Transmission Pricing of Power and Electricity Derivatives in Indian Market

Final Year Project Report submitted in partial fulfillment of the Requirement for the Award of the degree of

MBA (Energy Trading)

Submitted by-

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Certificate of Declaration

This is to hereby state that the intention of this report is very original in every sense of the terms and conditions and it carries a sense of honour and belief and that no shortcuts have been taken and I remained both meticulous and caring during the prevalence of this research work. I have put in my best to keep this work as informative and precise as possible.

It may be also stated here that during the preparation of this report some help has been taken from a scope of professionally shared information & knowledge, a comprehensive description of which has been mention in the references chapter of this report.

Dated: 25-04-2014

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Bonafide

This to certify that the Mr. Nithin Chandra Kode, student of University of Petroleum and Energy Studies, Dehradun pursuing MBA in Energy Trading has successfully completed his dissertation project. As a part of his curriculum, the project report entitled "Transmission Pricing of Power and Electricity Derivatives in Indian Market" submitted by the student to the undersigned is an authentic record of his original work which he has carried out under my supervision and guidance. This study has not been submitted anywhere else for degree purpose.

I wish him all the very best for his future endeavors.

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1. EXECUTIVE SUMMARY:

Energy plays a critical role in the socio-economic development of a country. Ever since the man came to this world, he has grown by finding one or the other way to make his life more comfortable through different means. Electric Power played an important role in human life since last decade of 19th century. It became more significant after IInd world war. In the growing consumption of energy, availability of energy including electric power from conventional sources is under pressure and it has becoming important to increase the efficient usages of energy, extracted from various renewable and non-renewable sources.

Over the last decade, electric markets have been significantly restructured throughout the world. This is a process of breaking up vertically integrated electricity utilities and introduction of commercial interfaces between the functions of generation, transition, distribution and retailing of electrical energy. The motivation for restructuring is to harness a pressure to improve the economic efficiency of electricity industry, to contribute to the environmental protection and to provide a better service for energy consumers.

The Indian Policy planners have planned a new methodology for transmission pricing introducing the hybrid method which is based on the Point of Connection (POC) mechanism. Now, as the power sector has opened up for private players as well this method plays a very important role in deciding the transmission tariffs. This research examines the types of methodologies available and its impact on the competition.

2. INTRODUCTION:

India ranks 5th in terms Electricity Generation after United States, China, Japan and Germany (as per economic survey 2013).The ratio of economic growth: Power demand growth is 1:1. The Compounded Annual Growth Rate (CAGR) of generation is expected to be about 5.1% during the 11th plan. However, higher growth could have been achieved if for the existing and new gas based plants commissioned during 10th plan, adequate gas would have been available.

The shortages in demand met during peak time and overall energy supply is characterized as power supply position. In the next 6 years the generation capacity is required to be doubled to meet the growing demand and shortages encountered in various regions, so that the total demand both in terms of peak and energy can be met.The India's power system today with its extensive regional grids is maturing in to an integrated national grid, and its millions of kilometers of T & D lines crisis crossing the country, are truly symbolic of the achievements of the developmental path pursued since independence.

The Government of India has an ambitious mission of 'POWER FOR ALL BY 2014'. This is a great challenge. At the same time, this provides great opportunities for developers and investors. The Electricity Act, 2003 has made special provisions for not only de-licensing generation of power, but even de-licensing distribution of power and systems which promote de-centralized distributed generation and supply. This challenge is converted into opportunities for development and growth, the Government of India has put in place a very ambitious programme, namely Rajiv Gandhi GraminVidyutikaranYojana to create a sound Rural Electricity Infrastructure. India's predicted strong economic growth the country will need to add over 150,000 MW of additional installed power generation capacity by 2025.

3. LITERATURE REVIEW:

There is enough literature available for the reference of the study. The broad use from all the literature has been made which is available for the data:-

1.) Transmission Pricing and Congestion Management by Shmuel S. Oren: Transmission pricing and congestion management are the key elements of a competitive electricity market based on direct access. They have also been the focus of much of the debate concerning alternative approaches to the market design and the implementation of a common carrier electricity system. This paper focuses on the tradeoffs between simplicity and economic efficiency in meeting the objectives of a transmission pricing and congestion management scheme. I contrast two extreme approaches: the postage stamp approach vs. nodal pricing. The paper questions the wisdom of the nodal pricing paradigm on the grounds of its rigidity and complexity. I argue that the theoretical efficiency properties of nodal pricing are unrealistic and do not justify the implementation drawbacks of the approach. The paper explains the underlying principles of least cost congestion relief, adopted in California that treat congestion relief as an ancillary service and enables the ISO to relieve congestion efficiently with minimal intervention in the energy market. I also discuss zonal aggregation and describe a new zonal priority network access pricing that complements interzonal congestion pricing by offering a market mechanism to guide inter zonal congestion management and provide economic signals for location of generation resources.

2.) Power Sector-Analyzing the Transmission Pricing and Its Impact on Competition by Sonam Choudhury: Growth of Electricity sector of a country is very important for country's development. Transmission services begin an intermediary product plays a very vital role in the sector. Transmission is internationally considered a natural monopoly. It is to the credit of the Indian Policy planners that we have a central agency of planning of the grid which has led to regional grids and synchronization of all regional grids except southern grid. Such anintegrated grid system doesn't exist even in the USA. In 2009 CERC (The regulatory commission proposed the new pricing mechanism that is a hybrid method based point of connection (POC) mechanism. The transmission capacity is allocated on a non discriminate basis depending on amount of power flows and point of injection/drawl. Any new generation coming up has to first plan for evacuation of power to thegrid and delivery of power through the transmission network to its consumers and need to coordinate with Central Transmission utility (Power grid).However, in the present scenario, no discrimination is there.

3.) Power Transmission by Dr. A. Didar Singh: India's GDP has grown by 6.3% in 2011-12 and 5% in 2012-13 with the rise in industrial and commercial activity in the country. Disposable income has risen by 19.1% and population has increased by 15 million in this period. With the growth in economy, energy demand has also seen a ~7% y-o-y growth. Despite having installed power generation capacity of 225 GW and power demand of 135 GW (as of May 2013), India faced a peak power deficit of 9% (12 GW) . Power shortages have adversely affected the country's economy. In 2012-13, power shortages in India accounted for a GDP loss of USD 68 billion (0.4% of GDP) , impacting multiple industries like agriculture, manufacturing, services etc. Improvement of this sector is essential for the economic well-being of the country and enhancement of the quality of life of citizens.In the last 5 years, power generation capacity has grown by ~50%, whereas transmission capacity has increased by ~30% . As per the 12th Five Year Plan, the future expansion in power generation capacity in India is planned around 88GW. In order to meet this capacity, investment in the transmission sector needs to be increased. Overall, an addition of 10,000 ckm of 765-220 kV lines, 154,000 MVA of substation capacity and 27,350 MW of national grid capacity is required in order to meet the 12th Five Year Plan . For this purpose, an investment of USD 35 billion is planned in the power transmission sector. Of this, about USD 19 billion is planned to come from Power Grid Corporation of India Limited. The remaining USD 16 billion, 46% of the total investments, needs to be secured from private players.

4.) Electricity Transmission Pricing: How much does it cost to get it wrong? By Richard Green:Economists know how to calculate optimal prices for electricity transmission. These are rarely applied in practice. This paper develops a thirteen node model of the transmission system in England and Wales, incorporating losses and transmission constraints. It is solved with optimal prices, and with uniform pricesfor demand and for generation, re-dispatching when needed to take account of transmission constraints. Moving from uniform prices to optimal nodal prices could raise welfare by 1.5% of the generators' revenues, and would be less vulnerable to market power. It would also send better investment signals, but create politically sensitive regional gains and losses.

5.) Electricity Trading in Competitive Power Market: An overview and Key Issues by PrabodhBajpai and S.N. Singh: A robust trading system is very important for free and fair competitive electricity market operation. Trading system should be capable of risk hedging associated with price volatility and other unexpected changes. Operating behavior of a competitive power market is significantly affected by the trading arrangements, strategic bidding, market model and rule. Trading arrangement is properly designed in every country to take care of other abuse of market. These arrangements are kept on changing from time to time depending on the requirement for transparent and non-discriminatory electricity market. In this paper, various financial risk hedging instruments and trading arrangements of Indian and some developed markets are discussed. The important key issues and challenges in this field are also critically analyzed.

6.)The Competitive Effects of Transmission Infrastructure in Indian Day Ahead Electricity market: Public infrastructure can improve welfare both by directly lowering the costs of tradeand by fostering competition. I study the competitive effects of transmission infrastructure on market outcomes in the Indian day-ahead electricity market. Transmission constraints may increase local market power by limiting competition across regions. Bidders in import-constrained regions are estimated to raise bid prices by 17 percent of themarket-clearing price in response to congestion due to exogenous within-day changes intransmission capacity. I estimate marginal costs from bids accounting for transmission constraints and run counterfactual simulations to measure transmission capacity with endogenous bidder response. I nd that relaxing import constraints into the two most constrained regions would increase total surplus by 19 percentof baseline market surplus. Comparing the results of this expansion with counterfactuals holding strategic bid at baseline levels, the strategic response to transmission expansions accounts for 72 percent of this welfare gain.

7.)Electricity Transmission Pricing: The European Perspective by Graham Shuttleworth: How can anyone trade electricity, without ultimately being able to transmit it? The EU Directive on the internal electricity market came into force in most Member States on 19 February1999.Electricity markets are being developed, or are already active, all around Europe. However, whilst trading opportunities are increasing rapidly, traders still find it difficult to transmit power to, from and between these markets, especially when cross-bordermovements are involved.

4. OBJECTIVE OF THE RESEARCH:

1.) To know about the different methodologies used to calculate transmission price.

2.) To know how transmission prices of different states are calculated.

3.) To know how these prices influence the competition.

5. RESEARCH METHODOLOGY:

Research is an art of scientific investigation. It is basically careful investigation for search of new facts in any branch of knowledge. Research is a systematic effort to gain new knowledge. Research considers as a movement. A movement from the known to unknown. Research has its special significance in solving various operational and financial problems of business and industry.

In order to accomplish the objectives of the study, it is essential to articulate the manner in which it is to be conducted i.e. the research process is to be carried out in a certain framework.

The proposed study consists of the following attributes:

Type of research: Descriptive Research

Source of Data: Secondary data

DATA COLLECTION:

The task of data collection begins after a research problem has been defined and the research Design/Plan chalked out. The data are collected in order to get the result of the problem.

SECONDARY DATA:

These are the data which have already been collected by someone else and which have already been passed through the statistical process. In this the researchers have to decide which sort of data he would be going to use. As this study is a descriptive type of research, so in order to attain the objective, the secondary data is also collected. The data collected was from the various websites like CERC, different states ERC's, etc

6. FRAMEWORK OF INDIAN ELECTRICITY INDUSTRY:

6.1 GENERATION:

During the five decades since independence Power generating capacity in the country has increased by more than thirty times and by far electricity generation has increased more than fifty times. About 15 million farmers use subsidized electricity today and approximately 50 million Indian households are electrified. The number of consumers connected to the Indian power grid is 75 million which the figure of pre-independence era is Fifty times.

Since independence, there has been sizeable growth in the power sector. Generating capacity in the country which was only 1362 MW has increased to 225793.10 MW on March 30, 2014. Despite, rapid increase in population over period of time, per capita consumption has increased from 15 Kwh to 879.22Kwh during the same period.

6.2 TRANSMISSION:

Transmission of electricity is defined as bulk transfer of power over a long distance at a high voltage, generally of 132 KV and above. In India bulk transmission has increased from 3708 ckt.km in 1950 to more than 265,000 ckt.km today. The entire country has been divided into five regions for transmission systems, namely Northern Region, North Eastern Region, Eastern Region, Southern Region and Western Region. The interconnected transmission system within each region is also called the regional grid.

The Government of India has an ambitious mission of 'POWER FOR ALL BY 2014'. To be able to reach this power to the entire country and expansion of the regional transmission network and inter regional capacity to transmit power would be essential. The latter is required because resources are unevenly distributed in the country and power needs to be carried great distances to areas where load centers exist.

The transmission system planning in the country, in the past, had traditionally been linked to generation projects as part of the evacuation system. Ability of the power system to safely withstand a contingency without generation rescheduling or load-shedding was the main criteria for planning the transmission system. However, due to various reasons such as spatial development of load in the network, non-commissioning of load center generating units originally planned and deficit in reactive compensation, certain pockets in the power system could not safely operate even under normal conditions. This had necessitated backing down of generation and operating at a lower load generation balance in the past. Transmission planning has therefore moved away from the earlier generation evacuation system planning to integrate system planning.

While the predominant technology for electricity transmission and distribution has been Alternating Current (AC) technology, High Voltage Direct Current (HVDC) technology has also been used for interconnection of all regional grids across the country and for bulk transmission of power over long distances.

Certain provisions in the Electricity Act 2003 such as open access to the transmission and distribution network, recognition of power trading as a distinct activity, the liberal definition of a captive generating plant and provision for supply in rural areas are expected to introduce and encourage competition in the electricity sector. It is expected that all the above measures on the generation, transmission and distribution front would result in formation of a robust electricity grid in the country.

6.3 DISTRIBUTION:

Due to lack of adequate investment on T&D works, the T&D losses have been consistently on higher side, and was 23.97% in the year 2010-11.The reduction of these losses was essential to bring economic viability to the State Utilities.

As the T&D loss was not able to capture all the losses in the network, concept of Aggregate Technical and Commercial (AT&C) loss was introduced. AT&C loss captures technical as well as commercial losses in the network and is a true indicator of total losses in the system.

High technical losses in the system are primarily due to inadequate investments over the years for system improvement works, which has resulted in unplanned extensions of the distribution lines, overloading of the system elements like transformers and conductors, and lack of adequate reactive power support.

The commercial losses are mainly due to low metering efficiency, theft & pilferages. This may be eliminated by improving metering efficiency, proper energy accounting & auditing and improved billing & collection efficiency. Fixing of accountability of the personnel / feeder managers may help considerably in reduction of AT&C loss.

With the initiative of the Government of India and of the States, the Accelerated Power Development & Reform Programme (APDRP) was launched in 2001, for the strengthening of Transmission and Distribution network and reduction in AT&C losses.

The main objective of the programme was to bring Aggregate Technical & Commercial (AT&C) losses below 15% in five years in urban and in high-density areas. The programme, along with other initiatives of the Government of India and of the States, has led to reduction in the overall AT&C loss from 38.86% in 2001-02 to 26.15% in 2010-11. The commercial loss of the State Power Utilities reduced significantly during this period from Rs. 29331 Crore to Rs. 19546 Crore.

6.4 TRADING:

Perhaps, the most distinguishing feature of the power sector among the various infrastructure sectors is that it does not have a storage value, i.e. it is produced and consumed instantaneously. In a country like ours, where the resources for power generation are so unevenly spread, it is imperative to have a mechanism where the regional surpluses and deficits can be balanced such that there is no demand-supply gap, thereby explaining the rationale behind the concept of power trading.

India is the third largest producer of electricity in Asia with an installed capacity that has increased from 1362 MW in 1947 to about 225793.10 MW as of Jun 30 2013. However, alongside this growth story is the existence of shortages in meeting overall demand. In spite of the overall shortage, the inherent diversity in demand of various States and Regions in the country results in periods of seasonal surplus in one State or region coinciding with periods of deficit in another.

This coexistence of overall shortages with complementary geographical and temporal surplus-deficits provides substantial opportunities to improve the economic efficiency and security of supply through trading of power both within as well as across Regions. Realizing the full benefits of trading requires the availability of adequate transmission capacity and inter-regional links for transfer of power from a surplus to a deficit entity and support the development of a power market in the country.

Power trading is an activity in which the utility having surplus power transfers electricity to the utility having deficit of power, at some price (mostly Rs/Kwh). Every utility during some or the other season faces the deficit of power in there region, to overcome that deficit they contacts to the utilities having surplus at that particular season and enter into agreement for Power Trading either through bilateral contracts, intermediaries or through Power Exchange(PX).

In other words we can say that Power Trading is an agreement or contract between buyer (i.e. deficit utility) and supplier (i.e. surplus utility) to provide power at certain date, at certain hour and at certain price through transmission lines involved in the process of transfer of power from one utility to another utility.

In India, power trading is in an evolving stage and the volumes of exchange are not huge. All ultimate consumers of electricity are largely served by their respective State Electricity Boards or their successor entities, Power Departments, private licensee etc. and their relationship is primarily that of captive customers versus monopoly suppliers. Currently 90% of electricity is sold through long-term, bilateral power purchase agreements between buyers and producers. Yet Discoms rely on traders for short-term needs.

The power sector has come a long way from being a bilateral contract driven long-term market to one which is also driven by short-term trades. There has been a steady growth in the number of short-term power trades, with the number of participating utilities in short-term open access (STOA) increasing steadily.

Trading in power helps in reducing the imbalance of power systems, both in the surplus and the deficit regions thereby optimizing the utilization of existing resources. It will result in better utilization of existing generation and transmission capacities, as well as help in realistic assessment of investment requirements in generation capacities in deficit regions, which in turn may result in deferring investment for additional power generation capacity.

The short-term market is growing but important thing in Power market is that there will no additions in transmission capacity for short-term power generation.

7. TRANSMISSION PRICING:

7.1 DIFFERENT TYPES OF METHODOLOGIES:

The pricing methodology adopted should satisfy the following conditions:

1.) It should be non-discriminatory and transmission charges for all the generators should be in a comparable manner.

2.) The transmission cost should be shared among the generators in the region equally without bias.

3.) The transmission facilities cost should be recovered.

4.) It should encourage new generators to be established in the region for reducing the constraints over that interface.

5.) Proper monitoring of loop flows should be done within the region.

6.) The proposed methodology should be simple and fast so that it benefits the open access costs and the market price revision will not take much time.

The different types of methodologies are discussed below:

1. MARGINAL PARTICIPATION METHOD:

This method helps in analyzing how the power flow in the grid is modified when minor changes are introduced in the consumption. The procedure is detailed below:

a.) Marginal Participation sensitivities are first obtained when the injection in the flow lines is increased by 1 MW.

b.) Total participation of each agent is calculated as a product of its net injection by its marginal participation.

c.) The cost of each line allocated is allocated on the basis of pro rata to different agents according to their total participation in the corresponding line.

2. AVERAGE PARTICIPATION METHOD:

This method works as follows:

a.) For every individual generator a number of physical paths are constructed starting at the node where the producer injects the power into the grid following through the lines as the power moves through the network and finally reaching several of the loads in the system.

b.) Similar calculations are also performed for the demands tracing upstream the energy consumed by a certain user from the demand bus until some generators are reached.

c.) One such physical path is constructed for every producer and for every demand.

Countries like United Kingdom, Brazil, and Colombia have implemented the Marginal Participation Method. But, in India Hybrid Method is adopted which is a mix of above two methods.

The following steps should be taken while implementing Hybrid method:

- Data Acquisition
- Computation of Load Flows on the Basic Network
- Network Reduction
- Identification of Slack Nodes
- Hybrid Methodology for the determination of transmission charges
- Hybrid methodology for the determination of transmission losses
- Determination of Sharing of YTC and Losses
- Creation of Zones

Detailed below are the Calculation of Different State Power Transmission prices for the FY 2013-14:

8. Transmission Tariffs of Different States:

1Andhra Pradesh Power Transmission Prices for the year 2013-14:

1Introduction:

The Transmission Price Schedule consists of **a)** Transmission Charge in Rs/MW/Month and **b)**Transmission Loss percent.

a) To recover the estimated net ARR (*Annual Revenue Requirement*), the commission levies the monthly Transmission Charge/Rate on Generation Capacities estimated (excluding auxiliaries) for each year of the Control Period.It computed the Transmission Charge by dividing the net ARR with the estimated generation capacity (excluding auxiliaries) for each year of the control period.

b) Since the energy drawn by the users from the transmission system is always greater than the energy injected into the transmission system, so there is always a transmission loss. The commission also gave the transmission loss percentage of each control period.

About Andhra Pradesh Electricity Regulation

Andhra Pradesh Electricity Regulatory Commission was constituted on 31.03.1999 under the A.P. Electricity Reform Act, 1998. Since its inception, the APERC has taken several initiatives to improve the functionality of the Power Sector in the state of AP to make it viable and more importantly to protect the interests of the consumers. The commission issued Licenses to the APTRANSCO, the four Distribution Companies and the nine Rural Electric Cooperatives in the state. Six Tariff Orders have been issued.

Several path breaking documents have been formulated and released relating to the performance of the Licensees and protection of the interests of the consumer's viz., Customer's right to information, Licensee's complaint handling procedure, the grid code, Guidelines for Investment proposals, Load Forecasting and Power Procurement procedure, Merit Order Dispatch and Long Term tariff Principles (LTTP) etc. Consequent to the enactment of the Electricity Act 2003, the

Commission formulated and notified a number of Regulations on important aspects of Supply of Electricity to the consumers.

1.2 Generation Capacity of APTRANSCO:

1. The Commission examines the generation capacity details and levy's the Transmission Tariff. The Commission has affected the following changes with reference to the generation capacity given by APTRANSCO:

   a. Based on discussions held with Generation Corporation of Andhra Pradesh (APGENCO) and APTRANSCO, the ex-bus generation capacities have been revised in tune with schedules of upcoming generating stations.
   b. The conventional generation capacities and non-conventional energy generation capacity have been reworked for each Distribution Company based on Third Transfer Scheme as announced by GOAP *(Government Of Andhra Pradesh).*
   c. Based on proposed amendments to Power Purchase Agreements, 20 percent of ex-bus generation capacity of four upcoming gas based thermal stations is considered as Open Access (OA) capacity.
   d. The available information suggest that there is a potential for 1000 MW (including 660 MW NTPC Simhadri Expansion) OA capacity. This number is considered in the computations.

The details of the capacity given by the commission are given in the following table:

Table 1: Generation Capacity of Andhra Pradesh

Financial Year	Distribution Companies	Other Generator Open Access	Other Generators, Third Parties	Total Capacity in the State
1	*2*	*3*	*4*	*5=(2+3+4)*
2009-10	12891	391	462	13744
2010-11	14038	1041	462	15541
2011-12	144410	1091	462	15963
2012-13	16274	1141	462	17877
2013-14	19649	1291	462	21222

Source: AERC

1.3 Revenue Requirement of APTRANSCO:

The ARR amount for a year refers to the amount needed by the transmitting station to meet the sum of estimated costs and allow return on capital employed as per regulation 5 of 2005, for transmission activity.

The required investment is worked out based on a resource plan to meet the forecasted transmission capacity requirement for each year of the Control Period.

Table 2: Net Aggregate Revenue Requirement, FY 2009-10 to 2013-14(Rs.Cr.)

Financial Year	Gross Revenue Requirement	Less Expenses Capitalized	Less Non-Tariff Income	Net Aggregate Revenue Requirement
1	*2*	*3*	*4*	*5 (2-3-4)*
2009-10	1155.40	86.07	25.26	1044.06
2010-11	1639.84	76.22	25.26	1538.36
2011-12	2260.83	68.51	25.26	2167.06
2012-13	2572.28	72.25	25.26	2474.77
2013-14	2792.54	75.61	25.26	2691.66
Total	10420.90	378.66	126.32	9915.91
Figures are Rounded				

Source: AERC

1.4Transmission Tariff Calculation:

1. The Commission gave the Transmission Charge in Rs/kW/Month as per Regulation 5 of 2005 using the approved Net ARR and the Generation capacity for each year of the Control Period. The Transmission Charge was computed using the following formulae:

Transmission Charge (Rs/kW/Month) =Net ARR/ (Generation Capacity in kW x 12)

2. The Transmission loss was approved by the Commission with provisional settlement of losses at average transmission loss level.

3. At the tariff determined by the Commission, APTRANSCO *(Andhra Pradesh Transmission Corporation)*recovers the approved revenue requirement without incurring any financial loss. The details of Transmission Tariff consisting of **a)** Transmission Charge and **b)** Transmission Loss (in kind) for each year of the Control Period are given in the following table:

Table 3: Transmission Price Schedule of Andhra Pradesh

			Transmission Price	
Financial Year	**Net ARR, Rs. Cr.**	**Generation Capacity, MW**	**Transmission Charge/Rate(Rs/kW/Month)**	**Transmission Loss(kind)**
1	*2*	*3*	*4(3/2)*	*5*
2009-10	788.13	13744	47.79	4.16%
2010-11	948.50	15542	50.86	4.13%
2011-12	1215.75	15963	63.47	4.10%
2012-13	1405.12	17877	65.50	4.06%
2013-14	1554.16	21222	61.03	4.02%
Notes: Figures are Rounded				

Source: AERC

Notes on Transmission Tariff:

1. The users of the transmission system shall pay transmission charge and bear the transmission loss in kind.
2. The Transmission charges payable and the energy losses to be borne shall be related to the contracted capacity in kW, at the entry point.
3. The other conditions applicable for levy and collection of these charges shall be as per the provisions of the Andhra Pradesh Electricity Regulatory Commission (Terms and conditions of Open Access to Intra-State Transmission and Distribution networks), Regulation, 2005 (No.2 of 2005) and the Balancing and settlement code, in force.

2.Bihar Power Transmission Prices for the FY 2013-14:

2.1 Introduction:

The Bihar Electricity Regulatory Commission (BERC) was constituted by the Government of Bihar under Section 17 of the Electricity Regulatory Commission Act, 1998. The Electricity Regulatory Commission Act, 1998 along with Indian Electricity Act, 1910 and Electricity (Supply) Act, 1948 was repealed by Section 185 (1) of the Electricity Act, 2003.

The main function of BERC is to determine the tariff for generation, supply, transmission and wheeling of electricity, wholesale, bulk or retail within the state. To regulate electricity purchase and procurement process of distribution licensees including the price at which electricity shall be procured from the generating companies or licensees or from other sources through agreements for purchase of power for distribution and supply within the state.

BSPTCL (Bihar State Power Transmission Corporation Limited) proposed suitable changes to the respective ARR's before it was finally approved by the commission. BSPTCL believes that this approach will provide a fair treatment to all the stake holders and eliminates the need for review or clarification.

2.2 Generation Capacity of BSPTCL:

BSPTCL owns and operates the transmission system above 33 KV i.e. 132 KV, 220 KV and 400 KV system in the State of Bihar. The existing transmission system (as on August'13) is as given below:

Table 4:GenerationCapacity of Bihar

Voltage	No of Substations	Line Length(CKM)	Transformation Capacity(MVA)
400 KV		75	
220/132/33 KV	10	1435	
220/132 KV	1		3550

132/33 KV	75	5819	4952
132/25 KV			110
Total	**86**	**7329**	**8612**

Source: AERC

Network additions during Control Period 2013-14:

Table 5: Network Additions for the FY 2013-14:

SI No.	**Voltage Level**	**FY 2013-14**
1	400 kV	-
2	220 kV	6
3	132 kV	257
4	33 kV	16
	Total	279

Source: AERC

Addition of Sub-Stations during the Control Period 2013-14:

Table 6: Addition of Sub-Stations for the FY 2013-14

SI No.		**Voltage Level**	**FY 2013-14**
1		400 kV	-
2		220 kV	-
3		132 kV	1
		Total	1

Source: AERC

Table : Transmission Loss of BSPTCL

Particulars	**FY 2013-14**	**FY 2014-15**	**FY 2015-16**
Transmission Loss	4.02%	3.97%	3.92%

Source: AERC

2.3 Revenue Requirement of BSPTCL:

The annual fixed charges for transmission function/transmission company has been calculated by aggregating all the expenses/fixed costs i.e., depreciation, interest on loan, interest as working capital, O&M expenses and RoE. The total expenses, less non tariff income are the net annual fixed charges or transmission charges.

Table 7:ARR for the FY 2013-14 (in Rs. Cr.)

SI No.	Particulars	FY 2013-14
1	Depreciation	103.83
2	Interest & Finance Charges	24.53
3	Interest on Working Capital	22.56
4	O&M Expenses	222.86
a	Employee expenses	91.29
b	R&M expenses	115.10
c	A&G expenses	10.99
d	Allocation of Holding Company Cost	5.49
5	Return on Equity	228.26
6	Total Requirement	602.05
7	Less: Non-Tariff Income	1.02
8	Net ARR	601.03

Source: AERC

2.4 Transmission Tariff Calculation:

BSPTCL should follow some directives while calculating the transmission tariff schedule for the Control Period 2013-14. These directives are issued by the commission.

Directive 1: Transmission Loss

BSPTCL should provide appropriate energy meters at all the interface points of DISCOMs, if not already provided, compute the monthly transmission loss based on the energy input into the BSPTCL grid from various sources and energy out go measured at interface points of DISCOMs and HT consumers.

Directive 2: Separate ARR for SLDC

BSPTCL came up with a proposal of giving separate ARR for SLDC because of the following reasons:

i) The SLDC is not functioning as a separate accounting unit.

ii) The final transfer scheme is yet to be notified by the Govt.

iii) Assets and O&M expenses of SLDC are not identified.

iv) No separate man power is allotted for working of SLDC.

v) Other common cost apportionment of BSPTCL to SLDC function is also pending.

vi) Maintaining separate expenditure for SLDC from the FY 2014-15.

The Commission directs BSPTCL to segregate the assets and liabilities and functions of SLDC and maintain separate account of the expenditure towards SLDC which is presently functioning under BSPTCL.

Table 8: Transmission Tariff for the FY 2013-14

SI No.	Particulars	FY 2013-14
1	Annual Transmission Charges	601.03
2	Transmission Cost to be realized per month from Distribution Companies	50.09

Source: BERC

3. Delhi Power Transmission Tariffs for the FY 2013-14:

3.1 Introduction:

Delhi Transco Limited is a Company incorporated under the Companies Act,1956 and is engaged in the business of transmission of electricity in the National Capital Territory (NCT) of Delhi. Delhi Electricity Regulation Commission (DERC or "the Commission") became operational from December 10, 1999. The Commission's approach to Regulation is driven by the Electricity Act, 2003, the National Electricity Plan, the Tariff Policy and the Delhi Electricity Reform Act, 2000 (DERA).

The Electricity Act, 2003 mandates the commission to take measures conducive to the development and management of the electricity industry in an efficient, economic, and competitive manner, which includes tariff determination.

3.2 Revenue Requirement for the FY 2013-14:

Table 9: ARR for FY 2013-14 (Rs. Crore)

SI No	Particulars	FY 2013-14
1	Net ARR for Transmission Business	593.22
2	Impact of provisional True up including carrying cost	1035.42
3	Payment to Pension Trust	400.00
4	Payment to Public Grievance Cell for meter testing and consumer advocacy	0.70
5	Sub-Total (1+2+3+4)	41.50
6	ARR allowed for FY 2013-14 including impact of partial past DVB Arrears	500.00
7	Total impact of past Arrears	1687.52
8	Balance past DVB Arrears (7-(5+6))	11406.02

Source: AERC

3.3 Transmission Tariff Calculation:

1. The transmission tariff has been designed in a way that beneficiaries will pay the tariff in order to recover the Aggregate Revenue Requirement given by the commission for the FY 2013-14.

2. The Commission determined the tariff by following the approach given in MYT (Multi Year Tariff) Regulations 2011.

3. The approved revenue requirement of the transmission business will be recovered through tariffs from the users of the transmission system in Delhi i.e., long term, short term open access consumers.

4. The Annual Transmission Service Charge (ATSC) will be divided between beneficiaries of the transmission system on monthly basis based on the Allotted Transmission Capacity or Contracted Capacity.

5. All of the above charges shall be recovered every month on pro-rata basis and will be shared by all the Distribution Licensees (long term transmission users) including deemed licensees in proportion to the generating capacity allocated from the various Central Sector Generating Stations, Generating Stations within Delhi and Contracted power on bilateral basis.

6. The transmission service charge shall be recovered fully, if the transmission system availability is 98% or above. The Charges shall be recovered on a pro rata basis in case the availability is lower than the target level.

Table 10: Transmission Tariff Schedule for FY 2013-14

Year	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11	FY 2011-12
Transmission Charges(Rs./Unit)	0.07	0.06	0.07	0.15	0.39

Source: AERC

4. Gujarat Power Transmission Tariffs for the year 2013-14:

4.1 Introduction:

The Gujarat Energy Transmission Corporation Limited (GETCO) was restructured and unbundled by the Gujarat Electricity Board with effect from 1st April 2005. The generation, Transmission and Distribution businesses of the erstwhile Gujarat Electricity Board were transferred to seven successor companies.

The commission considers the "Truing-up" for the FY 2011-12 and determines the tariff for the FY 2013-14. The commission has been primarily guided by the following principles while truing-up of FY 2011-12:

1. Controllable parameters are considered at the level approved as per the MYT (*Multi-Year Tariff*) order, unless the Commission considers that there are valid reasons for revision of the same.
2. Uncontrollable parameters have been revised, based on the actual performance observed.
3. For the determination of the Transmission Tariff for FY 2013-14, the Commission considers the ARR for FY 2013-14.

4.2 Generation Capacity of GETCO for the FY 2013-14:

Table 11: Generation Capacity (in MVA)

Year(As on 31st March)	400 kV	220 kV	132 kV	66 kV	Total
FY 2010-11	7410	17400	5813	21022	51645
FY 2011-12	8040	18970	5920	23662.5	56592.5
Additions during FY 2011-12	630	1570	107	2640.5	4947.5

Source: AERC

4.3 Revenue Requirement of GETCO for the FY 2013-14:

The ARR amount for a year refers to the amount needed by the transmitting station to meet the sum of estimated costs and allow return on capital employed as per regulation 5 of 2005, for transmission activity.

The required investment is worked out based on a resource plan to meet the forecasted transmission capacity requirement for each year of the Control Period.

Table 12: ARR for the FY 2013-14

SI No.	Particulars	FY 2013-14
1	Operations & Maintenance Expenses	890.17
2	Depreciation	688.07
3	Interest & Finance Charges	495.38
4	Interest on Working Capital	46.78
5	Return on Equity	537.97
6	Total Fixed Costs	2658.37
7	Less: Expenses Capitalized	193.00
8	Add: Provision For Tax	15.37
9	Total Transmission Charges	2480.74
10	Less: Other Income	103.00
11	Aggregate Revenue Requirement	2377.74
12	Add: Incentive for achieving target availability	0.00
13	Total Revenue Requirement	2377.74

Source: AERC

4.4 Transmission Tariff Calculation of GETCO for the FY 2013-14:

Table 13: Transmission Tariff Calculation of GETCO for the FY 2013-14

SI No.	Particulars	Unit	FY 2013-14
1	Approved ARR for the FY 2013-14	Rs. Crore	2377.74
2	Add: Additional Income Tax approved	Rs. Crore	1.13

SI No.	Particulars	Unit	FY 2013-14
	for FY 2009-10		
3	Less: Revenue Surplus(Gap) for FY 2011-12	Rs. Crore	200.61
4	ARR for 2013-14, including adjustment for the Truing up for FY 2011-12	Rs. Crore	2178.26
5	Total MW Allocation as per MYT Order dated 31.03.2011	MW	20076
6	Transmission Tariff	Rs./MW/Day	2973

Source: AERC

Reactive Energy Charges:

The capacity of Wind Generation is increased from 1185 MW in March 2008 to 2881 MW in March 2012. The drawl of the reactive energy increased from 66.44 Million KVARh in year FY 2007-08 to 223.61 Million KVARh in FY 2011-12. Capacitor installation work is done in order to supply VAR to maintain the voltage profile of the grid.

132 KV level---------------------------100 MVAR

11 KV level-----------------------------535 MVAR

Table 14: Reactive Energy Charges for FY 2013-14

SI No.	Category	Proposed Rate
1	For drawl of reactive energy at 10% or less of the net active energy exported	10 paisa/kVARh
2	For drawl of reactive energy of more than 10% of the net	25 paisa/kVARh

SI No.	Category	Proposed Rate
	active energy exported	

Source: AERC

Table 15: Transmission Tariff for FY 2013-14

SI No.	Particulars	Unit	FY 2013-14
1	Transmission Tariffs	Rs/MW/Day	2970

Source: AERC

5. Himachal Pradesh Power Transmission Tariffs for the FY 2013-14:

5.1 Introduction:

HPPTCL (Himachal Pradesh Power Transmission Corporation Limited) was declared as the State Transmission Utility in accordance with the Govt. of H.P Order dated June 10, 2010 and is therefore recognized as the Deemed Transmission Licensee vides Commission's Order dated July 31, 2010. The transmission charges payable by the Open Access Consumers for usage of the existing network of HPPTCL are determined on the bases of ARR approved by HPERC (Himachal Pradesh Electrical Regulatory Commission) for FY2013-14.

Tariff determined by the commission shall be the quid pro quo and mutually inclusive. The tariff determined shall, within the period specified by it, will be subject to the compliance of the directions to the satisfaction of the Commission.

The Himachal Pradesh State Electricity Board (HPSEB) was constituted in accordance with the provisions of Electricity Supply Act (1948) in the year 1971. All functions of the Department of Multi-Purpose Projects and Power such as generation, execution of hydroelectric projects except functions of flood control and minor irrigation were transferred to the Board. HPSEB carries out functions of Generation, Transmission and Distribution for the State of Himachal Pradesh.

The Himachal Pradesh State Electricity Board Limited ('HPSEBL') is a deemed licensee under the first provision to Section 14 of the Electricity Act, 2003 for distribution and supply of electricity in the State of Himachal Pradesh.

5.2 Generation Capacity of Himachal Pradesh for the FY 2013-14:

HPSEBL has given the generation capacity on the basis of actual sales data, actual Transmission and Distribution loss level during the year, own generation and power purchase data for the FY 2013-14:

Table 16: Generation Capacity of Himachal Pradesh for the FY 2013-14

Energy Balance	FY 2013-14
Power Availability	
Net Own Generation Sources	1934

Net Power Purchase Sources	7375
Total Availability	9308
Sales within the State (MU)	6641
Proposed T&D Loss% within the State	12.66%
Power Requirement for sale within the State (MU)	7604
Inter-State Sale(MU)	1705
Total Sale within & Outside the State (MU)	8346
Overall Losses (MU)-Total availability less Total Sale	963
Overall T&D Losses %	10.3%

Source: HPERC

5.3 Revenue Requirement of Himachal Pradesh for the FY 2013-14:

The Annual Revenue Requirement of Himachal Pradesh as given by HPSEBL for the FY 2013-14:

Table 17: Revenue Requirement of Himachal Pradesh for the FY 2013-14

Annual Revenue Requirement	FY 2013-14
Power Purchase Cost	1574.76
Employee Cost	815.87
Repairs & Maintenance	46.44
Admin & General	38.54
Interest	175.82
Depreciation	129.53
Extraordinary Items and Prior Period Charges	
Total Costs	2780.96
Add: Return on Equity	43.82
Less: Non-Tariff income	136.93
Annual Revenue Requirement	2687.85

Covered By	
Revenue at Existing Tariff	2338.33
Revenue from Sale outside state	193.70
Subsidy given by Himachal Pradesh Government	-
Roll Back Subsidy	-
Surplus Carry Forward	186.38
Revenue at Existing Tariff+ Subsidy	2718.41
Revenue/Surplus	30.56

Source: HPERC

5.4 Transmission Tariff Calculation of Himachal Pradesh for the FY 2013-14:

1. The transmission charges that are to be paid by the beneficiaries will be designed to recover the aggregate revenue requirement given as annual transmission charges by the Commission for each year of the control period.

Allocation of Transmission Charges:

1. The annual transmission charges (TSC) shall be shared by all beneficiaries of the transmission system on monthly basis based on the contracted transmission capacity.

2. The transmission charges payable by the beneficiaries shall be determined in accordance with the following formula: -

MLTC = {[(Net ARR of the transmission licensee/12)–0.75*STI–ITFI]/TCL_LT}* CL

Where -

"MLTC" means monthly long-term transmission charge in Rs. /month;

"Net ARR" means net aggregate revenue requirement;

"STI" means income from short-term open access customers of the transmission network;

"ITFI" means income from provision for intervening transmission facilities;

"CL" means contracted capacity of the transmission system by the long-term transmission customer or long term open access customer as the case may be;

"TCL_LT" means total contracted capacity of the transmission system by all long-term transmission customers and long term open access customers:

In the case of short term open access customers, charges payable shall be calculated in accordance to following methodology: -

ST_RATE = 0.25 x [TSC/ Av_CAP]/ 365;

Where, -

ST_RATE is the rate for short-term open access customer in Rs per MW per day;

TSC is annual transmission charge;

Av_CAP means the average capacity in MW served by the transmission system of the transmission licensee in the last financial year and shall be the sum of the generating capacities connected to the transmission system and contracted capacities of other transactions handled by the system of the transmission licensee;

(1) The transmission charges payable by a short-term customer in case of uncongested transmission corridor will be levied as under, namely: -

Up to 6 hours in a day in one block = 1/4th of ST_RATE;

More than 6 hours and up to 12 hours in a day in one block = ½ of ST_RATE;

More than 12 hours and up to 24 hours in a day in one block = ST _ RATE.

(2) 25% of the charges collected from the short term open access customer shall be retained by the transmission licensee and the balance 75% will be considered as non-tariff income and adjusted towards reduction in the transmission service charges payable by the beneficiaries.

The transmission charges payable by the Open Access Consumers for usage of the existing network of HPPTCL are determined on the bases of ARR approved by HPERC for FY2013-14 as follows:-

(i) For Short Term Open Access Consumers:

The transmission charges for Short Term Open Access consumers are determined on the basis of total ARR given by HPPTCL and the total quantum of energy handled by the interstate transmission system of HPPTCL during FY2013-14 as tabled below:-

Table 18: Transmission Charges for Short Term Open Access Consumers

Particulars	Quantum
ARR of HPPTCL for FY14 (Rs. Crore)	11.92
Total requirement of power at State Periphery (MU)	9099.61
HPSEB Own Generation (MU)	2067.39
Purchase from Private SHPs (MU)	1062.28
Total purchase within state (MU)	3129.67
Power routed through HPPTCL network (MU)	5969.95
Transmission Charges for short term Open Access Consumers (Paise/ Unit)	2.00

Source: HPERC

(ii) For Long and Medium term Open Access Consumers:

The open access charges for long term and medium term open access consumers; for use of the transmission system of the HPPTCL are determined in the following table:-

Table 19: Transmission Charges for Long and Medium Term Open Access Consumers

Particulars	Quantum
ARR of HPPTCL for FY14 (Rs. Crore)	11.92
Average Power Flows (MW)	900
Transmission Charges for Long and Medium term Open Access Consumers (Rs./MW/Month)	11037

Source: HPERC

Note:-

1.) Transmission charges for (i) as well as (ii) will be levied on the energy/ power injected into the State Transmission System.

2.) The recovery from distribution licensee, through transmission charges, will be limited to the approved ARR of HPPTCL based on the average power flows.

3.) The recovery from Open Access Consumers will be done on the basis of Contracted Capacity.

4.) The amount of ARR of HPPTCL shall be subject to True-up at the end of the Control Period.

9. BENEFITS OF NEW METHODOLOGY:

In the postage system which was used till date, all the grid users within a region, pay a uniform transmission charge and share transmission losses. This system is therefore not sensitive to the distance and the frequency at which the power is transmitted by the user. On, the other hand, new mechanism under which the transmission charges and losses among the grid users are allocated based on the actual utilization of the network by each user, taking into account the physical distance of power transmission and peak and off-peak hours of a day/ season (users only pay for point-to-point transmission of electricity).The following are few benefits of the new transmission pricing mechanism which is based on hybrid method:

- ✓ If the generation charges are high in a particular region and there is adequate transmission capability, adding generation there will reduce transmission charges.
- ✓ If the generation charges are high in a particular region and transmission system is operating close to capability, adding generation there may increase transmission charges.
- ✓ Demand access charges in the vicinity of a generation hub are low (provided the demand nodes are connected directly with the generation hubs). A commercial contract which is against the direction of physical flow of power will invite lower transmission charges – e.g. commercial contract between a plan in UP-West and Maharashtra would invite 11.11 paisa/kWh whereas, a commercial contract between a plant in Chhattisgarh and Maharashtra would invite 19.30 paisa/kWh.
- ✓ Earlier the transmission investments faced with the uncertainty in generation and also the cumbersome process of getting the Bulk Power Transmission Agreements (BPTAs) signed by all the expected beneficiaries of the transmission system. Under the new mechanism all the Designated ISTS Customers (DICs are default signatories to the Connection and Use of System Agreement (CUSA), which also requires these DICs to pay the point of connection charge, which covers the revenue of transmission licensees. This commercial arrangement would also facilitate financial closure of transmission investments.
- ✓ The new mechanism would facilitate integration of electricity markets and enhance open access and competition by obviating the need for pan caking of transmission charges.
- ✓ The National Electricity Policy requires the transmission charges to reflect network utilization. The Point of Connection tariffs are based on load flow analysis and capture

utilization of each network element by the customers (through average and marginal participation method). So there is better utilization of resources which is a component in improving competition.

- ✓ The hybrid method brings together the strengths of both of both margin and average participation method. The distinction between generation anddemand customers would provide siting signals to the DICs, through accurate transmission charges vis-à-vis. The current decision of generators is based on just the fuel transportation costs. With the implementation of thenew transmission pricing mechanism – where transmission charges are locational differentiated – the generators will have to take a view both on transmission costs of electricity and transportation costs of fuel.(An idealpricing mechanism should include both of these).
- ✓ The new framework will greatly facilitate fair and transparent competition for case-1 bids. Under the methodology which was followed till date, the case-1 bid processes were severely distorted because of pan caking, and this result in pit head / hydro plants not being competitive for inter-regional bids. The impact of pan caking is further amplified in such bid processes because of application of escalation factors to transmission charges over a 25 year period. The proposed methodology will remove such difficulty.
- ✓ Coal which is the primary source of power is extremely polluting during consumption as well as during extraction and the reserves of fossil fuel is also limited. So government is taking various initiatives to promote the use of renewable resources for power generation. The new regulation facilitate solar based generation by allowing zero transmission access charge for use of ISTS and allocating no transmission loss to solar based generation. Solar power generators shall be benefited in event of use of the ISTS. Since such generation would normally be connected at 33 kV, the power generated by such generators would most likely be absorbed locally.
- ✓ This would cause no / minimal use of 400 kV ISTS network and might also lead to reduction of losses in the 400 kV network by obviating the need for power from distant generators. Further, this is also aligned with the objectives of the Jawaharlal Nehru National Solar Mission which is "to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible." The cost of energy from solar based generation is in the range of Rs 14-18 / kWh and

application of ISTS charges and losses would further reduce the acceptability of power generated from solar sources. This regulation encourages solar based generation.

In short we can say, the new mechanism is independent of the contract "path". It is transparent as all the data used for computing the transmission charges are shared with the users leading to improvement in efficiency of pricing and which in turn will lead to more optimally utilization of transmission system. The transmission charge payable for any contract is known ex-ante and hence it can be considered while entering into a contract and this provide rational and economic logic for siting generation with respect to load(power withdrawn)Also the cost matrix is changing so there is reconfiguration of the market It is therefore expected that generators from other regions would now have a level playing field in competitive biddings and in the open market, thus paving way for a broader, deeper and fair competition and also better management of congestion .Overall impact would be rationalization and convergence of tariff across country in long run.

10. ELECTRICITY DERIVATIVES IN INDIAN POWER SECTOR:

As a commodity, electricity has many unique aspects, including instantaneous delivery, non-storability, an interactive delivery system, and extreme price volatility.

Electricity lends itself to futures trading. It meets the three broad criteria needed for successful futures markets: prices are volatile; there is a large, diverse universe of buyers and sellers; and the physical product is fungible.

The exchange clearinghouse provides a system of guarantees that mitigates counterparty credit risk.

The scenario in India:

In India, there will be an imminent opening up of the power sector. That would include amendments of archaic electricity laws. The competitive market in India would develop through structural changes in the power industry that have evolved in recent years, resulting in opportunities, price volatility, and market risk.

The physical power supply system in India is still encumbered by the British legacy of vertical integration. Electricity markets are subject to Central and State regulations that are still evolving. As a commodity, electricity has many unique aspects, including instantaneous delivery, non-storability, an interactive delivery system, and extreme price volatility.

The complexity of electricity spot markets is not conducive to common futures transactions. There are also substantial problems with price transparency, modeling of derivative instruments, effective arbitrage, credit risk, and default risk.

The Contract:

Greater market participation is a key issue for the emerging rather "under supplied" Indian power market. In an effort to address this, the Indian exchanges in consultation with regulators have to create a contract that reduces the barriers to market entry by removing the requirement for underlying physical OTC contracts and signatory status.

Electricity as a Commodity:

The two most significant characteristics of electricity are that it cannot be easily stored and it flows at the speed of light. As a result, electricity must be produced at virtually the same instant that it is consumed, and electricity transactions must be balanced in real time on an instantaneous spot market. Electricity's real-time market contrasts sharply with the markets for other energy commodities, such as natural gas, oil, and coal, in which the underlying commodity can be stocked and dispensed over time to deal with peaks and troughs in supply and demand.

Real-time balancing requirements also complicate the market settlement process. Some electricity market transactions occur before the system constraints are fully known or the price is calculated. In extreme cases, the settlement price may be readjusted up to several months later.

Electricity is typically "stored" in the form of spare generating capacity and fuel inventories at power stations. For existing plants, the "storage costs" are usually less than or equivalent to the costs of storing other energy fuels; however, the addition of new storage capacity (i.e., power stations) can be very capital intensive. The high cost of new capacity also means that there are disincentives to building spare power capacity. Instead, existing plants must be available to respond to the strong local, weather-related, and seasonal patterns of electricity demand. Over the course of a year or even a day, electricity demand cycles through peaks and valleys corresponding to changes in heating or air conditioning loads. Two distinct diurnal electricity markets also exist, corresponding to the on-peak and off-peak load periods. Each of these markets has its own volatility characteristics and associated price risks.

Challenges:

1.) Financial Risks: The financial risks resulting from the use of derivatives are illustrated by the number of companies that have suffered significant losses in derivative markets. Large losses can be the result of well-intentioned hedging activities or of wanton speculation. In either case, regulators must be concerned with the impact that such losses could have on ratepayers who, absent protections, might be placed at financial risk for large losses.

2.) Market Power: Controlling this potential threat to competitive markets will require substantial regulatory review, as well as physical changes in the marketplace itself. In many areas of the country, only a small number of suppliers are capable of delivering power to consumers on a particular bus bar, and each of the suppliers can easily anticipate the bids of the others. In such "thin" markets, the price of electricity can be driven by market power rather than by the marginal costs of production. The need for overall market transparency will be critical to traders and to the market monitors.

3.) Demand and Conservation: One of the key tools available to regulators for reducing the volatility of electricity prices is demand-side management programs. Electricity prices are likely to be most volatile during the on-peak hours of the day and substantially more stable (and lower) during the off-peak periods. This fact, coupled with the hockey stick shaped supply cost curve suggests that substantial reductions in volatility could be achieved through the use of market mechanisms and demand-side management programs to shift consumption to off-peak hours. State and Federal authorities have been examining a variety of possible methods for shifting consumer demand for electricity; however, one of the most direct methods real-time pricing for large electricity consumers remains largely untapped.

4.) Contract Features: Base load and Peak load contracts should be listed based on the power supply calendar and settlement cycle favoured by the industry with 12 months, 6 quarters and 4 seasons; No requirement to be a power supplier party; Margin offset between Electricity Futures and Natural Gas Futures/Coal Futures/Crude Oil Futures; Each contract will be physically deliverable and will be cleared by one central counterparty, Minimum trading size will be 10 lots; Months, Quarters and Seasons will be listed in parallel -- no cascading; All positions will be held as months for maximum flexibility for participants.

There should ideally be 50 per cent margin offsets between Peak and Base Load contracts; Inter-month spreads should be made available and there will be price implication down the curve.

Outright margin rates are envisaged to be about Rs. 136 per MWh for base load contracts and Rs. 248 per MWh for peak load contracts. Inter-month spread rates are envisaged to be Rs. 180/- per MWh for base load contracts and Rs. 300 per MWh for peak load contracts; the Contracts will initially be available for trading through existing commodity exchanges and will then be rolled out to ISV solutions.

The exchanges should provide financially settled monthly futures contracts for on-peak and off-peak electricity transactions based on the daily floating price for each peak day of the month at the respective regional hub. For eg: The western hub could consist of delivery points, primarily on the BSES /TATA Power transmission systems. Additional risk management and trading opportunities should be offered through options on the monthly futures contract.

The peak daily floating prices should be the weighted exponential average of say the western hub real-time locational marginal pricing for the 16 peak hours of each peak day, provided by the Utility service providers in the western hub. Peak hours should be designated from 7 am to 11 pm (the hour ending 0800 to the hour ending 2300) prevailing local time. Peak days are Mondays through Fridays, excluding the Railways consumption.

Off-peak hours are from midnight to 7 am (the hour ending 0100 to the hour ending 0700) and 11:00 PM to midnight (the hour ending 2400) Mondays through Fridays; also, all day Saturdays and Sundays (the hour ending 0100 to the hour ending 2400). All times are prevailing local time locational marginal pricing is the marginal cost of supplying the next increment of power demand at a specific location on the network, taking into account the marginal cost of generation and the physical aspects of the transmission system.

5.) Quality Specification: Electric energy delivered under this contract shall be in the form of three phase current alternating at a nominal frequency as prescribed by the Central Electricity regulatory authority, and be in conformance with the specifications of the CERC.

6.) Transmission: Except as set forth in, seller shall be required to make all transmission arrangements to deliver electric energy to central buyers, and buyer shall be required to make all transmission arrangements to receive electric energy at Central sellers.

7.) Different Delivery Procedures: Seller or buyer may agree with the buyer or seller with which it has been matched by the Exchange Rules to make and take delivery under terms or conditions which differ from the terms and conditions prescribed by the exchange. In such a case, Clearing Members shall execute an Alternative Delivery Notice on the form prescribed by the Exchange and shall deliver a completed executed copy of such Notice to the Exchange. The delivery of an executed Alternative Delivery Notice to the Exchange shall release the Clearing Members and the Exchange from their respective obligations under the Exchange contracts.

In executing such Notice, Clearing Members shall indemnify the Exchange against any liability, cost or expense it may incur for any reason as a result of the execution, delivery or performance of such contracts or such agreement, or any breach thereof or default there under. Upon receipt of an executed Alternative Delivery Notice, the Exchange will return to the Clearing Members all margin monies held for the account of each with respect to the contracts involved.

11. ANALYSIS AND FINDINGS:

Services according to competition act section 2(u) means services of anydescription which is made available to potential users and includes the provision of services in connection with business of any industrial or commercial matters such as banking communication, education, financing, insurance, real estate transport, storage, material, processing, supply of electrical or other energy, boarding, construction, conveying of news or information and advertising.

Transmission services are intermediate product (generation-transmission –distribution) so it plays an important role between what is produced and how much is consumed. The hybrid method is not only simple to understand but easy to implement. The new mechanism is providing signals to users like if demand charges are high in a zone – it would be advantageous to add generation there, similarly for demand. New regulation pricing policy on the assessment was found to provide more transparency by providing as all the data used for computing the transmission charges are shared with the users leading to improvement in efficiency of pricing, which in turn will lead to more optimally utilization of transmission system, so there is a movement from opaque pricing mechanism towards transparent pricing mechanism. Also the new pricing policy is more predictable and it provides rational and economic logic to the generator with respect to load as the transmission charge payable for any contractis known ex-ante.

Due to change in the process and method used for determination of transmission charges the cost matrix is changing leading to reconfiguration of market. On the assessment, generators from other regions would now have a level playing field in competitive biddings and in the open market, and as far as infrastructure is concern thus paving way for a broader, deeper and fair competition and also better management of congestion. So this attracts number of players like generators, distributors as well.

As of now on the assessment we can't focus any anticompetitive issues as such now but the following are the expected issues that have to be taken care of.

As Indian electricity sector faces supply deficit it is important to see the conduct of various players vis-à-vis the consumers and see whether there are any agreements that will affect long term contracts.

1.) As the new transmission pricing policy is distance and most importantly direction sensitive so we can say sensitivity to information is very high. A little bit of asymmetric information would disturb the market equilibrium. Once it is shifted the things are very technical, so we need to bridge gap of asymmetric information if any. Failure on this front might lead to differentiation among players and will favor discrimination.

2.) As the calculation of transmission charges is very technical so there is a need that there is fairness in measurement, so anything wrong might lead to disastrous results.

So the sectorial regulator that is CERC should ensure that the above mentioned points are fulfilled and adhered to.
Also being a natural monopoly CERC should ensure that there is no abuse of dominance and CCI should keep an eye this and will have to intervene if required

A commercial contract which is against the direction of physical flow of power will invite lower transmission charges – e.g. commercial contract between a plant in UP-West and Maharashtra would invite 11.11 paise/kWh whereas, a commercial contract between a plant in Chhattisgarh and Maharashtra would invite 19.30 paisa /kWh. In this example, the former contract will be against the direction of flow (which is generally from WR to NR), while in the latter case the power will flow along the direction of dominant flows in inter-state lines between Chhattisgarh and Maharashtra. So it should be seen that this transmitting firm doesn't lead to anti competition in the region through discriminating pricing, misusing the opportunity.

1. Indian Power market basically lacks infrastructure i.e. Generation, Transmission, which is a necessity for any developed market, so until the government provide enough infrastructure the derivatives cannot be useful.
2. Indian power sector works basically on the basis of Long Term contracts i.e. 90% is sold in long term contracts(PPA) and power being traded through exchanges is about 1%, this can be attributed to unawareness among the market participants of short term power trading, but for successful derivative market there should be enough volume in short term

contracts which is absent in India so to avoid crisis like California, so enough awareness should be spread among the participants to make derivative market successful.

3. Moreover market manipulation is high where the numbers of participants are low so to avoid any manipulation of electricity market there is a need of enough liquidity in the market.

4. But as we can see, the Indian power market has evolved very well in comparison to its global counterpart's i.e. Nord Pool, EEX etc so if above mentioned bottlenecks are overcome we can successfully introduce power derivatives.

5. The very concept of power trading may seem odd in a power deficit country India whereas as per the economic survey conducted by Planning Commission, the deficit in peak shortage is steadily rising from 12.2% in 2002-03.

There is huge scope in power trading in India due to leveraging on seasonal and time of the day fluctuation in different regions, apart from medium term mismatches as the available capacity in India are underutilized.

6. India`s transmission & distribution losses are among the highest in the world. When nontechnical losses such as energy theft are included in the total, losses go as high as 65% in some states and average about 35-40%

Future of Power Trading in India:

1. Cross Border Power Trading:

Cross border power trading sector is in constant evolution therefore players on the market need to keep up-to-date with the latest development in regional projects and within the regulation framework which will enable power plant operator to trade in a more efficient way. As the market develops and new business opportunities arise, trading across borders is becoming a key interest to more and more companies. Trading across different borders still implies trading with different rules and regulations. Cross border trade and investment are both the end and the means by which South Asia can achieve energy security. Through investment and cooperation, South Asia will be able to both close its burgeoning supply/demand gap and stimulate further reform, which will in turn open markets for further investment. It will now be possible for Indian companies to import power from across the border and sell it in the domestic market. The Central Electricity Regulatory Commission (CERC) announced significant changes in the power trading policy, including a regulatory framework for cross-border trading of power. The regulator has made a change in the definition of _inter-state trading□ that will enable trade of power between India and its neighbouring countries like Nepal and Bhutan. Cross border trading forms a part of inter-state trading. There have been very few instances of power import from across the border in the recent past. One of them is the Tala transmission project, which brings power from Bhutan to Delhi. This is being developed by Tata Power for Power Grid Corporation of India Ltd (PGCIL), the country's largest power transmission company. Tata Power has also recently signed a Power Purchase Agreement (PPA) for trading of power through the Dagachu power project in Bhutan. This had to be accommodated through policy changes.

2.) Hedging and Speculation in Power Market:

Price volatility introduces new risks for generators, consumers, and marketers. In a competitive environment, some generators will sell their power in potentially volatile spot markets and will be at risk if spot prices are insufficient to cover generation costs. Consumers will face greater seasonal, daily, and hourly price variability and, for commercial businesses, this uncertainty could make it more difficult to assess their long-term financial position. Power marketers sell electricity to both wholesale and retail consumers, often at fixed prices. Marketers who buy on the spot market face the risk that the spot market price could substantially exceed fixed prices specified in contracts.

Electricity futures and other electric rate derivatives help electricity generators, consumers, and marketers manage, or hedge, price risks in a competitive electricity market the futures contract is closed by buying or selling a futures contract on or near the delivery date. Other electric rate derivatives include options, price swaps, basis swaps, and forward contracts. Futures and options are traded on an exchange where participants are required to post margins to cover potential losses. Other hedging instruments are traded bilaterally in the —over-the-counter□ (OTC) market. Futures are not the only way to hedge electricity price risk electricity options contracts also. Futures and derivatives should not be regulated simply because they can produce losses. Not using futures in volatile commodity markets can also produce losses. A short hedger sells futures to hedge a long position in the underlying commodity (electricity), while a long hedger buys futures to hedge a short position in the underlying commodity. A generator is long in electric power and will use a short hedge.

A marketer who has sold power to a utility is short that power because he cannot produce it. A marketer will buy futures to hedge its short position in the power market. There is, however, no reason that the amount of short hedging will necessarily equal the amount of long hedging. For this reason, speculators are useful. If there is an imbalance of hedgers, then speculators can make money by shouldering the risk of hedgers.

A price swap is a negotiated agreement between two parties to exchange or swap specific price risk exposures over a predetermined period of time. A basis swap allows an individual to lock in a fixed price at a location other than the delivery point of the futures contract.

12. LIMITATIONS:

Some of the limitations to this study were:

i) Since the research was carried for just during the period so it was difficult to find information on it.

ii) The most important constraint was to the access of the required data. This study has been conducted after collecting data from various sources, however unavailability of some data has hampered the quality of the report.

Nevertheless full use of the available data has been made to study the subject.

13. CONCLUSION:

Transmission is internationally considered a natural monopoly .It is to the credit of the Indian Policy planners that we have a central agency of planning of the grid which has led to regional grids and synchronization of all regional grids except southern grid. Such an integrated grid system does not even exit in USA. The transmission capacity is allocated on a non discriminate basis depending on amount of power flows and point of injection/withdrawal. The new pricing mechanism provides a movement from opaque to transparent system and it rational andeconomic logic to the generator with respect to load. We expect that this mechanism will attract more players in the sector.

The Indian power sector is in the path of reaching its adolescence state. When the developed countries have undergone various modern and up-to-date systems to operate and function power sector along with various instruments and products of power trading, India follows them and trying to be one of the leaders in the power market operation. The journey of Indian power sector is definitely a credit worth. The Indian power sector now is growing in the same pace as w as the development of the information technology sector in India.

Power trading is the biggest instrument of Indian power sector which will unveil the growth opportunity of the power sector and optimize the natural resources of that lies in India. The growth of Indian power trading will invite many players to come into the operation of power trading and increase the competition in power market thereby achieving the economic efficiency, higher quality services as well as lower consumer prices for electricity

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