



Overview of the PJM RTO

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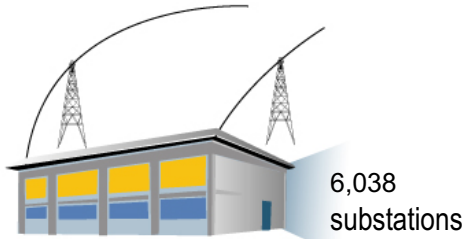
May 15, 2007



- Geography and Statistics
- Roles and responsibilities of a Regional Transmission Organization (RTO)
- Governance
- Historical Background on PJM and US deregulation

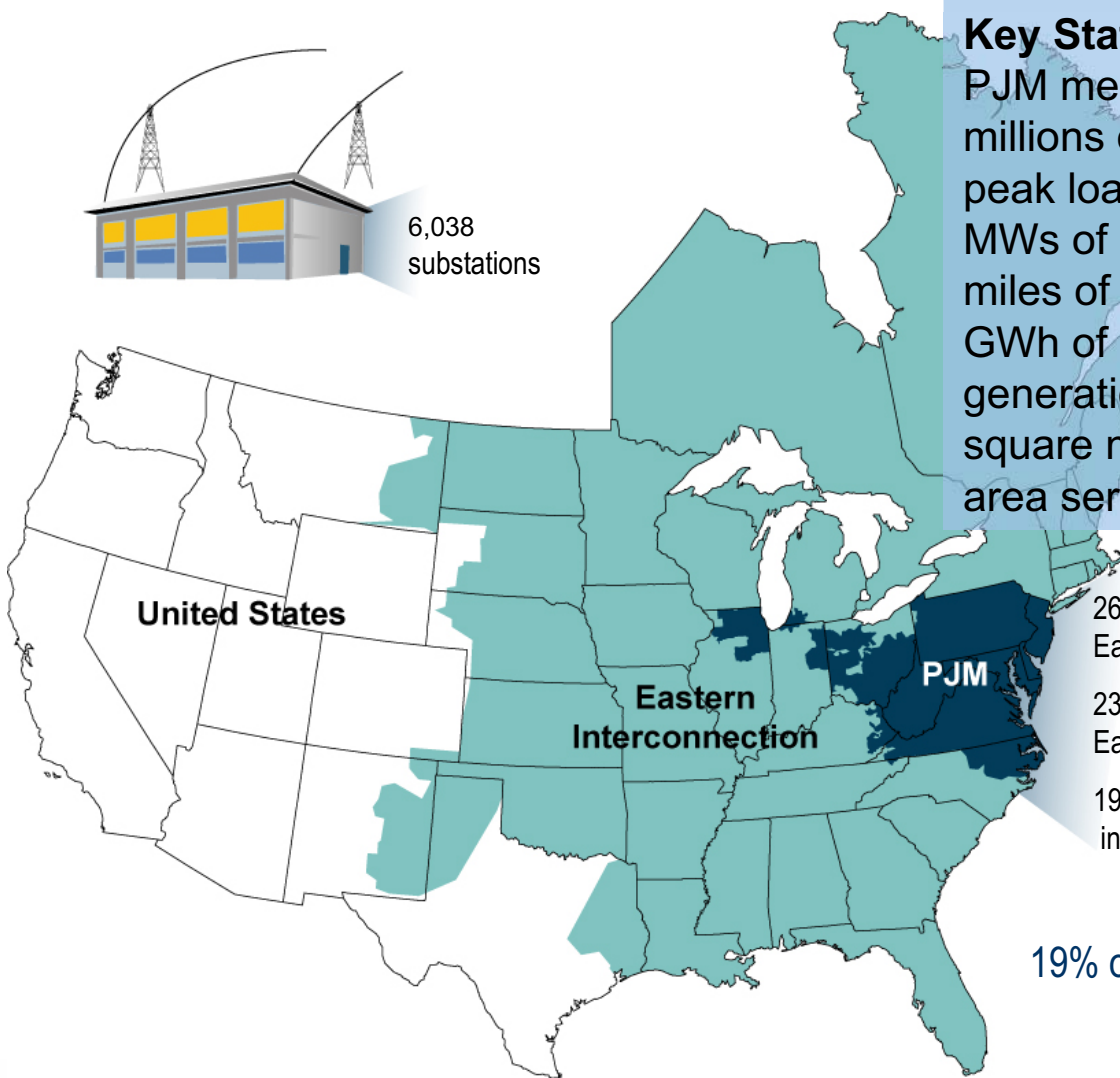


PJM as Part of the US Eastern Interconnection



Key Statistics

PJM member companies	470+
millions of people served	51
peak load in megawatts	144,796
MW of generating capacity	165,303
miles of transmission lines	56,070
GWh of annual energy generation sources	728,000
square miles of territory	164,260
area served	13 states + DC

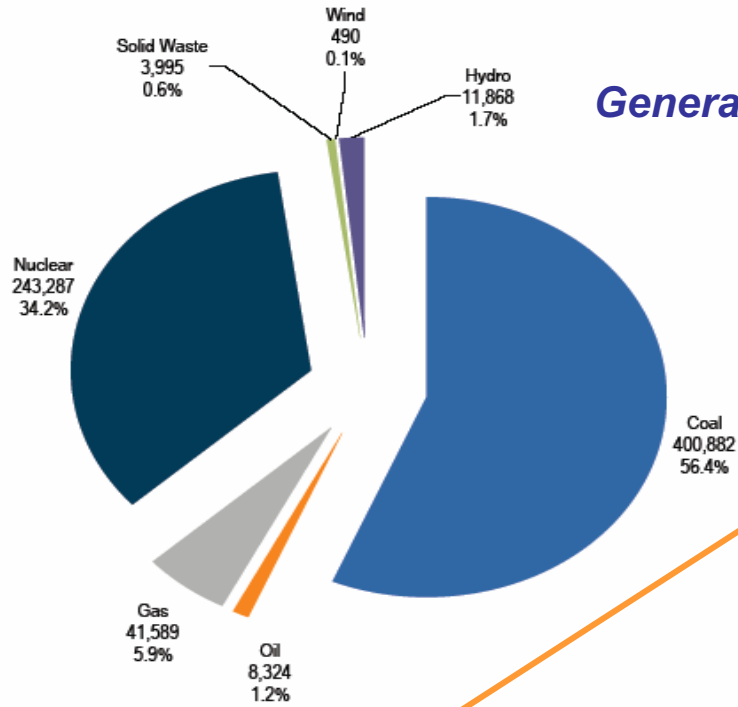


26% of generation in Eastern Interconnection

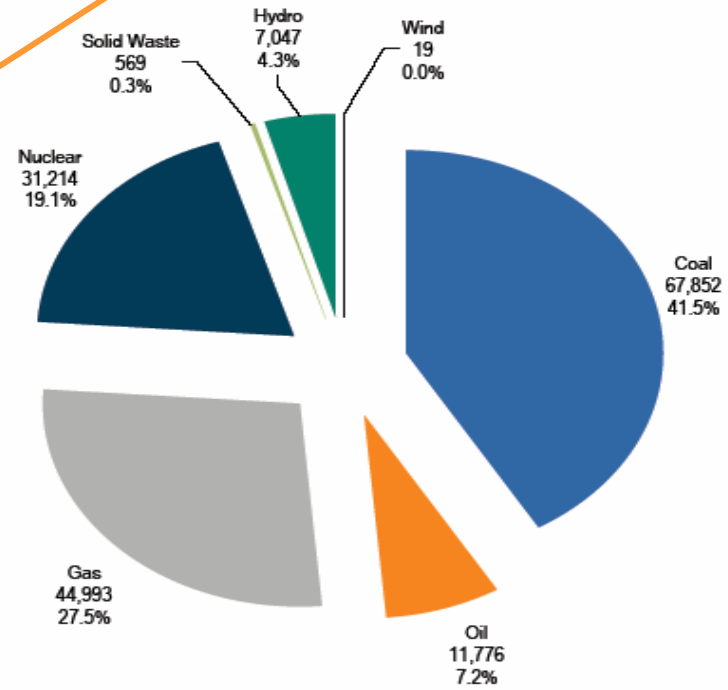
23% of load in Eastern Interconnection

19% of transmission assets in Eastern Interconnection

19% of U.S. GDP produced in PJM



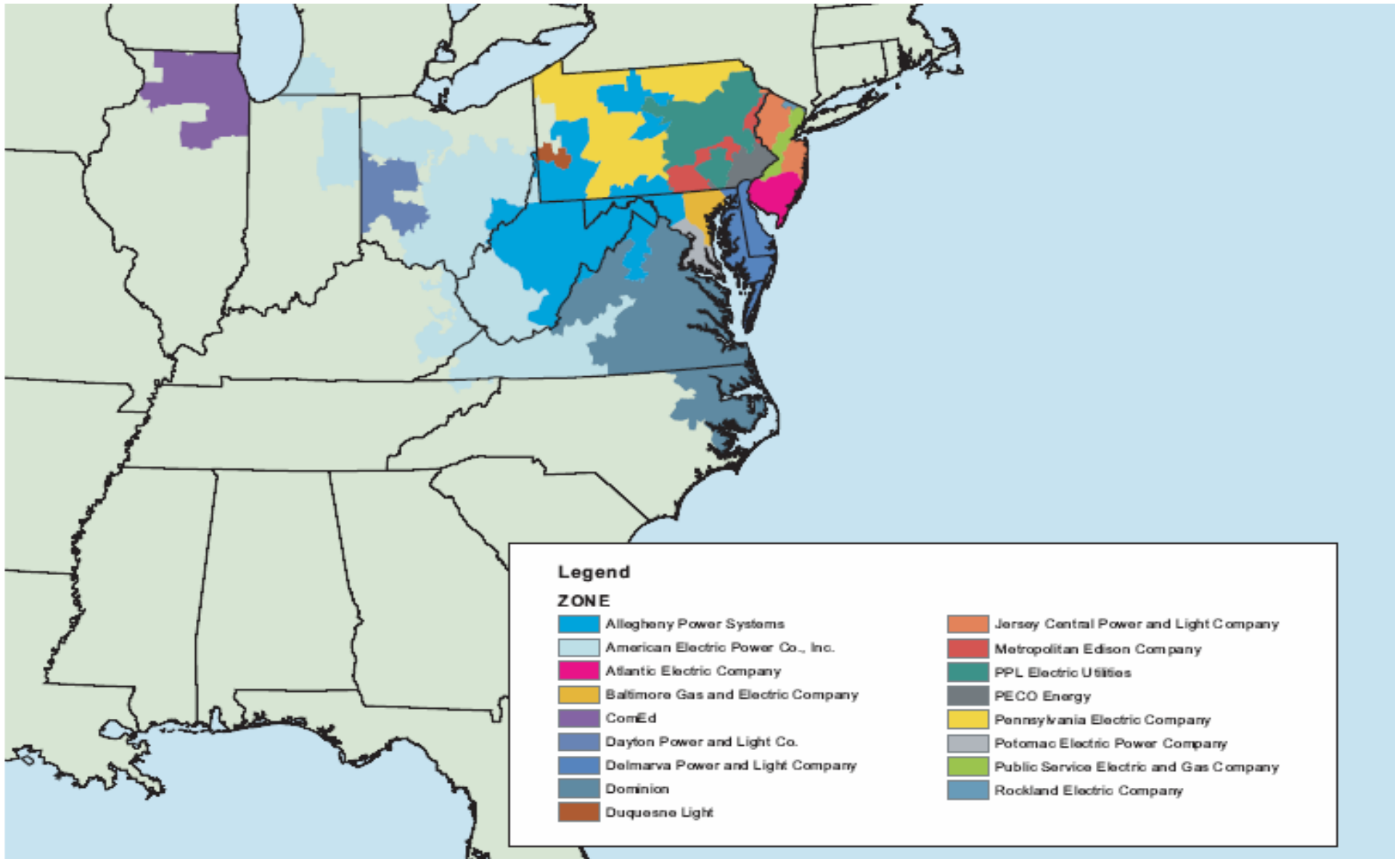
Generation by Fuel Type



Capacity by Fuel Type



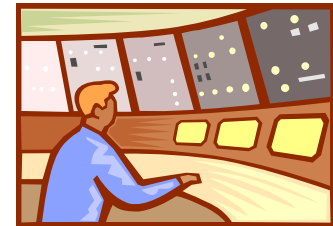
PJM Transmission Owners



- Operate the bulk electric power grid for reliability
- Facilitate various electric markets
- Plan for transmission expansion
- Monitor the markets to ensure competitiveness
- Share best practices with neighboring and international system operators



What is PJM?



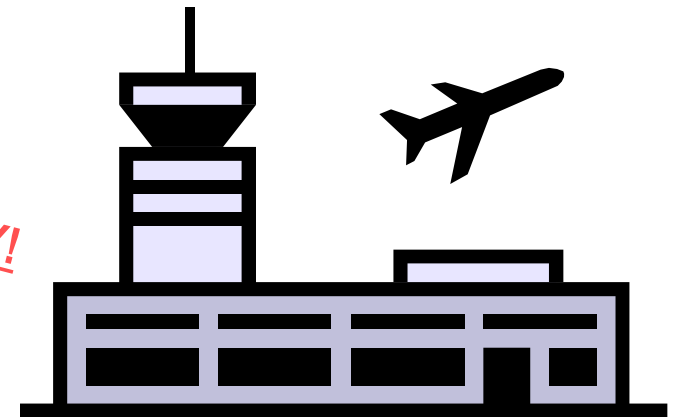
Operators of a Stock Exchange for Energy...

Air Traffic Controllers for the Transmission Grid....



SIMULTANEOUSLY!

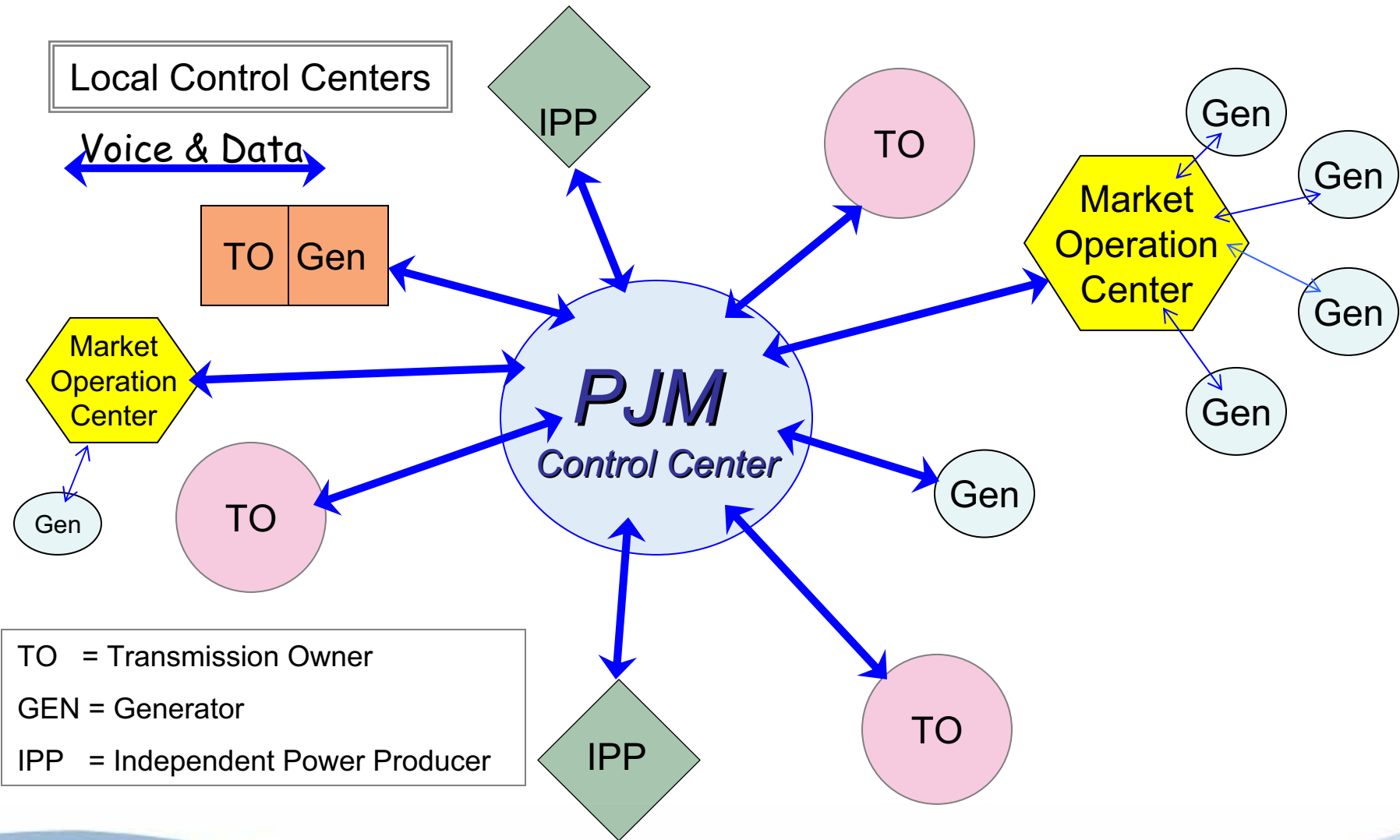
RELIABLY!



Match Generation to Load



Communicating Information Giving Direction





Market Design Details



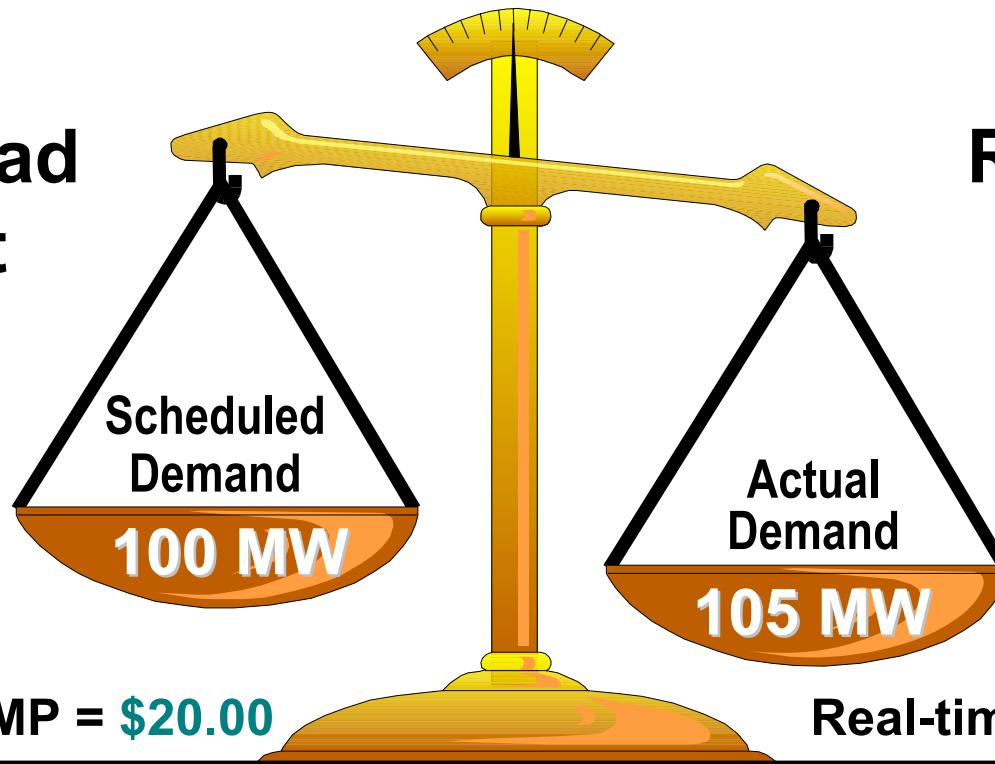
- **Generation Capacity Markets**
 - **Long-Term**
- **Energy Markets**
 - **Forward (i.e. Day-Ahead)**
 - **Real Time**
- **Financial Transmission Rights Market**
- **Ancillary Services Markets**
 - **Regulation**
 - **Spinning Reserve**

- A day-ahead hourly forward market for energy
- It provides the option to 'lock in':
 - scheduled MW quantities at day-ahead prices
 - scheduled energy deliveries at day-ahead congestion prices
- Provides additional price certainty to Market Participants by allowing them to commit to prices in advance of real-time dispatch

- Day-Ahead Energy Market
 - develop day-ahead schedule using least-cost security constrained unit commitment and dispatch
 - calculate hourly LMPs for next operating day using generation offers, demand bids and bilateral transaction schedules
- Real-Time Energy Market
 - calculate hourly LMPs based on actual system operating conditions

Day Ahead Market

Real-time Market



Day Ahead LMP = \$20.00

Real-time LMP = \$23.00

= $100 * 20.00 = \$2000.00$

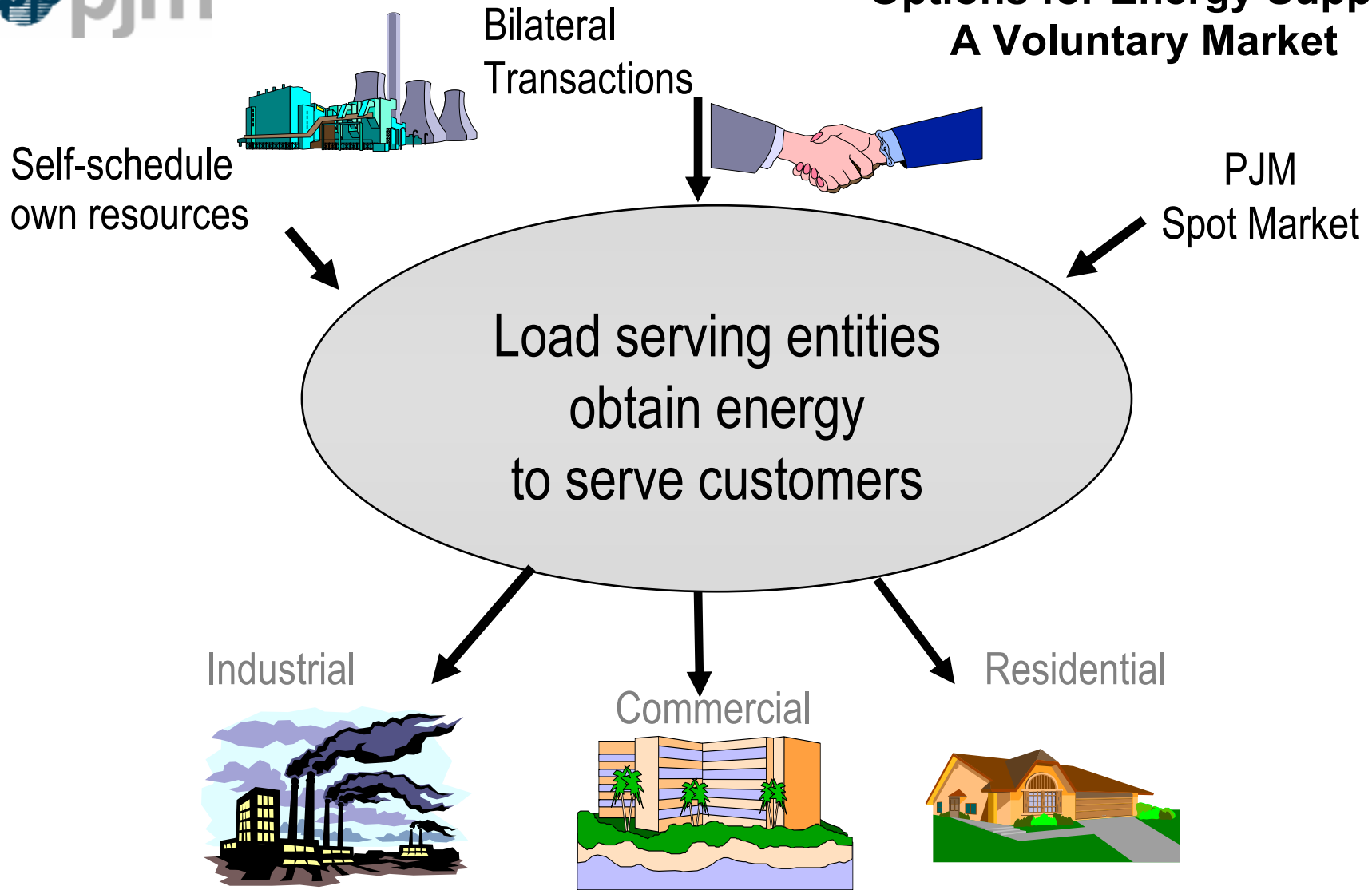
= $(105 - 100) * 23.00 = \$115.00$

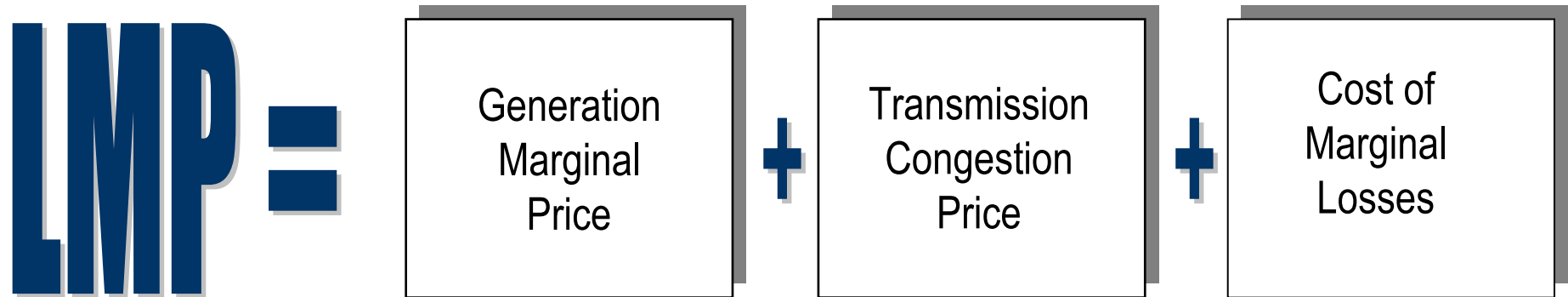
if Day-ahead Demand is 105MW = \$2100.00

as bid = \$2115.00



Options for Energy Supply A Voluntary Market



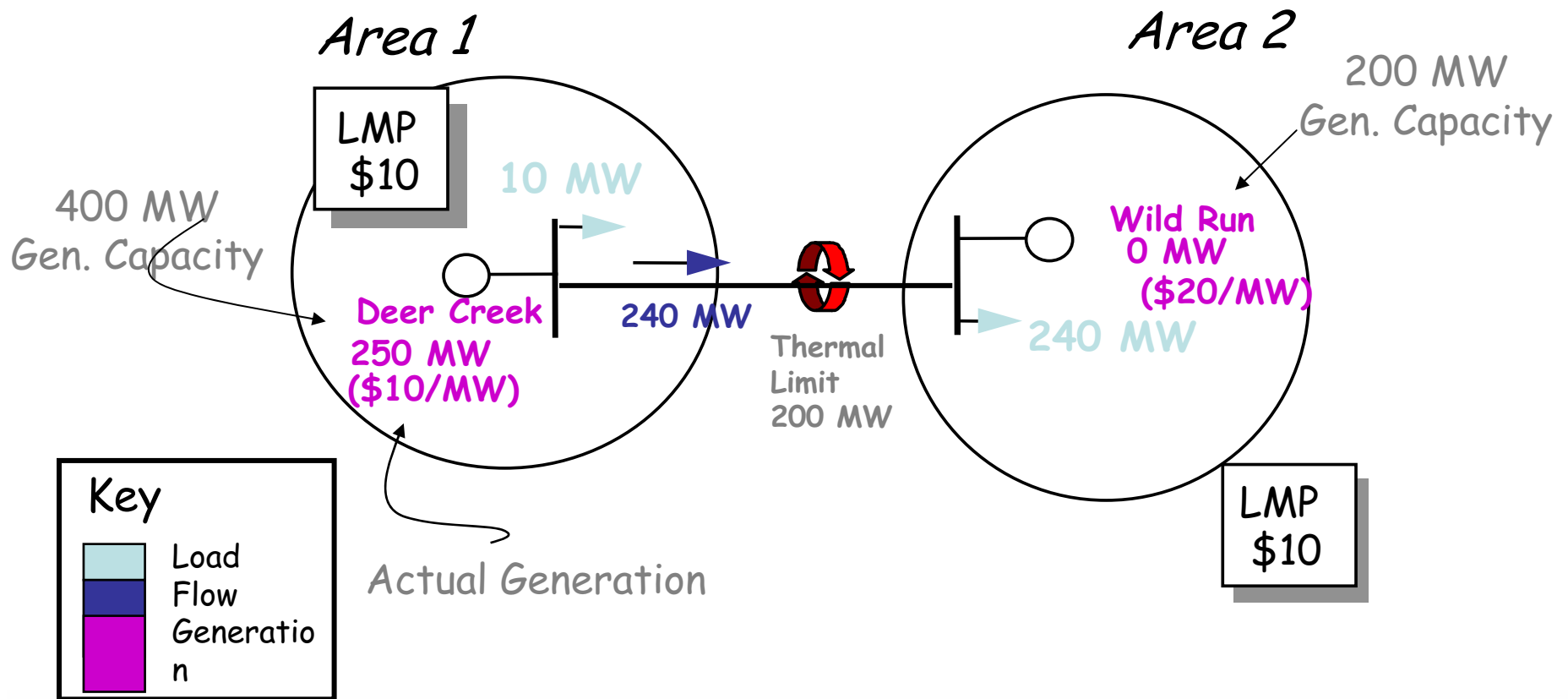
$$\text{LMP} = \text{Generation Marginal Price} + \text{Transmission Congestion Price} + \text{Cost of Marginal Losses}$$
A diagram illustrating the components of Locational Marginal Price (LMP). On the left, the letters "LMP" are written in a large, bold, blue font. To its right is an equals sign, followed by three white rectangular boxes with black borders, each containing a component of the LMP. The first box contains "Generation Marginal Price", the second contains "Transmission Congestion Price", and the third contains "Cost of Marginal Losses". Blue plus signs are placed between the boxes to indicate addition.

Price to serve the next MW of load at a specific location, using the lowest production cost of all available generation, while observing all transmission limits

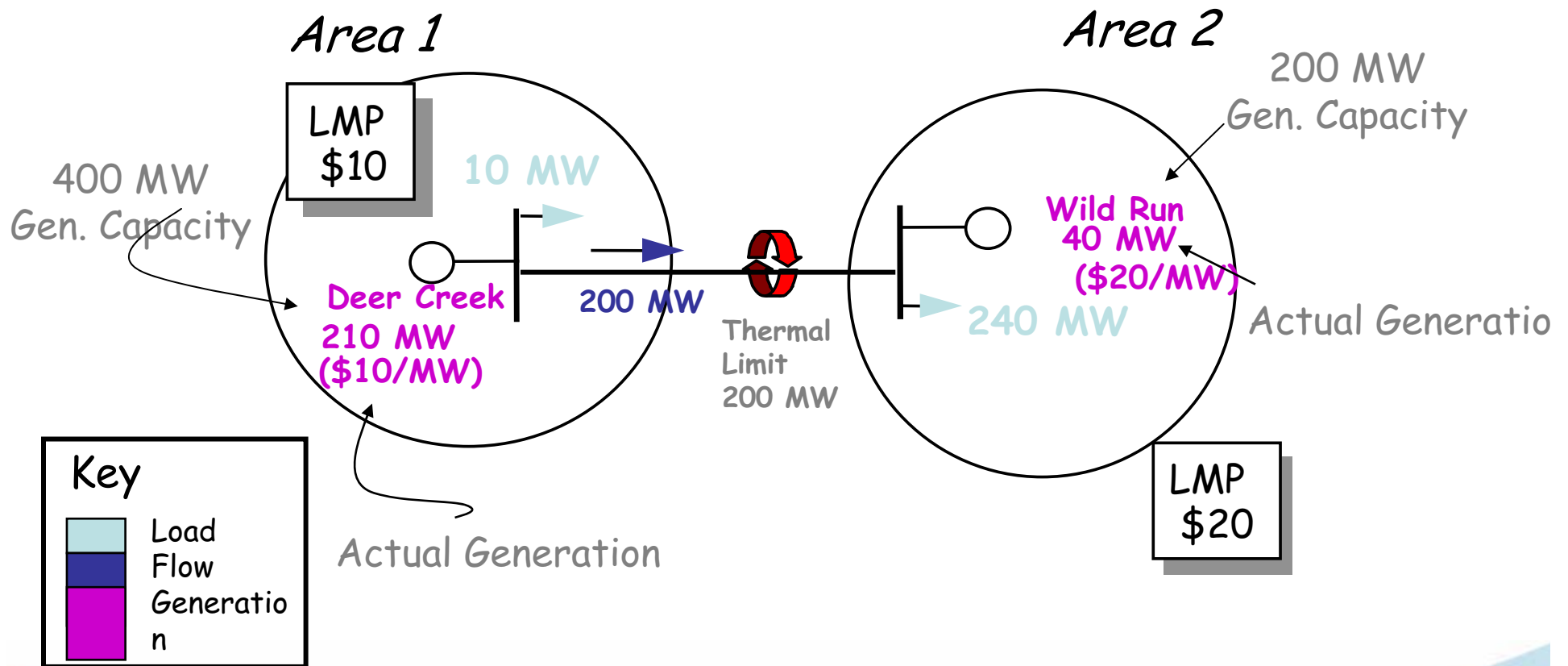
- Local Marginal Pricing (LMP) provides the real-time pricing signals which indicate where to build new generation or transmission
- Reliability Pricing Model (RPM) provides long term \$ incentives to build new generating capacity in congested areas, along with a benchmark for bilateral contracts

- The following examples demonstrate how LMP values are determined at all locations
- The LMP values are a result of security-constrained economic dispatch actions
- LMP values are calculated based on generation offer data and the power flow characteristics of the Transmission system.

Economic Dispatch Ignoring Transmission Limitation



Security-Constrained Economic Dispatch



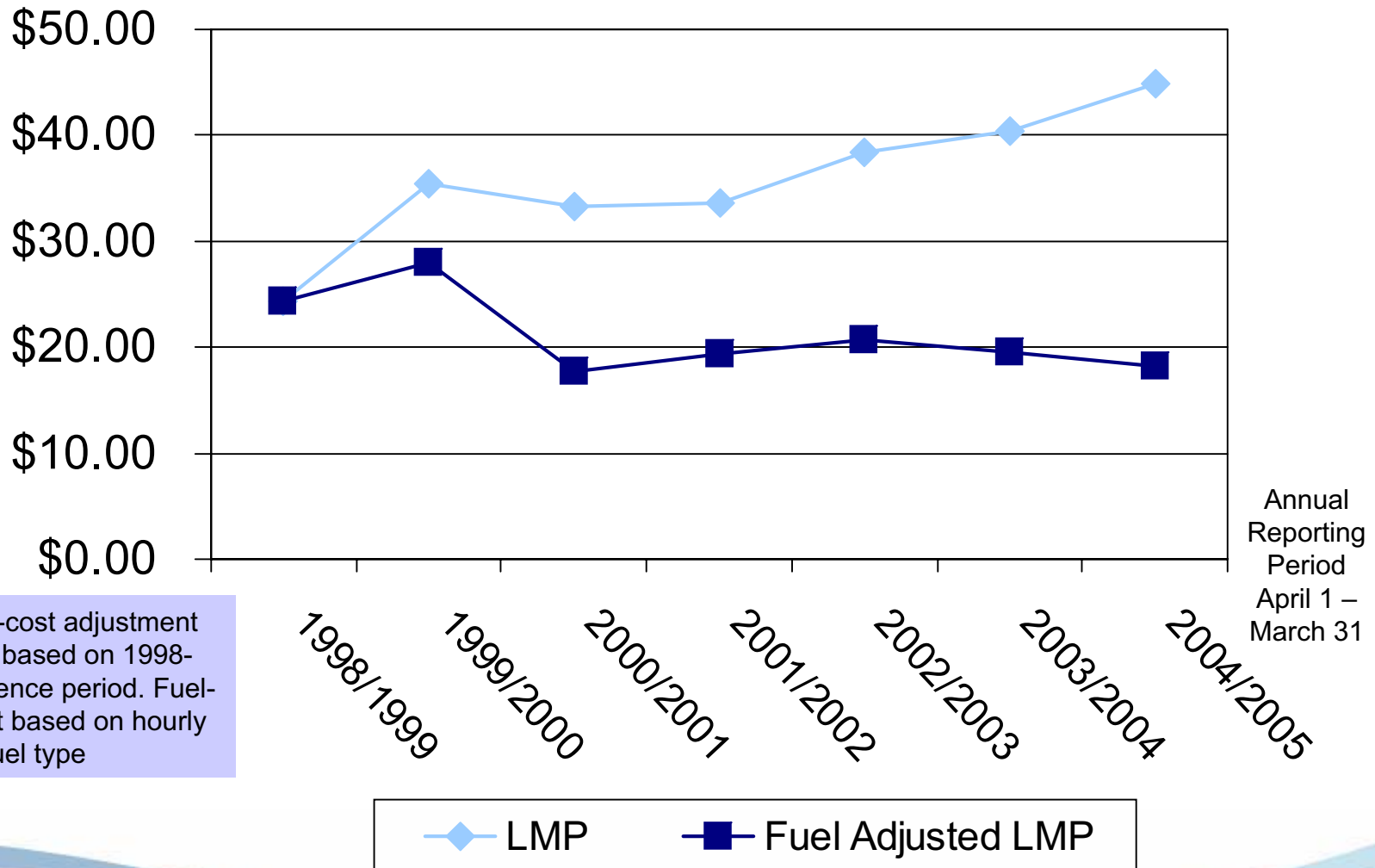


Customer	MW	LMP	Energy ¹ Settlement	Congestion Credit
Area 1 Demand	10	\$10	\$100	-
Area 2 Demand	240	\$20	\$4800	\$2000 ²
Deer Creek	210	\$10	(\$2100)	-
Wild Run	40	\$20	(\$800)	-
Totals	0		\$2000	\$2000

1. Positive indicates charge, negative indicates credit
2. Congestion Credit is due to ownership of 200 MW Financial Transmission Right from Area 1 to Area 2, FTR Settlement = 200 MW (\$20 - \$10)

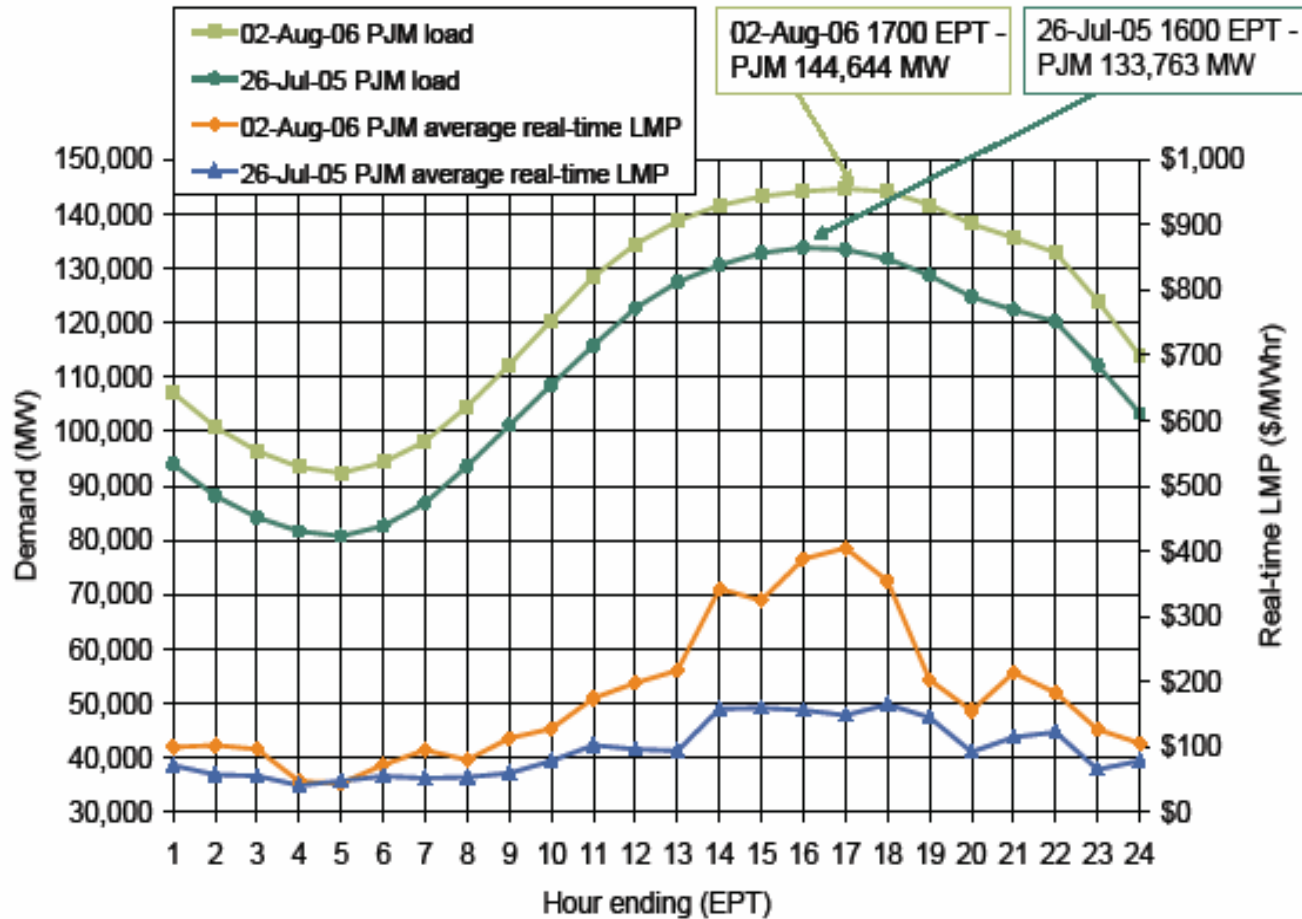


PJM Market Results 1998-2005 Comparison of Load Weighted Energy Prices to Fuel-cost Adjusted Load Weighted Energy Prices

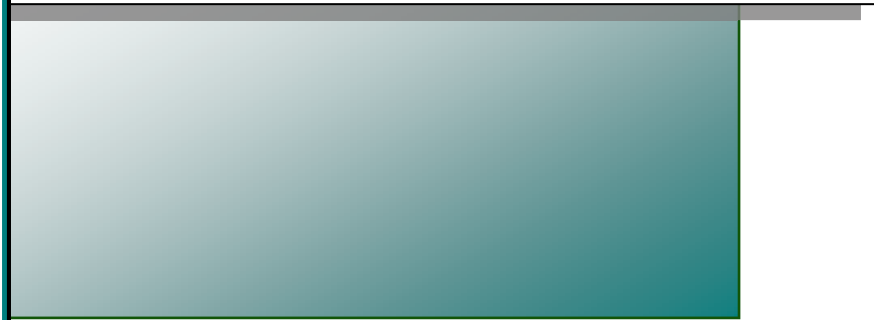
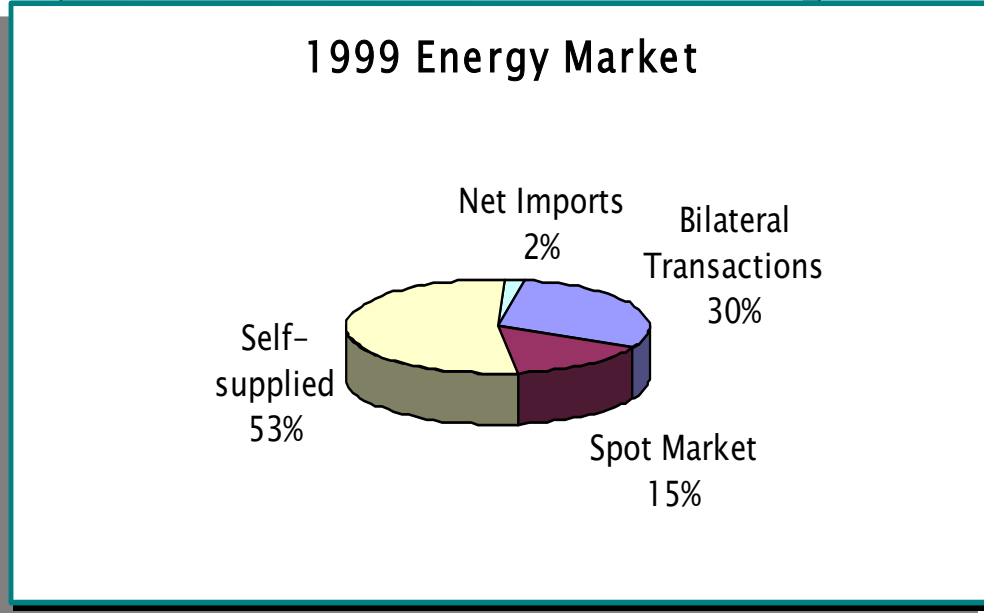
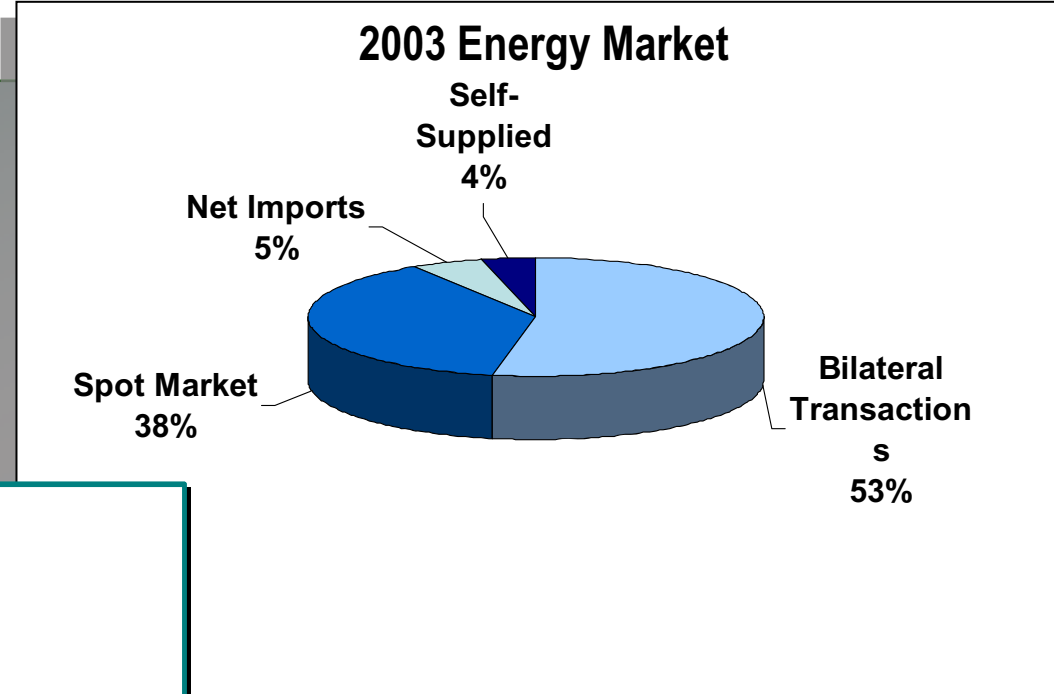




Peak Load Comparison



Competitive Market = More Customer Alternatives





Governance



- The Members have the following limited roles and authorities:
 - Elect the PJM Board (9)
 - Provide advice and recommendations to the PJM Board
 - Amend the Operating Agreement subject to FERC approval

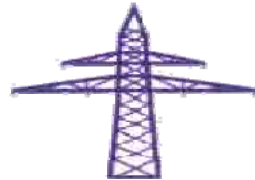


PJM Independent Board

Members Committee Sector Voting



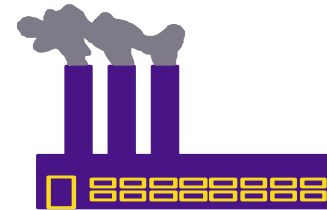
Generation Owners



Transmission Owners



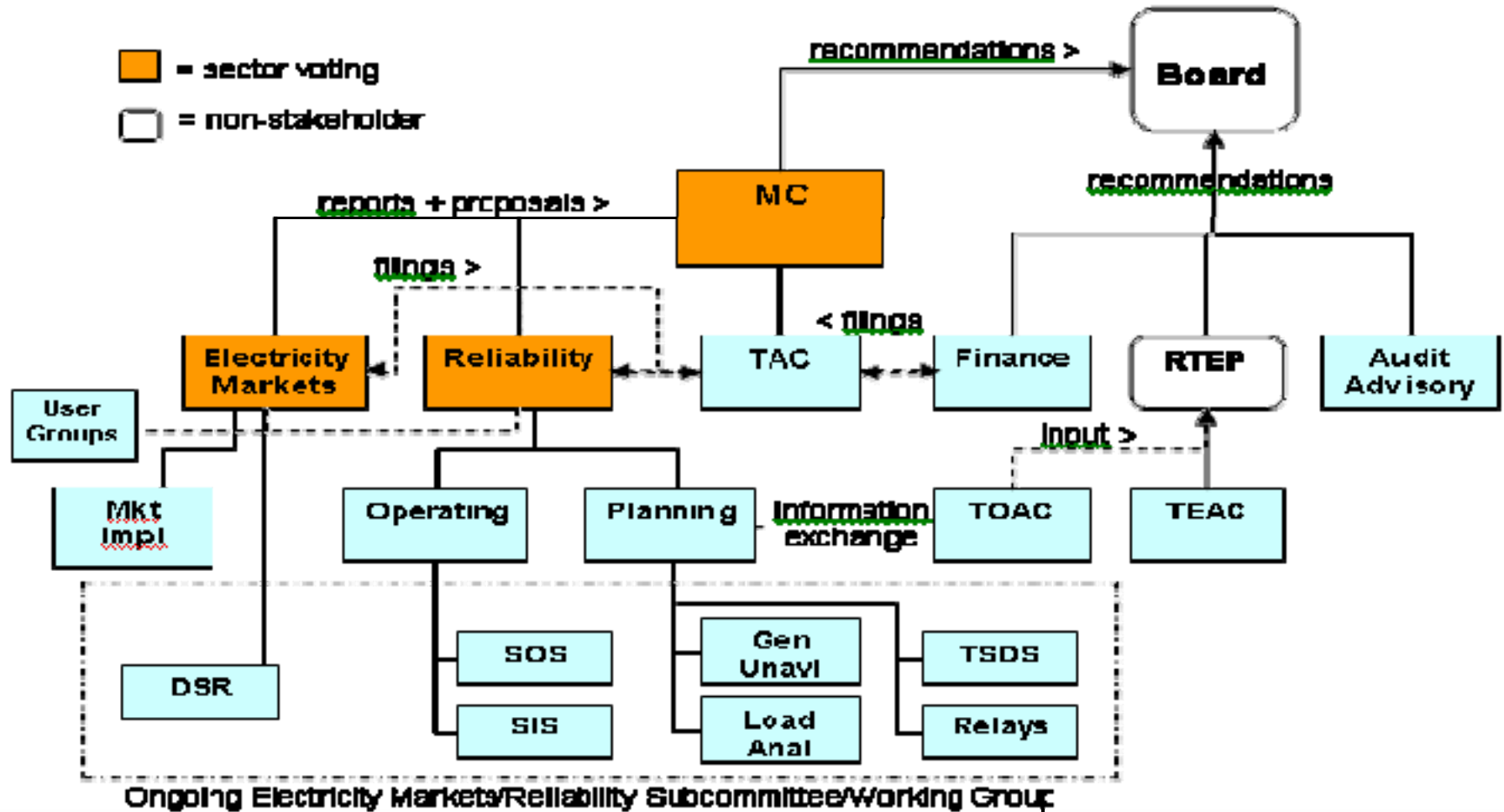
Other Suppliers



End-Use Customers

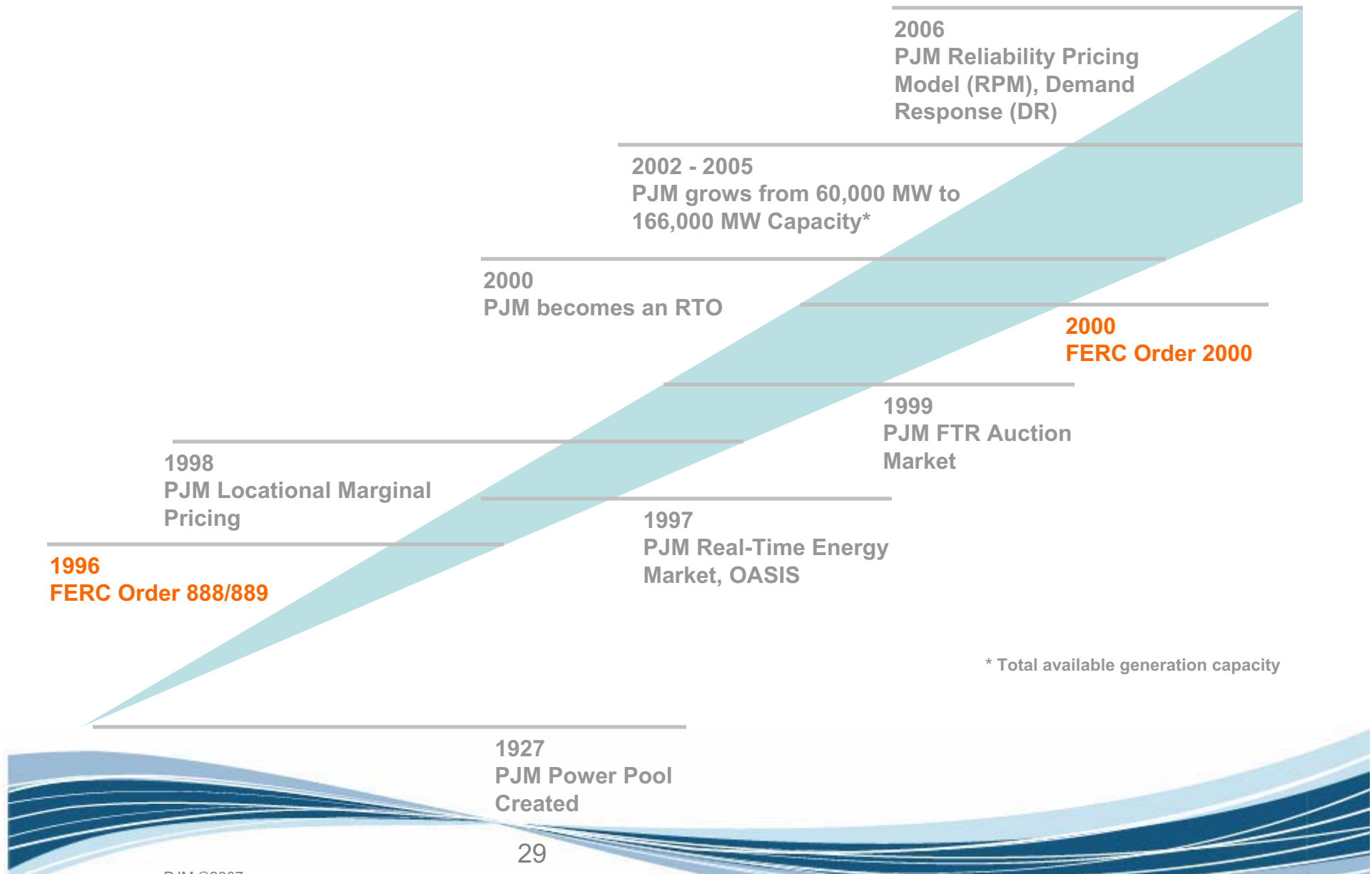


Electric Distributors





US Deregulation – Key Milestones





Deregulation vs. Regulation

Regulating agencies:

- Federal Energy Regulatory Commission (FERC)
 - State Public Utility Commissions (PUC)
 - Transmission Citing approved at the State level, can be overridden by FERC for DOE designated transmission corridors
-

Before Competition the Regulatory System:

- Guaranteed return on assets, once approved and costs built in the rate
- Ultimately, rate payer (the customer) bears the risk
- No incentive to operate assets efficiently



Questions?

PJM Web site: www.pjm.com
or contact: gdowikjw@pjm.com

