New York ISO
Independent System Operator

Modeling Improvements for Capacity Accreditation: Correlated Derates

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ICAPWG/MIWG
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Agenda

- Review
- Ambient Adjustments
  - Procedures for Air and Humidity Adjusted Resources
  - Procedures for Water Cooled Resources
- Capacity Limited Resources
  - Tariff
- 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 Improvements for Capacity Accreditation: Correlated Derates https://www.nyiso.com/documents/20142/39044934/Correlated_Derates_ICAPWG_072723_final.pdf/0f80f8f2-8100-b8f7-0c65-0098242634e1
September 5, 2023	ICAPWG	Modeling Improvements for Capacity Accreditation: Ambient Derates PowerPoint Presentation (nyiso.com)

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Review

Modeling Improvements for Capacity Accreditation: Correlated Derates

- As part of the 2022 Improving Capacity Accreditation project the NYISO identified that the functionality in the current resource adequacy analysis used to establish New York State IRMs may limit the basis of determining Capacity Accreditation Factors
- The "Correlated Derates" project address issues identified in Potomac Economics Q3 2022 State of the Market Report as "functionally unavailable capacity" that may not be properly modeled in the IRM/LCR
  - Ambient water-related deratings for steam units
  - Humidity-adjustments for combined and simple cycle combustion turbines
  - Emergency-only capacity that may not be reliably available in Real-time
- The Modeling Improvements for Capacity Accreditation project deliverable is a Q4 Functional Requirements

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Ambient Temperature Adjustments

- **Currently, DMNC tests for 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
- **This project considers methodologies to calculate seasonal capacity ratings that are adjusted for ambient water, air temperature and humidity conditions for affected generators**
- **Proposal is to modify NYISO procedures to expand the use of ambient adjustment of DMNCs**

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Capacity Limited Resources

- **MMU Recommendation #2021-4**
  - NYISO currently overestimates the installed capacity of certain generators. This includes resources with emergency capacity that is virtually never committed in practice
  - Recommends developing procedures to more accurately determine the ICAP of units with functionally unavailable capacity
- **Proposing to require Capacity Limited Resources to offer their ICAP equivalent of UCAP sold in the Energy market**
  - A Capacity Limited Resource (CLR) is an ICAP supplier that is able to take extraordinary measures to increase its output above its Normal Upper Operating Limit (UOL_N) and can sell UCAP based on taking those extraordinary measures
  - Currently, a CLR's Bid/Schedule/Notify requirement is based on their Emergency Upper Operating Limit (UOL_E)
- **Proposing Tariff modifications to sunset the CLR program**

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Ambient Air and Humidity Adjusted

Proposed Ambient Adjustment Process

- Thermal generators will be requested to describe their cooling systems and then 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
- Both changes become effective May 1, 2025, which will affect DMNC values for the Capability Year beginning May 1, 2026

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Ambient Air and Humidity Adjustment

- 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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Reference Point for Adjustment

- **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
- **Test Temperature and Humidity defined as the temperature and humidity measurements obtained at the nearest approved weather station or an auditable recording device at the generator site**

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Temperature and Humidity Data

- **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

- Ambient adjustment for once-through water cooled generators 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 for generators with once-through water cooling

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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, flow rates 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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Limited 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 to adjust an alternate DMNC test value to an output curve
- In making such request, the operator will be required to provide to NYISO a certified condenser pressure correction curve and all necessary data inputs, such as water inlet temperatures, water flow rates, etc.
  - Requests will be denied if valid correction curve and data is not provided

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Capacity Limited Resources (“CLRs”)

Review

- **MMU Recommendation #2021-4**
  - NYISO currently overestimates the installed capacity of certain generators. This includes resources with emergency capacity that is virtually never committed in practice
  - Recommends developing procedures to more accurately determine the ICAP of units with functionally unavailable capacity
- **A portion of the "Emergency Capacity" that is functionally unavailable as identified by MMU is from Capacity Limited Resources**

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ICAP Manual: Attachment M

- **A Capacity Limited Resource (CLR) is an energy supplier that is able to take extraordinary measures to reliably increase its output above its UOL_N and has sold UCAP based on taking those extraordinary measures**
  - To register as a CLR unit, the unit operator must describe the operational or plant configuration changes that can be taken to increase output. Examples of a CLR include, but are not limited to, a steam plant that has the ability to remove its top feedwater heater from service
  - The UOL_E submitted for the CLR resource must be: (i) greater than or equal to that of UOL_N in both the DA and RT offer; (ii) achievable at the request of the NYISO under extraordinary conditions; and (iii) in the DA offer, equal to or greater than the unit's ICAP obligation.

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NYISO Proposal

- **Sunset the Capacity Limited Resources provision in the Tariff**
  - Units would no longer be able to test by taking “extraordinary measures” to increase output
  - In the energy market these units would be expected to offer their ICAP equivalent of UCAP sold at UOL_N
  - Sunset date: May 1, 2025

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Tariff Changes

- **MST 2.3 Definition**
  - Changes the definition of a Capacity Limited Resource, such that it is no longer applicable after April 30, 2025
- **MST 4.2 Day-Ahead Markets and Schedules**
  - Deletes Capacity Limited Resources
- **MST 4.3 In-Day Scheduling Changes**
  - Deletes Capacity Limited Resources
- **MST 4.5 Real-Time Market Settlements**
  - Deletes Capacity Limited Resources
- **MST 15.3A.1 Persistent Undergeneration Charges**
  - Deletes Capacity Limited Resources

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Next Steps

Next Steps

- Requesting feedback from Market Participants on today's presentation
- NYISO to take Modeling Improvements to BIC for a vote

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Appendix

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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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

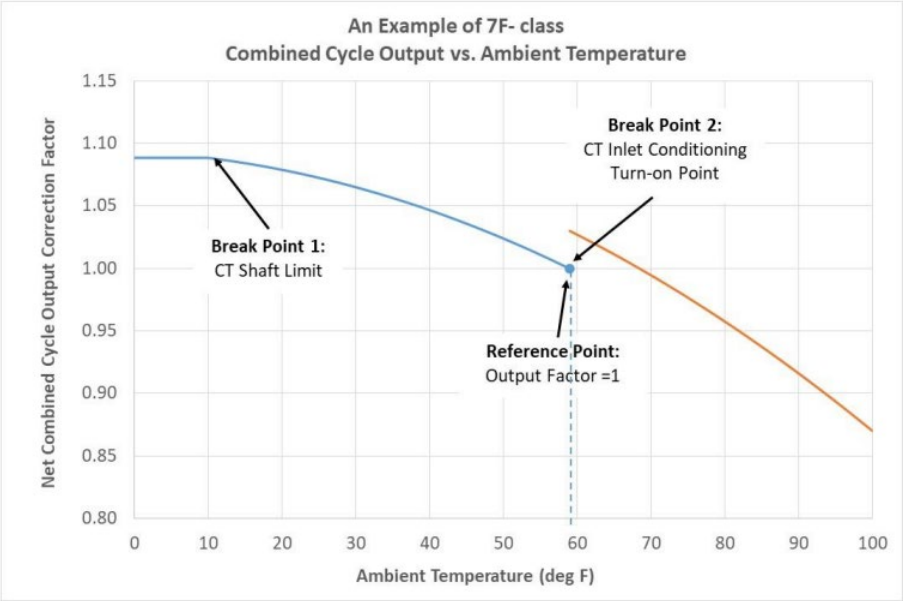
20 Year History of Cumulative Max Wet Bulb Temperature (CWB) on Day of NYCA Peak

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

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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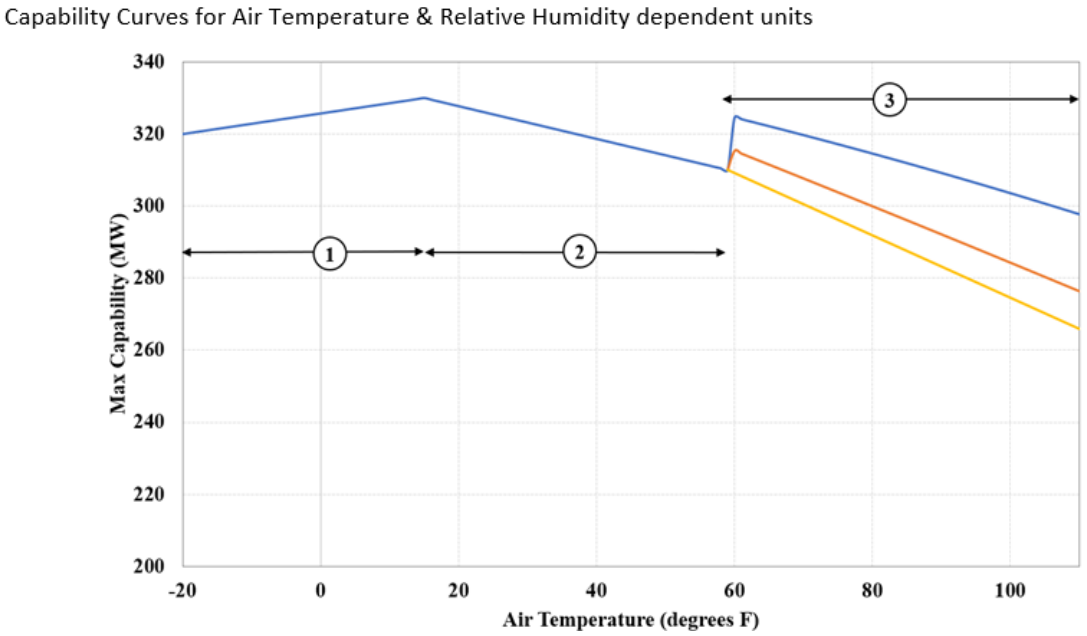
Temperature and Humidity Curve

- 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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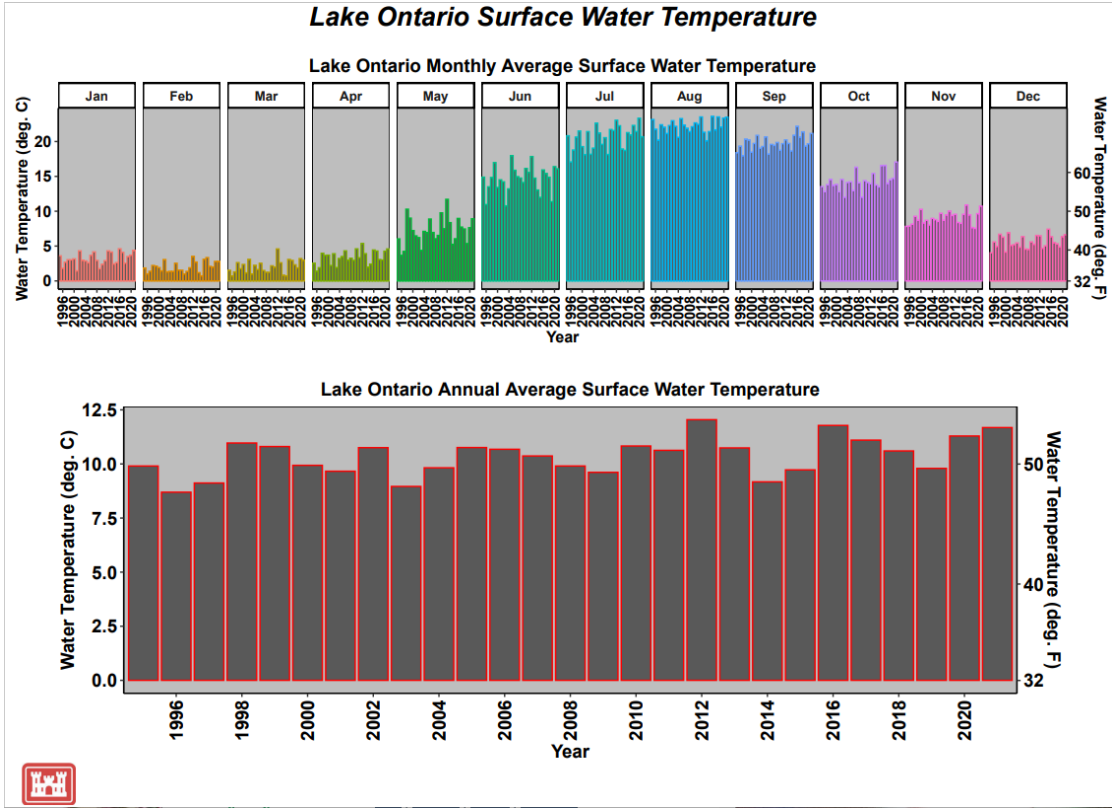
Example: Monthly Water Temperature



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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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