CALIFORNIA
AIR RESOURCES BOARD

Economic Impacts of Advanced Clean Cars II

REMI Users' Conference 2023

Cincinnati, OH

Tony Oliver, Ph.D.
and Desiree Porzio

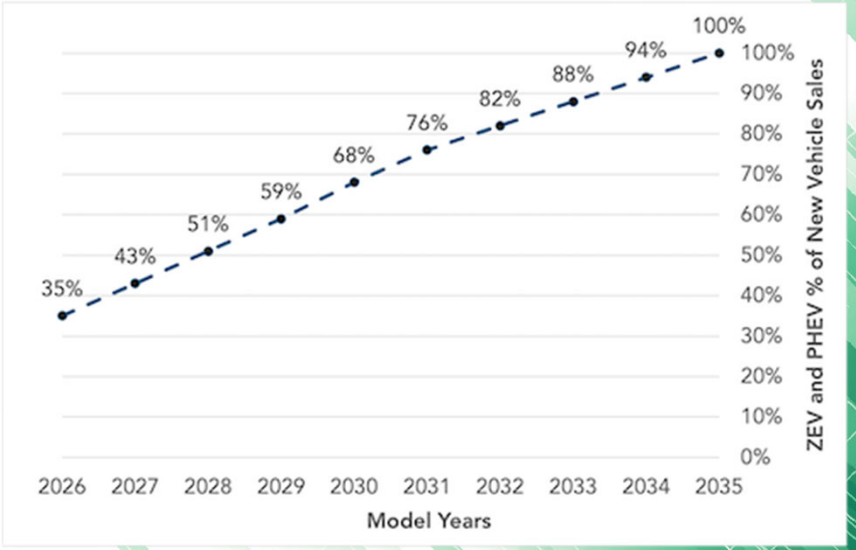
CARB

The California Air Resources Board

- CARB is charged with protecting the public from the harmful effects of air pollution and developing programs and actions to fight climate change.
- From requirements for clean cars and fuels to adopting innovative solutions to reduce greenhouse gas emissions, California has pioneered a range of effective approaches that have set the standard for effective air and climate programs for the nation, and the world.
- 16 member board, with 12 appointed by governor and 4 for local air districts

Regulations

- The Advanced Clean Cars II regulations will rapidly scale down emissions of light-duty passenger cars, pickup trucks and SUVs starting with the 2026
  - Zero-emission Vehicle Regulation to require an increasing number of zero-emission vehicles
  - Low-emission Vehicle Regulations were amended to include increasingly stringent standards for gasoline cars



CARB

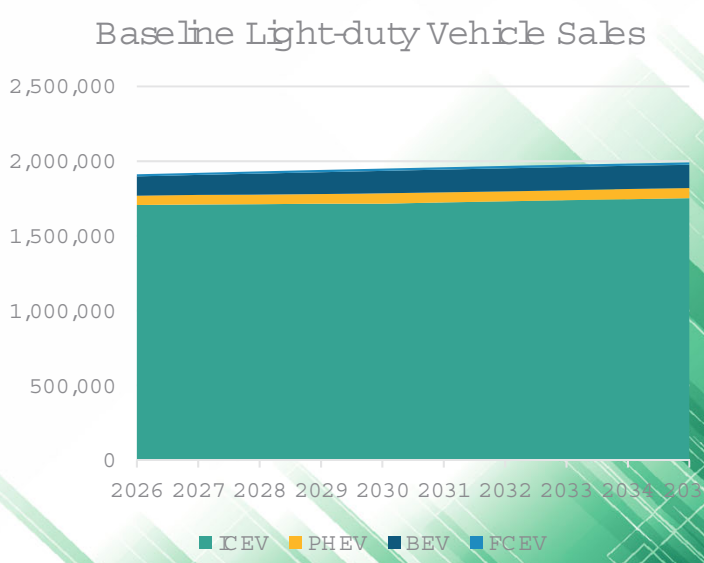
Standardized Regulatory Impact Assessment

- A comprehensive assessment of the costs, benefits, fiscal and macroeconomic impacts of a major regulation in the State of California.
- Major regulations are a defined as anything with an annual total economic > $50 million

CARB

Baseline

- Economic Regulation are evaluated against a baseline scenario each year for the analysis period from 2026-2040
- Existing requirements are accounted for, including the Low Carbon Fuel Standard (LCFS), the electricity Renewable Portfolio Standard (RPS), and the longer-term requirements of the 100 Percent Clean Energy Act of 2018 that requires electricity be supplied by zero-carbon sources by 2045.
- New vehicle sales forecast is based on CARB's EMFAC model, which projects about 1.9 million new light-duty vehicles sold per year.

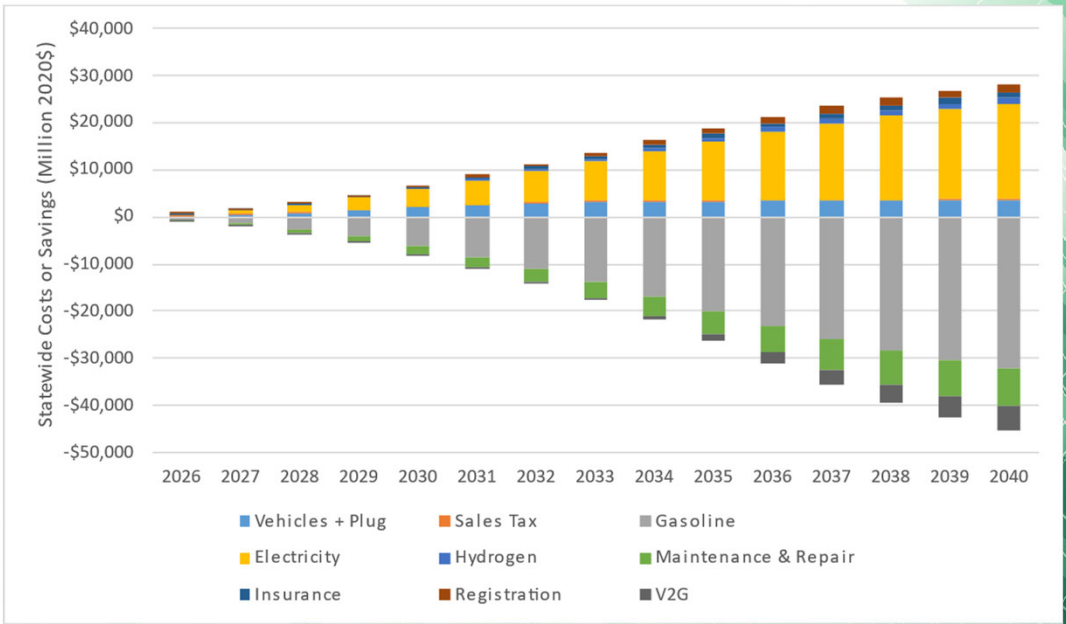


Direct Costs

- Estimates of direct costs are estimated of two main components:
  - Vehicle manufacturer cost:
    - Incremental cost of additional ZEVs are estimated based on least cost compliance pathway.
    - Cost are assumed to be passed on to consumers
  - Total Cost of Ownership (TCO):
    - Fuel cost (gasoline, electricity, and hydrogen)
    - Recurring cost (maintenance, insurance, registration, vehicle-to-grid)

Statewide Total Cost of Ownership

- Cost items:
  - Incremental vehicle cost
  - Electricity/Hydrogen cost
  - Registration cost
  - Insurance cost
- Cost-Savings
  - Gasoline
  - Maintenance & Repair
  - Vehicle-to-grid

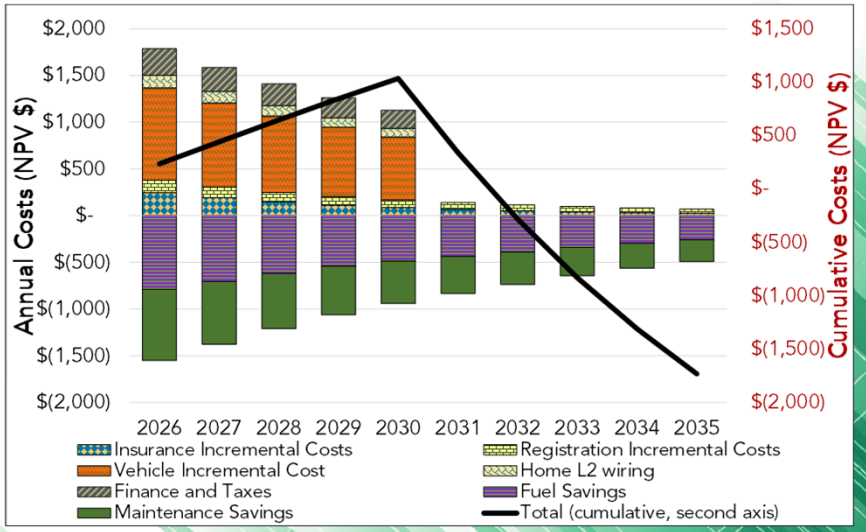


CARB

Cost to Individuals

- Total Cost Ownership estimated for initial purchase in 2026
- Breakeven for a typical driver occurs within 6-7 years

Total Cost of Ownership in 2026 for a BEV300



CARB

Health Benefits Monetization

- Improved air quality leads to improved health outcomes

Summary of Valuation for Avoided Health Outcomes (2023-2040)

Outcome	Value per Incident (2020$)	Total Avoided Incidents	Total Health Benefit
Avoided Premature Mortality	$10,030,076	1,287	$12.91 billion
Avoided Cardiovascular Hospitalizations	$59,247	211	$12.5 million
Avoided Acute Respiratory Hospitalizations	$51,678	252	$13.0 million
Avoided Emergency Room Visits	$848	647	$549,000
Total			$12.94 billion

CARB

Health Benefits REMI Inputs

- Consumer Spending variable
  - Modeled as reallocation from hospitals to other sectors
- Labor Productivity variable
  - Work loss days converted to increase in labor productivity using REMI's baseline Employment and Output values
  - The percentage change in labor productivity is applied to all industries

Economic Modeling

- The single region (California) 160-industry model was used to evaluate economic impacts
- Updates to both the National and California baseline forecast are performed

Economic Modeling

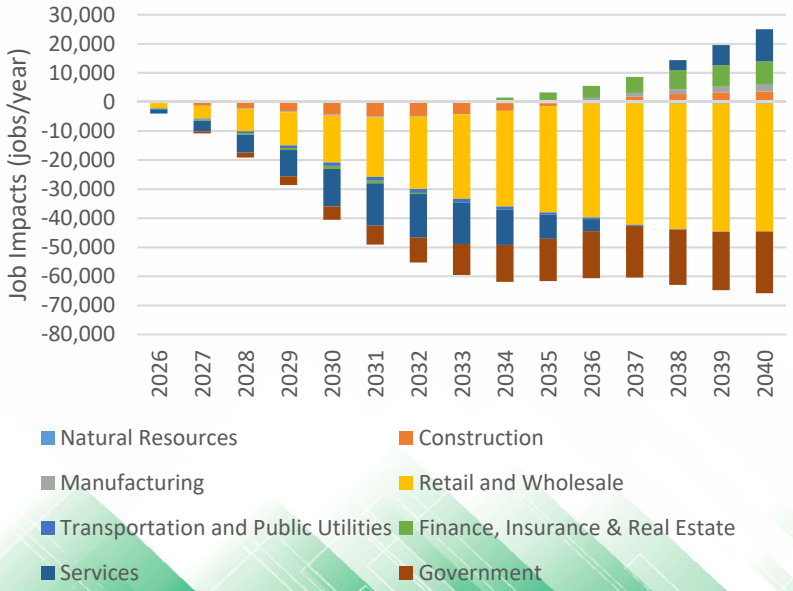
- Incremental Vehicle costs modeled as an increase in Consumer Price
- Operational costs modeled as changes to Consumer Spending.
- Health benefits reduce consumer spending
- Fiscal impacts of loss of gasoline tax revenue, reduce government spending

Source of Cost or Savings	Industries with Change in Production Cost or Prices (NAICS)	Industries with Changes in Final Demand (NAICS)
Vehicle prices and charging plug	Individuals, Businesses, and Government purchasers of new vehicles	Upfront cost: Electrical component mfg.[a] (3353)
Vehicle maintenance and repair		Recurring cost: Automotive repair and maintenance (8111)
Gasoline		Recurring cost: Petroleum and coal products mfg. (324), retail trade (44-45) and wholesale trade (42), and oil and gas extraction (211).
Electricity (including V2G savings)		Recurring cost: Electric power generation, transmission and distribution (2211)
Hydrogen		Recurring cost: Basic chemical mfg. (3251)

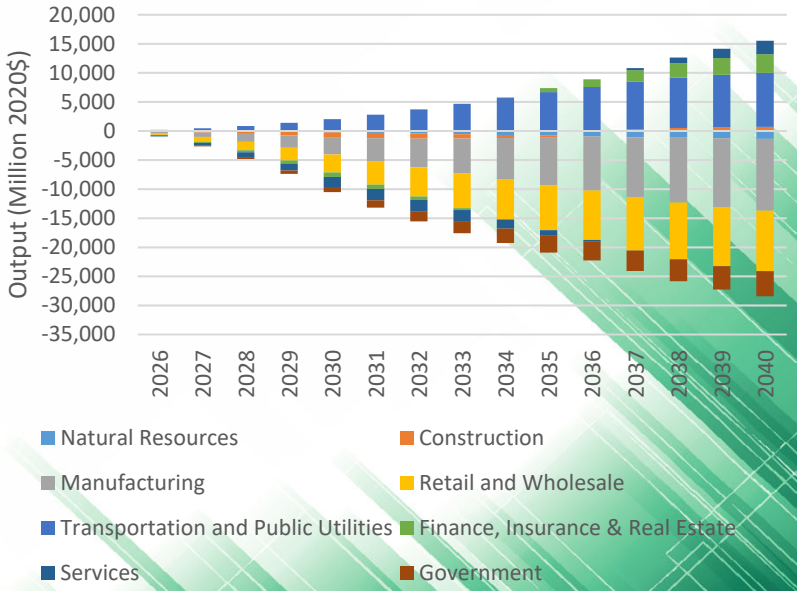
CARB

Macroeconomic Impacts

Jobs



Output



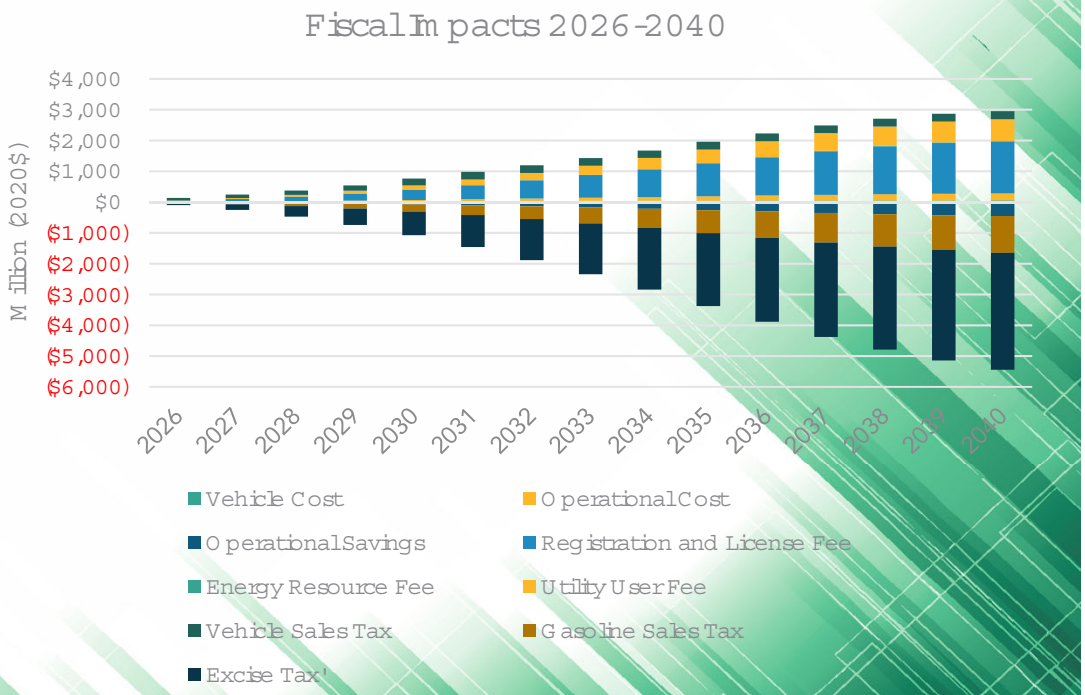
CARB

Industry Impacts

- Petroleum products mfg. sees large decrease in Output, but relatively small job impact
- Automotive repair has large impact: ~20% reduction in jobs
- Retail trade sees large absolute impact: 39,000 jobs foregone
- State and Local Government jobs reduced due to fiscal impacts of decreased gas tax revenues

Fiscal Impacts

- State and Local Government tax revenues reduced
  - State: Gasoline excise tax reduced by $15.2 billion, but partially offset increased registration and license fee revenue or $12.1 billion
  - Local: Gasoline sales and excise tax revenue reduced by about $20 billion, some offset from Utility User Fees ($5 billion)
- Suggest large impact to government programs and jobs, if not offset by other revenues



Cost-Benefit Analysis

Summary of Impacts

- Total Costs of over $200 billion, but this is outweighed by cost-savings of over $300 billion.
- Non-market benefits of $13 billion in California.
- Inclusion of the Social Cost of Carbon increase net benefits by $9.7-$41.2 billion
- Job impacts less than 0.4% of baseline employment

Cost and Benefits from 2026-2040 (Billion 2020$)

Total Costs	$210.35
Cost Savings (benefit)	$303.24
Health Benefits	$12.94
Tax and Fee Revenue	($14.76)
Total Benefit	$301.41
Net Benefit	$91.06
Benefit-Cost Ratio	1.43