



Planning Tools & Challenges

Steven R. Herling
PJM Interconnection, L.L.C.

Load Flow

- PSSE – Siemens analysis tool
- PSLF – GE analysis tool
- TARA – PowerGem analysis tool
- MUST – Siemens analysis tool

Stability

- PSSE – Siemens analysis tool
- DSA Tools – Powertech analysis tool

Short Circuit

- ASPEN – simulation tool and breaker database

Market Efficiency

- Promod / Powerbase Suite – analysis tool and database

Programming

- MATLAB - computationally intensive programming tool
- Python – open source programming language

Visualization

- ArcGIS – Geographical Information System

- PJM has also developed a number of tools that are used extensively as part of the development of the RTEP
 - Generation Deliverability
 - Load Deliverability
 - 15-Year Planning
 - NERC Category C3 (N-1-1)
 - Optimal Power Flow
 - Contingency Helper
 - PRISM – Probabilistic Reliability Index Study Model

- **Generation Deliverability**
 - Automates evaluation of over 7700 single contingencies and 4500 tower line and stuck breaker contingencies
 - Establishes a unique, statistically driven dispatch, based on impact, for each contingency event
- **Load Deliverability**
 - Evaluates expected risk associated with area import capability under emergency condition
 - Statistically derived generation outage conditions
 - Evaluates over 7700 single contingencies

- 15-Year Planning
 - Linear extrapolation for critical contingencies based on load growth or other variables
- NERC Category C3 (N-1-1)
 - Automates evaluation of over 30,000,000 second contingency events
 - Introduces optimal re-dispatch following first contingency

- Database Capabilities
 - Load data
 - Historic load data
 - Planning model templates
 - Resource data
 - Generator performance data
 - Interconnection project data
 - Demand response resource data
 - Transmission infrastructure data
 - Existing infrastructure impedance model
 - Ratings and limiting elements
 - Planned facilities – impedances and in-service dates

- **Database Capabilities**
 - Managing data across different planning process elements
 - Load forecasting
 - Resource adequacy
 - Reliability criteria analysis
 - Market efficiency analysis
 - Interconnection process
- **Model Management**
 - Managing data across the organization
 - Operational models – EMS, outage planning
 - Planning models
 - Markets models – Financial rights

- **Model Management**
 - Comparability across different software tools
 - Must support multiple tools for members
 - In-house tools based on primary production software packages
 - EMS to power flow transfers are problematic
 - Prod cost to power flow transfers are problematic
- **Proprietary generation models**
 - Wind generation models for stability studies
- **Run times for production cost simulations**
 - Need to evaluate multiple contingency lists
- **Ability to model dynamic ratings in production cost simulations**
 - Reactive interface limits are determined in real time – production cost simulation models static thermal proxy

- Eastern Interconnection Analysis
 - Faster tools will help – allow for more large simulations
 - Primary problem will be differing assumptions, methodologies, and approaches to cost allocation
- Renewable Integration
 - Faster tools will help – allow for more large simulations
 - Need to resolve disconnects between planning processes and interconnection processes
 - Need to resolve cost allocation issues
 - Between generation and network load
 - Many different state mandates within RTO boundaries, between RTOs, and between RTO and non-RTO areas