

# Fueling with Renewable Energy

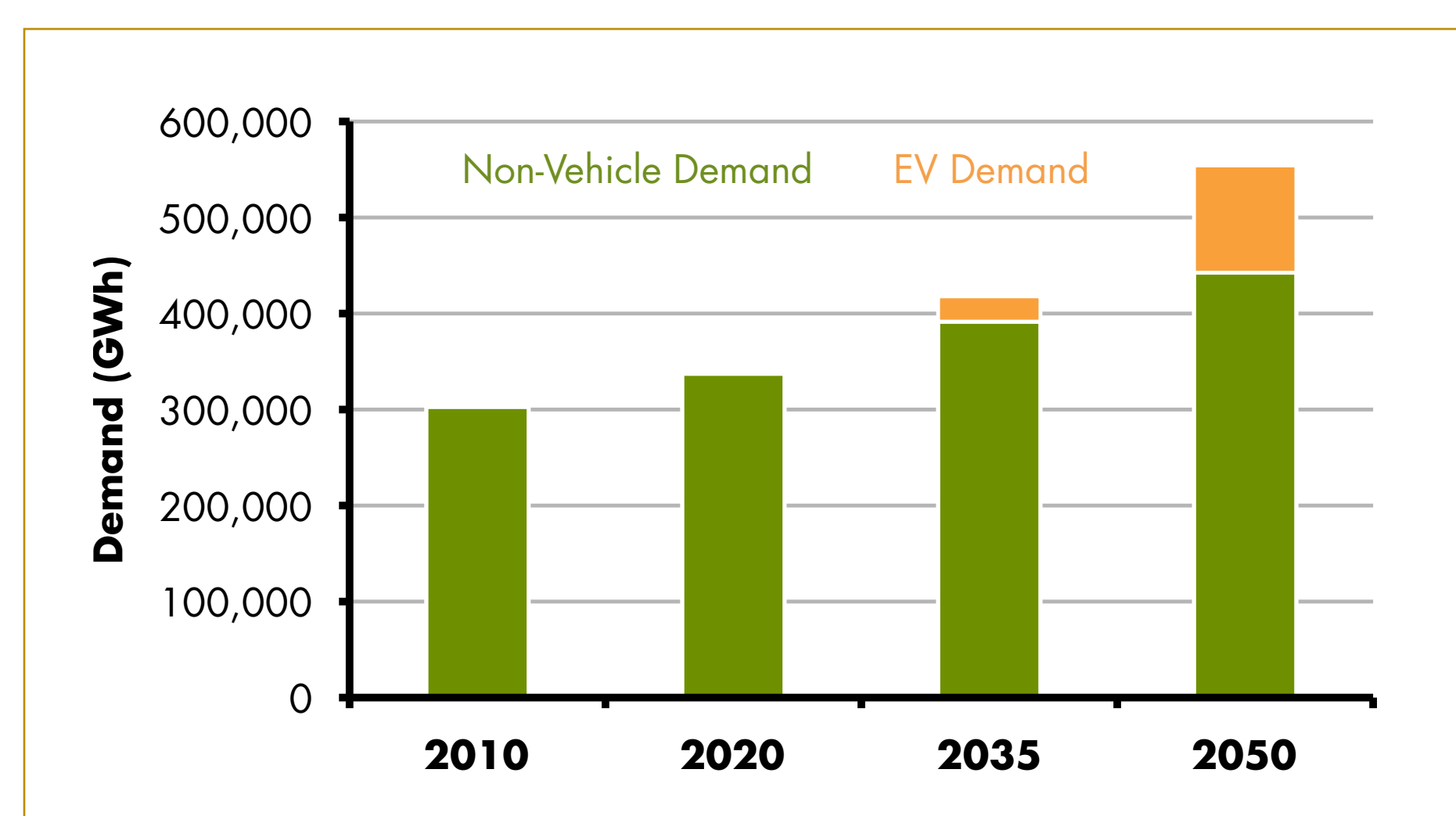
Exploring ways for California to reduce greenhouse gas emissions by 2050 using renewable energy, electric-drive vehicles and energy storage.

CALIFORNIA HAS SET an ambitious goal of reducing greenhouse gas (GHG) emissions to 80 percent below 1990 levels by year 2050.

Electric-drive vehicles are one of the most promising options for California because they produce no emissions when driven on electricity or hydrogen; however, producing the fuel for electricity and hydrogen production can lead to significant GHG emissions, specifically when solar and wind power sources are not available and fossil fuels are used.

This study explores whether California can achieve these cuts in GHG emissions by fueling electric-drive vehicles with electricity or hydrogen from various mixes of renewable energy such as biomass, geothermal, solar and wind power. The study also investigates whether stored electricity can address the unpredictability of a large renewable energy supply.

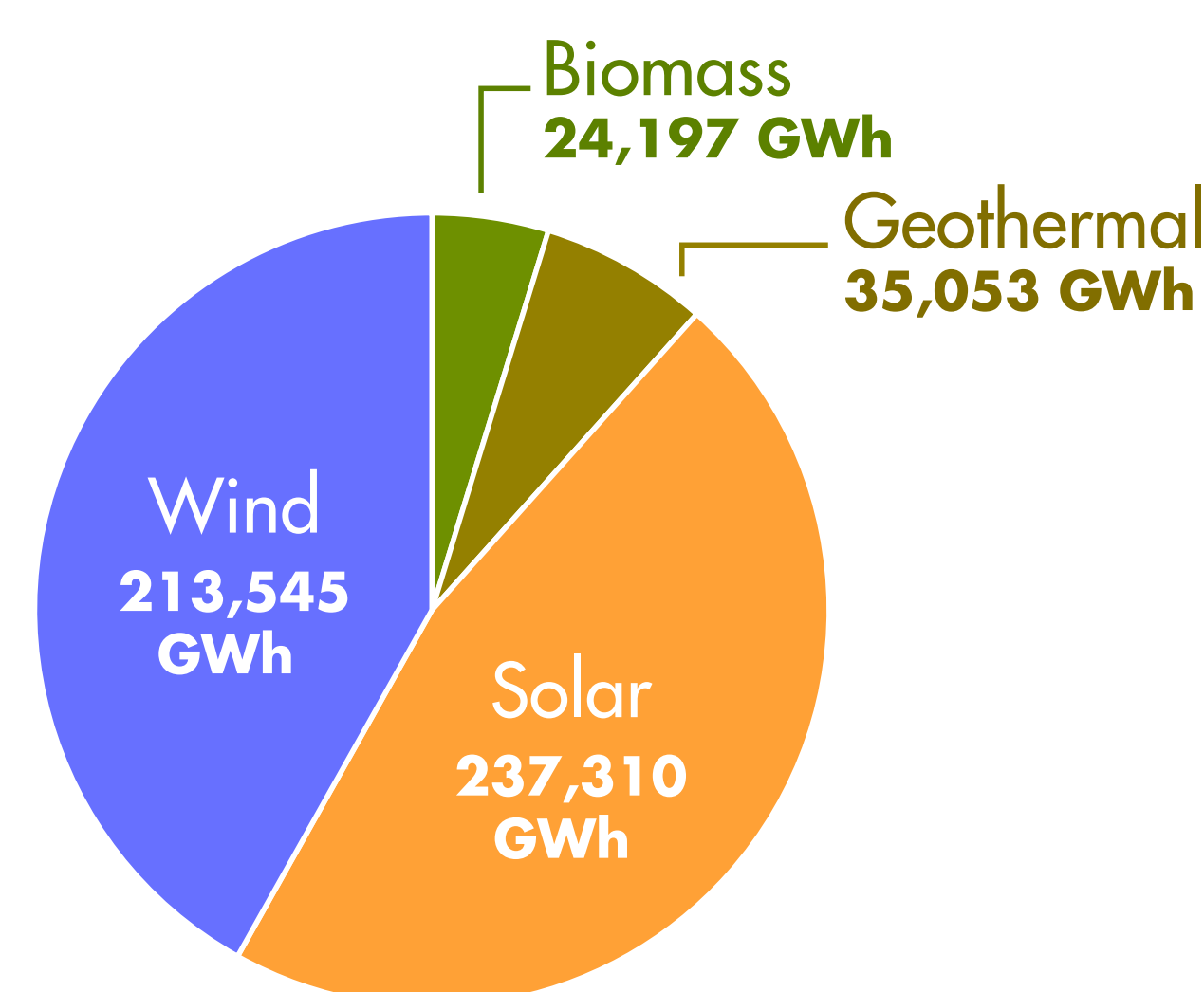
All scenarios in this study are compared with respect to energy demand, greenhouse gas emissions and cost to identify the best options California has for meeting its climate-change goals in transportation.



There are three electric-drive vehicle technologies available, each with different characteristics:

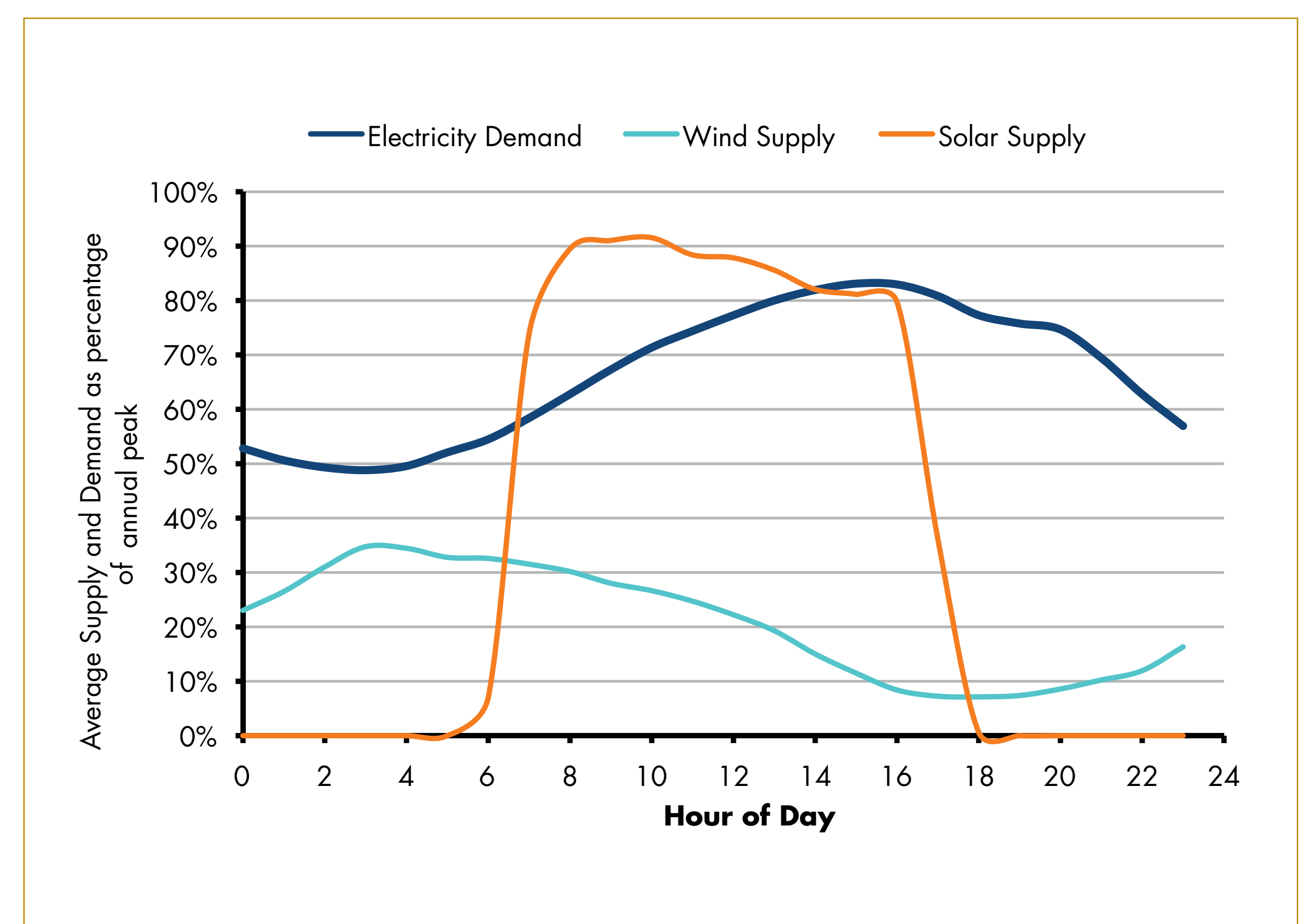


	PHEV	BEV	FCV
Technology	Plug-in-hybrid-electric vehicle	Battery-electric vehicle	Hydrogen Fuel cell vehicle
Fuel Economy (MPGGE)	<b>65 mpg</b>	<b>105 mpg</b>	<b>70 mpg</b>
Fuel	Electricity and Gasoline	Electricity	Hydrogen
Driving Range	Same range as a regular car. Up to 40 miles on electricity.	Up to 100 miles on a full charge.	Up to 300 miles on a full tank.
Where to Fuel	At home or at a charging station.	At home or at a charging station.	At a fueling station. Few currently available.
Time to Fuel	Hours	Hours	Minutes
Vehicle GHG Emissions	Vehicle emits CO <sub>2</sub> when powered by gasoline.	None from vehicle	None from vehicle



▲ In California and neighboring states, there is more than 510,000 GWh of renewable electricity—enough to meet 90 percent of year 2050 demand.

◀ Compared to current levels, California's electricity demand may jump 80 percent by 2050 due to population growth and the added impact of fueling large numbers of electric-drive vehicles.



▲ Solar and wind power are not always available when needed. This could require more fossil generation to meet demand, increasing GHG emissions.

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