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Independent System Operator

# Evolving Resource Adequacy Models: Min-Max Operating Temperatures


## Brendan Long

Associate Market Design Specialist


## ICAPWG/MIWG

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# Agenda

- Review
- Evaluation of Extreme Temperatures on Capacity
- Next Steps

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# Review

- Multiple units are providing minimum and maximum operational temperature limitations that do not meet the temperature thresholds corresponding to the upper Bins for their zone
  - Upper Bins (Bins 1-3) represent cases where the system experiences temperatures driving higher seasonal peak loads than the baseline forecast
  - This introduces risk to whether the NYCA system can adequately respond to loads driven by these temperatures
- The current Resource Adequacy (RA) model derates the output of some thermal units for a range of ambient temperatures. However, it does not model potential outages when units are experiencing ambient temperatures beyond their operable range
- As part of the Evolving Resource Adequacy project, the NYISO is researching the need for changes to the assumptions, inputs and modeling used in the RA (or Installed Reserve Margin (IRM)) model to address ambient temperature limitations on Generator operations
- Project Deliverable: Q4 Study Complete

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# Review Cont'd

- **Received stakeholder feedback from the 3/20 ICAPWG to clarify the periodic look-back requirements for submitting historical operating temperature data**
  - NERC suggests that generators use NOAA's Climate Data Online database to determine historical operating temperatures[1]
  - NOAA's Climate Data Online database can only export a single dataset spanning 10 years. Therefore, if generators would like to use a look-back timeframe larger than 10 years, it must combine multiple exports

[1] Calculating Extreme Cold Weather Temperature

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# Evaluation of Extreme Temperatures on Capacity

# Objective

- **Quantify the MWs with operational temperature limitations that do not meet the temperatures corresponding to the upper-Bins**
  - Additionally examine by:
    - Generation type
    - Temperature deviation

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# Inputs

- **Generator list**
  - From the Capacity Model of the 2024 IRM Study
- **Generator information**
  - Zone
  - Generation Type
  - Modeled Winter Capacity
  - Modeled Summer Capacity
  - Min-Max Operational Temperature Submittals
    - From the GFER Annual Survey[1]
- **Bin Temperature Data**
  - Area-based Dry Bulb Winter Temperatures
  - Zonal-based Dry Bulb Summer Temperatures

[1] Generator Fuel and Emissions Reporting User's Guide (pg. 8)

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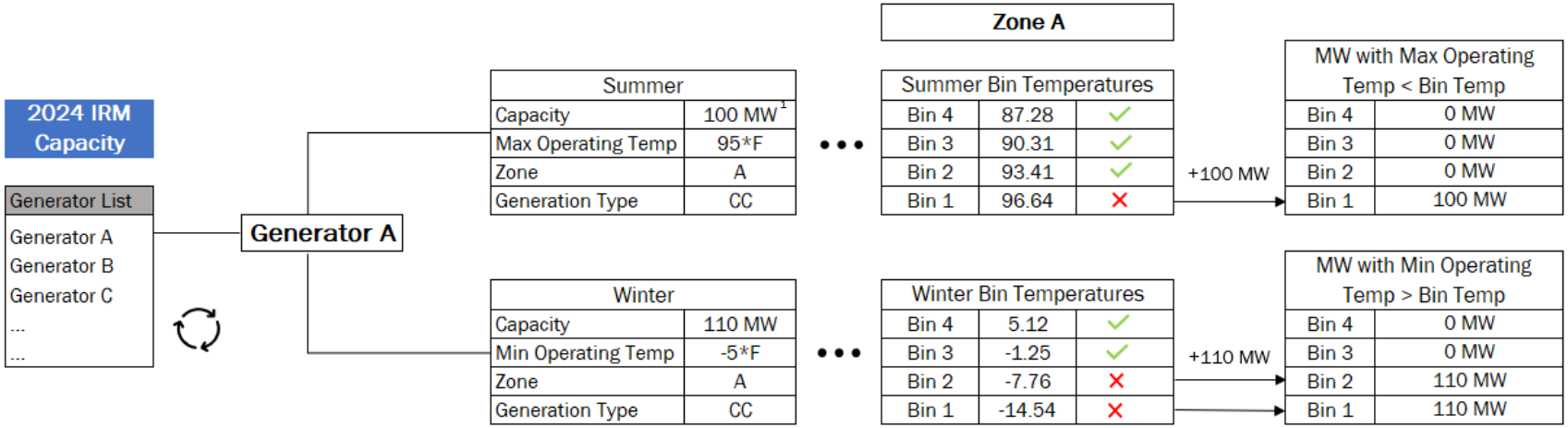
# Methodology Example




[1] The RA model currently derates CTs and CCs to reflect slightly reduced outputs at temperatures above DMNC test temperatures. These derates were not included in this analysis

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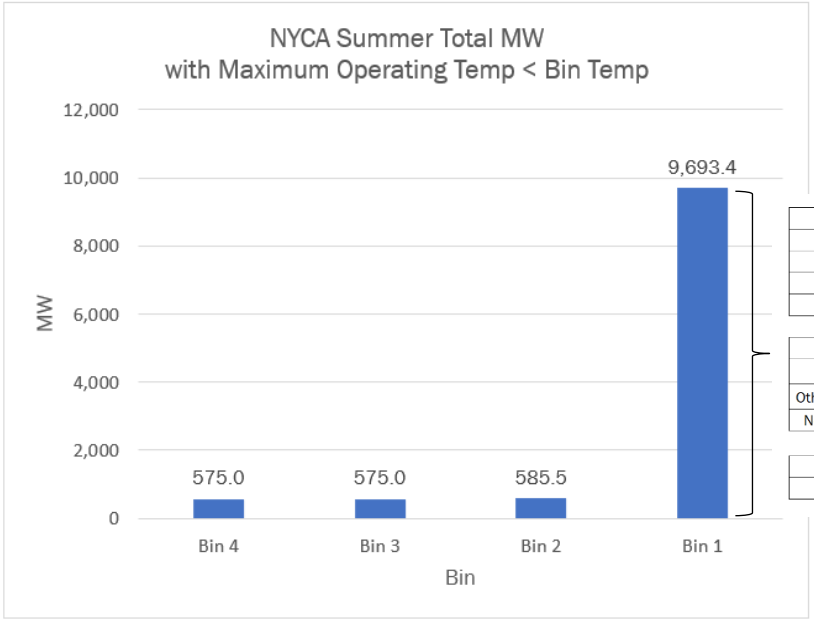
# Summer Results

| Zone | Bin Temp[1] Bin 4 | Bin 3 | Bin 2 | Bin 1 |
|---|---|---|---|---|
| A | 87.28*F | 90.31*F | 93.41*F | 96.64*F |
| B | 89.54*F | 92.19*F | 94.9*F | 97.72*F |
| C | 90.06*F | 93.02*F | 96.05*F | 99.2*F |
| D | 88.44*F | 91.91*F | 95.45*F | 99.14*F |
| E | 88.91*F | 91.56*F | 94.27*F | 97.09*F |
| F | 91.78*F | 94.69*F | 97.66*F | 100.76*F |
| G | 92.92*F | 95.51*F | 98.15*F | 100.91*F |
| H | 93.62*F | 96.45*F | 99.34*F | 102.35*F |
| I | 93.1*F | 95.91*F | 98.78*F | 101.77*F |
| J | 93.39*F | 96.28*F | 99.23*F | 102.31*F |
| K | 92.45*F | 95.84*F | 99.3*F | 102.9*F |
| **P(Bin)** | **38.3%** | **24.2%** | **6.1%** | **0.6%** |




| MW% by Capacity Zone | |
|---|---|
| A-F | 42.79% |
| G-I | 17.34% |
| J | 35.46% |
| K | 4.40% |

| MW% by Generation Type | |
|---|---|
| CC or CT[2] | 49.89% |
| Other Thermal[3] | 45.91% |
| Non-Thermal | 4.19% |

| Avg(Temp Δ[4]) |
|---|
| 2.13*F |

[1] Bin Temp is a dry-bulb temperature measurement
[2] Combined Cycles (CCs) & Combustion Turbines (CTs) are the only generation types currently derated in the RA model based on ambient temperatures
[3] "Other Thermal" units include nuclear steam plants and traditional steam turbines
[4] Avg (Temp Δ) = Avg (Bin 1 Temp – Max Operating Temp) weighted by MW | Max Operating Temp < Bin 1 Temp

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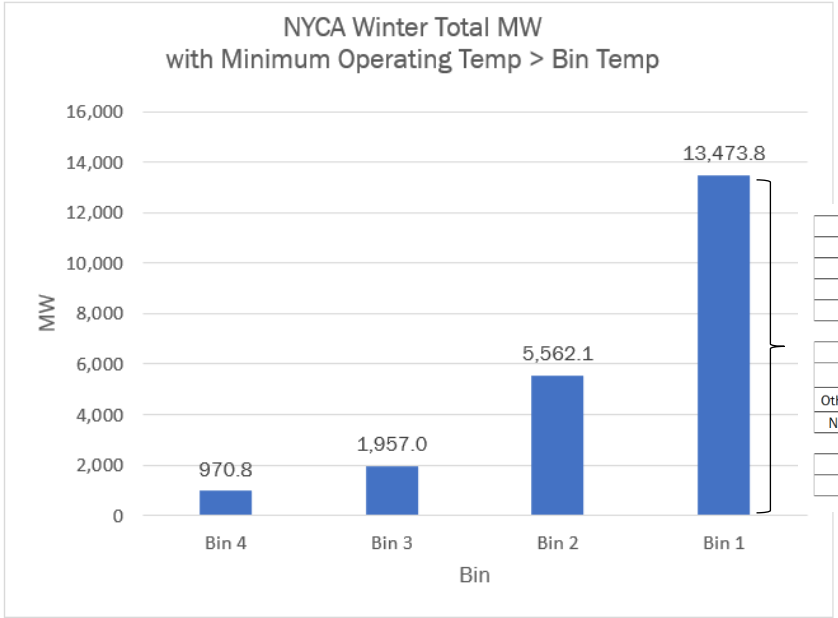
# Winter Results

| Zone | Approximate Bin Temp[1] | | | |
|---|---|---|---|---|
| | Bin 4 | Bin 3 | Bin 2 | Bin 1 |
| A | 5.12*F | -1.25*F | -7.76*F | -14.54*F |
| B | 5.12*F | -1.25*F | -7.76*F | -14.54*F |
| C | 5.12*F | -1.25*F | -7.76*F | -14.54*F |
| D | 5.12*F | -1.25*F | -7.76*F | -14.54*F |
| E | 5.12*F | -1.25*F | -7.76*F | -14.54*F |
| F | 7.97*F | 1.86*F | -4.38*F | -10.88*F |
| G | 7.97*F | 1.86*F | -4.38*F | -10.88*F |
| H | 11.42*F | 5.59*F | -0.38*F | -6.59*F |
| I | 11.42*F | 5.59*F | -0.38*F | -6.59*F |
| J | 13.76*F | 8.16*F | 2.44*F | -3.52*F |
| K | 22*F | 8.16*F | 2.44*F | -1.76*F |
| **P(Bin)** | **38.3%** | **24.2%** | **6.1%** | **0.6%** |




| MW% by Capacity Zone | |
|---|---|
| A-F | 34.30% |
| G-I | 18.04% |
| J | 44.13% |
| K | 3.52% |

| MW% by Generation Type | |
|---|---|
| CC or CT[2] | 47.34% |
| Other Thermal[3] | 23.19% |
| Non-Thermal | 29.46% |

| Avg(Temp Δ[4]) |
|---|
| 7.54*F |

[1] Approximate Bin Temp for a zone = approximate dry-bulb Bin Temp for the area surrounding the zone. Areas include A-E,F-G,H-I,J,K. Wind speed is assumed to be 0.

[2] Combined Cycles (CCs) & Combustion Turbines (CTs) are the only generation types currently derated in the RA model based on ambient temperatures

[3] "Other Thermal" units include nuclear steam plants and traditional steam turbines

[4] Avg (Temp Δ) = Avg (Min Operating Temp – Bin 1 Temp) weighted by MW | Min Operating Temp > Bin 1 temp

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# Analysis Considerations

- The NYISO plans to update the analysis to include zonal-based Winter Bin temperatures to drive more accurate results

# Modeling Improvement Considerations

- There is significant capacity with operational temperature limitations not meeting the temperatures corresponding to Bin 1 in both the Summer and Winter
- The NYISO will continue to investigate potential modeling enhancements that account for these limitations
- Enhancements to current ambient derating processes may extend to units beyond CCs and CTs
- The NYISO will consider the level of difference between operating temperature limitations and Bin temperatures when developing modeling enhancements

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# Next Steps

# Next Steps – Q2

- Present updates to the analysis
- Identify and evaluate areas of potential modeling enhancement
- Begin conducting modeling tests

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# Previous Discussions

# Previous Discussions

| Date | Working Group | Discussion Points and Links to Materials |
|---|---|---|
| February 7, 2024 | ICAPWG | Evolving Resource Adequacy Project Kick Off: https://www.nyiso.com/documents/20142/42807168/Evolving%20Resource%20Adequacy%20Models%20Kick%20Off%20v1.pdf/1c028164-74dc-cf39-d6d4-0873ea3367b3 |
| March 20, 2024 | ICAPWG | Evolving Resource Adequacy Min/Max Operating Temps: https://www.nyiso.com/documents/20142/43621521/4%2003-20%20ICAPWG%20-%20Min-Max%20Operating%20Temps%20-%20V5.pdf/4ef38ba7-a07a-b2aa-9620-1c9c760e7bfc |

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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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# Questions?