



Manual 21

Rules and Procedures for Determination of Generating Capability Changes

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Planning Committee
March 8th, 2018

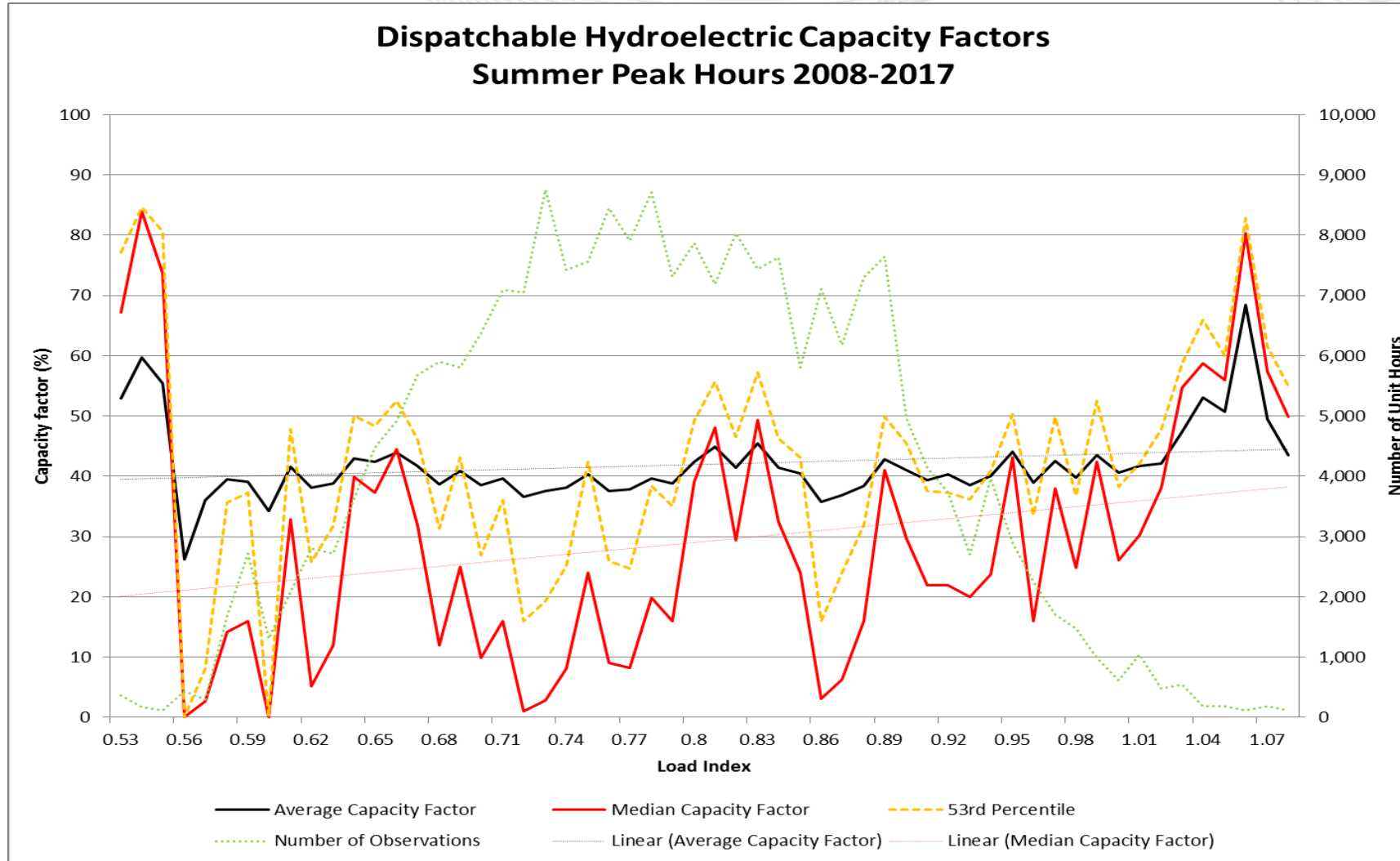
- Added wording in the introduction to emphasize Manual 21 is an extension of and augments the RAA, Schedule 9
- Added a new Capacity Interconnection Rights section
- Section 1, Installed Capacity
 - Add additional details for determining Installed Capacity.
 - Add wording about simultaneous testing for up to ten plants per summer per PJM directive
 - Shortened the summer test period to July and August
- Section 2, Net Capability, reconfigure, and split into Conventional Generators, Capacity Storage Units and Intermittent Units
 - Simultaneous testing at each plant for Capacity Storage and Intermittent Units
- Appendix B, basing the capacity factor calculations on the median rather than the average starting summer DY18/19

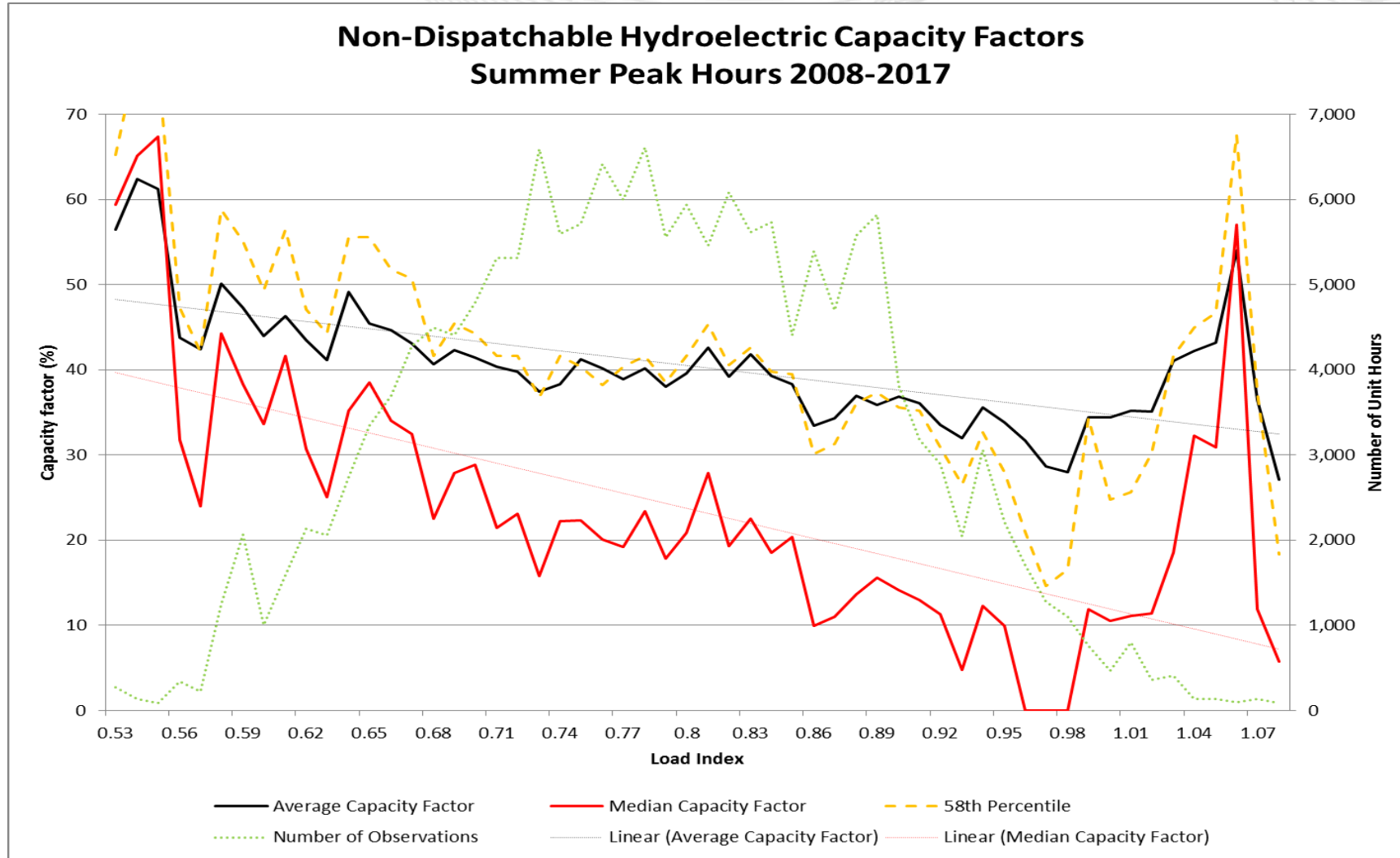
- Added wording that states:
 - “This manual is specifically intended to re-inforce and augment Schedule 9 of the Reliability Assurance Agreement.”

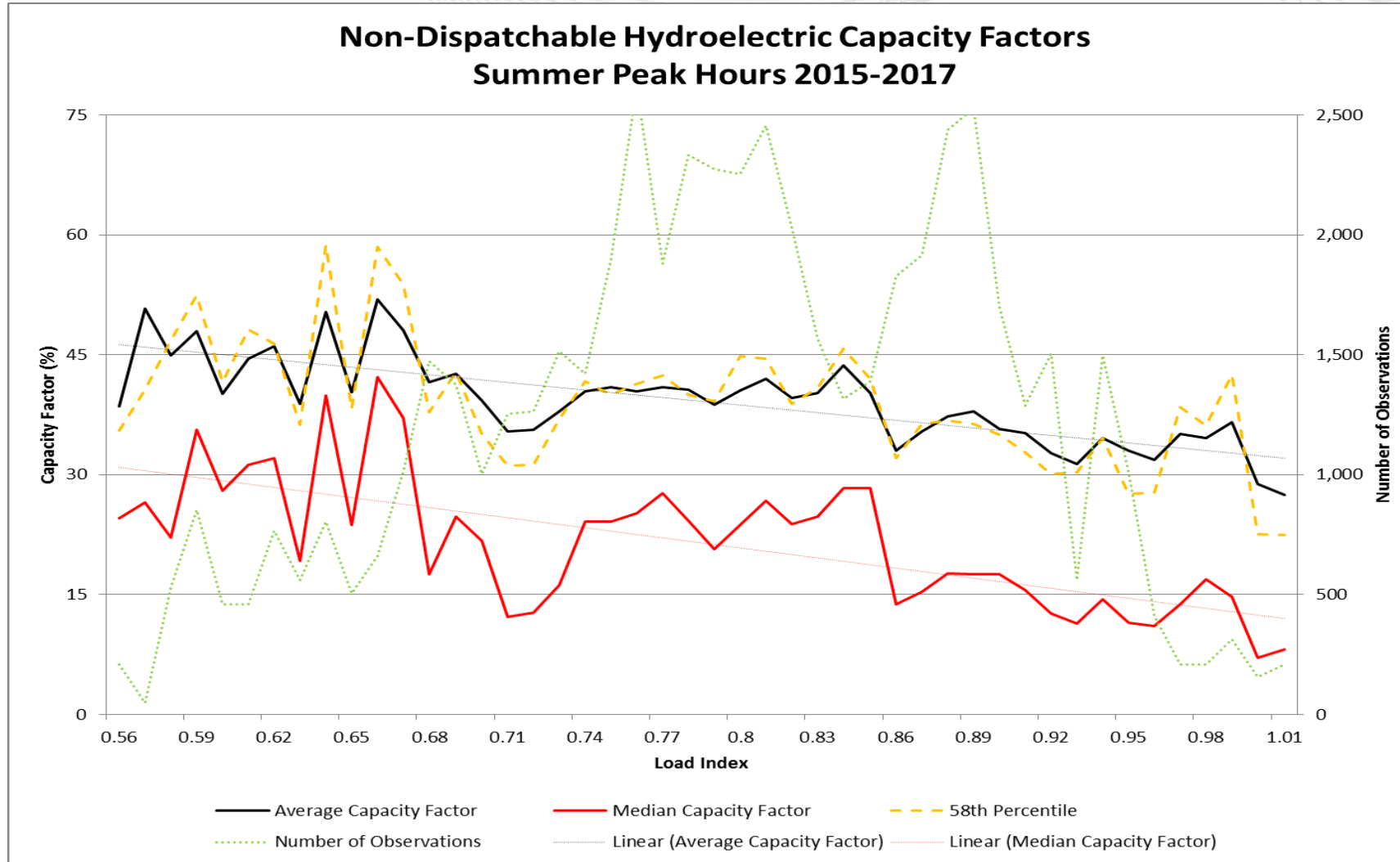
- How CIRs are attained
 - ISA, WMPA or Integration
 - Results of a deliverability study
- How CIRs are retained and lost
 - Performing summer capability verification tests
 - Proving CIRs once every three years
 - Specific rules for units with aggregated CIRs

- 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

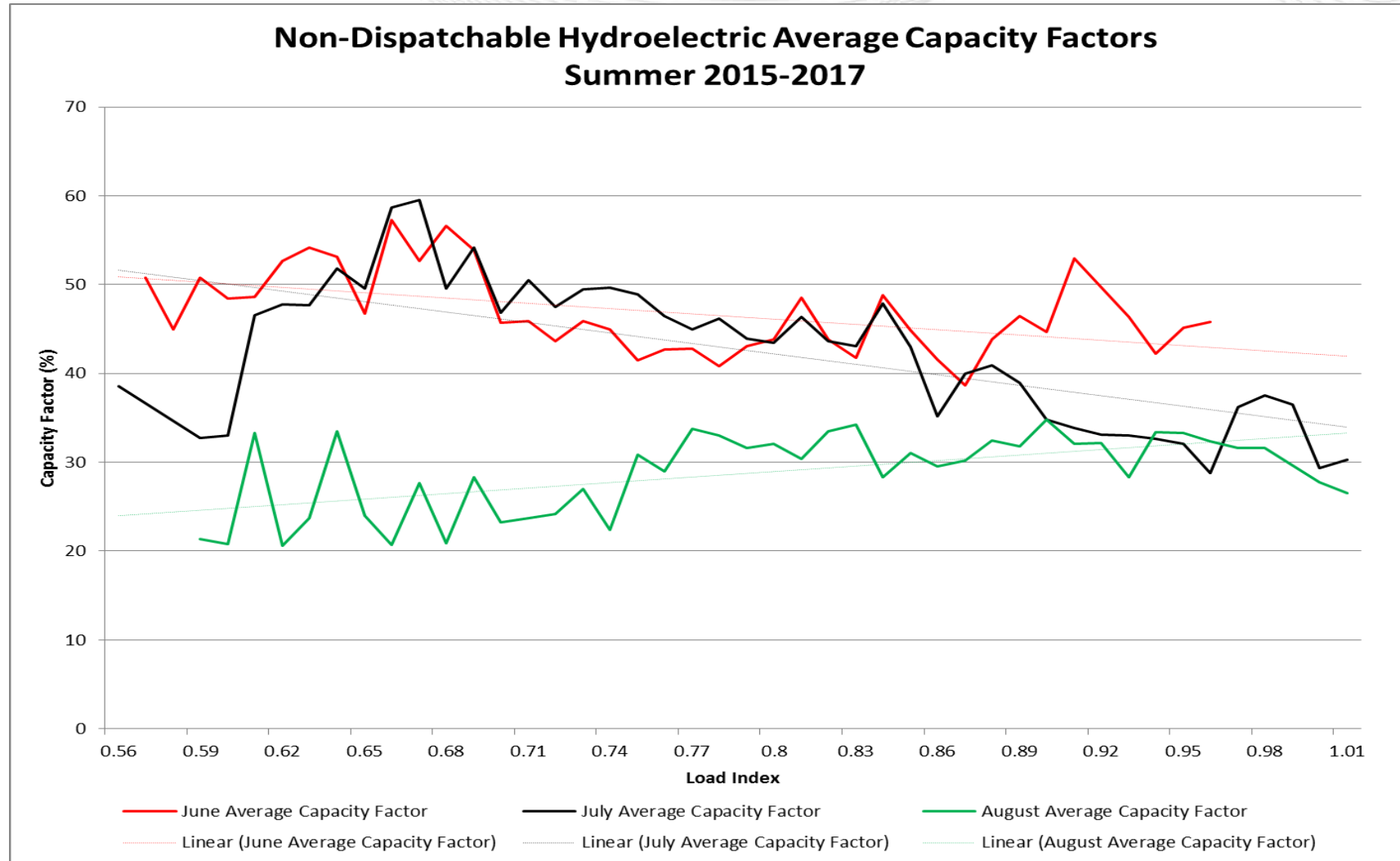
- For this analysis a load index was created that is the unrestricted PJM RTO load (for each peak hour) divided by the PJM Weather Normalized Peak for that year and plotted against average and median hydroelectric capacity factors
- The summer data consists of all peak hours (HE 1500-1800) in summer June 1 through August 31
 - For the years 2008 through 2017
 - For the years 2015 through 2017
- Data was grouped into two categories:
 - Non-Dispatchable Hydro
 - Dispatchable Hydro (excluding Pumped Storage)



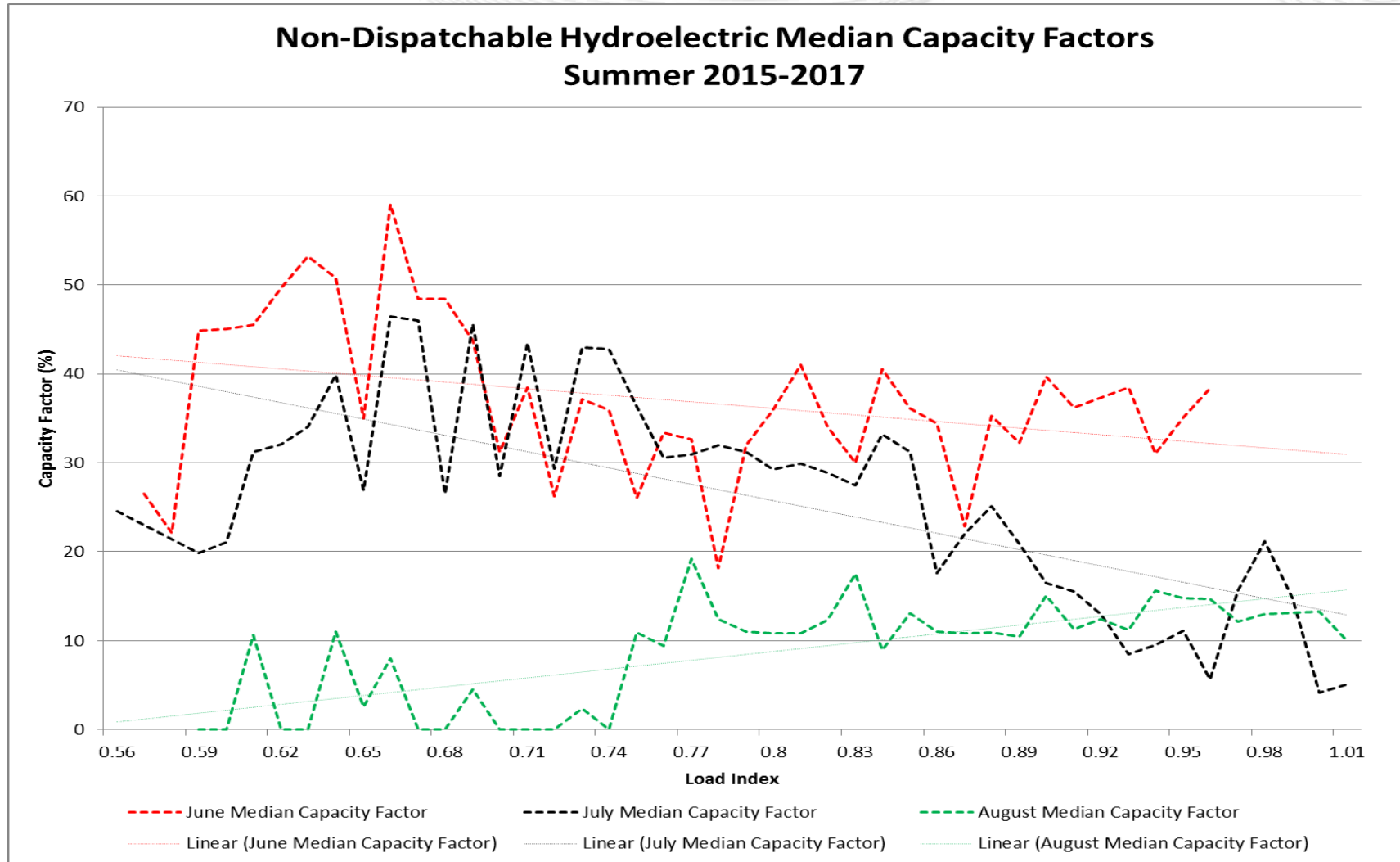




Non-Dispatchable Hydroelectric Average Capacity Factors Summer 2015-2017 HE 1500-1800 by month



Non-Dispatchable Hydroelectric Median Capacity Factors Summer 2015-2017 HE 1500-1800 by month





Non-Dispatchable Hydroelectric Median Capacity Factors (values in percent)

Time Frame	Median Capacity Factor	Median Capacity Factors During PJM 5 CPs	Median Capacity Factors During PJM System Peak
Summer 2008-2017	20.0	12.6	16.6
June 2008-2017	41.4	40.5	31.5
July 2008-2017	17.2	11.2	11.6
August 2008-2017	9.3	11.6	19.1
Summer 2015-2017	21.5	12.4	13.3
June 2015-2017	36.7	32.3	-
July 2015-2017	25.2	11.8	17.4
August 2015-2017	9.7	8.7	9.6

- There is 650 MW of non-dispatchable hydro
- The expected capacity factor of 20% shows that 130 MW is expected to serve load
- Non-dispatchable hydro capability may be overstated by about 520 MW

- Non-Dispatchable Hydroelectric could possibly use the wind and solar capacity factor method to determine its capacity value
- One company has suggested that we limit testing to June 15 through August 31
- We could alter the summer test period to ensure testing is done under summer conditions that are more in line with streamflows expected during the summer peak

- MW Committed
 - DY 2018/2019
 - 2,700 MW ICAP
 - 1,700 MW non-CP
 - 825 MW CP
 - DY 2019/2020
 - 2,700 MW ICAP
 - 1,900 MW non-CP
 - 625 MW CP
 - DY 2020/2021
 - 2,100 MW ICAP
 - 1,650 MW CP

- 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

- Since 2008 the 5 CP statistics are:
 - June
 - 6 have occurred
 - None have eclipsed the Weather Normalized Peak
 - The highest was 98.8% of the Weather Normalized Peak
 - July
 - 31 have occurred
 - 15 have eclipsed the Weather Normalized Peak
 - The highest was 108% of the Weather Normalized Peak

- Since 2008 the 5 CP statistics are:
 - August
 - 11 have occurred
 - 1 has eclipsed the Weather Normalized Peak
 - The highest was 101.3% of the Weather Normalized Peak
 - September
 - 2 have occurred
 - None have eclipsed the Weather Normalized Peak
 - The highest was 94% of the Weather Normalized Peak



Plant Verification Test Example

Three 300 MW units

2017 test data

	Unit #1 Gross MW	Unit #1 Aux MW	Unit #1 Net MW	Common or Startup Load	Unit #2 Gross MW	Unit #2 Aux MW	Unit #2 Net MW	Unit #3 Gross MW	Unit #3 Aux MW	Unit #3 Net MW	Station Gross MW	Station Use MW	Station Net MW	Aux, Common or Startup Load not considered
Actual Test Data	337.0	37.0	300.0											
Meter Data	338.7	17.4	321.3	39.5	0.0	0.9	-0.9	0.0	0.9	-0.9	338.7	58.8	279.9	20.0
Telemetry Data	335.6	21.9	313.7	40.7	0.0	0.0	0.0	0.0	0.0	0.0	335.6	62.6	273.0	25.6
Actual Test Data					307.2	7.2	300.0							
Meter Data	0.0	0.0	0.0	17.3	306.8	6.8	300.0	0.0	0.6	-0.6	306.8	24.7	282.1	17.7
Telemetry Data	0.0	0.0	0.0	17.0	306.5	7.0	299.5	0.0	0.0	0.0	306.5	24.1	282.5	17.2
Actual Test Data								308.9	8.9	300.0				
Meter Data	132.1	9.9	122.3	22.3	0.0	0.3	-0.3	300.0	0.0	300.0	432.1	32.5	399.6	13.4
Telemetry Data	128.5	11.8	116.7	22.9	0.0	0.0	0.0	308.0	7.9	300.1	436.6	42.6	394.0	13.9

- Generators may not be properly rating their units (determining ICAP)
 - They may not be considering supplemental load used during PJM Peaks
 - They may not be considering common load or other load at the times of the PJM Peaks
- Generators may not be properly accounting for aux load while testing
 - They may not be considering load on the common or startup bus
 - They may not transfer all load to the aux bus from the common or startup bus

- Change the summer testing period:
 - From June 1 through August 31 to *July 1 through August 31*
- Reasons for the change:
 - PJM summer peaks occur most often in July and August
 - June ambient conditions favor generator performance
 - Many generators do not properly account for auxiliary load
 - Common Load
 - Cooling and supplemental cooling load
 - Load left on, ignored or forgotten on a common or startup bus

- More reasons for the change:
 - If tests are conducted nearer the PJM peaks
 - Ambient corrections will be smaller
 - Test conditions will be nearer summer conditions
 - Summer conditions are site conditions coincident with the dates and times of the last 15 years PJM Summer Peaks
 - Supplemental cooling is more likely to be in service
 - This will get plants closer to the condition under which they should be rated (RAA, Schedule 9)
 - Expected summer conditions

- 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 (the beginning of the Delivery Year)
 - 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 are chosen to 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
 - This will close the common/startup bus load issues, since all MW will be counted
 - All Tests will be required to start at five minute intervals (to coincide with the five minute settlements commencing 4/1/2018)
 - This will help in verifying gross, auxiliary and net load on verification tests

- 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