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" A Billion Watts Question. "

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Cultural diversity, varying geographic domains, different economic parameters, different social obligations and One Billion Customers- all are the characteristics of the Indian Power Sector. How should India open up its power market and yet provide the basic power to its vastly diversified people? How should it lead the future, while completing its past? The paper aims to answer these questions for the biggest democracy of the World.

EXECUTIVE SUMMARY

The power supply industry in India is now over a century old. Starting with the slow and fragmented growth during the first 50 years of its existence, the sector consolidated, initially at the state level and later at a regional level, after the enactment of the Electricity (Supply) Act in 1948. It also led to public sector ownership of almost the entire industry. The sector was mostly self-regulated.

In spite of the reforms, the Indian power sector has been going through a period of severe power shortages (both in terms of peaking power and energy) for several years. There is very little redundancy in generation and transmission facilities. Most states are now proposing unbundling of generation, transmission, and distribution functions as part of the reform programme.

In developing countries with a supply constrained power sector and weak social security systems, it would be prudent to design the market for wholesale competition only, especially in the initial years of reform. The choice of an appropriate market structure for India has to be necessarily related to the present operating environment and the extent of competition feasible/desirable.

Keeping in view the pros and cons of the different power market models and the power sector scenario in India, various models have been considered and a model proposed. It has been followed by a consequent model as the market matures. Will it succeed in making the world's biggest democracy power – equipped? That is the **BILLION WATTS QUESTION !**

INTRODUCTION

Although the industry has made rapid strides in the recent past, it is now being found increasingly inadequate to meet present-day challenges. There are serious concerns about its performance, regulatory efficiency, and ability to finance projects. Hence the power sector is presently going through a process of reform and restructuring, as is the trend in many other parts of the world. Independent regulatory commissions are being set up and vertically integrated utilities are being unbundled on a functional basis into corporate entities. Efforts are also being made to facilitate competition wherever feasible. The choice of an appropriate power market model assumes significance in this context.

In the world scenario, virtually all OECD countries have decided to open up their power sector, at least to their big industrial users. By the year 2006, it is estimated that more than 500 million people (and all large industrial users) in the OECD area will be entitled to choose their power supplier, which accounts for nearly 50% of the population of OECD countries.

The paper starts with a research of existing power market dynamics throughout the world. It then proceeds to examine the different models possible. Finally it reasons the proposed model for the Indian power scenario.

A COMMON APPROACH

Recent reforms in many countries often share these four basic elements:

- Rapid introduction of full consumer choice
- An obligation to provide non-discriminatory Third-Party Access (TPA) to the transmission and distribution networks.
- Unbundling of transmission; and
- Liberalisation of electricity trade so that electricity can be traded both through organised power exchanges and on a bilateral basis.

This combination of elements is known as “**retail competition**”; where the demand and supply side dynamics play their own roles in the power market.

UNDERSTANDING THE COMMODITY

Before understanding the various methods to introduce and sustain healthy competition in the industry, it will be useful to analyse power as a commodity. The commodity component of electricity is similar to many other commodities although it has some special features:

- Demand fluctuates in various time horizons (day, year or business cycle) both randomly and non-randomly. The generation and transmission capacity needed to cope with peak demand is partly unused in periods of lower demand.

- Electricity cannot be economically stored. On the other hand, reserve capacity may be required to cope with random demand fluctuations or generation shortfalls.
- Economies of scale in generation do not seem significant at the plant level.

Table 1 analyses the VALUE CHAIN of the commodity, giving the economic characteristics and the possibility of competition in those sub-activities.

Table 2 gives the various alternatives that are have been used in this sector throughout the world.

Function	Key Economic Characteristics	Implications
Generation	Limited scale economies at plant level Co-ordination economies at system level Complementarity with transmission	Potentially Competitive
Transmission	Network externalities In general, not a natural monopoly Large sunk costs	Investment incentives need special attention One Grid but possibly several owners
Distribution	Often a natural monopoly Large sunk costs	No competition
System Operation	Monopoly (due to technical constraints)	No competition
End User Supply	Limited scale economies No special features	Potentially Competitive
Related Services *	No special features	Potentially Competitive

* Related services include power exchanges, financial contracts and most importantly, the construction and maintenance of assets.

Table 1 : Value Chain and Competitive structure of the Power Commodity

REFORM	DEFINITION	EXAMPLES
OWNERSHIP		
Nationalization	Public Sector (Normally Central government) purchases assets of industry (private or locally) in whole or in part	Postwar UK and France, Portugal
Privatization	Public sector (normally central government) sells assets to private sector in whole or in part.	UK, Spain (Partial)
ORGANIZATION AND REGULATION		
Non – Competitive		
Consolidation (or Horizontal Integration)	Utilities merge for economic political or strategic reasons (with or without ownership change).	Belgium
Vertical Integration	Utilities engaged in different functions(distribution, transmission, production) merge	
Competitive		
Access for non-Utility Generation	Terms for sale of power (often from renewables and /or cogeneration) published by utility. Often accompanied by government quotas, subsidies, etc.	Denmark, Germany, Portugal, UK.
Competition in Generation	Competition between incumbent generation companies, usually for dispatch in pool or for sales to distributors.	UK, Netherlands
Competition for Generation (also known as Build Operate Transfer or Build Own Operate)	Competition to bid for new power projects	Portugal
Integrated Resource Planning	Requirement for utilities to consider and compare demand-side with supply-side investments.	Some US states
All Source Bidding	Utilities required to call for bids for power generation or demand-side investments.	Some US states
Wholesale Wheeling	Utilization of transmission networks on the basis of use of system charges to other utilities.	US
Third Party Access (or Retail Wheeling or Open Access)	Competition for final consumers utilizing transmission and distribution networks on the basis of use of system charges. Utilities (production and distribution) and independent generators compete for markets.	UK
Yardstick Competition (or incentive regulation)	Schemes for comparing performance of utilities, often associated with penalties/rewards in tariff increases.	France, Spain, Some US states

Table 2 : Alternatives considered
(Based on existing power sector in countries around the world)

GENERIC MODELS

The power markets operating in different parts of the world can be broadly classified into four basic generic structures.

- 1 Monopoly model
- 2 Single-buyer model
- 3 Third-party or open-access model
- 4 Power pool (wholesale market or spot market) model

The monopoly model offers little scope for competition. Hence, the choice centres on the other three models. Each of these generic models may have variations within itself in respect of the agency responsible for management of the market and its governance and regulation.

Figure 1 and Figure 2 show the difference between the monopoly and retail competition model.

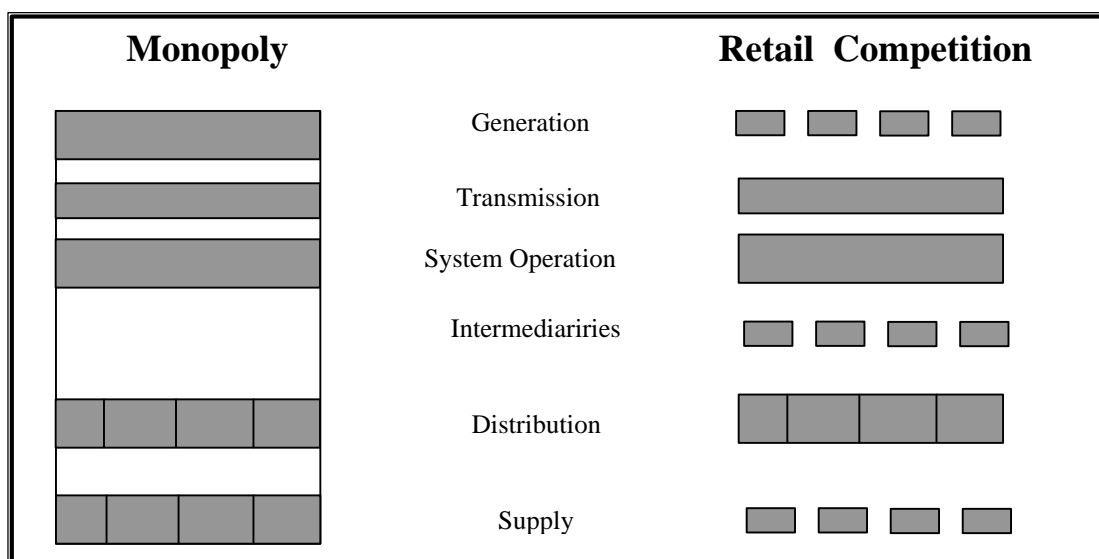


Figure 1 : Monopoly vs. Retail Competition

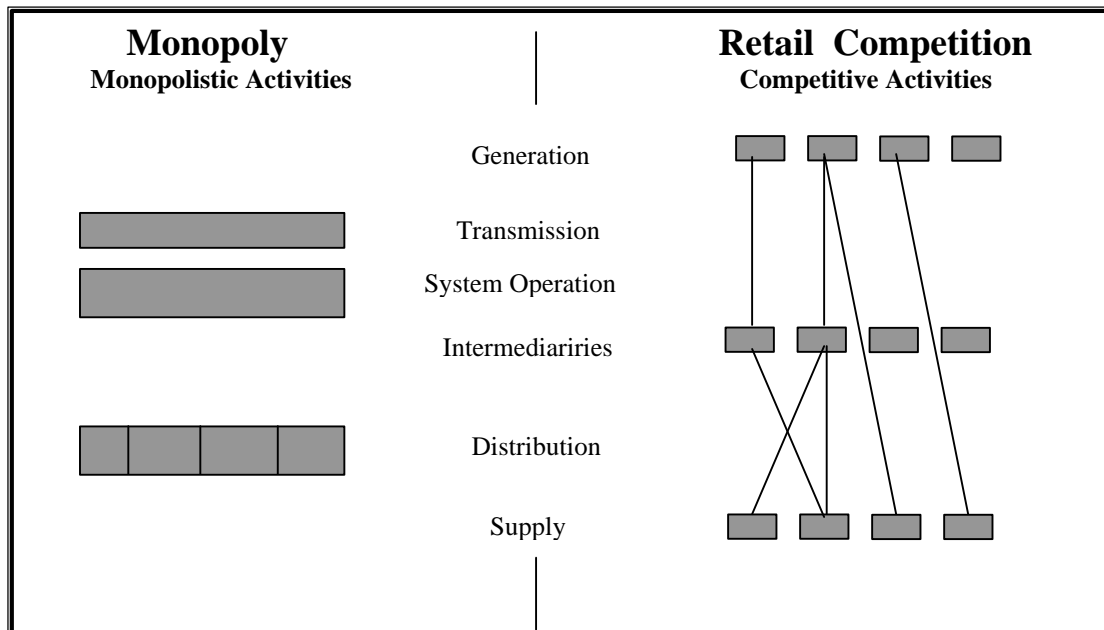


Figure 2 : Retail Competition : How does it Work

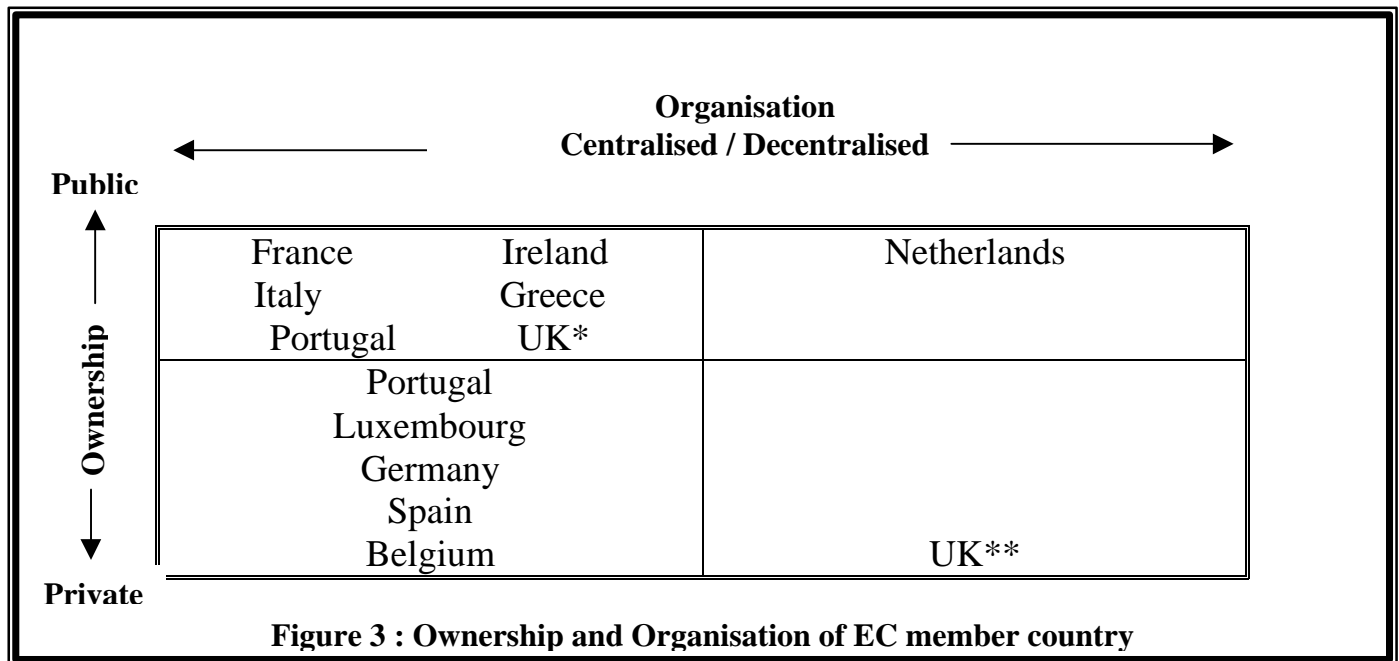
Figure 3 gives an account of the various models prevalent in the European countries in the power sector

Single Buyer Model

In a single-buyer model, a single entity purchases power from all generators on a competitive basis and in turn sells it to the supply entities. This model has the following advantages.

- It is simple and has minimum transaction costs.
- It facilitates design of equitable bulk supply tariff.
- Planning for capacity addition and strengthening of transmission systems is better coordinated.

- Splitting of existing contractual agreements with different generation companies is not necessary.



The demerits associated with this model are listed below.

- Competition is limited.
- The buyer may not have the incentive to seek out the most economical source of supply.

Open Access Model

Under the open-access model, the generators are in a position to enter into direct contract with distributors or large consumers without the need of an intermediary buyer. This, however, requires an open access to the transmission system. It is also important that the access to transmission is regulated and pricing policies

are compatible, transparent, and efficient. The main merit of this model is that it provides a better platform for competition, which would eventually help bring down the cost of supply. However, implementation of this model would entail the following.

- Transmission system development would become more complex with increased uncertainty in planning.
- The concern for stranded costs would increase.
- Transaction costs would be higher.
- Regulatory control on transmission access and pricing would be critical.

This model is being adopted in many countries where there is adequate redundancy in the generation and transmission system and the thrust is towards increasing competition especially at the wholesale level

The drawbacks of the model can be overcome to some extent through the adoption of a competitive bidding system for power purchase by the single buyer and imposition of an appropriate regulatory control, to ensure no supply constraint. Many developing countries are found to prefer a single-buyer model, especially during the transition phase of the reform.

Power Pool Model

The power pool model envisages different generators selling to a pool and the distributors or large consumers buying from it. The pool functions as a marketplace for trading. An open access transmission system is a prerequisite for this model too. Compared to the other models, this one offers the best framework for competition. These pools are designed to maximize competition in

generation, compete on price not cost, and remain open to all market participants. However, the successful operation of these pools would require highly developed information and decision support systems and a strong reliance on the market forces.

THE INDIAN SCENARIO

THE CONSIDERATIONS AND CONSTRAINTS

- Generators and distributors provide competition in a power market. Competition in generation is normally reflected in wholesale tariff while competition in distributors (supply) is reflected in retail tariff. Since the bulk of the supply cost (nearly 60%, it is as high as 75%–80% in some Indian states) constitutes generation cost, the main benefit from competition is at the generation level.
- Many governments are cautious in opening up the retail market. The apprehensions in this regard are cherry picking of influential customers, possible higher cost of supply to weaker sections of consumers (with serious social and political implications), added dimensions to the issue of stranded costs, etc. The state power utilities have not been operating on commercial lines.
- The power purchase agreements entered into / being finalized are long-term ones (typically 20–30 years) with committed take-offs and incentives for higher production.
- The average revenue realization is far below the cost of supply.

- The tariff structure is highly distorted with heavy cross subsidization between consumer categories. Agricultural and domestic consumers have been enjoying a highly subsidized tariff for many years. From social and political considerations, it may not be practicable to drastically change the tariff structure overnight.
- Significant differences may be present in the tariff design applicable to different generating agencies.
- The database of various financial and operational parameters needed for developing new pricing structures is presently lacking in most states.
- Load dispatch and communication facilities are yet to be adequately developed.
- Metering at the distribution level needs considerable improvement.

THE MODEL PROPOSED

Model: A single-buyer model consisting of one BPSA (bulk power purchase/supply agency) at the state level.

Reasons:

- The costs of power purchase from different generating companies vary widely. The BPSA structure would ensure that no distribution company would get the entire or substantial benefit of low-cost power, while others are forced to purchase high-cost power.
- The consumer mix in different distribution zones may not be same. If near uniform tariff has to be maintained throughout the state (which may be needed to avoid widespread criticism of the reform programme), it would

have to be achieved through a differential bulk supply tariff structure. An agency like the BPSA could implement this.

- It would not be necessary to immediately end the contractual commitments made by the electricity board / government to various generating companies.
- There would be better coordination in transmission system planning.
- The BPSA would be contracting for or buying power from different generating companies on the basis of the price and the ongoing contractual commitments. Since the BPSA would be a monopoly entity, it will be licensed and power purchase would be regulated by the state regulatory commission. The power thus procured would be pooled and supplied to the different distribution companies as per contracts entered into with them. Although the BPSA would be normally supplying power to distribution companies only, there could also be a provision for direct supply to some major bulk consumers. This would be a step forward in opening up the market and promoting competition.

Important : Such a provision might be seen as erosion in the market share of prospective investors in distribution and might thus dampen the response from bidders while privatizing the distribution zones. This aspect has to be critically reviewed on a case-to-case basis.

In future, this model can evolve into an open-access model. The strategy for this would be to allow the distribution companies (after they are well established) to buy power directly from new generating companies but limited to the extent that is in excess of what is already committed to the BPSA. Once the market is stable, the BPSA would have no role to play. The resulting structure would be similar to the open-access model.

Three options could be considered for the agency, which has to function as the BPSA.

- The transmission company
- The SEB (state electricity board)
- A consortium of distribution companies

In many countries, the transmission company is taking over this role. However, the main drawback associated with this model is that the transmission company, instead of being a facilitator, would be required to do trading as well. This may present increased risk to the company and possibly lead to conflict of interests within the organization. The Power Grid Corporation of India was to handle the responsibility of the bulk trader; but later it was felt that entering into trading would not be advisable.

SEB is a good option. It need not be totally abolished at the start of the reforms and as core unit continues to function. This entity could have an advisory group consisting of project analysts, engineers, negotiators, and a representative of the transmission company. It would have to be a licensee of the regulator.

The consortium approach has the advantage that the stakeholders are directly involved in the purchase. However, the success of this arrangement would depend greatly upon the spirit of understanding and cooperation among the distribution companies. Any conflict of interests between the consortium members could lead to delays in finalizing power purchase agreements, apportioning of existing agreements, etc. Past experience with the working of the regional electricity boards in India indicate distinct probabilities for such a situation. Also, there is the danger of cartel formation between the consortium and one or more groups of generators.

In the initial years of the reform, the first two options appear more pragmatic. In either case, the agency in charge of system operation (typically the transmission company in the Indian scenario) would be concerned with scheduling generation.

Conclusion

The choice of an appropriate power purchase/trading model is an integral component in the design of any reform programme. Three basic models are discussed and it is concluded that considering the power sector scenario in India, a single-buyer model would be best suited for the transition phase. The SEB may continue to perform this function or it may be entrusted to the transmission company. Yet another option would be a consortium of distribution companies. The pros and cons of these options have been discussed and the electricity board and transmission company options have been favoured. The agency would purchase power from different generating companies based on

competitive bids. It would also take care that existing contracts are not violated. Surplus power from other states and power from mega projects would be contracted through the corresponding state-level agencies and the proposed power-trading corporation, respectively. The power thus pooled would be supplied to different distribution companies and major consumers, adopting a differential bulk supply tariff wherever necessary. The provision for direct supply to major bulk consumers would, however, amount to a reduction in the market share for prospective investors in the distribution system. Hence, this option has to be exercised selectively especially in the initial years of reform. This model could gradually evolve into an open-access model.

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