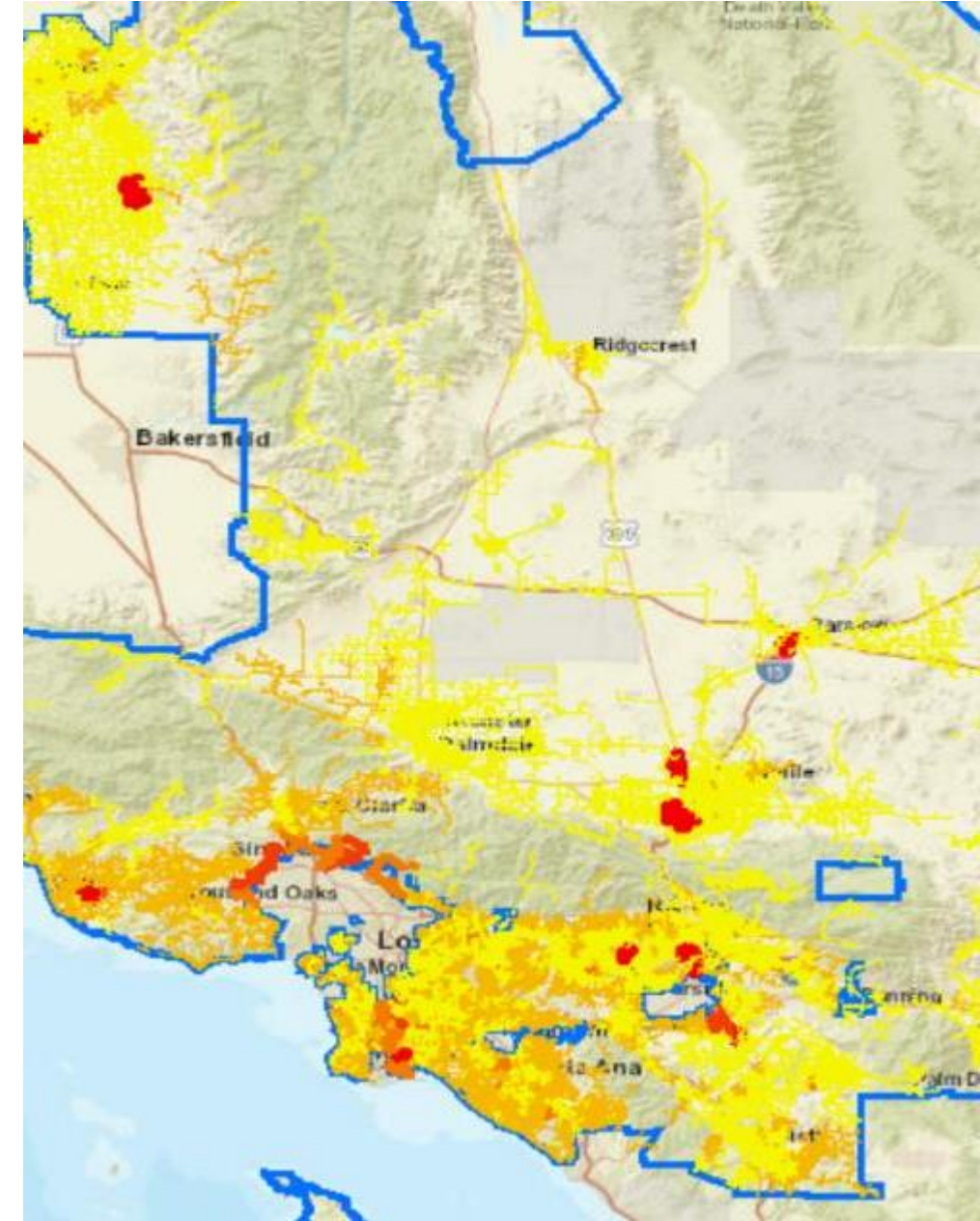


SCE's Transportation Electrification Forecasting and Planning

2023 Long-Term Load Forecasting Workshop
Energy System Integration Group
June 15, 2023

SCE Transportation Electrification Grid Readiness (TEGR) Drives GRC Load Growth Request

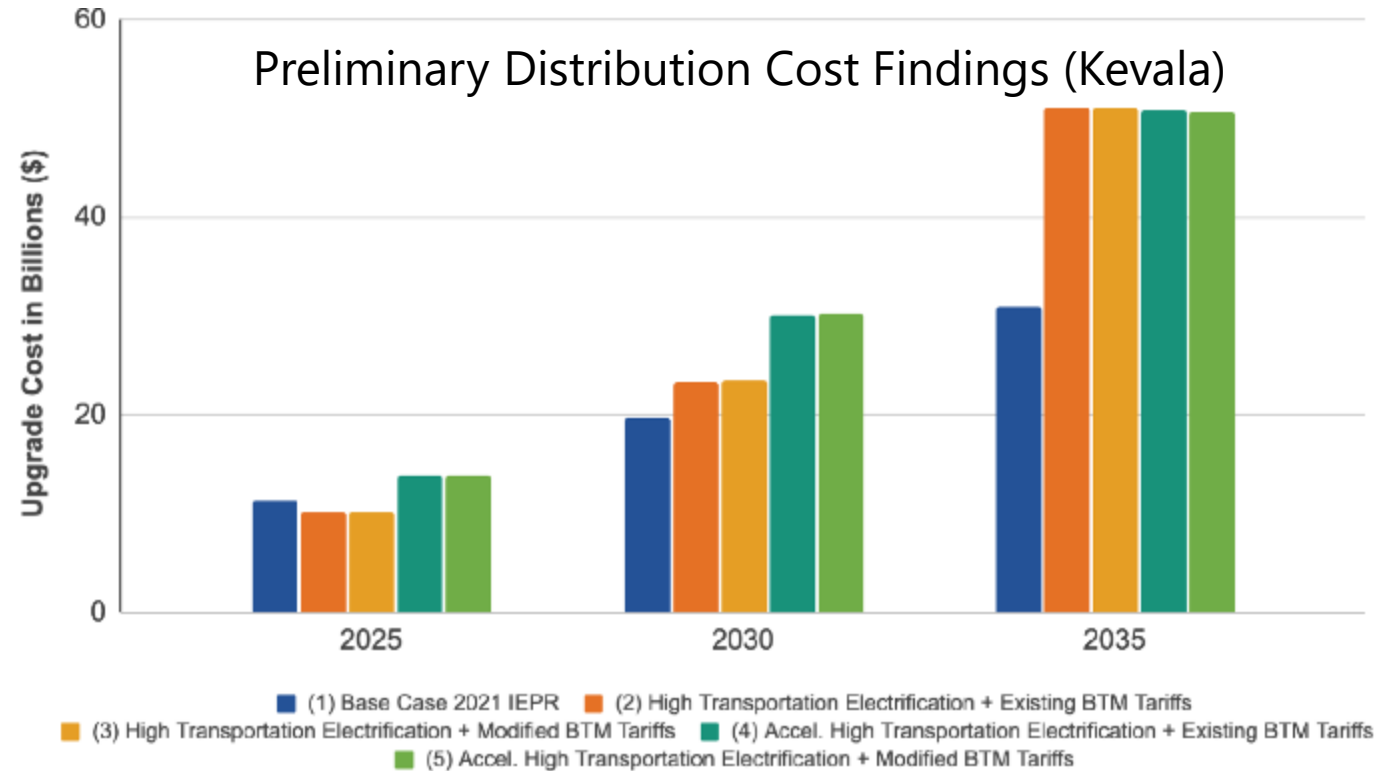
- Over past GRC cycles, SCE's traditional planning process has met historic needs given relatively modest and predictable load growth.
- Ambitious decarbonization policies, particularly in TE, increase both the pace and uncertainty of load growth.
- Grid-readiness and availability of supportive grid infrastructure needed to power EVs are a primary concern for EV adopters, especially important for commercial fleets, with the largest of these fleets anticipated to be regulated by the State's Advanced Clean fleet rule.
- Some projects like substations require long lead times, and if we are not planning now (land purchases, management) when load materializes, it could result in potential delays in project completions.
- If SCE has not planned for and completed these projects to ready the grid for these reasonably expected sizable load increases and long lead time projects, may lead to severe consequences for other sectors within California's economy, such as supply chain shortages for personal and industrial goods and services.
- Given this immense opportunity and responsibility, SCE undertook a comprehensive TEGR analysis to inform our GRC funding request that will allow SCE to meet anticipated customer needs.



Growing Consensus on Scale of Load Growth from the Clean Energy Transformation

With growing alignment on the scale of transformation electrification will have on the utility sector, there is growing interest in understanding the potential electric system impacts

- CPUC-driven (Kevala) Electrification Impact Study, identified significant need for distribution investments to 2035
- Kevala study highlights the significant investment needed
- CEC's latest IEPR shows a ~7x growth in TE load compared to previous report



INVESTMENT SCENARIO

TRANSPORTATION ELECTRIFICATION

Underfunding results in a steeper climb to TE adoption and broader electrification goals.



\$4.7 BILLION*

*CEC 2020 IEPR Recommendation

\$10 BILLION**

**SCE Transportation Electrification Grid Readiness Forecast/2025 GRC

Load Growth: Readying the Grid for Customers' Needs and Achieving California's Decarbonization Goals

The TEGR analysis

- uses a supplemental demand forecast that incorporates state policy targets
- utilizes enhanced customer-centric disaggregation approaches to identify likely areas of TE load increases
- Identifies long lead time projects for planning and proactive early action now, namely land management and initiation of permitting/licensing

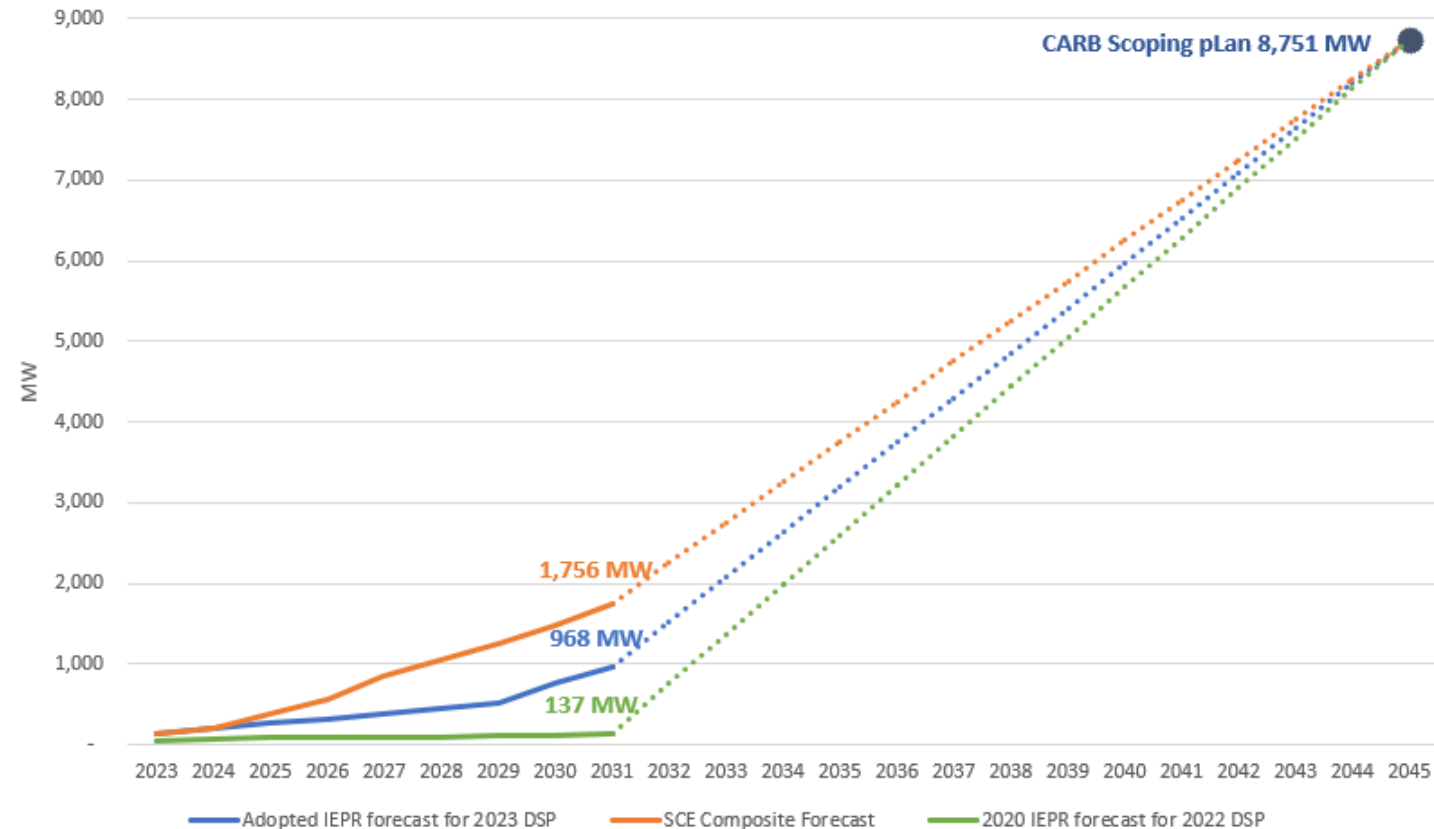
As a result of the TEGR analysis, SCE has identified additional projects that are needed to accommodate the reasonably expected increase in TE-driven load.

As part of TEGR, SCE stress-tested the electric system to further assess its readiness to accommodate higher levels of TE load, which effectively reflects adoption occurring past the 10-year planning window

- This included expanding adoption to "full" customer potential rather than what could be expected by 2032
- This also included a review of ability to expand/build out existing substations

SCE identified 20 potential substations that after accounting for the full physical build out of existing substations are still likely to be constrained when faced with additional increasing TE load that will require future upgrades to addressing arising capacity constraints

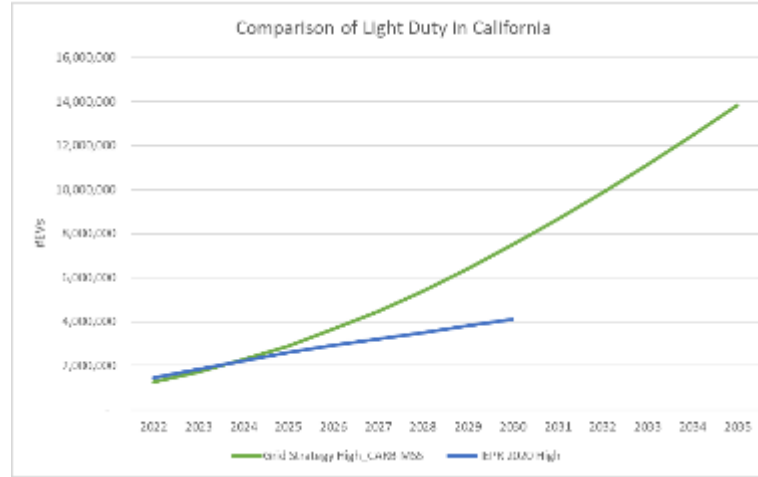
Transportation Electrification for SCE*



EV Forecast Comparisons

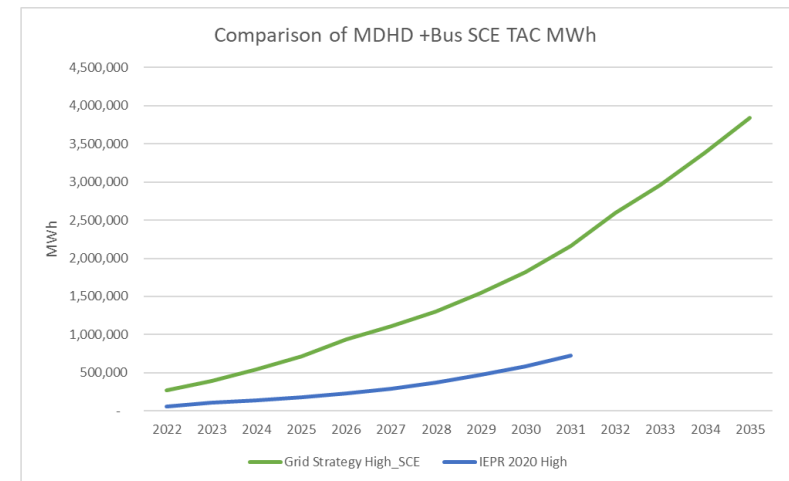
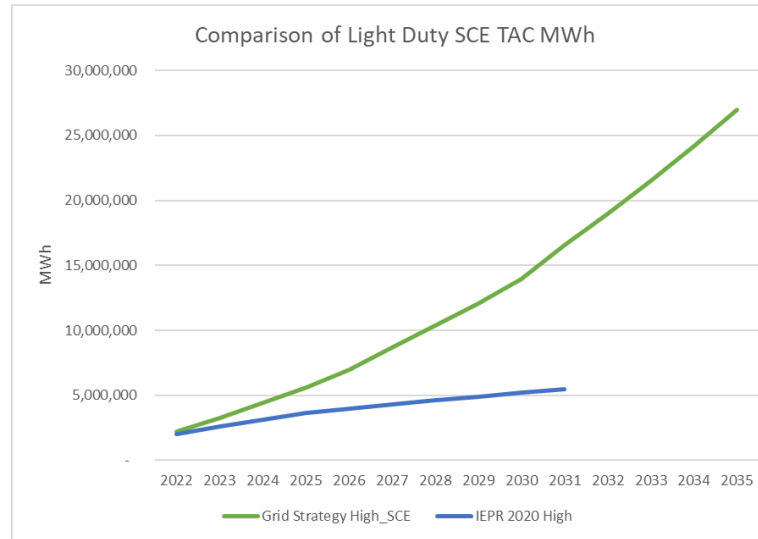
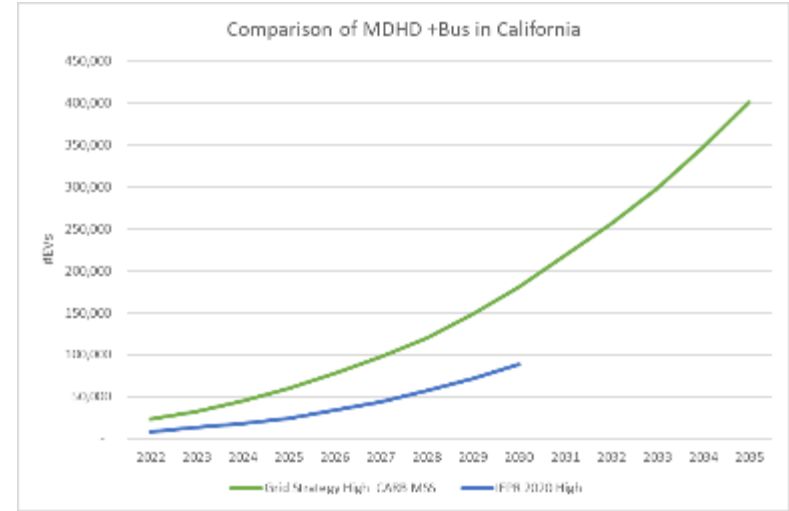
Light Duty Vehicles

EV Volumes



Medium/Heavy Duty Vehicles

Energy (MWh)



SCE's Composite Forecast (using AB2127)

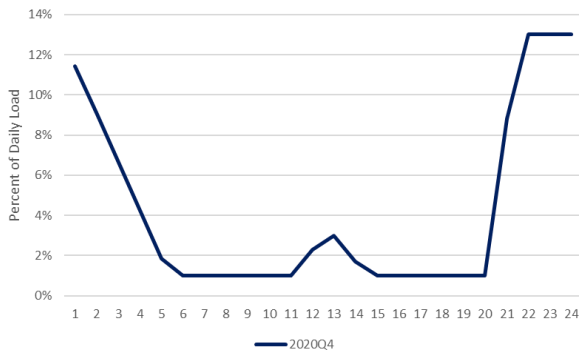
Given the significance of TE load in the TE Grid Readiness effort, composite TE forecast incorporated AB2127/CARB's Mobile Source Strategy forecast.

DER Type	General Methodology	Major Inputs
Light-duty EV	<ul style="list-style-type: none"> Regression Modeling Propensity analysis based # households whose income is over 150K Potential consideration of low-income area adoption based on customer survey and segmentation analysis Known projects such as Tesla, EVGO addition to system level forecast 	<ul style="list-style-type: none"> Historical EV Adoption American Community Survey Acxiom Data
Medium Duty EV	<ul style="list-style-type: none"> Propensity analysis based on customer annual peak demand Leverage recent TE Road Map analysis 	<ul style="list-style-type: none"> Mapping of NAICS to potential MD adoption SCE's customer data (usage, NAICS etc.)
Heavy-duty EV	<ul style="list-style-type: none"> Propensity analysis based on customer activities (e.g. # of moves to port) Leverage recent TE Road Map analysis 	<ul style="list-style-type: none"> SCE's Customer Service List of active customers who have access to Port of Long Beach
Bus	<ul style="list-style-type: none"> Propensity analysis using customer # of potential EV purchases/existing stock 	<ul style="list-style-type: none"> CARB's Innovative Clean Transit Plan Data National Transit Database (NTD) SCE's Customer data (address)
Forklift	<ul style="list-style-type: none"> Propensity analysis using non-refrigerated warehouse customers' annual peak demand 	<ul style="list-style-type: none"> SCE's Customer data (usage, building type etc.)
Other offroad (TRU)	<ul style="list-style-type: none"> Propensity analysis using # of dock doors for each facility 	<ul style="list-style-type: none"> CARB' list of facilities that are potential for TRUs SCE's Customer data (address)

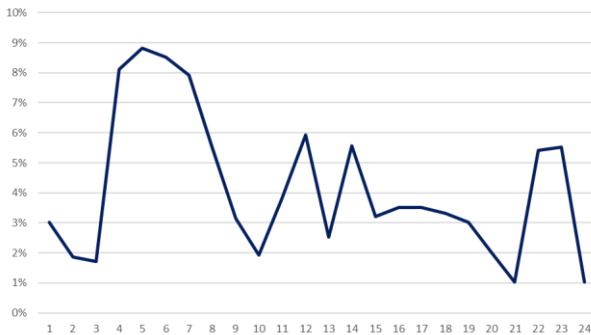
Key consideration for TE Forecasting are their load shapes

Sample of Load Shapes

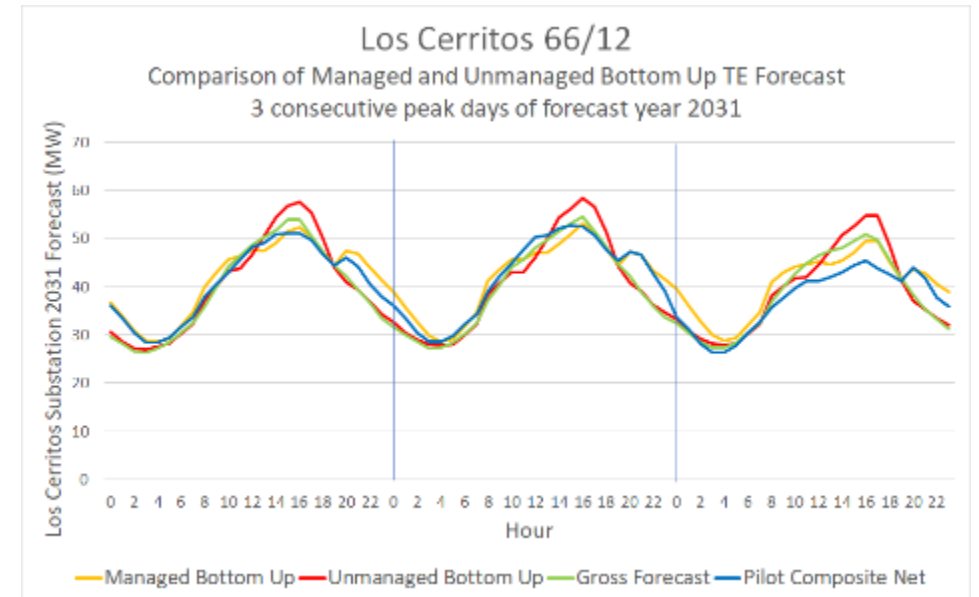
Normalized SCE MD HD Load Shape Summer Weekday in 2030 PST



SCE's Port Shape PST



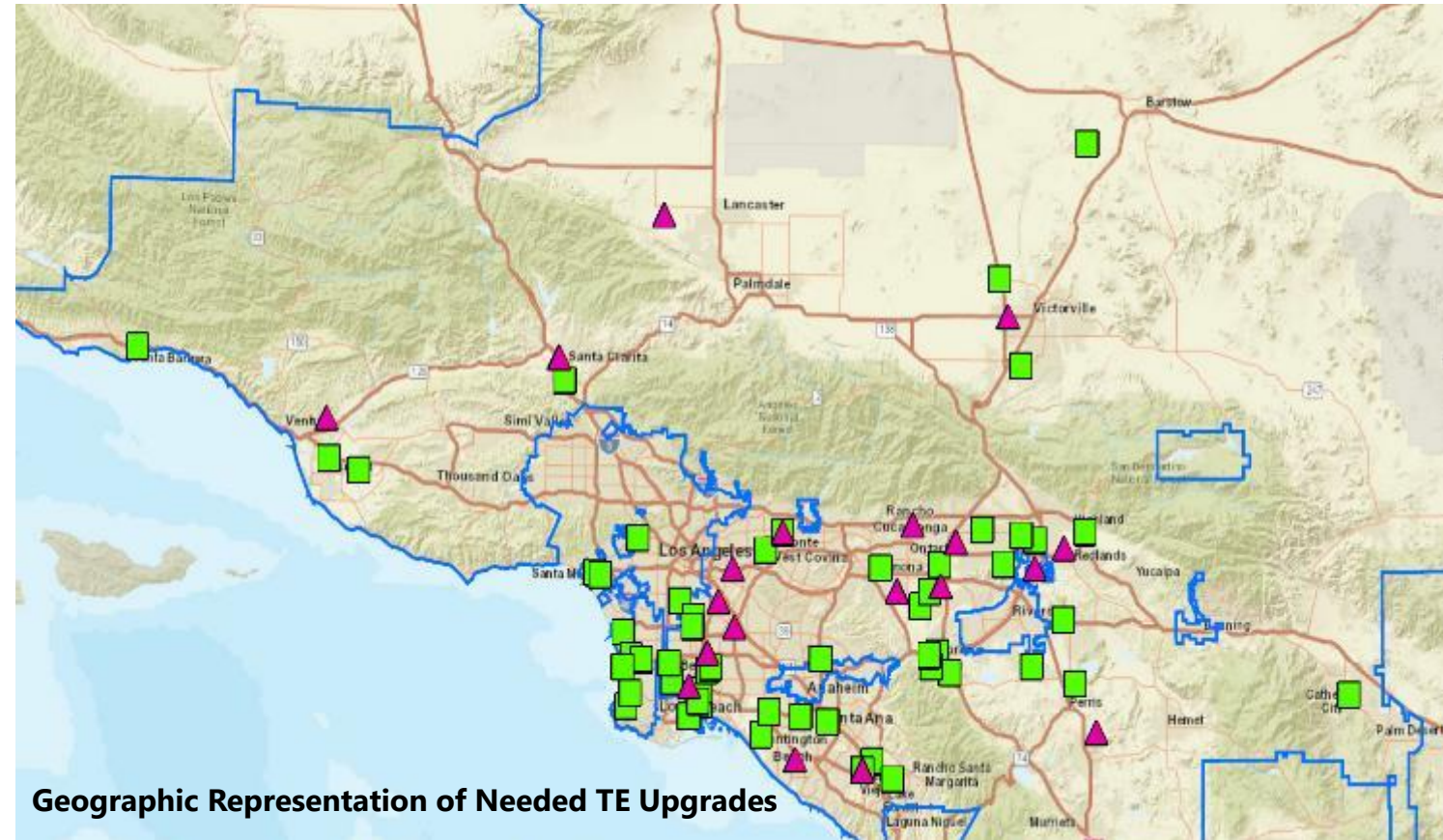
- Using various load shapes across different vehicle classes and charging locations
- These shapes have been developed using best available information, but are lacking empirical data
- Generally, the load profiles are placing charging outside of mid-day bulk system peaks, but depending on the circuit may or may not contribute to circuit overloads



- SCE explored impact of load shape assumptions on system overloads
- In this example, assumed load profile (managed) places additional load at non-coincident peak times, not triggering an overload
- However, as shown with "unmanaged" case, if charging occurs on peak, it would have significant impact and overload the circuit

Load Growth: Readying the Grid for Customers' Needs and Achieving California's Decarbonization Goals

- State policies, technological advancements, material federal investments, and customer adoption rates are converging to drive drastic shift in electricity consumption over the next ~10 years.
 - Targeted investments are needed now, in this GRC period, to ensure the grid is prepared for the scale of anticipated adoption to meet shared customer, State, and SCE decarbonization goals.
 - SCE undertook a bottom-up analysis¹ to identify areas requiring additional readiness work to prepare for reasonably expected TE Load Growth.
- Approximately 10-15 percent of SCE's sub-transmission and distribution assets being included for proposed grid development as part of the TEGR analysis.
- This growth can alter load demand in certain areas like, the Port of Long Beach, by 10-20x historical load.
- Preparing for this immense shift now will lessen otherwise potentially lengthy interconnection timelines.
- Since 2021, SCE has received over 700 interconnection requests for TE loads of at least 500 kVA or larger, with the TE interconnection request demand increasing YoY.
- SCE is also cognizant of the benefits this transition provides to our most vulnerable communities.
- More than 90% of the selected locations are either along a major transportation corridor or have proximity to the ports, and close to 70% of the selected locations are in a disadvantaged community.



Load Growth: Ready the Grid for Customers' Needs and Achieving California's Decarbonization Goals (continued)

- In this GRC period, load growth projected to rise approximately eight times faster annually than over last two decades
 - Historically high amounts of new demand anticipated, driven by TE and BE
 - State agencies (e.g., CARB, CEC, CPUC) forecasting significant load transformation—SCE's proposal is consistent with these forecasts
- In addition to SCE's TEGR driven projects, SCE is also leveraging existing programs, such as 4 kV remediation, to support grid readiness for rapidly evolving customer needs and impending load growth that will require proactive infrastructure planning and deployment
 - Disadvantaged communities receive additional prioritization in this program
- Continuing work to enhance Grid Modernization capabilities and leverage DERs as supply-side resources will help mitigate some of the expected challenges from electrification
- Allows SCE to be the most capable partner in helping our customers and the State achieve rapidly approaching decarbonization goals and meet the accompanying shift in demand

