RSG
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California Energy Commission

Surveying California's Transition to Zero-Emission and Autonomous Vehicles

Case Study

For over a decade, RSG has partnered with the California Energy Commission (CEC) to conduct the California Vehicle Survey (CVS), an effort supporting the state's transportation energy demand forecasts. Since 2015, RSG has led three survey waves (2016, 2019, and 2024), capturing evolving preferences among residential and commercial light-duty vehicle (LDV) owners. These insights are vital for maintaining the CEC's sophisticated vehicle choice models, which underpin the transportation energy demand forecast in the Integrated Energy Policy Report (IEPR).

The CVS tracks shifts in vehicle ownership, fuel adoption, and attitudes toward emerging technologies. In its most ambitious iteration, the 2024 CVS explored new dimensions of the energy landscape, including autonomous vehicles (AVs) and vehicle-to-grid (V2G) capabilities. The 2024 survey also expanded the questions about clean energy usage, including zero-emission vehicles (ZEVs), solar panels, and home battery systems.

The Challenge

The CEC's mandate to forecast transportation energy demand requires precise, policy-relevant data to model future scenarios. Its residential and commercial vehicle choice models simulate vehicle adoption and use, demanding current, representative data that keeps pace with technology and consumer behavior. As Californians increasingly adopt ZEVs, and as AV availability approaches, these models must account for rapidly changing market conditions.

Each CVS wave has presented new opportunities. RSG's challenge has been to maintain methodological continuity while aligning the scope of the survey to capture current technology trends. This required careful integration of new topics, including willingness to pay for AVs and participation in the energy ecosystem through V2G and solar ownership. The 2024 survey expanded modules targeting ZEV owners and introduced stated preference (SP) experiments that explored AV acceptance, grounded in behavioral theory. Achieving high-quality data across a diverse, tech-forward state like California required innovative sampling strategies, including address-based outreach, DMV registration data, and online panels, all while minimizing respondent burden and ensuring demographic and geographic representativeness.

RSG's Solution

To meet the project's needs, RSG led the development of three phases of data collection. First, RSG conducted a series of focus groups across California to gather qualitative data on vehicle preferences, energy usage, and travel

behavior. These sessions, held in San Francisco, Sacramento, Fresno, and Los Angeles, included both residential vehicle operators and commercial fleet managers. Data from the focus groups helped RSG and CEC refine the quantitative survey instrument and were used to generate a peer-reviewed paper in the Transportation Research Record.

Next, RSG conducted a pretest to evaluate the revised survey instruments and recruitment procedures. The pretest included both residential and commercial participants and helped assess respondent comprehension, SP design, and overall survey flow. Findings from this phase informed final updates to the main survey deployment.

RSG launched a survey designed to gather data across every county in California. Our team collected over 5,900 responses, including 3,890 from households and 2,029 from commercial establishments. ZEV owners were specifically oversampled, resulting in more than 1,350 responses from this key segment. Instruments were delivered in English and Spanish via a mobile-optimized survey platform, increasing accessibility and data quality.

The survey employed a dual revealed and stated preference (RP/SP) structure. Respondents first provided detailed information about their current vehicles, usage patterns, and energy behavior. This RP data was then used in real time to customize the SP experiments, ensuring close alignment between a respondent's actual circumstances and the hypothetical vehicle choices they were presented with. This approach reduced cognitive load and improved data quality by minimizing the gap between real-world behavior and modeled scenarios.

The SP component also included focused modules on autonomous vehicles (AVs), enabling estimation of how Californians might adopt and interact with emerging technologies. Designed using frameworks such as the Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM), this experiment estimated consumers' willingness to pay for various levels of automation. The results informed a peer-reviewed paper presented as a poster at the 2026 TRB Annual Meeting. This research revealed that while interest in AVs is growing, many Californians remain largely uninterested in purchasing a fully autonomous vehicle, with modest willingness to pay for full autonomy, even among those favorable to AV adoption.

Our team integrated data from these AV choice experiments into updated versions of the CEC's Personal Vehicle Choice (PVC) and Commercial Vehicle Choice (CVC) models. Enhancements included new model parameters for ZEV and AV adoption and additional questions about charging behavior and interaction with energy infrastructure. By analyzing factors like daily mileage, preferred charging locations, and vehicle replacement timing, RSG's work helped improve the state's ability to forecast demand for electricity, hydrogen, and other transportation fuels.

The cleaned, validated, and anonymized final dataset is publicly available through the Transportation Secure Data Center at the National Laboratory of the Rockies, expanding its value beyond the CEC to the broader research and policy community. The reports are also available on the CEC website.

Through a combination of rigorous methodology, innovation, and deep domain expertise, RSG ensured the 2024 California Vehicle Survey would not only reflect today's transportation landscape but also anticipate tomorrow's.