

ELECTRIC MARKET RESTRUCTURING IN THE U.S. AND THE MAIN LESSONS LEARNED

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Abstract

Market restructuring means changes in regulatory rules that alter control, ownership or regulatory mechanisms of specific industry sectors resulting in increased competition.

For more than one and a half decades, market restructuring has been a central policy path in the electricity supply industry in many countries and regions around the world. The movement to privatize and introduce competition in traditionally state-controlled and regulated sectors came to the electricity sector at the end of 1980s and early 1990s, with several countries pioneering the way with considerable success.

After up to fifteen years' experience with restructured electricity markets and even longer in some cases important lessons can now be drawn from some pioneering countries and regions. One of such pioneering countries is the United States (US), the market restructuring experience of which is the subject of this paper.

The paper reviews the history of electric market restructuring in the US, and development and characteristics of different types of market and Regional Transmission Organization (RTO) structures; discusses the current market structure and future prospects

in the US; and finally some conclusions, recommendations and lessons to other countries and regions are drawn.

Keywords

Electric Market; Market Restructuring; Market Structure; Regional Transmission Organization (RTO); Independent System Operator (ISO); Locational Marginal Pricing (LMP).

1. Introduction

The goal of a market structure should be to benefit customers by fostering reliable service, reasonable prices, fairly predictable bills, and to encourage innovation in the services provided.

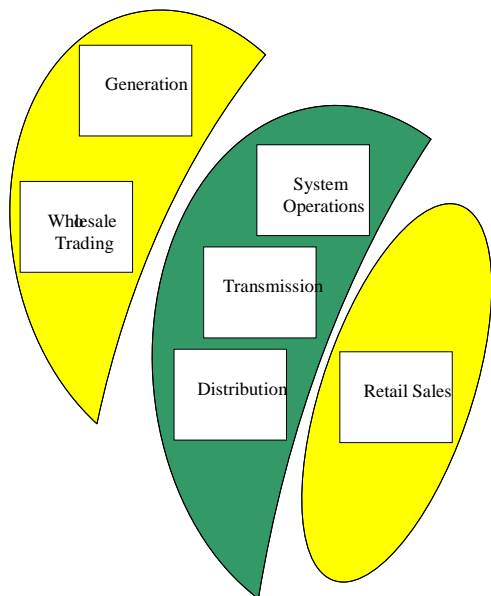
Many would argue that the first century of vertically integrated utilities did an effective job of meeting those criteria. Beginning in the 1970s, a number of utilities in the US were forced to raise rates due to cost overruns on nuclear construction and the rise in fuel costs.

Coupled with a general philosophical trend towards deregulation of US industries (including airlines, natural gas and telecom) this led to a reconsideration of the benefits and necessity of vertical monopoly utilities.

As the value of restructuring (Fig.1.1) was (and continues to be) considered, a number of important questions arose:

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- Can a competitive generation sector provide lower prices than regulated utility generation?
- Can competitive generation and wholesale marketing sectors result in adequate or improved reliability of supply?
- Will efficiencies resulting from a competitive wholesale trading marketplace result in lower prices?
- Will innovation in competitive retail services provide customer benefits that outweigh any negative aspects of competition?



- Can be opened to competition
- Remains a regulated monopoly but must be open to competition

Fig.1.1: Electric Market Restructuring

Various market observers would answer these questions differently, and given the immaturity of electric deregulation, no one yet has the answer.

2. The History of Electric Market Restructuring

2.1 Federal Restructuring

The first move towards restructuring of US electricity markets occurred in 1978, when Congress passed the Public Utilities Regulatory Policy Act (PURPA) (Fig. 2.1), which allowed private owners of cogeneration units to sell power into utility grids. Prior to this time, the US had virtually no non-utility owned generation.

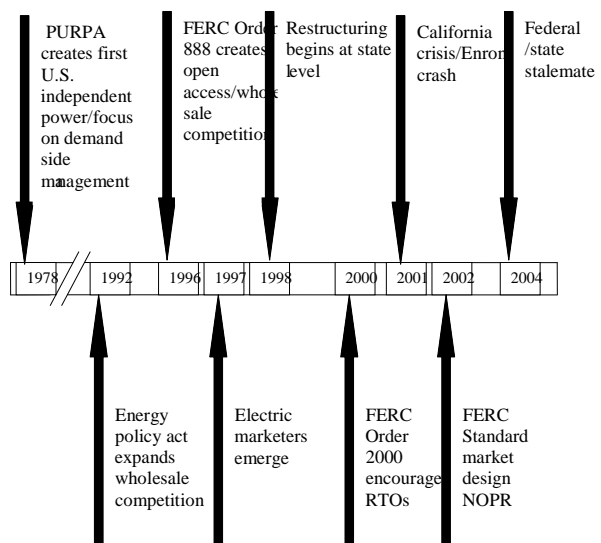


Fig. 2.1: The History of Electric Market Restructuring

Following PURPA, the concept of independent power producers (IPPs) became a trend in the utility industry. By 1992, IPPs were building 60% of the new capacity in the US. But opportunities were limited since sales could be made only to the incumbent utility. Congress moved to address this issue with the Energy Policy Act of 1992.

The key points to the Energy Policy Act which laid the groundwork for restructuring are that it created the legal framework for IPPs to sell to someone other than the local utility, it gave the Federal Regulatory Energy Commission (FERC) the authority to order

wheeling, and it put in place the integrated resource plan (IRP) process that required utilities to consider purchased power as well as construction of power plants.

While the Energy Policy Act furthered the movement towards competitive generation, it was not enough. In 1996, FERC adopted orders 888 and 889 that constituted the very first step towards the formation of Regional Transmission Organizations (RTOs).

It was clear for FERC that the essential point of success or failure with market liberalization lays with transmission that should support the development of markets.

These two orders therefore imposed on electricity utilities to grant open access to electricity transmission networks (obligation to set access rates, adopt non-discriminatory rules for congestion management and provide information on capacity) and proposed the voluntary formation of independent system operators (ISOs).

ISOs are nonprofit-making regulated organizations that operate the network without owning it (network assets remaining the property of utilities). The objective with ISOs was to separate the ownership and operation of transmission assets in order to increase transparency in the open transmission access regime.

A number of regions moved voluntarily with ISO formation including California, New England, New York and PJM (Pennsylvania, New Jersey, and Maryland, plus areas of other neighboring states).

To create a larger marketplace (like the one that has worked so well in the natural gas industry), FERC needed to find a way to eliminate the wide disparities in rules and rates in the various utility and ISO tariffs that resulted from order 888.

FERC concluded that a competitive market could be fostered by moving to system

operators that created uniform markets across larger regions, and coined the term Regional Transmission Organization (RTO). In 1999 FERC issued Order 2000, the centerpiece of which was the formation of RTOs.

RTOs are regulated entities that ensure the network operation of a grid that covers several US states and that they do not own. For some of them, RTOs also operate day-ahead and real-time markets. RTOs are nonprofit-making organizations. Order 2000 made the creation of RTOs purely voluntary. When set up however, they should meet some characteristics and functions.

In 2002, FERC proposed to foster the creation of RTOs in a proposal known as the "standard market design". This proposal aimed at spreading the best practice of Eastern RTOs (e.g. RTOs of PJM, New England and New York) to the whole country. As further to the Californian crisis and to the strong opposition of some state regulators however, the proposal failed and was withdrawn in 2005.

The existence of a – sometimes long - history of cooperation between the stakeholders of a region has helped in the creation of an RTO. In PJM for example, the pre-existence of a power pool contributed to the facilitation of the RTO's creation. However, RTOs were also successfully created in regions with no such history (e.g. the Midwest ISO – MISO). The historical difference explains that while PJM, New England have a centralized dispatch center, in MISO this could not be achieved (preexisting centers were maintained).

The US has 7 ISO/ RTOs: (Fig. 2.2)

- ISOs: California ISO (CAISO), Electric Reliability Council of Texas (ERCOT), New York ISO (NYISO)
- FERC-approved RTOs: ISO New England (ISO NE), Midwest ISO

(MISO), PJM, Southeast Power Pool (SPP).

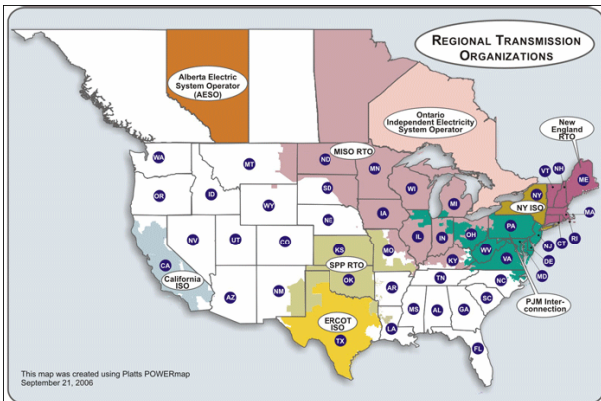


Fig. 2.2: Regional Transmission Organizations

The setup of an RTO purely results from a voluntary decision of the concerned ISOs and State Regulators. There is furthermore no obligation for any of the stakeholders to become member of an RTO.

FERC gave a very strong incentive to utilities for joining an RTO. Whenever a network owner is member of an RTO, it benefits from a guaranteed 12% rate of return on grid investments. In addition to this, FERC promised utilities to benefit from high efficiency gains in reserve sharing.

2.2 State Restructuring

While it is FERC's role to get wholesale trading, transmission and system operation markets working, it is in the role of the states to consider retail competition and break-up of the vertical utilities. Some states have chosen to do nothing, others have moved aggressively into restructuring the role and business structure of the utilities. In many cases it is the high price states that have taken the lead, given pressure from industrial customers who desire access to lower-cost sources of electricity.

Key issues for the states include:

- Which market structure to adopt.

- Which trading arrangements to adopt.
- Whether to support movement to an ISO or RTO.
- How to foster the separation of the vertical utility functions.
- Whether to allow retail access, and if so, how.
- How to continue regulation of the continuing monopoly utility function.

In general, states that have chosen to restructure have done it in one of the three ways – transitioning existing power pools into ISO structures (New England states, New York, PJM states), creating new state-wide ISO (California and Texas), or implementing restructuring without putting in place new competitive wholesale market structures (the rest).

3 Electric Market Structures

3.1 Vertically-Integrated Monopoly Utility Model

Many parts of the US still operate under the vertically integrated model (Fig. 3.1). These include most of the Southwest, the Northwest and much of the West outside of California. Virtually all municipalities, public utilities districts and co-ops still operate under the vertically integrated model (Fig. 3.2).

3.2 Single Buyer with Competitive Generation Model

Many states that otherwise subscribe to maintaining the utility monopolies have opened up their generation sectors to limited competition by implementing some form of the single buyer model (Fig. 3.3). A common implementation of this model in recent years has been the requirement that utilities needing new supply resources must consider power contracts with independent parties in addition to utility-constructed units when doing integrated resource planning. In some states using this model, new generation has been constructed by merchant generators who then sign long-term (7-10 year) supply agreement with the utility. In other states, the utilities seem to always conclude that utility-owned units will provide the most benefits.

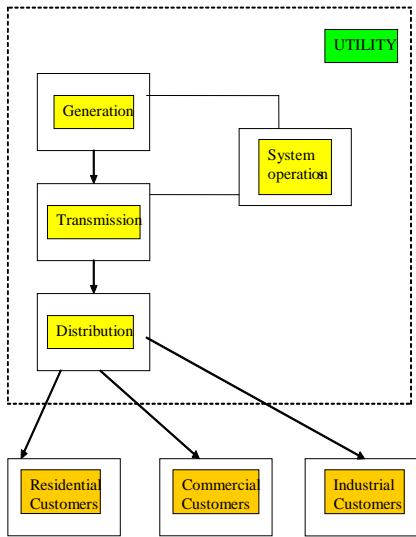
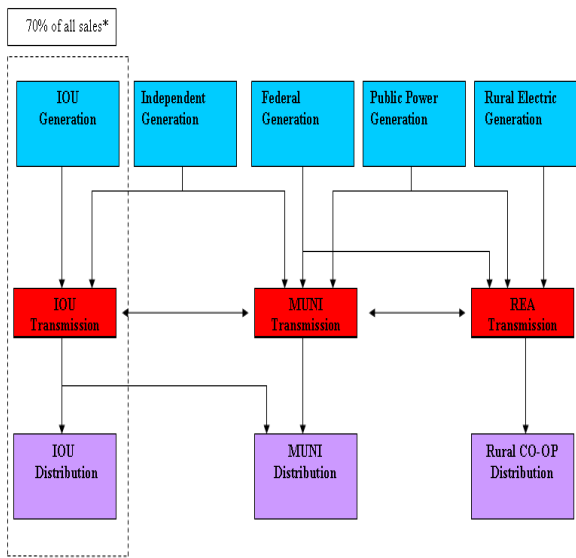


Fig.3.1: The Vertically Integrated Monopoly Utility



*Before state restructuring began in 1998

Fig 3.2: U.S. Vertical Utility Market

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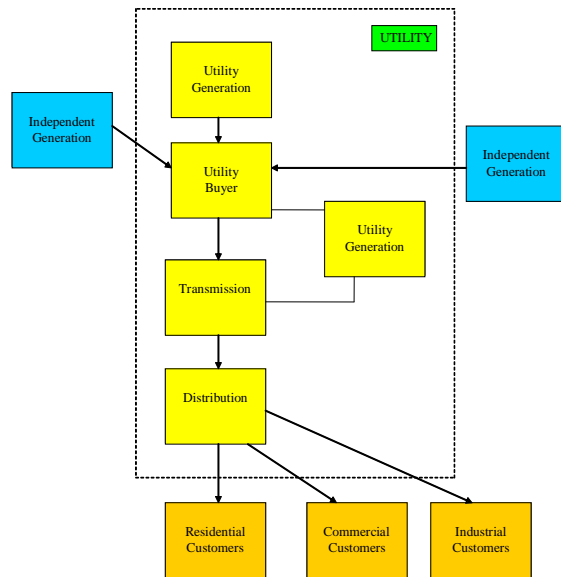


Fig. 3.3: Single Buyer with Competitive Generation

3.3 Wholesale/Industrial Competition Model

Many of the states that have undergone electric deregulation have implemented wholesale industrial competition (Fig.3.4) or some variation thereof.

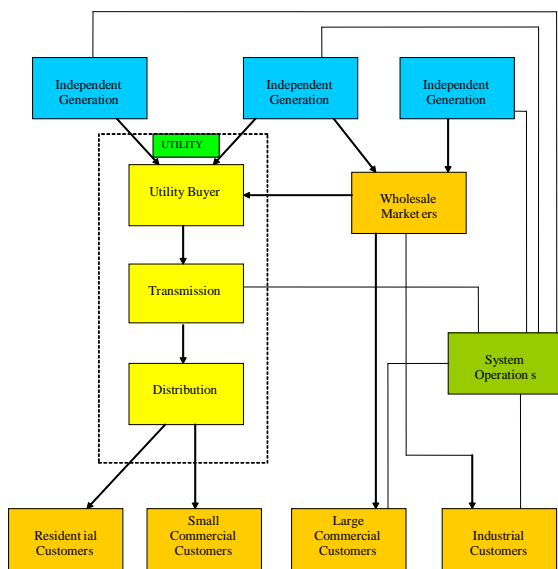


Fig. 3.4: Wholesale/Industrial Competition

A common variation is to give smaller customers the option of buying competitive supplies but to allow the utility to continue to provide default service (continued bundled distribution/supply service for customers that do not choose to acquire supply from a marketer). In most situations, smaller customers have overwhelmingly chosen to remain on default service, making the market a de-facto wholesale/industrial competition market. Thus, this model best represents the majority of states that have implemented deregulation.

3.4 Complete Retail Competition Model

Although many states now allow choice of supplier in some form or another to all customers, most still allow customers to choose to continue taking supply from the utility company.

So far, participation in customer choice by smaller customers has been minimal based on various market and regulatory impediments. Only the state of Maine has fully implemented the complete retail competition model (Fig.3.5), where utilities are completely removed from offering supply to end-use customers. Many other states have a mix of the complete retail and the wholesale/ industrial model where both utilities and marketers may supply smaller customers (Fig.3.6).

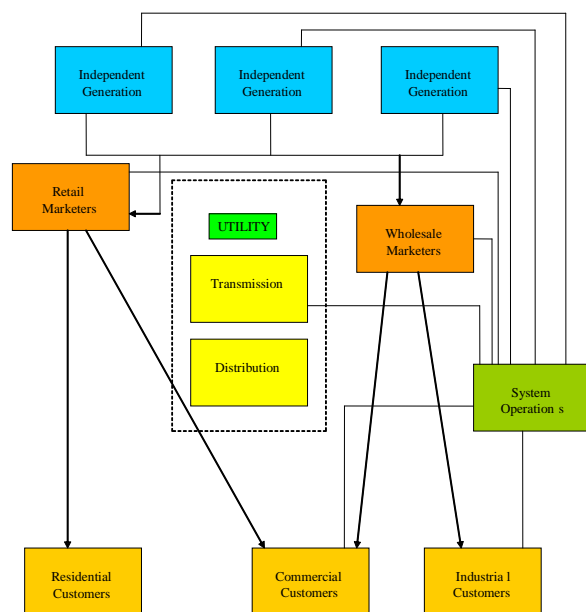
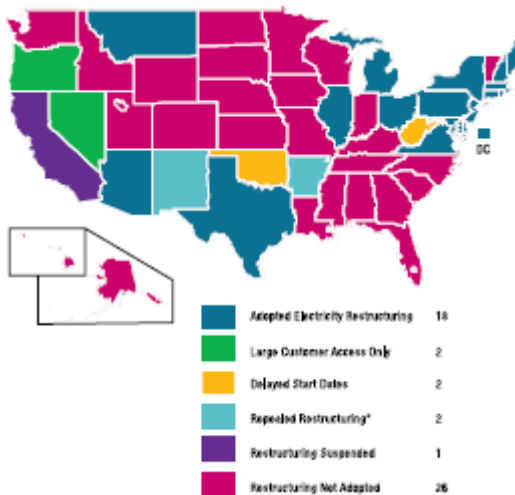


Fig. 3.5: Complete Retail Competition



* Arkansas and New Mexico repealed their restructuring laws 2/24/03 and 4/8/03, respectively.
 Source: Edison Electric Institute, status as of December 2006.

Fig.3.6: Status of Retail Electric Competition

4. Different Types of Market and RTO Structures

FERC has not imposed a specific market design and has left RTOs free to decide of the structure they wished to adopt. In this respect, US experts distinguish:

- **fully decentralized markets** (or “DAY 0”).
 These are “pre-RTO” markets as there are several transmission providers, each with their own network tariff (and a pancaking of tariffs for cross-border flows). In these markets, electricity companies remain regulated and vertically integrated and there is also relatively low cross-border trade, market transparency and liquidity.
- **partially decentralized markets** (or “DAY 1”). In this market structure, an RTO is in place. There is thus a single, independent transmission operator with a single tariff. This operator does not own the transmission assets it operates. Generation unit commitment and real-time dispatch are realized by the vertically integrated utilities. Such a market was in place in California before 2000.
- **fully centralized markets** (or “DAY 2”). They represent the most-advanced form of RTO markets. In these markets, the RTO has a hybrid nature. Not only does it operate the network of the region concerned (as a single, independent

operator with a single tariff) but it also operates the day-ahead and real-time markets. Generation unit commitment and real-time dispatch are performed in a centralized manner by the RTO. This situation corresponds to the market structure of e.g. PJM, New England, New-York, MISO.

Further to the Californian market failure of 2000, the day 1 type of market was heavily criticized and most markets switched to a day 2 structure (or, like in MISO, went for a day 1 type of market only temporarily – as a step on the way to a day 2 market).

A number of electricity experts in the US consider that real-time markets cannot reliably function with too little information and linkage with transmission.

5. Wholesale Market Services

A wholesale electric market refers to transactions that occur between two parties, neither of which is the ultimate consumer of the electricity.

Services in the wholesale marketplace include energy, capacity, transmission rights, ancillary services, and financial risk management. Participants include utilities, federal power agencies, merchant generators, wholesale marketers, ISOs, transmission companies, and financial services providers.

Energy and Generation Capacity

Energy sales refer to the sale of electricity that will be generated and transmitted on the grid to the point of sale. Capacity sales refer to the sale of a right to call on generation capacity if needed.

While energy sales are generally priced simply in \$/MWh, capacity sales commonly have a two-part price, a \$/MW that is paid for the reservation of capacity whether it is

used or not, and an additional \$/MWh that is paid if the unit is dispatched.

Two markets exist for both energy and capacity. Forward markets (which are commitments for a time in the future), and spot markets (which are commitments to deliver energy or capacity on the same day or for the day following the transactions).

Spot markets generally refer to day-ahead sales (energy or capacity being sold for the following day) or sales for energy or capacity to be used on the day of the sale. Sales for the same day are commonly termed hour-ahead (for the next full hour) or imbalance energy. Imbalance energy (also called balancing energy) is energy bought or sold by the system operation to keep the system in balance within a specific hour.

Transmission Rights

Transmission rights are used by generators and/or marketers to deliver power to a point of sale. Given the current state of the transmission infrastructure, rights to use transmission can make or break any given transaction.

Once a market has transformed to an ISO marketplace, transmission rights transition to a transmission congestion model.

Under this model, transmission is allocated on an hour-by-hour basis in the spot market with congestion charges applying to users of any congested paths. To hedge against the financial uncertainty associated with congestion charges, ISOs often offer financial transmission rights (FTRs). FTRs are auctioned off to the marketplace and provide a fixed price guarantee associated with use of a certain transmission path.

Ancillary Services

Ancillary services support the reliable operation of the transmission system as it moves electricity from generating sources to retail customers.

Forward and Rea-Time Operating Reserves ensure that sufficient resources are held in "reserve" and are available to produce electricity on short notice when an outage or another problem occurs. These markets also allow certain demand side recourses to provide reserves by reducing their electricity use when called on by the ISO.

Regulation allows the ISO to instruct specific power plants to increase or decrease output moment-by-moment to balance system frequency.

Voltage Support allows the system operators to maintain transmission voltages within acceptable limits.

Black-Start Capability is provided by specific power plants as strategic locations and involves restoring generation to restart the transmission system following a systemwide blackout.

Financial Services

Generators, marketers, and utilities holding assets or contracts and/or needing to purchase future supply that is subject to market fluctuations may turn to financial markets to hedge some or all of the price risk.

6. Future Market Prospects

The electricity industry is in the throes of radical change. Some regions, once dominated by vertical utilities that controlled all aspects of the business, have now become competitive markets with a robust wholesale marketplace and active competition for sales to end-use customers. Other regions remain dominated by strong vertical utilities and have felt little of the turbulent marketplace changes. And much of the US is somewhere in-between the two extremes.

PJM, the largest unified marketplace that stretches across much of the Northeast, Mid-Atlantic and Midwestern states. As the PJM

marketplace matures, along with markets in Texas, the remainder of the Northeast and possibly California, customers are likely to begin to see growing benefits from electricity competition.

This may rejuvenate the push towards competition in other states and ultimately lead to regional, if not national, competitive markets.

The one thing we can be sure of is that the electric business will continue to see frequent change. While no one can predict a precise course of events, a look at ongoing trends and past experience in other businesses might give us some indication of what to expect. And it is worth noting that of all the countries in the world that have initiated electric deregulation, none have gone back to the former model of vertical regulation.

7. General Conclusions

- In the US, regulatory powers are split between FERC (the Federal Regulator) and the State Regulators. While State Regulators are in charge of retail markets, FERC is responsible for wholesale markets and inter-State trade issues and is therefore the only authority in charge of RTOs.
- FERC, which has played a very active role in liberalizing the electricity business in the US and in setting up RTOs, has now dropped back and become more passive. FERC officials now take the view that it should only act as a “back-stop” Regulator, acting only when necessary for the existing market model to continue running but not any more to further develop it or extend it to other regions.
- RTOs/ISOs are non-profit making, regulated entities that ensure the network operation of a regional grid,

without owning it as assets remain in the hands of electricity utilities. They are the result of the adoption of order 2000 by FERC.

- RTOs in the US take varied forms. While some have entirely replaced the pre-existing operators (e.g. PJM, New England, New York), others have been created as an additional layer of operation control (e.g. MISO, where the pre-existing dispatch centres remain active). Moreover, some RTOs cover several States when others are limited to the border of one single State (e.g. ERCOT for Texas; California ISO).
- There is in the US no politically agreed objective to move towards an integrated American electricity market and the country remains a patchwork of liberalized and non-liberalized areas.
- Different types of market structures have been adopted in the liberalized US markets, resulting in different roles for RTOs/ISOs. By now however, most RTOs/ISOs have opted for a centralized approach according to which they act both as system operators and market (day-ahead plus real-time) operators. This centralised model is considered by US experts as the best solution to ensure efficient real-time market operation.
- When operating the market, RTOs/ISOs of the East Coast (New England, New York and PJM, an RTO covering 14 states) and of the Midwest Region use locational marginal pricing (LMP), i.e. setting the price of electricity at each grid location after calculations based on the prices offered by generators and taking into consideration the grid constraints.

- All RTOs have a responsibility in investment planning. In PJM and New-England, a distinction is made between reliability and economical grid reinforcements, and the RTO has the authority to impose investments for reliability purposes.

8. Key Lessons

8.1 The need for rules at regional level on cooperation and coordination. The role of FERC has been crucial in bringing together ISOs at regional level. Without such a federal Regulator, such an evolution would not have been possible.

8.2 Coordination of TSOs: a pre-requisite for market integration. The creation of RTOs has been the absolutely essential condition for market Integration in the US.

8.3 Locational/nodal pricing with additional signals: an appropriate system for system optimization. Locational/nodal pricing is adopted by all RTOs. The model seems to work relatively well in PJM and New England, but concerns are however

expressed in the larger market of MISO, where there are so many nodes and the calculation of prices is therefore more difficult.

8.4 Investment planning: the need for efficient and regional processes. Investment planning is not harmonized all over the USA but is instead done inside each ISO/RTO and there is currently much debate on this issue given the recurrent lack of investment in networks, in particular between ISOs/RTOs, and in generation.

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