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Independent System Operator

# Load Forecast Uncertainty Modeling: Phase 2 Scope Discussion

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### New York State Reliability Council – Installed Capacity Subcommittee

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# Agenda

- **Background & Motivation**

- **LFU Phase 2 Study Scope**

  - Historical Load Shape Duration Analysis

  - Phase 1 Follow Up Analyses

  - Additional Modeling Analyses

- **Phase 2 Timeline**

- **Questions & Discussion**

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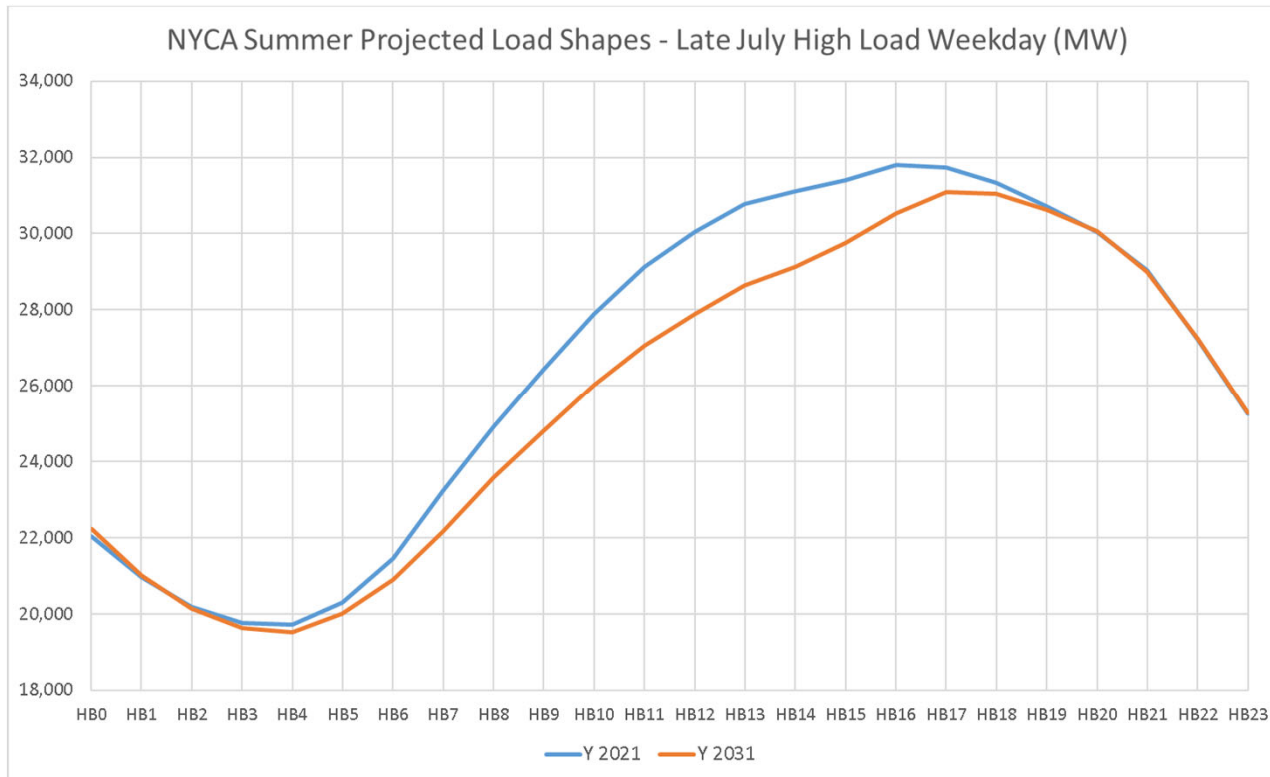# Background & Motivation

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# Background & Motivation

- Load patterns are continuing to change across the New York Control Area (NYCA). Factors that are expected to drive changes in load are:
  - Economic activity and demographic changes (e.g. Employment, Households, Population, Gross State Product)
  - End-use technologies (Lighting, Heating, Cooking, Plug-Loads, Electric Vehicles [EV]) and associated Energy Efficiency gains
  - Distributed Energy Resources (Solar, Storage, Combined Heat/Power, others)
  - A more active and "engaged" system load: Demand Management Programs, Time-of-Use Rates, Smart Devices

- Phase 1 Load Forecast Uncertainty (LFU) Study focused largely on the analysis of weather distributions and their impacts on the year-over-year variability of NYCA and regional peak loads
  - Particular attention paid to the distributions of peak load and temperature analysis
  - Comparison of Temperature Humidity Indices
  - Long-term CTHI Distribution Analyses (extreme temperatures, goodness of fit of the Normal distribution)
  - Inter-Annual Weather Sensitivity and LFU Trends

- Phase 2 LFU study scope will follow up on select Phase 1 recommendations and include work on Load Shapes

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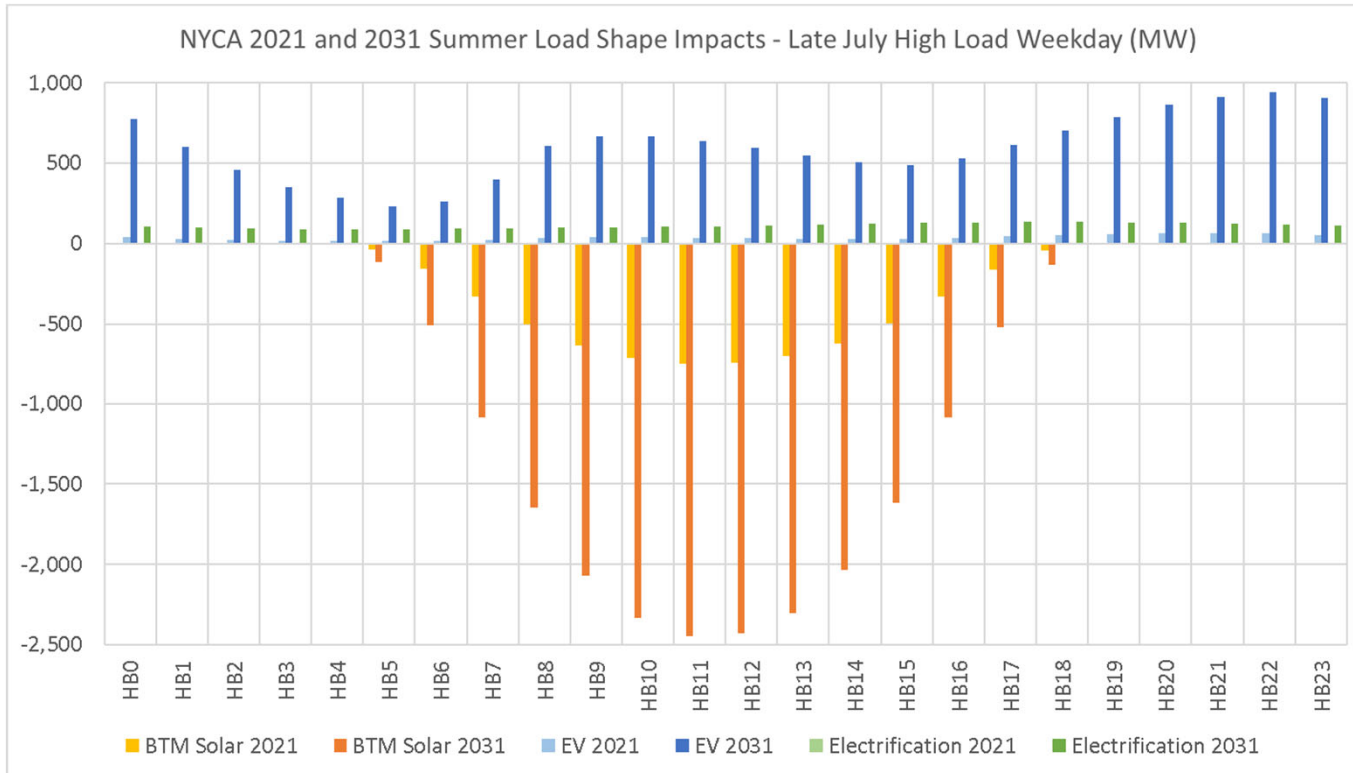# Background & Motivation



NYCA Weekday Load Profile - July Weekday
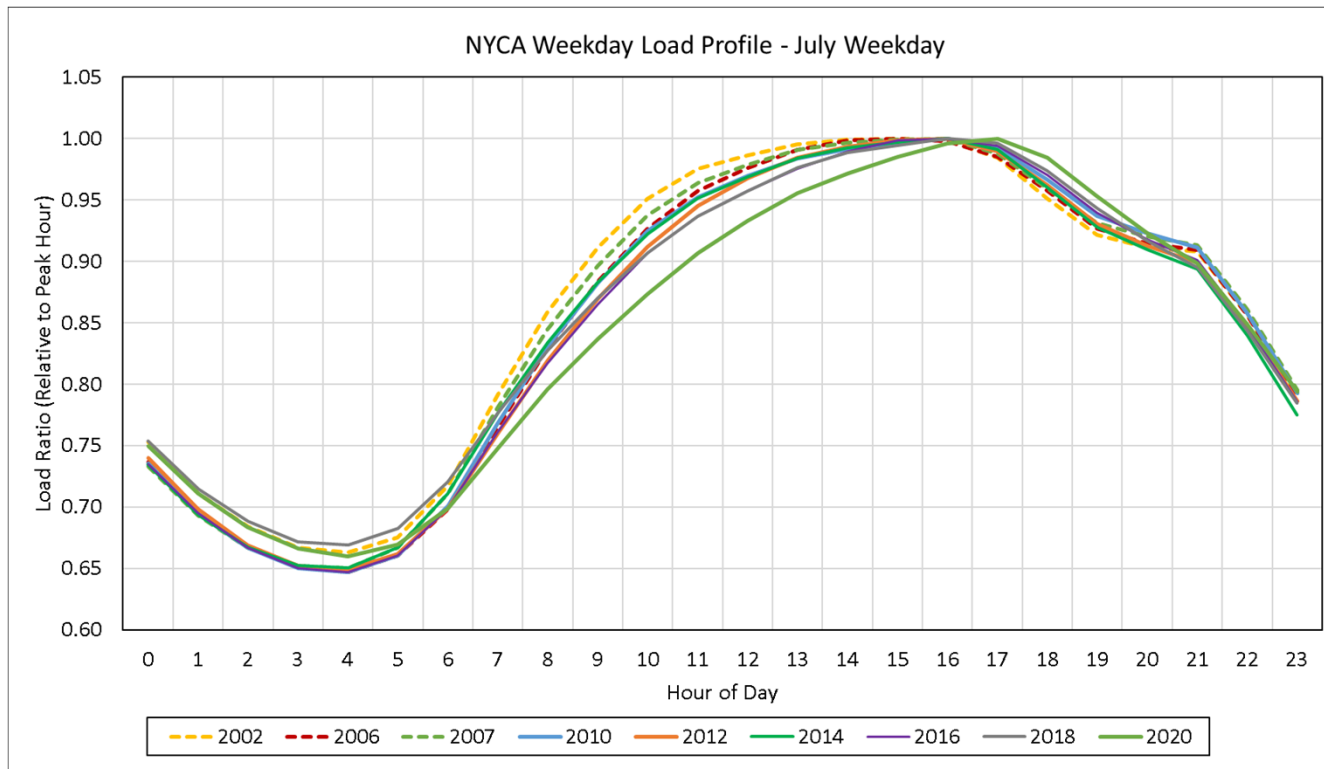
- Peak hour has been shifting into the evening hours
- This trend is projected to continue
- 2002, 2006, and 2007 Load Shapes are currently used in the IRM and RNA MARS modeling activities

# Background & Motivation



NYCA Summer Projected Load Shapes - Late July High Load Weekday (MW)

- Weather Normalized loads have been declining slightly year over year

- This trend is expected to continue for much of the next decade

- Source: 2021 Gold Book and Supporting Materials

# Background & Motivation



NYCA 2021 and 2031 Summer Load Shape Impacts - Late July High Load Weekday (MW)

Legend: BTM Solar 2021, BTM Solar 2031, EV 2021, EV 2031, Electrification 2021, Electrification 2031

- The largest driver in changing the load shape over the next 10 years is the projected impacts of growth in BTM Solar generation

- Source: 2021 Gold Book and Supporting Materials

__LFU Phase 2 Focus : Updated assessment of the impact of load shapes in reliability studies__

# Phase 2 LFU Scope

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# Historical Load Shape Analysis

- **Review Load Duration Curves from 2000 – 2020**
  - Perform daily and hourly peak load duration analysis
  - Develop metrics to quantify the steepness of the duration curve and inter-annual variability

- **Review Gross Load Duration Curves from 2012 - 2020**
  - Construct gross load profiles (net load + BTM solar generation estimates)
  - Perform daily and hourly peak load duration analysis
  - Assess the load shapes for chronological characteristics: shape evolution and the peak load hour
  - Analyze impacts of forecasted BTM solar penetration levels in future years

- **Compare MARS Load Distributions**
  - Review distribution of 2002/2006/2007 scaled load shapes with current LFU model
  - Select more recent years (e.g. 2012-2020) for load shape analysis and compare with 2002/2006/2007 distribution
  - Impact analysis with MARS
  - Recommend an updated set of load shapes for use in reliability & market studies
  - Provide forecasted BTM solar forecast shape consistent with load profile

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# LFU Phase 1 - Follow Up Analyses

- ## Expand trend analysis in regional LFU model results
  - Add additional modeling years to model results – review trends in LFU results
  - Gain a better understanding of the interannual variability of load/weather sensitivity by region

- ## Expand comparison of NYISO Cumulative Temperature Humidity Index (CTHI) and LIPA Temperature Humidity Index (THI4) Variable in Zone K
  - Compare use of Dew Point Temperature vs. Wet Bulb Temperature
  - Compare joint (THI4) vs. disjoint (CTHI) impacts and correlations with load
  - Examine lag (CTHI) vs. no lag (THI4) assumptions and correlations with load

- ## Study alternative LFU Bin Structures
  - Asymmetric Bin Structure -> More (less) bins above (below) design conditions, respectively
  - Impact analysis with MARS

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# Additional Modeling Analyses

- **Assess the impact of BTM Solar on LFU model results**
  - Develop Summer LFU models using gross load profiles (net load + BTM solar generation)
  - Compare model results with net load model results
  - Impact analysis with MARS

- **Winter LFU Model Update [if time allows]**
  - Evaluate the use of an updated weather variable for use in LFU model development (current models use Heating Degree Days, derived from daily average dry bulb)
  - Options to consider: Wind Chill, Temperature Humidity Index, Lagged Days
  - Review with NYCA model and assess regionally

- **Model Based Load Shapes [Phase 3 – not in scope]**
  - Bottom up load forecast – constructed from 8760 load shapes
  - Updates to SAE modeling framework to include modeled load shapes based on expected evolution of trended weather
  - Additional load shapes for end-uses (electrification, BTM storage, and other DERs)

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# Phase 2 Timeline

- Start: May 2021

- Historical Load Shape Analysis – July 2021

- Phase 1 Follow-Up Analysis – August 2021

- Additional Modeling Analyses – October 2021

- White Paper Draft: November 2021

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# Questions/Discussion

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