Effective Load Carrying Capability (ELCC) Analysis for Wind and Solar Resources

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Introduction

- At the September Planning Committee (PC) meeting, PJM presented results from an ELCC analysis of wind resources to justify making a change to the current wind capacity credit calculation
  - The change was to use the median instead of the mean performance of wind units over peak summer hours
- After PJM presented the wind ELCC results, stakeholders showed interest in the overall ELCC methodology
- In subsequent PC meetings, results from further analysis (now also including solar resources) have been presented

Effective Load Carrying Capability (ELCC)

- Well-known methodology to determine the contribution that an individual generator or a fleet of generators makes to overall system resource adequacy
  - MISO uses ELCC to calculate capacity credits for wind resources
- Specifically, ELCC is a measure of the additional load that the system can supply with the particular generator(s) of interest, without a change in reliability
- Consequently, the ELCC results are driven by the output of the generator(s) of interest during hours with potentially high reliability risk

Wind ELCC Analysis - Overview

- The ELCC analysis was performed using GE-MARS, a resource adequacy software tool.
- The Wind ELCC was calculated for the collection of wind resources projected for DY 2021/22.
  - 12,540 MW of nameplate capacity approximately
- Nine Wind ELCC values were calculated, one for each delivery year in the period 2009/10 – 2017/18
- The capacity model was from the 2017 Reserve Requirement Study

Wind ELCC Analysis – Procedure

- Using each of the nine 8760 hourly load shapes (and without using the 8760 hourly wind shapes), iteratively modify the hourly peak load until the LOLE is 0.1 days/year
  - Each of these nine **Base** cases now meets the 1 day in 10 years criterion
- Add the corresponding wind hourly shape to each of the nine Base cases. The LOLE will now be less than 0.1 days/year.
- Increase the hourly peak load in each of the nine cases above until the LOLE is back at 0.1 days/year.
- The difference between this New hourly peak load and the hourly peak load from the Base case is the ELCC (in MW). The ELCC is commonly expressed as a percentage of the nameplate capacity.

Wind ELCC Analysis – Results

Delivery Year	Base 1in10 Hourly Peak Load (MW)	Projected Nameplate Wind Capacity 2021 (MW)	LOLE After Adding Wind (days /year)	New 1in10 Hourly Peak Load (MW)	ELCC (MW)	ELCC (% of Nameplate)
2009/10	167,107	12,540		168,420	1,313	10.5%
2010/11	163,244	12,540		164,763	1,519	12.1%
2011/12	165,763	12,540		166,711	948	7.6%
2012/13	163,833	12,540		164,973	1,140	9.1%
2013/14	164,370	12,540		165,489	1,119	8.9%
2014/15	165,375	12,540		168,785	3,410	27.2%
2015/16	162,744	12,540		163,620	876	7.0%
2016/17	164,616	12,540		165,941	1,325	10.6%
2017/18	163,247	12,540		164,348	1,101	8.8%

The mean ELCC is 11.3%

Solar ELCC Analysis - Overview

- The ELCC analysis was performed using GE-MARS, a resource adequacy software.
- The Solar ELCC was calculated for the projected set of solar resources for delivery year 2021/22.
  - 1,710 MW of nameplate capacity approximately
- Six Solar ELCC values were calculated, one for each delivery year in the period 2012/13 – 2017/18
- The capacity model was from the 2017 Reserve Requirement Study

Solar ELCC Analysis – Results

Delivery Year	Base 1in10 Hourly Peak Load (MW)	Projected Nameplate Wind Capacity 2021 (MW)	LOLE After Adding Wind (days /year)	New 1in10 Hourly Peak Load (MW)	ELCC (MW)	ELCC (% of Nameplate)
2012/13	163,833	1,710		164,652	819	47.9%
2013/14	164,370	1,710		165,256	886	51.8%
2014/15	165,375	1,710		166,026	651	38.1%
2015/16	162,744	1,710		163,599	855	50.0%
2016/17	164,616	1,710		165,523	907	53.0%
2017/18	163,247	1,710		164,108	861	50.4%

The mean ELCC is 48.5%

ELCC of Individual Units

- The above RTO-wide Wind/Solar ELCC values apply to the entire set of Wind/Solar resources
- The ELCC needs to be allocated to the individual wind and solar units based on individual unit performance
  - The allocation must be performed for Existing and New units
- At the PC multiple options to perform the allocation have been discussed

Next Steps

- Make decision about using or not using ELCC to calculated capacity credits of wind and solar resources
- Continue discussions about options to allocate the wind/solar system-wide capacity credits to individual units
- Update system-wide ELCC results by using the 2018 Reserve Requirement Study capacity model