

Module 7 : Power System Structures

Lecture 33 : Structure of a Deregulated Industry

Objectives

In this lecture you will learn the following

- Structure of a deregulated industry.
- Different entities in a deregulated industry
- Ancillary Service Management

Overview of A Deregulated Industry

Unbundling of traditionally vertically integrated utility.

One of the principal characteristics of a competitive structure is the identification and separation of the various tasks which are normally carried out within the traditional organization so that these tasks can be open to competition whenever practical and profitable.

This process is called *unbundling*.

An unbundled structure contrasts with the so-called vertically integrated utility of today where all tasks are coordinated jointly under one umbrella with one common goal, that is, to minimize the total costs of operating the utility.

One of the first steps in the restructuring process of the power industry has been the separation of the transmission activities from the electricity generation activities.

The subsequent step was to introduce competition in generation activities, either through the creation of power pools, provision for direct bilateral transactions or bidding in the spot markets.

On the other hand, the transmission system has significant economics of scale (i.e., it is economical to have a common bulk transmission system of a large capacity rather than individual small capacity transmission links). Consequently it was suited to be a natural monopoly and a separate entity. It was felt necessary to introduce regulation in transmission so as to prevent it from overcharging for its services. The transmission system thus became a neutral, natural monopoly subject to regulation by public authorities. And to overcome the monopolistic characteristic, the trend has been to establish new legal and regulatory frameworks offering third parties "open access" to the transmission network subject to technical constraints.

An important point to note is that the restructuring process was however not uniform in all countries. While in many instances, it started with the breaking up of a large vertically integrated utility, in certain other instances restructuring was characterized by the opening up of small municipal monopolies to competition.

In brief, Electric utilities are expected to split apart into unbundled companies, with each utility re-aligning itself into several other companies that respectively focus on each part of the new industry, i.e., power delivery and retailing. This is known as Disaggregation.

Under deregulation, the vertically integrated utility, one giant company that generates, transmits, distributes and sells electricity in coordinated manner will become thing of the past. To function in an open access system, such utilities will have to rearrange their operational organization to match the unbundled functions they must perform. Each part of the company will need to work in its new form. Generation will have to compete in the competitive power generation market place. T & D will have to operate as an open provider of delivery services. Competition will be present in retailing.

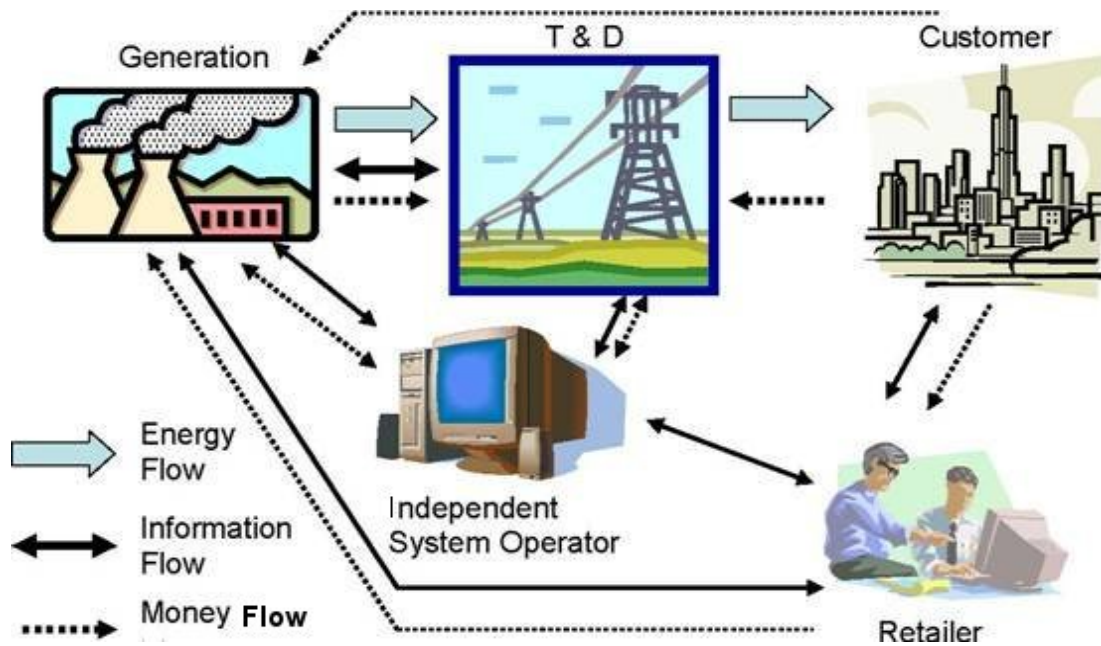
Generally, the governments advocating deregulation want competition in energy production, and they want to see significant levels of customer choice in the retail market for electricity. At the same time, it recognizes that it is best to have only one transmission and one distribution system in any one area.

Therefore, the purpose of deregulation is to restructure the electric industry so that power production and retail sales are competitive, while delivery is still a regulated, monopoly franchise business.

Structure of deregulated industry

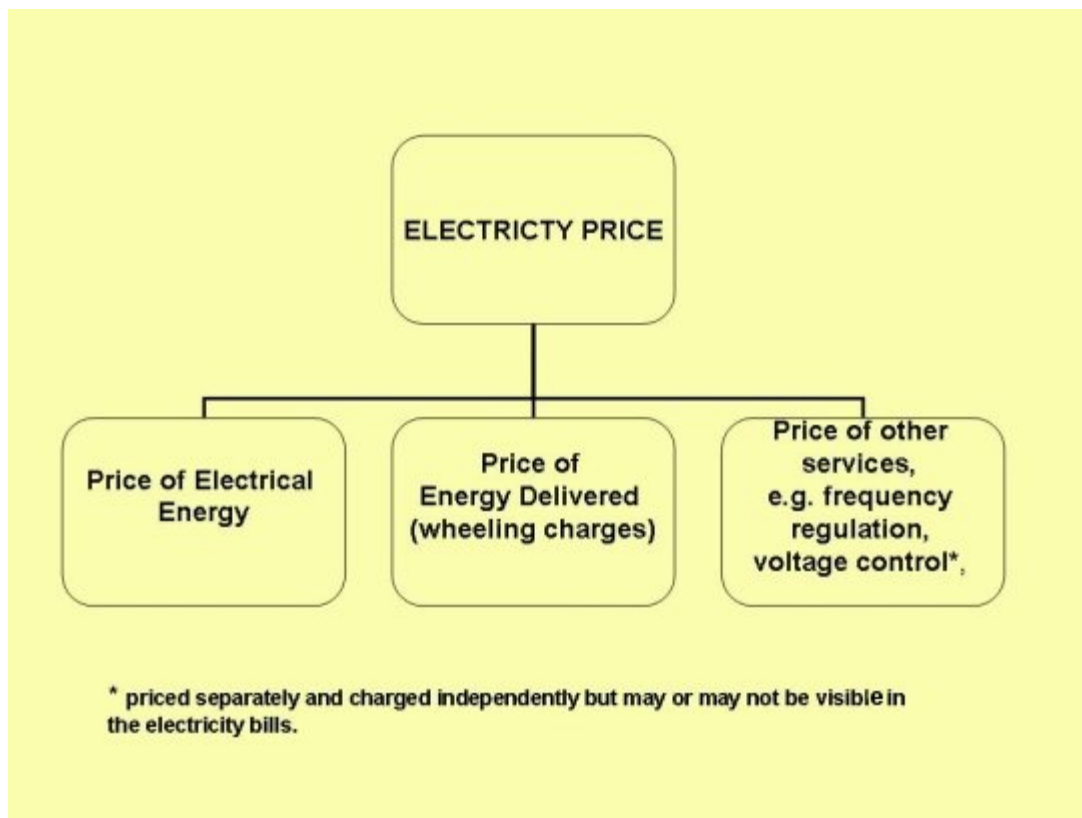
The figure below shows the typical structure of a deregulated electricity system with links of information and money flow between various players.

The configuration shown in the figure is not a universal one. There exist variations across countries and systems.



Different power sellers will deliver their product to their customers (via retailers), over a common set of T & D wires. These operations are supervised by an independent system operator (ISO). The generators, T & D utility and retailers communicate with the ISO. Mostly, customers communicate with a retailer, demanding energy. The retailer contacts the generating company and purchases the power from it and makes it transferred to its customer's place via regulated T & D lines. The ISO is the one responsible for keeping track of various transactions taking place between various entities. A customer can also enter into a bi-lateral contract with a generator directly for supply of the required energy.

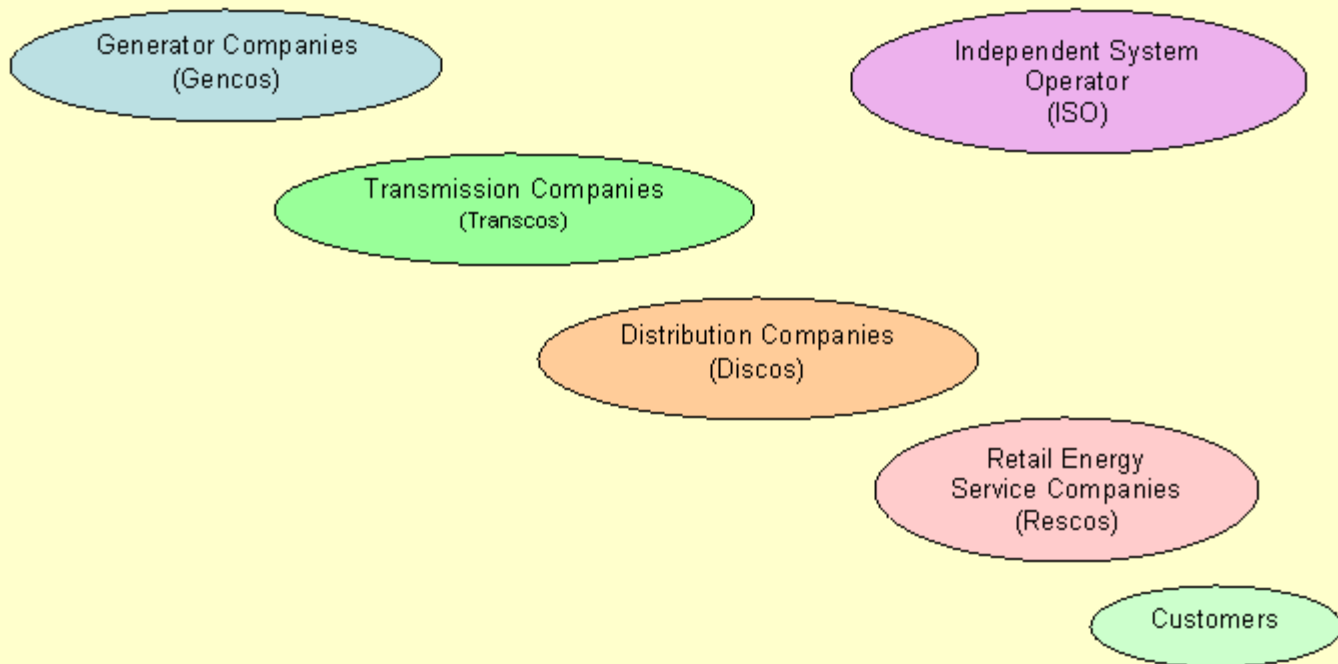
In the vertically integrated environment, the electricity bill consisted of a single amount to be paid towards the generation, transmission and all other costs. But, in the restructured environment, the electricity price gets segregated into the following:



Different entities in deregulated environment :

The introduction of deregulation has brought several new entities in the electricity market place, while on the other hand redefining the scope of activities of many of the existing players. Variations exist across market structures over how each entity is particularly defined and over what role it plays in the system. However, on a broad level, the following entities can be identified as shown in the figure below.

Different Entities in a Deregulated Environment



Genco (Generating Company)	Genco is an owner-operator of one or more generators that runs them and bids the power into the competitive marketplace. Genco sells energy at its sites in the same manner that a coal mining company might sell coal in bulk at its mine.
Transco (Transmission Company)	Transco moves power in bulk quantities from where it is produced to where it is delivered. The Transco owns and maintains the transmission facilities, and may perform many of the management and engineering functions required to ensure the system can continue to do its job. In most deregulated industry structures, the Transco owns and maintains the transmission lines under monopoly franchise, but does not necessarily operate them. That is done by Independent System Operator (ISO). The Transco is paid for the use of its lines. In some countries, Transco itself acts as a system operator.
Disco (Distribution Company)	It is the monopoly franchise owner-operator of the local power delivery system, which delivers power to individual businesses and homeowners. In some places, the local distribution function is combined with retail function, i.e. to buy wholesale electricity either through the spot market or through direct contracts with gencos and supply electricity to the end use customers. In many other cases, however, the disco does not sell power. It only owns and operates the local distribution system, and obtains its revenues by 'renting' space on it, or by billing for delivery of electric power.
Resco (Retail Energy Service Company)	It is the retailer of electric power. Many of these will be the retail departments of the former vertically integrated utilities. Others will be companies new to the electric industry that believe they are good at selling services. Either way, a resco buys power from gencos and sells it directly to the consumers.
ISO	The ISO is an entity entrusted with the responsibility of ensuring the reliability and security of the entire system. It is an independent authority and does not participate in the electricity

market trades. It usually does not own generating resources, except for some reserve capacity in certain cases. In order to maintain the system security and reliability, the ISO procures various services such as supply of emergency reserves, or reactive power from other entities in the system.

A customer is an entity, consuming electricity. In deregulated markets, a customer has several options for buying electricity. It may choose to buy electricity from the spot market by bidding for purchase, or may buy directly from a genco or even from the local distribution company.

(Independent System Operator)

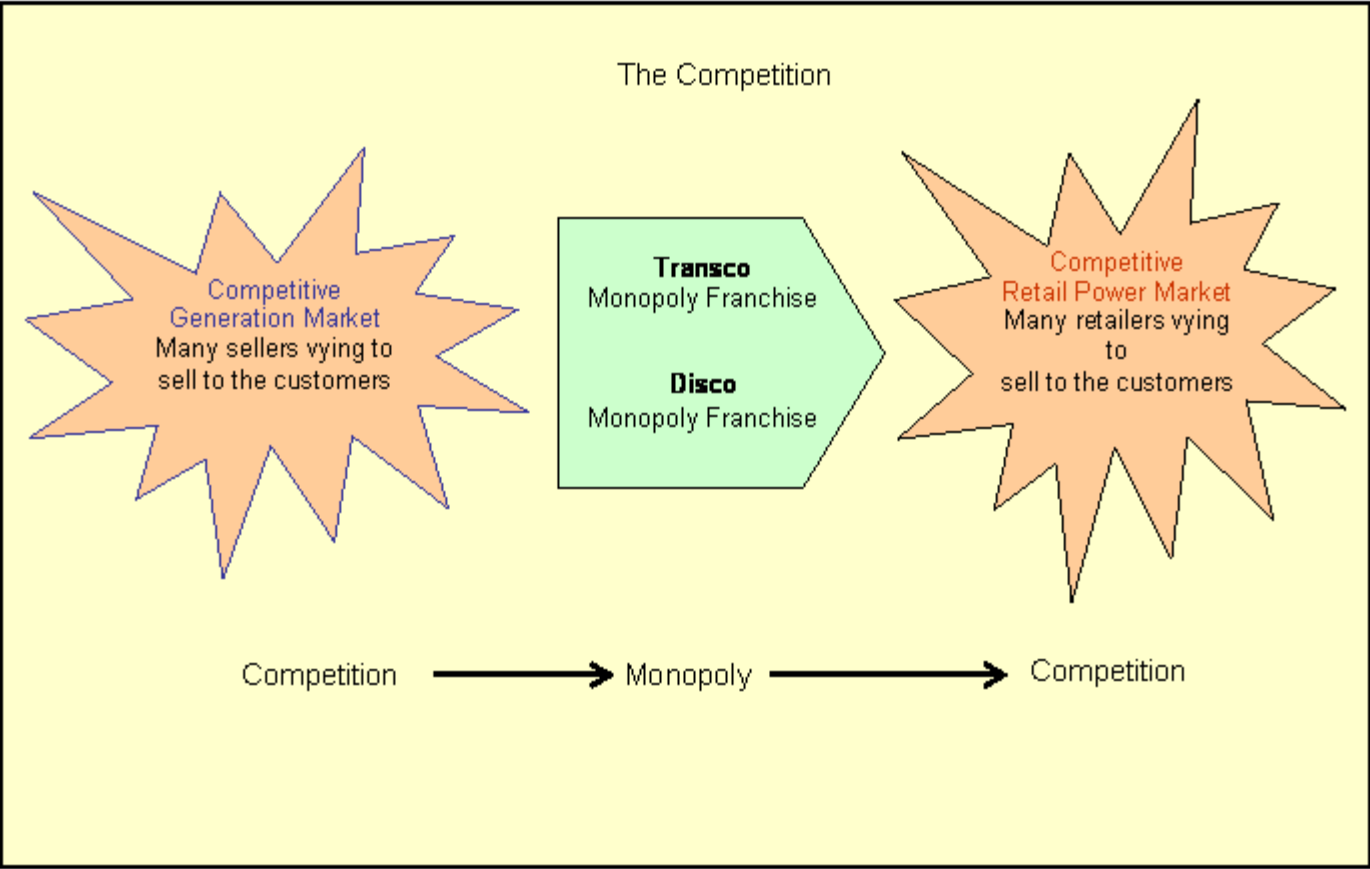
Customers

The competition :

In a deregulated environment, two levels of competition exist or are encouraged. At what can be termed as wholesale level, gencos produce and sell bulk quantities of electric power. Power is typically sold in bulk quantities to other companies or very large industrial customers, through some deregulated power market mechanism. The gencos bid their power at the marketplace so as to maximize their profits.

Locally, retail delivery is accomplished by retailers, who compete for the business of the consumers in the area by offering low price, good service and additional service features.

Thus, a restructured, completely competitive electric industry is a sandwich of competition above and below a power delivery system. This structure can be conveniently divided into wholesale and retail levels. The important thing to note is that the power delivery i.e. transmission and distribution remains a monopoly. This is shown in the figure below.



Ancillary Service Management

Ancillary services are defined as all those activities on the interconnected grid that are necessary to support the transmission of power while maintaining reliable operation and ensuring the required degree of quality and safety. This requires that a independent system operator should have adequate leverage to implement "normal" functions like frequency and voltage regulation, but also carry out actions of preventive , emergency and restorative control actions as discussed in module 6. In deregulated power systems, transmission networks are available for third party access to allow power

wheeling, and spot markets for electricity have been developed in many countries. In such an environment, **ancillary services are no longer treated as an integral part of the electric supply**. They are unbundled and priced separately and system operators have to purchase ancillary services from ancillary service providers. The following are some examples of ancillary services which are procured and managed by an ISO.

	Regulation	The use of generation or load to maintain minute-to-minute generation/load balance within control area (like AGC).
	Load Following	This service also refers to instant-to-instant balance between generation and load (governor action).
	Operating Reserve- Spinning	The provision of unloaded generating capacity that is synchronized to the grid and can immediately respond to correct for generation/ load imbalances, caused by generation and/ or transmission outages and that is fully available within several minutes.
	System Control	The control area operator functions that schedule generation and transactions and control generation in real time to maintain generation/load balance.
	Reactive Power and Voltage Control from Generator Sources	The injection or absorption of reactive power from generators or capacitors to maintain system voltages within required ranges.
	Real power transmission losses	Any power flow in the network will cause losses which have to be supplied by purchasing some additional power.
	Network Stability Services from Generation sources	Maintenance and use of special equipment (e.g. for emergency control) to maintain a secure transmission system.
	System Black-Start Capability	The ability of a generating unit to proceed from a shutdown condition to an operating condition without assistance from the grid and then to energize the grid to help other units start after a blackout occurs

Recap

In this lecture you have learnt the following

- Structure of a deregulated industry.
- Different entities in a deregulated industry
- Ancillary Service Management

Congratulations, you have finished Lecture 33. To view the next lecture select it from the left hand side menu of the page

