Light Load Reliability Analysis Procedures

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November 9, 2017
Light Load Methodology Revisit Approach

- Power Balance Equation

Load + Generation + Interchange
Light Load Methodology Revisit Approach

• **Load Data**

• Reviewed at August PC

• Statistical Analysis

• Recommend using Median Load Values by PJM Transmission Zone
  – Non normal distributions
Light Load Methodology Revisit Approach

- **Generator Data**
  - Data Gathering is in-progress

- Similar approach to Load Data
  - 3 years of hourly generation data for every PJM generator
  - Calculate capacity factors
    - Consider fuel type
    - Evaluate data for other patterns such as size or zone (e.g. small coal vs large coal)

- Determine how to implement generation dispatch
  - Avoid the granularity of dispatching individual units but also consider that a very broad approach such as by fuel type may miss some important dispatch patterns
Interchange

Following the modeling of the updated load and generation data, solve the power flow and observe the interchange.

Compare the interchange to historical values and determine next steps.
Light Load Methodology Revisit Approach

• Next steps
  – Complete generation data gathering
  – Evaluate generation data and determine a modeling methodology
  – Determine interchange approach
Historic Data Analysis
• Time period: 2014 - 2016

• High voltage alarms by station

• High system voltage emergency procedures

• Zonal load

• Unit Generation
• High voltage alarms distribution
• Statistics about high system voltage emergency procedures
• High voltage alarms vs. emergency procedures
• Zonal load distribution
• Zonal generation distribution
• Capacity factors by fuel
• Comparison with 2022 RTEP Light Load case
• High voltage alarms in PJM real time Operations

• High voltage alarms distribution by Transmission Owner by Month

• Observations
• High voltage alarms in PJM real time Operations

• High voltage alarms distribution by Transmission Owner by Month

• Observations
High Voltage Emergency Procedure by Month

- High voltage emergency procedures in PJM real time Operations
- High voltage alarms distribution by Transmission Owner by Month
- Observations
High Voltage Emergency Procedure by Hour

- High voltage emergency procedures in PJM real time Operations
- High voltage alarms distribution by Transmission Owner by Month
- Observations
High Voltage Alarm vs High Voltage Procedure

- Frequency of High Voltage Alarms and High Voltage Emergency Procedures

- Observations
High Voltage Alarm vs High Voltage Procedure

- Frequency of High Voltage Alarms and High Voltage Emergency Procedures
- Observations
Sample Zonal Load Distribution

- Example zonal load distributions
- Non-normal distributions
- Mean values appropriate
• Average of three years of historical zonal median load
• Frequency of High Voltage Alarms and High Voltage Emergency Procedures

• Observations
Median Zonal Generation by Fuel Type

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<tr>
<th>Year</th>
<th>Battery</th>
<th>Co-Fire</th>
<th>Coal</th>
<th>Gas</th>
<th>Hydro</th>
<th>Nuclear</th>
<th>Other</th>
<th>Petroleum</th>
<th>Solar</th>
<th>Wind</th>
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</tbody>
</table>

Legend:
- Battery
- Co-Fire
- Coal
- Gas
- Hydro
- Nuclear
- Other
- Petroleum
- Solar
- Wind
Average Capacity Factors for Major Fuels

- **Coal**
  - 2014: 41%
  - 2015: 35%
  - 2016: 35%

- **Gas**
  - 2014: 23%
  - 2015: 23%
  - 2016: 23%

- **Nuclear**
  - 2014: 99%
  - 2015: 99%
  - 2016: 99%

- **Wind**
  - 2014: 19%
  - 2015: 19%
  - 2016: 19%
Next Steps

- Discuss interchange with modeling group
- Apply revised draft modeling assumptions on light load case
- Perform light load simulations on a revised case
- Compare and verify results with historic voltage issues