CEC Development of Higher Electrification Grid Planning Scenarios

Michael R. Jaske, PhD

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CEC Electrification Assessments

The CEC staff set out in the 2021 IEPR proceeding to improve building and transportation electrification assessment for the official demand forecast.

- The Additional Achievable Energy Efficiency (AAEE) analysis was improved to better target geographic impacts
- The AAEE concept was extended to Additional Achievable Fuel Substitution (AAFS) for some building electrification programs in the 2021 IEPR managed demand forecasts.

A demand scenarios project was initiated to broaden fuel type coverage, extend the time horizon to 2050, and assess additional programmatic measures being considered by CARB.

- Additional building electrification measures were assessed via the FSSAT tool
- Additional transportation electrification measures proposed by CARB were assessed by post-processing of CEC vehicle choice models
- The demand scenarios project was completed, and a workshop held in April 2022.

Inter-Agency High Electrification Project

- CPUC and CEC leadership began discussing higher electrification forecasts even as the 2021 IEPR was winding down
- As a result of inter-agency discussions, the lead staff of the Energy Agencies (CEC, CPUC) and CAISO agreed to collectively develop an assessment of the transmission system impacts of a scenario with higher electrification than expected to be included in the original 2021 IEPR adopted demand forecast.
- This analysis was initially considered to be a sensitivity to supplement the regular inputs to the 2022-23 TPP.
- As the initial Inter Agency High Electrification (IAHE) scenario was being finalized agency leadership directed development of a second scenario focused on transportation.
- Eventually, agency and CAISO leadership determined that the Additional Transportation Electrification grid planning scenario, and complementary generation resource portfolio should be the “base case” for this TPP cycle.

Roles in Electrification Infrastructure Project

Each agency is carrying out segments of this assessment within their usual areas of responsibility for electricity planning:

- Inter-Agency Working Group (IAWG): Coordination of demand scenario and overall assessment activities
- CEC: Develop the demand side aggregate projections and allocation of impacts to load busses for the scenario design
- CPUC: Quantify the electric generation resources needed to satisfy a higher electric load, determine the appropriate resource mix, and geolocate additional resource development at transmission busses
- CAISO: Conduct power flow and other studies to determine the impact of higher loads and new generating resource locations on the transmission system

Scenario Designs

- The Inter-Agency Working Group (IAWG) met multiple times in December 2021, and January to March 2022, to design a scenario specification for consideration by agency and CAISO leadership.
- Two options emerged:
  - Inter-Agency High Electrification (IAHE) – very similar to the Policy/Compliance scenario of the original CEC project
  - Additional Transportation Electrification
- The CEC staff quantified annual electric energy and hourly load projections for both grid planning scenarios and provided them to CPUC.

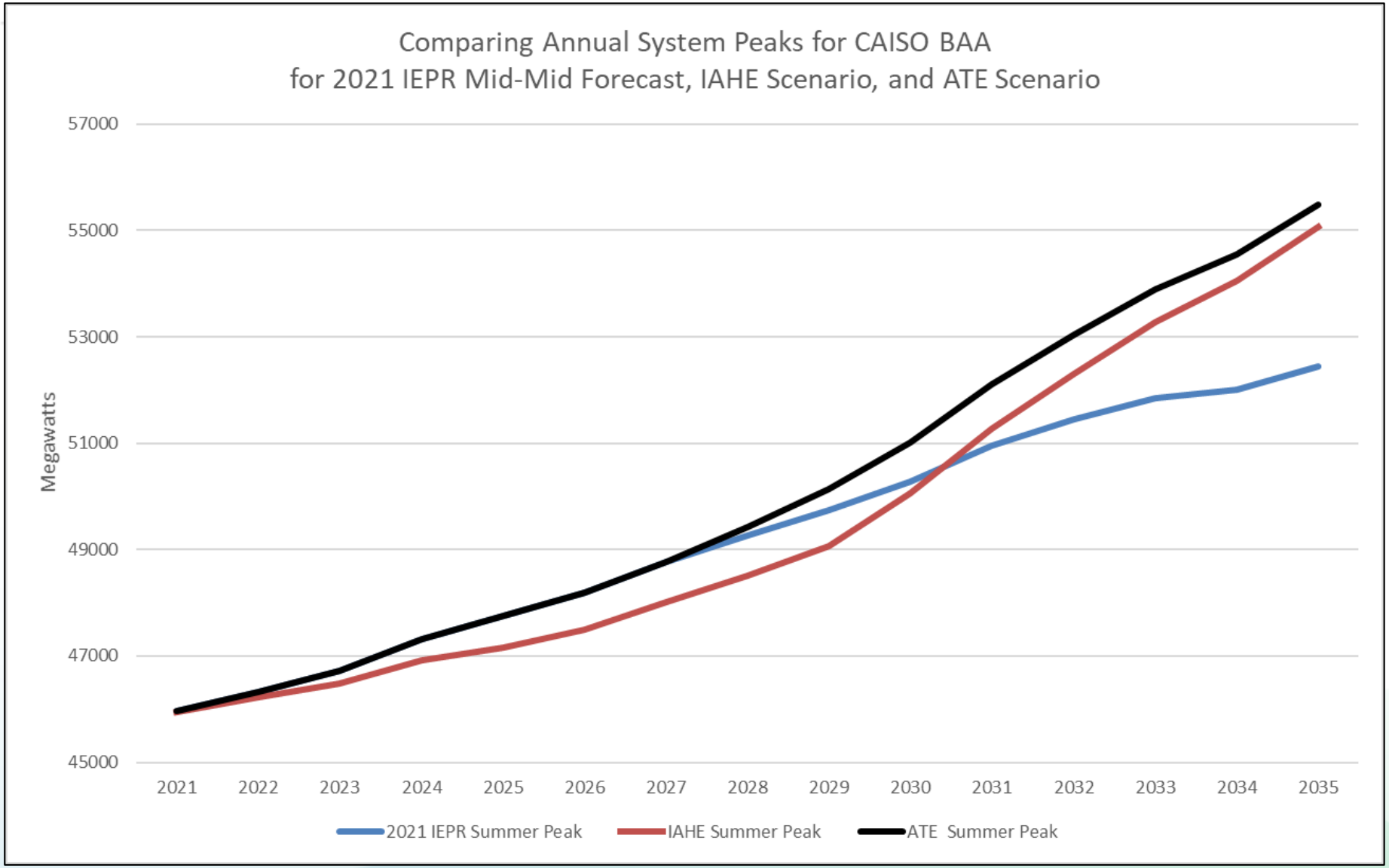
Comparison of Scenario Specification

	2021 IEPR	Interagency High Electrification (IAHE)	Additional Transportation Electrification (ATE)
Baseline Demand Case	Mid Case	Mid Case	Mid Case
Electric Vehicles	Mid Case	Policy 2021 - 2035	Mid 2021 - 2027 Policy 2028 - 2035
Additional Achievable Energy Efficiency	Scenario 3	Scenario 4	Scenario 3
Additional Achievable Fuel Substitution	Scenario 3	Scenario 4	Scenario 3
CARB State Implementation Plan NOx Rules	—	Included	—

CEC Actions

- The CEC lead commissioner overseeing electricity and gas topic conducted a workshop on April 7, 2022.
- After consideration of the comments submitted, including those of IOUs with interests in IEPR-adopted forecasts for distribution planning, May 24, 2022, the CEC adopted multiple demand scenarios and grid planning scenarios as part of the 2021 IEPR:
  - 3 multi-fuel, statewide, annual energy-only demand scenarios to 2050 from the original CEC demand scenarios project
  - 2 electric-only, planning area-specific, hourly projections to 2035
    - ATE grid planning scenario
    - IAHE grid planning scenario
  - Link to adopted scenarios - See Notice of Availability at California Energy Commission : Docket Log

Comparison of CAISO Annual Peaks



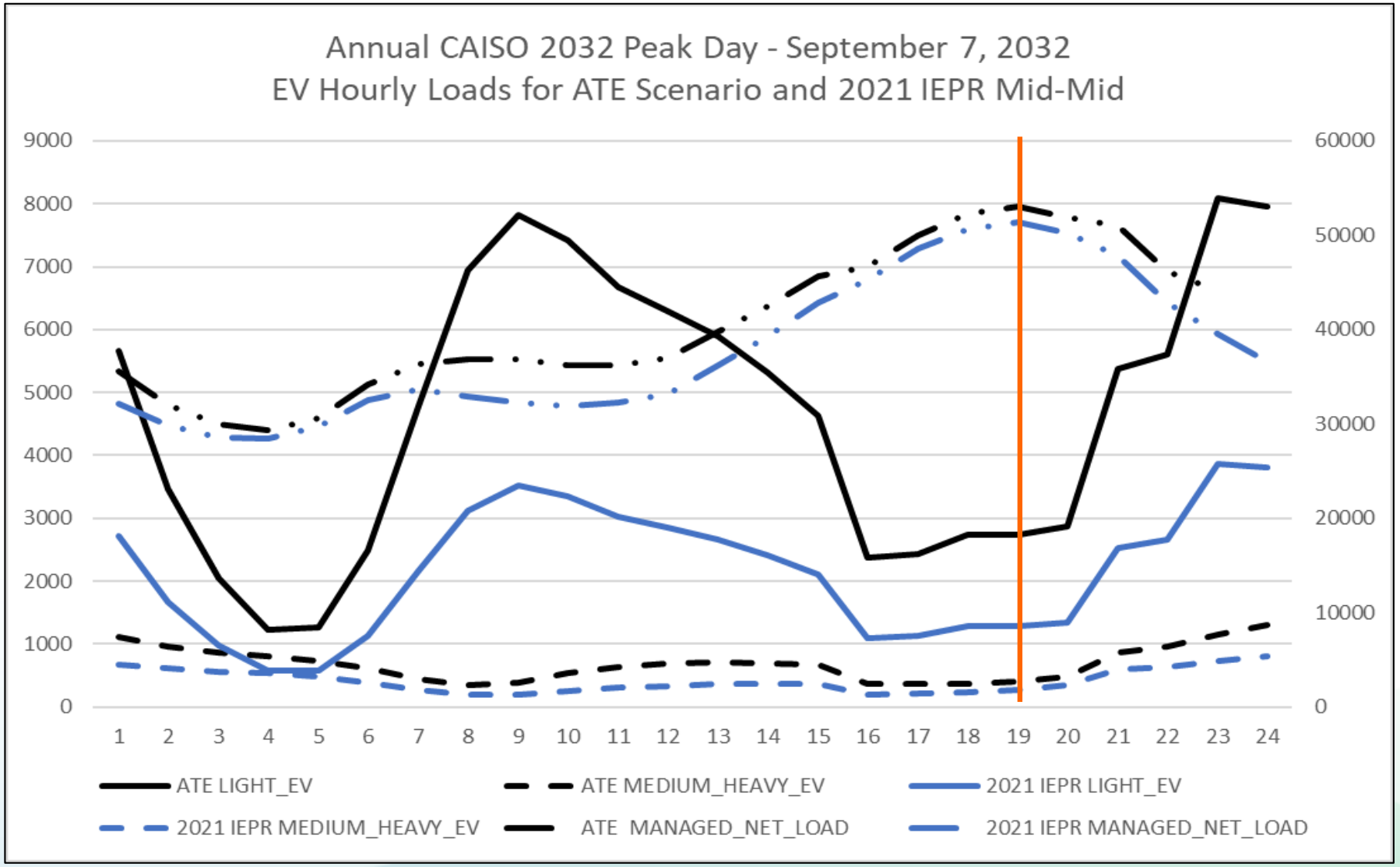
Importance of EV Load Shape

- Charging patterns placed on grid resources is critically important to system peak impacts as EV energy demand grows
- Factors affecting LDV and MDHD load profiles:
  - Access to charging infrastructure, type of charging, and price per kWh
  - The driving patterns of classes of vehicles
  - Current and future design of TOU rates, end-user choice of EV or other rates, and their response to such rates
- The CEC currently uses a two-stage process to develop EV profiles:
  - Vehicle class baseline usage pattern
  - Assumed response to TOU rates modifying baseline pattern
- Bottom line – given current CEC assumptions, the more EV load is added, system peak shifts further into nighttime hours

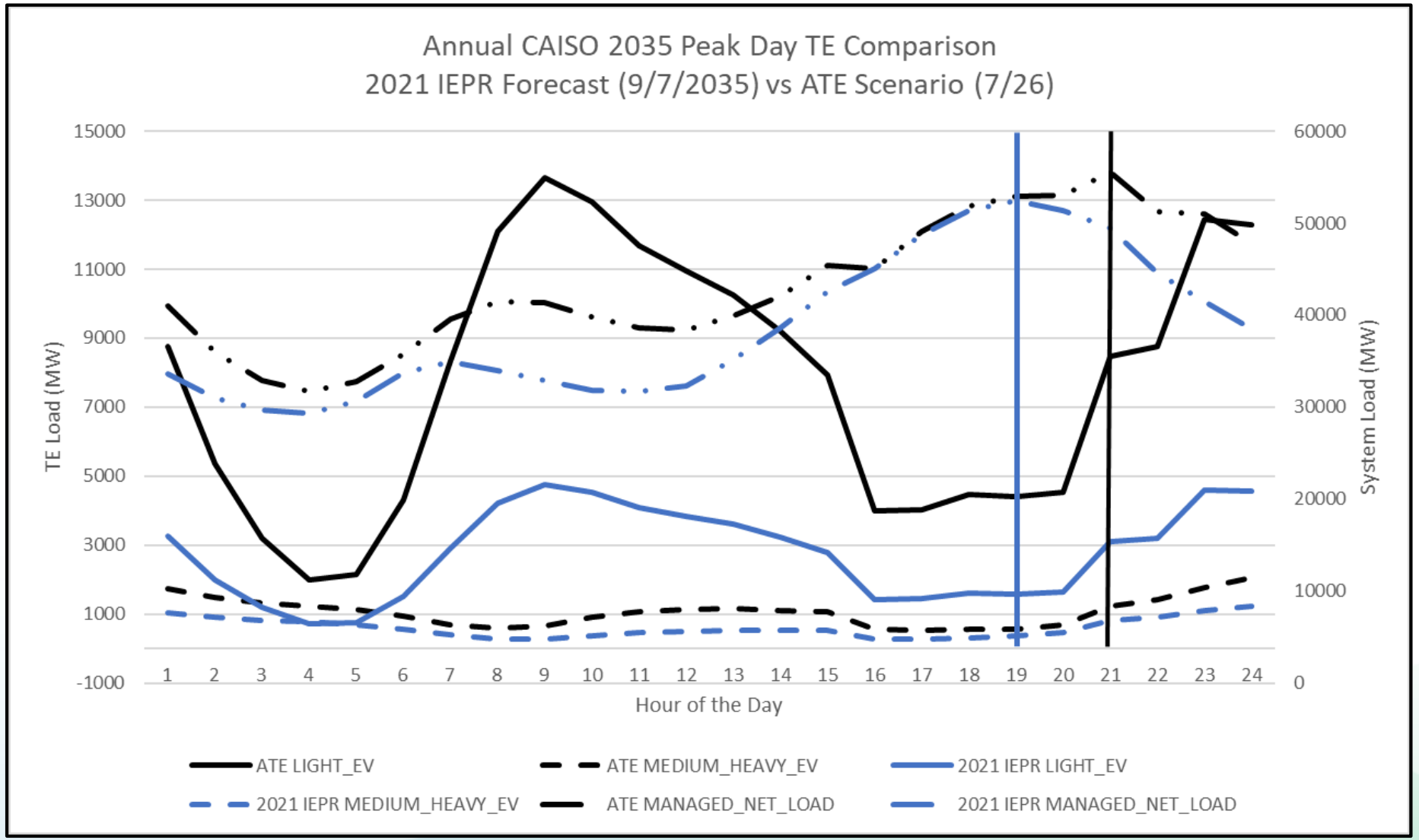
ATE Scenario Peak Hour Shift

- As TE loads increase relative to the other components making up the hourly load forecast of the 2021 IEPR Mid-Mid managed demand forecast, the peak hour shifts from HE 19 to HE 21 in some TAC areas
- Each of these components has their own unique load profile, so when the system peak hour shifts, the other components may have different loads – either higher or lower
  - E.g., EV charging loads are higher at 9pm, while the composite of AAEE measure savings are lower during this hour
- This means that the amounts of each load modifier that the CEC staff allocates to specific load busses must also change

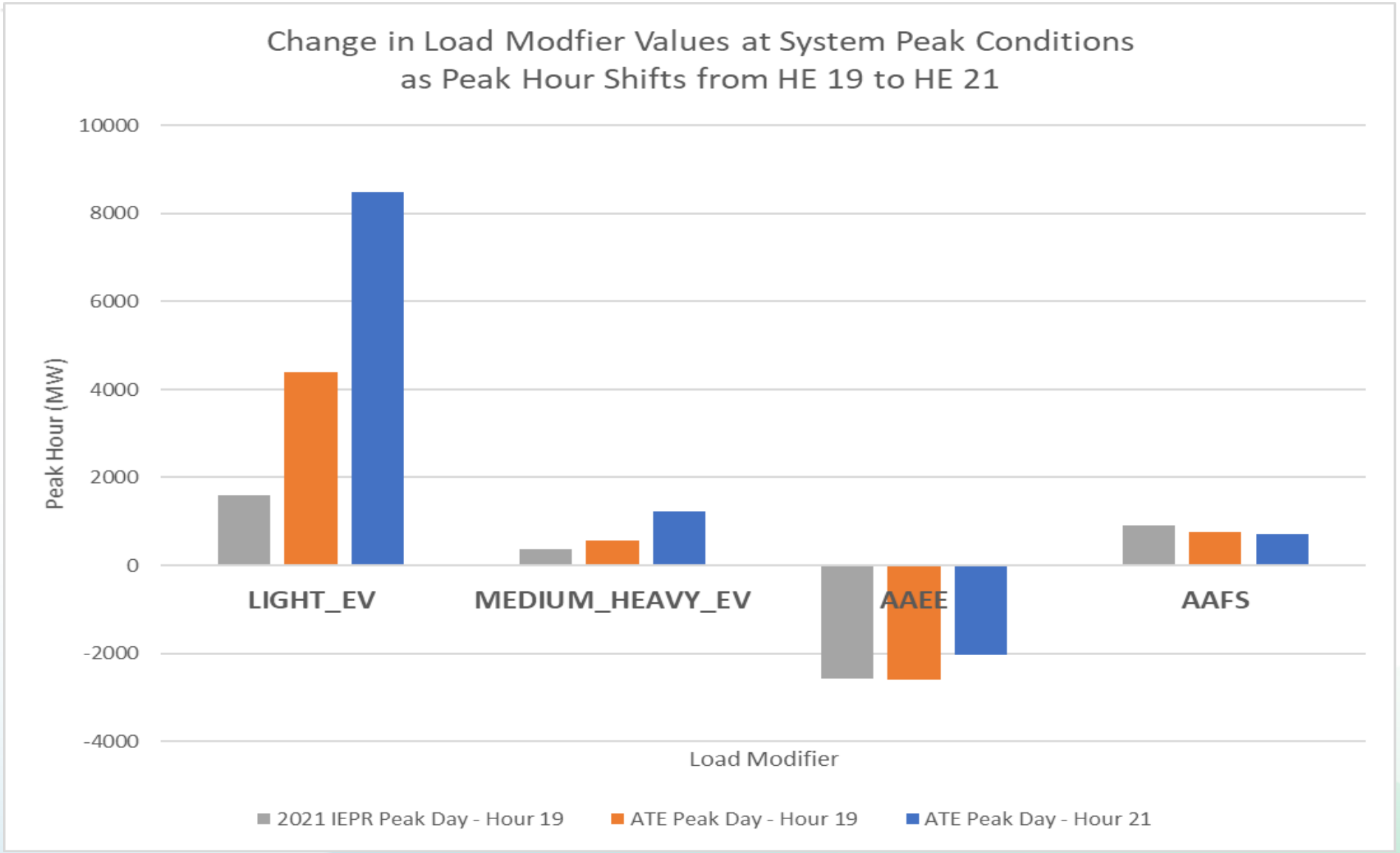
TE Load Impacts in 2032



TE Load Impacts in 2035



Comparison of Load Modifiers in 2035



Load Bus Allocations

- In order to assess transmission system impacts, the CAISO and utilities require that system-level load forecasts be translated into peak hour loads on load busses as an input to power flow models.
- Each IEPR Cycle, the CEC allocates the adopted IEPR demand forecast to a set of load busses used in a power flow study. The CEC staff has adapted its tools to improve the geolocation of incremental electrification loads.
- These load bus allocations provide grid planning scenario results to the CAISO in a format needed for power flow studies in its part of this overall infrastructure assessment effort.

Allocating AAEE and AAFS Peak Impacts

- The CEC has allocated AAEE to load busses for many years, but made changes for the 2021 IEPR:
  - Instead of allocating all program savings using a common factor, created several program groupings, each of which has an appropriate load allocation factor
    - E.g., new construction programs allocated to zip code-based new construction
- The CEC introduced AAFS in the 2021 IEPR, and uses new AAEE approach:
  - retrofit programs use load bus shares based on customer sector sales
  - New construction programs use load bus shares linked to new construction activity

Allocating TE Peak Impacts

- Light Duty Vehicles – LDV load projections at system peak day/hour using proportional mapping based on the following factors:
  - 70% DMV 2020 registration data by ZIP code
  - 15% retail gasoline sales by ZIP code
  - 15% commercial electricity sales by historic energy sales
- Medium and Heavy-Duty Vehicles – MDHD load projections at system peak day/hour using proportional mapping based on the following weights:
  - 50% retail sales of diesel fuel by ZIP code
  - 50% freight activity by ZIP code

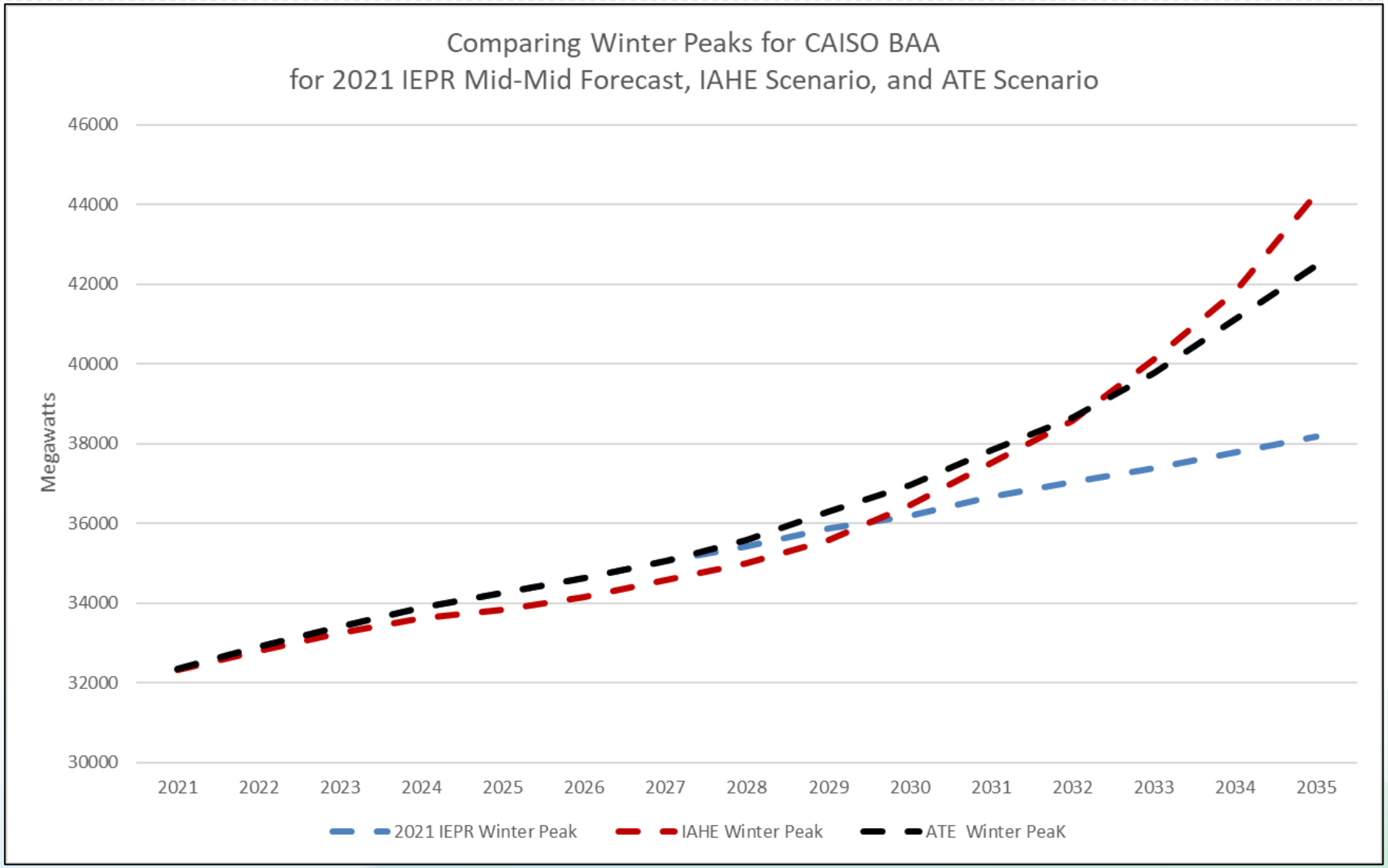
TE Load Bus Allocation Uncertainties

- There are multiple uncertainties about the allocation of TE loads to load busses as needed for transmission power flow studies. These include:
  - The projection of annual electric energy
  - The hourly TE load shape over the course of a year
  - The responsiveness of EV owners to TOU rates and or various VGI programs
  - Travel demand patterns not coincident with traditional peak conditions (e.g., increased DCFC usage during holiday weekends)
  - Flexibility of TE load relative to loads from other end uses
  - Poor data about EV charging location and usage rates now and how that may change as infrastructure grows, particularly with MDHD infrastructure
  - Mapping ZIP code location data to load busses

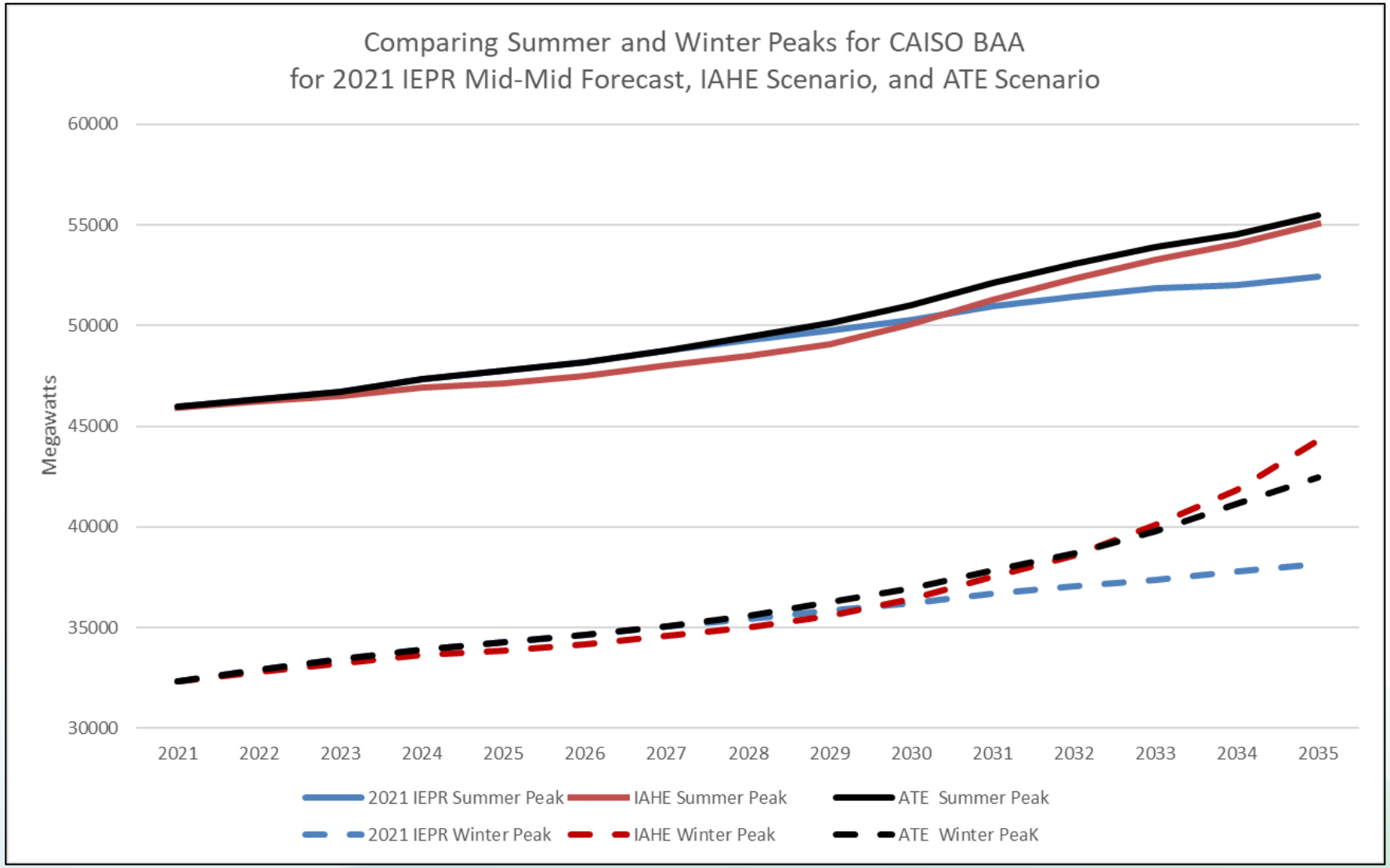
Questions?

APPENDIX

Comparison of Annual Winter Peaks



Comparison of Annual Seasonal Peaks



CPUC D.22-02-004, pp. 118-119

5.2 Sensitivity Portfolio

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"It may be possible to develop a portfolio with the 30 MMT GHG constraint in time to transmit a policy-driven high electrification sensitivity portfolio later in 2022, after the adoption of this decision. To facilitate this option, we endorse here the concept and delegate to Commission staff to work with the CEC and CAISO staff to explore development of such a portfolio for study as a policy-driven sensitivity in the 2022-2023 TPP. The portfolio would need to be based on the IEPR demand forecast, and not a PATHWAYS model forecast.

Unfortunately, this delegation to staff will mean that there will be limited opportunity for further stakeholder input on this portfolio at the proceeding level, prior to CAISO's utilization of the portfolio as an input to the TPP. However, given this is for a sensitivity case used primarily to develop future assumptions, it is still important to have a 30 MMT case with high electrification assumptions analyzed, to continue to prepare us for the next phase of infrastructure development. For these reasons, we endorse this sensitivity case and delegate to staff to transfer the requisite busbar mapping results after the adoption of this decision."

CAISO 2022-23 TPP Study Plan

7.2 Policy Driven Assessment of the High Electrification Sensitivity Scenario

"In the 2022-2023 transmission planning cycle, the CAISO will undertake a special study to evaluate the potential reliability impacts to the transmission facilities based on a high electrification scenario. The CEC, in collaboration with the CPUC and the CAISO, is developing a demand scenario that places a greater emphasis on electrification than is embedded within the CEC's 2021 IEPR energy demand forecast. The CPUC will also be developing a resource portfolio based upon the high electrification scenario. The CEC and CPUC are targeting to provide the high electrification scenario load forecast and resource portfolio to the CAISO by June 1, 2022.

The CAISO will engage stakeholders when further details are available."

[pp. 76-77]