DOCKETED	
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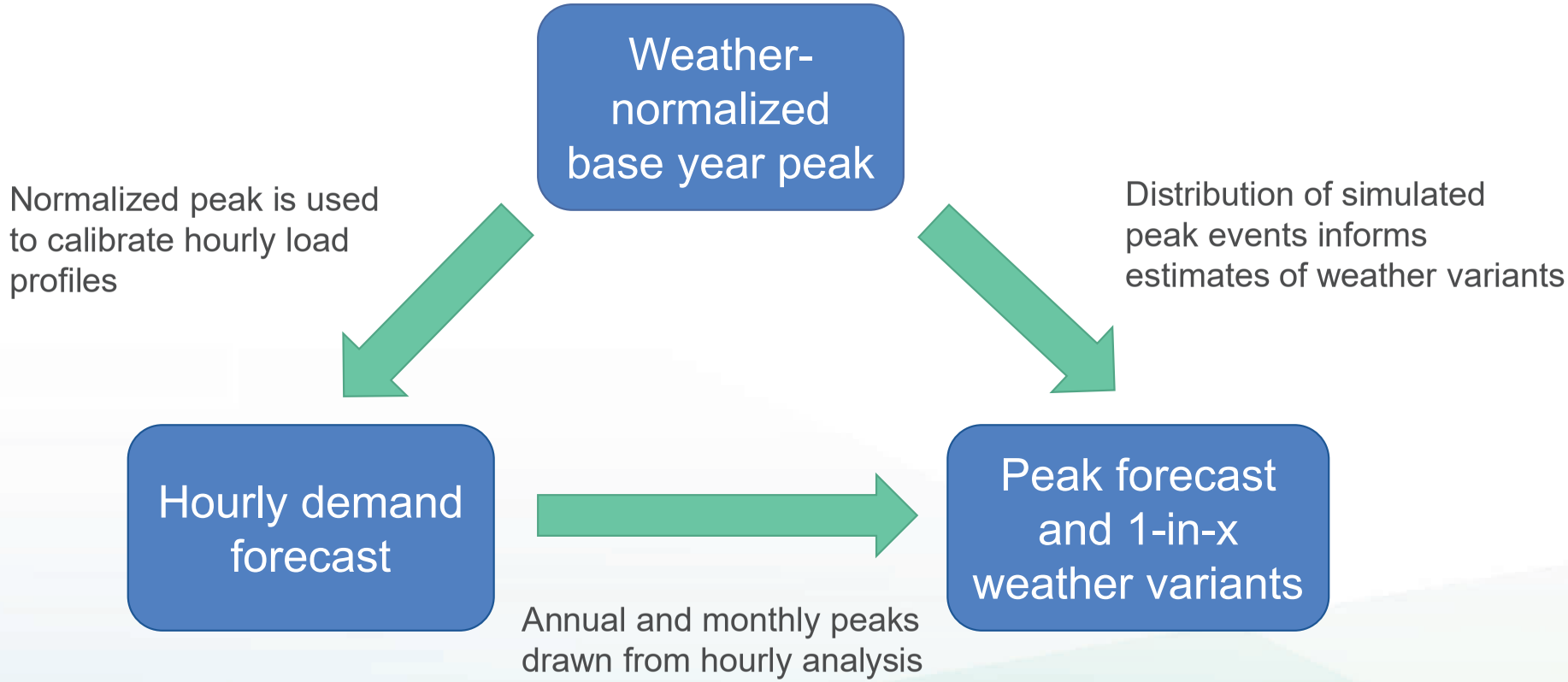
Hourly Load Model Updates

Nick Fugate, Energy Assessments

Use cases

- Input to system and reliability modeling
- Peak loads are derived from hourly forecast (IOU TAC areas)
- Monthly system peaks serve as a system-level benchmark for Resource Adequacy (RA)
- Hourly detail informs Flex RA studies

Process Overview

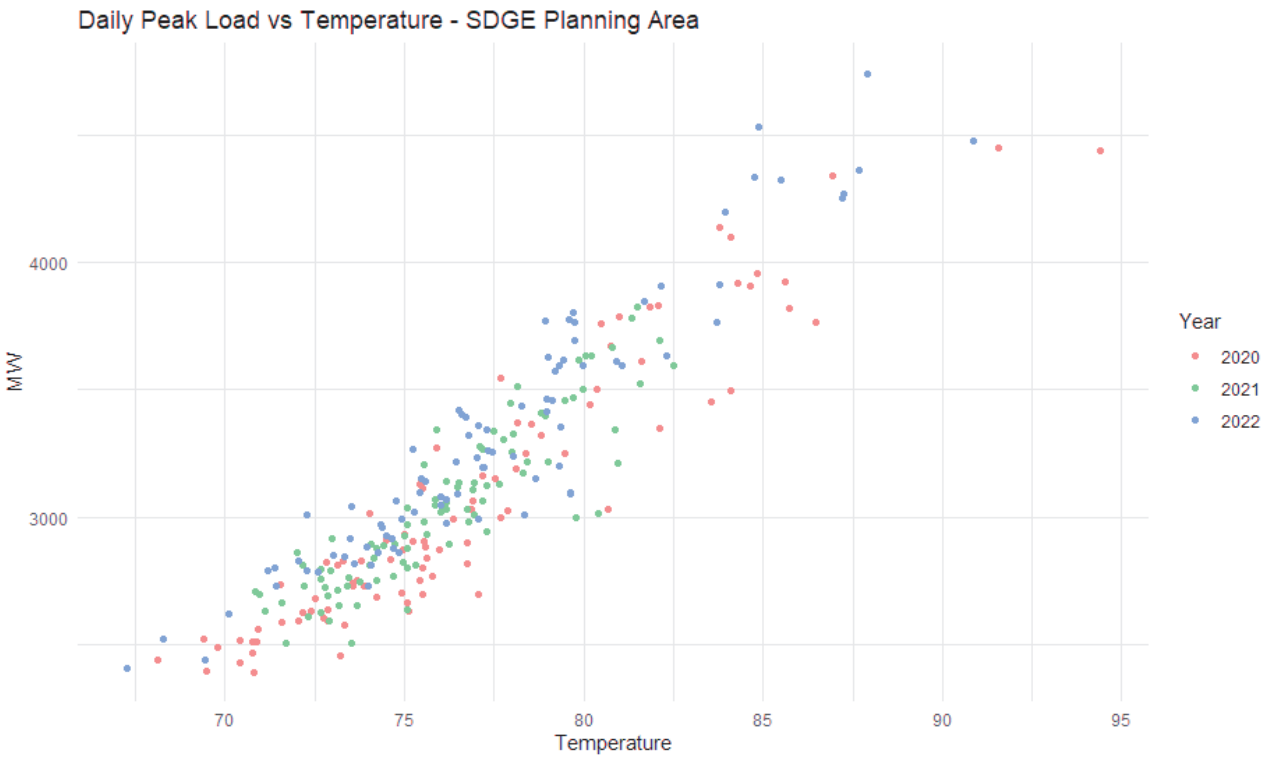


Weather-Normal Peak Load

Load vs Temperature

Daily peak load is highly correlated with temperature

Normalization involves characterizing this relationship over recent years and simulating peak loads over many weather patterns

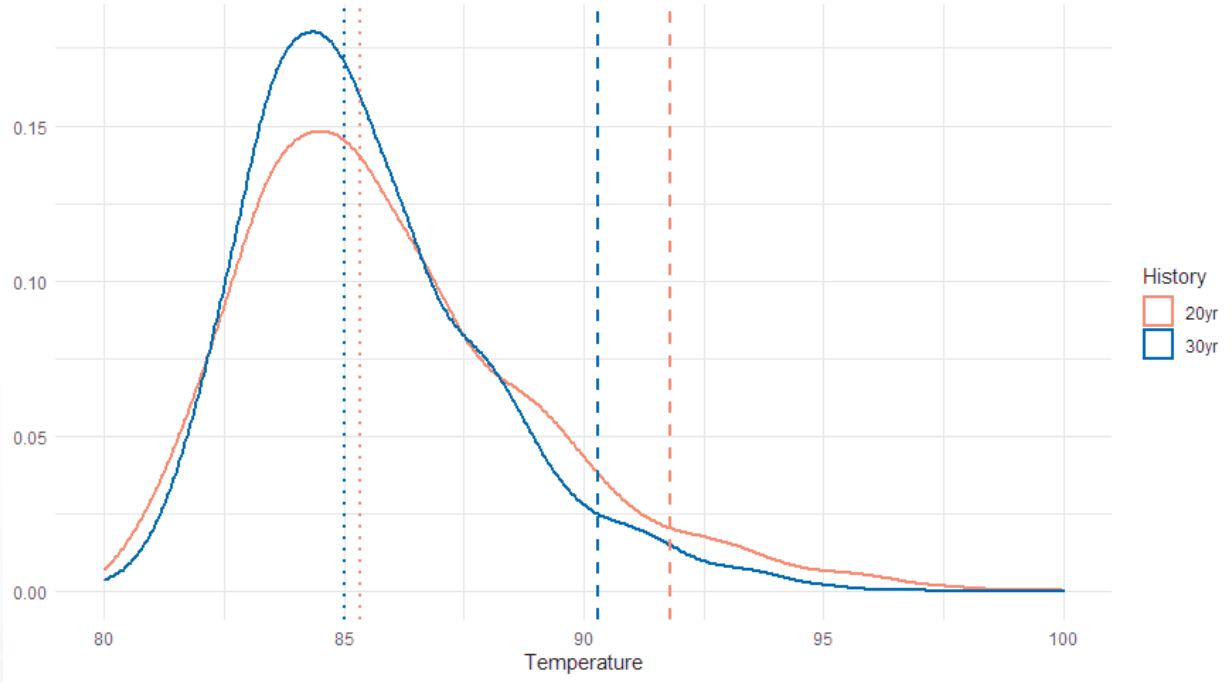


Climate Considerations

30-year historical window is likely to under-represent present-day peak load conditions

****Updates****

- Use 30 years of detrended climate-simulation data centered around the base-year
- Examine evolution of 1-in-x conditions over the forecast horizon



Hourly Demand Forecast

Hourly Forecast Approach

1. Apply baseline “consumption” profile to annual “consumption” forecast
2. Adjust hourly consumption using profiles for:
   - Climate change impacts
   - Electric vehicle charging
   - Behind-the-meter PV generation and storage
   - “Additional Achievable” efficiency and electrification
3. Calibrate to weather-normal base-year peak load

Hourly Load Model (HLM)

- Predicts hourly loads as a function of weather and calendar effects
- 5 years of historical data to estimate the model
- 20+ years historical weather data for simulation
  - ****Update**** Use detrended climate data
- "Consumption" profile created by:
  1. Arranging simulations into load-duration curves
  2. Selecting median values from each rank
  3. Calendarizing those medians by hour and day-type

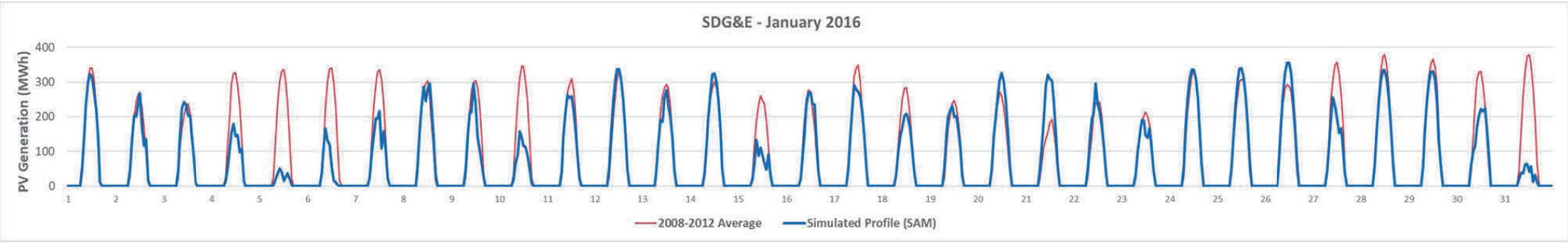
HLM Estimation

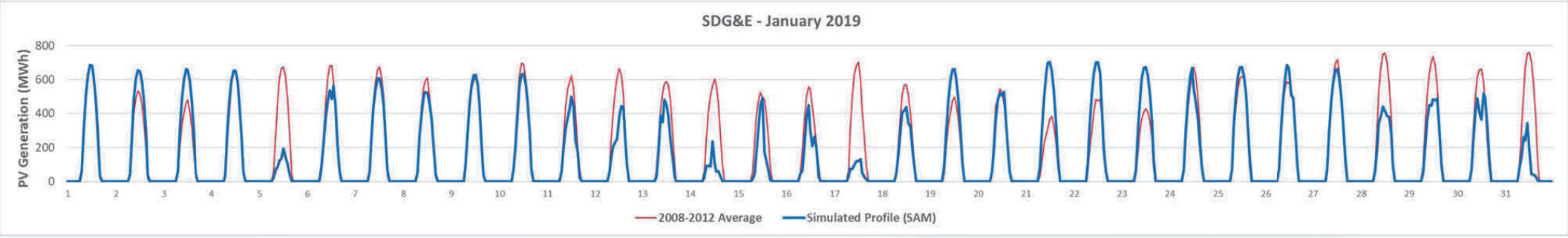
"Consumption" = System Load + Behind-the-Meter PV

- System Load is recorded (CAISO)
- BTM PV generation was originally averaged over days and weeks
  - E3 metered generation study (2008-2012)
  - Does not always reflect historic generation
  - Switched to modeled PV beginning in CED 2021

Modeled vs Average PV

Average profile over-predicts generation on cloudy days and under-predicts generation on sunny days





Historic PV Generation Data

New Data Source:

- Vendor-supplied inverter readings
- 15-minute intervals
- Res vs non-res
- Energy and total reporting capacity
- Twice annual updates
- All forecast zones

****Updates****

- Use inverter data in HLM model estimation
- Expand HLM to cover non-CAISO balancing areas
- Test alternate PV profiles for forecast years

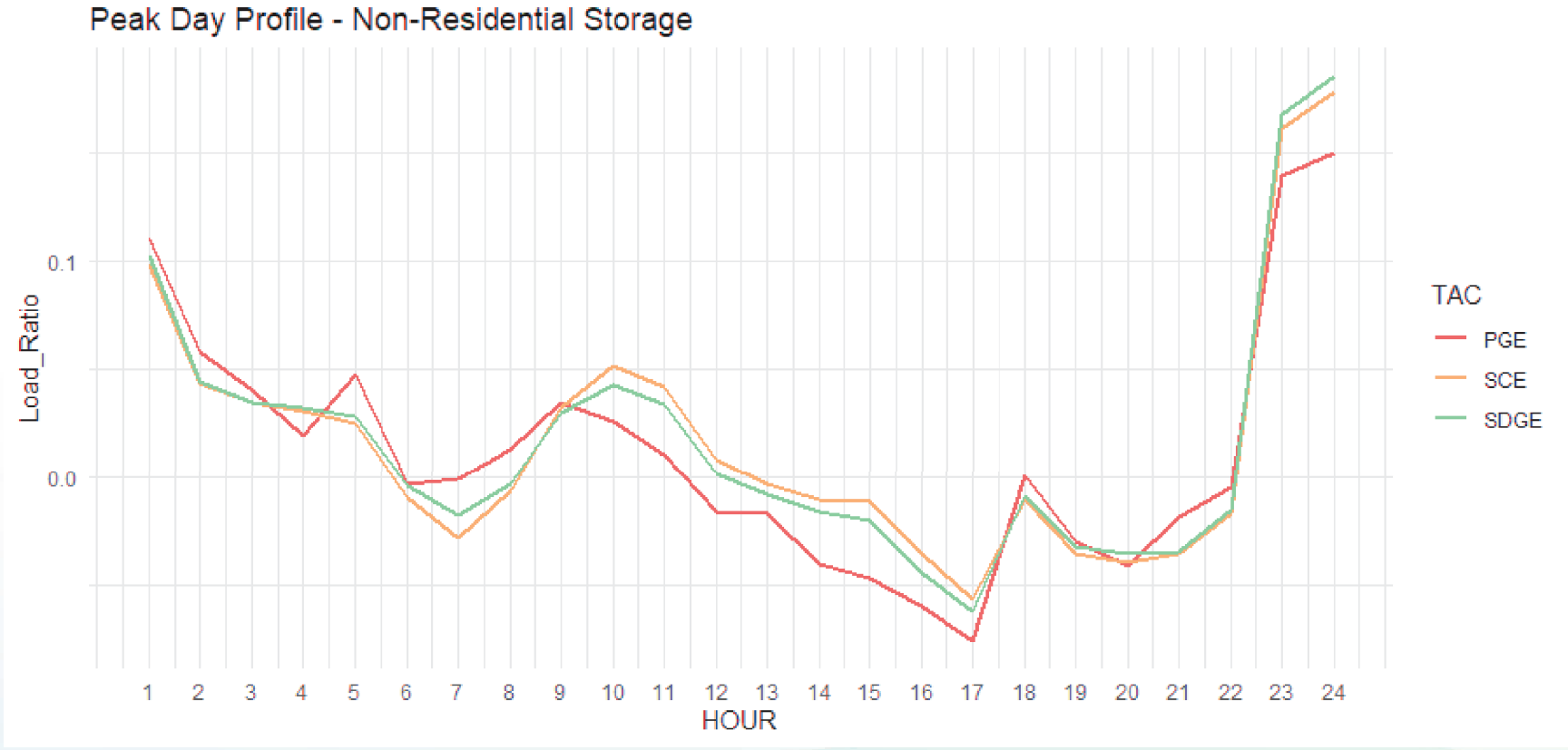
Additional Updates

The hourly forecast will also incorporate a number of maintenance and routine ****updates****

- Re-estimate base consumption profile
- Identify and address factors contributing to steep system ramps
- Re-estimate climate impacts using new HDD/CDD projections
- Re-estimate PV impacts using revised profiles and capacity estimates
- Incorporate updated “additional achievable” scenarios

Beyond CED 2023

BTM Storage Profiles



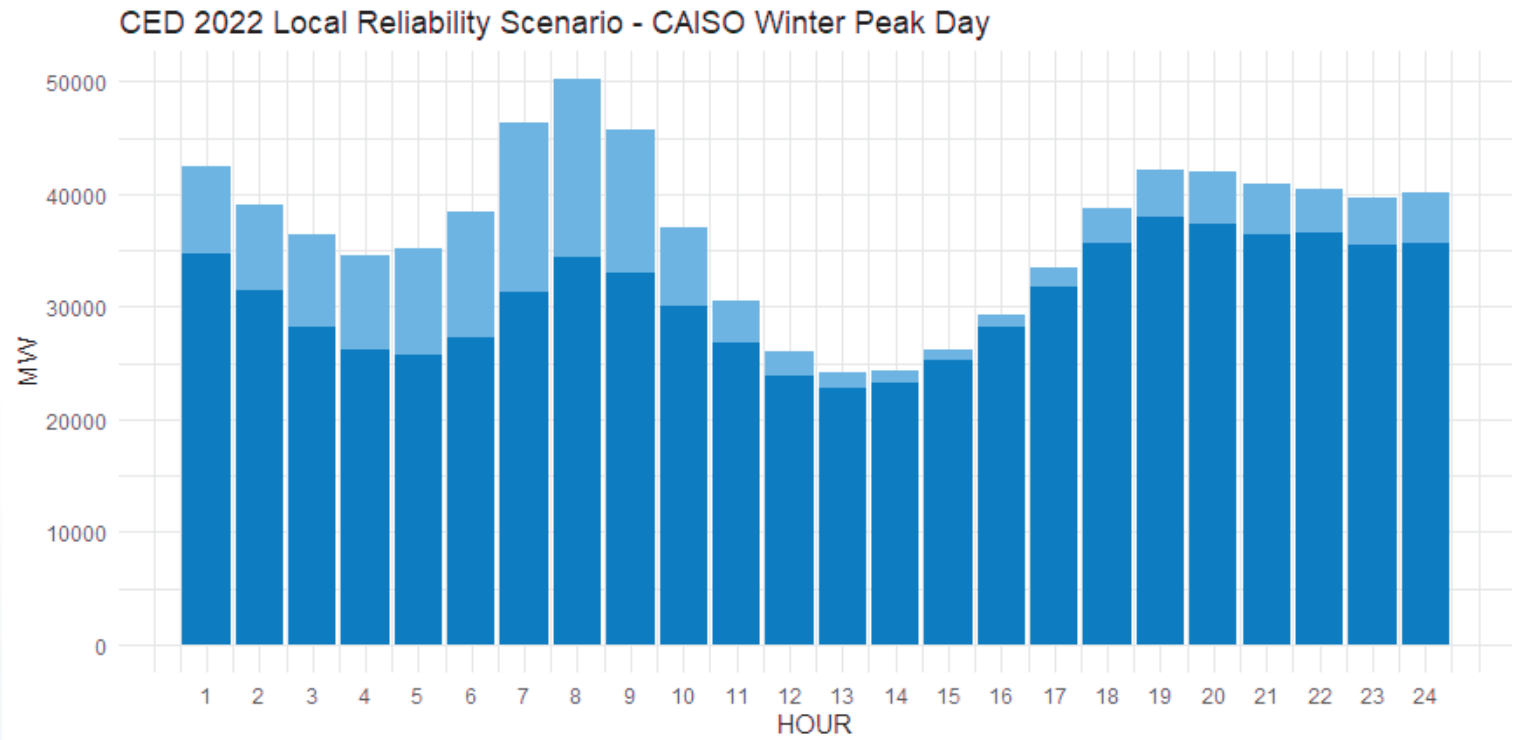
HLM Performance

- Greater alignment between HLM and peak normalization models
- Test explanatory variables that may have greater predictive power
- Greater temporal granularity within the HLM
- Explore PV efficiency reduction at high temperatures

Climate Impacts on Winter Load

CED 2022 Local Reliability scenario puts winter morning peaks on par with summer

Low temperature response for winter months in current HLM estimation



Thank You!