# PJM TRANSMISSION PLANNING AND MARKET MONITORING OVERVIEW

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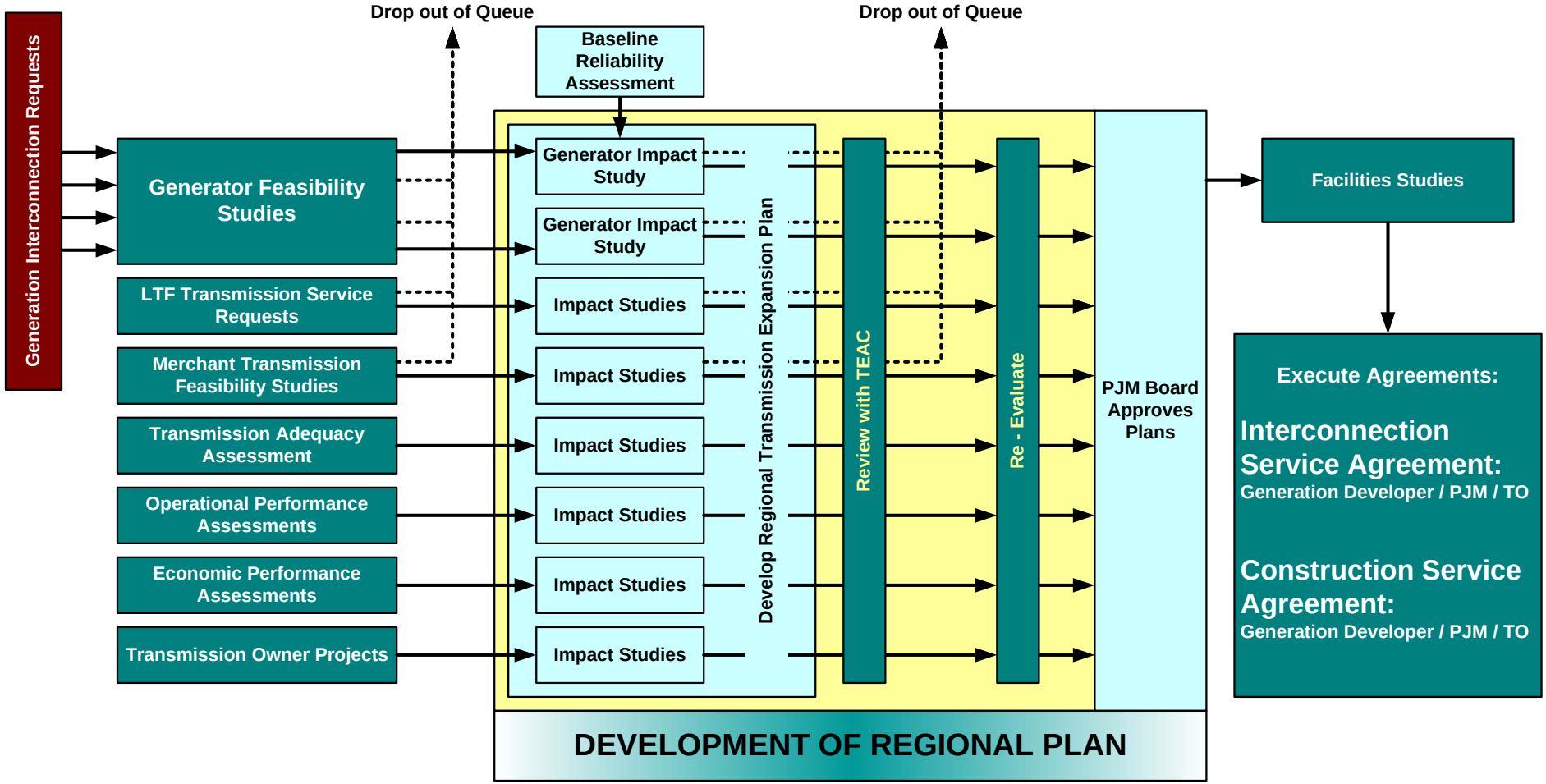
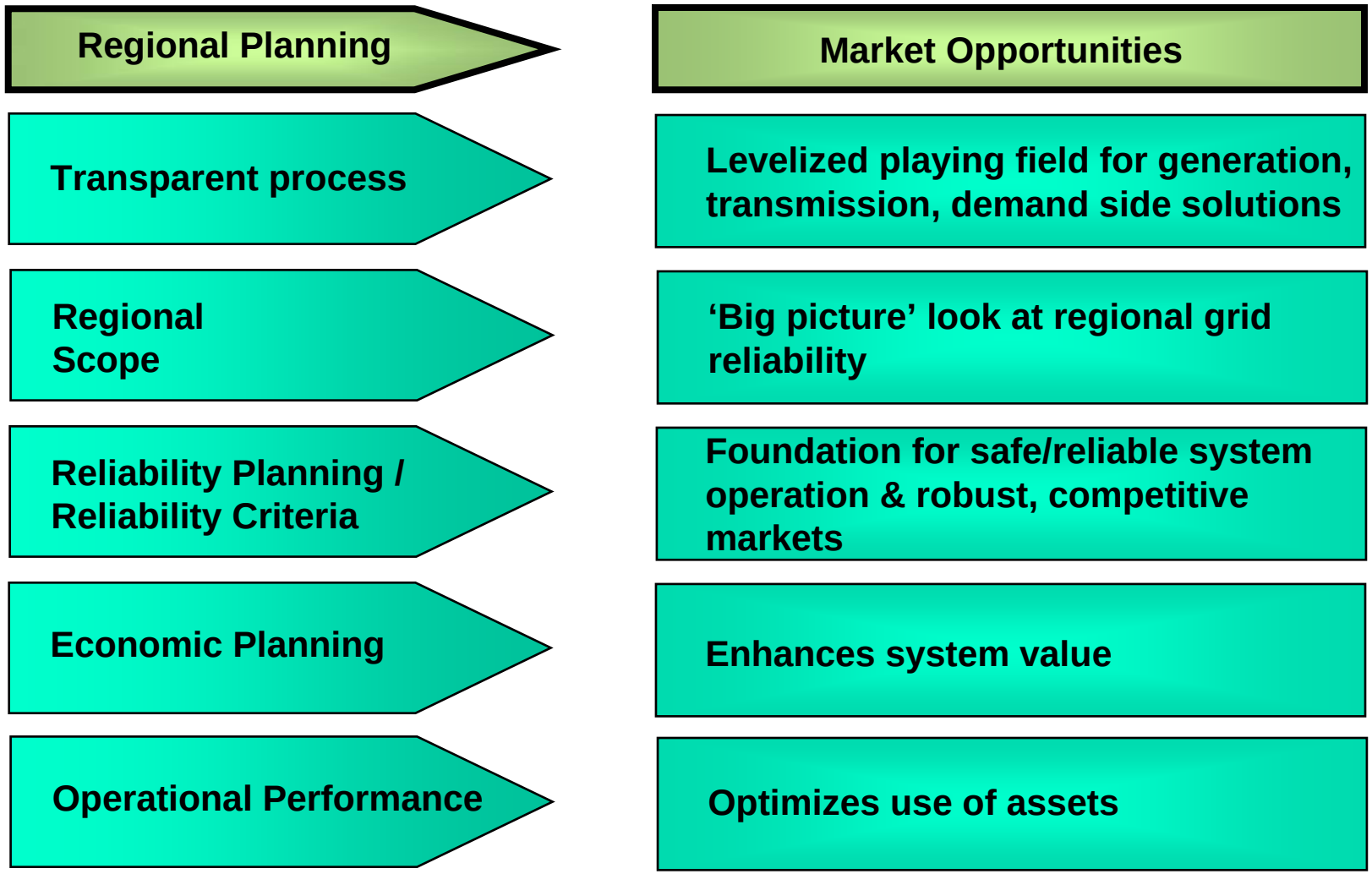
# PJM TRANSMISSION PLANNING PROCESS

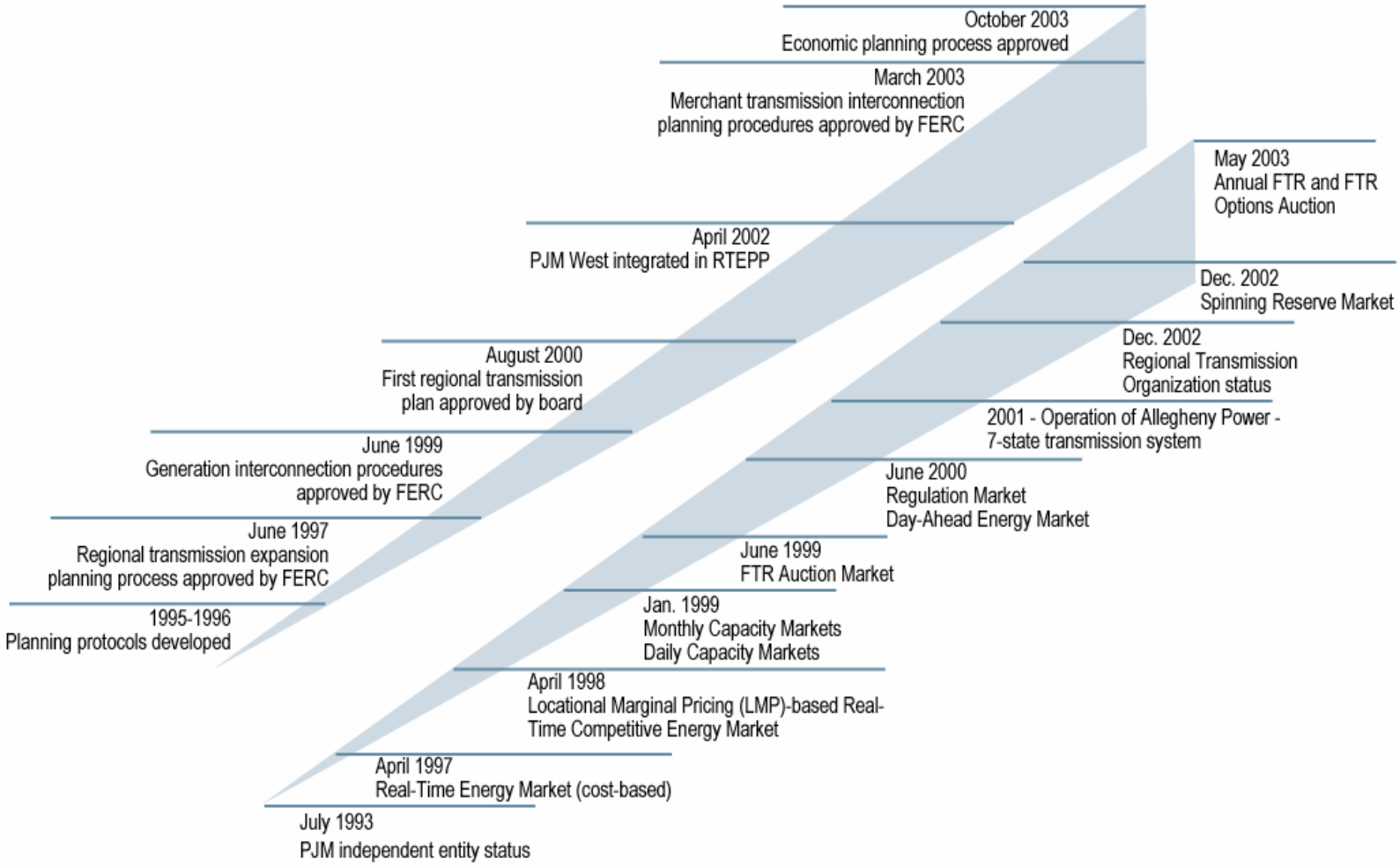
# PJM Regional Planning Process



# Integrating Reliability and Market Opportunities



# Evolution of the Planning Process



# Regional Transmission Expansion Planning Process

- RTEPP is a fully integrated process including:
  - On-going Adequacy and Reliability Assessments
  - Impact Studies related to generator interconnection requests
  - Impact Studies related to firm transmission service requests
  - Impact Studies related to new/advanced technologies
  - Understanding operational and congestion impacts
- Meetings with Transmission Expansion Advisory Committee to review study results and scope, procedure, and assumptions for upcoming studies
- Expansion recommendations provided to PJM Board for approval

# Regional Planning Process Objectives

- Planning Process Must Accommodate a Wide Range of Drivers
- Planning Process Must Evaluate Alternative Solutions Including Transmission, Generation and Load Options
- Development of Expansion Plans Must Reflect Broad Stakeholder Input to Process
- Expansion Plans Must Incorporate the Impacts of Operating Concerns and Congestion

# Solution Type Groupings

- Centrally Planned Solutions
  - Baseline Transmission Upgrades (Reliability)
  - Economically-Based Transmission Upgrades

- Market Solutions
  - Strategically Sited Generation Projects
  - Merchant Transmission
  - Active Load Management/Demand Response Resources
  - Distributed Resources

# Solution Alternatives

- Generation Solutions
  - Strategically Sited Generation Projects
  - Distributed Resources
- Load Solutions
  - Active Load Management
  - Distributed Resources
- Transmission Solutions
  - Traditional Expansion/Enhancement Alternatives
  - Advanced Technology Options

- These competitive solutions must be integrated through the Regional Planning Process to provide a reliable transmission system and to promote the long-term development of markets.

# WHAT IS MERCHANT TRANSMISSION?

- Traditionally, transmission has been built by utilities and included in rates.

- Merchant transmission is transmission that is built using non-rate base funds. These facilities can be transmission lines, transformers, or other transmission devices.

# Why is Merchant Transmission Being Developed in PJM?

- Markets provide the proper economic signals to incent investment in transmission.
- The business rules for interconnecting merchant transmission were developed through a stakeholder process and approved by FERC in March, 2003.
- PJM posts transmission information useful to the development of merchant transmission projects.

# Economic Planning Process Objective

- The economic planning process seeks to provide cost-effective transmission solutions to alleviate congestion on the Transmission System which cannot be effectively hedged, and that no market participant or other entity otherwise has proposed to resolve.
- FERC approved process in October of 2003
- Commenced retroactively with the regional planning cycle which began on August 1, 2003

# Economic Planning Process – Gross Congestion Costs

- PJM posts the hourly shadow price, along with the hourly and cumulative monthly total gross congestion cost of each constraint.
- When the cumulative monthly total gross congestion cost of a constraint exceeds the applicable Initial Threshold, PJM posts a notice to that effect and begins determining the extent to which the total affected load cannot be hedged

# Initial Threshold Values

| Operating Voltage Of Constrained Facility | Initial Threshold (gross congestion $) |
|---|---|
| greater than 345 kV | $2,000,000/month |
| 100 kV, up to and including 345 kV | $ 250,000/month |
| less than 100 kV | $ 100,000/month |

# Economic Planning Process – Unhedgeable Congestion Costs

- PJM posts the hourly and cumulative monthly unhedgeable congestion associated with each constraint for which it undertakes such calculations, as well as the portions of unhedgeable congestion that it attributes to recurring and non-recurring causes of transmission constraints.
- When the cumulative monthly unhedgeable congestion associated with a constraint exceeds the applicable Market Threshold, PJM posts a notice advising that it will commence an initial cost benefit analysis of potential transmission enhancements that would relieve the applicable transmission constraint and opens a one year “Market Window” to solicit merchant solutions

# Market Threshold Values

| Operating Voltage Of Constrained Facility | Market Threshold (gross congestion $) |
|---|---|
| greater than 345 kV | $100,000/month |
| 100 kV, up to and including 345 kV | $ 50,000/month |
| less than 100 kV | $ 25,000/month |

# What if No Market-Based Solution is Offered?

- In the event that no market-based solution is proposed within one year from the date of publication of the results of the initial cost-benefit analysis , PJM will propose to include in the Regional Transmission Expansion Plan the transmission enhancement that is the most cost-effective, feasible transmission solution

# What if a Market Solution is Withdrawn?

- In the event that the market solution is subsequently terminated or withdrawn, or that the project's designation as a market solution under the PJM Tariff otherwise is terminated or revoked, PJM shall promptly determine whether to include in the Regional Transmission Expansion Plan a cost-effective transmission enhancement to resolve the unhedgeable congestion

# Incorporation of Economic Enhancements into the RTEP

- Prior to recommending such an enhancement to the PJM Board, PJM convenes a meeting open to all interested stakeholders, to review and discuss:
  - Its cost-benefit analysis
  - The economic transmission enhancement that PJM proposes to recommend to include in the regional plan
  - The proposed allocations of responsibility to construct and pay the costs of such enhancement
- After making refinements based on stakeholder input, the recommended economic transmission enhancement is presented to the PJM Board for approval as part of the Regional Transmission Expansion Plan

# Approval of the Regional Transmission Expansion Plan

- PJM publishes the current, approved Regional Transmission Expansion Plan on the PJM Internet site
- Within 30 days PJM files with FERC a report identifying the economic enhancement, its estimated cost, responsibility for constructing the project, and the market participants designated to bear responsibility for the costs of the project.
- Following PJM Board approval, the final Regional Transmission Expansion Plan is submitted to the applicable Reliability Council for verification that all enhancements conform with or exceed all reliability principles and standards of the applicable Regional Reliability Council.

# Construction and Cost Reimbursement

- Subject to the requirements of applicable law, government regulations and approvals, including, requirements to obtain any necessary state or local siting, construction and operating permits, Transmission Owners designated shall construct, or enter into appropriate contracts to fulfill such obligations.

- PJM collects on behalf of the Transmission Owner(s) all charges established under Schedule 12 of the PJM Tariff in connection with facilities built pursuant to this Regional Transmission Expansion Planning Protocol. Such charges compensate the Transmission Owner(s) for all costs related to such RTEP facilities under a FERC-approved rate.

# What if a Transmission Owner Declines To Construct?

- In the event that a Transmission Owner declines to construct an economic transmission enhancement, PJM files a report on the results of the pertinent economic planning process in order to permit FERC to determine what action, if any, it should take.

# Designation as a Market Solution

- Upon determining that an Interconnection Request is a market solution, PJM notifies the affected Interconnection Customer and offers the formal designation as a “market solution.”

- PJM conducts Feasibility Studies, System Impact Studies, and Facilities Studies associated with projects that have accepted designation as market solutions on an expedited basis

# Gaming– Sponsor Incentive Information Disclosure

- Market Solution Providers Must Disclose the following to PJM within 30 Days of designation:
  - Their affiliate relationships with other Market Participants.
  - Theirs and affiliate Financial Transmission Rights and Auction Revenue Rights positions in any portion of the PJM system affected by the congestion for the project designated as a market solution.
  - Theirs and affiliate bilateral transactions and other material contractual relationships with any Market Participant that is affected by the congestion for which the provider's project is designated as a market solution.

# Gaming – Milestone Schedule

- PJM requires additional milestones for the development of the project designated as a market solution that PJM determines to be reasonable and appropriate to ensure diligent pursuit of the project.

- PJM may extend any of the additional milestones set forth in the Development Agreement if the market solution developer demonstrates that its inability to meet the milestone(s) is due to delays not caused by the developer and that could not be avoided or remedied by the exercise of due diligence.
- In the event that any milestone set forth in the Development Agreement is not timely met and is not extended by PJM, the project shall lose its designation as a market solution.

# Gaming - Additional Security Requirements

- The market solution developer must provide security in an amount equal to the lesser of 10% of Transmission Provider's reasonable estimate of the fixed cost of the project, or $250,000.

# Gaming – Default on Development Agreement

- The additional security provided will be forfeited in the event that PJM reasonably determines the following
  - That the developer's failure to meet milestones reasonably could have been avoided by the exercise of due diligence, and
  - Based on the developer's disclosures and other available information, that the developer or one or more of its affiliates or customers will profit from ongoing occurrence of the unhedgeable congestion for which the project was designated as a market solution

# Gaming - Disposition of Forfeited Additional Security

- PJM utilizes any funds that it retains due to forfeiture to offset the cost to affected load of unhedgeable congestion caused by the transmission constraint that the project to be built under the relevant terminated Interconnection Service Agreement would have remedied

# MARKET MONITORING

- Market Monitoring Unit implemented with competitive energy markets in PJM.
  - Effective April 1, 1999.

- MMU goals:
  - Develop/modify market rules to **facilitate competition**
  - **Limit returns to market power**
  - Provide **incentives to competitive behavior**
  - Make **exercise of market power more difficult**

- Independent Internal Market Monitoring
  - Independent System Operator
  - ISO/RTO has no financial stake in market outcomes
  - ISO/RTO has independent Board
  - ISO and MMU are independent from all market participants
    - Market Monitoring Plan is not subject to modification by PJM members.
    - Amendment to PJM's Open Access Transmission Tariff subject to FERC approval
  - MMU is independent from ISO

- MMU Accountability:
  - To FERC (per FERC MMU Orders and MM Plan).
  - To PJM Board.
  - To PJM President.

- Include diverse staff expertise
  - Economics/Engineering
  - Generation
  - Transmission
  - Power markets
  - Database/IT
- Build understanding of detailed market structure: macro/micro
- Build understanding of physical infrastructure
- Build understanding of operations
- Build in MMU data access/storage to RTO data designs
- Confidentiality protocols
- Complaint protocols

- Market Monitoring function: relationship with members
- Regular meetings with members from all sectors
  - Markets Committee
  - Operations Committee
  - Special Working Groups
- Report on issues to members
- Make proposals to members
- Briefings for sector/group members
- Active relationships critical

- Monitor **compliance with rules**, standards, procedures and practices of PJM.
- Monitor **actual or potential design flaws** in rules, standards, procedures and practices of PJM.
- Monitor **structural problems** in the PJM market that may inhibit a robust and competitive market.
- Monitor the potential of Market Participants to **exercise undue market power**.

- **Discussion of issues** with relevant Market Participants; informal resolution of issues.
- **Issue demand letters** requesting a change in behavior by relevant Market Participants.
  - Provide demand letters to relevant Authorized Government Agencies.
- **Recommend modifications to rules**, standards, procedures and practices of PJM.
  - **Make recommendations** to PJM Committees or to PJM Board.
  - **Make regulatory filings** to address market issues and seek remedial measures.
- **Evaluate additional enforcement mechanisms**.

- Interaction with market participants is critical to understanding real markets
- Interaction with state Commissions is critical to understanding retail/wholesale interaction issues
- Interaction with RTO staff is critical to understanding real markets
- Coordination with FERC is essential to efficient monitoring and mitigation

- Multiple markets have complex interactions
- All markets and market impact behaviors must be monitored
- Energy spot market
  - Day ahead
  - Real time
- Reserve markets
  - Regulation
  - Spinning
- Capacity markets
- FTRs
- Transmission
  - Facility ratings
  - Outage scheduling
- Bilateral markets
  - Complex feedback with ISO markets

- Market design
  - Market design critical for effective monitoring
  - Good market design does not obviate need for monitoring
- Market structure
  - Aggregate, supply-side market structure conditions not adequate to ensure competition
  - Transmission constraints limit competition in unpredictable ways
  - Full demand side participation a prerequisite - complex regulatory interactions to create required infrastructure
- Need to define market power as clearly as possible
  - Communicate definition to participants
  - Explain specific examples as they arise
- Need to define consequences of exercising market power
  - Explain specific examples as they arise

- Energy market
  - Price - cost margins
  - Net revenue
  - Market structure (e.g. HHI, RSI)
  - Price
- Capacity market
  - Price - opportunity cost
  - Market structure
  - Outage rate performance
- Regulation market
  - Price
  - Market structure
  - Availability
  - Performance (NERC standards)

- Day ahead and real time LMP: market; bus specific
- Congestion
- Constraints
- Unit specific and aggregate price-cost margins
- Aggregate supply curves
- Individual bid curves: day ahead and real time
- Unit operating constraints: day ahead and real time
- Concentration measures: HHI, RSI
- Frequency of must run conditions
- Day ahead and real time loads
- Companies' market incentives
- Net revenue: aggregate; unit specific

- Aggregate supply-demand conditions
- Entry conditions
- Imports and exports
- Bilateral markets: prices and quantities
- External market prices
- Fuel prices
- FTR auction supply and demand
- Capacity market supply and demand
- Outage behavior
- Capacity delisting
- Forward prices/spreads

- Energy market
  - High load conditions/Economic withholding
- Energy market
  - High load conditions/Operating constraints
- Energy market
  - FTR positions/Increment offers/decrement bids
- Transmission outage notification and FTR market
- Capacity market
  - Economic withholding
- Interface pricing/loop flow

- Subtle and complex ways to exercise market power
- Generally not aggregate market issue
- Operating reserves
- Bid parameters
- Retirements/mothballing
- Ramp violations
- Loop flows
- FTR/Inc/Dec
- Creation of congestion

# Prevention of Gaming - Interface Pricing and Loop Flows

- External contracts are assigned specific interface pricing nodes based upon Generation Control Area (GCA)
  - Prevents manipulation of loop flows to create congestion
  - Physical vs. Contract flow path correlation
  - Parking and Hubbing

# Mitigation of FTR Markets and Virtual Bidding

- FTRs are financial instruments designed to provide market participants a hedging mechanism against congestion costs

- Rules in place to prevent gaming of FTR and PJM Energy Markets through Virtual bidding
  - FTR benefits from gaming are subject to automatic forfeiture
  - Virtual Bidding closely monitored to detect strategic behaviors
  - Interaction with generation and load serving responsibility

# Generator Market Power - Offer Mitigation

- Prohibit the potential to exercise market power
- Units are offer-capped at marginal cost when operated for congestion management
- MMU has the right to request additional mitigation authority from FERC

# Generator Market Power - Withholding

- Generators are not permitted to withhold supply from the PJM market
  - Economic Withholding
  - Physical Withholding
- Market Incentives to Participate
  - Capacity Payments
  - Effective Forced Outage Rates

# Post-Contingency Congestion Management

- In part in response to stakeholders' concerns regarding congestion on the Delmarva Peninsula, PJM developed, tested and implemented a protocol that results in less frequent out-of-merit dispatch than under the current system.
- Program piloted for seven Conectiv flowgates that send power to the peninsula including portions of Delaware, Maryland, and Virginia. According to FERC, the pilot program enabled PJM to avoid the necessity for re-dispatch, resulting in savings of more than $2 million.
- On August 19, 2004 in Docket No. ER04-987-000 FERC accepted plan for wider implementation

# Program Benefits and Status

- FERC noted that the expansion of this program has the potential to:
  - Reduce re-dispatch costs in chronically congested areas in the PJM region
  - More accurately reflect the local benefits of avoided re-dispatch and enhanced reliability
  - Reduce the potential for the exercise of local market power
  - Reduce emissions
  - Allow for more efficient use of assets

- Program took effect on September 1, 2004

# Questions?