CHAPTER 1

INTRODUCTION

BACKGROUND

India is the third largest generator of electricity after USA and China. India touched a new mark of 1 Trillion units generation for the FY 2014-15. Yet, in comparison with USA and China, the specific or per capita consumption is woefully low. When India touched its record 1000 units per capita, the countries like USA, China, Brazil and Germany have multi-folds higher consumption of electricity. In order be in tandem with the growth rate of 7.4%, the power generation sector has to grow at 5.92% (considering the energy elasticity to be around 0.8). The power sector on the other hand has been growing at an average growth rate of around 8% per annum. Still, the gap of generation and the consumption could not be met. On the onset of "Make in India" campaign of Hon. PM, Shri. Narendra Modi, the power intensity of the country is expected be on the rise, increasing the need of power. Thus, India needs to make an agile move towards the expansion of the power sector. Considering Generation, there is a variety of options for establishment of power plants, each having its own pros and cons. India has to keep in mind, its short, medium and long term goals in order to develop an apt model fuel mix in the power generation industry. NitiAayog (previously known as "Planning Commission") had suggested a fuel mix in the power sector during April 2015 for the target year 2047. Since then, a lot of changes in the socio-cultural and the regulatory environment have pointed towards a different path. The role of renewables in the power generation portfolio has taken the driver's seat after the COP-21 held in Paris. India has promised to include an installed capacity of 175 GW of renewable in the power grid to meet the electricity consumption of the country.

The coal based thermal power plants produce the lions' share of about 61% in installed capacity and 76% in the overall energy generated. The share of power generation is better expressed in terms of a comparative pie-diagram in Fig 1.1 and Fig 1.2

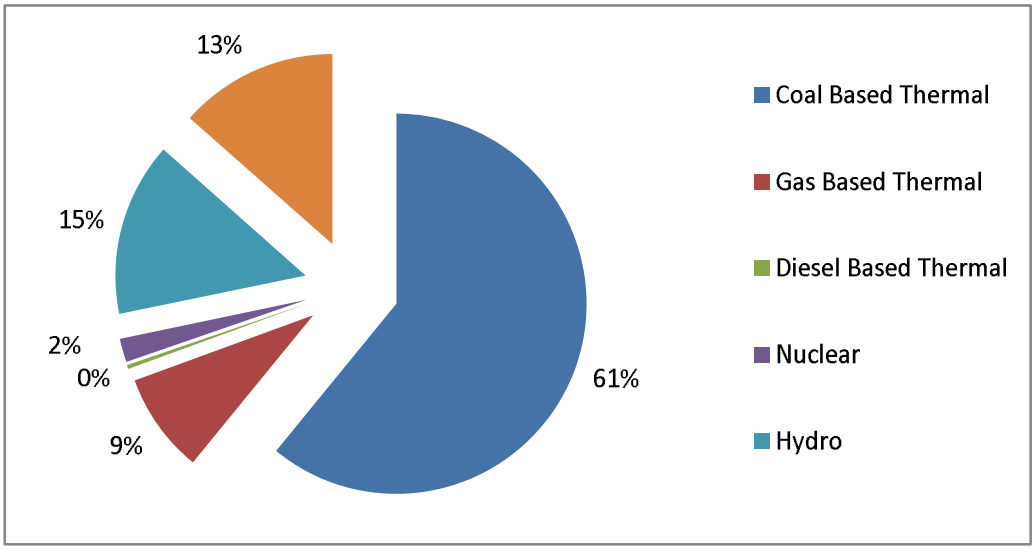

Fig1. 1: Fuel Mix (Installed Capacity)

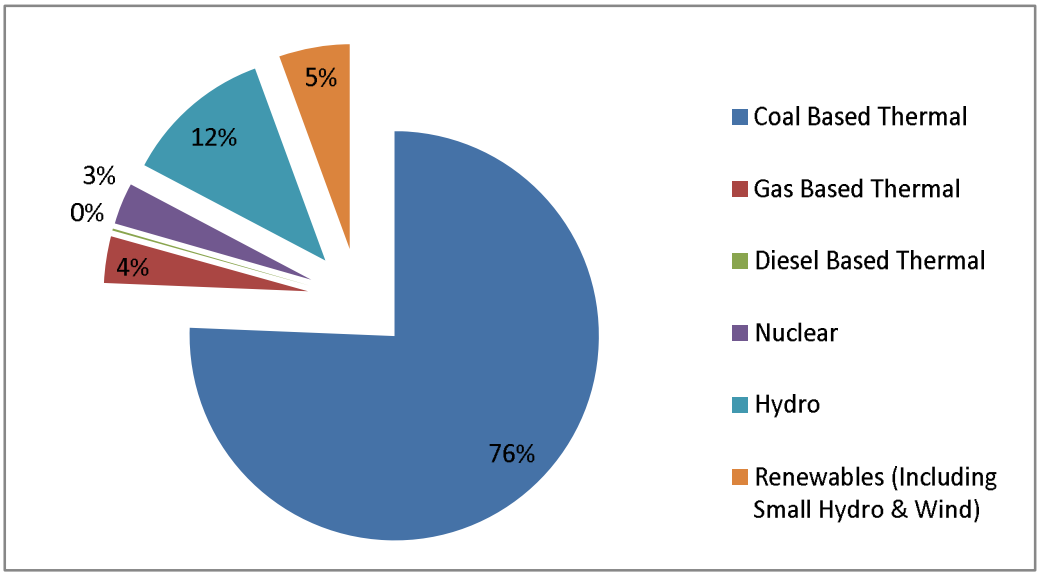

Fig1. 2: Fuel Mix (Actual Generation)

The COP21, held at Paris has projected India as a Pioneer in initiation of the Solar Based power generation for the future. India has promised a 100 GW of solar capacity addition by 2022, hugely surpassing its actual target of 18 GW. India has also added an installed capacity of up to 5 GW within a short term.

In the Union Budget of FY 2015-16, there have been special calls for the development of marginal oil and gas fields in India, which may lead to indigenous and cheaper gas resources for power generations and the gas contract with Iran through China is also in the tunnel. This may stress the necessity of Natural Gas Based Thermal Power Plants in the country. Gas is the cleanest of the fossil fuels and the gas based plants also improve the grid stability in the country. Gas based power plants are suggested to take up the uncertainties in the renewable power generation like solar and wind and to help make a stable hybrid plants. The gas based combined cycle power plants are also the most efficient thermal based power plants with efficiencies close to 70%.

In addition, the growth and development of nuclear power is also stressed in the present budget. India has a present installed capacity of 5780 MW and a couple of projects under construction and commissioning. But, most of the nuclear power plants are under stalled condition due to the repercussions of the Fukushima disaster in 2011. Kudankulam, a 2*1000 MW reactor (VVER Technology), in collaboration with Russia has been stalled since 2002 and has had a lot of problems in the commissioning of the second reactor from the fishermen in the vicinity.

India is making great strides in the coal based power production. India has stepped up its capacity in indigenous coal production, thereby reducing its risk and dependence on imported and costly coal. The coal handling processes are also planned to be made more efficient and effective by the implementation of UDAY (Ujjwal DISCOM Assurance Yojana). The emission control is not up to the global standards, yet, imported equipmentare imbibed with the global standards leading to reduced emissions from the thermal power plants.

Other Renewable sources, like wind & biomass are also spoken about nowadays. Though, their expected expansions of these power plants are duller than the forecasted rate of expansion. India needs to invest more in these resources as it has a very high agricultural produce (for biomass) and has a very large coastline for off-shore wind power plants that are more reliable and have a better capacity factor than the on-shore. But, the investment seems too little to support these sectors to have a sustainable environment.

The transmission sector on the other hand has been on the spotlight since the introduction of the enhancement of installed capacity of the renewables. India has been long struggling to link the five regional grids to operate as one. This is due to the fact that the inter-regional transmission capacity of the regional transmission grid is much lower than that required for hassle-free transmission within the country. The southern grid which had been the bottleneck in this transmission due to poor link with the NEW grid has been strengthened recently and has to be strengthened more to meet the high power requirements of the southern grid to be met by the power surplus eastern grid, which is unable to sell its power to the southern grid due to the congestion of the transmission networks connecting them to the southern grid. Even the 62650 MW capacity of inter-regional transmission capacity is much low compared to the overall transformation capacity of 700950 MVA, a transmission capacity of 359033 ckt km and an overall installed capacity of 308834 MW.

The renewable energy is said to create a lot of disturbances in the grid and is proposed to create a green corridor between the regional grids to make them sustain the added capacity of the renewables and to refrain from any grid disturbances. This is another important move to be introduced by the government to support the renewable capacity addition and scheduling in the country. Creating transmission lines of huge power handling capacity to carry green power to long distances is another capital intensive plan.

The distribution system has been the weakest link in the overall power value chain. It has been making continued, consistent and sustained losses over the

last few decades. It has had a lot of support from the government in the 2002 Alhuwalia commission reforms to lessen the losses made by them. Financial Restructuring Plan (FRP -2013) was not implemented, leading to an even worsened performance by the distribution sector. As on Mar 2015, it had an accumulated loss of about Rs. 4.3 lakh crores and is mounting as the DISCOMs are unable to collect the expenses spent on power procurement from these costly power generation companies due to the increase in the international coal prices, indigenous production of coal, being unable to meet the growing demand of power from the consumers. The lobbying against the economic hydropower and the nuclear power has made the power purchase costlier and unviable without the increase in power tariffs.

Break-up	Capacity At the end of 10th Plan	11th Plan Addition	Capacity At the end of XIth Plan	12th Plan Addition	12th Plan Addition	Expected at the end of 12th Plan	12th Plan Actual Achievement					Commulative 12th Plan Addition (Upto Nov-16)	Capacity As on Date (Upto Nov-16)
	Actual	Actual	Actual	Target	Expected		12-13 (Actual)	13-14 (Actual)	14-15 (Actual)	2015-16 (Actual)	2016-17(Upto Nov-16)		
	1	**2**	**3**	**4**	**4A**	**5=(3+4A)**	**6**	**7**	**8**	**9**	**10**	**11=(6+7+8+9+10)**	**12=(3+11)**
ER-NR	3430	8700	12130	5800	5800	17930	0	2100	0	1600	3700	5800	19530
ER-WR	1790	2600	4390	8400	8400	12790	0	2100	4200	2100	0	8400	12790
ER - SR	3130	500	3630	0	0	3630	0	0	0	0	0	0	3630
ER–NER	1260	0	1260	1600	1600	2860	0	0	1600	0	0	1600	2860
Sub Total	**9610**	**11800**	**21410**	**15800**	**15800**	**37210**	**0**	**4200**	**5800**	**3700**	**3700**	**17400**	**37210**
WR-NR	2120	2100	4220	10200	12700	16920	2000	2500	0	4200	0	8700	12920
WR-SR	1720	(-200*	1520	6400	6400	7920	0	2100	2100	2200	0	6400	7920
Sub Total	**3840**	**1900**	**5740**	**16600**	**19100**	**24840**	**2000**	**4600**	**2100**	**6400**	**0**	**15100**	**20840**
NR - NER	0	0	0	6000	6000	6000	0	0	0	1500	1500	3000	3000
132kV	600	0	600	0	0	0	0	0	0	0	0	0	600
Grand Total	**14050**	**13700**	**27750**	**38400**	**40900**	**68050**	**2000**	**8800**	**7900**	**11600**	**5200**	**35500**	**62650**

Table 1.1: Inter Regional Transmission Capacity --- Program of National Grid Development (in MW)

The reduced billing and collection efficiencies add woes to the already loss making distribution companies as the Aggregate Technical and Commercial losses increases leading to reduction of the revenue collected from the electricity consumers, leading to a large gap between the revenue realized and the actual revenue required to continue the operations without making any losses. This would mean that the power consumer has to bear these losses that have been due to the inefficiency of the distribution company. On the long run, this may affect the operation of the DISCOMs. To effect an integrative financial turnaround of the DISCOMs, not only in the capacity to pass the increase in costs to the consumers but also to improve their technical performance and reduce their inefficiencies to meet the international benchmarks for AT&C losses, the UDAY scheme was introduced in November 2015.

Many of the states have signed the MoUs for the implementation of UDAY in their states to avail coal on priority basis and to avail the attractive schemes of Integrated Power Development Scheme (IPDS) and DeenDayalUpadhyay Gram JyotiYojana (DDUGJY) in their states for implementing technical efficiency improvement through central and state grants. This has paved way to privatization and franchising of the distribution companies by the state government to make them more efficient and impart discipline in their operations. Segregation of Carriage and Content is such a clause in the Electricity Act Amendment that allows the segregation of the network business and the supply business.

Power trading is the latest addition in the power value chain that has made a lot of ripples in the power sector in the recent years. Since the power purchase consists upto 80% of the overall costs of the DISCOMs, the procurement of the economic power has also taken up the drivers' seat in the operation of the DISCOM. The generation companies have also ventured into the power trading platform since their surplus power generated could be sold in the market to fetch them some revenue (liquidity) and to reduce their cost of

power generation by increase in the plant load factor. The power trading has been the competitive market of power sale where the short term power sales are done in an economic basis. The establishment of Indian Energy Exchange (IEX) and Power Exchange India Limited (PXIL) have emerged as the source of short term power where the efficient discovery of power prices is done based on the demand and supply of the power in the market.

The power traders have also emerged with the license to purchase power for the resale purposes to power consumers. They operate with a margin of 4-7 paise per unit sold and purchased. The short term power market has improved in the recent years from 3-5% to 11% in 2015. The establishment of merchant power plants (MPPs) have also been a great leap in the short term purchase and sales of power. Thus, the introduction of open-access in the 2003-Electricity Act (EA) has paved way for the direct communication between the power generator (gencos) and the power consumers (bulk consumers of contract demand >1MW) for sale and purchase of economic power without the intervention of DISCOMs. This open access shall act as the catalyst for the transition of bulk competitive power market in India to a retail competitive market. In this paper, we shall discuss in detail about the emerging regime of Open Access and the issues and challenges faced by this reform and a suggestive framework for its implementation to make it sustain and flourish in the long run.

1.2 BUSINESS PROBLEM

Skewed electricity tariff is the biggest challenge faced by industrial/commercial consumers. Irrational tariff structure leads to high transaction cost in industry and service sectors (as Industry and commerce pay higher tariff than the cost of supply). Higher cost of energy affects global competitiveness of Industry and services. On other hand, domestic/agricultural, tariff (subsidized/free) not being cost reflective, leads to sub-optimal usage of resources, deterioration in quality of power, wastage of power, excessive pumping of ground water etc. This is adversely affecting the industrial competitiveness as there is inadequate policy framework mechanism

in place for free flow of electricity. Motivation for research is to reduce the business loss of Rs150 Cr. per day*.

OA is a concept to give a choice to customers, to source power from any supplier. This, if implemented properly, may bring in efficiency in distribution of electricity, rationalize tariff and improve quality of supply service.

In absence of operationalisation of OA, the competitive edge of the industries and service sectors in India, has been dented, thereby putting the economic development at stake. There is an urgent need to address this issue not only for the sake of improvement of the electricity distribution sector but also for sustenance of the health of the economy. OA has so far been resisted by distribution licensees in India.* Himachal Pradesh has surplus power and Haryana is deficient at the same time of day. High OA charges and arduous procedures imposed by Regulators at the instance of distribution licensees are not allowing seamless flow, thus, affecting the industrial competitiveness internationally. The deficiency of power is made up by diesel power generation, adding 2.68 kg of CO_2 for each liter of diesel. 70 MUs are daily transacted on Power Exchange (PX). If Rs. 6 is taken at differential tariff, Rs. 150 Cr. Per day is loss caused to the industry as only 01 out 05 consumers is being granted OA.

1.3 MOTIVATION FOR RESEARCH

It is felt necessary to undertake detailed research to identify the factors responsible for (non) implementation of OA in distribution sector. We relied on the literature survey, benchmarking study of distribution system of India and UK and identified the critical variables. This research study proposes an alternative framework for implementation of OA in the electricity distribution. Research study of (non) implementation of OA in distribution, therefore, becomes a necessity. Motivation for research is to reduce business loss of Rs. 150 Cr. Per day.

1.4 STRUCTURE OF THESIS

The Thesis covers seven chapters including the present Introduction Chapter.

Chapter 2: Overview of Power Sector and Open Access in India

The Chapter gives the overview of the structural framework of the power sector. It throws light on the Open Access framework in the country and the incorporation of the same into the Electricity Act of 2003. The Chapter also gives a detailed prescription of the value chain of the electricity sector, along with the workings of the wholesale and retail market and power trading.

Chapter 3: Literature Review

Chapter 3 delves into first category review of the literature available on the success and failure of the third party access regime in different countries and India's learnings from it. It comprises of three aspects namely: Theoretical underpinning evolution of the regulatory regime, restructuring and deregulation regime, Distribution reforms in Indian states, identifying factors affecting performance of OA and Challenges to OA Distribution and Framework development. The chapter has been concluded with a discussion on the literature review. The chapter also throws light on the theoretical premise of the research work conducted.

Chapter 4: Research Methodology

Chapter 4 focuses on the construction of the research methodology for the research work to be conducted. The first half of the chapter talks about the research need,the research gaps in this particular area of research and the corresponding research objectives corresponding to the research gaps. The chapter talks about the process of research, the sample size and the tools used for the primary survey, factor analysis and opinion survey.

Chapter 5: Analysis and Results

The chapter 5 coversthe reliability analysis carried out to validate the quality of questionnaire, analysis of the factors obtained from

literature review and from comparison of OA in India with that in UK and a factor analysis carried out on the same.

Chapter 6: Conclusions and Theoretical Contribution

The chapter provides concluding analysis of the way forward for the Indian Power Sector to incorporate OA as an integral feature of the sector. The chapter also provides a brief theoretical contribution for the research work conducted in this arena of power sector.

Chapter 7: Limitations and Future Study

Chapter 7 focuses on the limitations of the study like the limitations of applicability of OA in the country. The chapter also throws light on the future scope of study in this area.

The construct of the research is depicted below in **Table 1.2:**

Table 1.2: Construct of Research

Phase 1: Research Context This phase explains context of research and introduces the topics relevant to research	**Chapter 1** Introduction
	Chapter 2 Overview of Power Sector and Open Access in India
Phase 2: Extensive review on journals, Reports, other relevant literature has been carried out in this phase	**Chapter 3** Literature Review
Phase 3: Based on the Phase 2 Review, research problem/gap has been	**Chapter 4** Research Methodology

identified in this phase. The researcher has at this Phase drawn insights from the data and defined objective of the research and the methodology to achieve the objective.	
Phase 4: Questionnaire survey is the main research methodology used for primary data collection and Factor analysis tool has been used to analyse the data so collected. Secondary data has been analysed using various statistical tools. Parameters have been developed. Comparison has been done between two systems based on the parameters. Results of the analysis have also been highlighted at this Phase.	**Chapter 5** Analysis and Results
Phase 5: Findings are discussed and contributions to research and theory are highlighted. Directions for future work are also mentioned.	**Chapter 6** Conclusions and Theoretical Contribution
	Chapter 7 Limitations and Future Study