Resource Choices in a Decarbonized Future
How Storage Fits

CSP Program Summit

Oakland, CA

March 18-19, 2019

SCE Highlights

One of the nation's largest electric utilities

- 15 million residents in service territory
- 5 million customer accounts
- 50,000 square-mile service area

Significant infrastructure investment

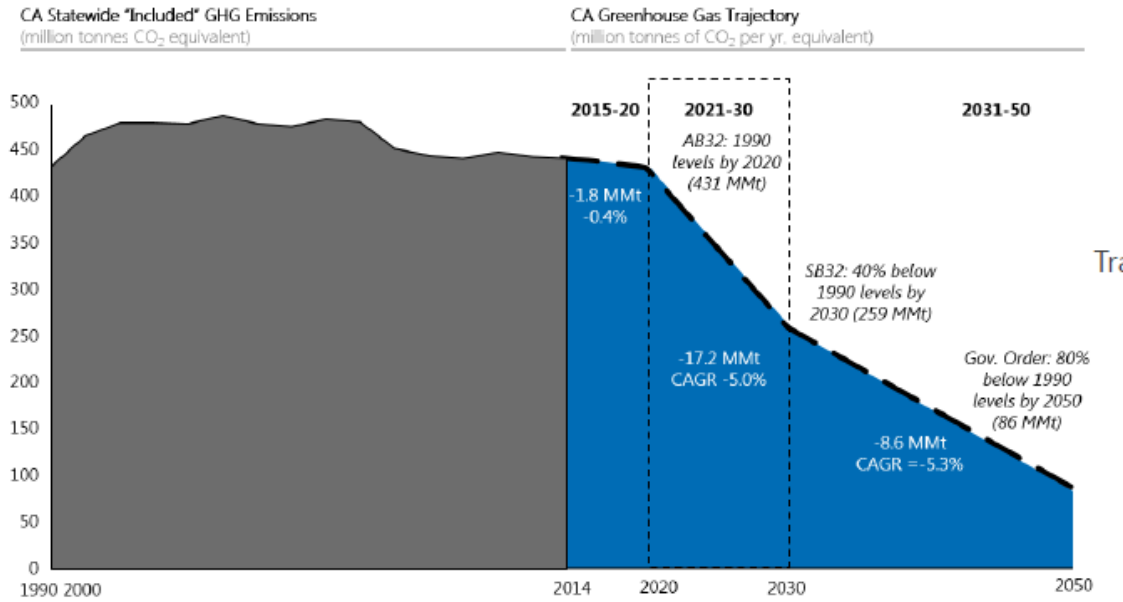
- 1.4 million power poles
- 724,000 transformers
- 118,000 miles of distribution/transmission lines
- 3,200 MW owned generation

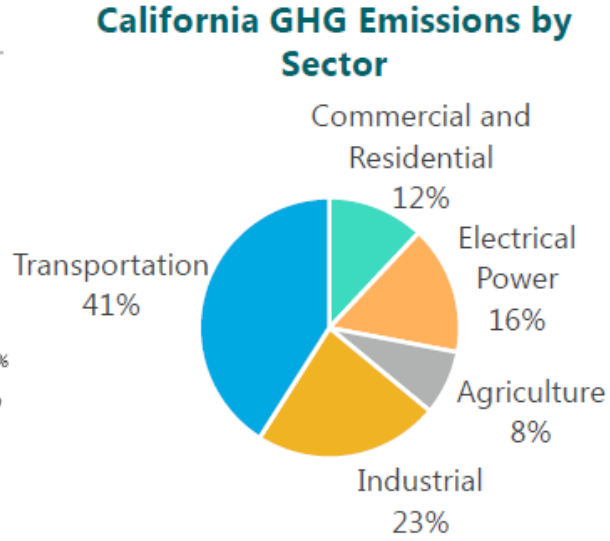
Focus on:

- Safety and reliability
- California's low-carbon objectives
  - Grid modernization
  - Transportation electrification
  - Electric vehicle charging
  - Energy storage

California's Emissions Overview

- On October 7, 2015, Governor Brown signed SB 350, which requires a doubling of energy efficiency in existing buildings for California by 2030
- On September 8, 2016, Governor Brown signed SB 32, which requires statewide GHG emissions to be reduced to 40% below the 1990 level by 2030; Governor Order set a 2050 target of 80% below 1990 levels
- On July 24, 2017, Governor Brown signed AB 398, which extends cap-and-trade to 2030
- On January 26, 2018, Governor Brown released an Executive Order calling for 5 million zero emission vehicles by 2030
- On September 10, 2018, Governor Brown signed SB 100, which requires that 60% of energy sales to customers come from renewable power by 2030 and sets a 100% clean electricity goal for the state, and issued an executive order establishing a new target to achieve carbon neutrality, both by 2045

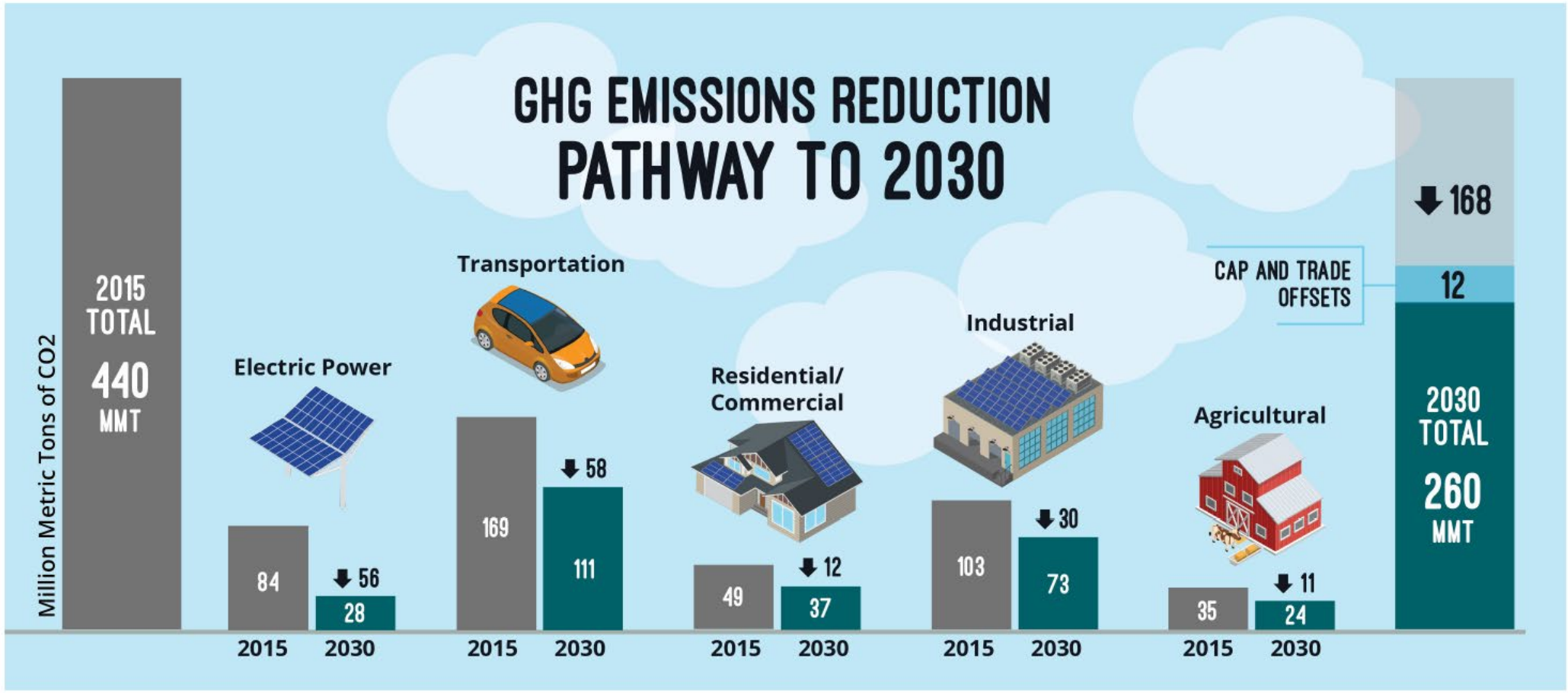




SCE is taking a leading role to ensure that transportation electrification plays a major part in reducing GHG and criteria pollutant emissions in California

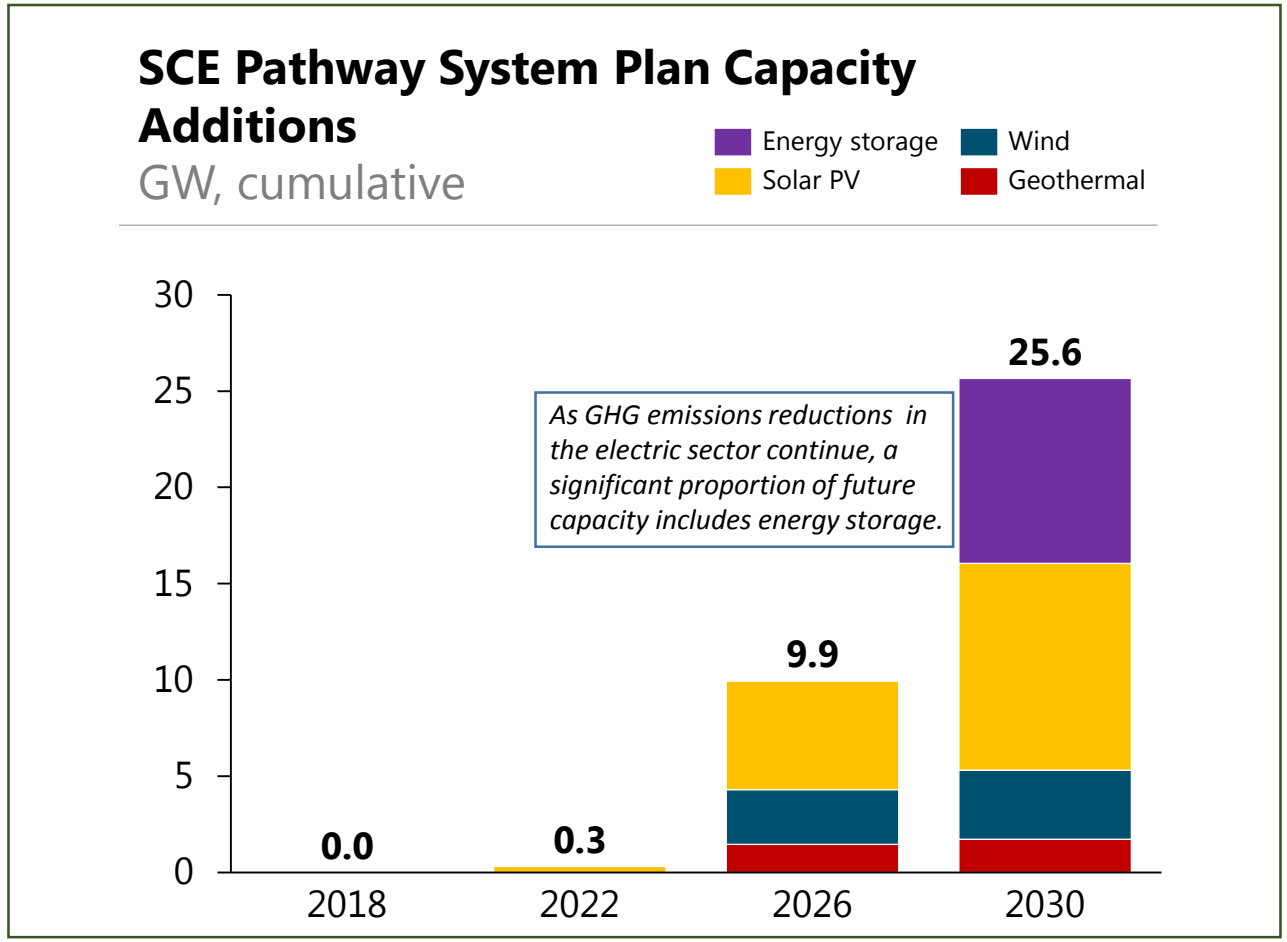
Source: Data for both charts from California Air Resources Board; California GHG Emissions data as of 2016.

SCE's Pathways Vision



As electrification adoption broadens, emissions reductions in various GHG sectors become dependent on the electric sectors ability to quickly and cost effectively decarbonize.

SCE designed a CAISO-wide System Plan that realizes its electric-led decarbonization vision



Actions to achieve 28 MMT statewide

- Increased electrification load outpaced by reductions from:
  - Energy efficiency
  - BTM PV
- More renewable build
- More energy storage

What Storage can add to the Resource Mix

- SCE, as a utility and user of storage, is generally 'agnostic' to the types of technologies needed. Whichever technology is the least cost to best fit is the preferred technology.
- Storage will need to be part of the solution to reducing reliance on the current fossil fleet by replicating it's flexible system profile and help the transition toward carbon-free power sources
  - SCE's recent Integrated Resource Plan (IRP) shows a need for new storage in the CAISO system beginning in 2027 with about 10,000 MW of new storage needed by 2030 in order to meet California's carbon goals – this was determined using simple capacity expansion and load /resource balancing
- The greatest benefit of energy storage is its flexibility and the wide variety of use cases it can serve. This also creates a great challenge: how to model and properly value its flexibility?
  - Serves as a grid (distribution) asset, local or system capacity, flexible resource (ramping and ancillary service), backup power, etc.

Costs, Attributes and Timing will drive the types of future energy storage deployed to meet CA's carbon goals

- The cost of battery related storage is clearly coming down, but the economics of storage also depend on new and emerging business models and use cases
- Additional state goals per SB 350 support resource portfolio:
  - Identifying a diverse and balanced portfolio
  - Strengthening the diversity, sustainability, and resilience of the bulk transmission and distribution systems, and local communities
- Timing is important – emerging competitive resources will need to be ready as need arises

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