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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

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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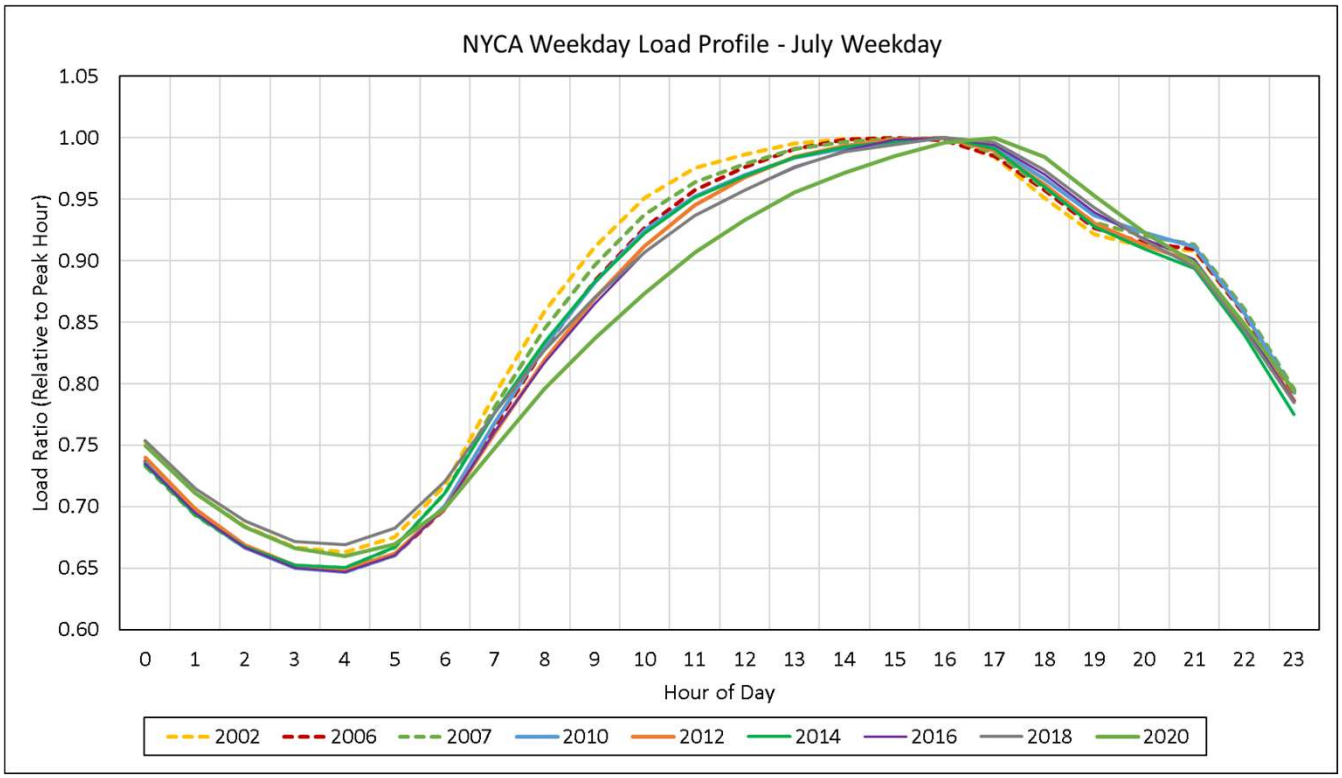

- Peak hour has been shifting into the evening hours
- This trend is projected to continue
- 2002, 2006, and 2007 Load Shapes are currently used in the IRM and RNA MARS modeling activities

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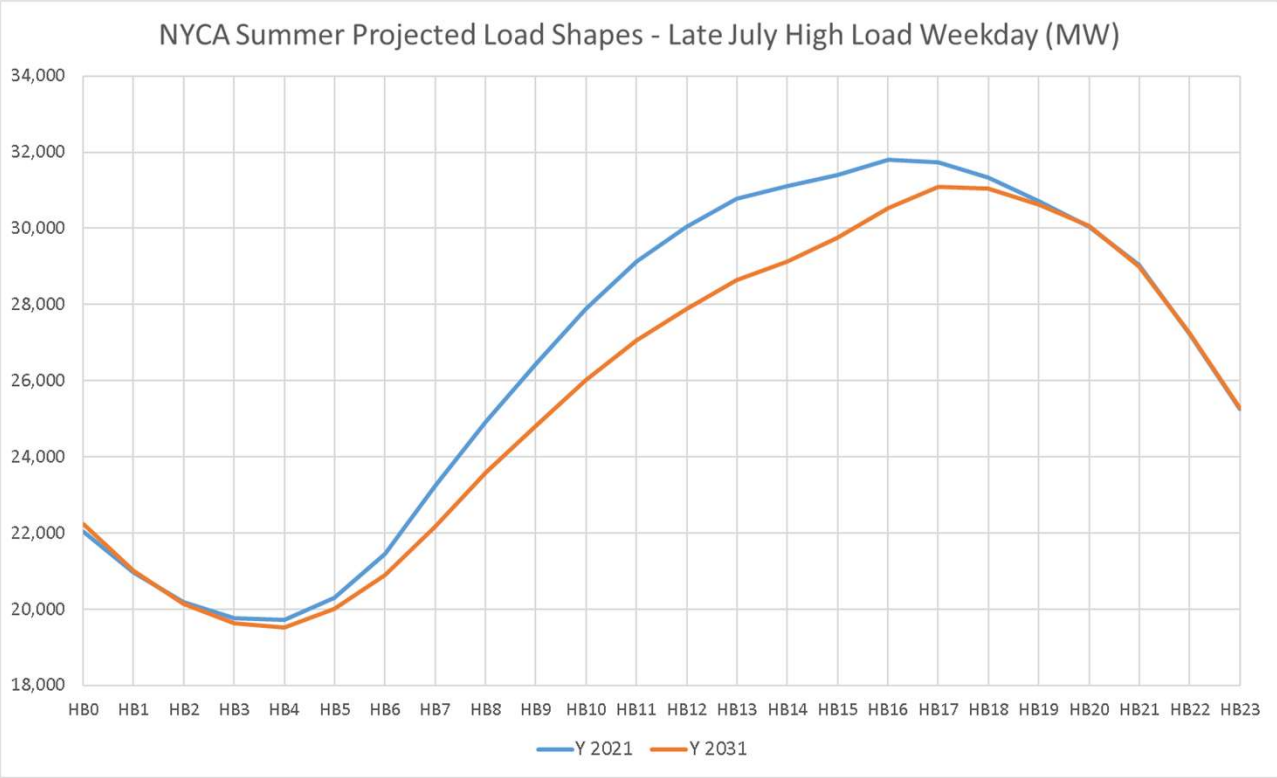
Background & Motivation



- 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

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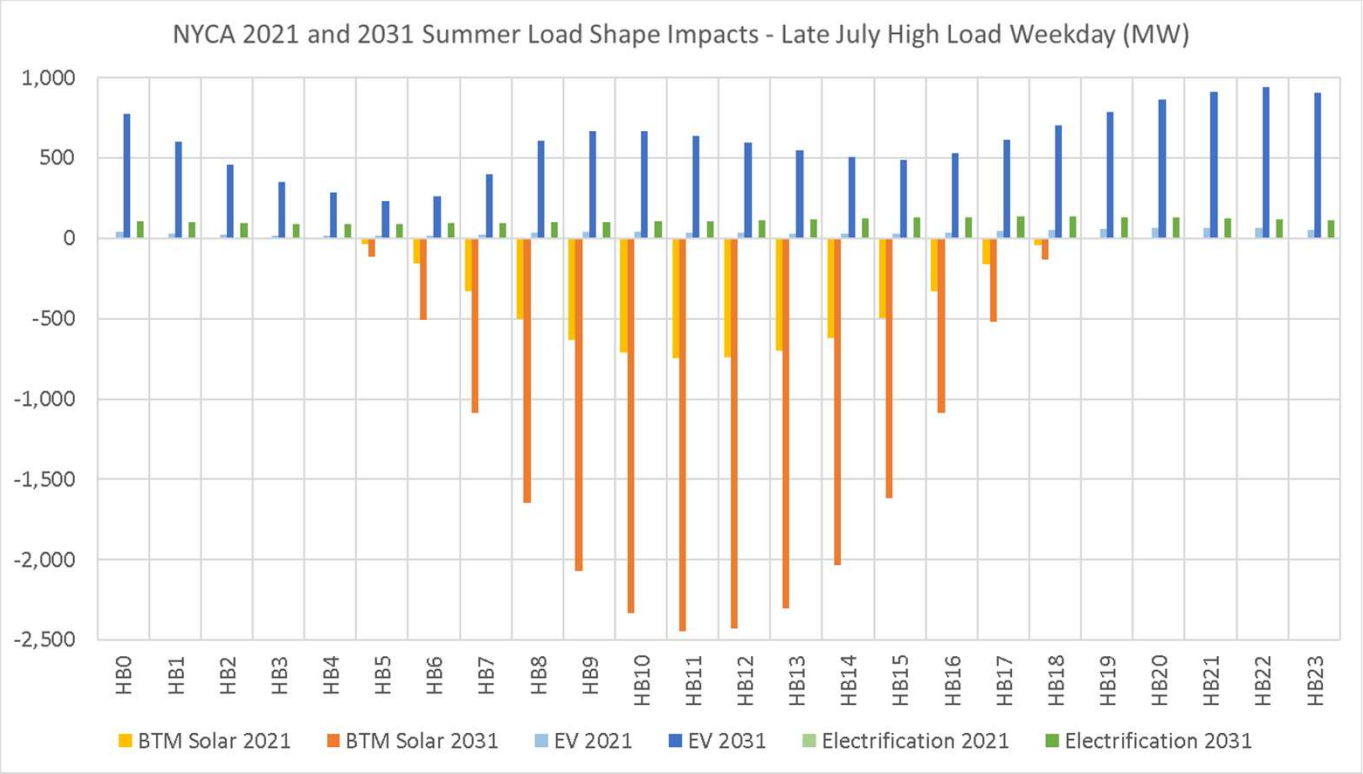
Background & Motivation



- 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

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