New York ISO
Independent System Operator

Modeling Improvements for Capacity Accreditation: Ambient Derates

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Agenda

- Review
- Ambient Adjustments: Temperature and Humidity
- Ambient Adjustments: Water
- Next Steps

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Previous Discussions

Date	Working Group	Discussion Points and Links to Materials
January 23, 2023	ICAPWG	Modeling Improvements for Capacity Accreditation: Project Kick Off: https://www.nyiso.com/documents/20142/35880057/2023-01-26%20ICAPWG%20Modeling%20Improvements%20-%20Kick%20Off.pdf/c7ac6b6e-c90b-54b4-832d-ec6ecfc8f7ff
February 28, 2023	ICAPWG	Modeling Improvements for Capacity Accreditation: Correlated Derates https://www.nyiso.com/documents/20142/36499713/Correlated_Derates_MIWG_022823_FINAL.pdf/35eaab46-740e-aed0-9e2d-2207c06a0659
May 8, 2023	ICAPWG	Modeling Improvements for Capacity Accreditation: Correlated Derates https://www.nyiso.com/documents/20142/37431277/5%20Correlated_Derates_ICAPWG_050823.pdf/a1e9a0f4-d922-503d-06d0-682b49c46c4c
July 27, 2022	ICAPWG	Modeling Improvement for Capacity Accreditation: Correlated Derates https://www.nyiso.com/documents/20142/39044934/Correlated_Derates_ICAPWG_072723_final.pdf/0f80f8f2-8100-b8f7-0c65-0098242634e1

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Review

Review

- **Currently, DMNC tests on internal combustion, combustion units and combined cycle units must be temperature adjusted**
  - The Average Ambient Temperature used for the temperature adjustment is the average of the ambient temperatures recorded at the time of the Transmission District's seasonal peak during the previous four like-Capability Periods
  - These units correct their DMNC test MW value to a curve, usually reducing the amount of capacity that can be sold
- **The MMU has noted a "significant amount" of ICAP from fossil-fuel and nuclear generators is qualified but functionally unavailable due to ambient conditions and recommends more units be temperature adjusted**
- **This project considers methodologies to calculate seasonal capacity ratings that are adjusted for ambient water, air temperature and humidity conditions for affected generators**

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Proposed Ambient Adjustment Process

- Develop a questionnaire for thermal generators to describe their cooling systems
- Thermal generators to be categorized based on their responses
  1. Air Temperature Adjusted, as currently required for CTs and CCs
  2. Air Temperature and Humidity Adjusted, for units with inlet coolers
  3. Water Temperature Adjusted, for units with once-through water cooling
- Air Temperature and Humidity Adjusted generators would then provide an output curve, and adjust their DMNC to expected ambient conditions at the time of ICAP peak forecast for their zone
- Water Temperature Adjusted Units will be expected to use actual operation for establishing the Resource's Installed Capacity Value

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Ambient Air and Humidity Adjusted

Temperature & Humidity Terminology

- Dry Bulb Temperature - The dry-bulb temperature is the temperature of air measured by a thermometer freely exposed to the air but shielded from radiation
- Wet Bulb Temperature - The wet-bulb temperature is the temperature read by a thermometer covered in water-soaked cloth over which air is passed
- Specific Humidity - Humidity is the concentration of water vapor present in the air. Specific humidity is a measure of the amount of water vapor in a unit mass of moist air. It is usually expressed as grams of vapor per kilogram of air, or, in air conditioning, as grains per pound
- Relative Humidity - Relative humidity is the actual amount of water vapor present in relation to the maximum possible water vapor the air can have at a particular temperature
- Given dry bulb, wet bulb and air pressure, the specific and relative humidity can be calculated
- The NYISO maintains a database that includes dry bulb and wet bulb temperature

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Ambient Air and Humidity Adjustment

- Propose units with inlet cooling systems will adjust DMNC to output curves based on both Temperature and Humidity
- These units can use Dry Bulb temperature and Wet Bulb temperature to obtain Relative Humidity (RH), Specific Humidity (SH) or any other variable they require to obtain the performance of their units at actual and design conditions

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Temperature and Humidity Data

- **Current methodology averages the ambient temperatures recorded at the time of the Transmission District's seasonal peak for four like Capability Periods**
  - Ambient adjustments based on observed conditions may not be consistent with design criteria conditions used for setting the ICAP requirement
- **Proposal for air temperature and humidity-dependent units is to adjust DMNC MW to a reference point based on the temperature and humidity used for the ICAP forecast**
  - NYISO uses 20 years of dry and wet bulb temperatures to weather normalize peak demand and ICAP demand forecast
  - NYISO to provide Dry Bulb and Wet Bulb values used for the ICAP forecast for each zone

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Example of Data to be Provided

- Zonal Mean of Cumulative Max Dry and Wet Bulb Temperatures on Day of NYCA Peak

Design Temps	A	B	C	D	E	F	G	H	I	J	K
Dry Bulb (F)	86.6	89.0	89.4	87.8	88.1	90.8	91.9	92.3	91.8	92.2	90.7
Wet Bulb (F)	74.3	75.0	74.4	74.7	74.8	75.5	76.3	76.1	76.2	76.5	76.9

20-year history in the Appendix of this presentation

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Ambient Water Adjusted

Ambient Water Adjustment

- NYISO does not collect water temperature data, and public sources are limited
- Ambient adjustment for once-through water cooled units is unit specific and can be affected by a variety of factors that make it difficult to validate condenser pressure correction curves, even with accurate water temperature data
- Proposing to use actual operation for DMNC
  - Performance correction curves may be used by exception only

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Ambient Water Adjustment, continued

- DMNC to be based on actual operation data for summer capability season
  - No need to provide output curves or inlet water temperatures
- Valid operation may occur from July 1 to August 31, with a start time of 10am (HB 10) or later and the testing end time is 10pm (HB 22) or earlier
- Performance based on the sustained maximum net output over four (4) consecutive hours

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Exceptions

- If a water-cooled unit is unable to provide valid data from actual operation during the prescribed seasonal window, but capable of testing, the plant operator may request adjusting an alternate DMNC test value to an output curve.
- In making such request, the operator would need to provide to NYISO a certified condenser pressure correction curve and all necessary data inputs, such as water inlet temperatures, water flow rates, etc.

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Next Steps

Next Steps

- Requesting feedback from Market Participants on temperature adjustment methodology
- NYISO to present draft Tariff language for:
  - Methodology for setting output adjustment reference points based on ICAP forecast (ambient air and humidity adjusted Resources)
  - Methodology for setting DMNC for water-cooled Resources
  - Sunsetting the Capacity Limited Resources program
- Targeting late September or early October

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Appendix

20 Year History of Cumulative Max Dry Bulb Temperature (CDB) on Day of NYCA Peak

Sum of CT_Max Zone												
Year	1	2	3	4	5	6	7	8	9	10	11	12
2003	85.71	88.78	88.27	91.10	87.84	91.82	91.86	91.20	90.88	91.99	92.25	90.27
2004	83.44	87.00	86.38	84.18	86.62	89.38	90.00	90.20	88.43	88.30	84.29	86.35
2005	87.34	88.17	91.08	81.72	89.05	88.68	91.56	92.94	92.44	91.55	88.86	88.51
2006	89.17	91.92	90.79	91.32	90.10	93.76	95.37	96.36	95.79	95.86	95.91	93.29
2007	84.08	85.56	86.49	81.22	83.66	85.87	88.49	89.82	89.04	89.57	90.23	86.95
2008	87.02	90.09	91.28	85.28	88.32	92.52	93.09	93.71	93.31	94.13	93.17	91.56
2009	87.11	88.03	88.26	88.52	88.54	89.53	89.45	89.87	89.77	89.96	88.59	88.37
2010	87.87	90.50	91.95	92.04	92.25	94.18	97.78	99.39	99.45	99.14	98.76	95.35
2011	92.22	93.98	96.25	90.88	91.66	95.49	97.55	97.57	96.75	98.87	95.50	95.56
2012	88.26	92.37	92.41	86.08	90.61	92.99	92.35	92.80	92.60	90.58	89.40	89.97
2013	88.06	91.20	91.64	90.10	91.25	94.24	94.13	94.55	93.66	95.19	92.28	92.59
2014	77.64	81.70	83.14	83.14	81.70	84.67	87.63	87.93	87.93	89.52	85.75	84.92
2015	89.08	89.74	87.65	88.72	88.84	91.80	91.37	91.17	90.41	91.70	89.71	90.17
2016	89.89	91.16	86.76	88.64	87.61	88.19	88.32	89.48	89.52	89.39	87.90	88.27
2017	82.13	84.06	84.21	82.72	82.91	85.48	88.80	89.24	89.23	88.79	86.61	85.64
2018	86.10	89.93	88.85	91.36	89.35	92.93	91.02	91.08	90.80	91.25	90.75	90.01
2019	84.92	88.98	89.56	92.54	88.46	91.74	91.12	91.22	90.45	92.23	91.59	89.73
2020	84.92	86.59	91.15	89.52	86.41	90.66	92.24	92.49	91.20	92.27	92.76	90.17
2021	90.04	91.87	91.56	88.92	89.23	90.57	93.04	92.55	91.60	91.79	87.61	90.15
2022	86.89	89.18	89.68	87.12	88.04	92.02	92.30	93.12	92.46	91.43	91.84	89.96

CT Max STats	A	B	C	D	E	F	G	H	I	J	K	NYCA
Max	92.2	94.0	96.3	92.5	92.3	95.5	97.8	99.4	99.5	99.1	98.8	95.6
Mean	86.6	89.0	89.4	87.8	88.1	90.8	91.9	92.3	91.8	92.2	90.7	89.9
Min	77.6	81.7	83.1	81.2	81.7	84.7	87.6	87.9	87.9	88.3	84.3	84.9
Std Dev	3.2	3.0	3.1	3.6	2.8	3.0	2.8	2.9	2.9	3.1	3.6	2.9

20 Year History of Cumulative Max Wet Bulb Temperature (CWB) on Day of NYCA Peak

Sum of CWB_Ma Zone												
Year	1	2	3	4	5	6	7	8	9	10	11	12
2003	72.02	73.15	73.01	76.70	73.20	76.67	75.98	76.59	75.98	75.68	75.04	74.46
2004	73.03	75.48	73.17	72.68	73.61	74.80	74.47	74.62	74.61	75.58	74.05	74.13
2005	76.32	75.40	74.21	71.52	76.11	73.56	73.74	75.62	77.27	76.56	77.94	75.26
2006	78.33	80.10	78.63	78.58	78.99	79.57	80.28	80.55	80.39	79.59	80.13	79.23
2007	75.08	74.07	74.48	72.64	74.29	75.05	76.89	76.60	76.54	76.82	76.74	75.34
2008	72.63	73.80	74.11	71.72	72.98	75.65	76.97	76.18	75.99	75.92	75.24	74.52
2009	73.22	74.50	73.37	73.58	73.49	74.83	75.32	74.01	73.73	73.88	74.64	73.51
2010	73.98	74.37	74.67	76.18	75.35	75.97	75.15	74.13	73.65	74.84	73.91	74.29
2011	76.92	77.43	75.69	77.30	76.46	77.43	79.13	79.62	80.08	80.04	80.17	76.82
2012	74.28	73.97	73.44	73.76	73.73	75.14	74.76	74.09	73.64	74.53	74.96	73.59
2013	77.31	77.76	76.39	76.60	77.17	77.11	79.10	78.22	77.95	78.54	80.14	77.88
2014	71.89	72.70	73.00	72.30	72.86	73.37	75.05	75.74	76.08	75.63	76.78	74.19
2015	71.51	71.99	72.15	75.96	72.60	72.95	72.82	72.63	73.27	75.12	75.14	72.53
2016	74.15	75.13	74.25	74.40	75.65	76.03	77.95	77.60	78.09	78.60	78.08	76.49
2017	70.71	71.74	71.22	71.42	71.63	70.92	74.15	74.18	74.57	75.53	76.69	72.53
2018	75.22	77.14	75.42	76.36	75.77	77.02	77.76	76.63	76.37	77.78	79.19	76.96
2019	75.35	78.04	78.44	77.20	78.83	78.37	79.89	79.29	78.99	78.82	80.21	77.99
2020	75.02	74.81	74.15	76.68	74.74	74.22	74.52	74.04	73.90	74.65	76.22	73.99
2021	74.97	75.28	75.11	73.50	75.55	76.61	77.33	77.07	76.92	77.15	77.43	76.23
2022	73.07	73.46	72.98	75.12	73.81	74.30	74.40	74.65	75.00	75.01	75.79	73.98

CWB Max Stats	A	B	C	D	E	F	G	H	I	J	K	NYCA
Max	78.3	80.1	78.6	78.6	79.0	79.6	80.3	80.6	80.4	80.0	80.2	79.2
Mean	74.3	75.0	74.4	74.7	74.8	75.5	76.3	76.1	76.2	76.5	76.9	75.2
Min	70.7	71.7	71.2	71.4	71.6	70.9	72.8	72.6	73.3	73.9	73.9	72.5
Std Dev	2.0	2.2	1.9	2.2	2.0	2.0	2.2	2.1	2.2	1.8	2.1	1.9

Gold Book Table I-20

Historical Peak Day Weather Distributions

Summer NYCA Peak Day Temperature - Daily Average (deg F)

Weather	A	B	C	D	E	F	G	H	I	J	K	NYCA
10th	74	75	75	73	75	77	78	79	80	82	79	78
Baseline	79	79	79	78	78	80	82	83	85	87	83	83
90th	83	84	83	83	81	84	85	86	87	90	87	86
99th	86	87	86	87	84	87	88	89	90	93	91	89

Summer NYCA Peak Day Temperature - Daily Maximum (deg F)

Weather	A	B	C	D	E	F	G	H	I	J	K	NYCA
10th	82	85	85	82	85	87	89	89	88	89	87	87
Baseline	87	89	90	88	89	91	94	94	95	95	92	91
90th	91	94	95	94	93	96	97	98	98	98	98	95
99th	95	97	98	98	96	99	100	102	102	102	103	99

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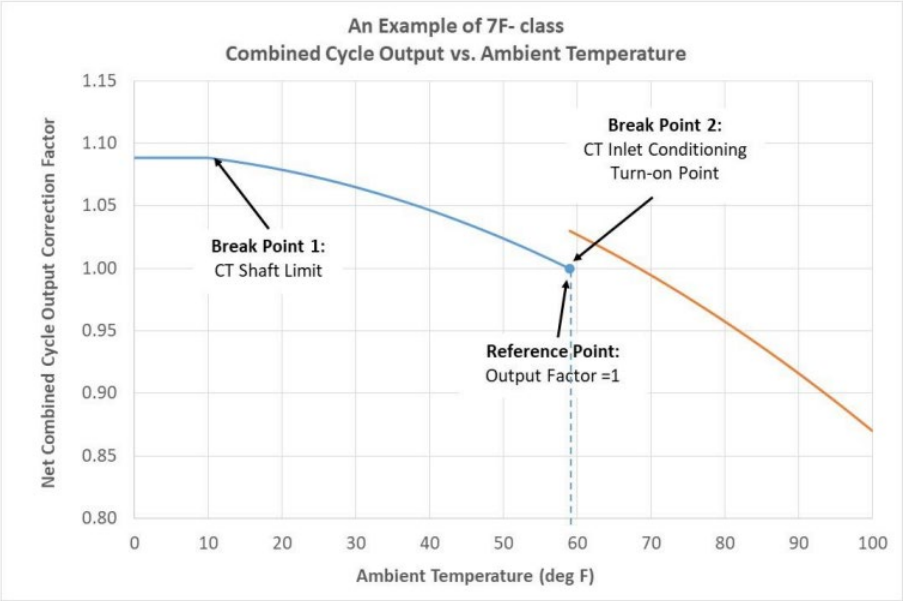
Ambient Temperature Adjustment

- Break points lead to multiple output factor equations in expressing the relationship between output ratio and the ambient temperature over the full ambient temperature range



Source: NYISO ICAP Manual, Attachment M

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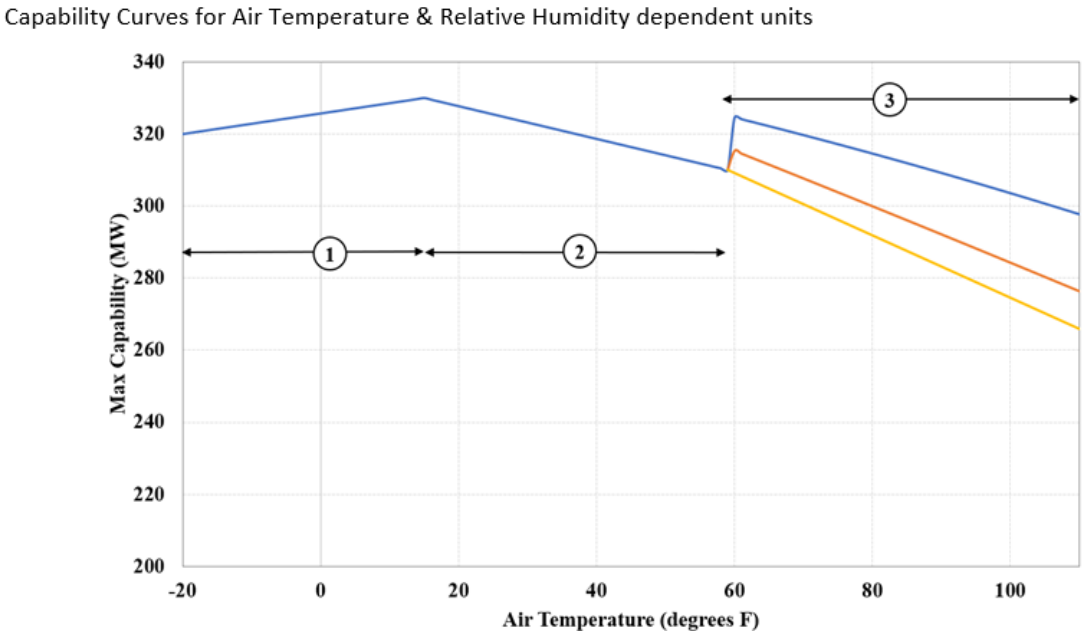
Temperature and Humidity Curve

- In this example the unit's output is adjusted as function of both air temperature and relative humidity (RH). In area 3 of the curve the unit turns on an evaporative inlet cooler to boost output. The three curves represent output at 20% RH, 60% RH and with the inlet cooler turned off.

(Curve provided by MMU)



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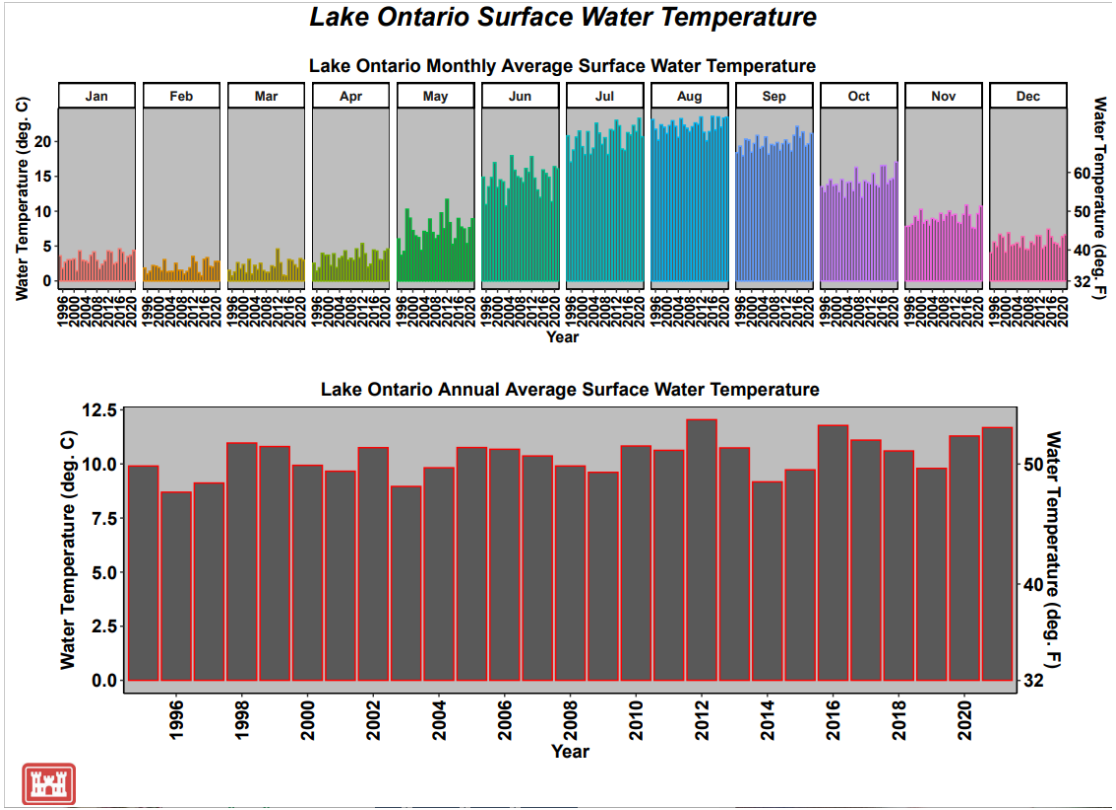
Example: Monthly Water Temperature



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Our Mission & Vision

Mission

Ensure power system reliability and competitive markets for New York in a clean energy future

Vision

Working together with stakeholders to build the cleanest, most reliable electric system in the nation

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