in 2004-05 at the rate of Rs. /kWh 5.64 (MoP, 2006).

Cost Structure

The major components of electricity supply cost are revenue expenditure and fixed costs. Revenue expenditure consists of expenditure on fuel, power purchase, operation and maintenance (O & M) and establishment & administrative costs (E & A). On the other hand fixed cost includes depreciation and interest payable to institutional creditors and to the concerned state governments. Cost of power purchase and fuel are the main parts of revenue expenditure of electricity supply industry in Haryana as given in table 3.21. This power purchase cost is increasing in pre-reform period in

Haryana, which is causing high cost to power. By the time both operation and maintenance cost and establishment & administrative costs are also increasing in Haryana. But the depreciation cost has decreased for the HSEB in initial phase of the reform process.

Table 3.21: Cost structure of electricity supply in Haryana

Pre-Reform Period						
(Paise/KWh)	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98
O & M Cost	5.63	6.97	6.98	11.8	11.52	11.91
Depreciation	9.18	9.57	9.57	16.9	16.78	16.66
Interest Charges	19.17	21.05	14.89	18.31	31.45	32.39
Fuel	38.6	35.57	35.57	46.21	53.94	63.1
Power purchase	37.75	60.43	60.42	79.99	92.84	110.09
E and A	21.14	26.09	26.09	33.1	39.39	49.28
Misc. exp.	2.93	5.71	5.71	2.41	3.97	9.97
Total exp (paise)	134.4	165.39	159.22	208.72	249.89	293.4
Post-Reform Period						
	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Fixed cost (Thermal + Hydro)						
O & M Cost (Rs. Crs)	188.94	180.97	236.28	136.28	313.85	300.23
Depreciation (Rs. Crs)	61.53	50.57	-19.41	111.64	124.10	129.80
Interest charges (Rs. Crs)	81.08	55.82	110.01	165.10	150.11	125.41
Interest on working capital (Rs. Crs)	10.26	10.43	7.70	4.83	15.08	29.46
Total Fixed Cost (Rs. Crs)	341.81	297.79	334.58	417.85	603.14	584.90
Variable cost (Rs. Crs)	547.09	566.32	762.07	993.35	1095.60	1191.62
Total cost (Rs. Crs)	807.82	808.29	986.64	1411.20	1548.63	1651.11
Net generation (Rs./Unit)	3603.66	3371.76	4611.48	5580.29	6283.07	6180.00
Variable cost per unit	1.52	1.68	1.65	1.78	1.74	1.93
Total cost per unit	2.24	2.40	2.14	2.53	2.46	2.67

Current status of cost structure of Haryana power industry (in Rs. Crores)

	Power purchased cost	Generation cost	Employees cost	O & M cost	Interest cost	Depreciation cost	Total exp.
2004-05	8451	1243	950	171	511	348	11698
2005-06	7399	1672	852	196	595	494	11579
2006-07	8839	1943	917	308	660	465	13206
2007-08	11475	2052	1070	236	836	508	16254

Source: Reports of working of State Electricity Boards Planning Commission and Power Finance Corporation

Current situation of power industry in Haryana describe that even today the power purchase is major factor in influencing the whole cost parameter of the industry. And this purchase of power is increasing with time in an absolute proportion, which is clearly explaining the lack of sufficient resources and administrative capabilities of the state power industry.

3.4.2 Commercial and Technical Losses of the Power Industry

Commercial profits/losses are one of the parameters to determine the financial position of the power industry of a state. The heavy commercial losses describe the pathetic condition of the power sector. Here the commercial profit/losses without subsidy and with subsidy have been taken to analyse the financial position of the different state electricity boards (SEBs). Commercial losses with and without subsidies have been given for all India and all unbundled states including Haryana in tables 3.22 and 3.23 for both the pre-reform and post-reform periods from 1992-93 to 2004-05.

The commercial profits without subsidies rarely exist for any state except Orissa which shows positive profits in current time period. Otherwise all the states are showing negative commercial profits, Haryana is also not exception from these negative commercial profits. This is clearly explaining the poor condition of financial sector of different state power supply industries even after the reforms.

Table: 3.22 Commercial profits/losses (without subsidy) of State Power Utilities (in Rs. Crores)

States	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
AP	-4	-23	-981	-1255	-939	-1376	-2679	-3117	-2559	-2948	-1232	-1579	-1194
HR	-404	-507	-468	-554	-635	-765	-704	-1247	-1960	-948	-803	-785	-1449
KT	-19	-2	-164	-502	-652	-322	-847	-975	-1675	-1870	-1599	-1315	-1107
MP	-493	-377	-594	-602	-464	-1058	-2655	-3151	-3264	-1703	-835	-667	-764
OR	-85	-196	-136	-231	-375	-392	-538	-187	-216	-261	-944	193	303
RJ	-260	-415	-412	-430	-498	-640	-1331	-1899	615	-1324	-1739	-1777	-2037
UP	-808	-1202	-1152	-1136	-3378	-3692	-3692	-2596	-2534	-2518	-2374	-2116	-3624
India	-4560	-5060	-6125	-8770	-11305	-13963	-20860	-26353	-25259	-29331	-21193	-19722	-22129

Source: Reports of Planning Commission and Power Finance Corporation

On the other hand commercial profits with subsidies have different picture for states Andhra Pradesh, Karnataka, Madhya Pradesh and Orissa with net positive profits in

post reform phase. But Haryana which had high commercial losses without subsidy regime, also have highest commercial losses with subsidies compared to other states except Rajasthan and Uttar Pradesh. It explains poor financial position of Haryana even after getting sufficient subsidies from state and central governments to compensate the losses. The main causes of these commercial losses are the low tariffs charged from agricultural sector and relatively high T & D losses in Haryana.

Table: 3.23 Commercial profits/losses (with subsidy) of State Power Utilities (in Rs. Crores)

States	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
AP	-4	-23	-37	4	-89	-1376	-130	-53	-932	284	855	1467	1231
HR	-368	-447	-13	46	7	-32	-340	-835	-1548	-919	-5	187	-392
KT	32	34	43	51	54	58	67	76	76	213	103	412	621
MP	-113	38	-80	-8	-163	-812	-2534	-2718	-2800	-2197	11	1015	-296
OR	26	30	25	27	-363	-386	-538	-187	-212	36	-475	422	464
RJ	22	10	77	81	63	65	-134	-133	615	-1581	-626	-412	-578
UP	-808	-1202	85	381	-1821	-1853	-1853	-2596	-1734	-1395	-295	-1004	-3557
India	-2725	-2706	-998	-1178	-4674	-7598	-10509	-15088	-17794	-16725	-4846	-2268	-3438

Source: Planning Commission and Power Finance Corporation

Profits and losses of two distribution segment of Haryana power industry have been given in table 3.24. Figures are explaining that both distribution agencies are incurring losses after restructuring.

Table: 3.24 Profits/Losses of DISCOM'S in Haryana (in Rs. Crores)

Years	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
UHBVNL	-234	-23.28	-34.05	16.9	37.04	-204.36
DHBVNL	-180	-74.85	-156.74	16.9	37.04	-192.58
Total	-414	-98.13	-190.79	16.9	69.93	-396.94

Source: Haryana Electricity Regulatory Commission (HERC)

In 2000-01, a new concept Aggregate Technical and Commercial (AT&C) losses was introduced because the T & D losses were not able to capture all the losses in the network. AT&C losses capture technical as well as commercial losses in the network and considered a true indicator of total losses in the system. High technical losses in the system are primarily due to inadequate investments over the years for system improvement works, which has resulted in unplanned extensions of the distribution lines, overloading of the system elements like transformers and conductors, and lack of adequate reactive power support.

The commercial losses are mainly due to low metering efficiency, theft & pilferages. This may be eliminated by improving metering efficiency, proper energy accounting & auditing and improved billing & collection efficiency. Fixing of accountability of the personnel / feeder managers may help considerably in reduction of AT&C loss. With the initiative of the Government of India and of the states, the Accelerated Power Development & Reform Programme (APDRP) was launched in 2001, for strengthening of sub-transmission and distribution network and reduction in AT&C losses. The main objective of the programme was to bring aggregate technical & commercial (AT&C) losses below 15 percent in five years in urban and in high-density areas. This programme, along with other initiatives of the Government of India and of the states, has led to reduction in the overall AT&C losses from 38.86 percent in 2001-02 to 34.54 percent in 2005-06(MoP, 2006).

Table 3.25 Average Technical &Commercial LOSSES (AT&C) (%) of DISCOM's in Haryana

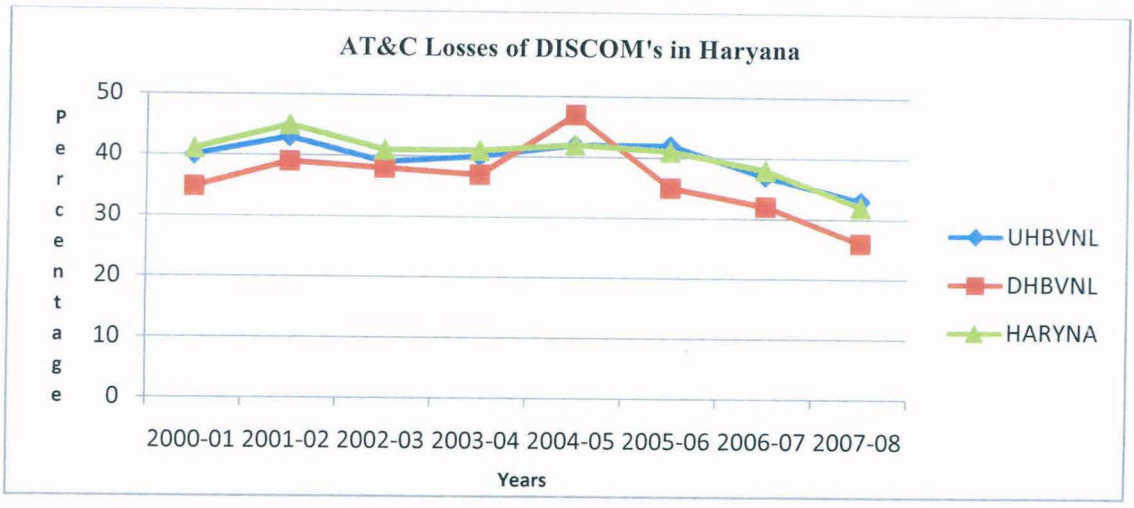
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
UHBVNL	40.01	43	39	40	42	42	37	33
DHBVNL	34.78	39	38	37	47	35	32	26
Total	41.06	45	41	41	42	41	38	32

Source: UHBVNL, DHBVNL (World Bank)

Performance of Haryana power sector distribution agency in terms of AT&C losses has been given in table 3.25. Except for current two years the AT&C losses are very high in Haryana distribution segments. Between the distribution companies (DISCOMs) of Haryana, the Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL) has the high AT&C losses compared to DHBVNL over the years. The clear cut picture can also be seen through the figure: 3.9. Haryana has tried to minimise its technical losses by investing a good amount of capital in distribution segment just after the reform process. Haryana invested around 21 percent of total capital investment of the power sector but the condition of the distribution segment is still pathetic. So these overall high values of AT&C losses are explaining inefficiency in Haryana power sector even after the reform process.

The unmetered supply to agricultural consumers is very high in Haryana (as had already been discussed in chapter-2) which is the main culprit in distorting the tariffs and therefore increase in losses.

Figure: 3.9 AT & C Losses of DISCOM's in Haryana



Source: UHBVNL, DHBVNL (World Bank)

Table 3.26 Capital Investments in the Distribution Sector in Haryana (in Crores)

Particulars	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	Total
Distribution	0	52.97	132.26	218.04	210.5	228.13	213.8	190.93	1055.7
Total	378.6	542.65	510.18	496.45	727.35	1439.98	921.22	754.2	5016.44
Distribution (%)	0	10	26	44	29	16	23	25	21

Source: Ministry of Power, Government of India

Table: 3.27 AT&C losses (in %) for all DISCOM's for Unbundled States

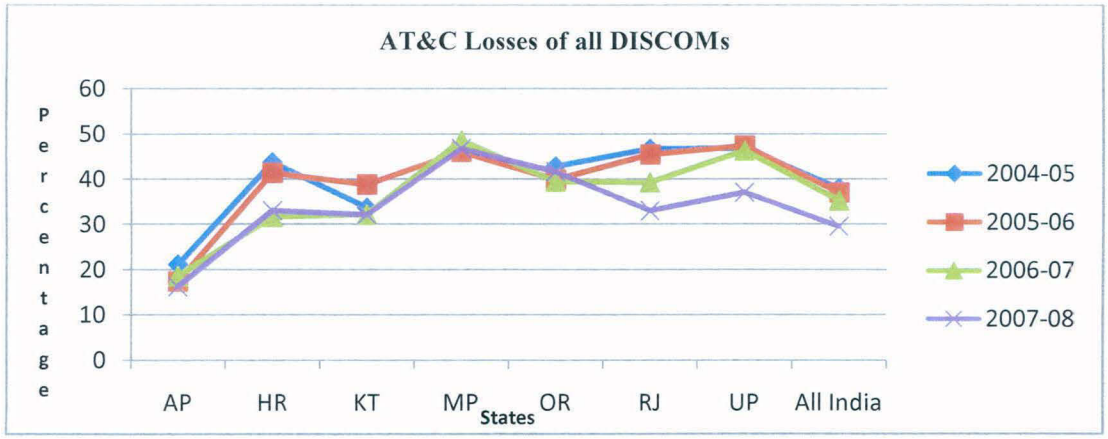
	2004-05	2005-06	2006-07	2007-08
AP	21.15	17.35	18.54	16.19
HR	43.66	41.35	31.69	33.02
KT	33.67	38.81	32.16	32.13
MP	-	46.01	48.61	46.78
OR	42.86	39.88	39.46	41.68
RJ	46.74	45.45	39.31	33.02
UP	46.81	47.36	46.36	37.10
Total	32.74	31.87	30.62	29.58

Source: Reports of Power Finance Corporation

According to the report of Ministry of Power (Reports on Sate Power Sector Performance Ratings), June 2006, Haryana had one of highest rating in terms of AT&C losses. The condition was very severe compared to other unbundled states.

But Haryana has improved a little bit as given in table 3.27 and figure: 3.10, but the losses are still high if they are compared with Andhra Pradesh, Karnataka and at all India level.

Figure: 3.10 AT&C losses of all Unbundled States



Source: Reports on Performance of State Power Utilities, Power Finance Corporation

3.5 Tariff Structure of Power Supply in Haryana

Most of the problems of the Indian power sector arise from the present retail pricing system and from the fact that too little of it is actually paid for. Out of total electricity generated, only 55 percent is billed and 41 percent is regularly paid for (GoI, 2001). Electricity is either stolen, not billed, or electricity bills are not paid. Retail tariffs in India (as well as bulk tariffs) are based on accost-plus mechanism established at the time of India's independence in 1948. Electricity prices are subsidised for domestic consumers and for farmers. Current retail prices for electricity in India represent less than 75 percent of real average costs. There is also a large amount of cross-subsidisation between consumer categories.

As the cost of providing electricity to low voltage (LV) consumers (domestic, agriculture, commercial, etc) is much higher on account of the additional cost of extensive distribution network, and more importantly, of higher distribution loss of energy, than the high voltage (HV) and extra high voltage (EHV) industries. However, the agricultural and domestic consumers enjoy a privilege of heavily subsidised supply of electricity at the cost of others. The AR realised from these two sectors is significantly lower than the overall AR, while that from the commercial

customers, industry and railway traction is much higher. Agricultural consumption is charged at the lowest.

As a result the SEBs had to experience commercial losses. In order to reduce these losses they adopted the policy of cross subsidising the domestic and agricultural consumers with other categories of consumers. It is noteworthy that average cost of providing electricity to LT consumers, mainly consisting of domestic, agricultural and commercial consumers are the highest. This highest cost is on account of extensive distribution network, a higher technical loss associated with low voltage wires, and higher possibility of theft. So according to the principle of marginal cost pricing, to ensure the efficiency, LT consumers should pay the highest. But the actual practice is in contrast to this.

The agricultural and household sectors are cross subsidised by above-cost tariffs for commercial and industrial customers and railways[1]. The situation was worsened in 1990's, subsidies to households trebled to 80.8 billion rupees over the period 1992-93 to 1999-2000 and subsidies to agriculture was more than tripled to 227 billion rupees over the same period. The government sought to justify these subsidies on social grounds but it clearly failed to achieve its social goal, as higher-income groups in fact appropriate most benefits since the subsidy is applied to the price of electricity within a given consumer-category, indifferently to the individual level of income (IEA, 2002).

Policies to achieve market pricing have been introduced in India with the establishment of Central and State Electricity Regulatory Commissions. The policies to implement a minimum price have been pursued since 1996, with the introduction of Common Minimum National Action Plan for power. Under the plan the state electricity boards were advised to charge not less than 50 percent of the average cost of supply from agricultural consumers. Haryana, Himachal Pradesh, Orissa, Uttar Pradesh and Meghalaya introduced a minimum rate of 50 paise/kWh but no state was able to achieve this goal.

[1] In theory, cost-reflective tariff structures do not differentiate between final uses of electricity. The lowest tariffs apply to customers with the highest consumption and load factors (industrial customers). Households, on the contrary, pay the highest rate due to their low load factor, limited consumption and the relatively higher cost of distribution.

Table: 3.28 Details of Retail tariff Revisions (in Paise) by Haryana Electricity Regulatory Commission (HERC)

Particulars	1995-96	1996-97	1998-99	2000-01	2001-02	2004-05
Agriculture	50	50	50	50	50	25
Domestic	Ist 40 units 90 paise, above 40 units 200 paise	Ist 40 units 150 paise, above 40 units 225 paise	Ist 40 units 191 paise, above 40 units 306 paise	Ist 40 units 260 paise,up to 300 units 360 paise , above300 units 425 paise	Ist 40 units 263 paise,up to 300 units 363 paise , above300 units 428 paise	Ist 40 units 263 paise,up to 300 units 363 paise , above300 units 428 paise
Industrial large HT	240	300	392	409	409	409
Industrial small LT	240	300	392	425	428	428
Commercial HT	240	300	392	409	409	409
Commercial LT	240	300	392	419	419	419

Source: Ministry of Power, Government of India

The main reason behind this deficiency is that, in Indian states, vested political interests impede utilities from collecting revenue. They maintain a price structure with large and unjustifiable subsidies. Politicians often interfere in the management of power utilities, hindering their efforts to curb power theft.

Here, table 3.28 is explaining the details of retail tariff charged in Haryana for different sectors at different time periods considering both the pre-reform and post-reform periods. All sectors are showing a positive increase in the electricity pricing after the reform-process except the agricultural sector.

An interesting point to note here is that Haryana was the first state which implemented the Common Minimum National Plan and has removed all subsidies from the domestic sector segments after the reforms. This was targeted to reduce the financial burden of the state power entity. But in case of agricultural pricing Haryana was not able to fulfil the criteria of plan and shows reduction below 50 paise/kWh after the reform process as shown in tables 3.28 and table 3.29. The tariff growth rate of agricultural pricing is also lowest at 1.69 percent from 1992-93 to 2001-02 in comparison to other sectors. One remarkable feature pointed out from the table is that domestic sector has highest growth of pricing in comparison to all other sectors whether it is industrial, commercial or agricultural, this is explaining an overburden of pricing on the households consumers with time.

Table: 3.29 Tariffs charged (paisa/kWh) for different categories in Haryana and their compound annual growth rate (%)

Categories	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	CAGR (%)
Domestic	70.09	76.9	106.5	133.5	169.4	203.95	240	248.44	259.3	280.51	7.41
Commercial	149.47	174.8	209.7	253.2	300.5	337.82	380.94	399.6	411.7	451.14	5.55
Agriculture	25.5	29	45.5	51.9	52.41	61.08	53.67	35.53	37.02	47.71	1.69
Industrial	170.95	195.7	222.3	266.6	319.9	372.2	397.93	411.09	428	477.94	5.17
Average	72.54	83.3	110.5	132.8	155.3	187.36	199.49	198.31	205.4	225.37	5.64

Source: Reports of working of State Electricity Boards (Planning Commission)

In comparison to other states who have unbundled their power industry, Haryana has the highest growth in domestic sector pricing of 7.76 percent and also above the all India average of 4.77 percent (given in table 3.30). This high growth among other states shows that, in Haryana the prices of electricity for domestic sector have been increased drastically. Means, burden of high electricity prices on domestic consumers which are basically households is very high in Haryana compared to other states.

Table 3.30 Domestic Tariff for Unbundled States (Paise/kWh) and their CAGR (%)

States	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	CAGR (%)
AP	85.75	89.3	91.8	107.5	142.5	165.6	165.6	165.6	174	174	4.15
HR	70.09	76.9	106.5	133.5	169.39	203.95	259.96	272	280	280.51	7.76
KT	85.82	107.9	106.9	107.7	131.62	177	179	201.2	249	282	5.83
MP	48.9	61.3	63	63.1	72.15	74.48	74.48	74.48	120.39	159.58	4.50
OR	37.74	53.7	87.6	88.85	113.88	140.33	165.23	180.2	0	0	-13.45
RJ	78.05	82	98.2	100.6	122.79	125.71	137	138	138	432	5.88
UP	80.92	78.2	83.7	101.3	99.19	104.95	104.95	104.95	129.53	181.09	3.23
India	77.27	84.3	92.8	85	96.25	128.13	141.82	149.71	174.16	196.8	4.77

Source: Reports of working of State Electricity Boards (Planning Commission)

3.6 Conclusion

Thus, from the above discussion it is clear that there is some improvement in the physical parameters after the reforms, there is a net addition of 1324.4 MW installed capacity, generation of power has increased, and transmission & distribution losses are also showing some declining trends, but improvement is very poor in comparison to other states which have also reformed their power industry. The financial position has deteriorated more after the reforms. The commercial losses have increased drastically after reforms and cost recovery through average tariff is still very low. AT&C losses have decreased but not enough to outway commercial losses. Cross-subsidisation has removed in case of domestic sector as the subsidy for the sector has come down to zero but the power subsidies for agriculture sector have been increased instead of declining. The tariff charged on agricultural sector has been decreased to 25 paise/kWh due to economic and political reasons. Agricultural consumers are even today are getting maximum unmetered power supply. The burden of this low pricing from agricultural has shifted to other sectors like domestic, industry and commercial sector. Among these sectors, domestic sector has highest growth in tariffs charged, which is a clear-cut increase in burden on household consumption expenditure. So it can be concluded that the reform process was not satisfactory in both physical and financial segments in Haryana.

CHAPTER IV

The Impact of Power Sector Reforms on Household Consumers in Haryana

CHAPTER – 4

The Impact of Power Sector Reforms on Household Consumers in Haryana

4.1 Introduction

The present changes in the Indian energy sector policy are directed towards providing better energy services and hence improved access, by allowing competition in the market. And all this is based on the assumption that these will lead to technological advances, and institutional and financial innovations in providing energy services, which will also benefit the poor. However, in their present form these policies will expand and serve the better-off users, who already have access to these forms of energy and technologies. The current challenge in the Indian energy sector is to find a fair balance between–issue of commercial viability of the energy sector; and, the issue of equitable access to modern energy fuels services among the urban and rural poor where there is no access or access is limited (Dubash and Chella Rajan, 2001; Sankar, 2002). If the government fails to provide access across various social and economic population groups, then it would face negative political implications and if the commercially viability were not reached, then it would have negative economic implications.

In India at present, the poor people in rural areas are constrained in energy use, both in terms of quantity (insufficient to meet their needs) and quality (fuels with poor combustion properties and negative health impacts) (WEC/FAO, 1999). Access to modern forms of energy (electricity and gas) is limited, and in some region, even access to biomass fuels is limited (Reddy, 1999; Venkata Ramana, 1998; WEC, 2000; WEC/FAO, 1999). The access to modern energy carriers becomes more important as the country has initiated an energy sector reforms policy. The energy sector reforms in India over the last one decade has focussed on reduction of the role of state, introducing the private sector in the market exclusively reserved for state owned enterprises and gradually liberalising control[1].

[1] Sinha Shirish, (2003), "Energy sector reforms and rural energy – will the rural poor benefit?" Paper Presented at Open Meeting of the Global Environmental Change Research Community, Montreal, Canada

This chapter is to discuss how the access to and affordability of electricity by households belonging to different socio-economic status in Haryana have fared during the reform process. As the Haryana is one of the pioneer states who have electrified the villages in long back 1970's, the issue of access to electricity does not arise much in case of Haryana but the impact of increased burden on household consumers can be seen clearly. There are three important reasons because of which the cost of supply of electricity has increased in Haryana the reasons are, required rate of return (where, required rate of return is a form of regulation which allows the utility to cover its operating and capital costs as well as a return on capital), permanent increase of charges for new connections after the reforms and elimination of subsidy and cross subsidies by the government[2]. These changes have led to tariff hikes that have considerably affected the access to and affordability of electricity to households. However, for the vast majority of the low capacity end users, energy access means access to bare minimum energy needs to meet their needs for lighting and cooking. But here access refers to the users' ability to obtain new connections and affordability refers to whether the poor users are able to pay the charge for using the service once they have it. In order to make it comparable to a situation two rounds of NSSO 50th conducted in 1993-94 and 61st in 2004-05 have been taken for consideration one includes time before the reform process and another after the reform process.

This chapter consists of six sections. The next section gives the description on the data used in the study. Third and fourth sections deal with access to and affordability of electricity to households respectively. In fifth section there is measurement of inequality in the access to and affordability of electricity among different socio-economic groups of the society. The last section concludes.

4.2 Data and Method

Here the 50th and 61st rounds of the consumption expenditure survey of the National Sample Survey Organisation (NSSO) conducted in 1993-94, and 2004-05 have been used. These two rounds include both the pre reform situation and post reform periods of power sector of Haryana. These NSSO surveys are conducted during the

[2] World Bank (1997), "*Haryana Power Sector Restructuring Project in support of The Phase of the Haryana Power Sector Restructuring and Development Program*, Report No. 17234, World Bank Document

agricultural year in India, which begins in July and ends in the month of June of the following year. The national sample survey uses a stratified two-stage sampling design, first sampling clusters (which are villages in rural areas and urban blocks in urban areas) and then selecting 10 households within each cluster (called first-stage sampling units or FSUs). The survey elicits consumption expenditures and consumption quantity for the household for the month preceding the date of survey. The date of survey varies between the FSUs as the survey is done at four different times (corresponding to quarters) within the 12 months from July to June.

Table 4.1: Number of Households Surveyed

	Haryana		
Rounds	**Rural**	**Urban**	**Total**
50th	1040	697	1737
61st	1680	1040	2720

Source: NSS 50th and 61st round survey on consumption expenditure

The NSSO data used here have been made comparable at constant prices (2004-05 prices) by deflating it through consumer price index for rural and urban areas separately. Here consumption expenditure data have been made useful for the required purpose. The whole sample has been divided into quintiles based on their household monthly total consumption expenditure (HMCE) in increasing order to have a measure of economic status of the households. The first quintile represents the bottom 20 percent of households with the lowest HMCE and fifth quintile represents top 20 percent of households with the highest HMCE.

Table 4.2 gives the quintile wise HMCE of the state. The HMCE of Haryana remains slightly lower in rural areas compared to urban areas in both pre-reform and post-reform situation. One interesting thing comes out is that household monthly expenditure of bottom quintiles has decreased in post-reform period in urban areas compare to pre-reform period. Other important thing here to note is that the annual growth rates of HMCE for all quintiles (for both rural and urban areas) in the state were quite similar except in lower quintiles where there is a decrease in the total expenditure. Another important feature of table 4.2 is that the coefficient of variation of the HMCE secularly declines from lower quintile up to the 4th quintile then in the 5th quintile its again rises at a high level, irrespective of region and time. The

coefficient of variation is high only in lowest 20 % households and richest 20 % households. This means that change in HMCE is sharpest among the poorest and the richest, where the direction of change for the poorest is unfavourable in urban areas.

Table 4.2: Average household monthly total consumption expenditure (HMCE) and its coefficient of variation (CV) for 1993-94 and 2004-05 (in Rs.)

	Rural		Urban		Total	
Quintile	Mean	CV	Mean	CV	Mean	CV
	Haryana 1993-94					
1	1353.60	0.25	1657.08	0.29	1428.41	0.26
2	2201.33	0.10	2993.58	0.10	2396.62	0.10
3	2944.67	0.09	3996.38	0.08	3203.92	0.08
4	4155.68	0.11	5491.69	0.11	4485.01	0.11
5	8126.97	0.76	9050.02	0.29	8354.50	0.64
Total	3759.28	0.97	4646.34	0.61	3977.94	0.87
	Haryana 2004-05					
1	1401.30	0.30	1438.48	0.23	1412.08	0.28
2	2470.59	0.09	2671.16	0.14	2528.75	0.11
3	3424.89	0.10	3984.82	0.09	3587.27	0.10
4	4789.12	0.10	5678.20	0.12	5046.95	0.11
5	9946.02	0.53	11691.15	0.83	10452.10	0.61
Total	4410.40	0.87	5064.34	1.10	4600.04	0.93

Source : Calculated from NSS 50th and 61st round survey on consumption expenditure

To have further idea about the distribution pattern of HMCE, Gini coefficient[3] has been calculated, as shown in Table 4.3. As expected Gini coefficient is higher in the urban areas compared to rural areas in the state.

Value of Gini coefficient in total HMCE in Haryana has increased from 0.32 to 0.36 in next period. It shows a slight increase in inequality in the next period. But one strange thing appears is that increase in inequality in urban areas is higher than the rural areas. This clearly explains that the changes in HMCE in rural areas remained much or less stable with time but in urban areas it changed very highly.

[3] Formula of Gini coefficient $G = 1 - \sum Pi\ (Zi + Zi\text{-}1)$ where Zi is the cumulative share of expenditure made by households and Pi is the share of population in each quintile.

Table 4.3 : Gini Coefficient of average household monthly total consumption expenditure for 1993-94 and 2004-05

	Rural		Urban		Total	
Years	1993-94	2004-05	1993-94	2004-05	1993-94	2004-05
Haryana	0.33	0.35	0.30	0.37	0.32	0.36

Source : Calculated from NSS 50th and 61st round survey on consumption expenditure

4.3 Issues in Access to Electricity

"In industrialised countries, majority of citizens have access to modern infrastructure services, and regulatory strategy focuses on overseeing established industries and customer relationships. In contrast large proportions of the populations of developing countries lack access to any formal infrastructure services. Two billion people lack access to adequate sanitation, two billion lack accesses to electricity, and one billion, access to clean water, transportation and communication networks also remain poorly developed. Those living in urban slums and in rural communities are least likely to have access. The effectiveness of any pro-poor regulatory strategy must be tested against the goal of expanding access to services, rather than just improving the convenience of those who already have services" (Smith 2000:6).

A substantial proportion of the poorest households lack access to basic energy supply through traditional utilities for their cooking and lighting purposes and consequently must find substitutes like kerosene, firewood or coal to meet their energy needs. Ironically, these fuels are often provided through informal means and involve high cost and risk (Estache, Foster and Wodon 2002). However, the avoided expenditures by households on energy forms that are substituted by electricity are likely to yield high savings which in effect increase the real incomes of these households. Low income households are highly sensitive to energy prices and could therefore be reluctant to modify rapidly their patterns of energy consumption once they gain access. Increased electricity access does not materialize in a large substitution effect because of households'high sensitivity to prices as well as to limitations on their ability to afford the purchase of electrical appliances. In other words, access may not translate rapidly in a larger consumption of energy services by individual households (Wilson Margaret, John Beasant Jones and Pierre Audinet, 2011).

4.3.1 Trends in Access Rates

Here access rates have been taken Quintile wise for Haryana and average wise for all India for both rural and urban areas in both periods. The access rate is quite low at all India level compared to Haryana and within all India rural area has very low access compared to urban areas in both periods. In 2004-05 the access rate has improved significantly for both rural and urban areas at all India level but access rate is still very low in rural areas compared to urban areas. Haryana has around double access rate in rural area compared to all India level in 1993-94. In 2004-05 there is increment of access rate in both Haryana and at all India level but still the access rates are high in Haryana specially in rural areas compared to all India.

Table 4.4 : Quintile wise trends in access rate in Haryana

	Rural		Urban		Total	
Quintile	1993-94	2004-05	1993-94	2004-05	1993-94	2004-05
	Haryana					
1	74.67	90.04	89.34	95.65	79.15	91.69
2	74.48	89.67	88.59	97.24	78.78	91.90
3	74.40	88.87	91.37	93.05	79.61	90.10
4	74.37	90.63	90.31	94.28	79.22	91.73
5	74.99	89.27	89.15	97.20	79.33	91.57
Total	74.58	89.69	89.76	95.47	79.22	91.40
	All India					
Average	37.10	54.90	82.80	92.30	48.85	65.29

Source : calculated from NSS 50th and 61st round survey on consumption expenditure

NSS data in table-4.4 explains that access to all economic groups is all around same in both rounds in Haryana. But it is notable here that even within the same quintile a household having no access to electricity is more likely to have low economic status (measured by consumption expenditure) in comparison to those who have electricity connection. In NSS sample the average HMCE of households without access to electricity are generally lower than compared to that of households with access to electricity with few exceptions (appendix 4A.1). The access to electricity is a very significant factor in determining the economic status of households. Low income households are highly sensitive to energy access and could therefore be reluctant to modify rapidly their patterns of energy consumption once they gain access. So the households having no access to electricity are considered as they cannot afford electricity.

4.4 The Issue of Affordability

Affordability of power can be affected by reforms and private sector participation through different channels. Following are some important ways affecting affordability:

- Tariff increases needed to cover the costs
- Increase in cost caused by increased rate of return requirement
- Reduction in cross subsidy along with withdrawal of subsidy.

Theoretically as the Staff Appraisal Report (World Bank, 1996) argued that reform has the potential to reduce the cost of service provision, but the current experience shows that cost has escalated instead of declining. The above mentioned reasons for the increase in the cost of electricity were true in case of Haryana in addition to this Government of Haryana up valued the assets of erstwhile HSEB to roll out its fiscal deficit and improve the financial position of the power sector.

Even after the reform process the private sector participation is negligible in both generation and distribution segments in Haryana because the political influence is so high for subsidising the agricultural consumers at a high rate and very high financial constraints. As all the power sector related decisions in Haryana are considered to be politically influenced there was a high subsidy for the household sector and agricultural sector in the pre reform period. From literature in chapter 1 &2 it can be concluded that there was a high tariff distortion in the power sector in Haryana. To reduce distortions in the tariff structure and partially eliminate cross subsidies, Haryana decided that tariffs paid by agricultural consumers should increase starting FY 2000, at least, by Rs. 0.25/kWh for the next three years to reach a level of Rs. 1.38/kWh by FY 2003, with an average annual increase of about 33 percent. For other categories (i.e. industry, commercial and domestic) the tariff adjustments are assumed at about 15 percent for FY 1999, 10 percent in FY 2000 and FY 2001, and 8 percent in FY 2002 (World Bank, 1997). This is considered a politically feasible pace of tariff adjustments though not adequate for the companies to earn their rate of return without subsidy. But the plan never achieved for agriculture sector but for other sectors the prices have been increased after the reform process (table-3.28, chapter-3) and the

financial burden of agricultural consumers got shifted to other sectors like domestic, industrial and commercial.

4.4.1 Instrument for Promoting Affordability

One of the important factors that affect the affordability is the targeted subsidy as mostly prevalent in India whether it is in public distribution system or in electricity. Electricity subsidy in India has been mainly dependent on category of consumers rather than income or socio-economic characteristics. Agricultural and domestic consumers are cross-subsidised by other categories of consumers. If one is agricultural consumer, he entitled to subsidised power irrespective of his socio-economic status (IEA, 2002). This kind of subsidy can in fact be detrimental for poor households who are basically subsistence farmers and largely depend on human power for their agricultural activities. They are unable to utilise the benefit of the electricity subsidies because they cannot afford and find it uneconomical to buy a pump set because their small land holding. During the dry season big farmers drag groundwater with the help of subsidised power to take groundwater level further down which was already at a very low level because of vagaries of weather. As a result all the wells from where small farmers draw water with help of human power to irrigate their fields get dried. Now only option left for such farmers in order to save his crop is to buy water from big farmers who can draw water from far below with the help of subsidised power. In this unorganised water market, small farmer often becomes the victim of market power of the large farmers. At the end of the day it can be said that electricity subsidy helps in widening inequality rather than reducing it along with indiscriminate extraction of precious natural resource like ground water.

Jain (2006), in case of Punjab, has shown that poor farmers remain worse while the big farmers utilise the benefits of electricity subsidy. According to International Energy Agency, "*Subsidies to agriculture more than tripled to 227 billion rupees over the years from 1992-93 to 1999-00. The government sought to justify these subsidies on social grounds but it clearly failed to achieve its social goal, as higher-income groups in fact appropriate most of the benefits since the subsidy are applied to the price of electricity within a given consumer-category, indifferently to the individual level of income*".

In case of household consumers, a similar story follows. One big source of inequality is that a proportion of poor households both in urban and rural is not having access to electricity. Electricity subsidy is provided to all households consumers irrespective of their socio-economic characteristics. Since subsidy is based on consumption, those who can consume more electricity enjoy more subsidies. It is natural to expect that richer household will be having more consumption of electricity. Those who are not having access to electricity they enjoy zero subsidy and those who have access to electricity enjoy positive subsidy. The actual amount of subsidy enjoyed by households will be directly proportional to its connected load. That is more you demand electricity the more you get electricity subsidy. This is quite in contrast to the policy objective.

4.4.2 Priority in Subsidy

The policy question relevant here is whether to emphasise subsidy for new connections of consumption subsidies among those already benefiting from connections. Moreover access subsidy is more likely to reach the intended population (poor) in comparison to affordability subsidy. Jain (2006), in context of agricultural consumers of Punjab, demonstrated that poor have willingness as well as capacity to pay for electricity because they generally spend more on the inferior quality substitutes of electricity e.g., diesel. But after the reform process affordability also became important consideration due to unprecedented rise in tariffs. It shows a heavy burden on consumers to buy electricity after reforms.

The one of the main objectives of the reform process was to provide easy and affordable electricity to all categories of consumers. But in India political factors impede utilities from collecting revenue. They maintain a price structure with large and unjustifiable subsidies. Heavy subsidies are provided to agricultural consumers (farmers) and to domestic consumers on behalf of high prices charged from the industrial and commercial sector. Priority in providing subsidy should be according to the socio-economic status of the consumers not on the bases of consumer categories. As seen in cases that only rich are able to get the benefits of power subsidisation.

4.4.3 Impact on Affordability

To see the possible impact on affordability, NSS data collected for the same rounds has been used. Here mean expenditure made on electricity by each quintile group ranked in increasing order of their HMCE is used as a proxy for affordability. While calculating mean expenditure made on electricity, only those households have been taken, which have positive expenditure on electricity assuming that remaining do not have access to electricity[4]. An ideal way to assess the impact on affordability would be to see changes in units consumed during the period of reform. But as the data on units on electricity consumed is not reliable and there are a lot of missing data even for those households showing positive expenditure on electricity. Therefore expenditure on electricity is used as proxy for affordability, which is product of price and units of electricity consumed. Table 4.5 gives the average share of electricity expenditure in HMCE of households belonging to different quintiles.

Table 4.5: Share of expenditure on electricity in total consumption expenditure (%)

	Rural		Urban		Total	
Quintile	1993-94	2004-05	1993-94	2004-05	1993-94	2004-05
	Haryana					
1	1.82	5.05	2.50	4.81	2.01	4.99
2	1.75	4.57	2.54	4.92	1.98	4.68
3	1.80	4.19	2.68	5.41	2.06	4.57
4	1.88	4.23	2.77	6.12	2.13	4.84
5	1.90	4.40	3.05	6.85	2.19	5.17
Total	1.96	4.15	2.94	6.06	2.23	4.75

Source: Calculated from NSS 50th and 61st round survey on consumption expenditure

Table shows that there is drastic increase in the share of expenditure on electricity of households in Haryana in 2004-05. The rise of share is higher in rural areas compared to urban area; urban share increased less because share in urban Haryana was considerable high even in the initial period (in 1993-94). On the other hand within rural Haryana bottom 60 percent of households suffered more compared to top 40 percent households. This shows that the share of rise of expenditure on electricity is

[4] But there are houses which show that their main source of lighting is electricity, but they do not report any expenditure on electricity. Such households have been ignored in calculating mean as they could affect the results. Those households might be illegally connected to the grid or might have connection offered by the institution where members of these households are employed.

higher among poor compared to rich in rural areas. Within urban area the rise is higher among top 60 percent of population compared to bottom 40 percent of households. This shows that the increase in urban area is higher among rich in comparison to poor. The share of expenditure on electricity on households can rise due to two reasons 1) rise in households total consumption expenditure and 2) high increase in prices of electricity of households. But it had already seen in table 4.2 that the total consumption expenditure has not increased much in 2004-05 relative to 1993-94 except for some quintiles. On the other hand in chapter-3 it had already observed that electricity prices have increased high for domestic sector compared to other sectors. So the rise in price of electricity has increased highly in Haryana for households' that's why the share is high in 2004-05.

This share of expenditure on electricity in HMCE indicates the burden of expenditure on electricity for households[5]. But the actual value of expenditure on electricity is more relevant to compare the burden of electricity expenditure for state. So in the table 4.6 there have been given average household expenditure made on electricity in 1993-94 and in 2004-05. There is drastic increase in the expenditure on electricity in both rural as well as urban areas of the state but the increase is higher in rural areas compared to urban area. This average expenditure can increase due to three factors. One is increase in access rates, second is increase in the prices and third is increase in consumption or due to cumulative effect of all the factors together. Haryana has already higher access to electricity given in table-4.4 and there is increment in access rate but i.e. not much significant. Consumption of electricity has also increased from 491 kWh in 1993-94 to 658 kWh in 2004-05 (table 3.6, chapter-3) but this is the total per capita consumption which includes all the consumers agriculture, domestic, industrial, commercial and railways and this higher increment also is not as fast as the increase in consumption expenditure on electricity which is more than double in the same period. So the main reason appears increase in tariff rates in household consumers, which had already analysed in the chapter -2 and chapter-3 that Haryana was the state who removed all the subsidies given to domestic sector after the reforms

[5] Similar study was conducted for Orissa by Md. Zakaria Siddque (2005) explains that after the power sector reforms in Orissa the burden of rise in electricity prices has increased drastically on household consumers. The paper concludes that the inequality has increased sharply among urban poor compared to rural poor in Orissa.

and rise in prices for domestic sector was much faster than the other sectors whether it was industrial or commercial.

Table 4.6 : Quintile wise average expenditure on electricity (Rs.) and Compound Annual Growth Rates

	1993-94			2004-05			1993-94 to 2004-05		
Quintile	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
	Haryana						CAGR (%)		
1	28.11	45.50	32.46	76.43	72.11	75.18	9.49	4.28	7.94
2	44.12	81.26	53.28	120.21	137.95	125.37	9.54	4.93	8.09
3	60.38	112.97	73.34	152.88	220.53	171.87	8.75	6.26	8.04
4	86.26	159.40	104.29	213.30	351.13	253.05	8.56	7.44	8.80
5	181.38	283.29	206.50	408.85	800.25	522.36	7.67	9.90	8.84
Total	80.07	142.74	93.97	194.10	314.46	229.56	8.38	7.94	8.45

Source : Calculated from NSS 50th and 61st round survey on consumption expenditure

In the table-4.6 the growths of rise in electricity expenditure have also been calculated for both the rural and urban areas separately. In rural area the growths are higher in all the quintiles compared to all urban quintiles except top most quintile. This shows high increased in expenditure on electricity in rural areas compared to urban areas. But within rural areas the growth is declining from bottom quintile to top which clearly showing the heavy burden on lower quintile compared to top quintiles. On the other hand within urban area the growth of electricity expenditure has reverse trend means the higher burden on top quintile compared to bottom quintiles. As already discussed earlier that bottom quintile is representing poor and top quintile representing rich so it can be confirmed that the in rural areas the burden has increased heavily among poor compared to rich on the other hand reverse is true for urban area. So it can be concluded from this analysis that the reform marginally favoured to rich in rural area and to poor in urban area.

4.5 Measuring Inequality in Access to and Affordability of Electricity

For a long time literature on measuring inequality have evolved specially in the area of income and health. Here the aim is to measure the inequality of access to and affordability of electricity among people of different economic status. This is being done here with the objective of examining the impact of reform. A variety of measures of inequality may be used to measure inequalities in access to and

affordability of electricity. Wagstaff (1991) argued that an index of inequality should satisfy the following three basic requirements[6] (1) it should reflect the socio-economic dimensions of inequalities. (2) It should reflect the experience of the entire population; and (3) it should be sensitive to changes in the distribution of the population across socio-economic groups. Most of measures fail to satisfy the all three requirements. The only two indices that satisfy all the three criteria are the relative index of inequality and the concentration index[7]. The added advantages of using concentration index are (1) it is related to relative index of inequality (Pamuk 1985); (2) it has more immediate visual appeal; (3) if it is estimated using regression method analysis, standard errors can be computed, based on which statistical tests can also be conducted to check of dominance relationship; and (4) it has a firm grounding in the literature on income distribution.

4.5.1 Inequality in Access to Electricity:

Here the population have been divided according to the economic status in N groups (quintiles) and ranks have been awarded. Then estimates of population having access to electricity for whole as well as for each quintile calculated separately.

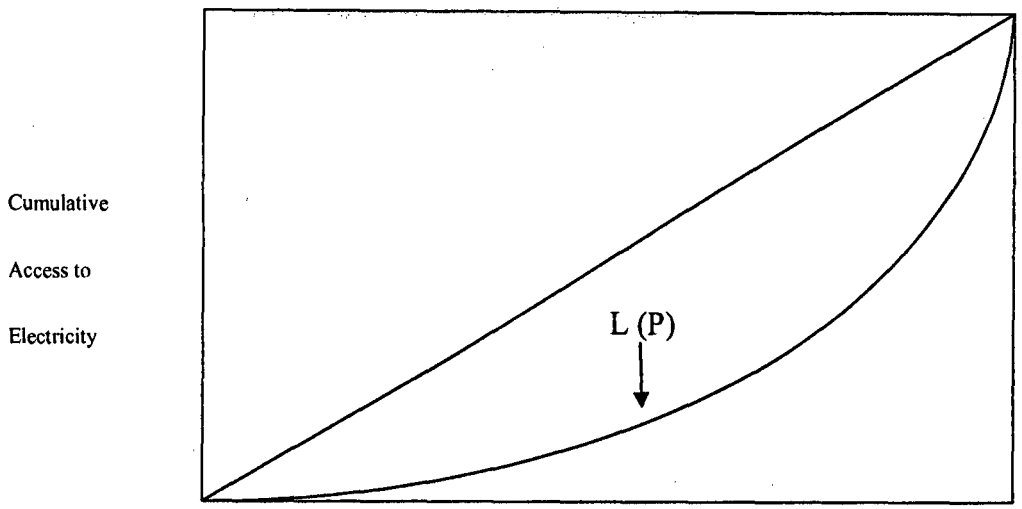
The concentration curve (L(P), shows the cumulative proportion of people having access to electricity by individuals against the cumulative proportion of population ranked by economic status beginning with poorest (Figure 4.1). Unlike Lorenz curve, variables under consideration is not ranked rather distribution of access to electricity across the population grouped by economic status has taken. If L (P) coincides with the diagonal, all groups irrespective of their economic status show same level of access to electricity. If L (P) lies above the diagonal, inequalities in access favours the poor and in such cases it is called inequality pro-poor. If L (P) lies below the diagonal, the distribution of access to electricity in pro-rich. The farther the L (P) lies from the

[6] Measures like Gini coefficient and index of dissimilarity used by Pappas et al (1993) fail to distinguish between a situation where the sickest members of the society are millionaires and where they are the very poor when examining health inequality. Similar cases generally does not arise in electricity consumption but never the less these properties are desired even in case of access to electricity and more so in case of burden of expenditure on electricity.

[7] For further information regarding concentration index see Wagstaff Adam, Pierella Paci and Edy Van Doorslaer (1991), "On the Measurement of Inequality in Health", *Social Science and Medicine*, Vol. - 33, No. 5, pp. 545-557

diagonal, the greater the degree of inequality in access to electricity across economic status.

Figure 4.1: Concentration Curve of Access to Electricity



If the concentration curves of two states A and B lies below the diagonal and concentration curve of state A lies everywhere above the concentration curve of state B, then state A's concentration curve dominates that of state B. It seems reasonable to conclude that there is less inequality in access electricity in state A than in state B.

When the concentration curves intersect each other, there is need to have a single measure to check their dominance, concentration index (CI) is used for that purpose. It is defined as twice the area between L (P) and the diagonal. CI is zero when L (P) coincides with the diagonal, negative when L (P) lies above the diagonal and positive when L (P) lies below the diagonal. In general, with N economic groups, CI can be expressed as

$$CI = \frac{2}{h} \sum_{n=1}^{N} p_n \, h_n \, Rn - 1$$

$$Rn = \sum_{i=1}^{n-1} p_i + p_n$$

$$h = \sum_{n=1}^{N} p_n \, hn$$

Where, h = average access to electricity of households, p_n = proportion of n^{th} group population in total population; h_n = Access to electricity of households in the n^{th} group, R_n = Relative rank of the n^{th} group; Where n = 1... N. The value of CI can range from minus one to plus one i.e. $-1 \leq CI \leq 1$.

Based on the above method, concentration index of access to electricity for Haryana for the year 1993-94 and 2004-05 have been Calculated. Table 4.7 represents the value of concentration index of access to electricity.

Table 4.7 : Concentration Index for Access to Electricity for 1993-94 and 2004-05

Sectors	Rural		Urban		Total	
Years	1993-94	2004-05	1993-94	2004-05	1993-94	2004-05
Haryana	0.52	0.55	0.49	0.56	0.51	0.55

Source: Calculated from NSS 50th and 61st round survey on consumption expenditure

Here the values of concentration index have increased for both rural and urban areas in 2004-05, but the increase is higher in urban area compared to rural area. This shows only marginal variation in access to electricity in rural area compared to urban area. In urban areas the value got changed from 0.49 in 1993-94 to 0.56 in 2004-05 which is a clear-cut justification of high variation among economic groups in urban areas. Variation in household total consumption expenditure had already seen in table-4.2 that the total consumption expenditure decreased in bottom quintile and high variation in accessibility exists in urban area. This expresses that the inequality has increased among urban poor in terms of accessibility compared to rural poor. So the policy of government of providing new connections or increasing access has favoured marginally to rural poor compared to urban poor. For the visual clarity the figures 4.2.1 to 4.2.3 can be looked.

Figure 4.2 Concentration curves for access to electricity

Figure-4.2.1 Rural Haryana

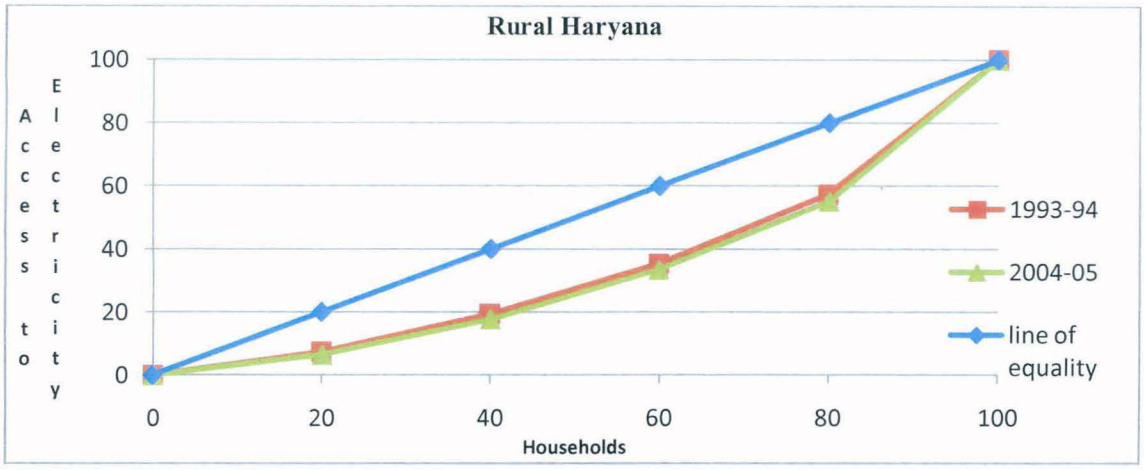


Figure- 4.2.2 Urban Haryana

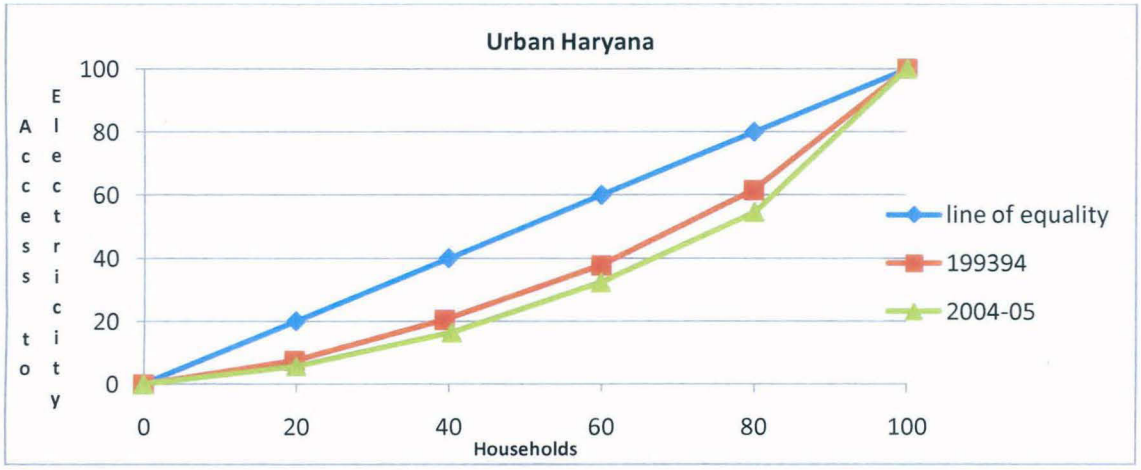
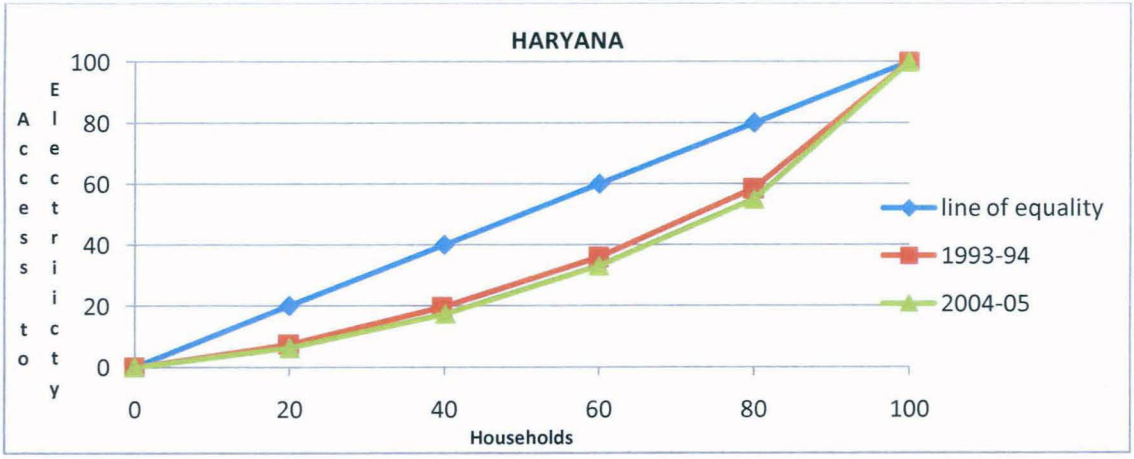


Figure- 4.2.3 Haryana



4.5.2 Inequality in Affordability of Electricity

Similar method has been used for calculating the concentration index of affordability of electricity.

$$CI = \frac{2}{h} \sum_{n=1}^{N} p_n \, h_n \, Rn - 1$$

$$Rn = \sum_{i=1}^{n-1} p_i + p_n$$

$$h = \sum_{n=1}^{N} p_n \, hn$$

Where, h = Average affordability of electricity to households, p_n = proportion of n^{th} group population in total population; h_n = Affordability of electricity to households in the n^{th} group, R_n = Relative rank of the n^{th} group; Where n = 1... N.

Based on this method, Table 4.8 gives the concentration index of affordability of electricity.

Table 4.8 : Concentration Index for expenditure on electricity for 1994-94 and 2004-05

Sectors	Rural		Urban		Total	
Years	1993-94	2004-05	1993-94	2004-05	1993-94	2004-05
Haryana	0.56	0.52	0.54	0.63	0.55	0.56

Source : Calculated from NSS 50th and 61st round survey on consumption expenditure

Here expenditure on electricity by households is taken as proxy for affordability. It is important to note here that the CI has been calculated by using the average expenditure on electricity by those households who have access to electricity (given in table 4.6). The interpretation of the CI in the case of electricity expenditure is slightly unusual. Here, decline in the value of CI would mean that burden of electricity expenditure on poor households are increasing and on rich the burden of electricity is decreasing which can be taken as a worse off rather than better off. Therefore higher the value of CI, lower will be burden of electricity expenditure on poor. Concentration curves have been also drawn to see the visual clarity. Y-axis in concentration curve

shows the cumulative share of expenditure on electricity while X-axis represents the cumulative population percentage.

The value of CI for rural Haryana has decreased from 0.56 to 0.52 which shows an increase in inequality in rural area. This decreased value explains that poor in rural areas suffered more compared to rich. But in case of urban Haryana a different picture appears the value of CI has increased here from 0.54 to 0.63 which shows an increase in inequality in rich households compared to poor households, as already given in table 4.6 that growth of electricity consumption was highest among rich in urban area. So it can clearly analyse in terms of affordability of electricity that the effect of prices rise was worse in rural areas compared to urban areas. The rise in prices favoured urban poor compared to rural poor. Further for visual clarity the figures 4.3.1 to 4.3.3 can be looked.

Figure 4.3 Concentration Curves for Expenditure on Electricity

Figure 4.3.1 Rural Haryana

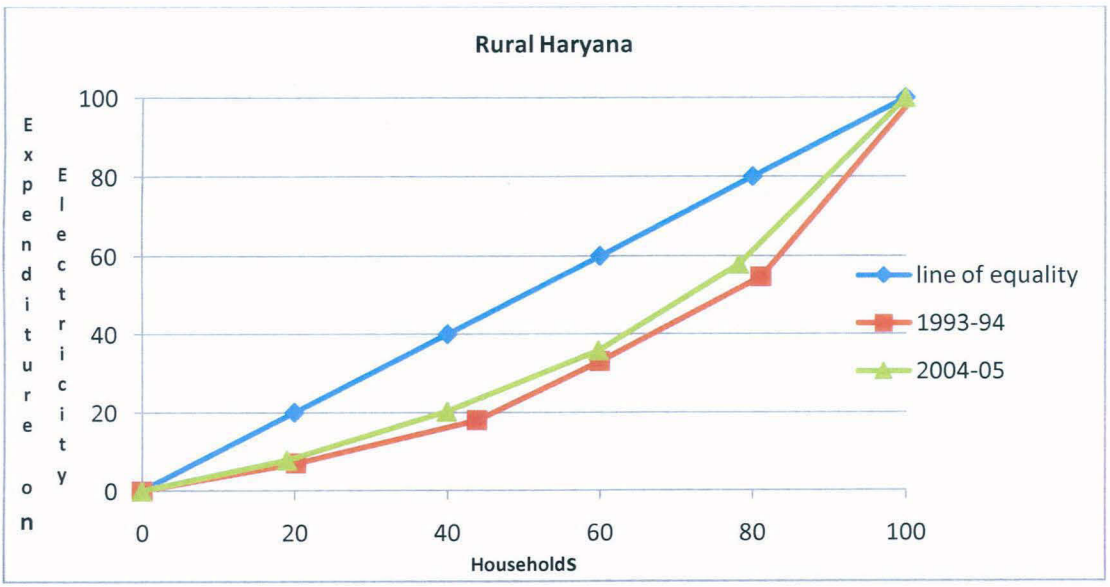


Figure 4.3.2 Urban Haryana

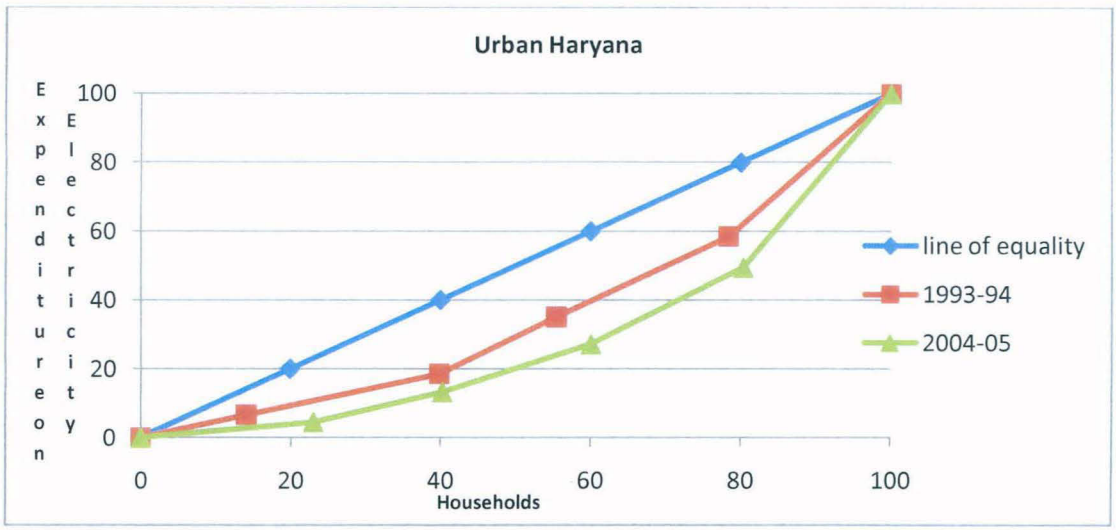
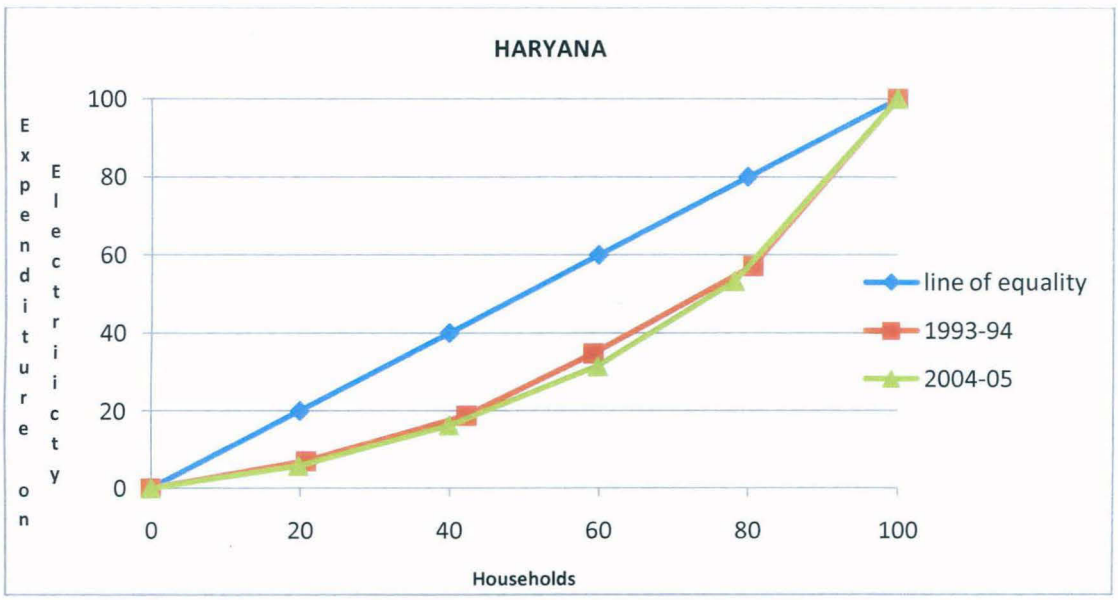


Figure 4.3.3 Haryana



4.6 Conclusion

From the above analysis the impact of reforms on household consumers, it can be summarised that the burden of rise in electricity prices has influenced both the rural and urban household consumers but with different intensities.

In terms of access rate the rural areas got more benefit compared to urban area. Within rural area the inequality in access has increased among rural rich compared to rural poor, means rural poor got more benefit compared to rural rich. And within urban area inequality in access has increased among urban poor compared to urban rich, means the urban rich got benefit at the cost of urban poor. In terms of affordability the burden of rise in prices of electricity has increased more in rural area compared to urban area. Within rural area the burden of rise in prices of electricity has increased more on poor compared to rich which shows that rural poor suffered more compared to rural rich. In urban area the reverse trend can be seen, here the burden has increased more on rich compared to poor means rich suffered more compared to poor in urban area. The inequality in terms of affordability has increased among rural poor compared to urban poor.

So it can be concluded that the impact of reforms on household consumers was not favourable as it was hoped, the reform favoured marginally to urban poor compared to rural poor and opposite in case of rich consumers.

CHAPTER V

SUMMARY & CONCLUSION

CHAPTER-5

SUMMARY & CONCLUSION

India launched its policy of electricity reforms in 1990 with a view to overcoming huge shortage in the availability of power and to improve the financial health of the utilities, which caused great drain to the state resources. In the pre-reform period, India's electricity-supply industry was mainly owned and operated by the public sector. The power sector was totally state owned and suffered from problems like low efficiency, shortages (imbalance between demand and supply of power), enormous T & D losses, pervasive theft and many more other major drawbacks. It resulted in huge transaction cost for the economy. India's power sector, henceforth, was opened with much fanfare for the private sector in early nineties.

Haryana is one of the pioneering states in India to initiate power sector reforms in 1998 just after Orissa. This study makes an attempt to analyse the current performance of the Haryana power sector after the reforms. Introduction of competition in the power sector that was to result in correction of distortions in tariffs was one of the objectives of the reform process. To introduce competition it was necessary to unbundle vertically integrated structure of the power industry. The review of literature discussed in chapter 1 & 2 on the justification and rational shows that the purposes of initiating these reforms were different for developed countries like USA & Europe and for developing countries like India. In the developed economies especially in the European Union and the USA motive of unbundling or restructuring was to enhance competition so that efficiency gains arising from it can be realised. Driving force for restructuring of power sector in developing countries was mostly to accommodate private capital to ease the financial burden of the government. Introducing competition was always a secondary objective and India was no exception to this. Power sector in India since 1990's was facing huge financial losses due to inefficiency and cross subsidisation of power. The restructuring of power sector in India was largely promoted by the donor agencies. In the state of Haryana, the World Bank promoted the model where vertically integrated monopoly structure of Haryana State Electricity Board (HSEB) was transformed into separate

monopolies for each segment through unbundling all segments, i.e., Generation, Transformation and Distribution.

Chapter-2 discusses the problems and objectives of reform in Haryana power industry. The power sector in Haryana suffered from huge physical and financial losses in terms of infrastructural and financial bottlenecks. One of the main objectives of the reform process in Haryana was to increase private capital, thereby resulting in improvement in financial condition. Along with it, the resultant structural changes were to lead to improvement of physical condition of the Haryana power industry. To attain these objectives, Haryana State Electricity Board was restructured in to three different entities for generation, transmission and distribution separately just after the reforms in 1998. Haryana opted for single buyer model following the footsteps of Orissa. Difference in reform process opted in Haryana and other states as shown in chapter-2 is that Haryana removed all the subsidies from domestic sector after reforms and shifted from single buyer model to multi-buyer model in 2008. But still Haryana is one of the unbundled states that have more than 60 % unmetered supply for agricultural sector which is creating problems in cost recovery.

Chapter-3 observes the physical and financial performance of the power sector in Haryana before and after the reform process in absolute terms. It reveals that before the reform process Haryana had high physical and financial losses in its power sector due to both demand and supply constraints. The main factors contributing to Physical losses were, high T&D losses, very low installed capacity, and low gross generation of electricity, low plant factor, low plant availability, low labour productivity and many more. Reduction of these losses was the primary objective of reforms. In terms of financial losses also the conditions was very pathetic; commercial losses with and without subsidy were very high, low cost recovery and high subsidy to domestic and agricultural sectors was one of the major factors attributing to financial losses.

The performance of the power industry of Haryana in aggregate has not improved much but there is some structural change as observed in chapter-3. The performance of generation sector has improved, T&D losses have decreased, plant load factor and other physical parameters have improved compared to pre-reform phase as shown in chapter-3. In comparison to all India and other unbundled states the performance of Haryana power industry has still not improved. The physical growth of Haryana

power industry is very low in post reform phase compared to all India and other reformed states. Financial performance is also far from the expected target compared to other reformed states like Andhra Pradesh, Karnataka and Orissa. Low cost recoveries from agriculture sector, high commercial losses, and high subsidy to agriculture sector are still the major constraints.

So it can be concluded on the basis of chapter-3 that there is only absolute improvement in the Haryana power supply in physical terms, relatively there is still a road ahead to accomplish. The efficiency issue still remains unresolved, even after a decade of the reforms the unbundled entities are working inefficiently. Agricultural sector still occupies a large part of the investment through the mode of subsidies. Power tariffs have been reduced further for agricultural sector which is an increase in financial burden on the power industry and on other consumers of different categories especially on domestic sector which are getting unsubsidised power supply after the reforms. The domestic sector is the only sector in Haryana which has highest tariff growth during the reform era compared to other states as well as within Haryana among different sectors.

As observed in chapter-3 that the physical and financial position of the Haryana power sector has not improved much after the reform process. The financial condition deteriorated due to low cost recoveries and high subsidy to agriculture sector even after reform process. The domestic sector faces the highest tariff growth during reform era, which has a negative impact on household consumers which we have seen here through chapter-4. In the chapter we tried to analyse the impact of power sector reforms on household consumers through parameters such as, access to electricity and affordability or burden of rise in prices of electricity on household consumers. Access is defined as the capability of getting the new connections and Affordability is the capability to purchase power after getting the connections. The result shows that there is an overall improvement in access rate implying that the new connections have increased both in rural as well as in urban areas. However, it can be inferred that between rural and urban households the benefit has reached maximum to the rural consumers and within rural area the benefit reached to the rural poor in comparison to rural rich. This means the poor households got benefits in comparison to rich households in rural areas. Contrary to it, in the urban areas the urban rich got benefit

compared to urban poor. *So it can be concluded for access of electricity that the reform policy was pro poor in rural area and pro rich in urban area.*

In terms of burden of electricity which has been measured through rise in prices of electricity after the reforms, however, depicts a different trend. Overall burden has increased on household consumers in post-reform period. But in relative terms the burden has increased very drastically for rural households compared to urban households. Within the rural area the burden has increased much more among the poor compared to the rich. The rural poor have suffered maximum due to rise in prices. In urban area reverse trend exists, here the burden among rich has increased compared to poor. So it can be observed that there is a negative impact of reforms in terms of burden of rise in prices of electricity on the rural poor and urban rich households in Haryana.

So, it can be concluded from chapter-4 that after the power sector reform the access rate has increased in rural area mostly among rural poor compared to urban poor, but side by side the burden of rise in electricity prices has also increased on rural poor compared to urban poor. So the reform policy which seems pro-poor in rural area in terms of access is actually pro-rich in terms of affordability. So the overall effect of reforms on household consumers was relatively biased against the rural poor.

Some of the policy implications that emerge from the study are:

As discussed in chapter-2 that power sector reform aimed in Haryana to restore the financial viability of public utilities by the involvement of private players in the generation and distribution segment but till today there is negligible involvement of private sector. Financial losses are still very high, so there is need to involve private capital to remove this bottleneck. Subsidy for agriculture sector, and political influence on tariff control should be reduced, so that the private sector can come forward to participate in both generation and distribution segments. Metering of agricultural consumers should be done properly to improve the financial position of the power sector. Labour productivity should increase. As the issue of affordability of electricity arises in Haryana for household consumers, the policy makers should keep in mind this issue with every policy formation.

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APPENDIX

Appendix

Table 4A.1 : Monthly average household total consumption expenditure (HMCE) and their coefficient of variation

	Households with Access to Electricity						Households without Access to Electricity					
	Rural		Urban		Total		Rural		Urban		Total	
Quintile	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
	Haryana 1993-94						Haryana 1993-94					
1	1546.63	0.25	1820.24	0.29	1614.08	0.26	1073.02	0.27	1050.66	0.31	1067.51	0.28
2	2518.37	0.08	3197.50	0.08	2685.77	0.08	1652.32	0.06	1819.50	0.07	1693.53	0.06
3	3355.78	0.09	4215.19	0.08	3567.62	0.09	2120.39	0.08	2459.71	0.09	2204.03	0.08
4	4600.40	0.10	5764.75	0.11	4887.41	0.10	2702.27	0.08	3418.20	0.10	2878.75	0.09
5	8956.84	0.77	9299.57	0.29	9041.32	0.65	4905.11	0.34	5252.26	0.28	4990.68	0.32
Total	4193.39	0.96	4857.10	0.59	4356.99	0.87	2485.34	0.61	2794.35	0.57	2561.51	0.60
	Haryana 2004-05						Haryana 2004-05					
1	1508.31	0.31	1497.83	0.24	1505.27	0.29	994.35	0.20	969.53	0.20	987.15	0.20
2	2629.42	0.09	2803.79	0.14	2679.99	0.10	1633.24	0.13	1411.72	0.12	1569.00	0.13
3	3650.05	0.09	4106.65	0.09	3782.46	0.09	2144.09	0.05	1919.54	0.10	2078.97	0.07
4	5038.50	0.10	5801.08	0.12	5259.65	0.11	2703.97	0.07	2592.72	0.07	2671.71	0.07
5	10414.01	0.51	11823.38	0.83	10822.73	0.61	4237.84	0.35	3791.26	0.22	4108.33	0.31
Total	4647.77	0.85	5202.70	1.09	4808.70	0.92	2344.97	0.56	2147.19	0.49	2287.62	0.54

Source : calculated from NSS 50th and 61st round survey on consumption expenditure

Table 4A.2: Average expenditure on electricity by households and their coefficient of variations.

	Households with and without Access to Electricity						Households with Access to Electricity					
	Rural		Urban		Total		Rural		Urban		Total	
Quintile	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
	Haryana 1993-94						Haryana 1993-94					
1	0.12	8.42	4.44	2.37	1.19	6.93	28.11	0.28	45.5	0.27	32.46	0.28
2	22.46	0.22	59.61	0.15	31.62	0.20	44.12	0.07	81.26	0.16	53.28	0.09
3	44.76	0.16	90.31	0.11	55.99	0.15	60.38	0.13	112.97	0.04	73.34	0.11
4	75.38	0.14	134.59	0.16	89.97	0.14	86.26	0.07	159.4	0.11	104.29	0.08
5	162.75	0.51	263.49	0.35	187.58	0.47	181.38	0.49	283.29	0.32	206.5	0.45
Total	58.86	1.14	119.93	0.84	73.92	1.06	80.07	0.81	142.74	0.65	93.97	0.77
	Haryana 2004-05						Haryana 2004-05					
1	13.43	1.55	45.07	0.67	22.60	1.29	76.43	0.30	72.11	0.31	75.18	0.31
2	89.60	0.17	124.59	0.17	99.75	0.17	120.21	0.06	137.95	0.13	125.37	0.08
3	123.65	0.04	217.99	0.13	151.01	0.07	152.88	0.07	220.53	0.12	171.87	0.08
4	170.45	0.13	346.30	0.15	221.45	0.14	213.3	0.11	351.13	0.16	253.05	0.13
5	386.72	0.56	784.94	0.51	502.20	0.55	408.85	0.51	800.25	0.50	522.36	0.51
Total	164.97	1.00	298.05	1.07	203.57	1.02	194.10	0.85	314.46	1.01	229.56	0.90

Source : Calculated from NSS 50th and 61st round survey on consumption expenditure