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### PJM's Vision:

To be the electric industry leader - today and tomorrow - in reliable operations and efficient wholesale markets.

### PJM's Mission:

• As the primary task, to ensure the safety, reliability and security of the bulk electric power system.

 Create and operate robust, competitive and non-discriminatory electric power market

• Understand customer needs and deliver valued service to meet those needs in a cost-efficient manner.

• Achieve productivity through the efficient union of superior knowledge workers and technology advances.

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# PJM'S Service Territory



## **Backbone Transmission System**



### **PJM Mid Atlantic**

### PJM RTO

Generating Units Generation Capacity Peak Load Transmission Miles Area (Square Miles)

Members Population Served

Area Served

**PJM South** 

1,083 160,450 MW 126,120 MW 56,020 164,250

350 + 51 Million

13 States and DC

**PJM West** 

### What is PJM?









Air Traffic Controllers for the Transmission Grid....



Energy...



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Match Generation to Load





# The Energy Balance



## Communication of Information Giving Direction



### **Continental Overview**



Prepared by the PJM Interconnection, L.L.C.

Last Revision 000214



PJM Independent Board

**Members Committee Sector Voting** 



Members Committee - Role & Authority

# •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 Committee Structure



### **MEMBERS COMMITTEE VOTING PROTOCOL**

Generation Owners	5/7	0.71
Transmission Owners	2/8	0.25
Other Supplier	21/23	0.91
End Use Customers	5/5	1.00
Electric Distributors	3/5	0.60
Required to pass = 0.667 Number of Sectors = 5		3.47
Required Affirmative = 5 x 0.667 = 3.335		

### PJM Authority Provided by Contract



- Regional Transmission Provider
- Regional Control Area Operator
- Market Developer and Coordinator
- Regional Transmission Planner

• NERC Security Coordinator



# PJM Markets

- Real time energy market *cost basis* (April 1, 1997)
- Real time <u>competitive</u> energy market (April 1, 1998)
- Capacity credit markets (January, 1999)
- FTR auction market (June 1, 1999)
- Regulation market (June 1, 2000)
- Day ahead energy market (June 1, 2000)
- Spinning Reserve Market (December 1, 2002)

### Evolution of PJM's Competitive Markets



# Locational Marginal Pricing

# What is LMP?

- Pricing method PJM uses to ...
  - price energy purchases and sales in PJM
     Market
  - prices transmission congestion costs to move energy within PJM Control Area
- Physical, flow-based pricing system
  - how energy actually flows, <u>NOT</u> contract paths

## **Definition:** Locational Marginal Pricing

Cost of supplying next MW of load at a specific location, considering generation marginal cost, cost of transmission congestion, and losses.



### **Cost of Marginal Losses = Not currently implemented**

## Factors That Affect LMP

- Energy Demand
- Economic Dispatch
- Available Flexible Generating Units
- Network Topology
- Binding Transmission Limits

# LMP Characteristics

- Single Market Clearing Price when system is unconstrained
- Under constrained conditions, the marginal cost of energy varies by location as low cost supply cannot reach all demand
- LMPs reflect increased cost to deliver energy when insufficient transmission exists
- Under constrained conditions, LMPs can be quite different from the economic dispatch rates due to costs to delivery energy from marginal generating units to load buses

## Real Time Market Incentives

- PJM market supports reliability because <u>generation is incented</u> <u>to follow real-time dispatch instructions</u>:
  - If generation is following real-time dispatch instructions then it is <u>eligible to set LMP</u>, otherwise it become a price taker.
  - If generation is scheduled by PJM and is following real-time dispatch instructions then it receives a <u>revenue guarantee</u> of at least its specified offer data, otherwise there is not revenue guarantee.
- As a result of the incentives, no penalties need to be imposed for over or under generation

### Liquidity at U.S. Hubs

#### Liquidity at U.S. Hubs

January 2004

■1Q 2003 ■2Q 2003

■ 3Q 2003





## State of the Market Report



# Financial Transmission Rights

# What are FTRs

## Financial Transmission Rights are ...

financial instruments awarded to bidders in the FTR Auctions that entitle the holder to a stream of revenues (or charges) based on the hourly Day Ahead energy price differences across the path



# What are ARRs?

## Auction Revenue Rights ...

are entitlements allocated annually to Firm Transmission Service Customers that entitle the holder to receive an allocation of the revenues from the Annual FTR Auction





# Why do We Need FTRs

- Challenge:
  - LMP exposes PJM Market Participants to price uncertainty for congestion cost charges
  - During constrained conditions, PJM Market collects more from loads than it pays generators
- Solution:
  - Provides ability to have price certainty
  - FTRs provide hedging mechanism that can be traded separately from transmission
     <sup>©200</sup> service

# <u>Characteristics of FTRs</u>

- ✓ Economic value based on Day Ahead LMPs
- Defined from source to sink
- can be in form of obligation or option
  - ✓ obligation can be benefit or liability
  - ✓ option can be benefit but never liability
- ✓ Financial entitlement, not physical right
- Independent of energy delivery
- ✓ Must be simultaneously feasible

# How are FTRs acquired?

FTRs are acquired in the following market mechanisms ...

- 1. Annual FTR Auction
  - entire system capability
- 2. Monthly FTR Auctions
  - purchase "left over" capability
- 3. FTR Secondary Market
  - bilateral trading
- 4. Transitional FTR Allocation



## Energy Delivery Consistent with FTR



Congestion Charge = 100 MWh \* (\$30-\$15) = \$1500

FTR Credit = 100 MW \* (\$30-\$15) = \$1500

## Energy Delivery Not Consistent with FTR



FTR Credit = 100 MW \* (\$30-\$10) = \$2000

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# <u>Bidding Process</u> <u>Overview</u>

### PJM Market Timeline



### **Resources Requested as Load Increases**

Typical Summer Peak



### PJM System Operator Sends \$ Signal



### **PJM Member Options in Time for Energy Supply**



### Real Markets - 2002 Energy Market



# TWO - PASS SETTLEMENT

What is Two-Settlement?



It provides PJM Market Participants with the option to participate in a forward market for electric energy in PJM

- -Consists of two markets
- Separate settlements performed for each market

## Two-Settlement Markets

- Day-ahead Market
  - develop day-ahead schedule using leastcost security constrained unit commitment and security constrained economic dispatch programs
  - 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 operating conditions

## Two Settlements



- Day-ahead Market Settlement
  - based on scheduled hourly quantities and day-ahead hourly prices
- Real-time Market Settlement
  - based on actual hourly quantity deviations from day-ahead schedule hourly quantities and on real-time prices

## PJM Market With Two Settlement ...

- Provides Market Participants with the option to 'lock in' day-ahead scheduled quantities at day-ahead prices
- Provides a means for participants to obtain increased price certainty









# **Regional Planning Process**

# Integration of Market Solutions

- Market will provide solutions that must be integrated into the Regional Transmission Expansion Plan
  - Generation Solutions
    - Strategically Sited Generation Projects
    - Distributed Resources
  - Load Solutions
    - Active Load Management/Demand-Side Resources
    - Distributed Resources
  - Transmission Solutions
    - Advanced Technology Options
    - Merchant Transmission
  - Traditional expansion/enhancement alternatives will also be identified through the Plan.

<u>Regional Planning Process Objectives</u>

- Allow for Open Process with Input from All Interested Parties
- Coordinate Expansion Plans Across Multiple Transmission Owner Systems
- Coordinate Expansion Plans Based on All Needs Identified Through Regional Planning Process
- Identify Most Effective and Efficient Expansion Plan for the Region

## PJM Cost Allocation Methodology

- Transmission Baseline Analysis
  - Transmission Owner Cost Responsibility Determined
- Developer Attachment Facility Requirements
  - Facilities Required for Direct Connection
  - Costs Allocated to Developer
- Developer Network Upgrade Requirements
  - Network Facilities Required to Accommodate Project
  - Costs Allocated On A "But For" Basis
  - Cost Allocation Among Multiple Developers If They Collectively Cause the Need For A Network Upgrade



### Planned units begin to come online



# Value of Regional Planning Process

### **Transmission Upgrades**

\$214 M transmission constructed by 2003
Approx. \$700 M in the transmission plan

<u>New Generation</u> Almost 10,000 MW in service Over 3,500 MW in construction



Summary: PJM Regional Planning Process

- Planning process contains a variety of planning assessments
- Planning process incorporates market solutions including transmission, generation and load options
- Planning process reflects broad stakeholder input
- Planning process integrates each of these drivers and looks for regional solutions whenever feasible and cost effective

# Market Settlements

# Billing Cycle



<u>Net</u> Billing Statements for previous month issued on 5th business day

Financial Settlements via electronic funds transfer (EFT) on first business day after the 19th

Overdue Balances accrue interest charges

Detailed Billing Reports (including monthly statement) provided electronically via PJM eSchedules system

# Guide to PJM Billing



### If You Have Questions

### **Customer Information**

Phone: (610) 666-8980 (8am – 5:45pm E.P.T.) or (866) 400-8980

Fax: (610) 666-4379

Internet: <u>http://www.pjm.com/about/contact/form-contact.html</u>

Subscribe to PJM e-mail lists: http://www.pjm.com/about/contact/form-majordomo.html

Off hours contact : (610) 666-8886