Summary of Generator Deliverability Test Modifications at the PC: Light Load, Summer & Winter

Purpose of PC Discussions

- Consider the evolving resource mix in PJM's planning process
  - In the RTEP Baseline Studies
  - In the Interconnection Studies

- Support operational flexibility

- Incorporate other miscellaneous improvements to the existing light load and winter generator deliverability tests

Background

- At the PC, PJM will be proposing modifications to each of the generator deliverability tests*.
  - Procedures have been relatively unchanged for many years.
  - Multiple reasons for an update including the need to better account for expected higher variability in dispatches under increased renewable penetration.
- Efforts to improve voltage testing to better account for operational concerns will be pursued separately.

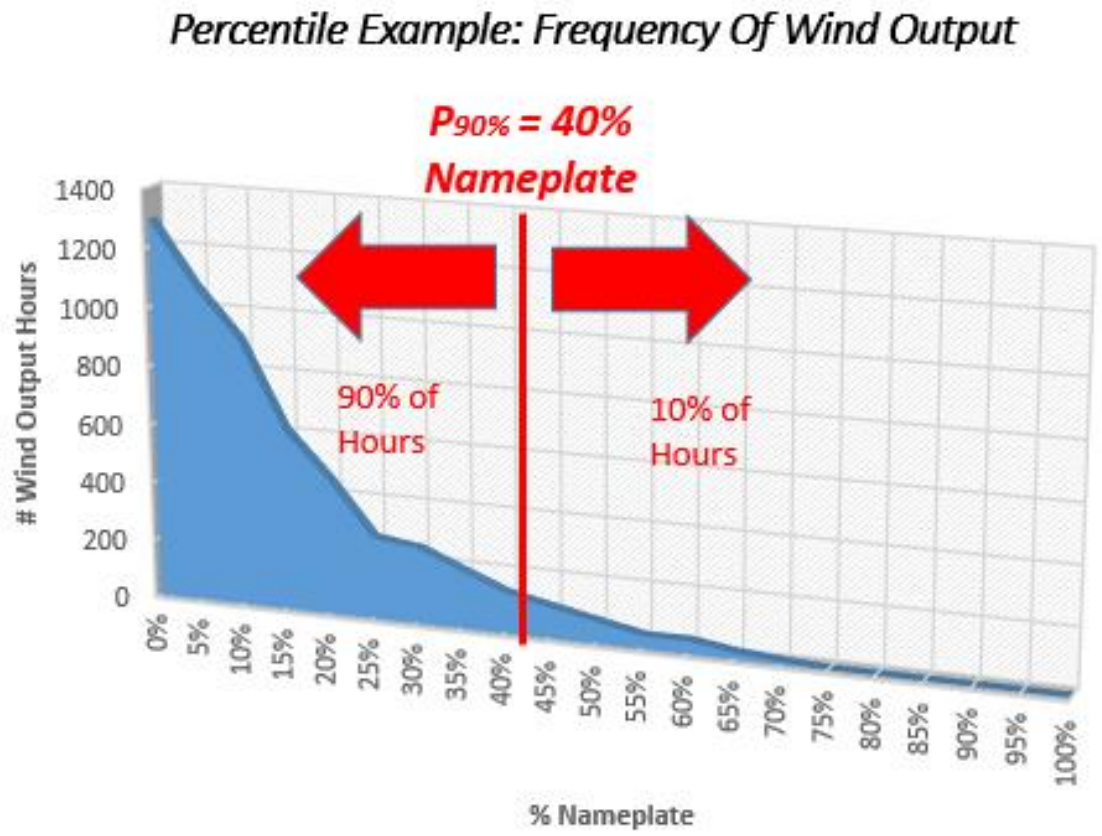
*https://www.pjm.com/-/media/committees-groups/committees/pc/2021/20211005/20211005-item-09a-generator-deliverability-test-modifications-manual-14a-14b-update.ashx

New Concepts

- The proposed changes to the generator deliverability test will use a few terms and concepts that warrant a brief overview.
- Deliverability Requirement: The ability of the transmission system to support the delivery to load of a specified MW injection at a location.
  - A prerequisite to the award of CIRs
  - Applicable to individual Capacity Resources, e.g. the deliverability requirements of a new queue unit
  - Also applicable to combinations of Capacity Resources, e.g. the deliverability requirements of all reasonably expected combinations of CIRs
  - Applicable to summer, winter and light load generator deliverability testing

New Concepts

- Percentiles: Represent the percentage of output hours with output levels below a particular output level.
- Example: if the $P_{90\%}$ (90^{th} percentile) of onshore wind outputs is 40% of nameplate, this means that 90% of the time onshore wind is producing less than 40% of nameplate.



New Concepts

- Block Dispatch: Groups resource types into three distinct categories based on economic considerations with block 1 containing the units expected to have the lowest offer prices and block 3 to have the highest. Each block will be dispatched as a whole and block 1 will be dispatched first, then block 2 and 3 as needed
  - Block 1: Nuclear, wind, solar, hydro, pumped storage, other renewables
  - Block 2: Coal, combined cycle gas
  - Block 3: IC/CT/ST oil and gas

New Concepts

- Energy-only MW: The MW capability of a generator or of a Merchant Transmission Facility (MTF) that is not examined as part of the generator deliverability test. A facility's energy-only MW may be different for each season.
  - Example 1: A 100 MW gas unit requests 80 MW CIRs. The unit therefore has 20 MW of energy-only MW.
  - Example 2: A 100 MW MTF has 80 MW of firm transmission. The MTF therefore has 20 MW of energy-only MW.
  - Example 3: A 100 MW wind farm has a summer deliverability requirement of 40 MW. The unit therefore has 60 MW of summer energy-only MW.
  - Example 4: A 100 MW solar farm has a winter deliverability requirement of 5 MW. The unit therefore has 95 MW of winter energy-only MW.
- While energy-only MW will not be considered in the generator deliverability testing, they will be examined as part of a new Individual Plant Deliverability test to ensure the maximum output capability of each generating plant and MTF is deliverable by itself in each season.

Summary of Changes

- Merged summer, winter and light load generator deliverability testing methods
- Harmonized dispatch procedures for all three RTEP base cases
  - Added new block dispatch approach to dispatch cases. No LDA allowed to import more than CETO in base case to ensure a realistic dispatch.
  - Only firm interchange modeled in base cases with separate procedures for performing sensitivities on historical interchange using simplified approach
- Redefined light load period to include any nighttime and daytime hours between 40-60% annual peak load
  - Established 59 deg F as default light load temperature rating set
  - Ramping procedures more consistent with summer and winter, i.e., ramp nuclear, coal, combined cycle and all renewables

Summary of Changes

- Established new deliverability requirements
  - Better account for volatility of wind and solar by using $P_{80\%}$-$P_{90\%}$ for Harmers and $P_{20\%}$ for Helpers
  - Removed all ramping caps except PGEN*EEFORd, which will be an overall ramping cap and even apply to the 50/50 generators
  - Single contingency and common mode outage testing is now identical – no more 80/20, only 50/50
  - Energy-only portion of units not studied in generator deliverability but as part of new Individual Plant Deliverability test
  - MISO wind considered in both light load and winter tests and option to consider other RTO renewables in the future
- Facility Loading Adders modelled at base case setting for resource type instead of 85%
- Remove EEFORd for plants < 50 MW

RTEP Baseline Testing

- Compare potential reliability violations under status quo and under proposed generator deliverability procedures
  - 2026 RTEP Light Load
  - 2026 RTEP Winter
  - 2026 RTEP Summer
- Expect to share test results at 11/2/2021 Regular PC Session

Interconnection Queue Testing

- AG1 Queue 2024 RTEP Light Load & Summer With Commercial Probabilities
  - Status Quo Rules
  - Proposed Rules
- Expect to share results at the 11/30 Regular PC

APPENDIX

Winter & Light Load Capacity Factors For Solar & Wind

MAAC	Summer CF**	LL CF	Winter CF
Solar Fixed	47%	12%	5%*
Solar Tracking	64%	16%	5%*
Onshore Wind	16%	31%	40%
Offshore Wind	38%	49%	55%

PJM West	Summer CF**	LL CF	Winter CF
Solar Fixed	54%	13%	5%*
Solar Tracking	65%	14%	5%*
Onshore Wind	19%	35%	43%
Offshore Wind	N/A	N/A	N/A

DOM	Summer CF**	LL CF	Winter CF
Solar Fixed	55%	14%	5%*
Solar Tracking	66%	16%	5%*
Onshore Wind	20%	34%	41%
Offshore Wind	33%	52%	57%

*** No change from status quo assumptions**

**** Only used for Facility Load Adders and CIRs are used to set base dispatch**

Proposed Default Deliverability Requirements For Wind & Solar As % Nameplate

MAAC	Summer $P_{80\%}$	Summer $P_{90\%}$	Winter $P_{80\%}$	Winter $P_{90\%}$	LL $P_{80\%}$	LL $P_{90\%}$
Solar Fixed	67%	N/A	5%*	N/A	23%	N/A
Solar Tracking	89%	N/A	5%*	N/A	33%	N/A
Onshore Wind	N/A	38%	N/A	73%	N/A	66%
Offshore Wind	73%	N/A	96%	N/A	92%	N/A

PJM West	Summer $P_{80\%}$	Summer $P_{90\%}$	Winter $P_{80\%}$	Winter $P_{90\%}$	LL $P_{80\%}$	LL $P_{90\%}$
Solar Fixed	76%	N/A	5%*	N/A	22%	N/A
Solar Tracking	84%	N/A	5%*	N/A	29%	N/A
Onshore Wind	N/A	52%	N/A	84%	N/A	77%
Offshore Wind	N/A	N/A	N/A	N/A	N/A	N/A

DOM	Summer $P_{80\%}$	Summer $P_{90\%}$	Winter $P_{80\%}$	Winter $P_{90\%}$	LL $P_{80\%}$	LL $P_{90\%}$
Solar Fixed	77%	N/A	5%*	N/A	29%	N/A
Solar Tracking	85%	N/A	5%*	N/A	38%	N/A
Onshore Wind	N/A	45%	N/A	78%	N/A	70%
Offshore Wind	68%	N/A	98%	N/A	95%	N/A

*** No generator ramping requirements**

Proposed Availability Under Stressed Conditions For Wind & Solar As % Nameplate

MAAC	Summer $P_{20\%}$	Winter $P_{20\%}$	LL $P_{20\%}$
Solar Fixed	28%	0%	0%
Solar Tracking	38%	0%	0%
Onshore Wind	0%	15%	8%
Offshore Wind	0%	13%	9%

PJM West	Summer $P_{20\%}$	Winter $P_{20\%}$	LL $P_{20\%}$
Solar Fixed	33%	0%	0%
Solar Tracking	43%	0%	0%
Onshore Wind	0%	13%	9%
Offshore Wind	N/A	N/A	N/A

DOM	Summer $P_{20\%}$	Winter $P_{20\%}$	LL $P_{20\%}$
Solar Fixed	35%	0%	0%
Solar Tracking	48%	0%	0%
Onshore Wind	0%	17%	11%
Offshore Wind	0%	13%	9%