9.0: Overview

Expanding interregional markets and system inter-operability require that PJM coordinate integrated system assessments and planning at RTO/ISO transmission interfaces. Map 9.1 shows PJM’s location within the Eastern Interconnection and the boundaries PJM shares with adjoining RTOs and ISOs.

9.0.1 – Interregional Coordination with RTEP Process

Just as the PJM RTEP process is codified in PJM’s FERC-approved Operating Agreement and Open Access Transmission Tariff, interregional contractual arrangements also codify specific planning activities between and among PJM and systems north, west and south.

Individual interregional studies may include reliability analysis, market efficiency analysis and interconnection analysis, each study in accordance with a specifically defined scope. PJM performs these studies in collaboration with the planning staffs of adjoining systems. All study scopes and results are reviewed by the appropriate interregional stakeholder bodies to ensure the broadest possible participation.

Within PJM, interregional activities are coordinated with stakeholders through Planning Committee (PC), Transmission Expansion Advisory
Committee (TEAC) and Markets and Reliability Committee (MRC) forums. These stakeholder activities include scope review for upcoming studies and reports of ongoing study developments and results. Results are reviewed for issues and potential projects that may be beneficial to PJM and that should be included in PJM’s own RTEP. In that way, interregional BES transmission plans can be introduced into the PJM RTEP process and, as appropriate, receive Board approval, formalizing their inclusion in PJM’s RTEP.

9.0.2 – Interregional Planning Drivers
Interregional planning is not new to PJM, which has engaged in successful, collaborative interregional studies for decades, many under the auspices of NERC. In recent years, PJM’s interregional planning responsibilities have grown in parallel with the evolution of broader organized markets and interest at the federal level in favor of increased interregional coordination.

Specifically, FERC Order No. 890 included transmission planning requirements to strengthen transparency, openness and interregional coordination. In addition, the U.S. Department of Energy (DOE) identified critically congested areas of the national grid, one of which is the Mid-Atlantic Area National Interest Electric Transmission Corridor (NIETC), as shown on Map 9.2, clearly implicating a region broader than the PJM market. These developments reinforced PJM’s own studies identifying projected grid limitations and needed transmission expansion.
**Public Policy**

PJM continues to engage federal regulators and legislative bodies on issues key to PJM’s future success and ability to serve customers’ growing energy needs, as in Figure 9.1. An increased focus, at both the federal and state levels, continues to make clear the critical role that transmission infrastructure will play in realizing public policy objectives regarding energy independence and climate change mitigation.

An important element of these policies is the integration of renewable resources, wind primarily among them. The growing integration of wind resources, often distant from the load centers they serve, raises significant policy issues regarding the transmission facilities required to connect the two. Additional public policy direction is required to address interregional reliability and economic efficiency, issues which span regions as part of the unfolding broader discussion around integration of wind and other renewable resources. Making this a reality requires that fundamental policy questions be addressed on how much and where transmission should be built and how costs should be recovered.

Recent state programs to encourage energy efficiency and renewable energy – especially wind-powered resources – have greatly expanded the scope of interregional planning initiatives. Several large interregional study efforts within the Eastern Interconnection are already in progress. These include the Eastern Interconnection Planning Collaborative (EIPC), the Eastern Wind Integration Transmission Study (EWITS) and the Joint Coordinated System Planning Study (JCSP).
9.1: Eastern Interconnection Studies

PJM is committed to ongoing efforts to strengthen agreements in order to establish greater interregional planning coordination. Doing so will enable PJM to respond to the changing power system demands under a wide range of possible future end-states. Several of these efforts encompass a wide portion of the Eastern Interconnection.

9.1.1 – Eastern Interconnection Planning Collaborative (EIPC)

During 2009, PJM spearheaded a new comprehensive approach to interregional planning. Partly in recognition of the strong relationship between national policy and the need for electrical infrastructure to support that policy, PJM initiated an unprecedented collaboration of Eastern Interconnection planning entities, known as the EIPC.

This group of 24 Planning Coordinators in the Eastern Interconnection have agreed to initiate technical work necessary to facilitate coordination of existing transmission plans, conduct reliability analyses of their combined systems, and complete studies to support federal, regional, state and provincial public policy goals. This work will leverage existing planning expertise and protocols already employed on a regional basis in the Eastern Interconnection, providing an efficient and timely means of analyzing the entire interconnection as a whole. EIPC participants from across the Eastern Interconnection include several Canadian provinces, Independent System Operators, Regional Transmission Organizations, investor-owned utilities, and municipal and cooperative systems. PJM actively participates in this group through representation on the Executive and Technical Committees. PJM functions as the lead Principal Investigator.

EIPC Status

On December 18, 2009, U.S. Secretary of Energy Steven Chu announced the EIPC had been selected to receive $16 million from the new stimulus funds. In a related award, the DOE also announced $14 million in funding to the Eastern Interconnection States’ Planning Council to assist in developing a consensus process to identify renewable resources and other policy options for input to the analysis by the EIPC’s technical team.

In early 2010, the DOE is expected to initiate what is anticipated to be a short process to finalize the scope and terms and conditions of an agreement to proceed with the DOE award work. Thereafter, the EIPC study process will proceed with the establishment of a Stakeholder Steering Committee and development of computer models and assumptions to be used in the studies. The results of these analysis efforts are expected to be published 2011, with updated results expected in 2013.

Once the DOE scope and agreement are finalized, then the DOE work will be subsumed under and become the near-term focus of EIPC planning activities. Significant synergies are expected between the core work plan concept already initiated by the EIPC and the targeted direction provided by DOE.

9.1.2 – Eastern Wind Integration and Transmission Study (EWITS)

Commissioned by the U.S. Department of Energy (DOE), EWITS is one of the largest regional wind integration studies ever undertaken in the industry. The National Renewable Energy Laboratory (NREL) provides project coordination and a Technical Review Committee (TRC) provides project analysis support. The TRC includes regional electric reliability council representatives, industry subject matter experts, transmission planners, utilities and wind industry representatives.

Background

The TRC has met six times over the 14 month duration of the project to review study progress, comment on study inputs, methods, and assumptions, assist with data collection and review study report drafts. PJM provided planning, operating and market representatives on the TRC. PJM continues to support these types of efforts insofar as they provide an important complement to PJM’s own RTEP process in assessing market and policy impacts on future grid expansion needs.

Study Scope

EWITS objectives are to evaluate the power system impacts, costs, and transmission requirements to increase wind generation capacity to 20 percent and 30 percent of retail electric energy sales in 2024.
The study area includes a large portion of the U.S. Eastern Interconnection including the following systems:

- ISO-New England
- MAPP
- MISO
- New York ISO
- PJM
- Portions of SERC
- SPP
- TVA

The study used detailed hourly Eastern Interconnection wind models developed in previous NREL studies and hypothetical generation expansion scenarios. A transmission overlay was designed to integrate the wind and to achieve a high degree of market efficiency across the Eastern Interconnection. EWITS utilized a transmission expansion method similar to that used in the 2008 JCSP study.

This “top down” transmission method is expected to produce high level results to quantify some of the major parameters associated with various hypothesized future energy scenarios. Overall, the method attempts to approximate the grid capital investment necessary to accommodate hypothesized transfers as roughly balanced by theoretical production cost savings. This provides important results of the conceptual feasibility of large scale generation and transmission grid development.

**Additional Analysis Needed**

More analysis, however, is required for full demonstration of feasibility for a number of reasons, including the following.

- Any identified grid overlay lacks full development of the required additional transmission expansion at the connection points to other voltage levels. Such connection point studies are not inconsequential.
- Additional attention must be paid to optimization. To date, no attempt to develop the minimum transmission infrastructure necessary both to integrate wind resources and the incremental transmission needed to transmit energy output to distant load centers.
- Additional efforts are also needed to identify if each increment of transmission investment in any grid overlay is justified by each additional increment of savings.

PJM supports additional efforts by EWITS especially those that encompass any proposed grid design to address these issues.

**Dependable Capacity**

A major advancement of the EWITS study over prior similar efforts has been the examination of the impact of wind integration on capacity reserves. EWITS is developing and applying new methods to quantify wind contributions to dependable capacity due to the effects of wind variability.

More work may be needed to assess fully the impact of greater wind generation levels on system operability. In particular, impacts on minimum generation and light load scenarios must be assessed. Additional reliability work is expected to examine increased load carrying capability for wind units which depends on specific transmission and wind modeling assumptions. For comparison, PJM’s current capacity value for wind based on actual PJM operating data is 13 percent.

*NOTE*

9.2: PJM / NYISO Focused Study

PJM pursues joint interregional analysis with New York and New England pursuant to the Northeast ISO/RTO Planning Coordination Protocol. 2009 study efforts produced significant advances in the breadth and depth of review. The analysis included the first joint market efficiency modeling of the combined RTO areas. In addition, a reliability review focused on the important interface between Northern Public Service Electric and Gas (PS-N) and Southeast New York (SENY). Rigorous reliability testing included load deliverability and generation deliverability using PJM’s own RTEP analysis tools. A report is expected to be published in the first quarter of 2010.

9.2.1 – Interregional Planning Stakeholder Advisory Committee (IPSAC)

IPSAC reliability analysis in 2009 focused on the critical PJM/NYISO interface located between SENY and PS-N. Specifically, the northern Public Service Electric & Gas and Rockland Electric area of PJM, and the Hudson Valley, Consolidated Edison and Long Island Power Authority areas of NYISO. The analysis examined the combined areas under PJM’s existing reliability testing procedures.

Reliability Analysis

Reliability analysis included screening of NERC Categories A, B and C contingencies. Both a generation deliverability and load deliverability screening tests were performed. No significant reliability issues were identified.

The reliability analysis was conducted on the most current PJM and NY power flow cases. The 2013 study year power flow base case included the following BES backbone and merchant transmission facilities:

- Susquehanna - Roseland 500 kV Circuit
- MAPP (Possum Point - Burches Hill - Chalk Point - Calvert Cliffs 500 kV AC)
- MAPP (Calvert Cliffs - Indian River and Vienna 500 kV DC)
- Branchburg - Roseland - Hudson 500 kV
- PATH (Amos - Kemptown 765 kV)
- TRAIL (502 Junction - Loudoun 500 kV)
- Neptune project modeled at 685 MW export to LIPA
- VFT (PJM Queue G22_MTX) modeled at 330 MW exports to ConEd
- Hudson Transmission Partners (PJM Queue O66) modeled at 670 MW exports to ConEd
- Long Island-to-New England cross sound cable

Generation deliverability testing examined PJM generation queue interconnection projects to assess any cross-border issues. No cross-border reliability criteria violations were identified.

PJM also performed load deliverability study tests, yielding the following results:

- Combined PS-N + RECO + SENY areas: the transfer limit into the area exceeded the reliability transfer objective of 9,180 MW
- Combined PS-N + RECO + NYC areas: The transfer limit into the area exceeded the reliability transfer objective of 8,340 MW

The combined study areas satisfied the load deliverability test.

Market Efficiency

In addition to the reliability analysis, PJM developed a joint system market efficiency model. Simulations produced a review of average nodal prices and congested BES elements. The market efficiency scope also included an evaluation of reliability upgrades identified in the reliability phase. However, because reliability screening did not show a need for upgrades, this portion of the scope was not required. This analysis marked the first attempt at such joint market efficiency modeling. Future efforts are expected to explore regional market efficiency in more detail using both PJM’s nodal PROMOD model and New England’s zonal model, which employs a transportation type transmission model.
9.3: PJM / MISO Studies

**PJM / MISO Joint Operating Agreement**
Provisions of the PJM-MISO Joint Operating Agreement (JOA) provide opportunity for periodic system review in response to inter-RTO, cross-border BES issues. This includes reviews of generation and transmission projects identified by one system with potential reliability impacts on the other.

JOA studies themselves may also identify the need for BES enhancements. Those that meet established cross-border criteria thresholds are then eligible for cross-border cost allocation according to provisions of the JOA. In 2009, FERC approved JOA revisions which addressed cross-border cost allocation for market efficiency upgrades.

9.3.1 – Southwest (SW) Indiana Study
The scope of the SW Indiana Study includes both reliability analysis and economic analysis. Power flow cases were developed to model expected 2014 summer conditions and transmission topology and likewise for 2019.

NERC Category A, B and C contingency sets were tested both for thermal and voltage criteria violations. Initial test results identified a number of 345 kV and 230 kV violations.

Additional power flow and economic analysis is expected to evaluate the benefits of 765 kV and 345 kV BES facilities. These outlets to area generation particularly would be expected to accommodate the impact of approximately 5,000 MW of queued generation in the area.

Additional PV analysis is also anticipated that will stress SW Indiana 345 kV BES facilities by increasing south-to-north power transfers. Voltage performance will be assessed under both expected system conditions and stressed conditions in order to measure the magnitude of operating margin from a reactive perspective.

9.3.2 – Lake Michigan Congestion Study
The “Lake Michigan” study was initiated to examine MISO stakeholder concerns regarding PJM - MISO border area flow gate operational issues. In response, MISO initiated a study to investigate similar issues on all of their borders. PJM’s involvement in this effort is focused on common issues with MISO along the interface between the two systems near Lake Michigan.

The study objective is to identify and implement transmission upgrades to relieve congestion on RTO Seams Flowgates, consistent with tariff provisions and existing regional and interregional processes and protocols. PJM, TVA, SPP and Midwest ISO constrained flowgates are candidates for consideration. This will include flowgates with a history of being constrained as well as those projected to be so into the future.

Expected to commence in January 2010, the study has a targeted completion date of 3rd Quarter 2010 under the auspices of the IPSAC, in accordance with the terms of the PJM / MISO JOA.

* NOTE
More information can be obtained at: http://www.pjm.com/committees-and-groups/stakeholder-meetings/stakeholder-groups/ipsac.aspx
9.4: PJM and Systems South

9.4.1 – PJM - Duke - TVA Interface
This interregional effort was initiated by PJM to examine its interface with TVA and Duke Energy. This is largely an exploratory effort to develop an understanding of the bi-directional strength of interface interconnections. The study will also examine the limitations to economic and emergency transfers across the interface and the potential benefits of reinforcements.

The study scope incorporates a special study to analyze the sensitivity of the interface to the location of large generating units on each side, each with special operational considerations. Traditional transfer analysis will be performed to evaluate thermal, reactive and stability reliability issues. Market efficiency analysis will provide information about potential economic benefits of strengthening the interface. Initiated in 2009, study completion is expected in 2010.

9.4.2 – NC Planning Collaborative Coordination

This collaboration has already provided the opportunity to coordinate and exchange transmission and interchange data, recent transmission and generation expansion plans and load forecasts. In addition, the NC Collaborative and PJM have engaged in discussions to understand and coordinate more effectively the treatment of transmission reservations and available capability for planning studies on seam issues of mutual interest.