Electric Power Industry Restructuring in India: Present Scenario and Future Prospect

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***Abstract*: Power industry restructuring, around the world, has a strong impact on Asian power industry as well. Indian power industry restructuring with a limited level of competition, since 1991, has already been introduced at generation level by allowing participation of Independent Power Producers (IPPs). The new Electricity Act 2003 provides the provision of competition in several sectors. It is felt that the prevailing conditions in the country is good only for wholesale competition and not for the retail competition at this moment. A suitable model is suggested based on the current and future market participants.**

***Indexing Term*: Power system restructuring, Power pool, Open Access, TSO model.**

I. INTRODUCTION

Electricity is a concurrent subject in the Indian Constitution, where decision-making and implementation involve both the State and Central governments. Power development in India has been carried out predominantly by the State controlled electricity boards. Till 1990, the power sector in India was evolved as a public monopoly. The power sector was governed by the Indian Electricity Act 1910 and the Electricity Supply Act 1948. The Ministry of Power (MOP) has overall authority for power sector development. The activities of the MOP include formulating policies and plans, processing power projects for investment decisions, research and development, formulating legislation pertaining to power generation and supply, and providing the required linkages between other ministries and departments in the Central government, State governments and the planning commission.

Electricity Supply Industry (ESI), throughout the world, is undergoing restructuring for better utilization of the resources and for providing quality service and choice to the consumer at competitive prices. In India, a limited level of competition, since 1991, has already been introduced at generation level by allowing participation of Independent Power Producers (IPPs). In order to ensure coordinated development of regional/national grids, separation of generation and transmission business at central sector has taken place during 1992-93 by amalgamating and transferring the transmission assets of central and joint sector to Power Grid Corporation of India Limited (PGCIL). Separation of the three organs of electric power business i.e. generation, transmission and distribution at state level has already been done in several States, followed by privatization of distribution in Orissa and Delhi. The independent regulatory bodies have been formed at central level and also in most of the states. These regulatory bodies have been established primarily for rationalization of electricity tariff, formulation of transparent policies regarding subsidies and promotion of efficient and environmentally benign policies. In addition, Central Transmission Utility (CTU) at the national level and State Transmission Utilities (STUs) at the state level have also been made effective after enactment of Electricity (Laws) Amendments Act, 1998. Further, private sector is now permitted to invest in all the three facets of electricity, i.e., generation, transmission and distribution.

This paper presents an overview of present scenario on power industry in India and highlights the reform processes, which is underway in several forms. A suitable model is suggested which can be effectively implemented in the present condition.

II. PRESENT INDIAN POWER INDUSTRY SCENARIO

Power systems in most of the states are owned, operated and managed by State Electricity Boards (SEBs), which generate, transmit and distribute power within the State territory. In addition to SEBs, few private sector utilities operate in the metropolitan cities like Bombay, Calcutta and Ahemedabad. In 1975, central government, through central public sector undertakings, also entered in the field of generation and transmission, to supplement the efforts of cash starved state electricity boards and also to take advantage of economies of scale. However, distribution continued to remain with SEBs as a monopoly business. Need for restructuring the electricity sector was felt since late 80s, firstly, due to limited resources available with central and state governments and secondly, to improve the technical and commercial efficiency. Consequently, power generation was opened up to private sector in 1991, followed by transmission in 1998. Electricity Regulatory Commissions Act was enacted in 1998 for establishing regulatory commissions. Today, regulatory commissions are operational at the national level and as well as in twenty-one states.

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As per the statute, the Central Electricity Authority (CEA) is responsible for power planning at the national level. CEA advises the Ministry of Power on the national power policy and national power planning, while the central electricity regulatory commission is looking after the regulatory issues. Day-to-day operation of the regional grid is carried out by Regional Load Dispatch Centers (RLDCs), which are under the operational control of CTU, i.e. PGCIL. The main function of RLDC is, to carry out the integrated operation of the power system in that region and that of Regional Electricity Board (REB), to facilitate integrated grid operation.

Presently, five REBs, namely, Northern REB, Southern REB, Western REB, Eastern REB and North-Eastern REB exist to promote the integrated operation of the regional power systems. The responsibilities of REBs are to review project progress, to plan integrated operation among the utilities in the region, to co-ordinate the maintenance schedules, to determine the availability of power for inter-state utilities transfer, to prescribe the generation schedule and to determine a suitable tariff for the inter-utility exchange of power. The names of States/Union Territories in each REBs are given in Table I. Table II shows the installed capacity and energy generation of REBs.

TABLE I
Organization Structure of Regional Electricity Boards

NREB	WREB	SREB	EREB	NEREB
Haryana	Gujarat	Karnataka	Bihar	Assam
Himanchal Pradesh	Madhya Pradesh	Andhra Pradesh	Andman & Nikobar	Arunachal Pradesh
Delhi	Maharastra	Kerala	West Bengal	Meghalaya
Punjab	Goa	Tamilnadu	Sikkim	Nagaland
Rajasthan	Daman & Diu	Pandichery	Orissa	Tripura
Jammu & Kasmir	Dadar & Nagar Havelli	Lakhadweep	Jharkhand	Manipur
Chandigarh	ChhatishGarh	-	-	Mizoram
Uttar Pradesh	-	-	-	-
Uttaranchal	-	-	-	-

TABLE II
Region-Wise Installed Capacity Mw as on 31-01-2003

Region	Hydro	Thermal			other	Grand Total
		Steam	Gas	Diesel		
NREB	8596.57	15469.5	3175.4	14.99	1190	28452.6
WREB	4477.13	20791.5	4929.1	17.48	1349	31564.0
SREB	10012.8	13182.5	2516.4	939.32	1801	28451.8
EREB	2459.51	14027.3	190	17.2	2.6	16696.7
NEREB	1108.41	330	750.5	119.82	0.2	2309.4
All India	**26660.2**	**63800.9**	**11561.4**	**1162.8**	**4348**	**107534**
State sector	22935.6	36512.0	2982.0	575.69	63.0	63067.8
Private sect.	676.20	4661.38	4160.4	587.14	1565	11650.5
Central sect.	3049.00	22627.5	4419.0	0.0	2720	32815.5

Source: Annual Report, Ministry of Power, 2002-2003.

Presently, State Load Dispatch Centers (SLDCs) are carrying out the optimum scheduling of the state generating units and the Regional Load Dispatch Centers (RLDCs), which are an apex body, are responsible for scheduling of the central sector generating units only. SLDCs send the requisition to the RLDCs against their entitlements out of available power from central sector generation and the RLDCs allocate total available power to various states in the ratio of their entitlements. However, after the implementation of Availability Based Tariff (ABT), optimum scheduling and dispatch of electricity in the entire region will be carried out either by RLDCs directly or with the help of SLDCs, based on the variable cost of generation using merit order dispatch. At present, the vertically integrated SEBs at the state level is carrying out the pooling of electricity. Apart from above, small amount of power is being traded through either bilaterally or with the help of Power Trading Corporation (PTC).

III. Indian Power Industry Restructuring

The Electricity Act, 2003, clearly focuses and calls for the restructuring of the electricity supply industry. The initial steps for restructuring process have already been taken and accordingly, PGCIL has been notified as central transmission utility at the national level and the SEBs or the main transmission companies in the restructured states are functioning as state transmission utilities at the state level. Regulatory commissions at the state and national level have been in operation. Further restructuring in the form of unbundling and corporatising the generation, transmission and distribution is envisaged in the Electricity Act, 2003. The salient features of the Electricity Act 2003 are:

- No techno-economic clearance for generating stations and no state licensing,
- Non-discriminatory and open access to the transmission system,
- Major role for regulators, SERCs and CERC in licensing, tariff, grid rules, and access rules,
- Provides for power trading, and the eventual creation of a spot market,
- Gradual reduction of subsidies,
- Mandate for the regulator to cover tariff in all segments,
- Stringent provisions to minimize theft and misuse,
- Compulsory metering for enhancing accountability and viability,
- Central and State Electricity Regulatory Commissions to continue broadly on the lines of the Electricity Regulatory Commissions Act, 1998,
- Special provisions for promoting access to electricity in rural areas and for the economically weaker persons,
- Provisions for transition from a State-owned monopoly to a liberalized and competitive industry,
- Creation of national transmission grid for optimum scheduling and dispatch of electricity among the regional transmission grids.

The Electricity Act 2003 will ensure the competition in the electricity market at the wholesale level, i.e., the bulk consumers and distribution companies will now be permitted to buy power directly from any generating companies. After gaining sufficient experience in wholesale trading, the competition at the retail level can also be introduced by creating the suppliers at the retail level, who will be supplying power to the retail consumers by utilizing the open

access to the network offered by transmission and distribution companies. These suppliers will be free to buy power against their requirement from any of the generating companies/ power pools/ power exchange, etc., and the electricity will be traded like any other commodity.

IV. SUGGESTED POWER INDUSTRY STRUCTURE [1]

India being a very vast country, several independent electricity markets may co-exist having their area of operation clearly demarcated from each other. In India, at the state level, the state power markets and at the regional/ national level, the regional/national power markets may emerge. In the immediate future, after the enactment of Electricity Act 2003, it is felt that the prevailing conditions in the country is ripe only for wholesale competition and not for the retail competition.

A. Model

Two main models are exiting in the world. First one is pool market and another one is pool plus bilateral/multilateral contract model. Power pools can be either mandatory or flexible. A mandatory pool (also known as rigid pool) is one in which all power plants are required to bid and are scheduled/ dispatched centrally. No physical trading is allowed outside the pool. The bid-based pools usually refer to prices as bid; therefore do not have to reflect costs. There are cost-based bids, which differ from a cost-based (non-bid) pool. On the other hand, a flexible pool arrangement is one in which trading outside the pool is also allowed. These are also known as Loose Pools. Loose Power Pools such as New York Power Pool (NYPP) or New England Power Pool (NEPOOL) are cost-based pool (non-bid based). In the privatization models adopted by Orissa and Delhi, state transmission company (Transco) is presently managing a mandatory cost-based power pool (non-bid based) at the state level and all the distribution companies (Discos) are required to purchase their entire requirement from Transcos alone at the price to be decided by the state regulator.

After the restructuring of power sector at the state level, STU can take the responsibility of running the mandatory power pool for the regulated generation plants within the state and state's entitlement from the central generating plants and the IPPs. This power pool will be a cost-based (non-bid) pool, pooling the regulated state owned or privately managed generation resources including the states entitlements from the regulated central power plants. All the Discos within the state will be provided power by this pool.

One power exchange, in each of the regions, can be established and regional electricity boards can assume the responsibility of running such power exchanges. Since REBs are proposed for managing the power exchanges, certain functions, viz. outage planning, coordination of protection system relay settings and finalization of automatic under frequency load shedding and islanding schemes, etc., which are very essential for integrated operation of power system, should be transferred to RLDCs . Further, no other Power Exchange is required to be established at the state level, as a power pool is already proposed at state level. All the new power plants, which have been constructed in the de-licensing regime, shall be free to supply power to any Discos/bulk consumers of their choice by entering into long-term or the short-term agreements with them or trade their power in the spot market through power exchanges.

All the vertically integrated power utilities at the state/ regional/ national level will be unbundled into generation, transmission and distribution entities and corporatized. The transmission company should not be permitted to trade in electricity, i.e., they cannot sale/ purchase power for commercial purposes. It is proposed that the transmission companies should be regulated natural monopolies and accordingly, the appropriate Regulatory Commissions should decide the open access tariffs for their network.

In the whole country, the distribution should be horizontally broken down into manageable units with separate accountability and privatized for better efficiency in metering, billing and collection. The state regulatory commissions should decide the Tariff of the distribution companies. The trading should be recognized as a separate distinct activity and any body should be permitted to act as power trader after getting a suitable license from the regulator and after fulfilling certain conditions.

B. System Operator

Amongst the various models being practiced, all over the world, for the system operation function, two models are prevalent i.e. Independent System Operator (ISO) model or Transmission system Operator (TSO) model. ISO model is prevalent in America, Canada and part of Australia. As per this model, as the transmission companies are also permitted to own, manage and control generation and distribution companies, an Independent System Operator is created to facilitate open access and competitive markets.

TSO model is prevalent in whole of the Europe, part of Australia & South Africa and is likely to be adopted in several Asian countries. Recently, some part of USA is moving away from ISO model by formation of RTOs (Regional Transmission Organizations), which may ultimately culminate into TSOs (Transmission System Operators). In TSO model, operation of the grid and the ownership of the grid are integrated in a single entity, which is responsible for development of transmission system and to provide non-discriminatory open access to all eligible market participants.

TSO model has several advantages over the ISO model looking at Indian scenario in terms of proper planning, effective operation, efficient control and suitable coordination with financial viability. Therefore it is felt that TSO model may be a better option in the envisaged restructured electricity market in India. This is also due to the fact that the main transmission company, which is government owned, is statutorily responsible for planning and developing the transmission systems and to provide non-discriminatory open access.

C. Load Dispatch Function in the Deregulated Environment

The system operator to meet the transactions and also to maintain system frequency and voltage profile will perform the load dispatch functions in the deregulated market. In

India, the Availability Based Tariff (ABT) has been adopted for maintaining the grid discipline and already been implemented in Western Region w.e.f. 1.7.2002, in Northern Region w.e.f. 1.12.2002 and in Southern Region w.e.f. 1.1.2003. This has yielded good results with respect to limiting the frequency excursion from its nominal value.

Since India, at least for the next 15-20 years, may remain a power deficit country, a separate market for the ancillary services may not be desirable in the beginning of the restructuring process and can be managed by the TSO. Only after experiencing the success of the restructuring, separate power market especially for various ancillary services like arranging power for the loss makeup or load following, start-up power, spinning reserve etc. may be introduced in a phased manner.

STU shall be responsible for planning, co-ordination, developing (either through its own resources or through the private resources) the intra-state transmission grid and shall also be responsible for the state load dispatch functions in line with TSO concepts. All the Discos within the state will be provided power by mandatory power pool as per the entitlements to be fixed by the respective state government or the state regulatory commission at the price to be decided by state commission. The Transcos shall be carrying out this function on no profit no loss basis. Further, Transcos should be debarred from any commercial business. Similarly, CTU shall be responsible for planning, co-ordination, developing (either through its own resources or through the private resources) the inter-state and inter-regional transmission grid and may be responsible for managing the regional and national load dispatch centers in line with TSO concepts.

An open access to transmission is a pre-requisite for wholesale electricity markets to provide equal opportunities to market participants in trading of electricity. Similarly, open access to transmission and distribution is a pre-requisite for retail electricity markets. To ensure free and fair access to the electricity market for all market participants, one of the foremost requirements is that the wire companies (Transcos and Discos) should not have any financial interests in the market. However, their services have to be paid by the customers allowing some regulated amount of profit. Therefore, it is felt that proposing the industry structure for retail competition is immature under the present scenario in India. The experience in the wholesale trading can be gainfully utilized for introducing competition at the retail level. The proposed market model in the wholesale power markets is presented in Fig. 1 and Fig. 2.

V. CONCLUSIONS

Electricity reform process in India is already in action although at a slow pace. Several state electricity broads are being unbundled into three distinct corporations namely Generation, Transmission and distribution. The distribution system are being horizontally broken down into manageable Discos with separate accountability and privatized for better efficiency in metering, billing and revenue collection. The system operation functions at the regional/national level can be with central transmission utility, while state transmission utilities may manage load dispatch centres in line with TSO concepts and these should not be allowed to have financial interest in the trading of power.

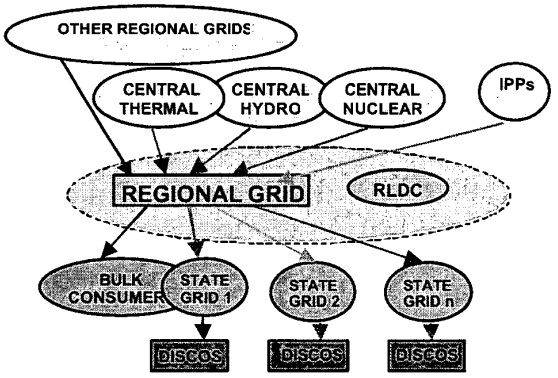

Fig.1: Proposed Regional Wholesale Market Model

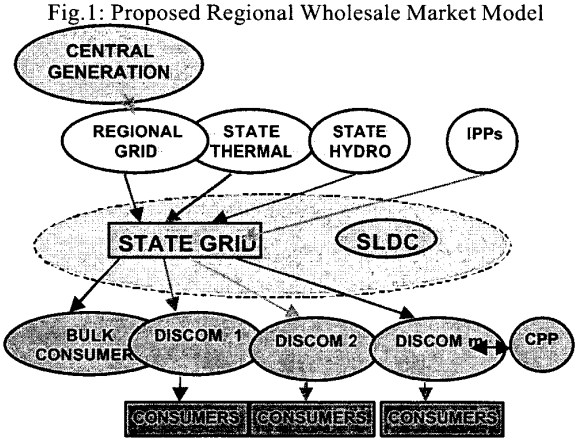

Fig.2: A Conceptual Model of State Wholesale Electricity Market

One power pool in each state managed by STUs and one in regional basis CTU may be established. REBs can assume the responsibility to operate the regional power exchanges. Since REBs are proposed for managing the power exchanges, certain important planning and operational functions should be transferred to the RLDCs. All the non-competitive old generators and old IPP having old contracts shall remain under regulatory control of the regulatory commissions and should supply power to the state power pools only at the regulated price.

Information flow is one of the main concerns along with the Distribution Management System (DMS), which is presently at a very nascent stage. These must be properly addressed before adopting competition at retail level.

VI. REFERENCES

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