



Manual 21

Rules and Procedures for Determination of Generating Capability Changes

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Planning Committee
February 8th, 2018

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

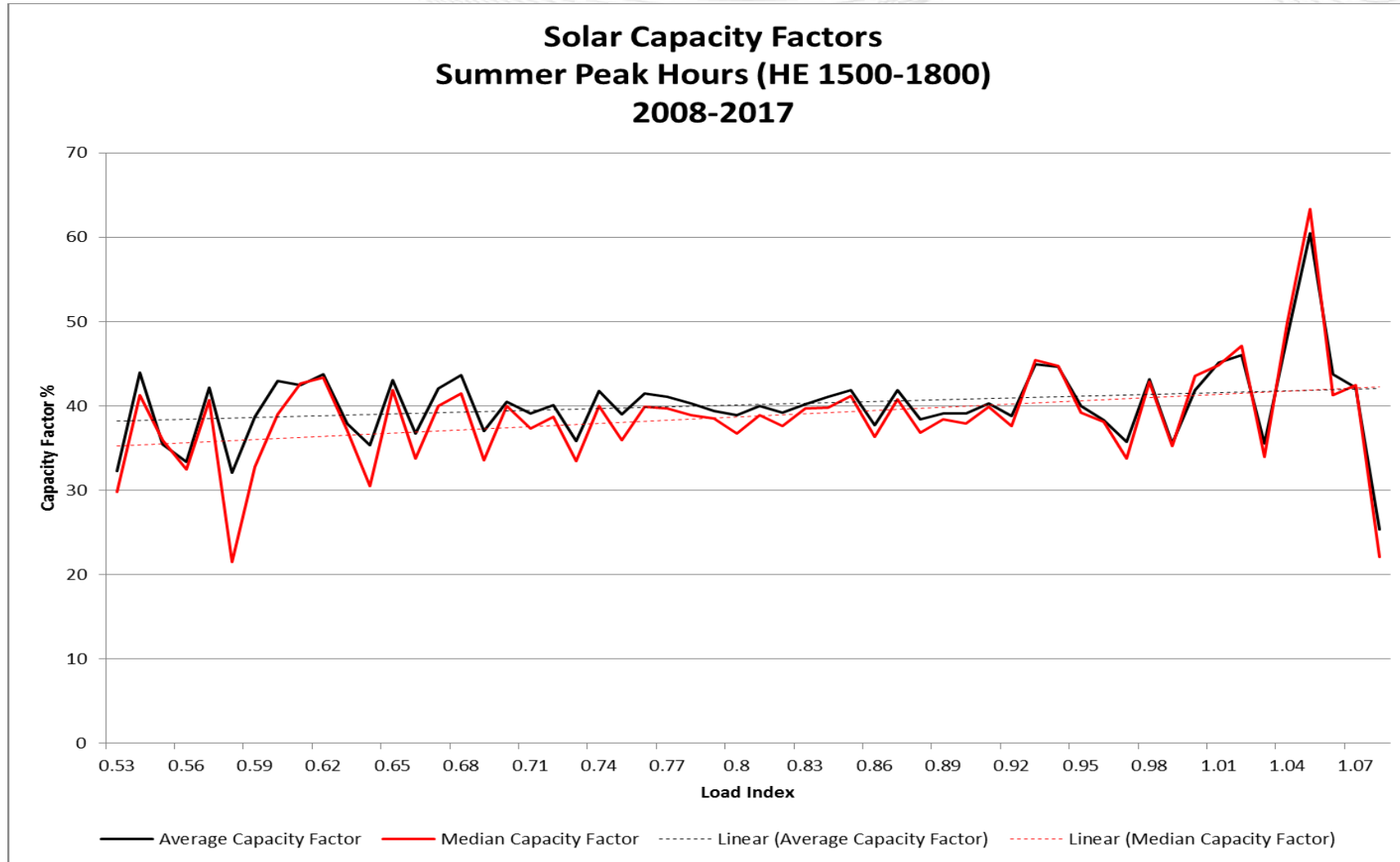
- How CIRs are attained
 - ISA, WMPA or Integration
 - Results of a deliverability study
- How CIRs are retained
 - Performing summer capability verification tests
 - Proving CIRs once every three years
 - Specific rules for units with aggregated CIRs

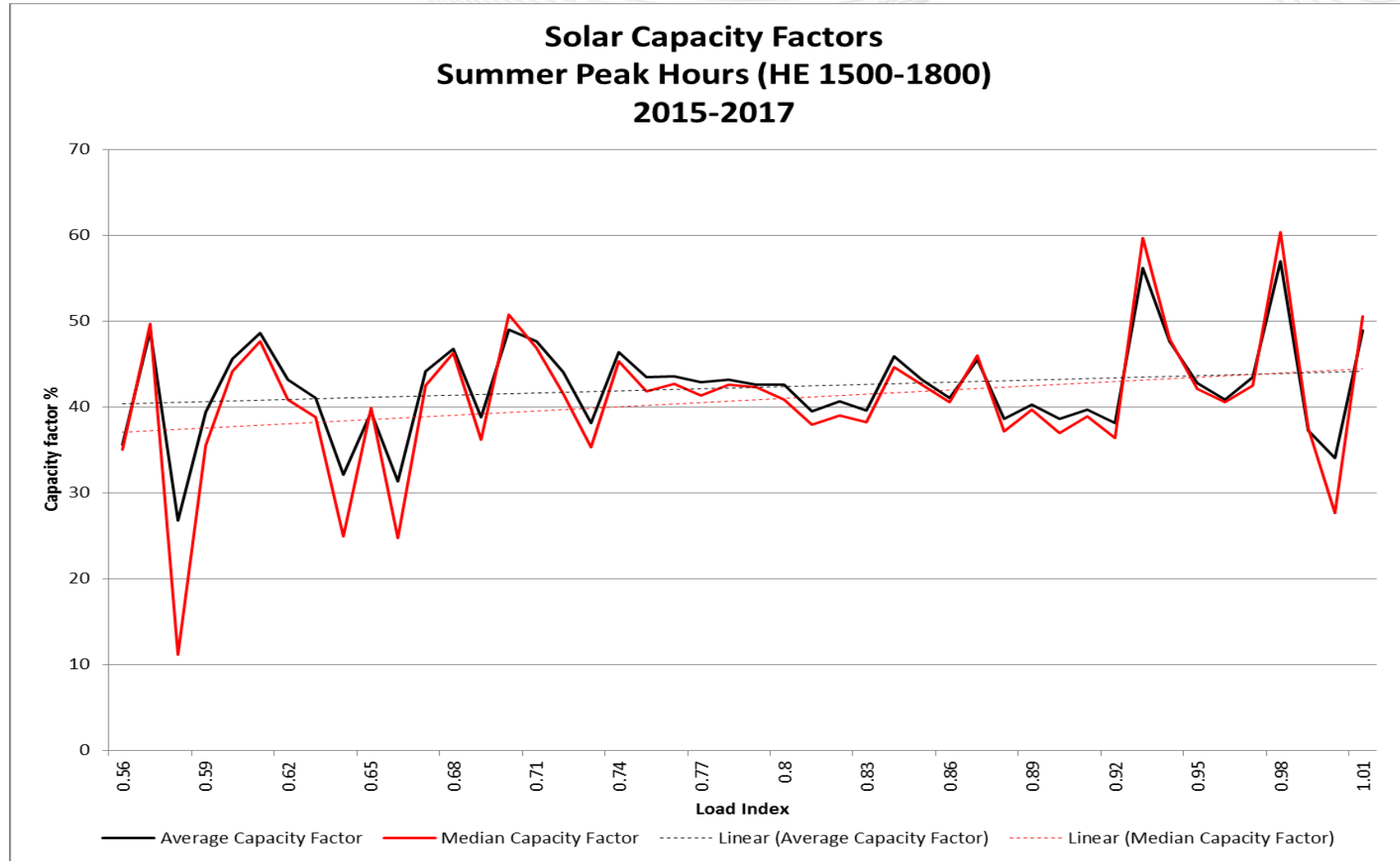
- ICAP is expected to be determined with respect to the RAA, Schedule 9 entitled "PROCEDURES FOR ESTABLISHING THE CAPABILITY OF GENERATION CAPACITY RESOURCES"
 - Schedule 9.A:
 - *Such rules and procedures as may be required to determine and demonstrate the capability of Generation Capacity Resources for the purposes of meeting a Load Serving Entity's obligations under the Agreement shall be developed by the Office of Interconnection and maintained in the PJM Manuals.*
- ICAP (Installed Capacity) needs to be based on summer/winter conditions defined in Manual 21
 - Schedule 9.B:
 - *The rules and procedures for determining and demonstrating the capability of generating units to serve load in the PJM Region shall be consistent with achieving uniformity for planning, operating, accounting and reporting purposes.*
 - Schedule 9.C:
 - *The rules and procedures shall recognize the difference in types of generating units and the relative ability of units to maintain output at stated capability over a specified period of time. Factors affecting such ability include, but are not limited to, fuel availability, stream flow for hydro units, reservoir storage for hydro and pumped storage units, mechanical limitations, and system operating policies.*

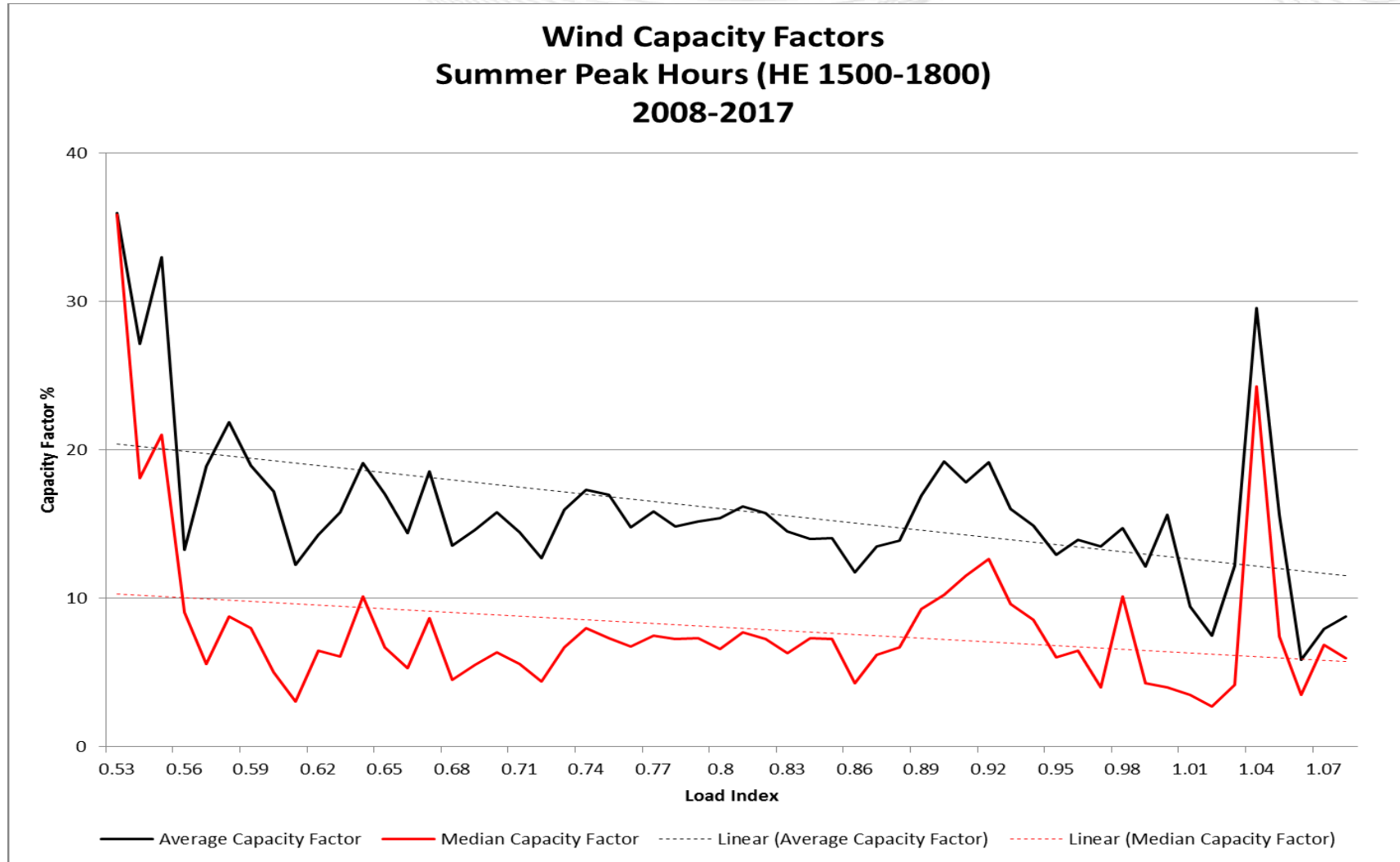
- Intermittent and Capacity Storage Resources are defined in PJM Manual 18
- These resource types have no must offer requirement in CP
- ICAP is expected to be determined with respect to the RAA, Schedule 9.C
 - *The rules and procedures shall recognize the difference in types of generating units and the relative ability of units to maintain output at stated capability over a specified period of time. Factors affecting such ability include, but are not limited to, fuel availability, stream flow for hydro units, reservoir storage for hydro and pumped storage units, mechanical limitations, and system operating policies.*
- ICAP needs to be based on summer/winter conditions per Manual 21; not specifically the nameplate rating
- ICAP needs to be based on streamflow under summer/winter conditions
- The new version of Manual 21 will require simultaneous testing of all Intermittent and Capacity Storage Resources at a plant

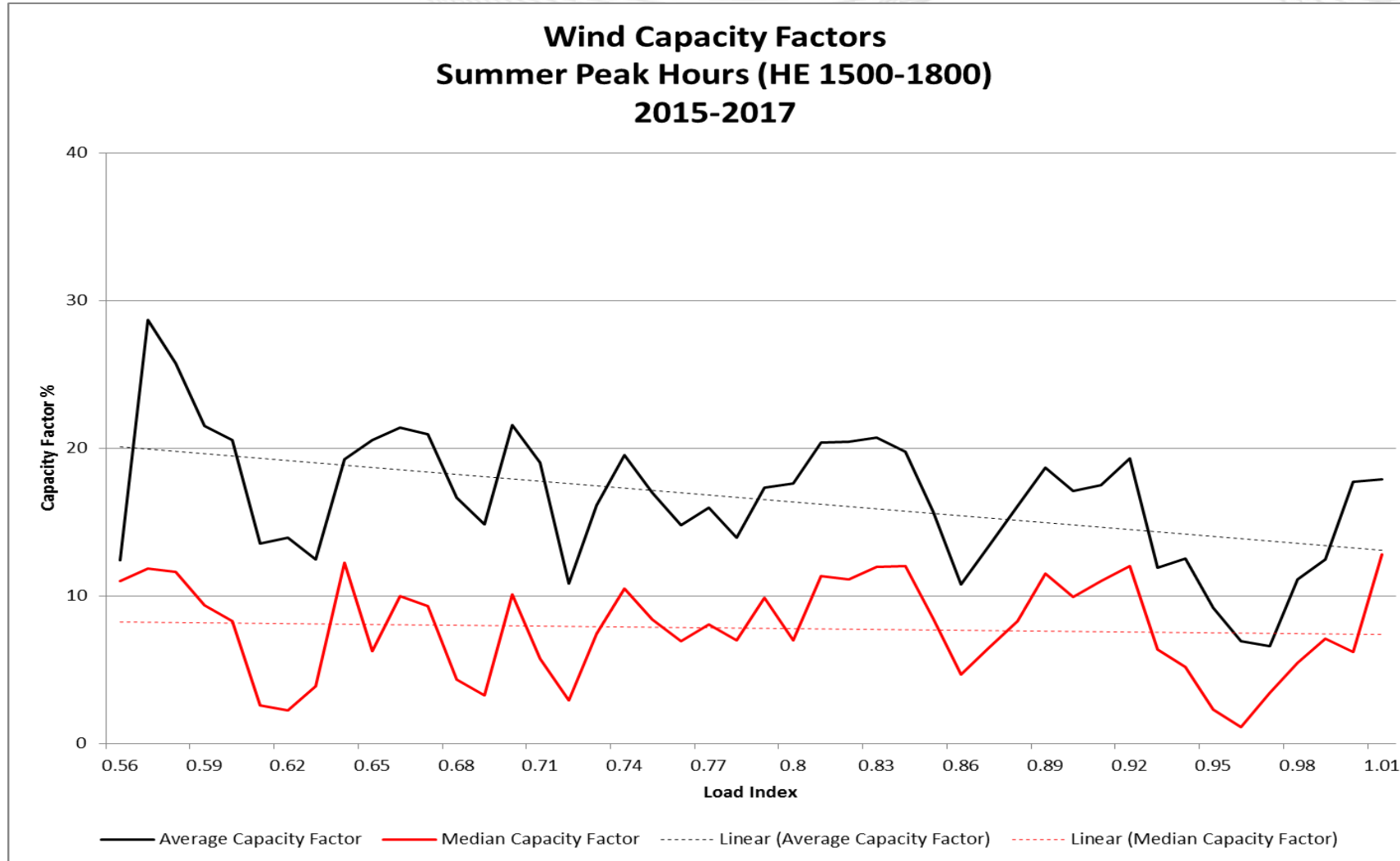
- Wind and Solar capability should be based on the 50/50 expectation of production
 - Current Wind capability is based on the peak hour average (June 1 through August 31 Hours Ending 1500-1800)
 - Current Solar capability is based on the peak hour average (June 1 through August 31 Hours Ending 1500-1800)
- It was thought that the peak hour average was a good approximation for the median
- However, nearly two in seven hours there is no production from the average wind unit

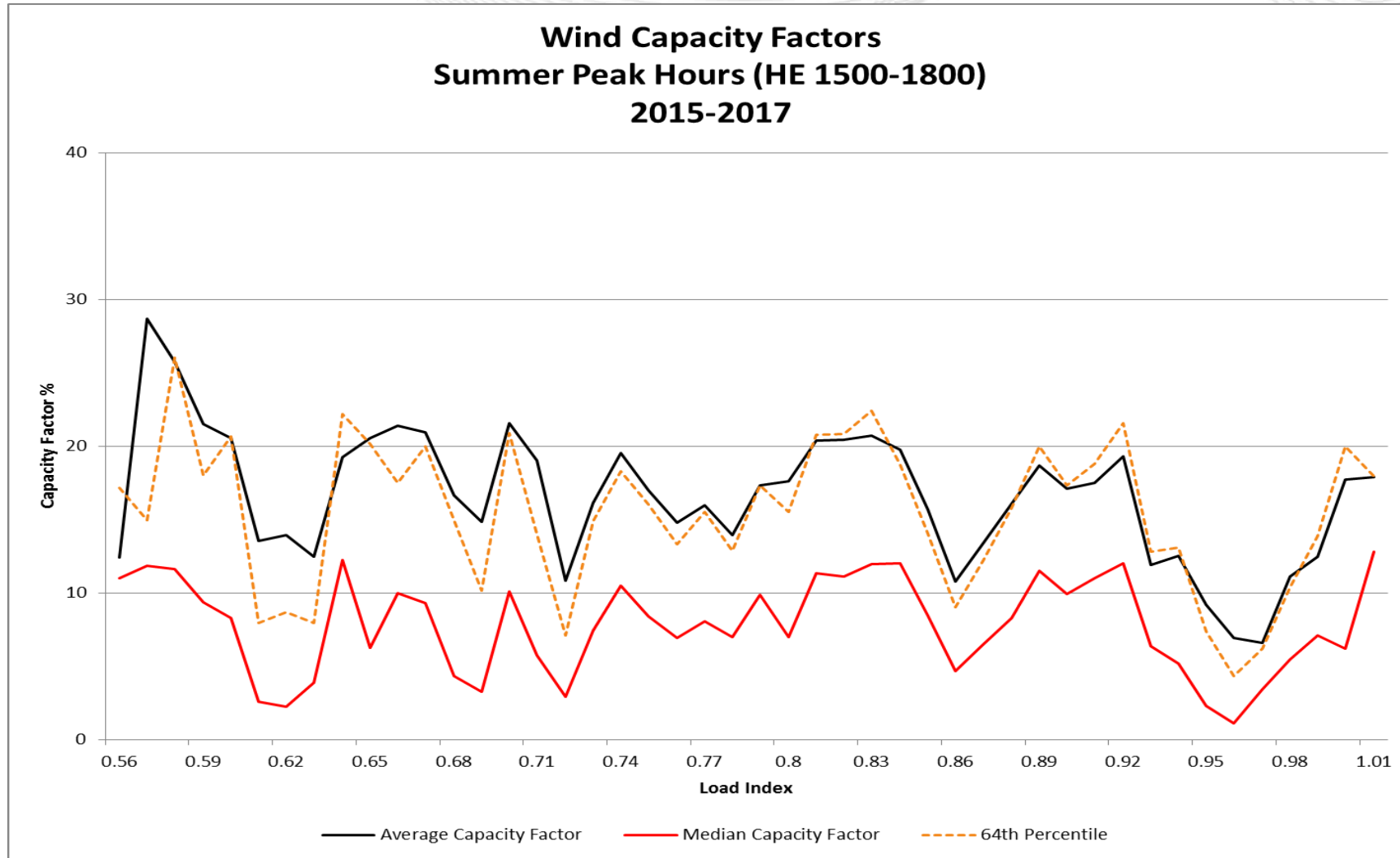
- For this analysis a load index was created that is the unrestricted PJM RTO load (for each peak hour) divided by the PJM Weather Normalized Peak for that year
- The summer data consists of all peak hours (HE 1500-1800) in summer June 1 through August 31
 - For the years 2008 through 2017
 - For the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



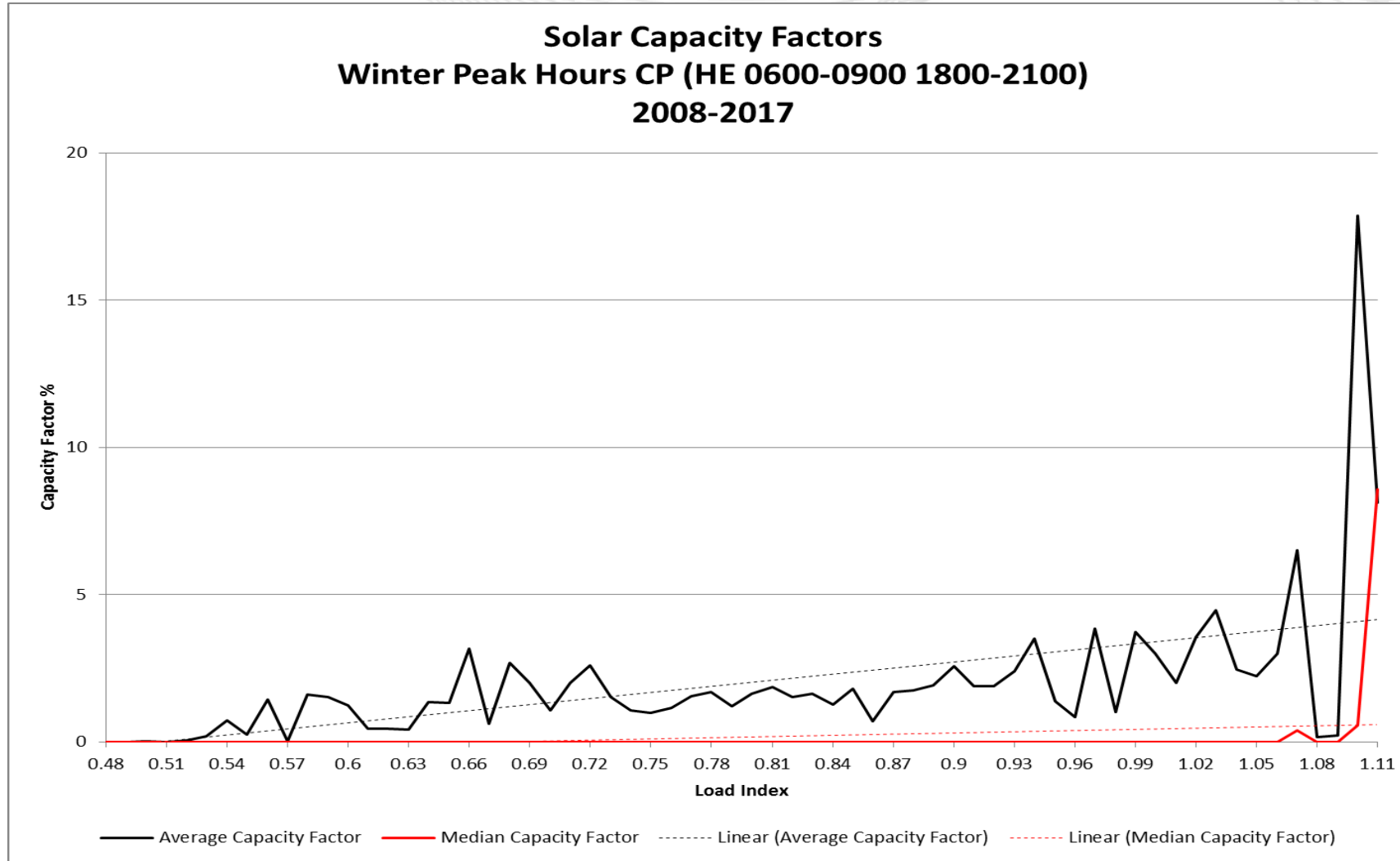


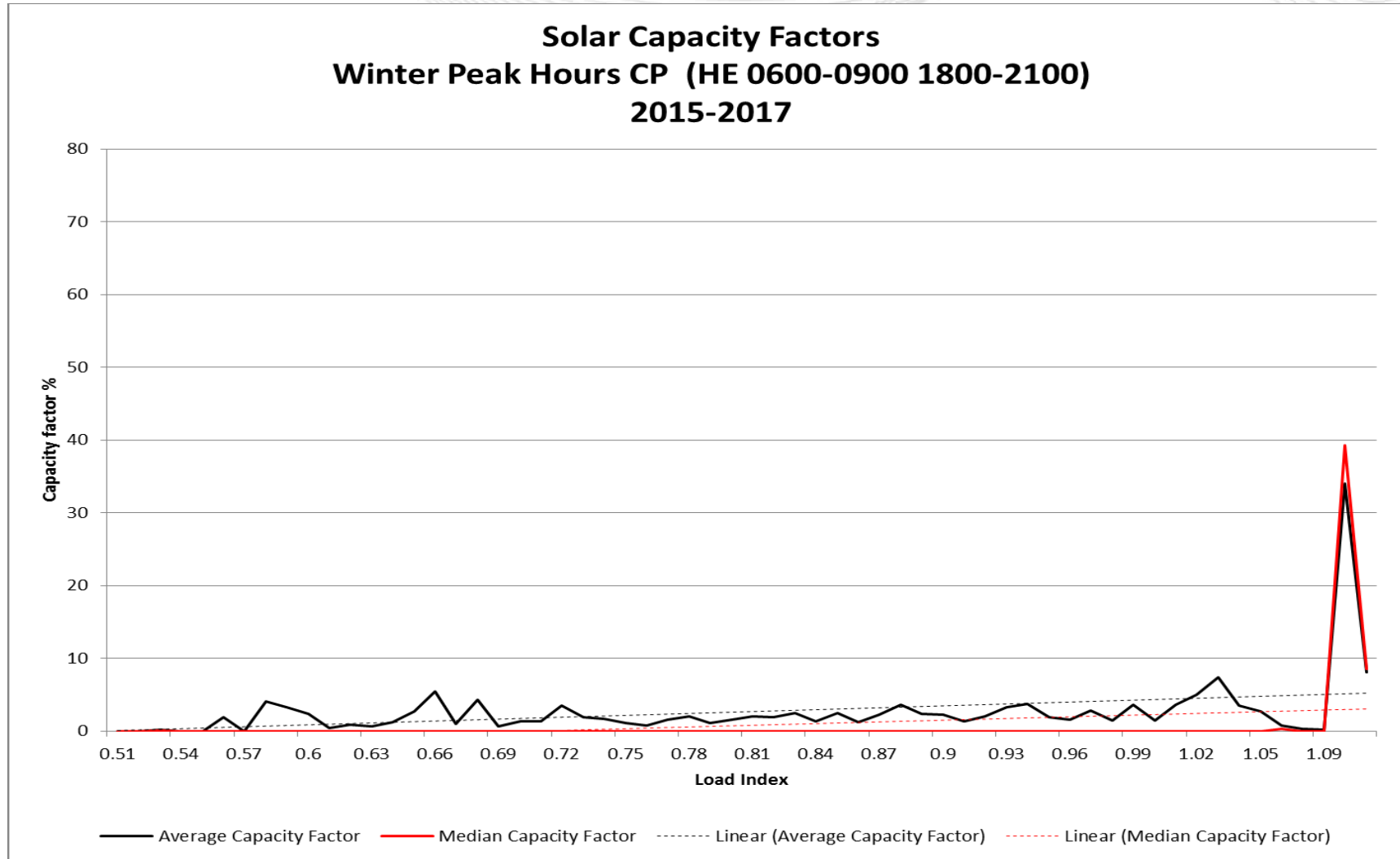


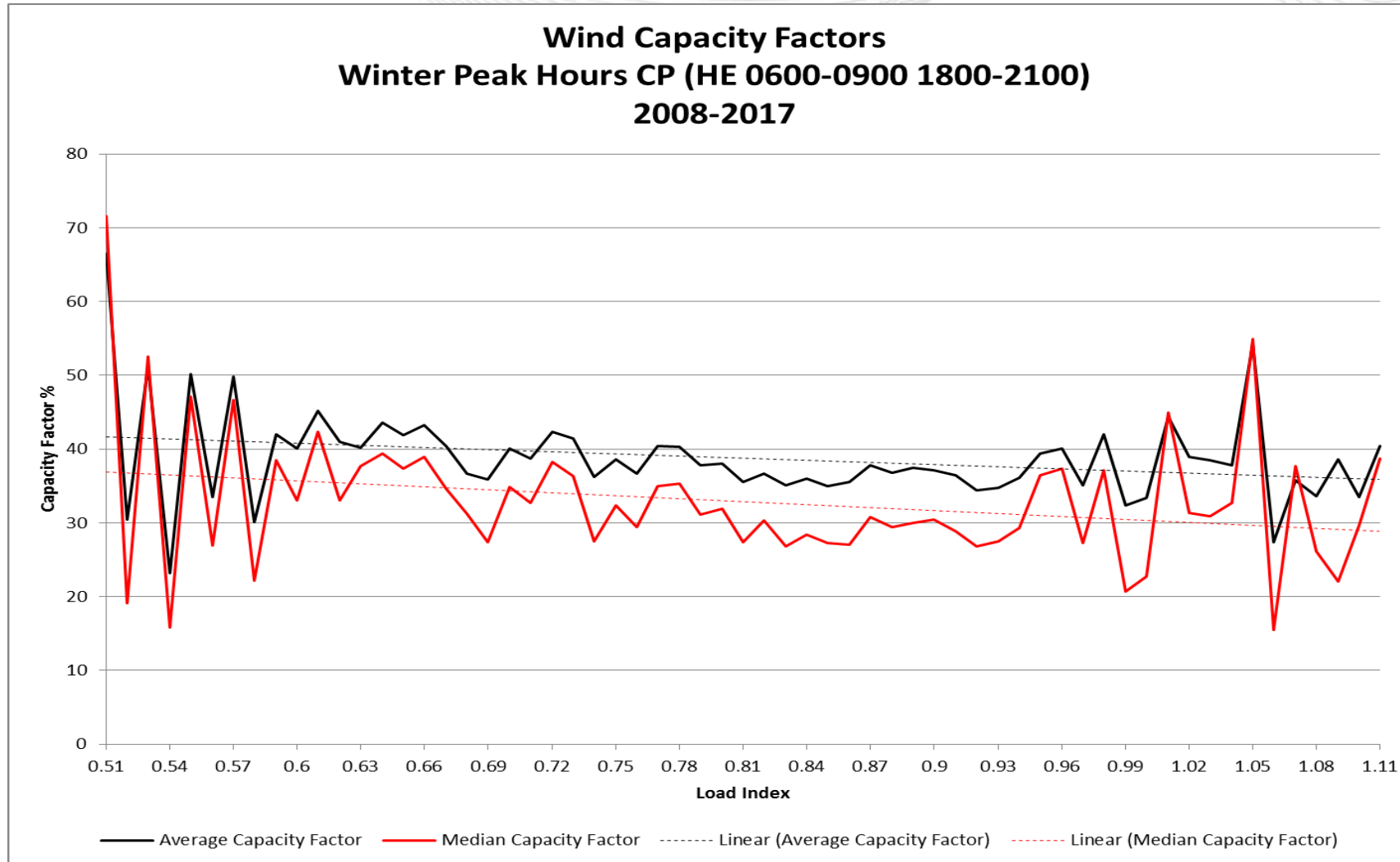


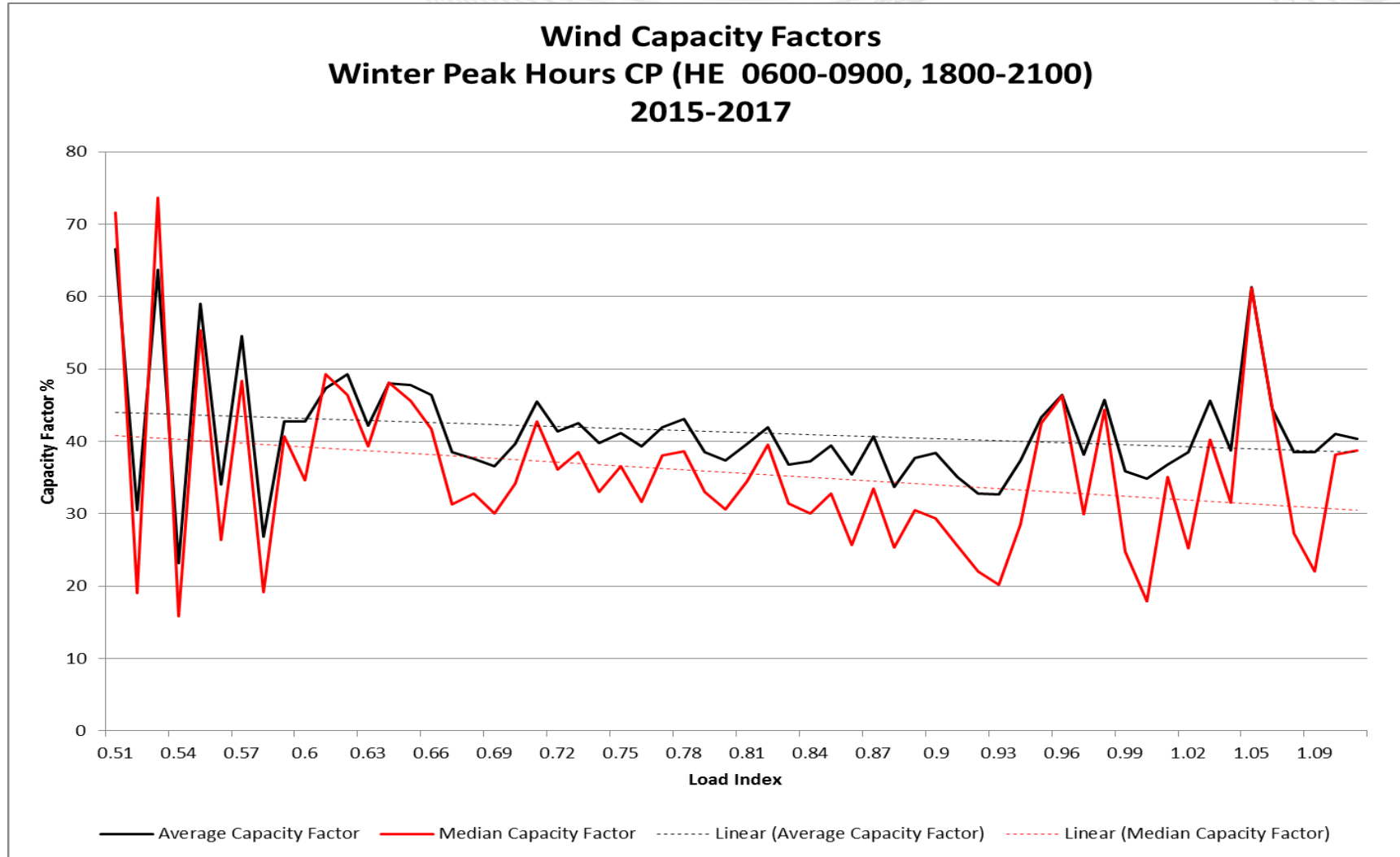


- The winter data consists of all peak hours (HE 0600-0900, 1800-2100) in winter January 1 through February 28/29
 - For the years 2009 through 2017 (one less winter than summer)
 - For the years 2015 through 2017









Unit Type	Average Capacity Factor	Median Capacity Factor
Wind	15.4	7.0
Solar	39.9	38.6

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

Unit Type	Average Capacity Factor	Median Capacity Factor
Wind	37.7	31.0
Solar	1.9	0.0

Unit Type	Average Capacity Factor	Median Capacity Factor
Wind	39.7	34.0
Solar	2.1	0.0

- Wind
 - The peak hour average is about the 64th percentile production level
 - In other words, that production level is expected only 36% of the peak hours
- Solar
 - The peak hour average is nearly the 50th percentile production level

- 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

- Use the median capacity factor instead of the average capacity factor for both wind and solar resources
- Use the actual five minute settlement values to estimate what generation would have been during any curtailments of wind by PJM operations

- Since 1980, 90% of the PJM summer peaks have occurred in July or August
- Since 1998, 86% of the 5CPs have been in July or August
 - All 5CPs have never occurred in June
 - June has never had more than 2CPs in any year
 - All 5CPs have occurred in July three times
 - All 5CPs have occurred in August once
 - 4CPs have occurred in July three years
 - 4CPs have occurred in August four years

Percent of tests conducted by unit type and month									
	Pumped Storage	Hydro	Nuclear	Fossil Steam	Diesel	Fluidized Bed	Combined Cycle	Combustion Turbine	Total
June	79%	53%	47%	42%	41%	37%	37%	29%	39%
July	17%	28%	34%	33%	34%	37%	37%	43%	36%
August	5%	19%	19%	25%	25%	26%	26%	28%	25%



Station Service Use During Verification Tests Compared to Ambient Corrections

Summer Capacity Verification Tests 2013 through 2017				
Plant/Unit	Multi Unit Plant (Y/N)	Low Station Service Use as a percent of Average Station Service	Low Station Service Use as a percent of Average Station Service	Ambient Correction as a percent of Average Station Service
Plant 101 Unit 2	Y	-19.1%	20.5%	9.4%
Plant 103 Unit 1	Y	-43.5%	164.3%	0.7%
Plant 108 Unit 3	Y	-26.1%	19.6%	5.6%
Plant 11 Unit 1	Y	-26.9%	11.9%	0.0%
Plant 11 Unit 2	Y	-26.1%	12.6%	0.0%
Plant 119 Unit 1	Y	-94.2%	94.2%	27.5%
Plant 119 Unit 2	Y	-36.0%	180.2%	15.9%
Plant 19 Unit 2	Y	-32.0%	27.6%	13.2%
Plant 21 Unit 3	Y	-55.6%	39.4%	13.8%
Plant 24 Unit 1	Y	-24.8%	15.6%	5.5%
Plant 26 Unit 1	Y	-16.8%	47.7%	11.9%
Plant 26 Unit 2	Y	-31.0%	34.2%	4.1%
Plant 31 Unit 1	Y	-41.7%	33.3%	0.0%
Plant 65 Unit 1	Y	-47.2%	23.4%	4.0%
Plant 65 Unit 2	Y	-45.1%	105.0%	35.8%
Plant 65 Unit 3	Y	-60.1%	65.4%	19.7%
Plant 86 Unit 1	Y	-29.4%	19.0%	17.3%
Plant 86 Unit 2	Y	-44.4%	24.3%	12.2%
Plant 86 Unit 3	Y	-31.0%	33.4%	6.1%
Plant 95 Unit 1	Y	-28.3%	31.7%	2.3%
Plant 95 Unit 2	Y	-27.7%	14.0%	3.2%

- Proposed Changes
 - Summer testing period will be shortened by one month to July 1 through August 31
 - Required derate events for test shortfalls will continue to be retroactive to June 1
 - PJM will reserve the right to require all units at a plant (up to ten plants per summer and irrespective of unit type) to test simultaneously in the summer test period
 - PJM will send notice (via email) which plants must test simultaneously, prior to July 1 annually.
 - This provision will be for plants other than those considered Capacity Storage or Intermittent Resources per Manual 18
 - All Tests will be required to start at five minute intervals (to coincide with the five minute settlements commencing 4/1/2018)

- Revised CIR section
- Intermittent and Capacity Storage Resources Simultaneous Testing
- Appendix B, Wind and Solar Capacity Factors (Median instead of Average)
- Summer Testing Period (July 1 through August 31)

- 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