Manual 21
“Rules and Procedures for Determination of Generating Capability”
Proposed Changes - Part #3

Jerry Bell
Resource Adequacy Department
Operating Committee
June 5th, 2018
Changing from Average to Median Capacity Factors

• How can a generator retain its CIRs in the change to the median capacity factor?
  – CIRs will be lost September 1, 2024 @0000 hours (after 3 years using the median)
    • Wind and solar unit owners have more than six years to prepare for the change
    • Wind and solar unit owners should already be aware of their units median and average capacity factors
  – Generators subject to CIR loss can sell them or use them for another project per the OATT section 230.4
    “Transfer of Capacity Interconnection Rights:”
    • Capacity Interconnection Rights may be sold or otherwise transferred subject to compliance with such
      procedures as may be established by the Transmission Provider regarding such transfer and notice to the
      Transmission Provider of any generation facilities that will use the Capacity Interconnection Rights after the
      transfer. The transfer of Capacity Interconnection Rights shall not itself extend the periods set forth in Section
      230.3 regarding loss of Capacity Interconnection Rights.
    – Official notice of this action must be received by PJM no later than August 31, 2024 and these CIRs must
      be used in a interconnection queue project no later than one year after the date of the aforementioned
      official notice from the generator (similar to the reuse of CIRs when a unit is retired).
    – The CIRs must be used at the same POI

www.pjm.com
<table>
<thead>
<tr>
<th></th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PJM Summer Peak</strong> (occurrences since 1980)</td>
<td>3</td>
<td>20</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td><strong># of 5CP (since 1998)</strong></td>
<td>11</td>
<td>49</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td><strong># of 5CP greater than the W/N Peak (since 1998)</strong></td>
<td>0</td>
<td>15</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong># of times 5CPs occurred in same month (since 1998)</strong></td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong># of times 4CPs occurred in same month (since 1998)</strong></td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

If an overwhelming majority of PJM peaks occur during July and August shouldn’t we confine capacity verification testing to those months?
Observations from the prior slide

- Net generation drops as cooling body temperature rises due to the use of helper cooling towers.
  - Helper cooling tower load is enormous compared to once thru cooling and/or natural draft cooling towers
- The corrected unit test value is similar to what is experienced during summer conditions
  - On the plot where the actual river temperature, rated river temperature and net generation lines meet
- Summer 2017 was cooler than average
- As river temperature increases, generator capability wanes, but the majority of the capability decrease can be attributed to the cooling towers that are placed in service incrementally as river temperature increases and control of thermal discharge is needed
- Aux load (other than cooling tower load) is rather flat across the whole summer
- Helper cooling tower performance is a function of the wet bulb temperature
- Any generator with supplemental/mechanical cooling may be incorrectly determining their ICAP because they may be disregarding the load of mechanical cooling under summer conditions
### Plant Verification Test Example
#### Three 300 MW units
##### 2017 test data

<table>
<thead>
<tr>
<th></th>
<th>Unit #1 Gross MW</th>
<th>Unit #1 Aux MW</th>
<th>Unit #1 Net MW</th>
<th>Common or Startup Load</th>
<th>Unit #2 Gross MW</th>
<th>Unit #2 Aux MW</th>
<th>Unit #2 Net MW</th>
<th>Unit #3 Gross MW</th>
<th>Unit #3 Aux MW</th>
<th>Unit #3 Net MW</th>
<th>Station Gross MW</th>
<th>Station Use MW</th>
<th>Station Net MW</th>
<th>Aux, Common or Startup Load not considered</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Test Data</strong></td>
<td>337.0</td>
<td>37.0</td>
<td>300.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Meter Data</strong></td>
<td>338.7</td>
<td>17.4</td>
<td>321.3</td>
<td>39.5</td>
<td>0.9</td>
<td>-0.9</td>
<td>0.0</td>
<td>0.9</td>
<td>-0.9</td>
<td>338.7</td>
<td>58.8</td>
<td>279.9</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td><strong>Telemetry Data</strong></td>
<td>335.6</td>
<td>21.9</td>
<td>313.7</td>
<td>40.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>335.6</td>
<td>62.6</td>
<td>273.0</td>
<td>25.6</td>
<td></td>
</tr>
<tr>
<td><strong>Actual Test Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Meter Data</strong></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>17.3</td>
<td>306.8</td>
<td>6.8</td>
<td>300.0</td>
<td>0.0</td>
<td>0.6</td>
<td>-0.6</td>
<td>306.8</td>
<td>24.7</td>
<td>282.1</td>
<td>17.7</td>
</tr>
<tr>
<td><strong>Telemetry Data</strong></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>17.0</td>
<td>306.5</td>
<td>7.0</td>
<td>299.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>306.5</td>
<td>24.1</td>
<td>282.5</td>
<td>17.2</td>
</tr>
<tr>
<td><strong>Actual Test Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Meter Data</strong></td>
<td>132.1</td>
<td>9.9</td>
<td>122.3</td>
<td>22.3</td>
<td>0.0</td>
<td>0.3</td>
<td>-0.3</td>
<td>300.0</td>
<td>0.0</td>
<td>300.0</td>
<td>432.1</td>
<td>32.5</td>
<td>399.6</td>
<td>13.4</td>
</tr>
<tr>
<td><strong>Telemetry Data</strong></td>
<td>128.5</td>
<td>11.8</td>
<td>116.7</td>
<td>22.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>308.0</td>
<td>7.9</td>
<td>300.1</td>
<td>436.6</td>
<td>42.6</td>
<td>394.0</td>
<td>13.9</td>
</tr>
</tbody>
</table>
Verification Test Issues

• Generators may not be properly rating their units (determining ICAP)
  – They may not be considering supplemental load
  – They may not be considering common load or other load
  – They may be using the nameplate rating rather than rating their unit at conditions expected at the time of the PJM Peaks (RAA, Schedule 9.C)

• Generators may not be properly accounting for aux load while testing
  – They may not be considering load on the common or startup bus
  – They may not transfer all load to the aux bus from the common or startup bus

• The solution is to test all units at the plant simultaneously
  – The new version of Manual 21 will require simultaneous testing of all units at a plant
  – Up to ten plants per summer
  – Within a minimum two week period of time delineated by PJM prior to the beginning of the summer test period
Summer Testing Period Changing

• The summer testing period will change:
  – From June 1 through August 31 to *July 1 through August 31*

• Reasons for the change:
  – PJM summer peaks occur most often in July and August (90%)
  – June ambient conditions allow generators to overstate their units capabilities
  – If tests are conducted nearer the PJM peaks
    • Ambient corrections for performance will be smaller; auxiliary load may be greater
    • Test conditions will be nearer summer conditions
      – Summer conditions are site conditions coincident with the dates and times of the last 15 years PJM Summer Peaks
  • Supplemental cooling is more likely to be in service
  • Thermal discharge limits are more likely to be reached or in need of control
  • This will get plants closer to the conditions under which they should be rated (RAA, Schedule 9)
    – Expected summer conditions
Manual 21 update schedule

- PC first read and redline: 9/13/2018
- MRC first read and redline: 9/27/2018
- PC endorsement: 10/11/2018
- MRC endorsement: 10/25/2018
- Manual 21 effective date: 11/1/2018