CHAPTER I

INTRODUCTION

Background

Electricity is considered to be the most convenient and versatile form of energy. It is classified as a secondary source of energy because anyone of the primary sources like coal, gas, petroleum, hydro-power, wind and solar energies may be used to produce electricity. Due to its more adaptable nature, it is a preferred source of energy at the consumer ends. However, energy being a scarce and valuable resource, great emphasis is laid on its optimal use. Given the characteristics of non-storable nature, requirement of continuous connection between suppliers and consumers and economies of scale, the electricity supply industry was treated as a natural monopoly, all over the world.

This Chapter is divided into four sections. Section I.1 presents an overview of the power sector in India. A source wise break up of the installed generating capacity is given. In the Section I.2, developments in the legislative initiates have been highlighted. Sections I.3 gives an update on the electricity reforms initiated in various states. In the Section I.4, the objectives, methodology, limitations of the study have been discussed.
I.1: Overview of Power Sector in India

The development of power sector was a high priority area for the overall rapid development of the economy after India’s independence. Adequate financial support was provided to boost up the power sector. Power was listed as a concurrent subject in the Constitution of India. It implies that Centre as well as State Governments have jurisdiction to make rules/laws to govern the power sector. During the British period, Electricity Act 1910 was enacted to regulate the electric power sector. After independence, Electricity (Supply) Act 1948 was enacted to reshape the power industry in the public sector. It provided for the constitution of Central Electricity Authority (CEA) at the Central level and State Electricity Boards (SEBs) at State levels. The CEA was made responsible for overall coordination and planning of the power sector. The State Electricity Boards were constituted to operate the generation, transmission and distribution activities at state level. That structure remained in place till implementation of New Economic Policy in 1991. In the Mid 1990s, power sector reforms were initiated as a part of new economic reforms. A major milestone in power sector reforms was the enactment of the Electricity Act 2003. This Act opened new avenues for the power sector to create a competitive environment in the Electricity Supply Industry.
Since independence, power sector was dominated by publicly owned undertakings. The generation capacity was owned and operated by public sector utilities—either by SEBs or by Central Power Undertaking (CPUs) such as National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), etc. Before 1990s, the share of private sector participation was negligible in the generation segment. However, after the initiation of new economic reforms process in early 1990s, the share of private sector in the total installed generating capacity has increased significantly. The ownership wise details of the generating capacity are presented in the Table 1.1.

**Table 1.1: Total Installed Generating Capacity in the Country**

<table>
<thead>
<tr>
<th>Sector</th>
<th>MW</th>
<th>Relative share</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Sector</td>
<td>86,275</td>
<td>42</td>
</tr>
<tr>
<td>Central Sector</td>
<td>62,074</td>
<td>30</td>
</tr>
<tr>
<td>Private Sector</td>
<td>56,991</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,05,340</td>
<td>100</td>
</tr>
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</table>

Source: Website, Ministry of Power, [www.powermin.nic.in](http://www.powermin.nic.in) (visited on 04.08.2012)

It is given in the Table 1.1 that out of the total 2,05,340 MW generation capacity 42% generating capacity was owned by the state power undertakings as on March 31, 2012. The share of Central Power Undertaking was 30% in the total installed capacity. Currently (FY June 2012), the share
of private sector was reported to be 28% of the total installed generation capacity.

Recently due to increasing global warming concerns, the focus on developing the clean sources of energy have increased. Taking the environmental concerns into account, the share of green energy such as small hydro, wind power, solar energy, bio-mass etc. needs to be increased. However, among the various fuel sources, the share of thermal power generating capacity is the highest. It is 66% of the total generating capacity available in the country. Then, hydropower is the second largest source of electricity generation. It accounts for 19% of the total generation capacity. The share of renewable energy has increased rapidly in the recent time (Table 1.2).

Table 1.2: Share of Different Fuel Sources in total generating capacity
(as on June 30, 2012)

<table>
<thead>
<tr>
<th>Fuel Source</th>
<th>Capacity (MW)</th>
<th>Percentage in Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Thermal (i+ii+iii)</td>
<td>1,36,436</td>
<td>66%</td>
</tr>
<tr>
<td>i) Coal</td>
<td>1,16,333</td>
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<tr>
<td>ii) Gas</td>
<td>18,903</td>
<td>9%</td>
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<tr>
<td>iii) Oil</td>
<td>1,200</td>
<td>1%</td>
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<tr>
<td>B. Hydropower</td>
<td>39,291</td>
<td>19%</td>
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<tr>
<td>C. Renewable</td>
<td>24,833</td>
<td>12%</td>
</tr>
<tr>
<td>D. Nuclear</td>
<td>4,780</td>
<td>2%</td>
</tr>
<tr>
<td>Total</td>
<td>2,05,340</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: Ministry of Power Website (visited on 04.08.2012)
It may be noted that Ministry of Non-Conventional Energy Sources (MNES) was renamed as Ministry of New and Renewable Energy (MNRE) in 2006. The main objective for this restructuring was to boost up the renewable energy generation in the country. The Ministry for New and Renewable Energy (MNRE) has taken a number of initiatives in this regard. The major focus areas of the MNRE are specified as:

- Develop, demonstrate and commercialize technologies for harnessing new and renewable energy sources in close coordination with corporate, scientific and technical institutions.
- Replace use of different fossil fuels wherever possible, and increase access to electricity/ lighting in remote and rural areas, through Renewable Energy Systems (RES).
- Increase the contribution of Renewable Energy in the total energy mix of the country to 6 per cent by 2022, with about 10 per cent contribution to total electricity generation in the country.

As a result of the initiatives taken on part of Central as well as State Governments, the renewable power generation capacity has increased significantly and the current relative share is about 11% in the total installed
capacity. The fuel mix of total generating capacity available is also given in the Figure 1.1.

![Figure 1.1: Relative Share of Various Sources in Generating Capacity (2,05,340 MW)](image)

Source: Ministry of Power, Website (visited on June 30, 2012)

During the development process, there was a significant progress in increasing the installed generating capacity in the country. The per capita consumption of electricity has increased from 50 Kwh in 1950-51 to 749 Kwh in 2009-10. Similarly, rapid progress has been achieved in completing rural electrification. Some of the states achieved the target of complete electrification in the decade of 1970s. For example, Haryana State was the first to ensure 100% rural electrification in 1976.

Over time, electricity supply industry was governed by various statutes and policy guidelines. According to the requirement, statutes were
enacted and amended from time to time. The main objective of the next section is to review the changes in various policies in the operation and management of power sector over time.

**I.2 Historical Background of the Legislative Initiatives**

The first generating station in the country was commissioned in Kolkata (erstwhile Calcutta) on 17 April, 1899. It was the beginning of thermal power generation in India. The electrification of Calcutta took place seventeen years after New York, which boasted of electricity in 1882 and eleven years after London, which was electrified in 1888. Surprisingly, in Calcutta the initial per unit rate of power was Rupee one, the price being the same as in London during that time (Website, Calcutta Electricity Supply Corporation, cited on 01.07.2012).

From times to times, the power sector in India has been governed by the various statutes. The Electricity Supply (ESI) Industry has gone through different phases after independence. An overview of the different phases of the ESI in India is presented in the Box 1.1. The ESI was governed by the following states from time to time:

1. The Indian Electricity Act, 1910
2. The Electricity (Supply) Act, 1948
3. The Electricity Regulatory Commission Act, 1998
4. The Electricity Act 2003
A brief historical prospective of various statutes is presented below:

**Box 1.1: Different Phases of Power Sector Restructuring in India**

**Phase. I: (1950s & 60s - Era of State Patronage)**
- Enactment of Electricity (Supply) Act, 1948
- Establishment of State Electricity Boards (SEBs) in an integrated system to generate, transmit and distribute power at the state level
- Predominantly state ownership of electricity utilities
- Professional management of SEBs and establishment of Bharat Heavy Electricals Limited (BHEL)

**Phase. II: (1970s & 80s - Era of Subsidization and Populist Policies)**
- SEBs started giving electricity at a flat rate to the agriculture sector in 1980s
- Non-metering of agricultural consumption started and it helped the respective SEBs to conceal the theft of power and T & D losses by overestimating the agricultural consumption
- Deterioration of the pricing policy being followed by SEBs
- Establishment of Central sector generation companies like NTPC, NHPC, etc.

**Phase. III: (1990s - Era of Liberalization)**
- Increasing the role of Central Government and International Financial Institutions in the sectoral policies
- Stage. I (early 90s): Focus on generation through private sector - IPP policy which proved to be counter productive due to poorly negotiated contracts (High capital cost, unfair incentives, wrong fuel choice etc)
- Stage. II (mid 90s) : Focus on restructuring of SEBs and introduction of Electricity Regulatory Commissions (ERCs) such as Orissa model
- Stage. III (late 90s): Enactment of Electricity Regulation Act, 1998, creating the Central Regulatory Commission and providing legal framework for constituting State level ERCs

**Phase. IV: (2003 till date - Era of Far Reaching Changes)**
- The number and reach of policy changes introduced were unprecedented
- Consolidation of increased role of Central Government on sectoral policies
- Enactment of Electricity Act, 2003
- Restructuring of SEBs, de licensing of generation, open access and competition in distribution, cost reflective tariffs, limiting cross subsidies etc., are the implications of the Electricity Act 2003

*Source: Pani, B. Saranga et. al. (2007) Power Sector Reforms in Andhra Pradesh: Their Impact and Policy Gaps, Centre for Economic and Social Studies, Hyderabad (AP)*
The Indian Electricity Act, 1910

It was the first statute that formalized the electricity supply industry mainly operated in the private ownership in the country. After the initiation of generation activity in the country, it was appreciated that some statute should be introduced to govern the power sector. Basically, the Act provided the basic framework for electric supply industry in India. It targeted the growth of the sector by promoting licensees. The responsibility of issuing licence was assigned to the provincial governments. It laid down the provisions for licence for supply of electricity in a specified area and laying down of wires and other related works. It also specified the provisions for defining the relationship between licensee and consumers. Under the provisions of the Indian Electricity Act 1910, the licenses were issued to private the firms to operate the business in urban areas such as Calcutta (now Kolkata), Bombay (now Mumbai), Ahmadabad etc.

The Electricity (Supply) Act, 1948

After independence, the development of power sector was identified as a priority area to facilitate the rapid industrialization in the country. Like other heavy and large scale industries, the operation of power sector was kept in public sector. It was anticipated that only public sector can fulfill the increasing investment requirements of power sector. Therefore, The Indian
Electricity Act 1910 seemed to be out dated. The Electricity (Supply) Act 1948 mainly focused on the development of power sector in the public sector.

The Electricity (Supply) Act 1948 mandated creation of State Electricity Boards (SEBs) to discharge the generation, transmission and distribution activities at the state levels. It also provided for the constitution of Central Electricity Authority (CEA) to coordinate the development and planning of power sector at the central level. Another important responsibility of SEBs was to speed up the rural electrification programme.

Till the initiation of new Economic Policy in early 1990s, power sector was governed by the provisions of the Electricity (Supply) Act 1948. However, some amendments were made in the Act as per requirement. For example, in mid 70s, it was realised that the capacity addition targets achieved by the SEBs were not adequate to fulfill the increasing demand for electricity. Therefore, it was decided to create some agencies at the Central level to start the power generation. Accordingly, amendment was made in 1975 to enable generation in Central sector Consequently, National Thermal Power Corporation (NTPC) and National Hydro Power Corporation (NHPC) were constituted as statutory bodies to build and operate the power generation plants.
In 1980s, the SEBs were not financially viable, one important amendment was incorporated in the Electricity (Supply) Act 1948. The amendment was made in 1985 to ensure commercial viability in the functioning of SEBs. Section 59 of the Act was amended to make the earning of a minimum return of 3% on fixed assets a statutory requirement. This amendment allowed SEBs to operate maintaining commercial principles. When the New Economic Policy of 1991 was implemented, it opened the way for private participation in the generation business. Therefore, the Electricity Supply Act 1948 played an important role in providing the current shape to the industry.

However, after the implementation of New Economic Policy in 1991, power sector was opened for private sector participation. At the same time it was advocated that there was a need to depoliticize the decision-making process in power sector in order to attract adequate private sector investment. There was a need to initiate the regulatory reforms in the power sector. So, the Electricity Regulatory Commission Act 1998 was enforced to initiate the regulatory reforms at the Central as well as State levels.

**The Electricity Regulatory Commission Act, 1998**

It was the first power reforms Act initiated at the Central level. However, by the time the Electricity Regulatory Commission Act 1998 was
notified, some of the states had already passed their own state level power reforms Acts. For example, Orissa was reported as the first state of the country undertaking power sector reforms at the state level. After Orissa, Government of Haryana initiated the reforms in the power sector. Haryana Electricity Reforms Act 1998 was enforced by Government of Haryana to start up the reforms process at the State level. The Central Electricity Regulatory Commission Act 1998 and the State Reforms Acts mainly provided for the constitution of the independent Electricity Regulatory Commissions (ERCs) at the central as well as state levels to regulate the generation, transmission and distribution business. It also provided for the unbundling of the integrated SEBs into separate generation, transmission and distribution entities. The tariff-making job was assigned to respective ERC so that the process is depoliticized. It was assumed that tariff should be fixed on the basis of economic factors. Undue political interferences affecting the decision making process in the power sector needs to be plugged.

Though, the Electricity Regulatory Commission Act 1998 provided for the unbundling of SEBs and establishment of the Electricity Regulatory Commissions (ERCs), however, it did not provide any major focus on the competition and market issues in the electricity sector. Later, it was argued
that competition is feasible even in the power sector, which was regarded as one of the best examples of natural monopoly. After a long discussion with various stake-holders such as State Governments, Power Utilities, investors, consumers’ organizations, a detailed roadmap of power sector reforms was drafted by the National Council for Applied Economic Research (NCAER), New Delhi. This road map was then converted into a draft bill namely Electricity Bill 2001. After the approval of Parliament, this bill finally enacted as the Electricity Act 2003.

**The Electricity Act 2003**

The Electricity Act 2003 can be seen as a major milestone in the development of electricity industry in the country. This Act targeted a complete restructuring of integrated power industry. This Act has repealed all the above mentioned central Acts namely (i) The Indian Electricity Act, 1910 (ii) The Electricity (Supply) Act, 1948 and (iii) The Electricity Regulatory Commission Act, 1998. The provisions of State Reforms Acts were saved under section 185 (3) of the Electricity Act 2003 subject to the condition that the provisions of the enactments were consistence with Electricity Act. Therefore, the Act targeted at creating a uniform structure of the power industry across the states to facilitate competition in the sector. The salient features of the Electricity Act 2003 are as follows:
The generation business except large hydropower is completely delicensed. No formal licence is required for initiating generation business including captive generation if the proposed plant fulfills the technical norms and standards as laid down by Central Electricity Authority (CEA). Hydro projects exceeding the capital cost notified by Central Government however, need concurrence of the CEA.

In the rural areas, not only the generation but also distribution of power was given some relaxation in the license conditions. Though, the Act empowers the ERCs to issue license for the distribution of power, however, no license is required for the generation and distribution of power in notified rural areas. The main objective of this provision is to promote the stand alone systems in the rural areas to boost up the non-renewable energy sources such as bio-mass, solar, wind power etc.

The State Governments are required to re-organise the respective power utilities. The integrated SEBs were supposed to be unbundled into separate generation, transmission and distribution companies to discharge the functions at state levels. No generation or distribution company is allowed to engage in the transmission business.

The Act provides for the constitution of independent regulatory agencies to regulate the power sector. At the central level, Central Electricity
Regulatory Commission (CERC) has been established to regulate the interstate generation and transmission business. State Electricity Regulatory Commissions (SERCs) have been constituted to regulate the generation, transmission and distribution activities at the state level.

The transmission business and load dispatch Centre are supposed to be independent of generation and distribution activities to ensure competitive neutrality of the business. Transmission utilities are established at the central (inter-state) as well as state level. There is also a provision for private licensees in transmission business. However, the load dispatch centres are supposed to be a public company so that no undue favor is extended to any distribution company.

For the first time, trading of electricity has been recognised as a distinct commercial activity. The Act allowed trading of power just like trading other commodities in the market. However, the Act provides some safeguards to protect the interest of consumers. The respective Regulatory Commissions are authorised to fix ceilings (upper limit) on trading margins if it was necessary according to respective Regulatory Commission.

As per provisions of the Act, to promote competition in power sector, open access to the transmission and distribution network is essential. The consumers having connected load above one Mega Watt (MW) are provided
a choice to select their distribution company. The consumers may enjoy open access to the transmission or distribution network after paying the wheeling and cross subsidy surcharges to the distribution company. The cross subsidy surcharges are levied to compensate the distribution companies. If a consumer belonging to a category generating surplus revenue is migrating to another supplier, the consumer would have to pay surcharge to the distribution company. That is why for the distribution companies are allowed to levy cross-subsidy charges.

The Act also provided for the establishment of Appellate Tribunal for Electricity to hear appeals against the decision of the electricity regulators. If any party such as a consumer or a utility is not satisfied with the decision of respective regulatory body, it can file an appeal before the tribunal against the order of the regulatory body.

The Act targets to ensure more accountability and transparency in the operation of the business. Earlier, poor metering was one of the major problems in the power sector. It specifies that all electricity supply needs to be metered. Moreover, there are strict provisions relating to theft of electricity. The theft of power has been defined as a non-bailable offence.

It is accepted that civil society organizations have a vital role to play in facilitating rural electrification. It provides that the role of these
institutions is very essential to complete the rural electrification programme and support the management in distribution of electricity at local level. The local civil society actors such as panchayats, cooperative societies, non-government organizations have a crucial role in implementing the various provisions of the Act.

**National Electricity Policy 2005**

National Electricity Policy was notified by the government of India in 2005. The policy targets to achieve universal access to power by the year 2012. It also specifies that shortage of power should be plugged at the earliest and power demand would be fully met by 2012.

The policy mentions that supply of reliable quality of power at reasonable rates is the priority area of power sector reforms. It requires the respective state governments to take steps to improve the quality of service.

Per capita consumption of power is an important indicator of the economic propriety of a country. So, the policy targets to increase the per capita consumption of electricity to 1000 units by 2012.

Electricity being an essential service, protection of consumers’ interest is also provided adequate focus in the policy. It requires that the consumers’ interest should be protected by respective regulatory commission. Moreover, it specifies that one unit of electricity (One Kwh)
should be available as minimum lifeline consumption should be available to each household on daily basis as a merit good.

There is a need to promote competition in the power sector at the generation and distribution levels. The role of private sector is also very important in promoting competition and bridging the investment gaps in the sector. However, commercial viability of the sector is a pre-requisite to attract the adequate private investment in the sector.

**Electricity Tariff Policy (2006)**

In consistent with the Electricity Act 2003 as well as National Electricity Policy, National Tariff policy (NTP) required elimination of cross-subsidisation in a time hound manner. The policy appreciates tariff rationalisation as a major task before the respective regulatory bodies constituted at the central as well as state levels. It advocates that the respective state government to pay the subsidy directly rather than bridging the revenue gap though cross-subsidization process. If subsidy is required on the basis on socio-economic grounds, only deserving consumers may be subsidised. However, the subsidy should be provided in a transparent and accountable manner so that the subsidy is not misused.

The policy assumes that existing cross subsidisation is unsustainable and needs to be eliminated. The electricity tariff should be based on the cost
of supply of electricity. For this purpose, respective ERC would prepare a roadmap to fix the tariff payable within ± 20% to the average cost of supplying power.

Tariff Policy addresses the issue of deteriorating position of ground water in various states of the country. It clearly mentions that the sustainability of the ground water is a very important issue and needs to be regulated properly. The policy also raises serious concerns over the free power supply as being provided by some of the states such as Punjab and Tamil Nadu. It states that excess use of groundwater adversely affects the water table. Free power supply leads to wasteful consumption of electricity and also affects the quality of service available to consumers.

The policy also targets ensuring universal metering at consumer ends to promote accountability in the system. The support of local stakeholders such as Panchayats, user associations may be taken to complete 100% metering at the Consumers, ends.
I.3 Current Status of Power Sector Reforms

Power sector restructuring process was initiated in early 1990s. The choice of restructuring was prompted by the poor technical as well as financial performance of the State Electricity Boards (SEBs). Consequently, the state electricity utilities were unable to generate any surplus revenue for making new investment in generation. Therefore, some initiatives were taken to promote the private sector participation in generation, transmission and distribution businesses. Since power is listed as a concurrent subject in the constitution of India, the reforms were undertaken at both the levels-centre as well as states. In the early 1990s some fast track projects were approved for private the generation of power. The Dabhol Project Company (DPC) in Maharashtra was approved to facilitate the private sector participation. This plant was installed on Build, Own and Operation (BOO) basis. Since its beginning this plant was questioned on several grounds. Moreover, many writ petitions in public interest were filed in Bombay High Courts as well as in Supreme Court against this project. A serious crisis was came out when DPC sent a bill to MSEB for power purchase @ Rs. 7.80/unit. The project was questioned openly at national as well as international platforms. Ultimately, the Government of Maharashtra had to constitute a committee to review the policy issues concerning this power
project. The committee was constituted under the chairmanship of Madhav Godbole. Some of the main findings of the committee are:-

- At that stage when the project was approved there was no need for such a large scale and costly power plant
- The negotiations were made in a hurry and without rationality.
- No transparency was ensured in making negotiations and agreement with DPC
- The project cost was very high and artificially inflated
- All types of risks such as fuel prices, exchange rate fluctuations were shifted on the Maharashtra State Electricity Board (MSEB)
- The money invested in the plant was sourced mainly from the domestic financial institutions. So, it was not a category of foreign investment.

In short, the project was criticised on several grounds by the committee. Some members of the committee also proposed for a judicial inquiry of the procedures and negotiations made in approving the project. Therefore, the DPC was not a good success in the power generation.

The second phase of restructuring started in the second half of 1990s. Drastic structural changes were made in the power sector. Some of the states such as Orissa and Haryana initiated restructuring process under the
supervision of World Bank. The Bank offered long term financing to the respective states government. More or less, the World Bank suggested almost the same model to all states initiating reforms. It included unbundling, corporatisation & privatisation of SEBs. Some states privatised the distribution businesses after making unbundling of the SEBs. These included Orissa and Delhi. While many other just initiated unbundling of SEBs. An update on the progress on the restructuring process in each of the states is given in the Table 1.3.

As it is shown in the Table 1.3, all the states have initiated structural reforms in the power sector. The reforms have been undertaken to address various problems in the power sector. The major problem in the sector include high energy losses, low recovery of dues, irrational tariff structure etc. Some of the states have initially undertaken the process at state level by initiating state level power reforms Acts such as Orissa, Andhra Pradesh, Haryana etc.. Some other states had undertaken restructuring under the Electricity Regulatory Commission Act 1998 enacted at the national level. Later, The Electricity Act 2003 was enacted to liberalise and privatisate the power utilities in a competitive manner in June 2003. The Electricity Act 2003 repealed all earlier Acts in the power sector.
Table 1.3: Status of Power Sector Reforms in Various States

(in March 2012)

<table>
<thead>
<tr>
<th>States</th>
<th>Reforms Initiated</th>
<th>ERC Constituted</th>
<th>Unbundling of SEB</th>
<th>Gen.</th>
<th>Trans.</th>
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<td>0</td>
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</tr>
<tr>
<td>North East</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

Source: Ministry of Power (www.powermin.nic.in) cited on 31.01.2012

1=Yes, 0=No

Therefore, in the light of above stated reforms initiatives undertaken across various states, it is worth to examine the impacts of power sector reforms on the financial health of the utilities as well as consumers. The reforms process has completed about one and half decades. So, it is high
time to study to what extent the reforms process was successful in the country.

Punjab is considered as one of the economically advanced states. The per capita income as well as per capita consumption of power in Punjab was one of the highest in the country during the FY 2009-10. In Punjab, the independent regulatory commission was established at the very early state of reforms in the country (even before the enactment of Electricity Act 2003). However, PSEB remained as an integrated utility for a quite long time after the reforms process. Therefore, it is very purposeful to study the impact of power sector reforms on the technical and financial performance of power sector in Punjab. The performance of power sector in Punjab is compared with some of the best performing power utilities of the countries.

I.4 About the Study

This study proposes to focus on the outcomes of power reforms in the state of Punjab. As stated, some key initiatives have been taken at the central as well as state levels to address the various problems in the development of power sector in India. In some of the northern states like Punjab, Delhi and Haryana, the transmission and distribution losses were reported to be as high as 50% of the total energy available to the state. Consequently, their financial performance was reported to be very poor. So, the impact
assessment of power sector reforms on financial performance of SEBs is one of the very crucial aspects of reforms.

Power is an essential infrastructure service for various sections of the society. Electricity is used as a major energy input in the production process in various sectors of the economy. Electricity consumption can be considered to be the major determinant of the economic development in a modern economy. Per capita availability of power is being used as an indicator for measuring the growth and development of a country. Electricity is used as a basic energy service in households for heating and lighting. Ensuring some minimum level of consumption is socially desirable. National Electricity Policy 2005 also specifies forty units per month as lifeline consumption to be supplied to every household at an affordable price. The other important concern is the existence of the social cost and benefits in supplying a service. It has serious implications on the environmental aspects of our social existence in a state like Punjab. The production as well as consumption of electricity affects the environment in an adverse manner. In Punjab, the agricultural sector dominates in consumption of electricity. Moreover, free power supply to agriculture sector is a major policy and regulatory issue. Therefore, to study the impacts of regulatory reforms is a very important exercise for an economy. To make
an efficient allocation of resources, economic regulation is needed to achieve the socially desirable outcomes. Therefore it is of great significance to study the extent of improvements in the technical and financial performance of the power sector in Punjab.

**Objectives of the Study**

The main objective of this study is to examine the impacts of power sector reforms on the financial performance of the utilities in Punjab. Key parameters, such as Plant Load Factor, Auxiliary Consumption, Aggregate Technical and Commercial (AT&C) losses, collection efficiency, Cost Recovery Ratio (CRR), etc. have been examined to measure the performance improvements. It makes an attempt to evaluate whether reforms process have been successful in Punjab in achieving the stated objectives such as restoring the financial health, improving quality of service, etc. It also compares the physical and financial performance of Punjab utilities with some of the best performing power utilities in the country- Maharashtra, Andhra Pradesh, Karnataka and West Bengal. Therefore, the study targets to achieve the following objectives:

1. To compare the technical and financial performance of the power utility in the Pre-reform and Post-reform period
2. To evaluate various outcomes of restructuring process in power sector in Punjab

3. To undertake a comparative analysis of the financial performance of the power utility of Punjab with some best performing SEBs/utilities

4. To examine the pricing policy in relation to the cost of supply adopted in post-reforms period in Punjab

5. To make suggestions and recommendations to improve the financial performance of power sector in the state

**Research Methodology**

The present study is analytical in nature. Secondary sources of information are used as database for the purpose of this study. The information available from various sources such as states, central and international agencies has been used. It includes publications of Government of Punjab, Annual Reports of PSEB, Tariff as well as general orders passed by the Punjab State Electricity Regulatory Commission (PSERC). Some other sources include the studies conducted by the World Bank, the Central Electricity Authority (CEA) and the Planning Commission etc. All the Orders of PSERC on ARRs and tariff filled by power utilities have been examined. Another major data source used was the Annual Reports on the
Performance of Power Utilities published by Power Finance Corporation (PFC).

**Time period of the study**

This study examines the outcomes of reforms process on the basis of performance improvements in the post-reforms period (Post 1990) achieved by the power utilities in Punjab. Consistent time series data has been generated to undertake a comparative analysis of the performance during the two time periods. For the purpose of performance analysis in the pre-reforms period, the data has been taken for the period from 1994-95 to 2000-01. For measuring the performance in the post reforms period, the data for the period from 2004-05 to 2009-10 has been taken. Since audited accounts are available only up to the FY 2009-10, the performance of Punjab as well the other selected states has been examined up to the year 2009-10 only.

**Comparative Analysis**

The study also compares the technical and financial performance of Punjab power utility with some of the best performing electricity utilities in the country. For this purpose, four utilities the following states have been selected:
- Andhra Pradesh
- Maharashtra
- Karnataka
- West Bengal

The selected states are regarded as best performing states on one account or the other. They have made adequate progress in controlling the energy losses. The operational and financial performance of these states has been appreciated by various agencies at the national and inter-national levels. A comparative analysis of Punjab state has been undertaken using some important performance indicators.

**Ratio Analysis**

The Study is proposed to calculate various financial ratios to examine the financial and managerial performance of the power utilities. Some statistical techniques like regression is also used to measure the growth rates of various economic variables related to technical and financial performance of power utility in the state.

Ratio Analysis is undertaken to measure the financial performance with a view to bring out inefficiencies involved in the financial management. The followings key ratios have been used to examine the financial performance of the utility:
- Liquidity Ratio (Current ratio, Quick ratio, Cash Ratio)
- Activity Ratio (Assets Turn over Ratio)
- Profitability Ratio (Gross Profit Margin, Net Profit Margin)
- Expenses Ratio to Sales
- Capital Structure Ratio (Return On Capital Employed)

The trend of Aggregate Technical and Commercial losses (AT & C losses) is studied to examine the impacts of reforms on financial positions of power utility in Punjab. The AT&C loss is a composite index which is the aggregation of there components, namely i) technical losses, commercial losses and under recovery of dues towards consumers.

**Least Square Growth Rate**

The Method of Least-Squares Growth Rate (LSGR) has been used for computing the growth rates of the key variables used in the study. Since the long period time series have been used in the study, the method of LSGR is quite suitable measure to estimate the trends of the selected variables. The least-squares growth rate is estimated by fitting a linear regression to the logarithmic annual values of the variable during the time period under consideration. The regression equation may be defined as:
\( Y_t = Y_0 B^t \) 

\( Y_t \) is the current value of the dependent variable while \( Y_0 \) is base year value.

In the equation ‘t’ stands for time and B is the parameter to be estimated. It may be noted that the equation (i) is non-linear. However, it can be transformed into the linear form after making a simple logarithm operation.

Taking log on both sides of the equation (i)

\[
\log Y_t = \log Y_0 + \log B^t \\
\log Y_t = \log Y_0 + t \cdot \log B \\
Y_t^* = a + bt
\]

Where:
\[
Y_t^* = \log Y_t \\
a = \log Y_0 \\
b = \log B
\]

Equation (ii) is the logarithmic transformation of the compound growth equation (i). In the equation (ii), ‘a’ and ‘b’ are parameters to be estimated using the method of least squares. The average annual growth rate, \( r \), can be obtained using the following formula

\[
r \text{ (growth rate)} = [\exp(b) - 1] \times 100
\]

The calculated growth rate is an average rate that is a representative of the all observations taken for the entire period of the study. It may not match
the actual growth rate between any two periods. If the trend is more secular, it is nearer to the annual growth rate and vice versa. However, this method is superior to the simple annual compound growth rate. Since the compound rate formula is based only on the two years data-base year and terminal year. Rest of the values of the series are completely ignored by the annual compound growth rate method.

**Limitations of the study**

The study mainly focuses on the economic and financial issues in the operation of the power sector. Though the technical up-gradations and innovations made on the part of utilities are very crucial issues of power sector reforms, however, the study has not examined the pure technical and engineering issues. For example, the study did not compare the technologies of energy meters used in the pre-reforms and post reforms periods. Secondly, this study has utilised the information available from the documents of the erstwhile Punjab State Electricity Board as well as Punjab State Electricity Regulatory Commission and the other official reports. Attempts were also made to refine the available information and to bridge the informational gaps. The major limitation of the study is the non-availability of appropriate type of economic data with the utilities. As most of the electricity consumed in the agriculture sector was un-metered, the
accurate estimation of energy losses and cost of supply to various consumer categories becomes arbitrary to a good extent. Therefore, the study was constrained by these limitations.

In this chapter, we have shown that the power sector is a very important and crucial segment of any economy. There have been radical policy and regulatory changes in the power sector in the past two decades. Therefore, it is very crucial to assess the impact of power sector reforms on the financial performance of power sector utilities and on the consumer welfare. Before, conducting any study, the researcher should scan the relevant literature so that the proposed study justifies its contribution to the existing stream body of literature. The next chapter (Chapter II) has been devoted to the review of literature. It presents an overview of the studies conducted on power sector in relation to the technical and financial performance and pricing policy in the power sector.