

Path for Restructuring of Electricity Supply Industry in India

Anjan Roy P Pentayya R K Mediratta

Abstract-- Restructuring is the buzzword in almost all the sectors more particularly in the Electricity Sector. We have began the journey for bringing rationalisation in the sector by enacting omnibus law i.e. Electricity Act,2003. Though deficient in some aspects, lot has been achieved by putting in place major framework for Electricity Supply Industry (ESI). Electricity being the concurrent subject, makes it difficult to create a seamless structure across all the states.

The states have been forced to carry out mandatory unbundling and create state regulators. Since the Act is silent on the restructuring model, it is also natural that states would follow their own paths to restructuring. Several decisions would be taken by states and state's electricity regulators differing in creating different models. This paper attempts to explore the path for restructuring. Along this path we would find ourselves at several crossroads and would need to make decisions. Several issues that arise include Regulatory issues such as market model (single buyer or multiple buyer), market mechanism for deviations (similar to contracts for differences), billing and metering, Models for competitive generation, Ancillary Services, System Operator, Spot trading, phases in open access in distribution, issues with non-conventional energy sources and other issues related to generation, transmission, distribution and conditions of compliance from Private electricity suppliers etc.

I. INTRODUCTION

Vertically integrated monoliths in the States which were at one stage a necessity for its capital-intensive nature now turns out to be ineffective in present scenario. The transition of this structure after operating almost for five decades would not be easy. The State governments and regulators are seized with the matter. Financial restructuring plans and roadmaps are at different stages of development in different States. But the clarity among all the stakeholders and within State Electricity Boards (SEB) is desirable. The brief discussions on the issues and options available is given in the ensuing paragraphs.

II. ISSUES RELATED TO MARKET STRUCTURE

After unbundling the most likely structure would be formation of three companies GENCO, TRANSCO and DISCOM. Though law allows rebundling of Genco and Discom, except for small states all other states would opt for minimum three separate companies. Further generating stations can be grouped into hydro and thermal generating companies (SHPC) and STPC). We may also think of not forming smaller companies owning less than 500MW capacity since it would not yield any additional benefit. The questions arise as to whether all generating stations would be despatched as separate control areas or a single control area. Presently, SEBs own a mix of generating stations wherein one or two stations are maintained in good condition and these operate efficiently whereas other stations are not so efficient and the average cost of power from all generating stations together is affordable. The inherent cross-subsidisation of inefficient stations by efficient generating stations would make all generating stations to be treated at par and therefore GENCO would prefer to have all generating stations as single control area. The other side is, if generating stations are not made separate profit centres the Discoms cannot truly despatch them on merit order. Therefore, treating state generating stations as single control area is an alternative which may be utilised for transition period and efforts should be made to switch to their treatment as different control areas. Under Availability Based Tariff (ABT), each generating station can be considered as a separate company or profit centre. The generator is assured of recovering the fixed charges based on the availability norms and not based on actual generation. In case the unit or station is scheduled by the SLDC as per the merit order, the generator also gets paid for the variable charges based on scheduled energy.

Broadly, the market models can be classified in tow categories.

a) Single Buyer Model

In Single Buyer Model (SBM), a single state-owned utility would aggregate all generation and sell to Discoms. This would also include the contracted power from ISGS (so far allocated to SEB) and power purchased in the short-term. The cost charged to Discoms would be average cost of all generation available. The single-purchase responsibility in the present framework can be entrusted to a separate bulk power trading company, nonprofit and government-owned,

Anjan Roy (e-mail: gmwrlcd@rediffmail.com)

P.Pentayya (e-mail: ppentayya@indiatimes.com)

R.K.Mediratta (e-mail: rmediratta@indiatimes.com)

are with Western Regional Load Despatch Centre (WRLDC), Power Grid Corporation of India Ltd., Mumbai, India.

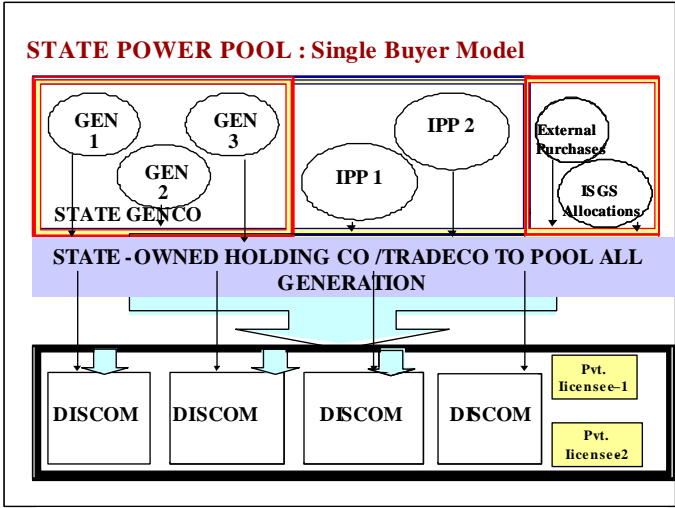


Figure 1 : Schematic of Single-Buyer Model

to manage all bulk power purchases and sales to distribution companies, with the transmission company providing only transmission services.

b) Multi Buyer Model

In Multi-Buyer Model (MBM), all Discoms would be free would base their decision on the merit-order of the cost of power.

Cheaper power available within or outside the state would get priority over costlier power. In both models, the optimization of costs take place. SBM considers the optimization at State level and MBM takes care of merit order at Discom level. Therefore, for giving full autonomy to Discoms and making them responsible for their actions, Multi Buyer Model (MBM) is a necessity. Decision makers may choose SBM as starting point and and switch over to Multiple Buyer Model (MBM) as soon as possible but not before some pre-requisites are satisfied.

In the above phases of single buyer model and initial stages of multiple-buyer model, the tariffs may be regulated on cost-plus basis. Later, full-competition in generation may be allowed. The pre-requisites for any one of the model to get effected are the decisions from the regulators on settling cost-plus tariffs. The parameters for such tariff settling may include: 1. financial norms, 2. norms for operation, 3. two-part tariff 4. availability targets for full recovery of capacity charges if applicable tariff is two-part tariff..

The variants of multi-Buyer Model are:

Option 1: All the generation including IPPs to be pooled /purchased by single common agency for the state and direct sale /purchase through bilateral contracts.

Option 2: All the generation including IPPs to be sold/purchased by DISCOMs directly and all power sale / purchase from other agencies also directly by DISCOMs.

Option 3: All the generation including IPPs to be sold/purchased by DISCOMs directly except those from other agencies.

The comparative summary of market models is given in Table 1.

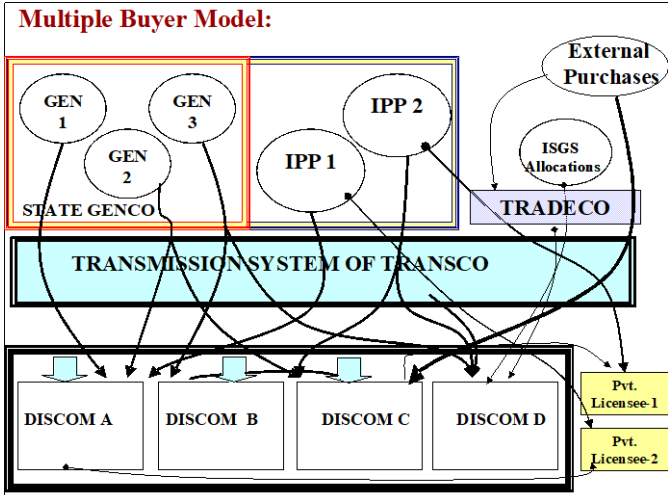


Figure 2 : Schematic of Multi-Buyer Model

Table 1 : Summary of Options for market Models

	SGS Gen.	IPP Gen.	ISGS Allo.	Bilateral trading
Single Buyer Model-1	Purchased / Pooled by Single entity and sold to DISCOMs. Private licensees to purchase/trade separately.			
Multi Buyer Model-1	Purchased/pooled by single entity and sold to DISCOMs. Private licensees to purchase/trade separately			Direct purchase
Multi-Buyer Model-2	Direct	Direct	Direct	Direct
Multi-Buyer Model-3	Direct	Direct	Direct	Purchased / Pooled

We may consider the phase-wise staged development as also an option, which would begin with SBM followed by MBM

III. MARKET MECHANISM FOR UNBUNDLED STATE UTILITIES

The unbundled Discoms and GENCOs would operate in the restructured environment. The Discoms would be required to meet their consumer’s demand and GENCOs would try to generate and sell their output to Discoms and direct access consumers. In the absence of proper mechanism, the Discoms would keep on drawing power from the pool irrespective of demand-supply situation in the grid without regard to frequency and Gencos would dump power into the pool even when the supply already exceeds demand. In the former case, reliability and security gets endangered and in the latter the economy suffers. Similar problems existed at inter-state level before Availability Based Tariff (ABT) as notified by CERC was implemented. It is not worthwhile to reinvent the wheel and the automatic choice would be to implement intra-state ABT.

The transactions between GENCOs and DISCOMs would be scheduled in Day-Ahead Market (DAM) but the actual demand of Discom would vary depending on real-time conditions. Similarly, actual generation of GENCO's plant would differ from schedules fixed before-the-fact. The deviations need to be priced. Having priced the deviations, at inter-state level, on the basis of average frequency of the grid during particular 15-minute time-block, it is most appropriate to link the deviations in the intra-state utility level to the same parameter. This arrangement transfers the price-setting signal downward closer to point of actual consumption. The pricing of Unscheduled Interchanges in the frequency range of 49-50.5Hz (the safe range) at the same level as that at inter-state level is recommended.

The Open Access for Captive power Producers is allowed since June,2003 and similar provisions would be recommended for non-conventional energy sources like wind farms etc. The power system reality is that it is not possible to match the injection of power by the seller with drawal of power by the buyer. The deviations would undeniably exist and need to be priced. Policy decisions would need to be made whether deviations of the injections/drawals of OA customers, CPPs and wind farms would be charged at UI rates or at HT rate of the Discom.

Presently, there is no mechanism for utilising power produced by state-owned Pumped storage schemes. It is difficult to plan pumped storage power plant in the absence of a scheme for pricing pumping power which is available during off-peak hours. These would become despatchable if the power is priced at the incremental cost.

IV. ALLOCATIONS FOR DISCOMS FROM SGS AND ISGS

It is also required to decide upon the mode of allocation of power from the State owned generating companies to the distribution companies. The allocations from SGS, ISGS and IPPs to DISCOMs can be done as per the following options:

Option 1: Pro-rata allocation : The power can be allocated to DISCOMs in the ratio of their demands at the time of restructuring. They can also be fixed for complete period of PPA or life of shared generating stations.

Option 2 : Differential allocation based on 'Capacity to pay' : The DISCOMs having more agricultural load can be allocated more from cheaper power stations and those with more of industrial loads be allocated more from costlier power stations. Such differential allocations may be done for 3-5 years initially and be converted to pro-rata allocation after phasing out of cross-subsidies.

Option 3 : Variable allocations for each day under Single-Buyer model : The 'Single Buyer' entity a state owned trading company, may purchase power from all the generating stations and sell to all the distribution companies at a single price (basket price) and allocations to all the distribution companies can be made based on their estimated peak demands for the

day. The average price paid, would be same for all DISCOMs for that day and would be different for each day. Similar treatment may be given to power from IPPs.

Though option 1 seems justified when Discoms have balanced customer-mix, however, it is unlikely. The Discoms having more of industrial consumers may be allocated more allocations from costlier State Generating Stations.

V. METERING AND SETTLEMENT SYSTEMS

The metering system for new market mechanism would need special features for recording of active energy for each time-block along with average frequency and reactive energy for high and low voltage conditions depending on tariff scheme finalised by SERC. The settlement systems would be operated by State Load Despatch Centre (SLDC). Elaborate systems would need to be put in place for data collection from meters to be installed at inter-utility boundary points and data communication from meters. The inter-utility boundary points would be boundaries between 1. Discom-to-Discom 2. Discom-to-GENCO 3. Discom-to-ISGS 4. Discom-to-ISTS 5. Discom-to-CPP and 6. Discom-to-IPP.

In some of the states, the boundaries of Discoms are defined as 11kV feeders from 66/11kV substations and in others 33kV feeders from 110/33kV substations. Metering 11kV system for calculation of actual drawal at 11kV feeders is impracticable for installing ABT metering. In such cases, SERCs should rather make provisions for installing meter not at electrical boundaries of Discom but at 220 or 132 or 66kV lines below which complete TRANSCO network supplies to same Discom. The losses of part of TRANSCO network which is used to deliver power to a Discom would be attributed to the particular Discom. The losses of part of Transco network which is crossing boundaries of Discoms would be shared by all Discoms in proportion to their drawals. The reduction in number of meters would reduce the original cost of scheme as well as the recurring cost in terms of manpower requirement and data communication efforts.

VI. GENERATION RELATED ISSUES

Under Multi-Buyer model, the existing generating stations of SEB would operate under Long Term Contracts with Discoms where each Discom will have allocation of power from different projects. SERCs may decide on allocating complete generation to all Discoms or allocate upto 80-85% and balance may be traded in short-term or spot trading. In case, Discoms are not interested in purchase of power from a particular generating station, the unallocated portion may be left for trades. The fixed charges of generating stations would be borne by all Discoms together with generators under obligation to maintain availability upto target levels as approved by SERCs. There would be several issues to be decided upon by SERCs for hydro and thermal SEB-owned projects. These are summarised below:

1. Determine if SEB's hydropower projects should be

transformed, ultimately, into independent companies that are allowed to compete for power sales in a competitive power pool market.

- a) How would multipurpose hydro projects operate?
- b) How would several hydro projects in cascade on the same river operate?
- c) What efficiency improvements can be expected if independent companies are established?
- d) How would tariffs for such independent companies be established?
- e) If such hydro project companies sell into a competitive power pool market, they would dominate the market as the competitive power pool prices that are set by the marginal costs of new thermal power plants will be much higher than the average accounting cost now for power from these SEB-owned hydro projects.

The recommended guidelines to such issues are already provided in CERC's orders

2. Determine if and when SEB's thermal power plants should be transformed into independent companies that are allowed to compete for power sales in a competitive power pool market.
 - a) What efficiency improvements would be expected?
 - b) How would tariffs for such independent companies be established?
 - c) The ultimate purpose of making these thermal power plants independent would be to ensure fair competition with the private sector for dispatch in a competitive power pool. When should such competition be introduced in State?
 - d) If the new independent power projects operate under long-term power purchase agreements for some period of time, with take-or-pay provisions, would continued SEB ownership of its thermal power plants represent a conflict of interest during this phase? At what stage does continued SEB ownership of its old thermal power plants create unfair competition?
 - e) Should these thermal power plants be sold to the private sector at that stage, or should they simply be transformed into independent state-owned enterprises; but then how would their independence be assured?
 - f) Determine the appropriate duration of bulk power supply contracts for new private power projects: whether these should all be long-term power purchase agreements for a period of 20 years; or whether the market structure for private power sales should change at some stage so that all bulk power is sold into a power pool with short-term contracts and spot market prices; or whether a mix of short-term, medium-term, and long-term

contracts should be allowed, depending on buyer and seller preferences.

VII. TRANSMISSION AND DESPATCH RELATED ISSUES

It is well accepted that transmission being a natural monopoly, would remain out of competition. Though for increasing the capital inflow for transmission capacity addition, the option of allowing private transmission licensees would be considered. The presence of many transmission licensees would help the state systems in adding the capacity or improve efficiency. In case of smaller states the presence of many transmission licensees would not be required whereas in case of bigger state-systems like Maharashtra, UP etc. the private licensees may be allowed on Build, Own and Operate (BOO) basis. State Transmission Utility(STU), as envisaged in the Act, would plan, coordinate and supervise the transmission systems within the state.

STU is the designated Transmission System Operator in the State. SLDC, operating under State Transmission Utility(STU) can remain System Operator.

A new set of services must be recognised as separate functional services and these are essential for smooth and reliable power system operation. These are known as Ancillary Services and include 1. Black start facilities 2. Voltage regulation 3. Balancing power under direct control of System Operator etc. The cost of ancillary services are borne by all market participants. The pricing would be approved by SERCs for intra-state and by CERC for inter-state transmission system.

VIII. DISTRIBUTION RELATED ISSUES

In the distribution sector, we strongly feel that Supply function should have been separated from Wires function i.e. distribution. In the absence of such differentiation, it would be difficult to bring competition in true manner. The existing distribution licensees formed after unbundling of SEBs would continue to own distribution system and at the same time supply to consumers. The new suppliers without adding their own distribution system would not be able to function effectively in the supply area. If same distribution system is proposed to be utilised using Open Access provisions, existing customers would not switch to new suppliers since maintenance of last-mile network would be responsibility of existing Distribution licensee and there would be no incentive for them to maintain the network and promptly serve the customers. Therefore, supply function need to be separated.

The distribution licensee should only maintain the distribution network and do metering and billing. The suppliers will arrange power through short and long-term contracts from State Gencos, ISGS, IPPs and other traders/marketers and brokers. The present Discom can be broken into government-owned distribution licensee and supply company. The supply company can be privatised. The other suppliers would be allowed to compete with existing supply company. Again, staged development would be

essential to avoid transition-related issues.

To start with, the government owned company may continue to own wires business to avoid issue of pricing of distribution assets which is highly depreciated. In case, they are transferred at book value then private company would make windfall and if transferred at market value, then consumers will bear the additional brunt.

Performance-based ratemaking for transmission and distribution services would be approved by SERCs. The objectives for SERCs in ratemaking process is clear i.e. allow profitability of distribution companies that will promote efficiency improvements, will ensure fair tariffs to consumers, will ensure a reasonable self-financing ratio, and could attract private investment if these companies are privatised.

SERCs would also be required to stipulate minimum conditions for compliance by suppliers. The conditions would consist of 1. Financial requirement so as to ensure its genuineness and to ensure that customers' deposits are not misutilised. 2. Operational requirements that they must be able to show their capacity to deliver the power as per consumers' requirement. and 3. Technical requirements, that they understand power system operation and would comply with rules and regulations governing power system including State Grid Code and IEGC.

IX. CONCLUSION

The transition from a simple to more complex but more economically prudent system would not be smooth. In world-wide power sector reform experience, transition issues are recognised as most important problem areas that need attention. It takes leadership quality to turn the current sector structure to desired structure where market should be primary and regulation would be secondary. It requires committed and concerted efforts from administrators, regulators, decision-makers and the market participants to achieve such daunting tasks. In the light of the above issues, the paper suggested the path to be adopted for successful restructuring.

X. ACKNOWLEDGMENT

The authors acknowledge with thanks the guidance and support given by the management of POWERGRID and for permitting the publication of this paper. The views expressed in this paper are of the authors in their individual capacity and not necessarily that of Power grid Corporation of India.

XI. BIBLIOGRAPHY

- [1] 'Electricity Market Design & Creation in Asian Pacific' published by World Energy Council, UK, May 2001
- [2] Paper on 'Intra-state ABT – issues and challenges' presented in PowerQuest 2004 on 10-11 April 2004 by Mr.Anjan Roy, Mr.P.pentayya, Mr.R.K.Mediratta, Mr.Haresh Patel