ABSTRACT

Worldwide structure and governance of electricity industry & markets are evolving and thus various stakeholders use different approaches to achieve enhanced economy, efficiency, reliability, energy security, safety, resilience and eco-friendliness. In order comprehend the trends and maturity levels of markets and participants it is essential to understand nitty-gritties of the electricity industry and key influences including disruptive technologies shifting the operation and management of various participants. This publication is aimed to present essentials of the competitive electricity industry, various participants and terminology & metrics used. It is also intended to bring out cognizance of aspects that are affecting business model evolution. A series of publications are being planned to bring out global trends, market maturity, its pros and cons to the end consumers.

Keywords: Wholesale; Retail; Distribution; Competition; Business Model; Industry Trends

OBJECTIVES OF THIS PAPER

1. To study the competitive markets of electricity industry
2. To examine the electric industry its participants
3. To assess competitive markets and business model evolution
4. To compare electricity business model
5. To identify the trends of challenging market status across the globe

Electric Industry and Participants

Electric energy produced from a mixture of sources, including coal, nuclear, gas, hydroelectric and other renewable sources such as wind, solar Photovoltaics etc. In the traditional electricity business model utilities were vertically integrated with each company owning energy production, transmission& distribution, wholesale and retail trades. This resulted in greater challenge managing system and operation efficiencies due to its structure. And regulators were challenged with tasks in managing accountability of pricing mechanism, reliability & energy quality and security issues etc. In order to revive the sustainability of the electricity industry it was essential to legally unbundle the organizations in to logical functional entity whose performance could be tracked using management metrics.

Diverse unbundling approaches were instigated worldwide contingent on the evolving business models and applicable performance metrics. Regulators are progressing business model innovations to yield
maximum benefit to end customers, society and environment in the view of current scenarios, challenges and existing process & technologies.

Unbundling and other business innovations are engrossed around the borders such as generation, wholesale and retail trades, metering services, market data management services etc., keeping aside natural monopolistic portions such as transmission and distribution wire assets management which facilitates carrying electricity from one place to other. An independent system operator is retained responsible for dispatching electricity in real time with required reliability and power quality. This is to ensure adequate support towards meeting of Socio-economic anticipations of end consumers. Regulators continue to oversee fair competition and mitigation of market power, monitoring of capacity margins etc. until it achieves requisite maturity.

**Competitive Markets**

Price of electricity varies across countries, region largely dependent on the business models. Over the period of years regulatory processes and guidelines created a vast gap between management and competitive efficiency. Electricity Industry participants undergo sustenance challenges due to lack of competitive markets. In any industry instituting of competition is foremost to the maneuver of markets, and promotes novelty, productivity and growth.

Competition, the process of challenge between organizations striving to gain sales and make profits, is the driving force behind markets. Well-organized and impartial markets are critical for catalyzing sector development and economic growth. While markets effort equally functioning, competition can only be prepared and has potential for evils by unsuitable government policies, lack of technology, lack of planning and legal frameworks because of anti-competitive conduct of organizations.

The reality and significance of these relations are still not sufficiently recognized in the growing markets. The focus is to bring resiliency and economic viability by enabling importance of competitive markets. Markets are often controlled by large organizations with close links to government, and active competition eases prospects for exploitation and generates more space for entrepreneurs to grow.

An effective electricity market should allow substantial commercial freedom to market buyers, sellers, and various types of traders. Trading rules would then allow the market participants the freedom to fashion and implement various trading and risk management arrangements with each other, at prices to which they mutually agree, in pursuit of their respective commercial interests.

The retail side of electricity market involves the final sale of power from an electricity provider to an end use consumer. These sales range from the service for a large manufacturing facility to small businesses and to individual households. Market design should, on the other hand, recognize the fact that the laws of physics dictate certain essential characteristics of system operations and the complexities of electricity networks require a degree of centralized coordination over system operations to ensure system reliability.

We always tend to assume electricity prices are constructed on the principle of supply and demand equilibrium. This includes dormant supply and demand curves, which may vary over time, and assumes that observed price/quantity pairs are obtained as the intersection of the two curves, for any particular point in time.

**Aspects Shaping Business Model Evolution**

In this section some of aspects influencing business model evolution are summarized. Business and regulatory models are determining future utility grid which meets socio-economic expectations as well as the service providers are aptly reimbursed and incentivized. This means more techno-commercial engagement of consumers& utilities with aid of technology progress to be intelligent and achieve next generation utility systems. The below picture summarizes the various business model maturity levels.
Key factors that are guiding the maturity of competitive markets include Energy or fuel mix, financial options, asset management practices, consumer mix, segmentation, their requirements such as reliability, engagement experience etc., as-is technology solution implementations, emergence of disruptive new technologies and government external regulations and policies on aspects such as society, environment etc.

Comparison of Electricity Business Model & Its Status

In this section a comparison of four different electricity market models such as New Zealand, North America, Europe and Japan are explained, followed by summary of status of electricity model in India.

The New Zealand electricity market is split into areas such as administration and market clearing, regulation, generation, transmission, distribution and retailing. The Electricity Industry Reform Act 1998 prevents the ownership of energy and lines functions. This demands a generation company cannot own or have an interest in a distribution company and a distribution company cannot retail electricity or deal in electricity hedges with minor exceptions to the regulations. The exceptions are generation companies can own the lines required to transport electricity from their power stations to the grid or local distribution network and distribution companies can own a small amount of conventional generation capacity within their network but are not limited in the level of renewable generation capacity. System Operator responsible for ensuring real time electricity supply security and quality. They are also the market schedulers, predicting likely demand to help generators make offers, and the dispatcher, in charge of matching demand and supply in real time.

Since 2000 Japan’s electricity market has been partially liberalized which amounts to about 68% of electricity energy share, though big ten Electric Power Companies (EPCOs) dominates the market. Share of non-big EPCOs for over 50KW retail market is only about 4.2% and only 1.3% is transacted at Japan Electric Power Exchange (JEPX). The Great East Japan Earthquake in 2011 revealed negative aspects of regional monopoly system which includes, lack of system which transmits electricity beyond regions, little or no competition & strong price control and little flexibility in changing the existing energy mix; It was also hard to increase the ratio of renewable energy. The Organization for Cross-regional Coordination of Transmission Operators (OCCTO) founded in 2015 whose main functions include review the short term power system reliability and grid capacity planning. It is also expected to expand retail competition to the residential sector starting from next year (2016). However government plans to maintain regulation on retail tariff for under 50kW users until 2020 through 10 EPCOs.
In North America Regional Transmission Organization (RTO) and Independent System Operators (ISO) constitute regulated electricity participants responsible for performing system and market operations with responsibility for safety, short term reliability of power systems and coordination between other competitive market participants such as bids and market prices. As on date, there are four RTOs and seven ISOs are performing duty of providing open access to wholesale and retail market participants as well as providing regional market support in some cases.

Power System Security Constrained Economic Dispatch Model

In Europe system and market operations are governed by different entities with system operators responsible for maintaining short term security and market operators responsible for signaling market prices to participants. European Transmission System Operators (TSOs) are entities operating independently from the other electricity market players and are responsible for the bulk transmission of electric power on the main high voltage electric networks. TSOs provide grid access to the electricity market players (i.e. generating companies, traders, suppliers, distributors and directly connected customers) according to non-discriminatory and transparent rules. In order to ensure the security of supply, they also guarantee the safe operation and maintenance of the system. In many European countries, TSOs are in charge of the development of the grid infrastructure too.41 TSOs from 34 countries are members of the European Network of Transmission System Operators for Electricity (ENTSO-E).
In many countries regardless of prevalence of retail competition or not, electricity for end use customers is acquired either through the open, competitive wholesale market, from utility owned rate-based (cost-plus) generation, or some combination of the two. In sections where full retail choice is provided, customers have option between their incumbent utility supplier and an array of competitive suppliers. Competitive retail suppliers provide a variety of service plans which provide consumers and businesses flexibility in their energy purchases. They may also offer services to hedge against price fluctuations, more choices for alternative energy resources, and newer energy efficiency projects, among others. These prospects allow consumers and businesses to choose the services that meet their needs appropriately. In cases where customers don't choose a supplier are served by their incumbent utility through a service called "provider of last resort" (POLR) who will secure its needed power on the wholesale market through a competitive bid process. In sections not offering retail competition, regulators monitor the investments and expenditures of the monopoly utilities by allowing a fixed rate of return. To restrain in inadequacies under monopoly, regulators award the prospective organizations through competitive bid process.

In India, The Electricity Act 2003 allows the power sector to a number of players by laying down provisions for a power market and competition. Open access means the non-discriminatory provision for the use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the Appropriate Commission. Open access is one of entry points for emergence of retail electricity markets. Even after many years, its acceptance, adaption and enablement of consumers have been constrained by state electricity organizations and many other factors.

Other Trends of Challenging Market Status across Globe

The following are some of key industry trends are influencing utilities for shaping their business model.

- Larger addition of renewables such as photo voltaic, wind energy in the grid.
- Quicker Infusion of energy storage service providers in to the energy market.
- In many countries solar PV prices have crossed grid parity even from retail customer perspective and thus set to go into competitive market space without any subsidies.
- Liberalization of import restrictions
- Reducing oil & gas prices across the globe

CONCLUSION AND FURTHER DISCUSSIONS

In developed countries though maturity of business models are rolling faster, detailed analysis represents that current maturity of competitiveness is still vulnerable owing to various factors as described in section 3 and section 5. In growing countries, restructuring of vertically integrated organizations were initiated with the aim to promote greater system and operational efficiency of generation, transmission, distribution and retail. While many utilities have started their unbundling into
generation, transmission and distribution organizations, central agencies attempts towards wholesale and retail trading lacks momentum as those reforms did not bring much results, owing not only in basic inefficiencies in market design but also in strategy and execution. In most countries detailed review of indicators brings out concerns related to transparency and accountability lapses in the existing design. Implementation of an appropriate measurable market design that would help reduce longer outage duration, higher undelivered energy to maintain committed reliability and security of the power network. In the successive publications, it is intended to elaborate the cases relating to dynamic data requirements, its analytic capabilities as well as its non-functional requirements in order to manage those aspects challenging competitive maturity.

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