



## Manual 21

# Rules and Procedures for Determination of Generating Capability Changes Pertinent to Wind and Solar Resources

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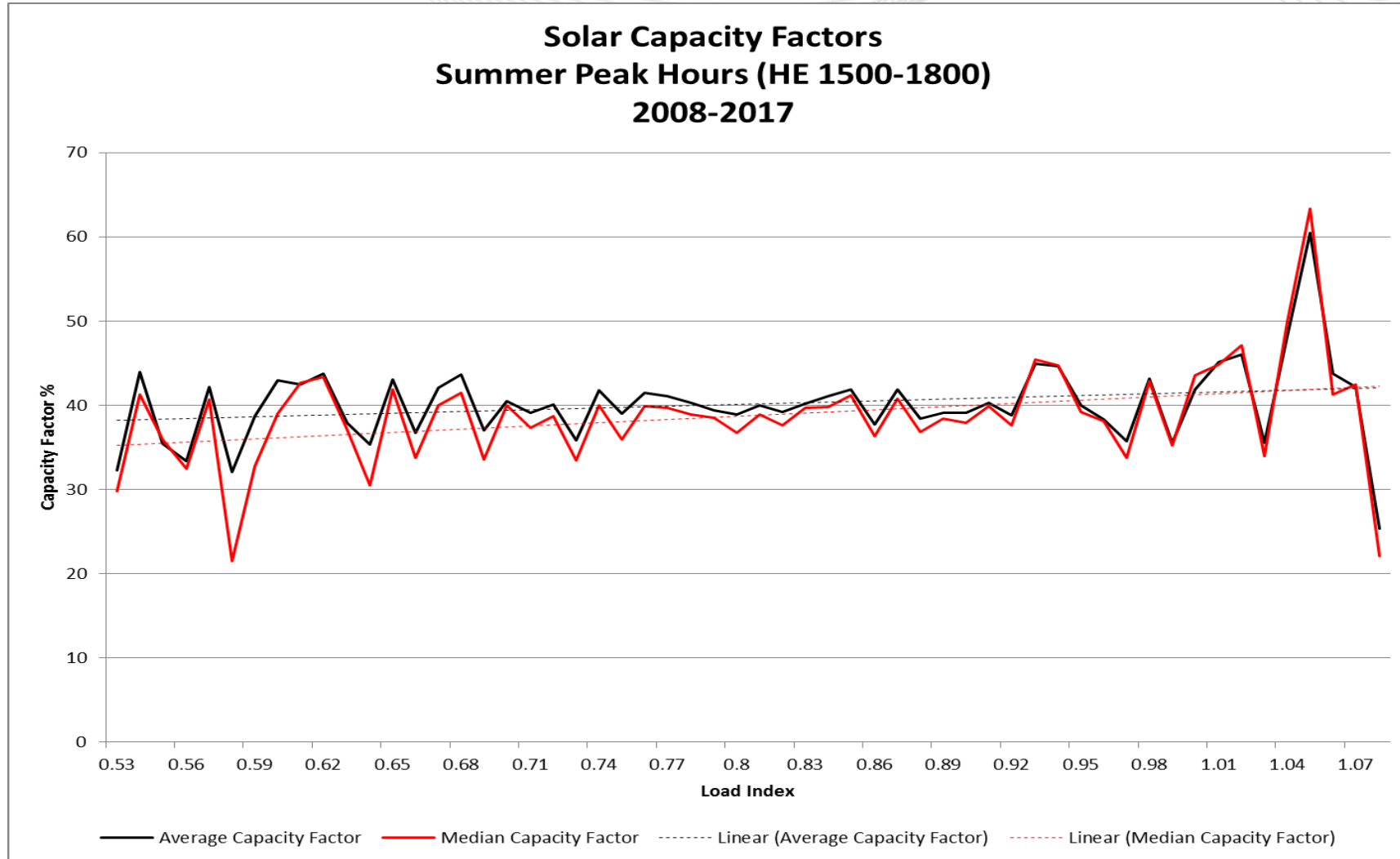
Resource Adequacy Department

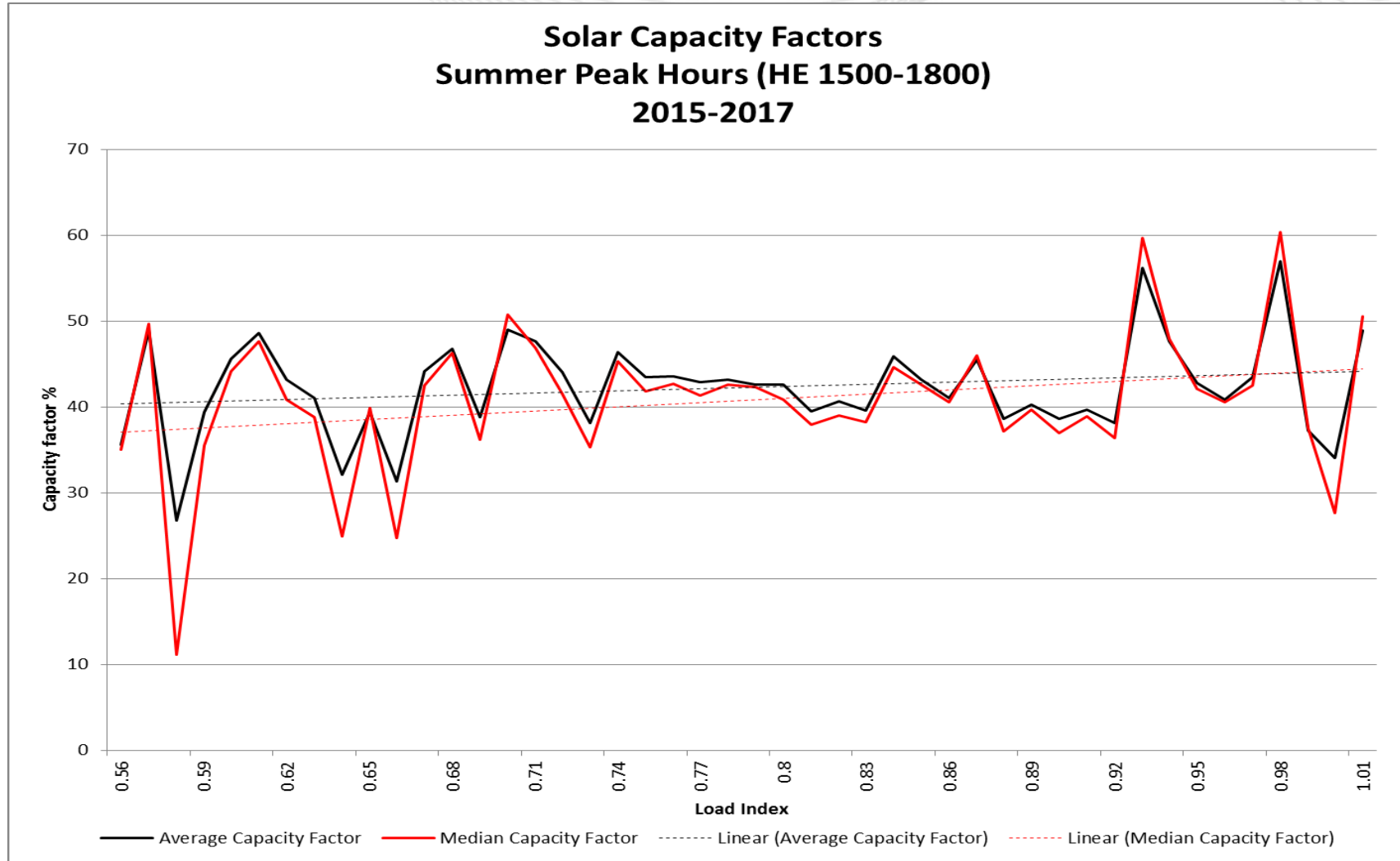
Intermittent Resources Task Force

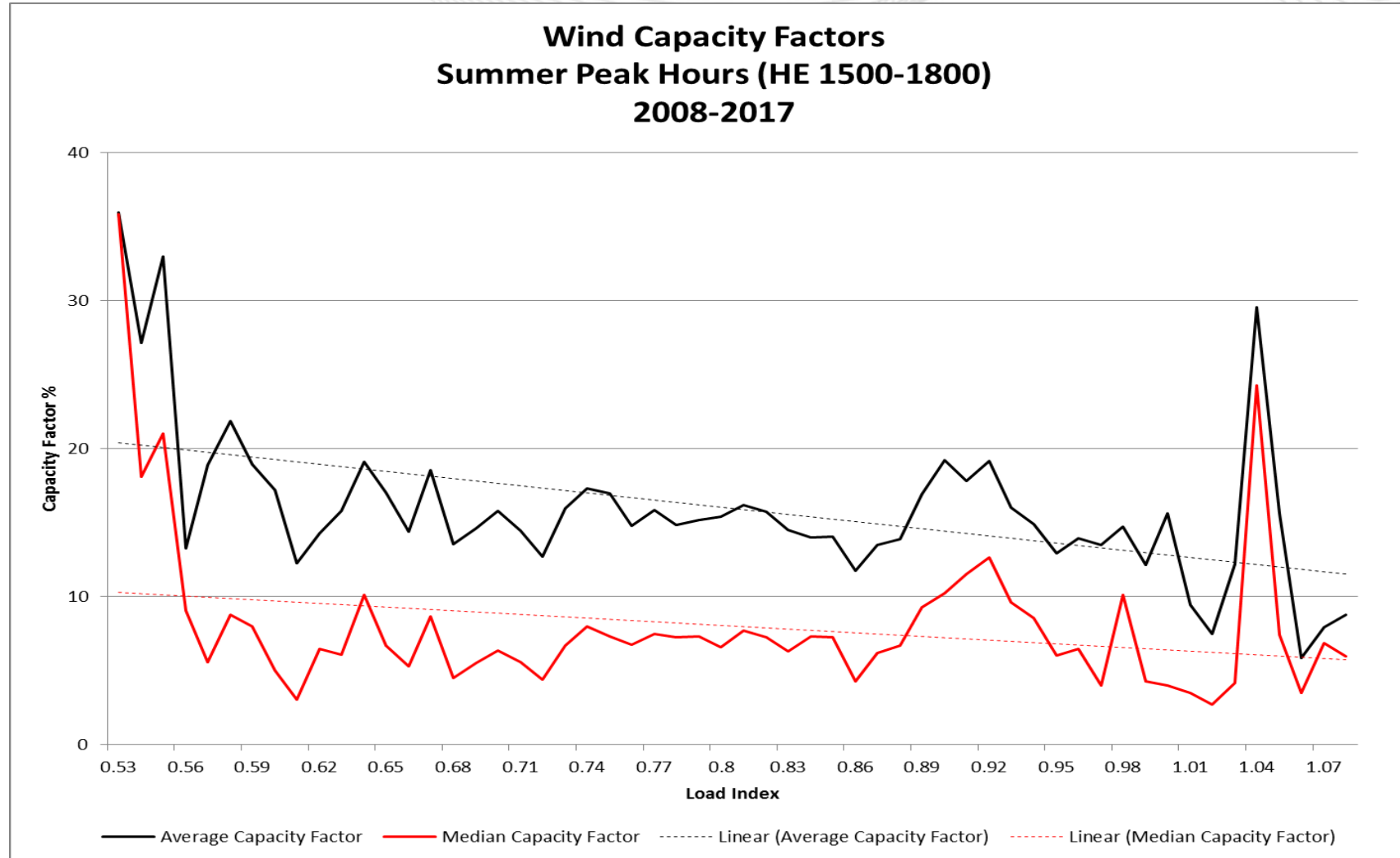
March 5<sup>th</sup>, 2018

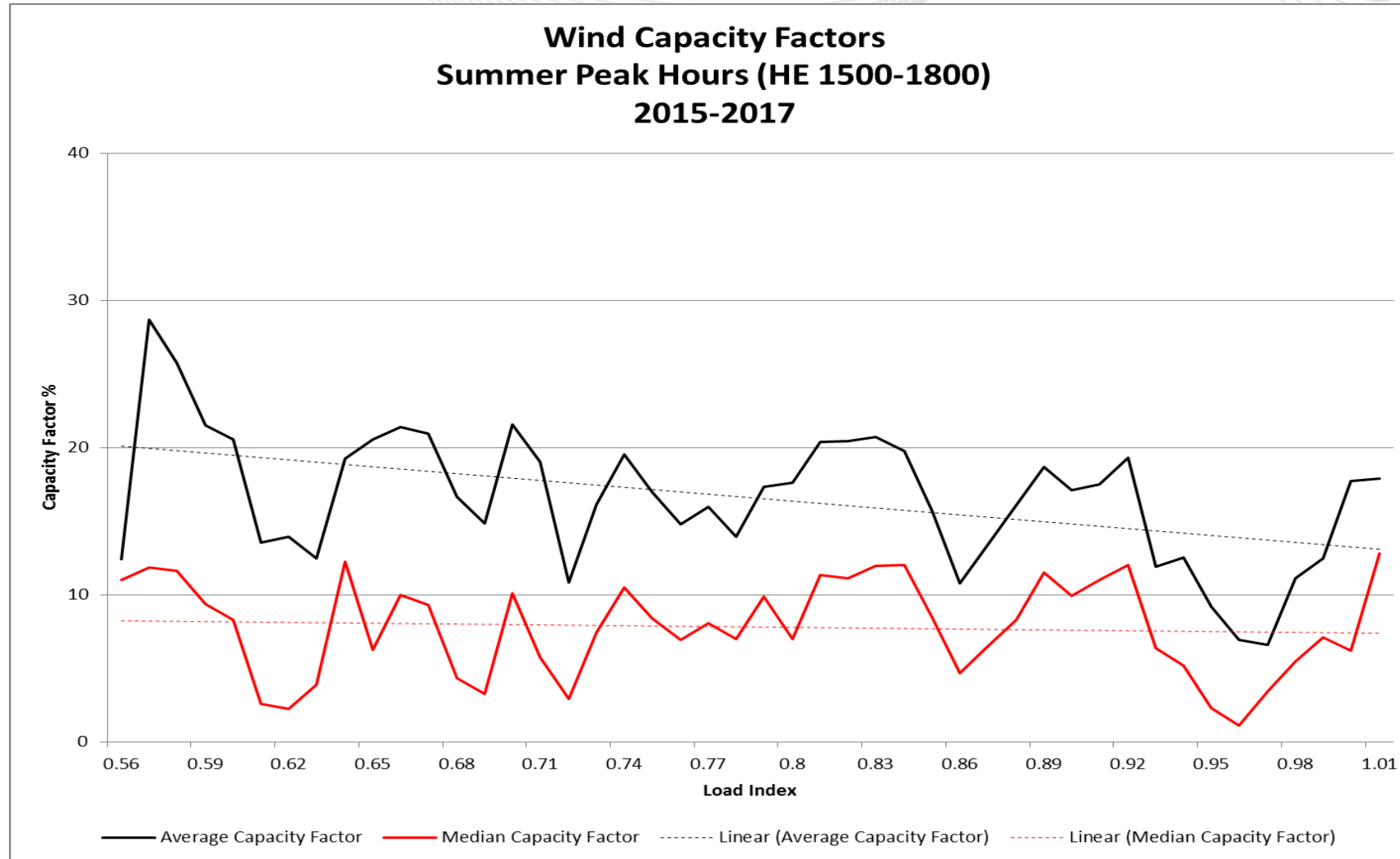
- Revised CIR section
- Intermittent and Capacity Storage Resources Simultaneous Testing
- ***Appendix B, Wind and Solar Capacity Factors***
- Summer Testing Period

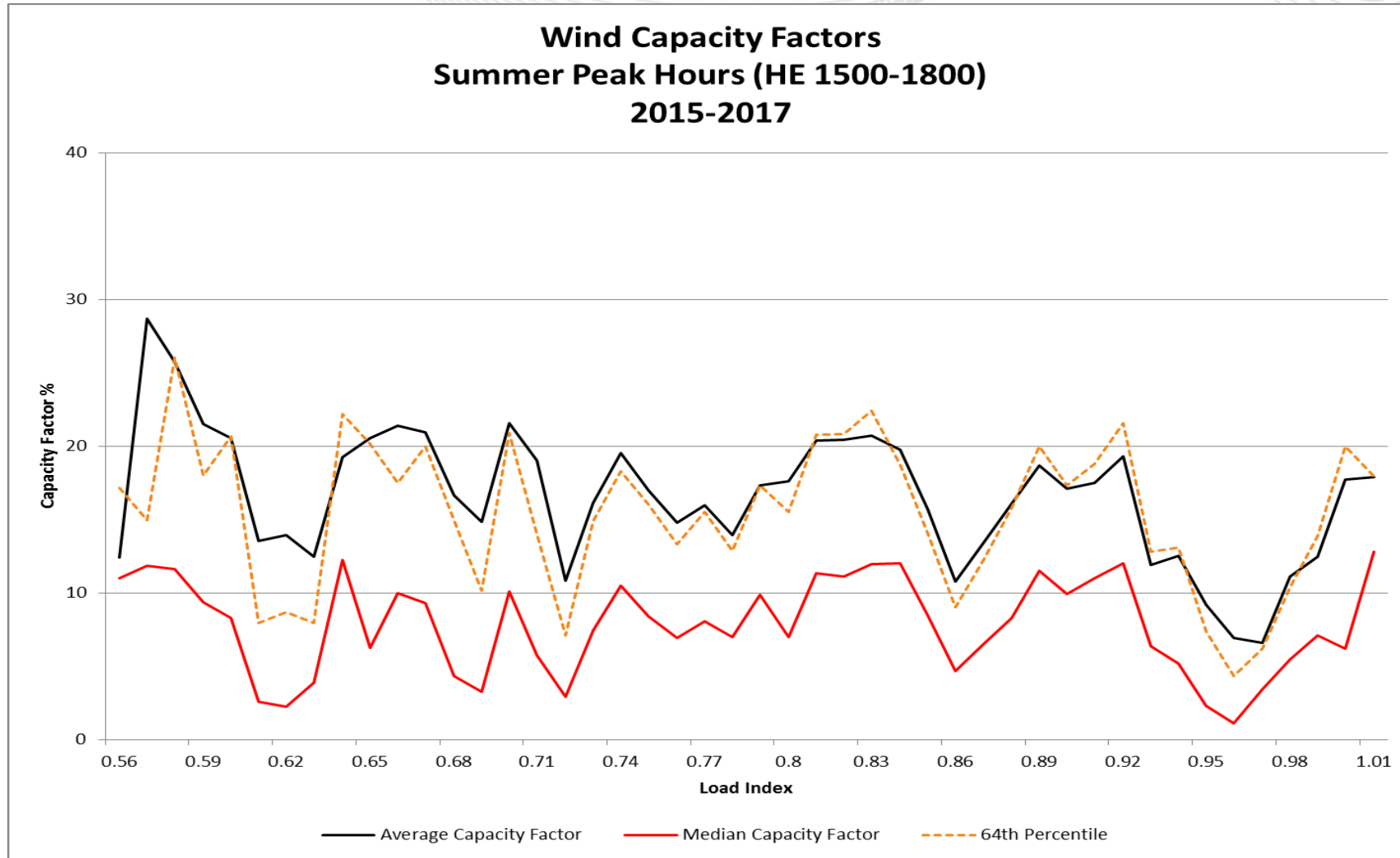
- For this analysis a load index was created that is the unrestricted PJM RTO load (for each peak hour) divided by the PJM Weather Normalized Peak for that year
- The summer data consists of all peak hours (HE 1500-1800) in summer June 1 through August 31
  - For the years 2008 through 2017
  - For the years 2015 through 2017













- Wind
  - The summer peak hour average is equivalent to the 64<sup>th</sup> percentile production level
  - In other words, the 64<sup>th</sup> percentile production level is expected only 36% of the summer peak hours
  - In 2 of every 7 peak summer hours, the average PJM wind unit experiences inadequate wind to generate
- Solar
  - The summer peak hour average is nearly the 50<sup>th</sup> percentile production level



# Capacity Factors 2015-2017

Summer Peak Hours (HE 1500-1800, June 1 through August 31)

Unit Type	Average Capacity Factor %	Median Capacity Factor %
Wind	16.7	7.9
Solar	42.1	40.9

# Capacity Factors PJM Summer 5 Coincident Peaks\* Only (Values in Percent)

Unit Type	Average 2008-2017	Percentile 2008-2017	Average 2015-2017	Percentile 2015-2017	Median 2008-2017	Median 2015-2017
Wind	12.9	66 <sup>th</sup>	10.5	66 <sup>th</sup>	6.3	4.0
Solar	42.4	50 <sup>th</sup>	44.8	51 <sup>th</sup>	42.2	44.5

\* The 5 Coincident Peaks (CPs) are the 5 highest peak load hours in summer from June 1 through August 31 annually; none of these hours were outside the HE 1500-1800 (3 in HE1500; 8 in HE1600; 33 in HE 1700; 6 in HE 1800)

# Capacity Factors PJM Summer Peaks Only (Values in Percent)

Unit Type	Average 2008-2017	Percentile 2008-2017	Average 2015-2017	Percentile 2015-2017	Median 2008-2017	Median 2015-2017
Wind	12.4	65 <sup>th</sup>	8.7	66 <sup>th</sup>	7.2	7.9
Solar	40.4	54 <sup>th</sup>	43.0	54 <sup>th</sup>	39.3	40.8

- For Wind, when curtailments occur, generation during curtailed five minute periods are estimated with an interpolation of the generation from the state estimator using the period immediately prior to and after the curtailment
- These state estimator values are not available to the generator as a normal course of business
- These values are nearly identical to the actual generation except in periods where the unit has been curtailed or has an outage
- The actual settlements MWH for the five minute period, once five minute settlements go live, should be used since they will be available to the generator owner

- Actual settlements MWH for the five minute periods immediately prior to and after a wind unit curtailment will be used to interpolate across 5 minute periods during wind curtailments instead of the state estimator MWH
  - This will allow calculation of capacity factors from readily available settlements data
- Starting Delivery Year 2018/2019 the median will be used to calculate UCAP, CIRs and Capacity Factors for wind and solar units
  - For Delivery Year 2019/2020 wind and solar capacity values, UCAP and CIRs will be based on the DY16/17 and DY17/18 average capacity factors and the DY18/19 median capacity factors
  - For Delivery Year 2020/2021 wind and solar capacity values, UCAP and CIRs will be based on the DY17/18 average capacity factors and the DY18/19 and DY19/20 median capacity factors
  - For Delivery Year 2021/2022 wind and solar capacity values, UCAP and CIRs will be based on the DY18/19, DY19/20 and DY20/21 median capacity factors

- PC First Read - 3/8/2018
- MRC First Read - 3/22/2018
- Request for PC Endorsement - 4/5/2018
- Request for MRC Endorsement – 4/19/2018
- Manual 21 changes to become effective 5/1/2018

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