Real-Time Operational Considerations
Objectives

Students will be able to:

• Identify the various conditions and considerations for operating during real-time

• Describe the process for maintaining voltage schedules & guidelines at PJM

• Identify the reporting guidelines and process for Instantaneous Reserve Check (IRC)
System Dispatching in Real-Time Operations
When to Notify PJM

• Generation owners planning to run generation resources are required to call the PJM Control Center at least 20 minutes prior to bringing the unit online.

• Generation owners must also notify PJM when:
  – Any change in MW output (assumes unit is not following SCED)
  – Coming offline
Unit Hourly Updates

- If a status changes during real-time (for example, the unit limits change), the Operating Company uses the Unit Hourly Updates web page to provide the updated status.
Deviations from Day-ahead Market for Pool Scheduled Resources

• If a generation resource has been scheduled in the Day-ahead Market and wishes to deviate from that schedule (i.e. not run), the generation owner should contact the PJM Scheduling Coordinator to determine the ramifications of this course of action. The generation owner will always be responsible for all imbalance and operating reserve charges
  – If the PJM Master Coordinator determines that the generation resource is not needed for reliability purposes for the operating day, the generation owner can decide to not run the resource and no forced outage will be incurred.
  – If the PJM Master Coordinator determines that the resource is needed for reliability purposes, he/she will inform the generation owner. The generation owner may still elect to not run the resource, but a forced outage for the duration of the scheduled operation of the resource will be generated.

• The guideline for notifying PJM of deviations for pool scheduled resources will be the greater of the notification time plus time to start or 45 minutes
Unit Problems in Real-Time Operations
**Unit Problems**

*Events that can influence Unit Operation*

- Governor Control
- Blocked Governor
- AVR/PSS Out of Service
- Unable to Maintain Reactive Output
Governor Control

• Mechanism that senses machine speed and adjusts the input to the prime mover to change the mechanical power output of the machine to compensate for changes in load restoring frequency to nominal value
  
  – **Fossil Unit:** Controls the input of steam to the high pressure stage of the turbine
  
  – **Hydroelectric Unit:** Controls the flow of water into the hydraulic turbine
  
  – **Combustion Turbine Unit:** Controls the amount of fuel flow into the combustor
  
  – **Wind Turbine:** Controls the pitch of the blades
• Blocking the governor bypasses the governing feedback mechanisms maintaining the generator at a fixed output level
  – System instability can occur since fewer units will be able to respond to deviation in frequency
  – Longer period of time is needed to restore system frequency to normal
Blocked Governor

• Blocking a governor:
  - Notify PJM’s Generation Dispatcher verbally of the outage
  - Create and submit an eDART ticket to notify PJM of an outage to the governor on the unit
  - Initiate the associated eDART governor ticket by submitting a “Start” time for the equipment outage
  - Update the unit status in Markets Gateway

• Placing a governor in service:
  - Notify PJM’s Generation Dispatcher verbally of the governor being placed into service
  - Close out the associated eDART governor ticket by submitting an “End” time for the equipment outage
  - Update the unit status in Markets Gateway
Generator AVR/PSS Status Reporting

• Per NERC Standard VAR-002-3
  – R3. Each Generator Operator shall notify its associated Transmission Operator within 30 minutes of:
    • R3. Any status change on a generator’s AVR, power system stabilizer, or alternative voltage controlling device
    • R4. Becoming aware of a change in generator reactive capability due to factors other than a status change described in Requirement R3

• Reporting of AVR status and Reactive Capability changes accomplished via eDART generator reporting
Generator AVR/PSS Status Reporting

• PJM Manual 14-D;
  – Whenever a PJM unit’s Automatic Voltage Regulation (AVR) status is off (or is planned to be off), the generator’s owner/operator must immediately enter a ticket via eDART
    • Excluding the time period when a generator is in the startup or shutdown mode
  – For real-time changes, the generator’s owner/operator must also notify the PJM Power Dispatcher (PD) and the respective TO by phone
Generator AVR/PSS Status Reporting

• PJM Manual 14-D:
  – Generation Owners/Operators must coordinate any voltage schedule issues with PJM and the TO
    • Includes issues with stability, automatic voltage regulator, and power system stabilizer outages
  – If automatic voltage regulating devices are out-of-service, the Generator shall provide manual voltage regulation to maintain the prescribed voltage schedule
Generator AVR/PSS Status Reporting

• PJM Manual 14-D:
  – The Generator must notify PJM and the TO with as much lead-time as possible prior to performing all voltage regulator and power system stabilizer maintenance
  – Notifications of unplanned outages on automatic voltage regulators (AVR) and/or power system stabilizers (PSS) must be communicated to PJM and the TO as soon as possible but no later than within 30 minutes of the occurrence
  – For modeling accuracy the provision of telemetered AVR and PSS status points by Generator Operators to PJM is preferred
What Reactive Reserve information is reported?

• MOCs/GOs must report to the TO and PJM any limitation or restriction on their unit which would prevent it from being able to follow it’s reactive capability curve as recorded in eDART
  – Unless an eDART ticket already exists documenting the condition

• Submit an updated capability curve via eDART
Voltage Schedules
Voltage Limits

• Established by equipment manufacturers
  – Affected Equipment
    • Motors
    • Transformers
    • Generators
    • Loads
    • Capacitors

• ANSI Standards provide basis for voltage schedules
  • 97.5% - 105.0% Normal
  • 95.0% - 105.8% Emergency
  • These limits are for customer voltage
Purpose Of PJM Voltage Limits

• Voltage limit
  – Maintain system reliability
    • High voltage limit protects equipment from damage
    • Low voltage limit protects system from voltage instability and equipment damage
High Voltage Causes

• Causes of High Voltage
  – Light loads
    • Caused by excess line capacitance
    • Voltage rise in area rather than a single bus
  – Switching in a line with high capacitive charging current
    • Reactive supplied by charging of line
  – Other
    • Voltage regulation malfunction
    • Excess VAR sources on system
Low Voltage Causes

• Causes of Low Voltage
  – Excessive VAR loading
    • Typically over an area, not a single bus
  – Voltage regulation equipment malfunction
    • Generator voltage regulator may fail
    • Transformer tap hang-up
    • Typically at a single bus, not an area
    • May result in an imbalance in MVAR flows or circulating MVAR
  – Geo-Magnetic Disturbances
    • Increased VAR requirement in system
      ▪ Var absorption by EHV transformers
Consequences of deviations from voltage limits

- High voltage
  - Light bulb life decreased
  - Electronic devices life decreased

- Low voltage
  - Dim lights
  - Slow heating of heating devices
  - Difficulty starting motors
  - Overheating/damage to motors
**Voltage Schedules**

- NERC Standard VAR-001-4:
  - Each TOP shall:
    - Specify a voltage or reactive power schedule
    - Provide the schedule to the GOP
    - Direct them to follow it with AVR in service
    - Provide the GOP with the notification requirement for deviations from the schedule
    - Provide the criteria used to develop the schedules

- The TO/TOP Matrix identifies shared or assigned responsibilities
Voltage Schedules

• PJM:

  – Requires the following subset of generators to follow voltage schedules:
    • Individual generating units greater than 20 MVA
    • Generators that aggregate to 75MVA or greater that are connected to a common bus
    • Black start generators
    • Any other Generation Owners/Operators that request a voltage schedule
Voltage Schedules

- **PJM:**
  - Will define exception criteria
    - Reactive and Power Factor Schedules are considered as exceptions
  - Requires PJM Transmission Owners to notify generators if writing of TO voltage schedules or PJM default schedule
    - If the TO does not provide a TO voltage schedule to a generator in their zone they must notify PJM and PJM will notify generator in writing of PJM default voltage schedule

<table>
<thead>
<tr>
<th>Voltage Level (kV)</th>
<th>765</th>
<th>500</th>
<th>345</th>
<th>230</th>
<th>161</th>
<th>138</th>
<th>115</th>
<th>69</th>
<th>66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule (kV)</td>
<td>760.0</td>
<td>525.0</td>
<td>350.0</td>
<td>235.0</td>
<td>164.0</td>
<td>139.5</td>
<td>117.0</td>
<td>70.0</td>
<td>67.0</td>
</tr>
<tr>
<td>Bandwidth (+/- kV)</td>
<td>+/- 10.0</td>
<td>+/- 8.0</td>
<td>+/- 7.0</td>
<td>+/- 4.0</td>
<td>+/- 4.0</td>
<td>+/- 3.5</td>
<td>+/- 3.0</td>
<td>+/- 2.0</td>
<td>+/- 1.5</td>
</tr>
</tbody>
</table>
Voltage Schedules

• **PJM will direct:**
  
  – Deviations from default voltage schedules based system conditions
  
  – Generators to adjust voltage schedules if such a direction adversely impacts the units MW output
  
  – Generator to come online or remain online in the condensing or generating mode to provide voltage support

• **TO (via TO/TOP Matrix) can:**
  
  – Request generators to adjust MVAR output within the prescribed voltage schedule
Voltage/Schedule Adjustments

230 kV Schedule: 235 kV +/- 4 kV

TO can direct changes *within* the approved schedule.

PJM will direct changes *outside* the approved schedule.

- 239 kV
- 235 kV
- 231 kV
Identify How Generator Owners Are Informed of Their Voltage Schedules

• Generation Owner/Operator shall:
  – Follow the voltage schedule with the AVR in service
    • If AVR is out of service, GO/GOP must notify PJM and TO
  – Communicate voltage schedule concerns to PJM via the PJM TO for resolution
    • If there are additional reserves based on D-Curve:
      ▪ Generator is required to notify PJM and the TO that they cannot maintain their assigned voltage schedule and provide updated D-Curve via eDART
    • If operating at full lead or full lag MVAR based on submitted D-Curve:
      ▪ Generator is required to notify PJM and the TO that they cannot maintain their assigned voltage schedule
      ▪ PJM will determine if MW reduction is required in order for unit to adjust MVAR output to maintain voltage schedule
Instantaneous Reserve Check (IRC)
• IRC is used to verify PJM’s reserve situation
  – **ALL** generators must validate/update their reserve information to PJM when requested
  – A minimum of one request via PJM All-Call before each daily peak
    • Usually 30 to 45 minutes prior to the peak
  – Could be more than 2 requests in a day depending on system conditions
    • Establish benchmarks which can be used to estimate reserves
    • Determine if reserve shortages exist and what if any emergency procedures should be declared
PJM Instantaneous Reserve Check

• Expectations:
  – Receive accurate member information “Instantly”
    • Data accuracy – maintain hourly updates in Markets Gateway
The following reserve information must be validated for each control area in which a member has generation resources located:

- Operating Reserve
- Synchronized Reserve
- Quick Start
  - Hydro
  - Other
- Supplemental
IRC Tool Usage

• Company Reserve Data (Self-Check tool):
  – Display of PJM view of company reserve data
  – Updated every 5 minutes
  – Available only when IRC is not in progress

• IRC Submission
  – User can acknowledge reserve values displayed
  – User can submit reserve values and acknowledge submissions
IRC values can be verified, changed and acknowledged in the IRC screen.
## IRC Company Data

**Company:** [Redacted]  
**Request Timestamp:** 05/14/2018 16:17  
**Date Updated:** 05/25/2018 14:11  
**User Name:** [Redacted]  
**Posted Timestamp:**

### Company Totals

<table>
<thead>
<tr>
<th>Time Range</th>
<th>Reserve Category</th>
<th>PJMCZ</th>
<th>TEST_CZ</th>
<th>AP</th>
<th>AEP</th>
<th>DAY</th>
<th>DLCO</th>
<th>CE</th>
<th>DOM</th>
<th>CE_OLD</th>
<th>RTO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0m-30m</td>
<td><strong>OPERATING Reserve</strong></td>
<td>* 162</td>
<td>0 * 5</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>* 177</td>
</tr>
<tr>
<td></td>
<td>PRIMARY Reserve</td>
<td>* 142</td>
<td>0 * 5</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>* 157</td>
</tr>
<tr>
<td></td>
<td>SYNCHRONIZED Reserve</td>
<td>* 118</td>
<td>0 * 5</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>* 133</td>
</tr>
<tr>
<td>0m-10m</td>
<td>Non-synchronized Reserve (Quick Start)</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>-- NSR Hydro</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>-- NSR Other</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10m-30m</td>
<td>Secondary Reserve</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>30m-180m</td>
<td>Beyond Secondary</td>
<td>101</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>101</td>
</tr>
</tbody>
</table>
## IRC Unit Data

### IRC Company Unit Data

If you do not wish to acknowledge any unit, please uncheck the acknowledge check box prior to clicking Recalc/Submit.

<table>
<thead>
<tr>
<th>Unit Name</th>
<th>ACAP</th>
<th>Unit Type</th>
<th>Zone</th>
<th>Eco Max</th>
<th>Real-Time MW</th>
<th>Regulating</th>
<th>Synchronized Reserves</th>
<th>Quick Start NSR</th>
<th>Secondary</th>
<th>Beyond Secondary</th>
<th>Acknowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUG Unit 1</td>
<td>33</td>
<td>Nug</td>
<td>PN</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>87</td>
<td>✅</td>
</tr>
<tr>
<td>Diesel Unit 1</td>
<td>12</td>
<td>Diesel</td>
<td>PS</td>
<td>0</td>
<td>11</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>✅</td>
</tr>
<tr>
<td>NUG Unit 2</td>
<td>227</td>
<td>Nug</td>
<td>JC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>279</td>
<td>□</td>
</tr>
</tbody>
</table>
# IRC Process Review

## Normal Operations

- Review Company Reserve Data
  - Is Reserve Data correct?
    - No → Contact: irc_help@pjm.com
    - Yes → No Additional Action Required

## IRC In-Progress

- Are reserve values correct?
  - No → Correct values and select "Submit"
    - No Additional Action Required
  - Yes → "Acknowledge" Reserve Values
    - No → Report Issues
    - Yes → Review Report
      - Are there any issues?
        - No → Follow-up with PJM
        - Yes → No Additional Action Required
Some Notes!

• Reserve quantities should reflect current regulation assignments

• If a Maximum Generation Alert is issued and Maximum Emergency Generation is called into the capacity, Emergency Maximum should be used in place of Spin Max or Economic Maximum

• TTS = Time to start (Notification Time + Startup)

• Eco Max value used in calculations ONLY when no Spin Max value is provided
Operating Reserves

• Operating Reserves: Offline + Online
  – Offline (the lesser of):
    • Offline Spin Max
    • Spin Ramp Rate X (30 min – TTS)

  **NOTE:** Offline Reserve Units that have a (Notification + TTS) ≤ 30 minutes shows should be included

  – Online (the lesser of):
    • Ramp rate x 30 minutes
    • Spin Max – Current MW level
### Operating Reserves Example

<table>
<thead>
<tr>
<th>Gen</th>
<th>Fuel Type</th>
<th>Emerg. Min</th>
<th>Eco Min</th>
<th>Eco Max</th>
<th>Emerg Max</th>
<th>Current MW output</th>
<th>Spin Ramp Rate MW/Min</th>
<th>Notification &amp; TTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amus</td>
<td>Hydro</td>
<td>10</td>
<td>15</td>
<td>180</td>
<td>200</td>
<td>80</td>
<td>20</td>
<td>10 Min</td>
</tr>
<tr>
<td>Grange</td>
<td>CT</td>
<td>0</td>
<td>0</td>
<td>600</td>
<td>600</td>
<td>0</td>
<td>10</td>
<td>5 Min</td>
</tr>
</tbody>
</table>

- Calculate the Operating Reserves for the Amus and Grange units
  - **Amus**, Online Unit
    - \((\text{Spin Ramp Rate} \times 30 \text{ Min}) = (20 \text{ MW} \times 30 \text{ min}) = 600 \text{ MW}; \text{ or}\)
    - \((\text{Eco Max} – \text{Current Output}) = (180 \text{ MW} – 80 \text{ MW}) = 100 \text{ MW}\)
  - **Grange**, Offline Unit
    - Eco Max = 600 MW; or
    - \((\text{Spin Ramp Rate} \times (30 \text{ min} – \text{TTS})) = 10 \times (30 \text{ mins} – 5 \text{ mins}) = 250 \text{ MW}\)
Synchronized Reserves

- Synchronized Reserve
  - Synch Reserve = lesser of:
    - $Spin \text{ Ramp Rate} \times 10 \text{ min}$
    - $Spin \text{ Max} – current MW level$
**Synchronized Reserves Example**

- Calculate the Synchronized Reserves for the Amus and Grange units
  
  - **Amus:**
    - \((\text{Spin Ramp Rate} \times 10 \text{ Min}) = (20 \text{ MW} \times 10) = 200\text{MW};\text{ or}\)
    - \((\text{Eco Max} – \text{Current output}) = (180 \text{ MW} – 80 \text{ MW}) = 100 \text{MW}\)
  
  - **Grange:**
    - 0 MW – Offline Unit
Quick Start Non Synchronized Reserves

- Quick Start NSR
  - Offline Reserve Units that have a (Notification + TTS) ≤ 10 minutes should be included
  - Quick Start Reserve = lesser of:
    - $Spin\ Max$
    - $Spin\ Ramp\ rate \times (10\ min - TTS)$
Quick Start NSR Example

- Calculate the Quick Start Reserves for the Grange unit
  - Grange:
    - Eco Max = 600 MW
    - Spin Ramp rate * (10 min – TTS)
      - $(10 \text{ MW} \times (10 \text{ min} - 5 \text{ min})) = (10 \text{ MW} \times 5 \text{ Min}) = 50 \text{ MW}$
Secondary Reserves

Secondary Reserve = Operating Reserve – Primary Reserve

• Supplemental Reserve for Amus & Grange:
  – \(((\text{Amus Operating} + \text{Grange Operating}) – (\text{Amus Primary} + \text{Grange Primary}))\)
    • \(((100 \text{ MW} + 250 \text{ MW}) – (100 \text{ MW} + 50 \text{ MW})) = (360 \text{ MW} – 160 \text{ MW}) = 200\text{MW}\)
Once data is received from Member, PJM determines:

- PJM Operating Reserve
- Adjusted Primary Reserve vs. requirement
- Adjusted Synchronized Reserve vs. requirement
- Unaccounted for capacity
- Area Synchronized Reserve levels

PJM compares values calculated from Member data to reserve requirements to determine deficiencies.

PJM report results to Members via eDART.
PJM Instantaneous Reserve Check

- eDART is the tool used to report Reserve information.
# PJM Instantaneous Reserve Check

<table>
<thead>
<tr>
<th>Unit Name</th>
<th>ACAP</th>
<th>Unit Type</th>
<th>Control Zone</th>
<th>Eco Max</th>
<th>Real-Time MW</th>
<th>Ramp Rate MW/Min</th>
<th>Notification and TTS (minutes)</th>
<th>Regulating</th>
<th>Synchronized Reserves</th>
<th>Quick Start NSR</th>
<th>Secondary</th>
<th>Beyond Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbus</td>
<td>200</td>
<td>Hydro</td>
<td>AEP</td>
<td>225</td>
<td>0</td>
<td>25</td>
<td>5</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lexington</td>
<td>688</td>
<td>Fossil</td>
<td>AEP</td>
<td>700</td>
<td>680</td>
<td>8</td>
<td>360</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedford</td>
<td>290</td>
<td>CC</td>
<td>AP</td>
<td>300</td>
<td>210</td>
<td>15</td>
<td>20</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elmwood</td>
<td>1200</td>
<td>Nuclear</td>
<td>CE</td>
<td>1200</td>
<td>1200</td>
<td>5</td>
<td>2880</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitehouse</td>
<td>400</td>
<td>Hydro</td>
<td>DAY</td>
<td>400</td>
<td>0</td>
<td>30</td>
<td>14</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleasantville</td>
<td>66</td>
<td>CT</td>
<td>DLCO</td>
<td>70</td>
<td>45</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richmond</td>
<td>585</td>
<td>CT</td>
<td>DOM</td>
<td>600</td>
<td>0</td>
<td>50</td>
<td>7</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corolla</td>
<td>24</td>
<td>CT</td>
<td>DOM</td>
<td>25</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elizabeth</td>
<td>550</td>
<td>Fossil</td>
<td>PJMCZ</td>
<td>590</td>
<td>410</td>
<td>12</td>
<td>720</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>1147</td>
<td>Fossil</td>
<td>PJMCZ</td>
<td>1150</td>
<td>620</td>
<td>10</td>
<td>1200</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PJMCZ©2018
Given the portfolio:

- Fill out the IRC data in eDART with the following values:
  - Synchronized Reserve
  - Quick Start NSR
  - Secondary
  - Beyond Secondary
<table>
<thead>
<tr>
<th>Unit Name</th>
<th>ACAP</th>
<th>Unit Type</th>
<th>Control Zone</th>
<th>Eco Max</th>
<th>Real-Time MW</th>
<th>Ramp Rate MW/Min</th>
<th>Notification and TTS (minutes)</th>
<th>Regulating</th>
<th>Synchronized Reserves</th>
<th>Quick Start NSR</th>
<th>Secondary</th>
<th>Beyond Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columbus</td>
<td>200</td>
<td>Hydro</td>
<td>AEP</td>
<td>225</td>
<td>0</td>
<td>25</td>
<td>5</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lexington</td>
<td>688</td>
<td>Fossil</td>
<td>AEP</td>
<td>700</td>
<td>680</td>
<td>8</td>
<td>360</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bedford</td>
<td>290</td>
<td>CC</td>
<td>AP</td>
<td>300</td>
<td>210</td>
<td>15</td>
<td>20</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elmwood</td>
<td>1200</td>
<td>Nuclear</td>
<td>CE</td>
<td>1200</td>
<td>1200</td>
<td>5</td>
<td>2880</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whitehouse</td>
<td>400</td>
<td>Hydro</td>
<td>DAY</td>
<td>400</td>
<td>0</td>
<td>30</td>
<td>14</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleasantville</td>
<td>66</td>
<td>CT</td>
<td>DLCO</td>
<td>70</td>
<td>45</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richmond</td>
<td>585</td>
<td>CT</td>
<td>DOM</td>
<td>600</td>
<td>0</td>
<td>50</td>
<td>7</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corolla</td>
<td>24</td>
<td>CT</td>
<td>DOM</td>
<td>25</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elizabeth</td>
<td>550</td>
<td>Fossil</td>
<td>PJMCZ</td>
<td>590</td>
<td>410</td>
<td>12</td>
<td>720</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lebanon</td>
<td>1147</td>
<td>Fossil</td>
<td>PJMCZ</td>
<td>1150</td>
<td>620</td>
<td>10</td>
<td>1200</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Instantaneous Reserve Check Tool

• The Instantaneous Reserve Check (IRC) is used to verify the PJM reserve situation at a given moment in time

• Unit by Unit Design:
  – Reserve data is pre-populated from PJM Markets and EMS systems on a Unit by Unit basis
  – User option to acknowledge reserve values: all units or per unit
  – User entry fields to submit changes to reserve values

• IRC Self-Check:
  – Display of current reserve data when IRC is not in progress

IRC_help@pjm.com
Instantaneous Reserve Check

- Company Reserve Data:
  - Display of PJM view of company reserve data
  - Updated every 5 minutes
  - Available only when IRC is not in progress

- IRC Submission
  - User can acknowledge reserve values displayed
  - User can submit reserve values and acknowledge submissions
Company Reserve Check

### Company Reserve Self-Check

**Company:**

**User Name:**

**Request Timestamp:** 06/05/2018 07:38

**Data Updated:** 06/11/2015 14:25

---

### Company Totals

<table>
<thead>
<tr>
<th>Time Range</th>
<th>Reserve Category</th>
<th>PJM</th>
<th>ZC</th>
<th>TEST</th>
<th>C2</th>
<th>AP</th>
<th>AEP</th>
<th>DAY</th>
<th>DLCO</th>
<th>CE</th>
<th>ATSI</th>
<th>DEOK</th>
<th>ERPC</th>
<th>DOM</th>
<th>RTO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0m-30m</td>
<td>OPERATING Reserve</td>
<td>3578</td>
<td>27</td>
<td>1915</td>
<td>370</td>
<td>41</td>
<td>966</td>
<td>975</td>
<td>197</td>
<td>173</td>
<td>438</td>
<td>749</td>
<td>5926</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRIMARY Reserve</td>
<td>1296</td>
<td>23</td>
<td>434</td>
<td>157</td>
<td>49</td>
<td>325</td>
<td>322</td>
<td>146</td>
<td>37</td>
<td>562</td>
<td>3341</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SYNCHRONIZED Reserve</td>
<td>776</td>
<td>17</td>
<td>45</td>
<td>157</td>
<td>48</td>
<td>325</td>
<td>320</td>
<td>146</td>
<td>37</td>
<td>419</td>
<td>2281</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-synchronized Reserve</td>
<td>320</td>
<td>5</td>
<td>389</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>153</td>
<td>1068</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NSR Hydro</td>
<td>223</td>
<td>6</td>
<td>389</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>153</td>
<td>761</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NSR Other</td>
<td>229</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>291</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10m-30m</td>
<td>Secondary Reserve</td>
<td>2282</td>
<td>4</td>
<td>1481</td>
<td>213</td>
<td>1</td>
<td>641</td>
<td>657</td>
<td>52</td>
<td>401</td>
<td>187</td>
<td>519</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30m-180m</td>
<td>Beyond Secondary</td>
<td>1810</td>
<td>29</td>
<td>179</td>
<td>105</td>
<td>15</td>
<td>1636</td>
<td>724</td>
<td>181</td>
<td>0</td>
<td>519</td>
<td>5248</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Note:** Regulation assignments should not be included in the Synchronized Reserves unless the reserve is beyond the regulation bandwidth.

**All numbers on this form have been rounded for display.**

---

### Unit Data

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Unit Name | ACAP | Unit Type | Zone | Eco | Real | MW | Time | MW | Regulating | Synchronized | Reserves | Quick | Start | NSR | Secondary | Beyond | Secondary |
| 0          | 0    | 134      | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 909      | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |
| 0          | 0    | 0        | 0    | 0   | 0    | 0  | 0    | 0  | 0            | 0          | 0        | 0    | 0    | 0    | 0     | 0    |

---

PJM©2018

10/8/2018
Questions?
Resources and References

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.