

# **Transmission ITP**

## **Introduction**

**PJM State & Member Training Dept.**

# Objectives



At the conclusion of this presentation, the student will be able to:

- Describe the structure of the Transmission ITP course
- Define PJM's role as a Regional Transmission Organization (RTO)
- Describe the relationship between PJM and its Member Companies
- Identify the PJM Training and Certification requirements for Transmission Owner Operators

# Agenda



- **Introduction to Transmission ITP**
- Introduction to PJM
- Member TO Training and Certification Requirements

# Course Outline

- Schedule
  - 0800 Daily Start Time
    - Open Discussion Format – Please use microphones provided on table so everyone can hear your questions and comments
  - Lunch & Breaks
    - Schedule
    - Locations
  - End of Class Day
    - Turn in badges daily



# Course Outline

- Housekeeping
  - Evacuation procedure
  - Restrooms
  - Break/smoking locations
- Productivity
  - Phones on vibrate
  - Wireless printer available
    - Email document to [pjmctc1@hpeprint.com](mailto:pjmctc1@hpeprint.com)
  - Quiet area (near wireless printer)



# NERC CEH

- To Earn NERC CEHs, You MUST:
  - Scan your badge/sign in at the start of each session
  - Attend all presentations and complete all activities
- Rules for Quizzes
  - 75% or higher is required (re-testing is available)
- Rules for Simulations:
  - You must participate in the full Simulation activity
  - You must complete and sign the accompanying Activity Sheet

# The Transmission ITP Course

- This goal of this course is to provide you with the knowledge you need to successfully execute any of the shared tasks on the Transmission Owner Operator Task List
- This task list is mandated by NERC (PER-005) and also serves as the basis for the PJM Certification Exam content outline
- Task List is continuously evaluated by the PJM Dispatcher Training Subcommittee (DTS)

# Agenda



- Introduction to Transmission ITP
- **Introduction to PJM**
- Member TO Training and Certification Requirements



# What is an RTO?

PJM State & Member Training Dept.

# PJM as an RTO

## What is an ISO/RTO?

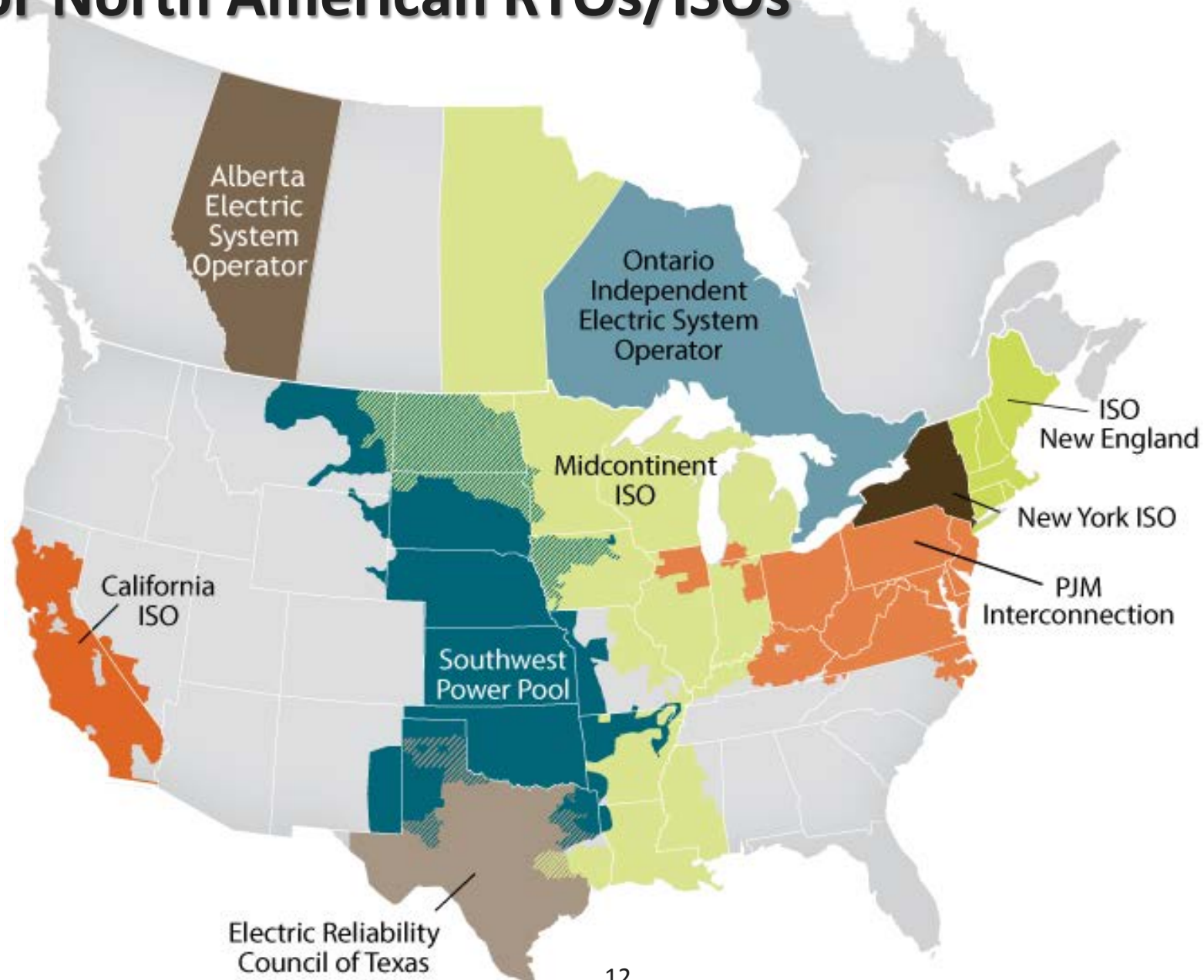
- Independent from all market participants
- Independent governance structure
- Possesses operational authority
- Responsible for (within the region):
  - Grid operations
  - Reliability
  - Transmission service

# PJM as an RTO

## Functions

- Administer tariff
- Administer regional wholesale electric markets
- Provide independent market
- Provide for comprehensive regional transmission expansion planning
- Manage congestions
- Supply ancillary services
- Operator OASIS
- Plan and coordinate transmission additions and upgrades

# Nine Major North American RTOs/ISOs



# **PJM Organization and the PJM Committee Structure**

**PJM State & Member Training Dept.**

# How is PJM Different From Other Utility Companies?

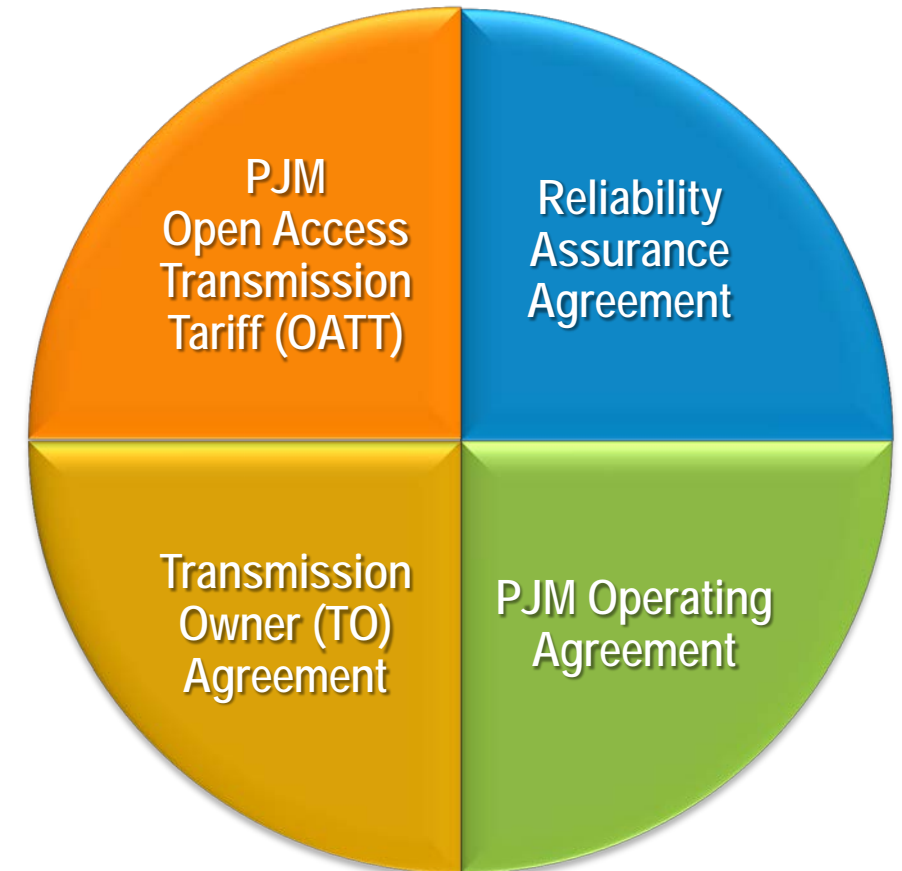
## PJM Does:

- Direct operation of the transmission system
- Remain profit-neutral
- Maintain independence from PJM members
- Coordinate maintenance of grid facilities

## PJM Does *NOT*:

- Own any transmission or generation assets
- Function as a publicly-traded company
- Take ownership of the system's energy
- Perform maintenance on generators or transmission systems (e.g. repair power lines)
- Serve or direct any end-use customers (retail)

## PJM Authority Provided by Contract

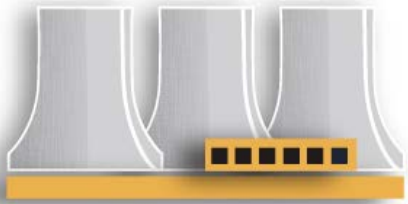


# Independence and Governance Process

Independent Board of Managers

Market Monitor

Members Committee



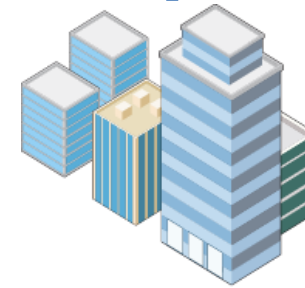
Generation Owners



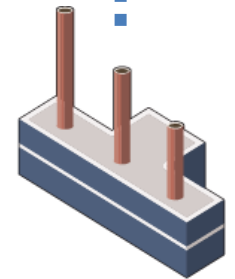
Transmission  
Owners



Competitive Retail  
Companies &  
Trading Companies



Utility Electric  
Distributor &  
Retail Business



Wholesale  
End Use  
Customers  
(Industrial)

- Independent Board of Managers
- Stakeholder process – provide balanced stakeholder input
- Established process for discussion of market evolution

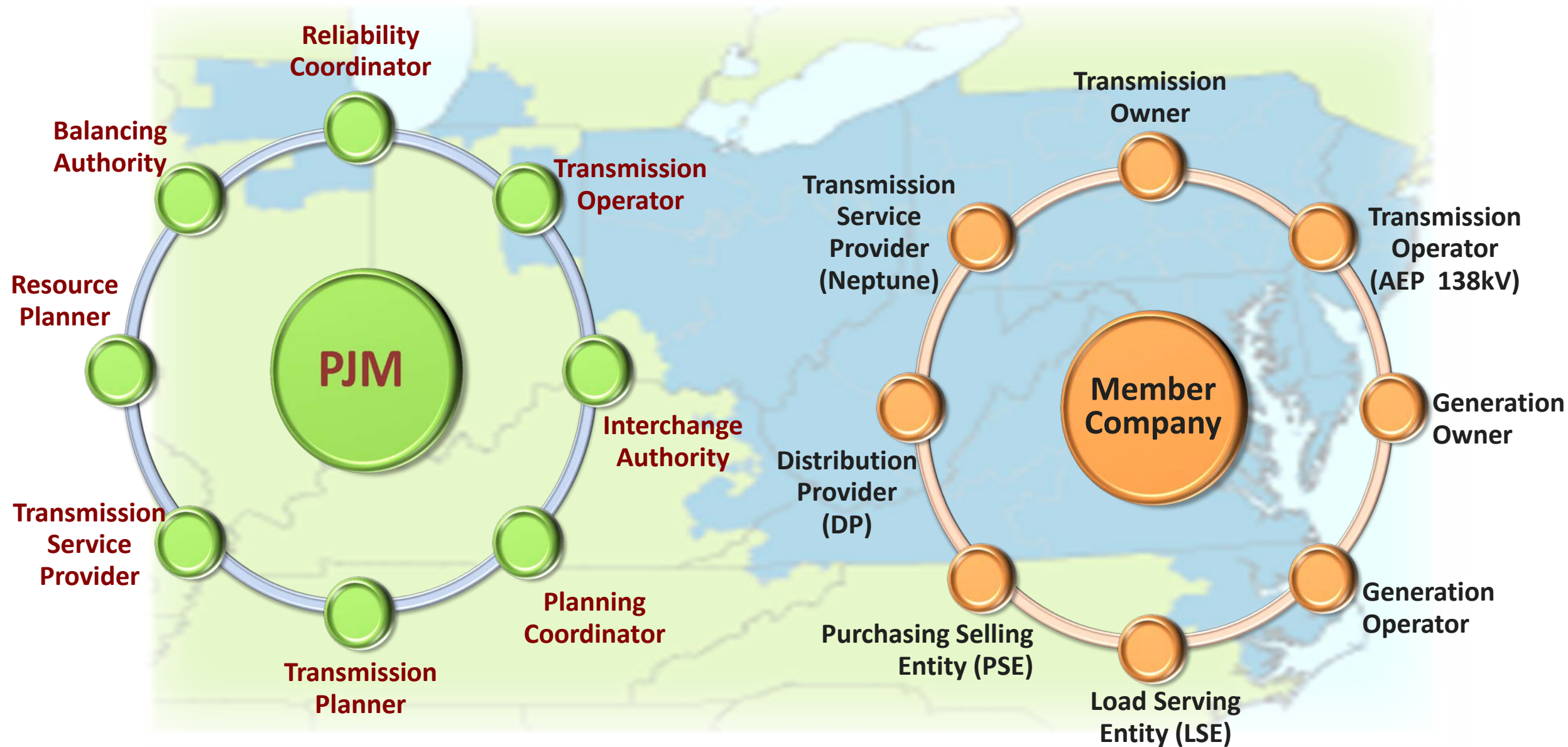
# Working Together....

- Agreements are developed with stakeholders to ensure reliability of the electric power grid
- Stakeholders include:
  - Members
  - ISOs/RTOs
  - FERC
  - NERC
- ***PJM Operating Agreement***
  - Governs operation of PJM
  - Defines roles & responsibilities
  - PJM Membership requires signing of PJM Operating Agreement

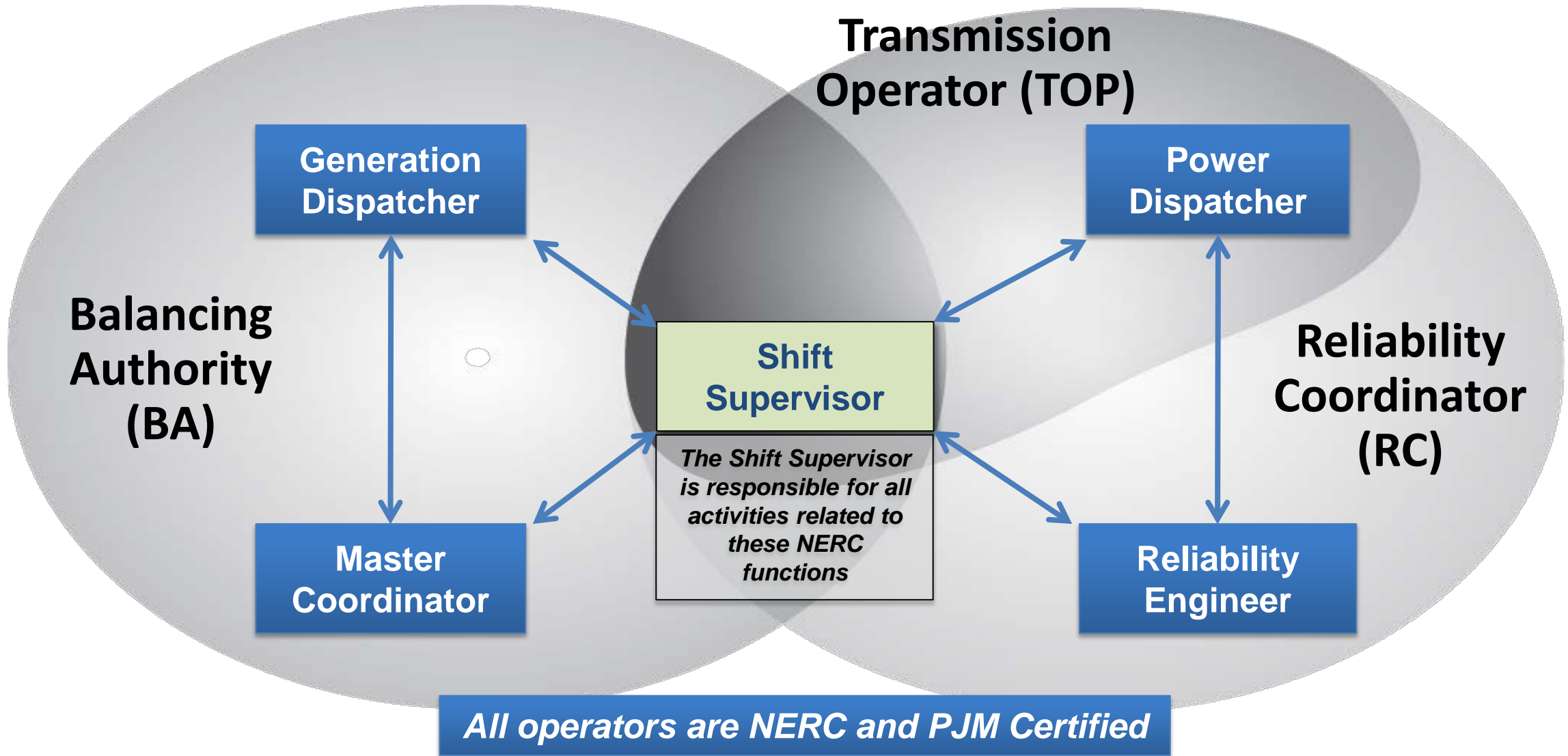




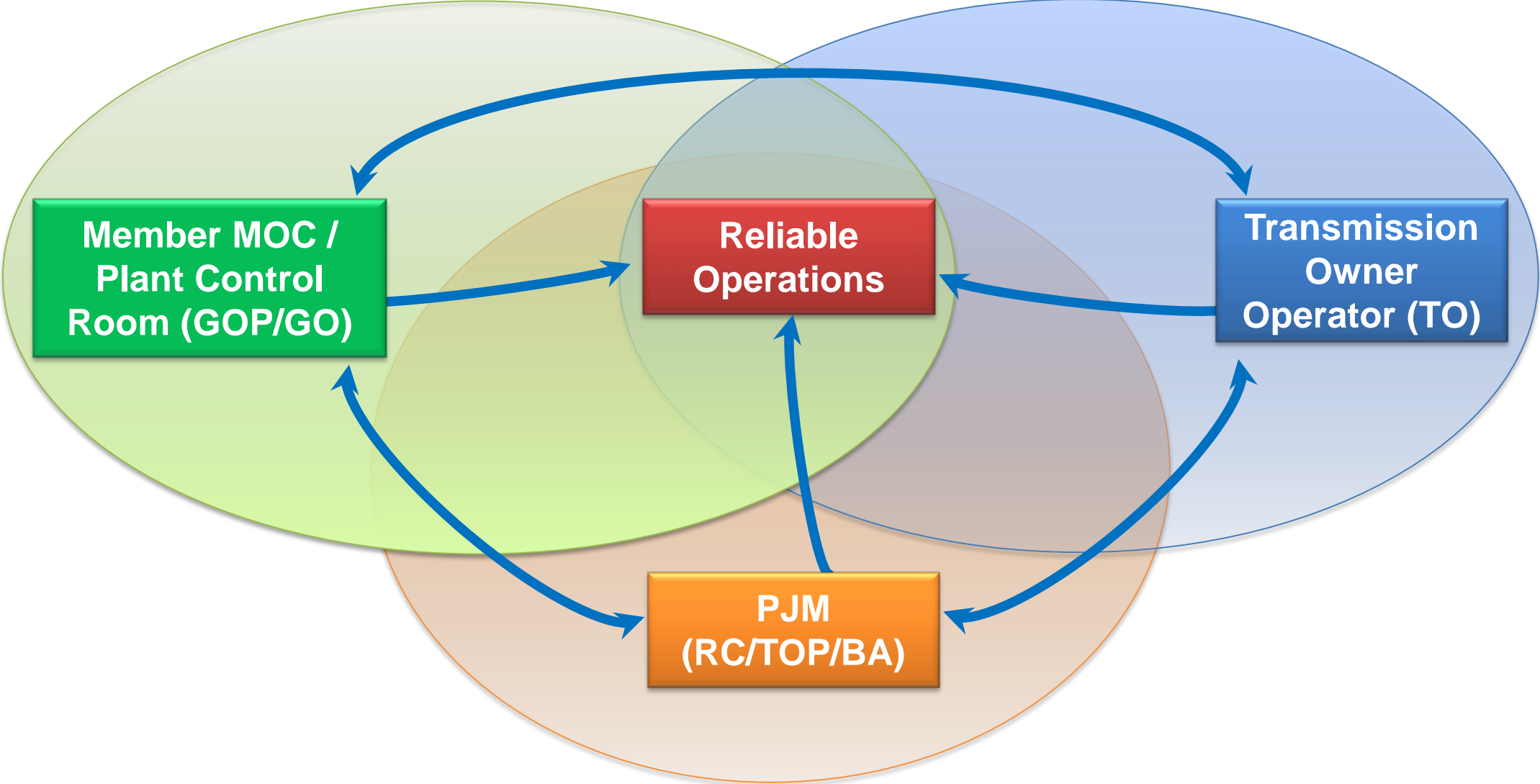
# NERC Functional Model



# PJM Control Room Positions and NERC Responsibilities



# Interaction among Members & PJM



# NERC Functional Model – Transmission Operator

- Definition

- The functional entity that ensures the Real-time operating reliability of the transmission assets within a Transmission Operator Area

- Tasks

- Monitor and provide telemetry (as needed) for all reliability-related parameters within the reliability area
- Monitor the status of, and deploy, facilities classed as transmission assets, which may include the transmission lines connecting a generating plant to the transmission system, associated protective relaying systems and Special Protection Systems
- Develop system limitations such as System Operating Limits and Total Transfer Capabilities, and operate within those limits

# NERC Functional Model – Transmission Operator

- Tasks (*cont.*)
  - Develop and implement emergency procedures
  - Develop and implement system restoration plans
  - Operate within established Interconnection Reliability Operating Limits
  - Perform reliability analysis (actual and contingency) for the Transmission Operator Area
  - Adjust flow control devices within the transmission area to maintain reliability
  - Deploy reactive resources to maintain transmission voltage within defined limits

# NERC Functional Model – Transmission Owner

- Definition
  - Owns and provides for the maintenance of transmission facilities
- Tasks
  - Develop interconnection agreements
  - Establish ratings of transmission facilities
  - Authorize maintenance of transmission facilities rights-of-way
  - Design and install owned facilities classified as transmission and obtain associated rights-of-way
  - Design and authorize maintenance of transmission protective relaying systems and Special Protection Systems

# PJM and Transmission Owners – TO/TOP Matrix

- PJM has the responsibility for planning and directing the operation of PJM Transmission Facilities in accordance with applicable NERC, RF, SERC and PJM standards
- Requirements for Transmission Owners to assure compliance by both the TO and PJM in the role as the TOP, RC and BA
  - Various agreements
  - PJM Manuals
  - **PJM TO/TOP Matrix**
    - <http://www.pjm.com/-/media/markets-ops/compliance/pjm-to-top-matrix-version-11.ashx>

# PJM and Transmission Owners – TO/TOP Matrix

- PJM, as the TOP, is involved in all transmission operating decisions
  - Pre-existing procedures can be executed by the TO, but PJM approves any deviations
  - New procedures do not proceed without approval from PJM as the TOP
- All TOP requirements are performed by PJM
  - Tasks can be **assigned** to the TOs, but only via an agreement and with *PJM still holding the responsibility*
- PJM has enough knowledge and information, so that it can execute the TOP requirements without information from the TO



# PJM and Transmission Owners – TO/TOP Matrix

- Those requirements cover all of the following areas:

Security	Training	Staff Certification	Responsibility and Authority	Transmission Operations
Emergency Operations	Operations Planning	Real-time Monitoring (Meters	Plans for Loss of the Primary Control Center	System Restoration
Outage Coordination	Capacity and Energy Emergency Plan	Nuclear Power Interaction	Communications Facilities	Operator Voice Communications
Ratings Coordination	Modeling	Voltage Control	Protection Coordination	Sabotage Reporting

# Purpose and Use of the TO/TOP Matrix

- Clarify the assignment of tasks based on the unique relationship between PJM and its Member TOs
  - Relationship is outlined in OA, OATT and PJM Manuals
- Does not create any new obligations for PJM or its members
  - Simply a cross-reference to indicate where the assignment of various reliability tasks is documented

*PJM/Transmission Owners NERC Standards Compliance Matrix*, as approved by the TOAAC

All of the requirements in the Matrix come directly from reliability standards or the PJM manuals. No new requirements are included, however, in some cases the manuals contain additional detail not included in the standard

# Example – TO/TOP Matrix

Category	TOP	Purpose	Scheduled generator and transmission outages that may affect the reliability of interconnected operations must be planned and coordinated among Balancing Authorities, Transmission Operators, and Reliability Coordinators.
Standard Number	TOP-003-1		
Requirement Number	R1		
Approved BOT/FERC Standards	Generator Operators and Transmission Operators shall provide planned outage information.		
A/S	S		
Assigned or Shared TO Tasks	<ol style="list-style-type: none"> <li>1. The Member TO must submit transmission outage information to PJM based on the procedures in PJM Manual 3</li> <li>2. PJM shall inform Member TOs and external TOs of planned transmission and generation outage information.</li> </ol>		
Audit Questions	Do you submit transmission outage information based on the procedures in PJM Manual 3?		
Evidence of Compliance	Show examples that you provide outage information based on the procedures in PJM Manual 3 (eDART Tickets; PJM day ahead email; and day-ahead discussion with PJM Reliability Engineer).		
Reference Documents	PJM OA; 11.3-Member Responsibilities, Schedule 1, 1.7.15 Corrective Action M-3 Transmission Operations; Section 5-Index and Operating Procedures for PJM RTO Operation M-10 Pre-Scheduling Operations; Section 2.2-Planned Outages M-37 Reliability Coordination, Section 1.1-Policy Statements M-38, Operations Planning; Section 3-Next Day Reliability Analysis		

# Transmission Owner Operator Responsibilities

## Awareness

- Member TO company operators need to maintain an awareness of the delineation of responsibilities and assignment of tasks within PJM TO/TOP Matrix

# TO/ TOP Authority Examples – Example

A company operator has received a call from the PJM control center each day this week requesting the capacitors at Station X for low voltages on the A to B 230kv line.

This morning, although not receiving a call from PJM, the company operator seeing similar conditions on his system to those observed every day this week, switches in the capacitors at Station X to successfully alleviate the low voltage condition

- Is this a TO or a TOP task?
- Who is primarily responsible?

# TO/ TOP Authority Examples – Example

Standard Number	Requirement Number	Approved BOT/FERC Standards	Assigned Tasks
VAR-001-4.1	R3	Each Transmission Operator shall operate or direct the Real-time operation of devices to regulate transmission voltage and reactive flow as necessary.	At the instruction of PJM, the Member TO shall operate the devices under its control necessary to regulate transmission voltage and reactive flow. (On transformers with low side voltage of 138 kV or lower, the Member TO can operate the tap changers without notifying PJM)

# TO/ TOP Authority Examples – Example

- PJM authorizes the Local Transmission Control Center to automatically or manually switch/adjusting reactive devices 138kV and below without notifying PJM

## Manual 3 Section 3:

Transmission Owners shall analyze the impact of switching BES capacitor/reactors or adjusting BES LTC on voltage limits and lagging/leading MVAR reserves. Analysis may require use of EMS Security Analysis or other analysis packages depending on system conditions and proximity to limits. Transmission Owners shall request PJM to study the impact of switching capacitor/reactors if the TO determines they are unable to analyze the impact on BES facilities

# **PJM Regional Transmission Expansion Process (RTEP)**

**PJM State & Member Training Dept.**

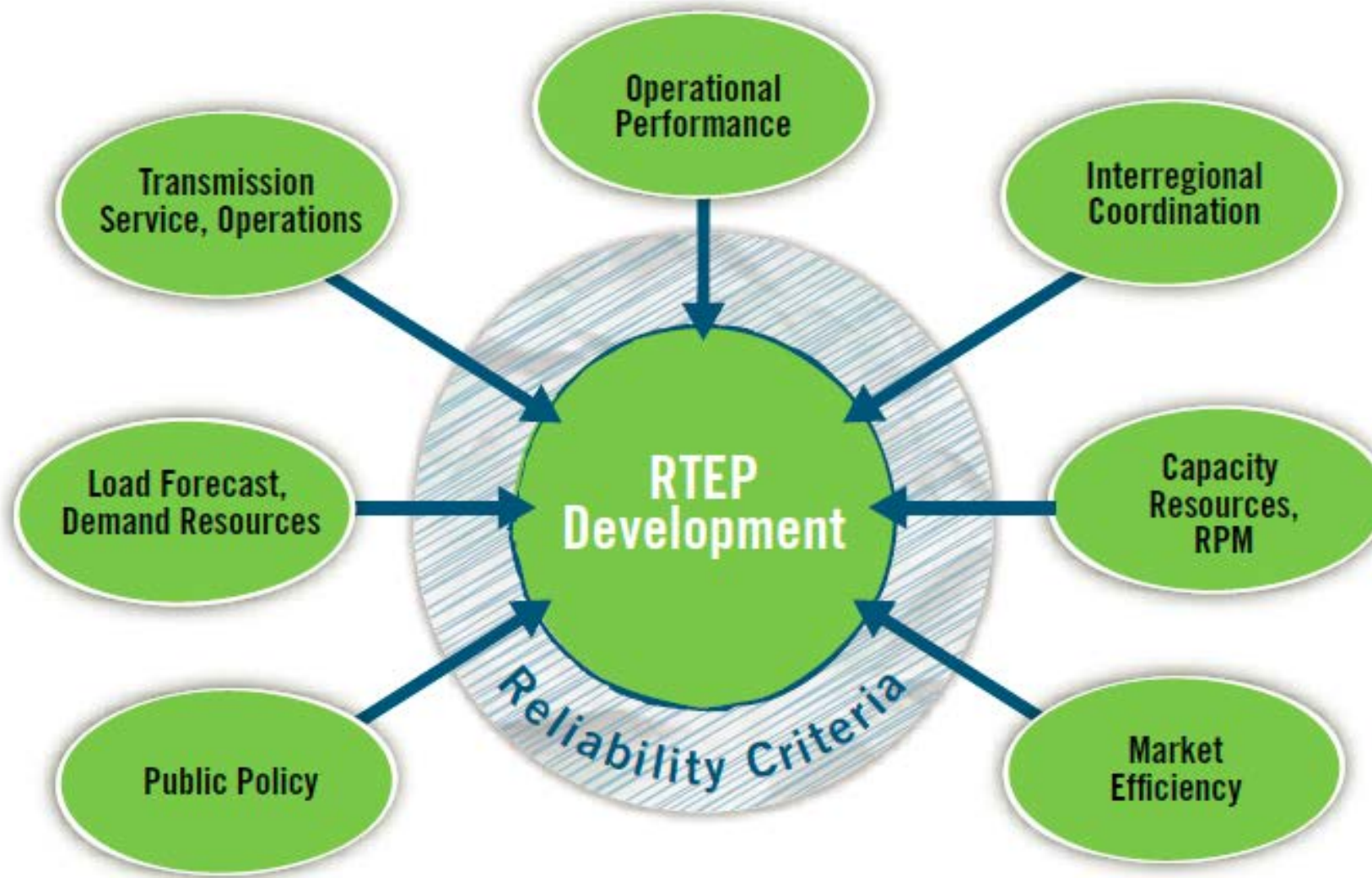


# Regional Planning Objectives

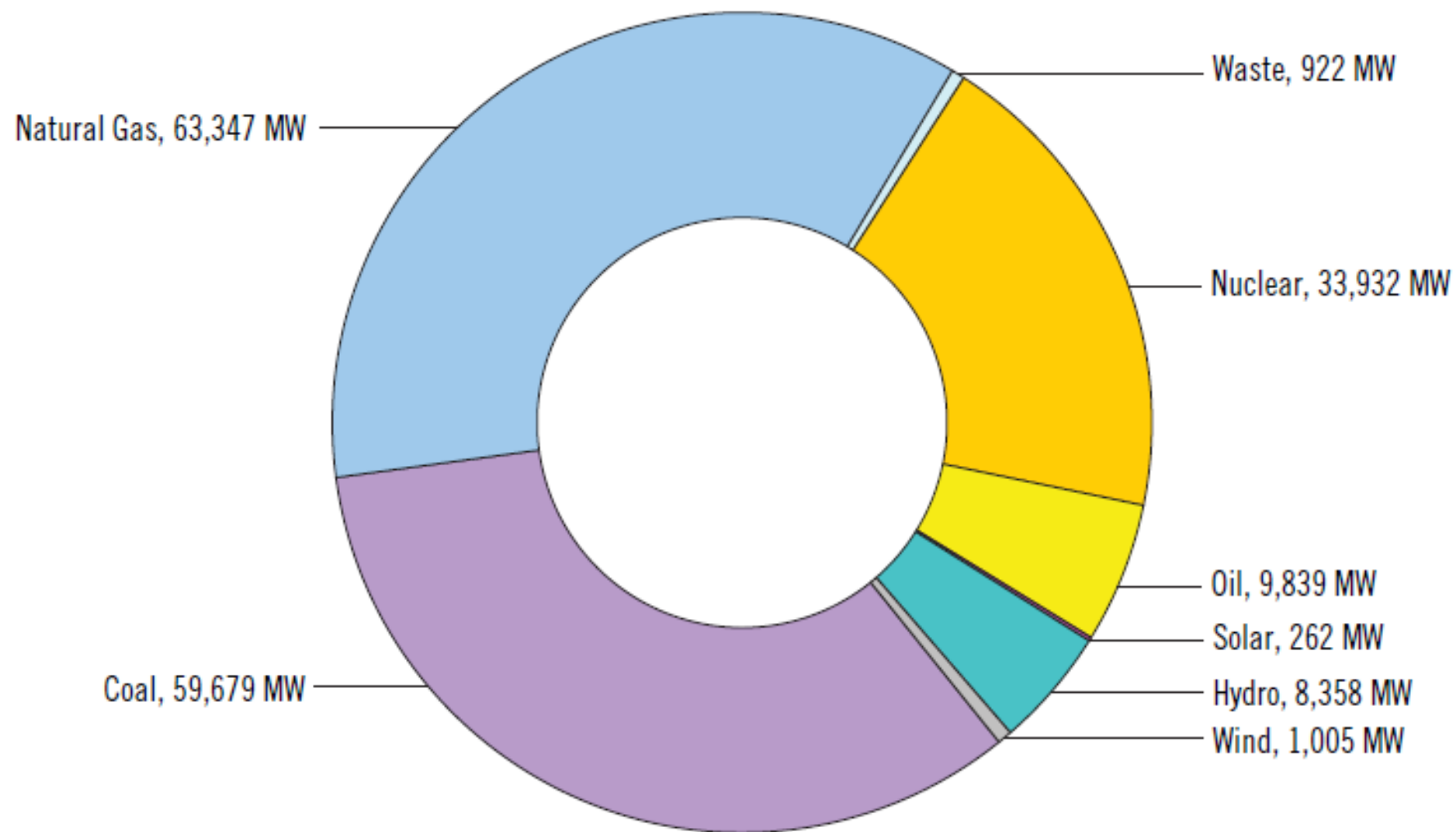
- 15 year outlook to identify reliability standards violations
- Test the transmission system against mandatory national standards and PJM regional standards
- Reliability and economic efficiency drivers
- Develop transmission reinforcements in collaboration with Transmission Owners
- Develop a unified Strategy for the entire PJM footprint – the RTEP
- Submit Plan to PJM's independent governing Board for consideration and approval



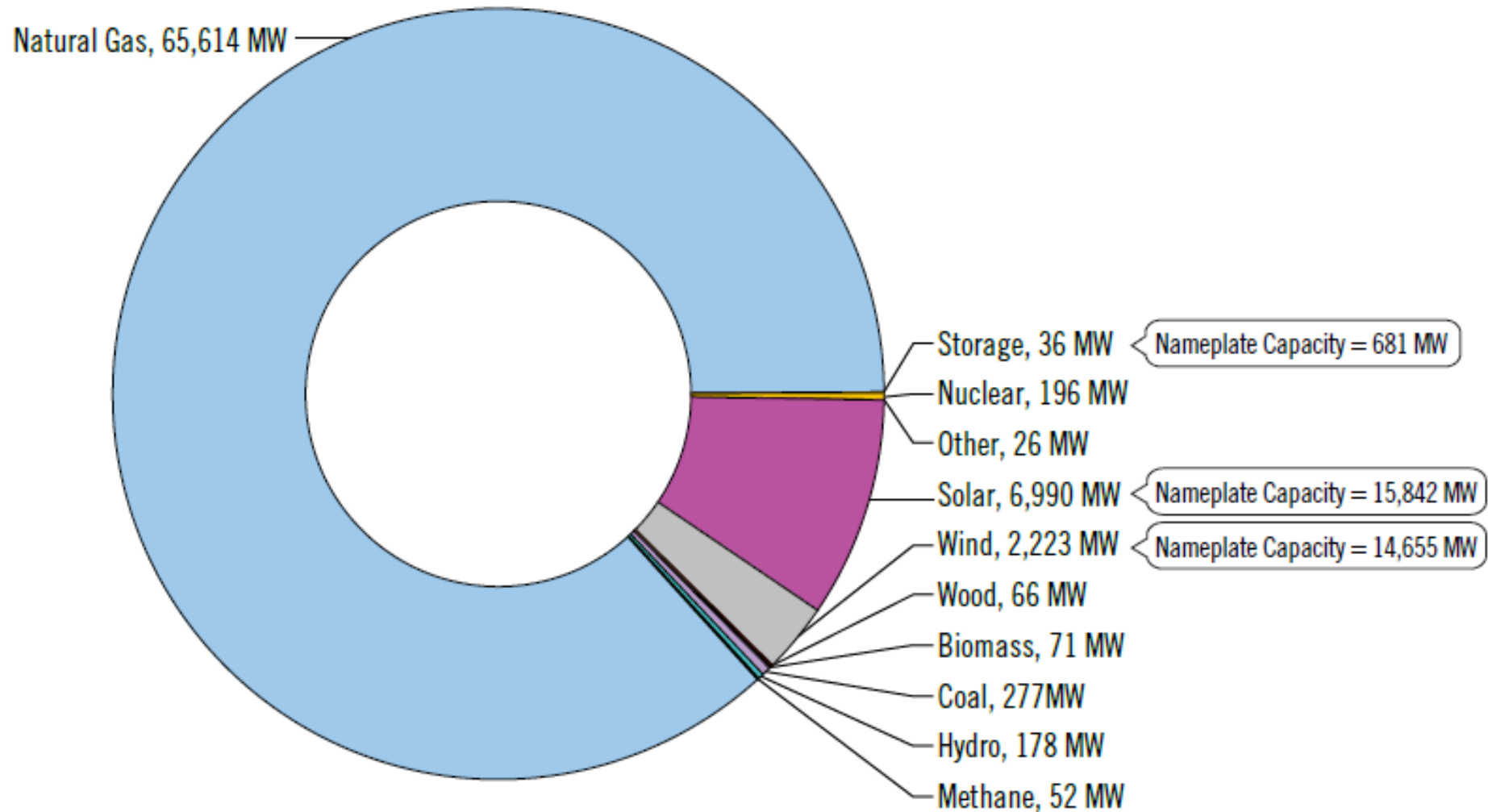
# RTEP Development Drivers



# Fuel Mix – Existing PJM Installed Generating Capacity (MW, Capacity, December 31, 2016)



# PJM Queued Interconnection Requests (MW, Requested Capacity Rights, December 31, 2016)



# Accessing the RTEP Report

The screenshot shows the PJM website's navigation bar with links for 'Hi Russell', 'Tools Sign In', 'Glossary', 'Calendar', a search bar, and social media icons. Below the navigation bar is a secondary menu with links for 'about pjm', 'training', 'committees & groups', 'planning' (highlighted), 'markets & operations', and 'documents'. The main content area is titled 'Planning' and features a large image with the text 'Strengthening the region's capacity resources'. Below the image is a paragraph describing the RTEP. To the right of the main content is a 'RELATED INFORMATION' section with links to 'Manuals', 'Compliance', 'Transmission Expansion Advisory Committee', 'Regional Planning Process Task Force', 'Eastern Interconnection Planning Collaborative', 'Public Policy Considerations and Drivers', and 'Regional Transmission Expansion Plan Documents' (circled in red). Below this is a 'RECENT DOCUMENTS' section with a link to 'RRS Assumptions Letter RAAS' dated March 12, 2014.

Hi Russell | Tools Sign In | Glossary | Calendar | Go advanced | Follow us on: [Social Media Icons]

**pjm** | about pjm | training | committees & groups | **planning** | markets & operations | documents

Generation Interconnection  
Merchant Transmission  
Long-Term Firm TSR Customers  
Generation Deactivation  
ARR Analyses  
RTEP Upgrades & Status  
RTEP Development  
Resource Adequacy Planning  
Planning Criteria  
Design, Engineering & Construction  
Interregional Planning

Home > Planning

## Planning

Strengthening the region's capacity resources

PJM's Regional Transmission Expansion Plan (RTEP) identifies transmission system additions and improvements needed to keep electricity flowing to 51 million people throughout 13 states and the District of Columbia. Studies are conducted that test the transmission system against mandatory national standards and PJM regional standards. These studies look 15 years into the future to identify transmission overloads, voltage limitations and other reliability standards violations. PJM then develops transmission plans in collaboration with Transmission Owners to resolve violations that could otherwise lead to overloads and black-outs. This process culminates in one recommended plan - one RTEP - for the entire PJM footprint that is subsequently submitted to PJM's independent governing Board for consideration and approval.

**RELATED INFORMATION**

- Manuals
- Compliance
- Transmission Expansion Advisory Committee
- Regional Planning Process Task Force
- WEB Eastern Interconnection Planning Collaborative
- PDF Public Policy Considerations and Drivers
- Regional Transmission Expansion Plan Documents**

**RECENT DOCUMENTS**

- MAR 12 RRS Assumptions Letter RAAS 2014 Posted 79 days ago PDF

This report is a comprehensive study of the planned system upgrades within PJM. It explains:

### System Upgrade Drivers

- Load growth
- Generation additions
- Generation deactivation

### Reliability Criteria Violations

- Transmission constraints
- Voltage limits

### Enhancements Needed

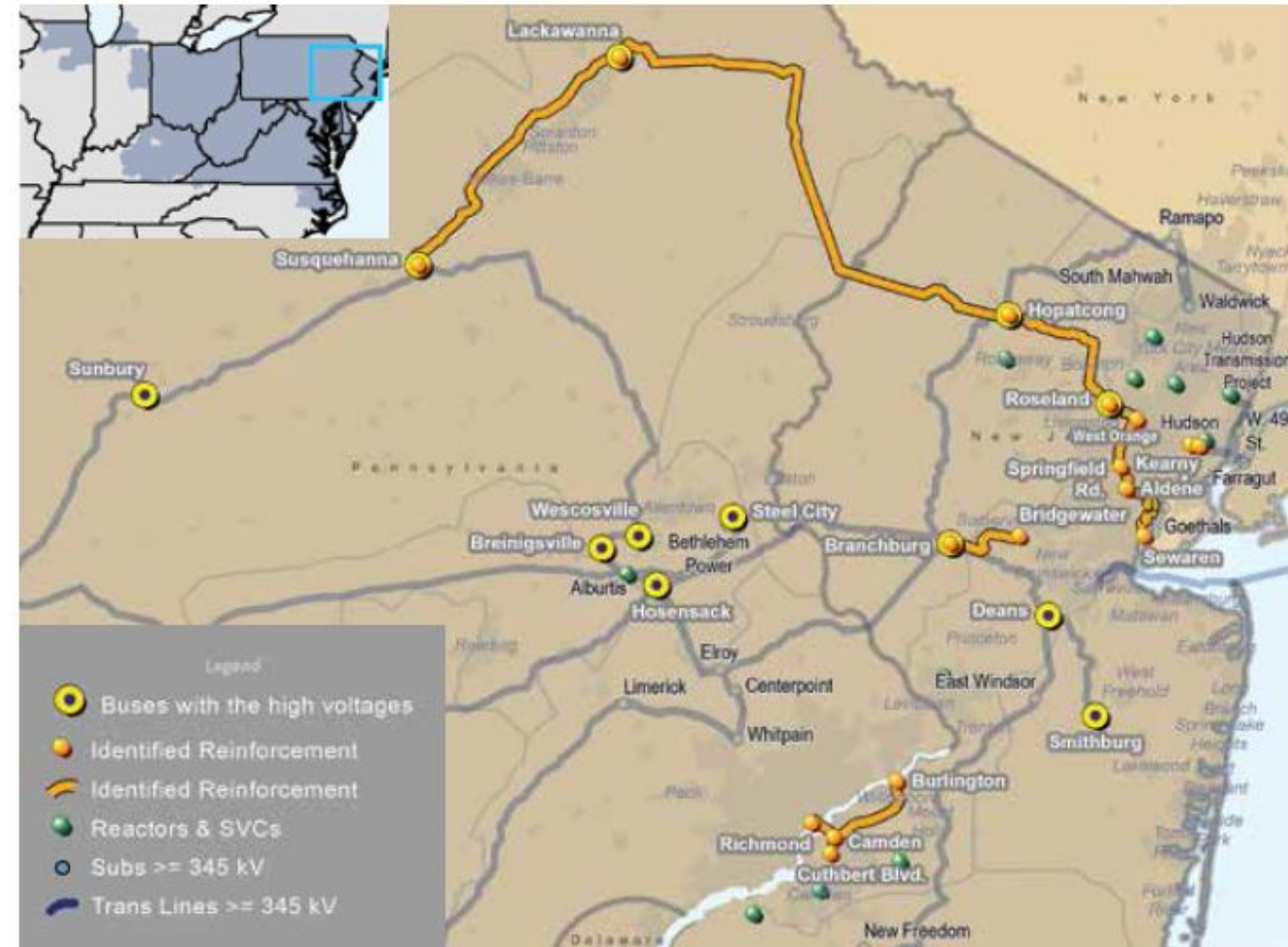
- New facilities
- Upgrades to existing facilities



# Example RTEP Project

- High System Voltages
  - Eastern PJM
    - RTEP solutions
      - Shunt reactors to be installed at:
        - Roseland – 350 MVAR
        - Bergen – 100 MVAR
        - Essex – 150 MVAR
        - Bayonne – 100 MVAR
        - Lackawanna – 200 MVAR
      - Variable reactive devices at:
        - Bergen & Bayway – 200 MVAR

Map 3.5: RTEP Reactive Solution to Control High Voltages in Eastern PJM



# Agenda



- Introduction to Transmission ITP
- Introduction to PJM
- **Member TO Training and Certification Requirements**

# Member Transmission Owner Operator Requirements

## Initial Training Requirements

- PJM Transmission ITP Course
  - Training is linked to each shared task on the Transmission Owner Task List
  - PJM provides training on all shared tasks; member companies provide training on company-specific tasks
- Task Verification
  - Each operator must be verified as having the capability to perform each task at least one time (PER-005)
  - Verify within 6 months for new or changed tasks



# Member Transmission Owner Operator Requirements

## Certification Requirements

- PJM Transmission Certification
  - Certificate good for 3 years
  - May be renewed in 2 ways:
    - Re-test before the prior certificate expires
    - Over the 3 year period, accrue 140 CE hours (of which 30 must be simulation related)
- NERC Certification
  - 3 acceptable versions
    - Transmission (TO)
    - Balancing, Interchange and Transmission (BT)
    - Reliability Coordinator (RC)
  - Certificate good for 3 years
  - May only be renewed by CE hours (140/160/200, respectively)

# Member Transmission Owner Operator Requirements

## Continuing Training Requirements

- Each operator must complete:
  - **32 hours** of emergency operations related training annually
  - Training related to tasks identified as requiring annual training (DIF analysis)
- How can you meet these requirements?
  - PJM-provided training (in-person, online via LMS)
  - Company-provided training
  - Third-party, NERC-approved providers

# Summary

- Reviewed the structure of the Transmission ITP course
- Defined PJM's role as a Regional Transmission Organization (RTO)
- Described the relationship between PJM and its Member Companies
- Identified the PJM Training and Certification requirements for Transmission Owner Operators

# Contact Information

**PJM Client Management & Services**

**Telephone: (610) 666-8980**

**Toll Free Telephone: (866) 400-8980**

**Website: [www.pjm.com](http://www.pjm.com)**



The Member Community is PJM's self-service portal for members to search for answers to their questions or to track and/or open cases with Client Management & Services

# Resources and References

- “ISO/RTO Council. (n.d.) Map. Retrieved from <http://www.isorto.org/about/default>
- NERC. (n.d.) *Functional Model*. Retrieved from <http://www.nerc.com/pa/Stand/Pages/FunctionalModel.aspx>
- NERC. (2016). *Glossary of Terms*. Retrieved from [http://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary\\_of\\_Terms.pdf](http://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf)
- PJM. (2017). *PJM Manual 40: Certification and Training Requirements (rev. 18)*. Retrieved from <http://www.pjm.com/~media/documents/manuals/m40.ashx>
- PJM. (2017). *2016 Regional Transmission Expansion Plan Report*. Retrieved from <http://www.pjm.com/library/reports-notice/rtep-documents/2016-rtep.aspx>