# CHAPTER 1

# BACKGROUND AND INTRODUCTION

## 1.1 **BACKGROUND**

The economy of India has been growing fast and it is expected that this trend of growth is expected to continue in forthcoming decades. Since power is a key input to build blocks of economic developments, it is always endorsed to materialize the relative benefits through time to time structured reforms. The structured reforms and restructuring are necessary in order to assure the growth of power sector with the subsequent growth of the economy. Hence Government of India has been giving priority to sectorial reforms which are necessary in order to achieve consistent growth in GDP.

## 1.2 POWER INDUSTRY OF INDIA

Indian Power Sector exemplifies reforms. The present study focuses on the sectorial reforms. Initially, power generation, transmission, and distribution operations were combined. In early years of reforms, the vertically integrated State Electricity Boards (SEBs) were unbundled into companies viz. GENCO for power generation, TRANSCO for power transmission and DISCOM for power distribution. For managing operations of generation, transmission and distribution companies, regulatory reforms were introduced through Central Electricity Regulatory Commission and State Electricity Regulatory Commission.

The technical cum advisory technical support to the newly formed power generation, transmission and distribution companies was assigned to Central Electricity Authority. The recent structure of Indian power sector is presented below in Figure 1.1 by the researcher. The Figure outlines regulatory bodies, generation companies, transmission companies, load dispatch centers, distribution companies, and power trading at the Central and State levels.

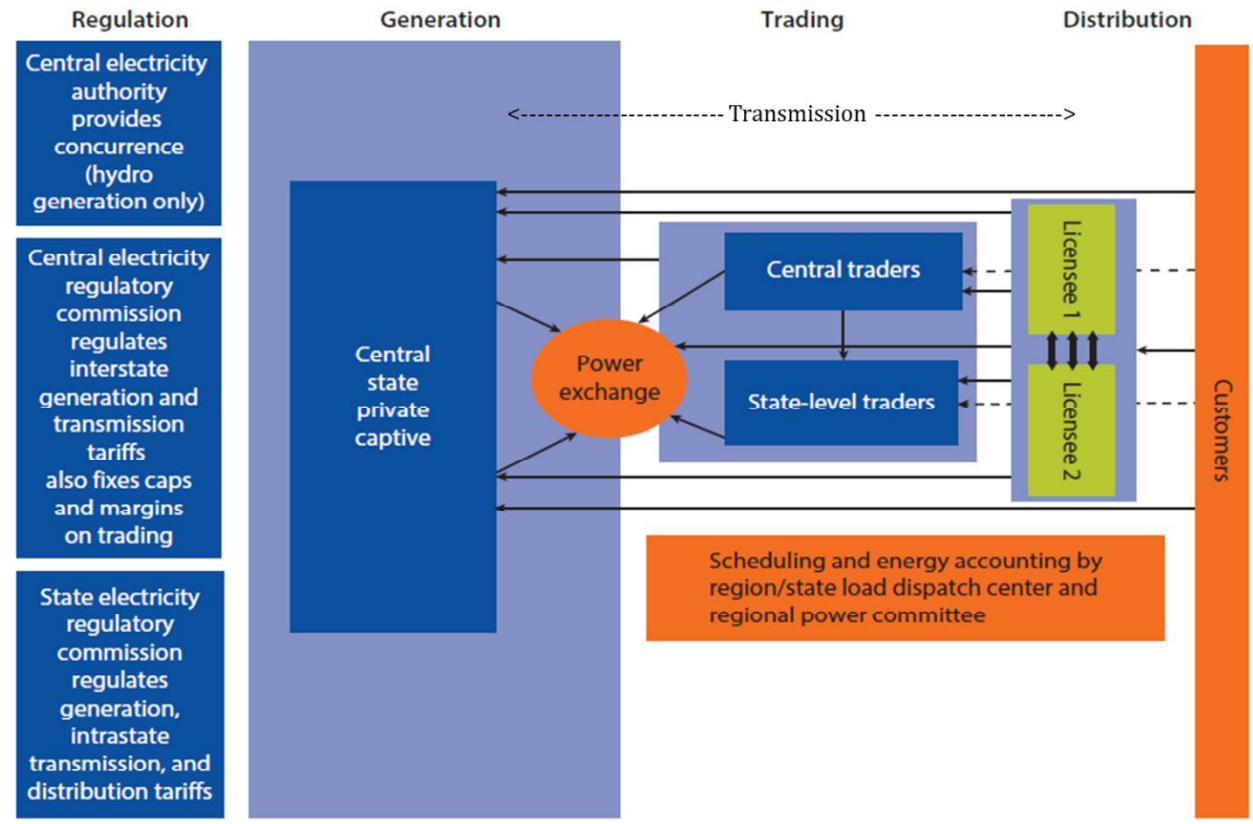


Figure 1.1: Overview of Indian Power Sector Structure Vis-à-Vis Regulatory Framework (Source: Pargal and Banerjee, 2014)

The above Figure 1.1 suggests that the four main verticals of Indian power system are: Power Generation; Power Transmission; Power Distribution and Power Trading. Overview of these verticals is as follows: -

1) **Generation:** Indian power system is serving the second largest population of the world. Definitely to cater world's second largest population the power generation requirements of India are also high. India holds the third rank for being largest installed generation capacity in the world. As of September 2017, the country has the installed capacity of 329298.27 MW [Thermal 219449.51, Nuclear 6780.00, Hydro 44765.42, RES 58303.35 (CEA, 2017)]. The installed capacity i.e 304760.75 MW is nearly about 4.8 % of global power generation (Bhalla, 2017). The average per capita consumption of electricity in India is 1075 kWh which is lower than world's average of 2,980 kWh (CIA, 2017). India is

suffering from a mismatch of power demand and supply due to a significant shortage of electricity generation capacity (Sen, 2014).

2) **Transmission:** Power Grid, as on August 2017, owns 142433 circuit km of the extra high voltage transmission lines in the county. The company owns and operates 224 EHV & HVDC AC substations with the transformation capacity of 2,96,988 MVA. The transmission capacity of 220 kV+ voltage level stands at - 378087 ckm transmission lines with the transformation capacity of 776855 MVA. India's inter-regional national grid capacity stands at 76550 MW Though present installed transmission capacity of India is only 23 % of the total installed generation capacity, the availability of transmission network is more than 99%. (MoP, 2017). Indian Government is focusing on increasing its power generation capacity to match the power demand and supply. There are signs of increased investments in the transmission sector in near future.
3) **Distribution:** Distribution sector is the source of the entire value chain of Indian power sector. According to World Bank Report (2015), State Electricity Boards and DISCOMs in India are making huge losses which estimate nearly 14 billion dollars (U.S $) which is equivalent to 5% of India's GDP. An inefficient operation of the distribution sector effects entire sector. Despite the introduction of private participation in Indian power distribution sector, the government-owned SEBs still owns about 95% of the distribution network.
4) **Trading:** Power Trading Corporation of India Ltd was established in April 1999 to undertake the long and short-term power trading activities. To bridge the gap between demand and supply, 'Power Exchanges' were operationalized in the year 2008. Power Exchanges provides a common platform to power buyers and sellers. The two Power Exchanges of India are - Indian Energy Exchange and Power Exchange of India Ltd. The 'Day Ahead Market' of the Power Exchange provides physical trading market space where market clearing volume and market clearing price is determined by double-sided closed auction bidding. Whereas, 'Term Ahead Market' trade products like - daily and weekly contracts, day ahead contingency and intraday. These Power Exchanges also offers trade through Renewable Energy Certificates [RECs] and Energy Saving Certificates [ESCs].

Competition in power generation and power trading is leading to significant achievements in terms of installed capacity and unit price reduction. On the other hand, the distribution sector is considered as the most critical segment of power sector value chain. The studies on power

distribution sector are suggestive of low competition in this sector (Agrawal, 2017). Thus there is a need to study and analyze the overall demeanor of Indian Power Sector especially in reference to the competition in Indian electricity market.

### 1.2.1 POWER DISTRIBUTION COMPANIES (DISCOMs)

Distribution companies are the most critical link in the power markets. Distribution companies provide revenue to the whole value chain of the power system by establishing an interface with the end consumers hence considered as the cash register for the entire sector.

In India, Power Distribution Companies christened as 'DISCOMs', came into existence upon introduction of reforms in power sector in 1991. Prior to DISCOMs State Electricity Boards were responsible for generation, transmission, and distribution. Under the provisions of Indian Constitution, electricity is a concurrent subject. State Governments are responsible for power distribution and supply of electricity to urban and rural consumers. Central Government provides assistance to State Governments through various schemes for improving the sector (MoP, 2017). Electricity Act, 2003 mandated the separation of generation, transmission and distribution activities. This Act also laid down provisions for more than one distribution license in one area. Distribution companies were allowed to - take participation in open access, power trading, and distribution franchisee.

Presently, by serving around 200 million consumers through 400 GW of connected load, Indian Power Distribution System stands as the second largest consumer base. Power is distributed to this large consumer base through 73 DISCOMs. These 73 Distribution Companies include 13 Electricity Departments, 41 Corporatized DISCOMs, 17 Private DISCOMs, 2 State Electricity Boards (Alam et al., 2014).

### 1.2.2 REGULATION OF ELECTRICITY SECTOR

As per studies, production of power in India can be established in the year 1897 (Kalam, 2015). Origin of the regulatory framework for Indian Power Sector is also traceable from 1897 (Kurulkar, 2008). It is in 1910 that the first sectorial Act of Indian Power Sector was introduced as 'Indian Electricity Act, 1910'. To meet the growing demand for power 'Electricity (Supply) Act 1948' was introduced. With this, the power generation capacity was reached to 1392 MW (Singal et al.,

2008). The Electricity (Supply) Act, 1948 defines 'Electricity' as a 'Concurrent' subject of Indian Constitution which makes both Central and State Legislature responsible to establish the related policy framework (Carstairs, 1995). Major regulatory reforms in Indian Power Sector were ushered as an outcome of privation in 1991. The State Electricity Boards were unbundled into Generation Companies (GENCO), Transmission Companies (TRANSCO) and Distribution Companies (DISCOMs) (Tongia, 2003).

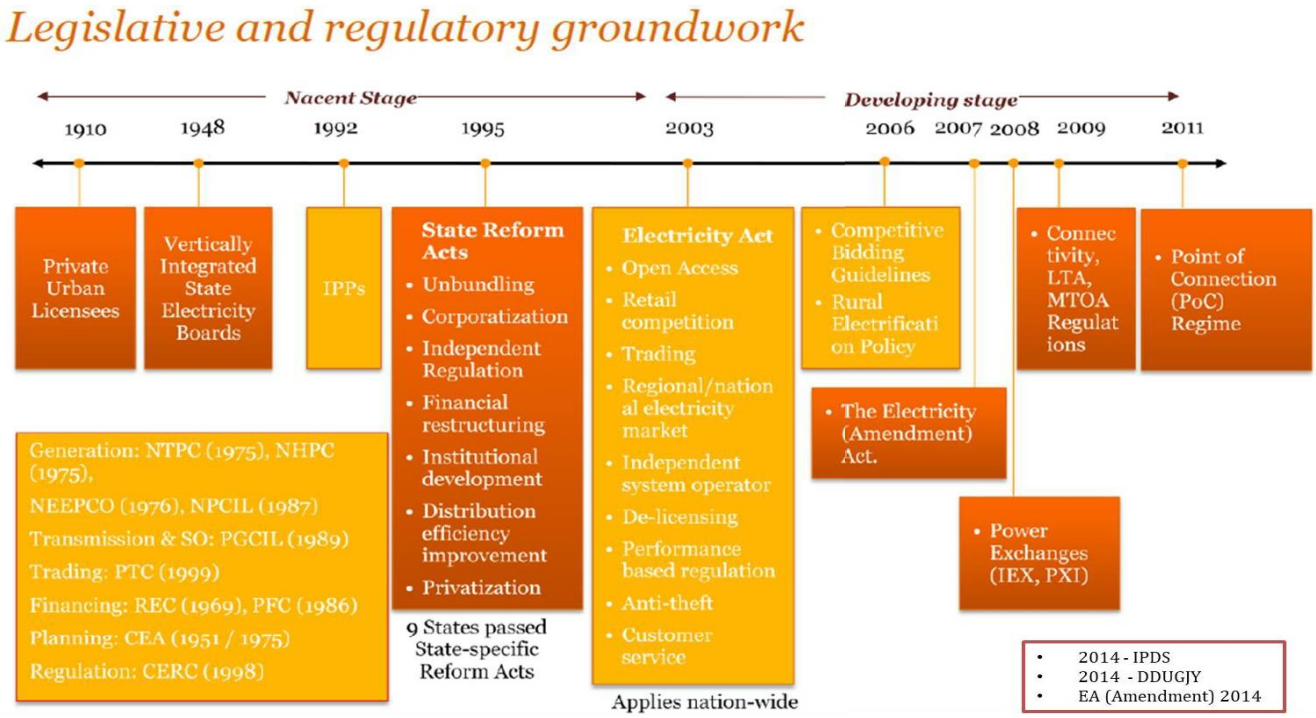


Figure 1.2 Transition of Indian Power Sector (1910 – 2014)

Source: Extended from Emerging Opportunities and Challenges, India Energy Congress, 2012, p 14

In 1998, enactment of "Electricity Regulatory Commissions Act 1998" provided establishment of regulatory commissions at the Central level and State Level. Provisions for rationalized electricity tariff and transparent policies for subsidies were also laid down. The year 2003 was the milestone in regulatory reforms of Indian power sector when most awaited "Electricity Act 2003" was introduced. The Act consolidated all previous acts i.e. the Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948 and the Electricity Regulatory Commissions Act, 1998. The

Electricity Act 2003 laid down various competitive measures and introduced second generation reforms in Indian Power Sector. The first step to introduce third generation reforms is Electricity Amendment Bill, 2014 (Agrawal et al., 2017).

### 1.2.3 WHOLESALE AND RETAIL ELECTRICITY MARKET

#### A) WHOLESALE ELECTRICITY MARKET

The Electricity Act, 2003 laid down various provisions to enable competition in Indian Power Sector. Establishment of wholesale market and promotion of power trading activities is one of them. After the approval of Central Electricity Regulatory Commission, the first power exchange of India was established in 2008 entitled as, 'Indian Energy Exchange' (IEX). With the success of IEX another power exchange, 'Power Exchange of India Ltd' (PXIL) was started (ET, 2017). Presently, power exchanges in India offer trading of products like - Day Ahead Market (DAM), Term Ahead Market (TAM), Renewable Energy Certificates (REC) and Energy Saving Certificates (ESCerts). Electricity Act, 2003 allows power trading through GENCO, DISCOM, power traders and power exchanges.

#### B) RETAIL ELECTRICITY MARKET

Power distribution system in India serves for both network and supply. Initially, there were no parallel players hence competition in this segment was nil. Electricity Act 2003; section 14 (6) contemplated parallel licenses to undertake distribution activity in one of the areas. Development of parallel distribution network needs heavy investment. With this, now the distribution licensee need to do fresh investments for developing parallel distribution network (PTC, 2014). For example, four distribution licensee in Mumbai: i) Brihan Mumbai Electricity Supply and Transport Undertaking (BEST); ii) Reliance Infrastructure Ltd - Distribution (RInfra-D); iii) Tata Power Company Ltd. Distribution (TPC-D), and iv) Maharashtra State Electricity Distribution Co. Ltd. There were several legal and regulatory challenges and conflict of interests (FOR, 2013). To meet these challenges Standing Committee on Energy, 2014-15 in its fourth report recommended the following: -

a) Electricity Amendment Bill 2014

b) Separation of Carriage and Content

c) Introduction of Second Licensee in the Supply Activity

d) Introduction of Retail Competition in Indian Power Sector

## 1.3 NEED FOR RESEARCH

### 1) Income, Expenditure and low profitability of Distribution Utilities

The combined revenue of the sale of electricity by - Distribution Companies, State Electricity Boards or such other utilities which sell power directly to the consumer has recorded at Rs. 288632 Crores in 2012-13 which is 19.66% higher in comparison to the amount of Rs. 241217 Crores in 2011-12. On the other side, the total amount of energy sold registered the growth of 5.23%; as 657629 Mkwh of energy was sold in 2012-13 against the amount of 624951 Mkwh in 2011-12. The Table 1.1 below shows the region-wise growth in the sale of power as well as growth in the amount of energy sold in the year of 2012-13.

Table 1.1: Region-wise Performance of State Power Utilities

| POWER REGION | Growth | |
|---|---|---|
| | Energy Sold (Mkwh) | Revenue |
| Eastern | 9.27% | 27.47% |
| North Eastern | 1.65% | 7.77% |
| Northern | 6.49% | 22.94% |
| Southern | 0.56% | 18.38% |
| Western | 7.70% | 16.12% |
| **TOTAL** | **5.23%** | **19.66%** |

Source: The Performance of State Power Utilities; Power Finance Corporation Limited (GoI), 2014

The growth in revenue is achieved due to the rationalization of the tariff. Although this revenue does not include wheeling and related charges, meter charges, subsidies from the State Government etc.

### Recovery of Cost[1]

[1] For the Utilities, who sell power directly to consumers

The cumulative turnover[2] of the utilities observed the growth of 16.73% in 2011-12 in comparison to 2010-11 and 18.69% in 2012-13 in comparison to 2011-12. The cumulative expenditure also witnessed the growth of 22.81% and 14.65% for respective years as illustrated. The recovery of cost (including depreciation) as shown in Table 1.2 given below.

Table 1.2: The Performance of State Power Utilities (2010 -13)

| **Particulars** | **2010-11** | **2011-12** | **2012-13** |
|---|---|---|---|
| Total Income excluding subsidy (Rs. Crores) | 229213 | 267560 | 317557 |
| Total Expenditure (Rs. Crores) | 300678 | 369275 | 423377 |
| Recovery of cost (%) | 76.23% | 72.46% | 75.01% |

Source: The Performance of State Power Utilities; Power Finance Corporation Limited (GoI) 2014

Due to low recovery ratio, total recorded losses of the utilities were increased from Rs. 49577 crores in 2010-11 to Rs.72629 crores in 2011-12. Although these losses were decreased to Rs.69108 crores in the year 2010-11. On the other hand, the cash losses[3] increased from Rs. 60344 crores in 2010-11 to Rs.94100 Crores in 2011-12. These losses decreased to the amount of Rs. 36105 crores in the period of 2012-13.

If the subsidy received are also considered, the losses of utilities increase from Rs 51948 Crores (2010-11) to Rs 76867 Crores (2011-12). These losses were calculated as Rs 6895 Crores (76867 – 69972) for the year 2012-13.

On the other hand, if we do not consider subsidy; the losses of utilities increase from Rs.72282 Crores (2010-11) to Rs.102638 Crores (2011-12) and subsequently to Rs.106071 crores (2012-13).

## 2. Increase in Financial Losses of Distribution Utilities

Operational and collection inefficiency is the main concern of distribution sector, the sector which is considered as the weakest link in the entire value chain. The gap between average revenue

[2] revenue through sale of power + other income - subsidy booked
[3] on revenue and subsidy realized basis

realization and the average cost of the supply along with average power purchase cost has been widening continuously and it has been almost doubled since 2003. Figure 1.3 below shows the financial performance of all the verticals of Indian Power Sector:

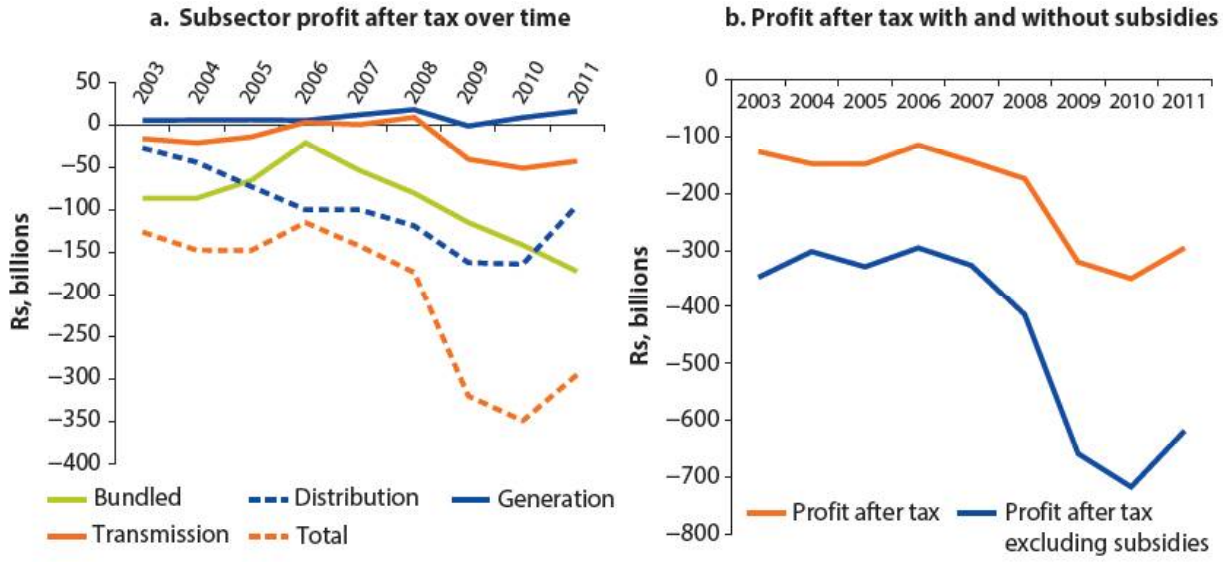


Figure 1.3: Profit /Loss(After Tax) of Power Sector (2003-11)[4]

Source: Khurana and Banerjee, 2015

From the above Figure 1.3, it can be asserted that the losses are mostly located in bundled State Electricity Boards which did not stop even with the measures like unbundling of SEBs and formation of DISCOMs except in Kerala, where all the bundled State Electricity Boards are recovering from losses. i) Generation segment: Can now be considered as the profit-making segment. ii) Transmission segment: Mid 2000's figure suggests that transmission segment made a profit but this trend did not continue for long. Losses were figured in the year 2009 – 2011. iii) Distribution Segment: it was a loss-making segment which recovered slightly in 2011. The figures are suggestive of recovery in losses and upward trends.

Further, Table 1.3 below depicts the position of profitability/loss of the power sector utilities[5] in India for the period of 2010 – 2013.

[4] Sector finances have reached crisis proportions: India's subprime crisis = 17% of gross fiscal deficit
[5] Utilities selling directly to consumers

Table 1.3: The Aggregate Income, Expenditure, and Profitability of Power Utilities

*Rs. in Crores

| S. No. | Coding | Particulars | 2010-11 | 2011-12 | 2012-13 |
|---|---|---|---|---|---|
| 1 | A | Income (Without Subsidy) - Utilities selling directly to consumers | 229,213 | 267,560 | 317,557 |
| 2 | B | Expenditure (Without Depreciation, writeoffs & tax) - Utilities selling directly to consumers | 292,507 | 362,141 | 413,960 |
| 3 | C | Profit (loss) without depreciation, writesoff, subsidy & tax - Utilities selling directly to consumers (A-B) | -63,294 | -94,581 | -96,403 |
| 4 | D | Profit (loss) without depreciation, subsidy & tax - Gencos, Transcos & Trading Utilities | 6,369 | 10,867 | 13,864 |
| 5 | E | Profit (loss) without depreciation, writesoff subsidy & tax for all utilities (C+D) | -56,925 | -83,714 | -82,538 |
| 6 | F | Subsidy Booked | 22,728 | 30,030 | 36,985 |
| 7 | G | Income Tax | 1,339 | 1,562 | 1,746 |
| 8 | G1 | Deferred Tax | 770 | 769 | 742 |
| 9 | H | Total Profit/Loss without depreciation, writesoff for all utilities(E+F-G) | -35,536 | -55,246 | -47,300 |
| 10 | I | Subsidy Unpaid | 2,384 | 4,252 | 880 |
| 11 | J | Depreciation & Writeoffs | 16,263 | 16,366 | 20,043 |
| 12 | K | Total book profits/losses of all utilities (H-J-G1) | -52,569 | -72,381 | -68,085 |
| 13 | L | Total Profits/Loss on subsidy received basis of all utilities (K-I) | -54,953 | -76,633 | -68,964 |
| 14 | **M** | **Total Profits/Loss on without subsidy of all utilities (K-F)** | **-75,297** | **-102,411** | **-105,070** |

Source: The Performance of State Power Utilities, Power Finance Corporation Limited, 2014

The above table shows that the aggregate income, expenditure, and profitability of the power utilities[6] for the period of 2010 – 2013. The expenditure of utilities is higher than the income. By considering some other factors like depreciation, tax, subsidies, write-offs; the loss amount of utilities comes out at Rs. 75,297 Crores in 2010-11, Rs. 102,411 Crores in 2011-12, Rs. 105,070 Crores in 2012-13. The figures in Table 1.3 shows that the power utilities are making losses.

[6] Utilities selling directly to consumers

### 3. Increase in the Debt burden of Utilities:

As discussed at above point that there were losses in Indian Power Sector. For instance, the total debt figure of 2011 for Indian Power Sector was Rs. 3.5 trillion which is equivalent to 5% of GDP. Therefore, in order to provide support for the running of these power utilities, borrowings were made from the Financial Institution (ET, 2016). Khurana and Banerjee (2015) analyzed the debt for segments namely transmission, generation, distribution and bundled SEBs from 2003-11. The researcher has sourced same analysis in Figure 1.4.

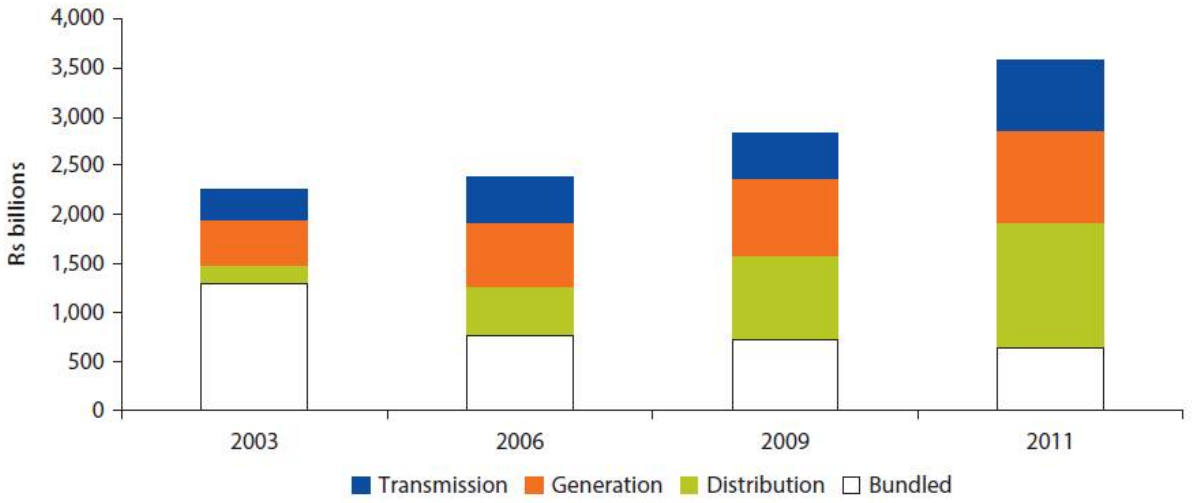


Figure 1.4: Debt Analysis of Power Sector
Source: Khurana and Banerjee, 2015

The debt analysis clearly shows that the debt in distribution segment grew at a rate with compound annual growth rate (CAGR) of 23% while debt in transmission and generation segment grew at 10% and 9% CAGR respectively. In 2003, the debt burden on the distribution segment was 9% which expanded to 36% in 2011. It raised by four times in eight years which was alarming. Thus State-wise analysis was made as shown in Figure 1.5.

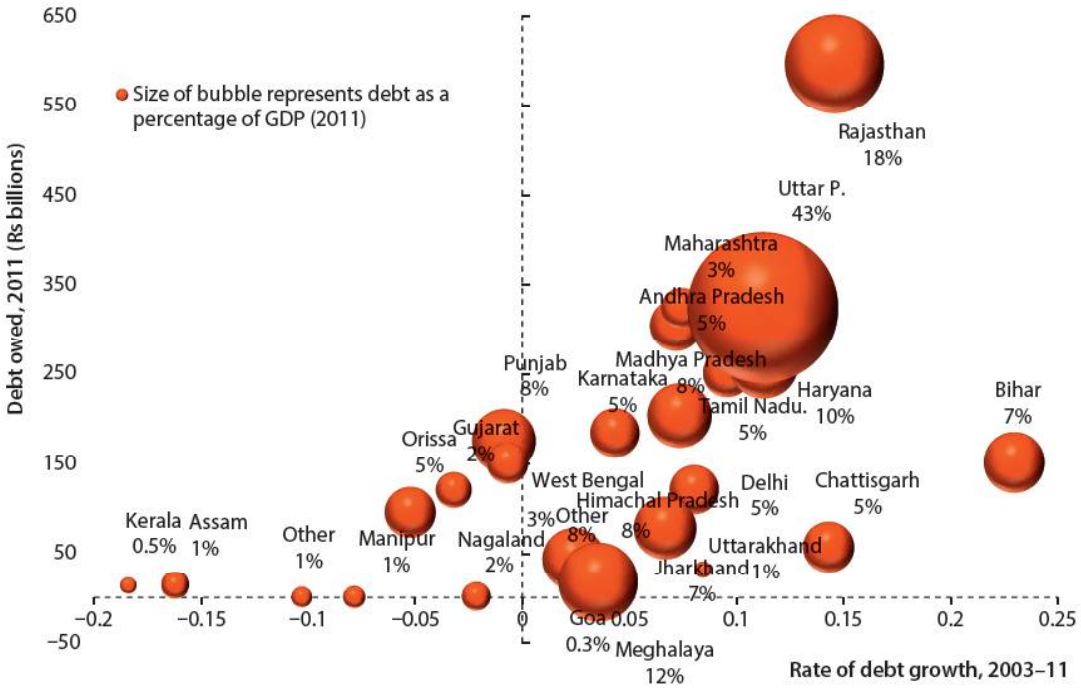


Figure 1.5: Power Sector Debt as a Percentage of GDP[7]
Source: Pargal and Banerjee, 2014

Total debt on Indian power sector corresponded to 5% of National GDP in 2011. The state-wise analysis shows that a few States account most of it. In Haryana, Meghalaya, Rajasthan and Uttar Pradesh, the debt is more than 10% of State's GDP. The analysis shows that in the year of 2011, debt on Uttar Pradesh Power Sector was equal to 43% of the State's GDP. Similarity, debt on Rajasthan Power Sector was equal to 18% of the State's GDP. The State of Rajasthan had the highest debt among all the Indian States which grew at the phenomenal rate of 15% between 2003 to 2011. There were 10 States in 2011 which together accounts for 78% of India's Power Sector Debt of Rs. 3.5 trillion.

**4. High Aggregate Technical and Commercial (AT&C) Losses checked performance**:

The performance of the Power Distribution Companies (DISCOMs) in India is measured on the basis of two types of losses - i) Transmission and Distribution (T&D) Losses: These are the Losses made during the transmission and distribution known as Transmission and Distribution losses.

[7] Source: The financial performance of India' s power sector; World Bank Report 2015

T&D losses are calculated by finding the difference between the 'Energy Input' and the 'Energy Billed' for a particular consumer. T&D losses consider all the losses in transmission and distribution system comprising commercial losses up to the billing stage, this does not include the energy for which revenue is being actually realized. ii) Aggregate Technical and Commercial losses (AT&C losses): These are calculated from the difference between the 'Energy Injected' and the 'Amount of Energy' for which revenue from the consumer is actually realized. Table 1.4 presents Region Wise details of Aggregate Technical and Commercial losses (AT&C losses) for the year 2011-12 and 2012-13.

Table 1.4: Region Wise Aggregate Technical and Commercial Losses (2011-2013)

| S. No. | Region | 2011-12 | 2012-13 |
|---|---|---|---|
| 1. | Eastern Region | 41.80% | 42.06% |
| 2 | North-Eastern Region | 35.15% | 37.60% |
| 3. | Northern Region | 30.34% | 28.84% |
| 4. | Southern Region | 18.89% | 17.24% |
| 5. | Western Region | 24.81% | 23.36% |
| **National Average** | | **26.63%** | **25.38%** |

Source: The Performance of State Power Utilities; Power Finance Corporation Limited, 2014

The region wise analysis of AT&C Losses identifies a National Average of 26.63% losses in 2011-12 and 25.38% losses in 2012-13. The Power Finance Corporation (PFC) Limited has published this report in 2014. They further analyzed the AT&C losses at the State level in order to identify the States reducing on AT&C losses as presented in Table 1.5 and States responsible for increasing AT&C Losses as presented in Table 1.6.

Table 1.5: Reduction in Aggregate Technical and Commercial Losses (2011-2013)

| Total Number of States | Reduction Ratio | States |
|---|---|---|
| 6 | 0-2 % | Tamilnadu, Kerala, Odisha, Andhra Pradesh, Goa, Punjab. |
| 4 | 2-4 % | Delhi, Chhattisgarh, Uttarakhand, Karnataka. |
| 10 | Above 4% | Puducherry, Meghalaya, Himachal Pradesh, Jammu and Kashmir, Mizoram, Rajasthan, Madhya Pradesh, Sikkim, Arunachal Pradesh, Bihar. |

Source: The Performance of State Power Utilities; Power Finance Corporation Limited, 2014

Table 1.5 shows a reduction in AT&C losses by –i) 0-2% in six States namely Tamilnadu, Kerala, Odisha, Andhra Pradesh, Goa, Punjab. ii) 2-4% in four States namely Delhi, Chhattisgarh, Uttarakhand, Karnataka. iii) above 4% in ten States contributing to overall signs of improvement (Table 1.4) by reducing the AT&C losses of distribution utilities by 1.25% [see Table 1.4 for national average].

Table 1.6: Increase in Aggregate Technical and Commercial Losses (2011-2013)

| Total Number of States | Increment Ratio | States |
|---|---|---|
| 5 | 0-2 % | Gujarat, Maharashtra, Tripura, Uttar Pradesh, West Bengal. |
| 1 | 2-4 % | Assam. |
| 4 | Above 4% | Jharkhand, Haryana, Nagaland, Manipur |

Source: The Performance of State Power Utilities; Power Finance Corporation Limited, 2014

Table 1.6 shows increase in AT&C losses by – i) 0-2% in five States namely Gujarat, Maharashtra, Tripura, Uttar Pradesh, West Bengal ii) 2-4% in the State of Assam and iii) above 4% in four States contributing to signs of retrogression on these States (Table 1.4) as the above data outlines the States where AT&C losses have increased.

On the basis of above four points, various concerns plaguing the Indian power sector are: Increasing financial losses, increasing debt burden on State DISCOMs, negative impact of losses and debt on GDP, increasing AT&C losses, increasing power purchase cost, increment in per unit cost of power, increasing gap between average cost and average revenue.

## 1.4 BUSINESS PROBLEM

As discussed the financial losses of Power Sector have shown an increase of Rs 29,773 Crores from 2011 to 2013 (PFC, 2014). There is an increase in debt burden on DISCOMs by 27% from 2003 to 2011 (Khurana and Banerjee, 2015). Though AT&C losses have shown an upward trend, this is not as expected. The AT&C losses have reduced by 1.75% from 2011 to 2013 (PFC, 2014).

The Average Revenue and Average Cost Gap has increased by Rs. 33, 109 Crores from 2010 to 2013. (PFC, 2014). There is an increment of 70% in average cost of power from 2003 to 2011 (Pargal and Banerjee, 2014). Since the average cost has increased, it has directly affected the tariff. Thus, there is an increase of Rs. 1.74 in average per unit tariff for sale of electricity in India from 2007 to 2014 (Indiastat, 2016). Though the tariff has increased and despite the claims of better facility the customer satisfaction surveys conducted by GoI from time to time has reported customer dissatisfaction. For example:

i) Customer Satisfaction Survey, DERC 2007 and 2009: The rating of the performance of all 3 Distribution Companies was mapped at 5.4/10 in 2007 and 5.9/10 in 2009.
ii) Customer Satisfaction Survey, SEDC 2011: 35% of the respondents had expressed their dissatisfaction with current electric supply.
iii) Customer Satisfaction Survey, MERC 2012: Survey shows that only 49.8% of the electricity consumers are satisfied with the service of DISCOMs.
iv) Customer Satisfaction Survey, CUTS 2012: 69% of the consumers were not satisfied with the services of Rajasthan Distribution Companies.

The above discussion clearly points out that the expectations from the first phase of reforms were not achieved and the results of the second phase have subset the euphoria. For this, now in the third phase of reforms the Standing Committee on Energy (2014-15) recommended for the following:

a) Electricity Amendment Bill 2014
b) Separation of Carriage and Content
c) Introduction of the second licensee in the supply activity
d) Introduction of retail competition in Indian Power Sector

The recommendations are in line with the developments in the global power sector. For example, the introduction of retail competition in the United Kingdom and New Zealand has yielded better results by reducing per unit cost of power (IEA, 2005). Similarly, the study reveals that the introduction of retail competition UK, New Zealand has also resulted in higher customer satisfaction (IEA, 2011). India can also take bifurcation of content and carriage for opportunity cost. Thus if, retail competition through bifurcation of carriage and content as recommended by

Standing Committee on Energy 2014 -15, it can be expected that there can be a reduction in power prices which can further bridge the gap between Average Cost and Average Revenue so that utilities will be able to make profits. Competition in the market will lead to efficiency and subsequently, may result in a healthy and financially viable power sector.

Hence, concluding from the present scenario and foreseen scenario of Indian Power Sector, the business problem for the present study may be stated as follows:

**"Non-Bifurcation of Content and Carriage in Indian Power Distribution Sector is leading to opportunity Cost"**

## 1.5 SIGNIFICANCE OF THE STUDY

**1) Need for Separation of Carriage and Content to check Distribution Losses:** Researcher can safely assert that the various concerns plaguing the Indian power sector are: Increasing financial losses, increasing debt burden on state DISCOMs, negative impact of losses and debt on GDP, increasing AT&C losses, increasing power purchase cost, increment in per unit cost of power, increasing gap between average revenue and average cost. World Bank (2014) in its report entitled, 'Indian Power Sector Diagnostic Review' has emphasized on minimization of in-efficiencies for significant cost savings. Few important points recommended for increasing the efficiency and effectiveness of Indian power sector are as follows:

a) Align Stakeholders' Incentive**:** Grant funded programs of Central Government such as Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), Restructured Accelerated Power Development and Reforms Programme (R-APDRP) may be used to persuade better performance as well as to achieve operational and financial targets. Lending rates for the utilities should be based on the ratings released for the utilities so that clear signal to improve the performance can go into the system. On the other hand, State Governments should be made accountable for the performance of respective State utility.
b) Strengthen Regulatory Governance and Processes: Transparency in the regulatory system should be enhanced to increase the credibility and effectiveness of the regulatory process. State electricity regulatory commissions are needed to provide greater strength to design

and implement regulations; to monitor compliances and take necessary action for non-compliances.

c) Implement Key Regulatory Mandates: Data related to the standard of performance like - measures of service quality, outages, transformer failure rate, frequency and system interruption rate should be made publicly available through the state utilities. SERCs should impose the mandates to regularly update the same. Consumer satisfaction surveys can be organized and incentives for better performer may be fixed.

d) **Separation of the Carriage and Content:** In order to reduce inefficiencies of the sector, this report recommends to initiate with a pilot project to identify the institutional preconditions. The learnings from the international experiences on retail introduction in various countries can help policymakers in India to form grounds for the initialization of pilot projects. The report further recommends an exploration of different electricity models adopted by countries where retail competition has been introduced.

e) Full vertical unbundling: Operational and financial unbundling of utilities is an important tool to improve the accountability of each component in the value chain. The report recommends for **full vertical unbundling with separation of staff, accounts, and other particulars to increase the competition on the supply side**.

The report points out the need to bifurcate carriage and content business in order to facilitate the introduction of retail competition in India.

**2) Widening Gap between Average Cost and Average Revenue leading to low profitability of Distribution Utilities**

The gap between average cost and an average revenue of power sector utilities has been rising continuously. Cost recovery of DISCOMs in 2003-11 was between 76-85% with an average of 82%. The main reason behind this was the commercial losses, less number of tariff revisions (refer Figure 1.8) by the State Electricity Regulatory Commission [due to the interference of State Government and other reasons] and overdue subsidies. Subsequently, the cost of electricity kept increasing. This increase was also due to raising of fuel cost and up-turns in operational inefficiency. Hence the gap between electricity cost and revenue realization was continuously

widening. This gap between Average Revenue and Average Cost was 20% in the year of 2011. The Figure 1.6 details the widening of the gap between average cost and average revenue from 2003 – 2011:

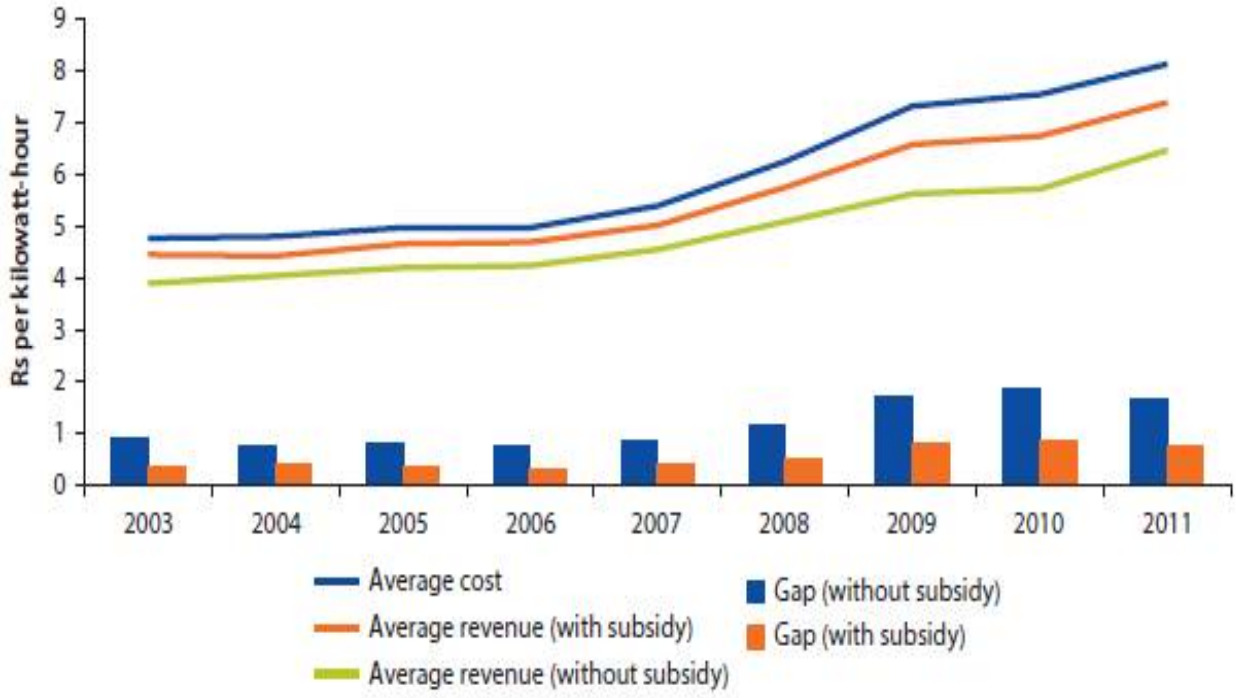


Figure 1.6: Increase in Gap between Average Cost and Average Revenue over the Years (2004-11)
Source: Khurana and Banerjee, 2015

The above Figure 1.6 shows that there is an increase in the gap between Average Revenue and Average cost. The gap between collected revenue and total cost incurred is grounded on the basis of three major components – i) Distribution Losses ii) Collection Losses iii) Underpricing due to low tariff structure. Khurana and Banerjee, 2015 suggested 'Power Purchase Cost' as an important component to be considered while calculating the difference between Average Revenue and Average Cost. The researcher will now discuss the all the four in detail – 1) Distribution Loss 2) Commercial Loss 3) Power Purchase Cost 4) Tariff Structure.

**1) Distribution Loss**

Distribution losses are calculated by finding the difference between 'energy input' and 'energy sold'. Distribution losses include both technical and non-technical losses. International

benchmarking suggests that technical losses should be less than 10%. In India, 32% distribution losses were recorded in 2003 which fell down to 21% in 2011. Lowest distribution losses were recorded in Kerala at 12%. Distribution losses of Punjab, Goa and Andhra Pradesh also came down to below than 15%. This demonstrates the capacity of Indian States for registering impressive results in loss reduction.

**2) Commercial Loss**

Commercial losses are also known as collection losses. In 2003, the share of revenue realized to the energy billed was 89% which rose to 94% in 2011. That indicates the improvement in the collection efficiency of Indian Power Distribution Companies increased by 5%. As of now, collection efficiency in most of the states is higher than 90% though ideally, it should be 100%. Measures for accurate metering and billing and use of upgraded metering infrastructure through the nation may help in this direction.

**3) Power Purchase Cost**

Cost of power is increasing continuously. There are many reasons like - the cost of fuel, employee cost, low availability of generation plant, high operation and maintenance cost etc., but the most significant and hidden reason in 'power purchase cost'. Figure 1.7 (a) below illustrates the composition of power cost in India in various years and Figure 1.7 (b) shows the grouping of states on the basis of power purchase cost in total cost.

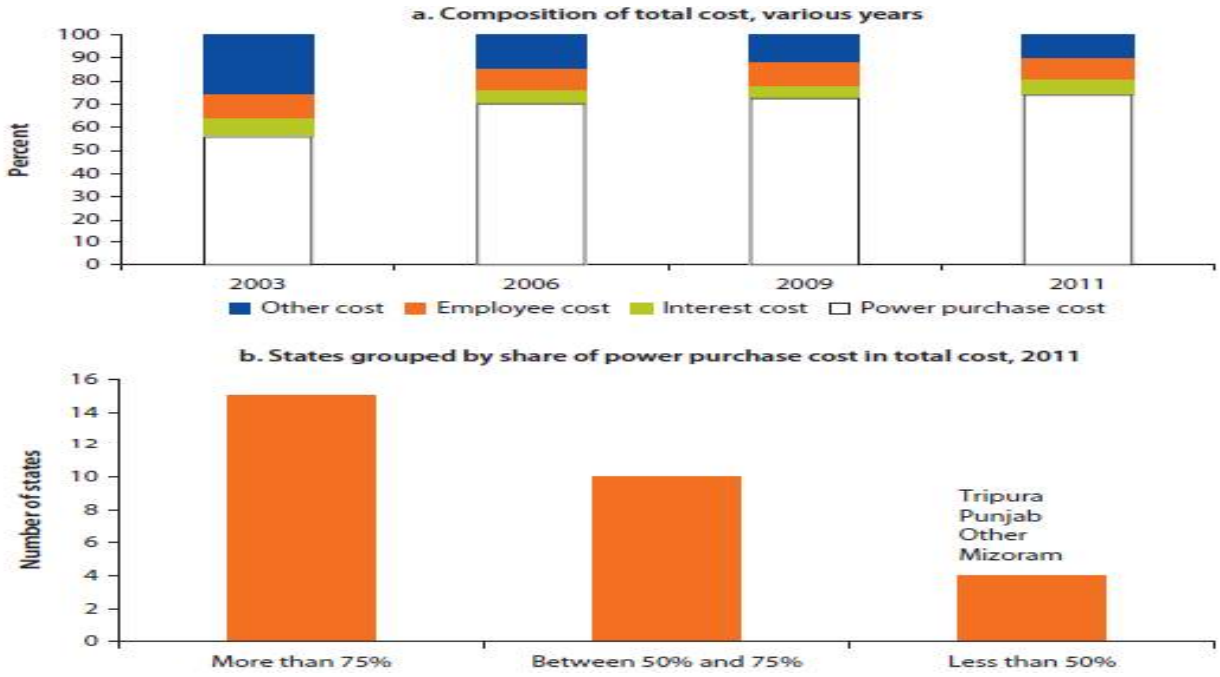


Figure 1.7: Composition of Power Cost

Source: Khurana and Banerjee, 2015

The pattern of the composition of total cost of power shows that power purchase cost in India has been increasing continuously for years. The share of the power purchase cost in total cost was 56% in 2003, 70% in 2006, 72% in 2009 and 74% in 2011. This share increased by 18% from 2003 to 2001. There were 15 states where the share of power purchase cost was approximately 75% of the total cost. Main reasons behind the increasing share of power purchase cost in per unit cost of electricity are the rising gap between demand and supply, improper management of Power Procurement by respective Discom/ respective power procurement center.

**4) Tariff Structure**

Two observations have been carried out from the analysis of Figure 1.7 and 1.8: i) Power purchase cost is increasing over the years; ii) the gap between average cost and average revenue of utilities is widening over the years. Hence to bridge the gap between average cost and revenue, utilities are increasing tariff on electricity. Figure 1.8 below shows the number of times tariff increased by distribution utilities in the period of 2008 -13:

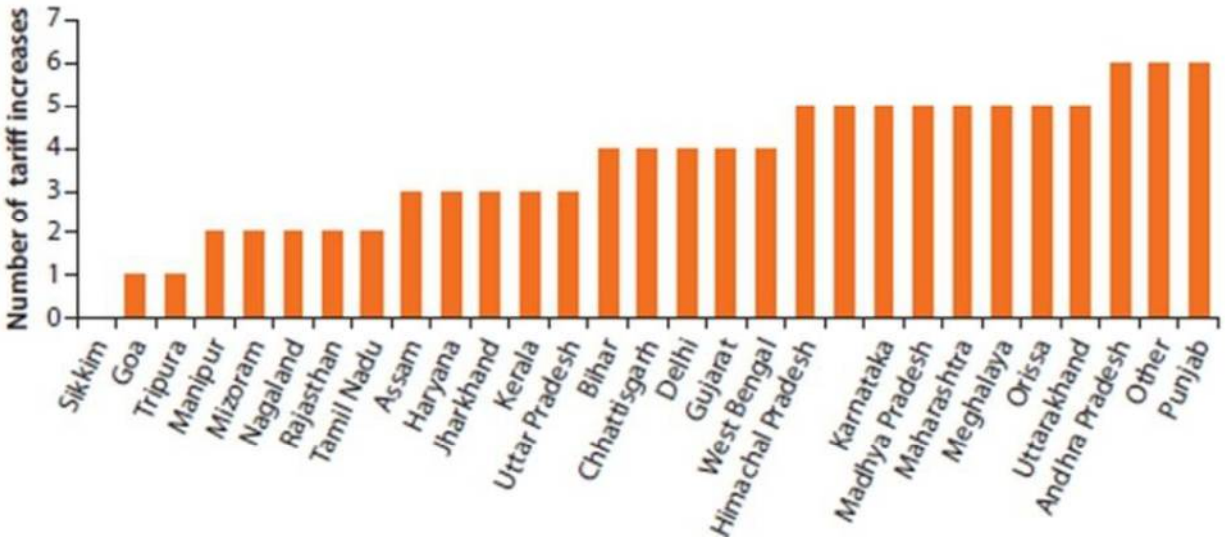


Figure 1.8: Number of Times Tariff increased by Indian States (2008 –13)

Source: Khurana and Banerjee, 2015

As per the mandate of State Electricity Regulatory Commission, the tariff of electricity for the end consumer needs to be revised annually. Although the literature suggests that the state-owned distribution utilities do not revise it annually due to political pressure (Alagh., 2010). By the result, the Indian States are still far behind in implementing the concept of cost-reflective tariffs. Table 1.7 below shows the present tariff structure of electricity in Indian states.

Table 1.7: Tariff Structure of Electricity in the Indian States (2007 – 2014)

| Selected State-wise Average Tariff for Sale of Electricity in India (2007-2008 to 2013-2014) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | (In Paise/Kwh) |
| **States/UTs** | **2007-08** | **2008-09** | **2009-10** | **2010-11** | **2011-12** | **2012-13 (R.E)** | **2013-14 (A.P)** |
| **SPUs** | | | | | | | |
| Andhra Pradesh | 254.15 | 251.6 | 266.53 | 310.8 | 338.28 | 400.8 | 547.21 |
| Assam | 427.55 | 491.56 | 428.77 | 428.31 | 493.99 | 511.46 | 478.2 |
| Bihar | 296.46 | 311.63 | 303.02 | 387.02 | 464.2 | 450.66 | 515.66 |
| Chhattisgarh | 339.87 | 337.01 | 286.79 | 299.59 | 309.29 | 340.21 | 335.09 |
| Delhi | 443.05 | 396.14 | 446.66 | 379.52 | 407.18 | - | - |
| Gujarat | 337.31 | 417.84 | 352.54 | 384.62 | 422.14 | 450.25 | 462.78 |
| Haryana | 274.73 | 323.02 | 342.51 | 391 | 326.22 | 406.49 | 401.49 |
| Himachal Pradesh | 356.35 | 405.98 | 404.46 | 399.65 | 432.22 | 439.64 | 447.46 |
| Jammu and Kashmir | 254.78 | 234.45 | 242.14 | 292.19 | 334.82 | 385.9 | 386.36 |
| Jharkhand | 324.93 | 319.06 | 284.61 | 296.25 | 348.56 | 408.66 | 415.9 |
| Karnataka | 305.62 | 303.42 | 351.01 | 428.73 | 433.23 | 456.94 | 476.92 |
| Kerala | 350.61 | 379.96 | 337.93 | 354.17 | 349.99 | 444.49 | 441.99 |
| Madhya Pradesh | 301.45 | 319.56 | 313.05 | 361.2 | 383.88 | 411.67 | 423.52 |
| Maharashtra | 361.81 | 403.69 | 432.31 | 466.29 | 493.61 | 547.31 | 582.3 |
| Meghalaya | 297.9 | 371.02 | 419.74 | 337.35 | 342.84 | 385.91 | 378.74 |
| Odisha | 295.58 | 306.79 | 306.75 | 370.94 | 446.57 | - | - |
| Punjab | 238.6 | 267.21 | 255.23 | 292.49 | 319.91 | 363.01 | 367.03 |
| Rajasthan | 328.44 | 315.65 | 304.01 | 306.8 | 325.96 | 350.25 | 429.65 |
| Tamil Nadu | 296.66 | 290.69 | 290.11 | 339.72 | 339.38 | 456.03 | 493.26 |
| Uttar Pradesh | 268.4 | 266.36 | 291.75 | 346.61 | 348.48 | 420.59 | 508.83 |
| Uttarakhand | 247.66 | 290.95 | 288.88 | 364.34 | 365.95 | 384.04 | 383.64 |
| West Bengal | 355.4 | 390.85 | 398.26 | 452.79 | 535.75 | 549 | 580.85 |
| **Average (SPUs)** | **306.72** | **325.57** | **326.93** | **368.27** | **388.35** | **440.15** | **481.25** |
| **EDs** | | | | | | | |
| Arunachal Pradesh | 276.51 | 265.5 | 328.72 | 300.39 | 319.31 | 340.26 | 358.65 |
| Goa | 297.99 | 376.56 | 323.01 | 326.68 | 312.6 | 362.95 | 368.46 |
| Manipur | 306.57 | 405.3 | 320.79 | 290.72 | 286.4 | 285.69 | 282.05 |
| Mizoram | 292.28 | 326.11 | 287.46 | 222.45 | 420.98 | 443.77 | 452.51 |
| Nagaland | 270.88 | 332.62 | 278.21 | 261.41 | 349.55 | 383.11 | 382.94 |
| Puducherry | 252.77 | 255.08 | 239.55 | 264.42 | 298.49 | 346.56 | 375.64 |
| Sikkim | 412.66 | 407.27 | 429.34 | 287.68 | 320.37 | 328 | 305.87 |
| Tripura | 296.53 | 387.74 | 343.59 | 314.31 | 363.22 | 400.1 | 475.28 |
| **Average (EDs)** | **290.86** | **336.91** | **307.55** | **294.91** | **318.35** | **358.06** | **379.8** |
| **India Average** | **306.46** | **325.76** | **326.63** | **367.15** | **387.31** | **438.96** | **479.84** |

Source: Indiastat, 2016

Table 1.7 illustrated the tariff structure of electricity in the Indian States from 2007-2004. In 2007, the average power tariff of Indian Power Distribution Utilities was Rs. 3.06 per unit. In 2014, the electricity tariff rose to Rs. 4.80 per unit. The rise of Rs. 1.74 in per unit cost was significant but it could not make the tariff cost reflective.

On the other hand, despite the significant increase in tariff, distribution utilities are unable to bridge the gap between of revenue and cost and hence continuously making losses. On the other hand, the increment in tariff is raising the undue burden on consumer's pocket.

## 1.6 RATIONALE OF THE STUDY

### 1) Retail Competition in Global Electricity Market

The United Kingdom, Chile, and Australia are the countries where liberalization in electricity markets started in the 1980s and subsequently, in 1990s, it reached to European Union (EU). New Zealand became the first country to open up the full retail market in the year 1994. In New Zealand, all the electricity consumers had the facility to switch between their power suppliers. Research has sourced the introduction of retail competition around the word from Morey and Kirsch, 2016 in Table 1.8.

Table 1.8: Years of Worldwide Full Retail Competition Market Opening

1990 - 2000

| Country | Year |
|---|---|
| New Zealand | 1994 |
| Sweden | 1996 |
| Norway | 1997 |
| Finland | 1998 |
| United Kingdom | 1999 |
| Hungary | 2000 |
| Ireland | 2000 |

2000 - 2010

| Country | Year |
|---|---|
| Austria | 2001 |
| Korea | 2001 |
| Netherlands | 2001 |
| Australia | 2002 |
| Italy | 2002 |
| Denmark | 2003 |
| Spain | 2003 |
| Turkey | 2003 |
| Czech Republic | 2006 |
| Portugal | 2006 |
| Belgium | 2007 |
| Greece | 2007 |
| Poland | 2007 |

Source: Morey and Kirsch, 2016

The above Table 1.8 shows that after New Zealand the retail was introduced in countries like Sweden, Norway, Finland, United Kingdom in 1996, 1997, 1998, 1999 respectively followed by Hungary and Ireland in the year 2000; Austria, Korea and Netherland in the year 2001; Australia and Italy in 2002; Denmark and Spain in 2003. Later on, in 2006, the retail was introduced in Czech Republic and Portugal while the Belgium, Greece, and Poland introduced retail in 2007. The studies have revealed that the there are reasons why countries are introducing retail competition. Few of such reasons are: Price reduction was seen due to both efficiency improvements and capture of economic rents (IEA, 2005). The choice to the consumer was provided by retail, through which consumers had an option to switch the electricity supplier (IEA, 2011).

**2) Retail Competition and Price Benefit**

In few countries, which introduced the retail competition, the actual prices paid by the consumers fell over a period after the introduction of retail. The researcher has presented this data in Figure 1.9 and Figure 1.10.

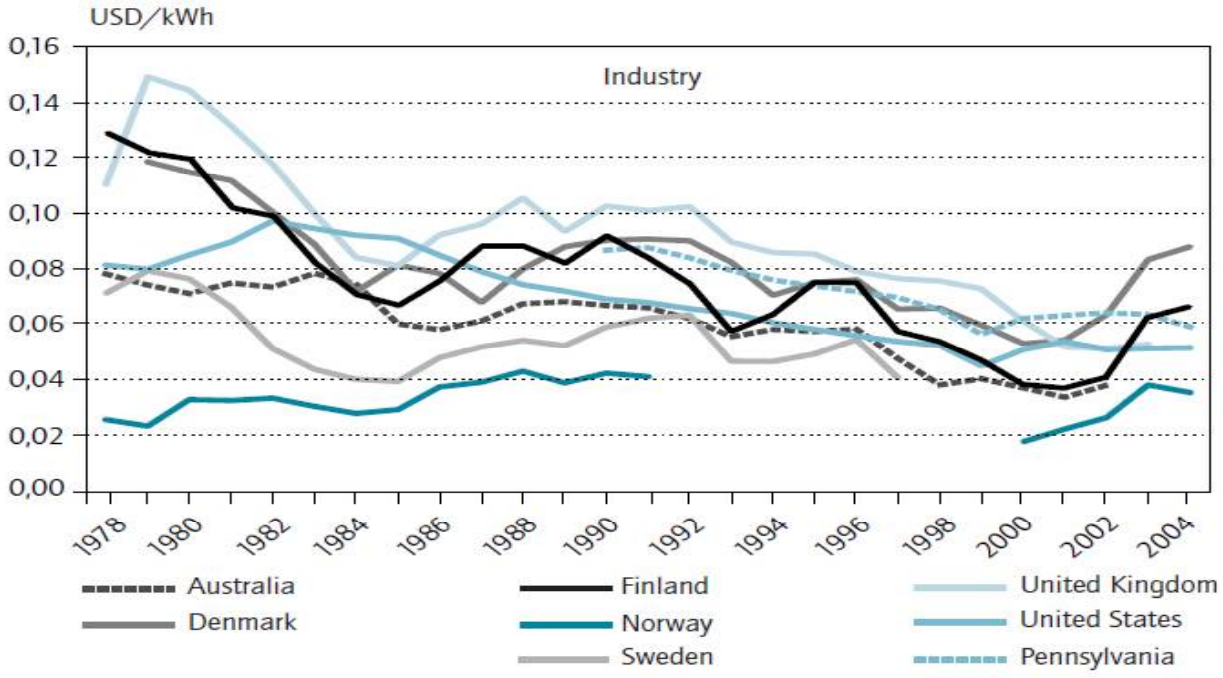

Figure 1.9: Electricity Prices Paid Worldwide by Retail Industry Consumers (1978-2004)

Source: Lessons from Liberalized Electricity markets, IEA 2005

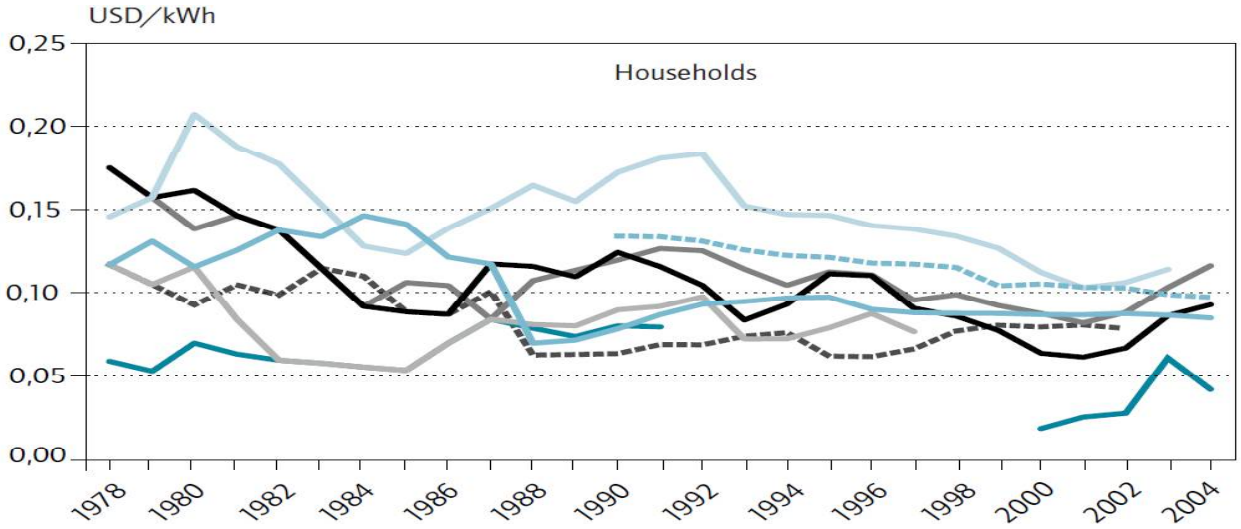


Figure 1.10: Electricity Prices Paid Worldwide by Retail Household Consumers (1978-2004)

Source: Lessons from Liberalized Electricity markets, IEA 2005

In the above Figures 1.9 and 1.10, electricity price trend has been analyzed for the industrial and residential consumers respectively. After liberalization, the downward trend in electricity prices began in the 1980s. A clear falling tendency of electricity prices was seen in United Kingdom. After 1998, the electricity prices in Australia were almost stable. This may be because the electricity consumers of few states had the facility of choosing their power supplier (Simshauser et al., 2013). In Nordic Countries (Denmark, Norway, Finland, Sweden), a significant price fall was seen after the introduction of retail, however, increase in price was observed in 2002 due to severe drought in the Nordic region.

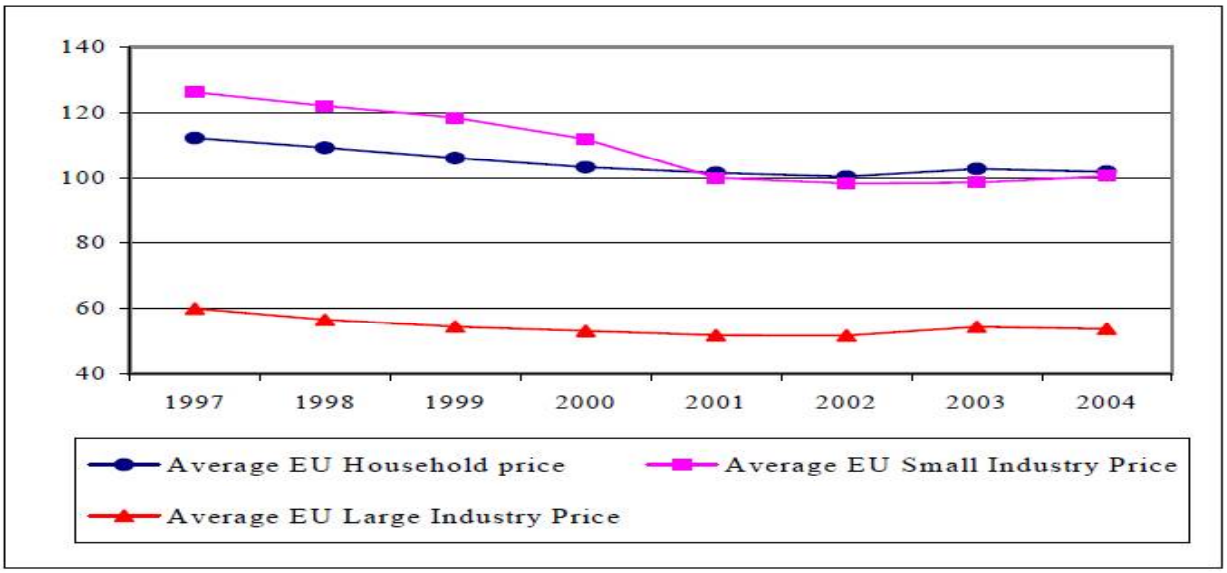


Figure 1.11: EU Average Electricity Price (2004 Euro per MWh)[8]

Source: Jamasb and Pollitt, 2005

The retail competition was introduced in the European Union in 1996. In the European Union, the electricity prices fell down after the introduction of retail competition. The reduction in prices is shown for the period 1997 – 2003 as shown in Figure 1.10. The quotient of reduction for average prices of electricity for large industrial consumers, small industrial consumers and households is 9.5%, 20%, and 6% respectively as shown in Fig 1.11.

From the above discussion, it can be said that liberalization and introduction of retail competition resulted into a significant drop in power price for the end consumer. The retail prices are presently showing increasing trend in many countries due to increment in fuel cost and increment in cost to lower down the $CO_2$ emissions. Benefits of liberalization can be visualized by comparing the electricity price paid by the end consumer before the liberalization and after the liberalization (Joskow, 2008). Hence many countries are taking lessons from successful cases of liberalization and making promises that liberalization increases the competition and decreases the electricity price in a market.

[8] Source: Electricity Market Reform in the European Union: Review of Progress toward Liberalization and Integration 2010

3) **Increase in Consumer Satisfaction from Retail Competition "Global Evidences**

The mobility of consumer reflects the nature as well as the frequency of switching retail supplier. The same indicates market dynamics with a higher degree of strength, diversity, and quality of product offering and scale of consumer awareness, consumer participation, and consumer satisfaction. All of them are key channels to empower consumer choice in a market. In retail marketplace, if the consumer is not satisfied with the service of its present electricity supplier then he can switch the supplier. Figure 1.12 below shows the residential and commercial consumer switching ratio in IEA countries for the period of 1995 – 2007:

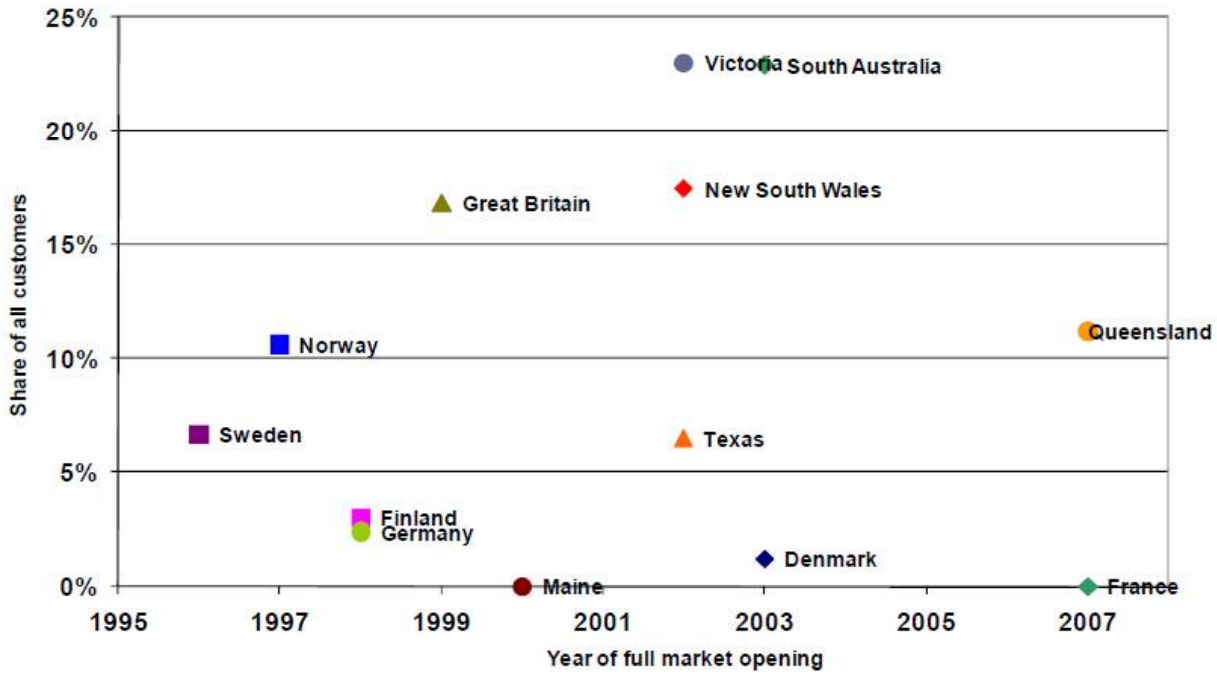


Figure 1.12: Residential and Commercial Consumer Switching in IEA Countries

Source: Empowering Consumer Choice in Electricity Markets, IEA 2011

Most of the IEA countries observed high switching rates after the opening of retail marketplace. In Australia, cumulative switching rate reached 100% in the regions of South Australia and Victoria. The European Union also saw a significant level of switching in the countries like -the United Kingdom, Netherlands, Sweden, and Norway. According to Office of Gas and Electricity

Market (OFGEM), 38% residential consumers in United Kingdom have changed their electricity supplier since the opening of the retail market. 50% of Norwegians consumers have also switched their power suppliers.

According to the report of International Energy Agency "Residential and Commercial Consumer Switching in IEA Countries 2011", usually the electricity consumer's supplier switching rate is higher in initial years of retail introduction which later become steady. This can be because of increase in competition. With the increase in competition, suppliers attempt to offer better services at a low price than other in the market for increasing their market share.

### 4) Retail Competition and T&D Losses

The Transmission and Distribution (T&D) Losses are identified as one of the major reasons of increase in debt share of Indian Power Sector. The Figure 1.13 shows India's position in terms of T&D Losses in the world.

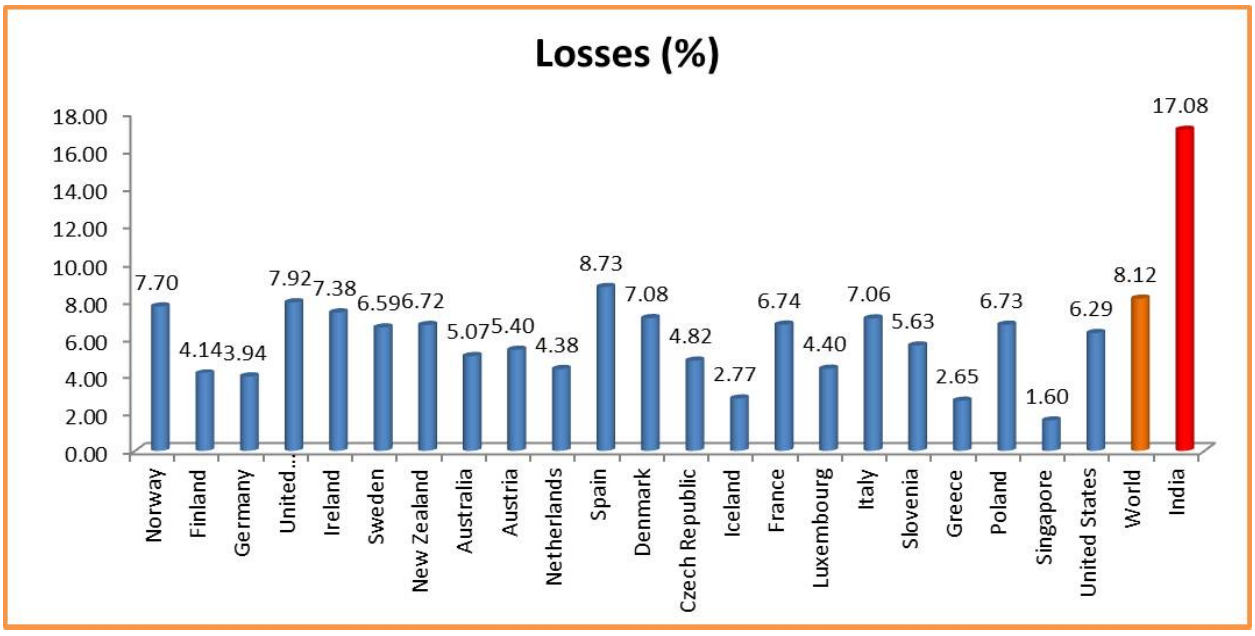


Figure 1.13: Worldwide Effect of Competition on T&D Losses[9]

Source: Adapted from IEA Statistics, OECD/IEA 2014

[9] Source: World Bank

India shows 17.08% of T&D losses which is highest among selected countries as per the IEA Statistics for 2014. While the losses of developed countries are in single digit, India's losses are in double digits. Countries like Singapore, Greece, Iceland, and Germany have losses around 1.60%, 2.65%, 2.77%, 3.94% respectively while UK, New Zealand, and Australia shows T&D losses around 7.92%, 6.72%, and 5.07% respectively. Average of T&D losses in the world is 8.12%. India's losses stand at 17.08% which is almost two times of the average T&D losses of the world which is an alarming situation.

**5) Price Benefit from Power Exchanges in India**

The Republic of India has two power exchanges – Indian Energy Exchange and Power Exchanges of India Ltd, both of them were established in 2008 and since then they are providing a common platform both to traders and buyers to sell and buy power in a competitive way. The competition created by power exchanges brought down the electricity[10] prices drastically. Figure 1.14 shows the year-wise trend of a price drop.

[10] Electricity which is traded through power exchanges

| Year | Price of Electricity transacted through Traders (₹/kWh) | Price of Electricity transacted through Power Exchanges (DAM+TAM) (₹/kWh) |
|---|---|---|
| 2008-09 | 7.29 | 7.49 |
| 2009-10 | 5.26 | 4.96 |
| 2010-11 | 4.79 | 3.47 |
| 2011-12 | 4.18 | 3.57 |
| 2012-13 | 4.33 | 3.67 |
| 2013-14 | 4.29 | 2.90 |
| 2014-15 | 4.28 | 3.50 |
| 2015-16 | 4.11 | 2.72 |

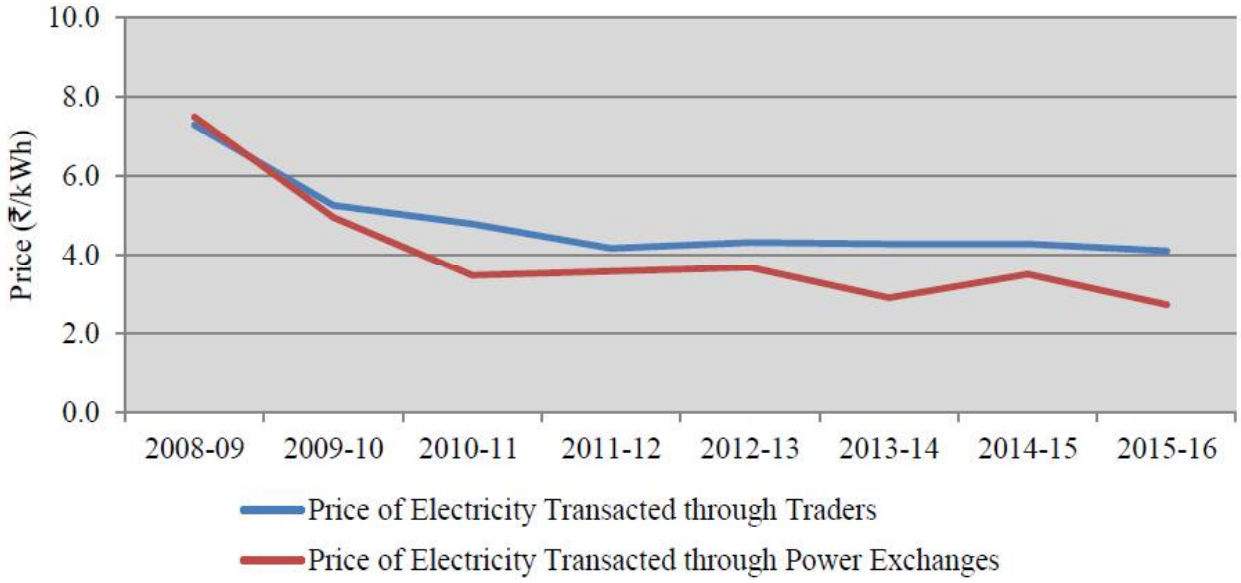


Figure 1.14: Price of Electricity Transacted Through Indian Power Traders and Power Exchanges (2008-16)

Source: Short-Term Power Market in India, CERC report 2016

The Figure 1.14 above clearly depicts that the prices were dropped to approximately 50% of the earlier price only in one year of the establishment of power exchanges. The average price of the transacted electricity was Rs. 7.49 in 2008-09 which came down to Rs. 4.96 in 2009-10. With the effect of competition, year-on-year, a gradual reduction in the average price of transacted electricity was seen. Price of transacted electricity prices was further dropped to Rs. 2.72 in 2015-16.

Price drop through the power exchanges shows that introduction of competition leads to significant price benefits.

## 1.7 ORGANIZATIONAL SCHEMATA OF REPORT

The present work is organized into eight chapters for the purpose of presentation and exploration. The first chapter, 'Introduction and Background' constitutes the business problem and its scope. The second chapter describes the scenario of reforms in India. The third chapter details worldwide retail electricity markets and theories around the market structure. Chapter four does a structured review of the literature. Chapter Five describes research methodology. Chapter Six does conceptualisation to develop the interview protocol. Chapter Seven analysis interviews and presents various findings and discussions to develop the framework. Finally, the last chapter of this report concludes the final framework to introduce retail competition in Indian power sector

1) The first chapter introduces the Indian power sector in a general way and derives business problem by quoting various facts and figures. The chapter presents need, significance, and significance of the research. The chapter also includes the plan of the execution and presentation of the research.
2) The second chapter presents brief genesis and present status of power sector reforms. Reforms leading to the emergence of the wholesale market and retail markets are also discussed. The chapter derives two themes to carry out a structured review of the literature.
3) The third chapter gives the overview of global electricity markets. The chapter discusses various models of electricity markets. The chapter identifies underpinning theory of the study and also derives another two themes for the structured literature review.
4) The fourth chapter does detail structured review of the literature on identified themes and theoretical underpinning. The chapter derives research gap through funnel approach. On the basis of research gap, research question and research objective are formulated in the chapter.
5) The fifth chapter presents research methodology adopted for the study. The chapter includes research methods, research design, operating definitions, theory adopted for conceptual development and the most importantly – "Framework Analysis" as the adopted research methodology for data analysis.

6) The sixth chapter conceptualises a framework by developing conceptual lens. The first part of the chapter develops two conceptual lens based on various retail regulations. The second part of the chapter develops a conceptualized framework for the introduction of retail competition in Indian power sector.
7) The seventh chapter develops the framework. The first part of the chapter does the analysis of in-depth interviews through framework methodology. Based on the analysis, the second part of the chapter presents various findings and discussions which lead in developing the framework.
8) The eighth and final chapter of this report presents a proposed framework to introduce retail competition in Indian power sector through the separation of carriage and content from existing distribution business. The chapter completes the report by presenting necessary conclusions, implications, and limitations of the study.

The report has eight chapters only. The researcher presents his research chapter by chapter in order to better manage the content and derived knowledge.

## 1.8 **SUMMARY**

1. Reforms in the power sector have brought certain major changes in the operating environment. With this, it was expected that Indian Power Sector will make profits. In the first two phases of reforms, the SEBs were unbundled into Genco, Transco and Discoms and Power Exchanges were established for power trading. Thus, we can say that Power Generation, Power Transmission, Power Distribution and Power Trading are the four pillars of Indian Power Sector.
2. The studies revealed that the reform outcomes were not as per the expectations leading to the end of euphoria owing to reasons such as obstructing and inconsistent policies, procedural complications internal to the sector and dire financial state of SEBs (Kumar and Chatterjee, 2012).
3. The various concerns various concerns plaguing the Indian power sector are increasing financial losses, increasing debt burden on State DISCOMs, negative impact of losses and

debt on GDP, increasing AT&C losses, increasing power purchase cost, increment in per unit cost of power, increasing gap between average cost and average revenue

4. The above points lead to following "Non-Bifurcation of Content and Carriage in Indian Power Distribution Sector is leading to Opportunity Cost" as the Business Problem for the present study.
5. The above business problem is significant as i) The financial losses of Power Sector increased by Rs 29,773 Crores from 2011 to 2013. ii) The debt burden on DISCOMs increased by 27% from 2003 to 2011. iii) The AT&C losses reduced by 1.75% from 2011 to 2013 (high rate of reduction in AT&C Losses were expected than achieved) iv) The gap between Average Revenue and Average Cost increased by Rs. 33,109 crores from 2010 – 2013. iv) The average cost of per unit power increased by 70% from 2003 - 2011. v) Average tariff of per unit power increased from Rs. 1.74 from 2007 – 2014.
6. The rationale for present study stands on the following points: a) In India, Establishment of Power Exchanges in 2008 resulted in lowering of electricity price due to 'competitive pricing'. b) Retail competition through separation of carriage and content was introduced in New Zealand in 1994 followed by United Kingdom and other countries. The study reveals that competition resulted in i) reduction of power prices ii) increase in consumer satisfaction iii) low transmission and distribution losses.
7. The next chapter presents the detail on the reforms in Indian Power Sector and their impact.