CIR For ELCC Resources Discussion

Background

- There are two related stakeholder processes at the Planning Committee
  - Special Sessions of the PC on CIRs for ELCC Resources
    - Started in April 2021: Issue Charge and Problem Statement
    - Purpose is to address changes that might be needed to the initial assignment of CIRs, the retention of CIRs through the implementation of appropriate testing procedures, the inclusion of CIRs in resource adequacy studies and the role of CIRs in determining a resource's accredited UCAP
  - Generator Deliverability Proposed Modifications
    - First introduced in August 2021
    - Primary purpose is to ensure the ongoing reliability and operational flexibility of the PJM system under the continued evolution of the resource mix
    - Addresses generation deliverability study thresholds for reliability assessments

Related Solutions

- Special Sessions of the PC on CIRs for ELCC Resources
  - PJM has proposed a solution that would cap hourly output values at the tested summer deliverability MW value when performing ELCC capacity value calculations.
  - Under such capping, higher levels of tested summer deliverability vs. those tested today are needed to maintain current capacity values for wind and solar.
  - The special sessions also discussed approaches to achieve higher tested summer deliverability levels for wind and solar.
- Generator Deliverability Proposed Modifications
  - Among many other changes, PJM proposes to increase the summer tested deliverability levels of wind and solar.
  - For all wind and solar units with an executed ISA, including both in-service and many unbuilt plants, the total upgrade cost to accommodate this higher level of tested summer deliverability is $7 million, which is needed to accommodate 5 MW of unbuilt solar.

Deliverability Considerations In UCAP Accreditation

- With the introduction of ELCC, PJM took a large step toward better accounting for deliverability in the accreditation process by including historic curtailments into the UCAP calculation, while also continuing the status quo practice of limiting the UCAP to be no more than the CIRs
- By introducing historic curtailments into the ELCC calculation, PJM now has a metric in the UCAP accreditation process to account for actual hourly deliverability of ELCC Resources
- PJM's position is that under a rapidly changing resource mix, we will also need to limit a resource's hourly output in the ELCC calculation to the planned deliverability levels associated with its CIRs

Deliverability Considerations In UCAP Accreditation

- In its July 30, 2021 Order accepting the ELCC updated tariff revisions, FERC found that our current practice is just and reasonable
  - "PJM states it will implicitly account for historically binding transmission constraints by considering each Variable Resource's historic performance, including instances of curtailment due to transmission constraints. Given the fact that a Variable Resource may deliver more than its CIR quantity to the PJM system during hours when the transmission system is not constrained, ***we find PJM's approach reasonable in contrast to artificially limiting a Variable Resource's output to its CIRs within the ELCC model.***"
- FERC was aware that PJM would initiate a stakeholder process to explore this issue further to see if improvements were warranted

Conservative Generator Deliverability Procedures Exist Today

- PJM studies wind and solar at their CIR level as part of the summer, single contingency generator deliverability test
- PJM also studies wind and solar at 100% MFO as part of the summer, common mode outage generator deliverability test
  - Single contingencies are N-1 conditions and common mode outages are N-2 conditions, which are much more severe
  - PJM currently has 17,400 common mode contingencies vs 14,400 single contingencies – a lot of overlap
  - Types of common mode outages
    - Double circuit tower line
    - Line fault coupled with a stuck breaker
    - Bus fault
- PJM also studies wind at 80%+ MFO in the light load and winter test for single and common mode contingencies

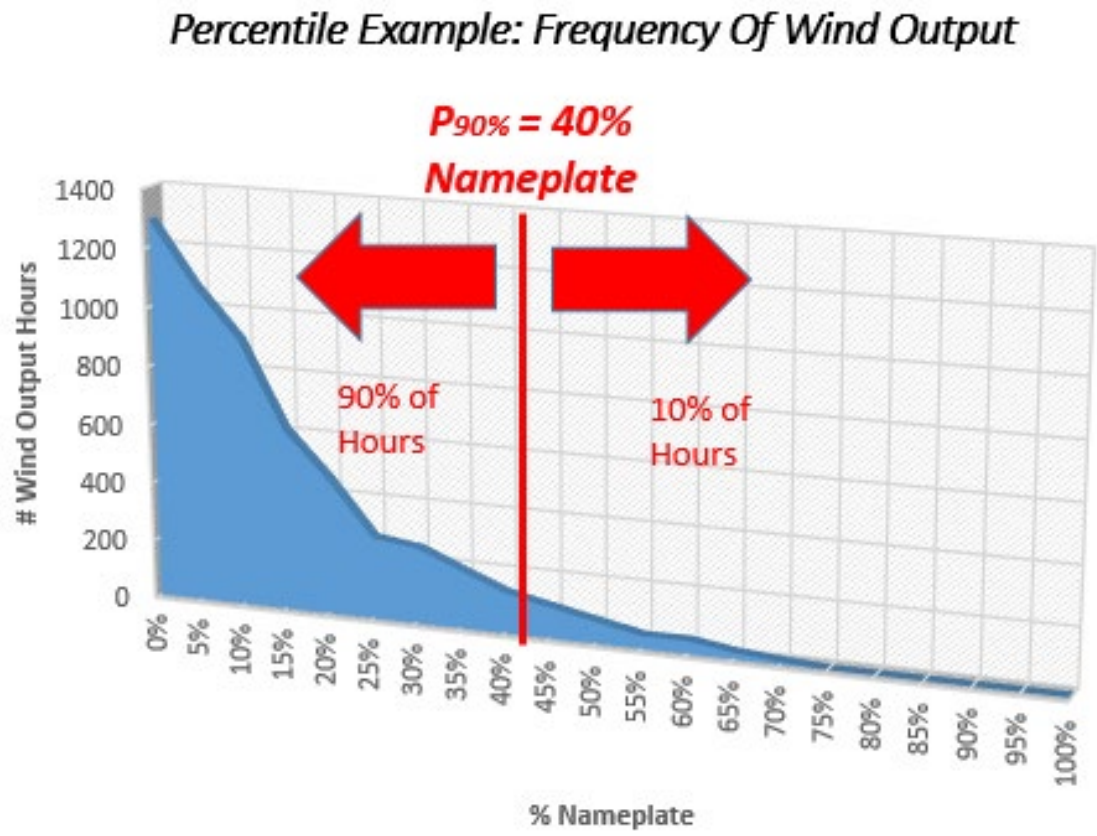
PJM's New Generator Deliverability Procedure
Wind & Solar Is Deliverable Today

- PJM is proposing a variety of modifications to its generator deliverability procedure to better account for a future resource mix
- One of the proposed modifications PJM is introducing is to test wind and solar under summer, single contingencies at a higher level than their CIRs to better ensure that transmission system is capable of delivering full spectrum of output levels that might be required for reliability and operational performance
- PJM applied this new generator deliverability procedure to the current RTEP and confirmed that in-service wind and solar units are deliverable today under these higher summer, single contingency deliverability requirements
- The appendix to this presentation provides some additional background on the new deliverability requirements for wind and solar

Appendix: Proposed Generator Deliverability Requirements For Wind & Solar

New Concepts

- Percentiles: Represent the percentage of output hours with output levels below a particular output level.
- Example: if the P90% (90th 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.



Basis of Percentile Selection

- PJM performed a series of ELCC studies and had a series of internal discussions to determine the minimum output level by region and intermittent resource type that would meet the following objectives
  - Avoid the risk of jeopardizing the continued reliability, operational flexibility and public policy objectives by planning the grid to only support average outputs of renewable resources
  - Avoid a significant reduction in UCAP for intermittent resources when introducing CIR deliverability into the ELCC studies
- To meet these objectives for the summer period PJM concluded that it should
  - Plan the grid to support the highest solar and offshore wind output levels that are expected to occur 20% of the time during the summer
  - Plan the grid to support the highest onshore wind output levels that are expected to occur 10% of the time during the summer

Analysis - RTEP Baseline Impact

Increased summer deliverability requirements result in only two reliability issues

Violation Driver		Summer	Winter	Light Load	Total
Higher Intermittent	# of Violations:	2	0	2	4
	$M Cost	$ 7.00	$ -	$ 12.00	$ 19.00
Block Dispatch	# of Violations:	1	1	7	9
	$M Cost	$ 28.00	$ 8.50	$ 118.00	$ 154.50
Block Dispatch + Lower Intermittent Helpers	# of Violations:	2	0	0	2
	$M Cost	$ 11.50	$ -	$ -	$ 11.50
Impact of All Drivers	# of Violations:	5	1	9	15
	$M Cost	$ 46.50	$ 8.50	$ 130.00	$ 185.00

- Nine of the 15 violations in the table above were driven by single contingency events and only four of these violations have not been observed as binding constraints in operations over the past couple of years.
- The four violations in the first row in the table above are driven by higher deliverability of intermittent resources that are not in service yet.

Summary of Harmer Ramping Levels For Wind & Solar

		Generator Deliverability Harmer Ramping			
		Single Contingency		Common Mode Outage	
Period	Resource Type	Existing	Proposed*	Existing	Proposed*
Summer	Fixed Solar	38%	67-77%	100%	67-77%
Summer	Tracking Solar	~60%	84-89%	100%	84-89%
Summer	Onshore Wind	13%	38-52%	100%	38-52%
Summer	Offshore Wind	~30%	68-73%	100%	68-73%
Winter	Fixed Solar	10%	5%	100%	5%
Winter	Tracking Solar	10%	5%	100%	5%
Winter	Onshore Wind	80%	73-84%	100%	73-84%
Winter	Offshore Wind	80%	96-98%	100%	96-98%
Light Load	Fixed Solar	0%	78-87%	0%	78-87%
Light Load	Tracking Solar	0%	82-86%	0%	82-86%
Light Load	Onshore Wind	80%	66-80%	80%	66-80%
Light Load	Offshore Wind	80%	90-93%	80%	90-93%

* Proposed values vary based on which region resource is located in

Red Font = CIR MW

Proposed Default Deliverability Requirements For Wind & Solar As % Nameplate

- Percentile illustration: The $P_{90\%}$ for onshore wind during the summer in the MAAC region is 38%, which implies that during 10% of the peak summer hours onshore wind in wide areas across the MAAC region wind will likely be outputting more than 38% of their nameplate.
- Percentile weighting example: If region X is composed of two areas X1 and X2, where

Area	% of Nameplate	Nameplate (MW)
X1	40%	900
X2	60%	100

- Then the deliverability requirement level for region X is calculated as:

$$P = (40\% \times 900 + 60\% \times 100) / (900 + 100) = 42\%$$

Proposed Default Deliverability Requirements For Wind & Solar As % Nameplate

MAAC	Summer	Winter	LL (10AM-3PM)
Solar Fixed ($P_{80\%}$)	67%	*	78%
Solar Tracking ($P_{80\%}$)	89%	*	86%
Onshore Wind ($P_{90\%}$)	38%	73%	66%
Offshore Wind ($P_{80\%}$)	73%	96%	90%

PJM West	Summer	Winter	LL
Solar Fixed ($P_{80\%}$)	76%	*	82%
Solar Tracking ($P_{80\%}$)	84%	*	82%
Onshore Wind ($P_{90\%}$)	52%	84%	80%
Offshore Wind ($P_{80\%}$)	N/A	N/A	N/A

DOM	Summer	Winter	LL
Solar Fixed ($P_{80\%}$)	77%	*	87%
Solar Tracking ($P_{80\%}$)	85%	*	85%
Onshore Wind ($P_{90\%}$)	45%	78%	71%
Offshore Wind ($P_{80\%}$)	68%	98%	93%

*** No generator ramping requirements**