Understanding of Consumer Behaviors and Potential Policy Impacts on New Vehicles Technology Purchases

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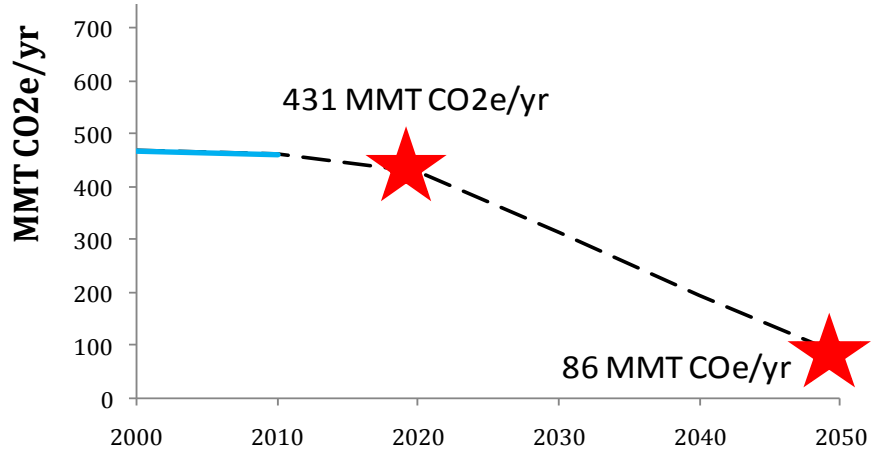
Since 2007, California goverment has started a series of legislations/regulations to mitigation GHG emissions

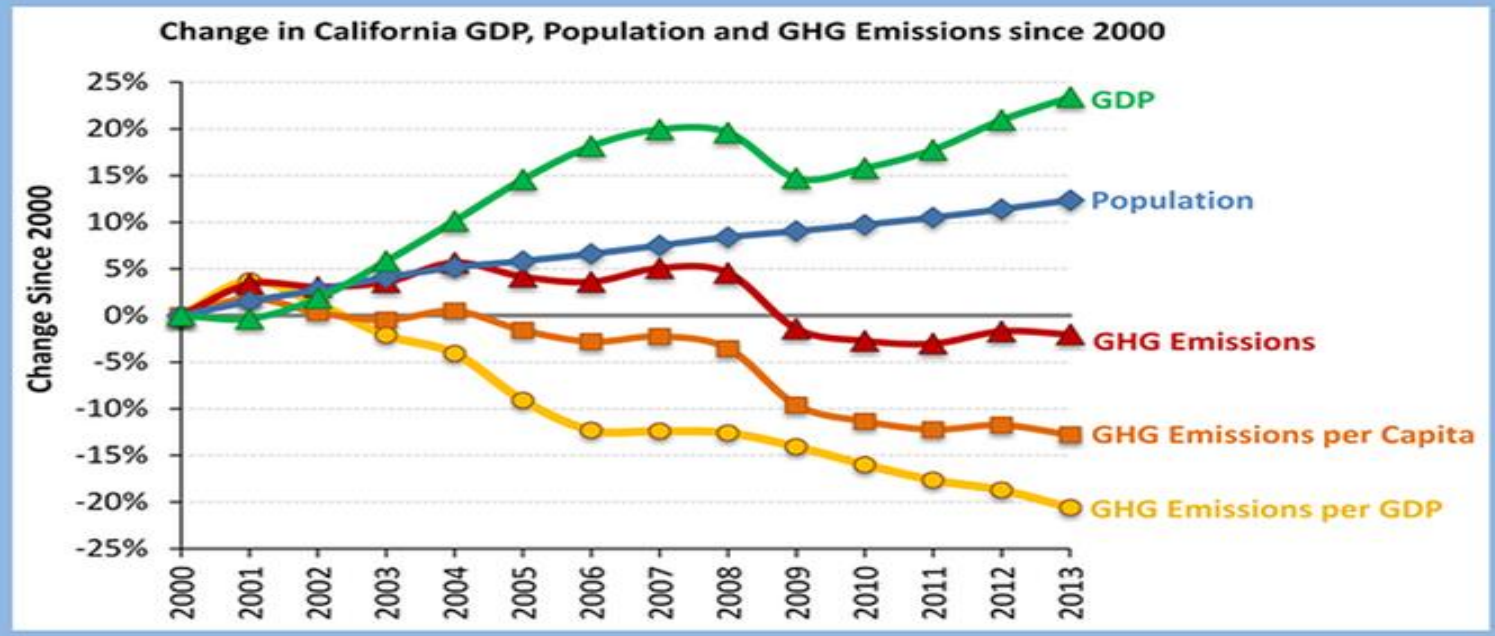


MYTH **Reducing greenhouse gas emissions will kill jobs and harm our economy.**

FACT

CA's economy is growing while our emissions fall.

#SB350 | focus.senate.ca.gov/climate



Governor's 2030 Climate Goals

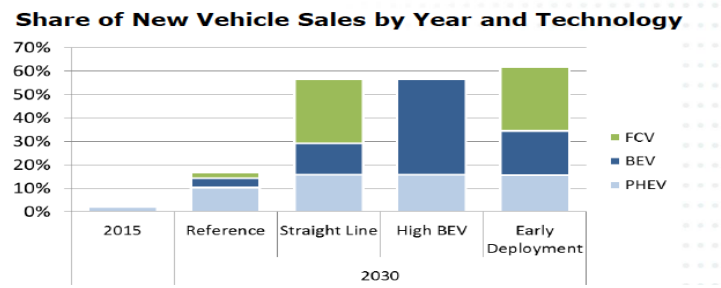
- "*California must show the way*"
- "*This is like a tsunami engulfing the world, and we have CA, which generates 1% of the pollution, trying to turn this around*"
- 2030 goals
  - Increase to 50% electricity derived from electricity
  - Reduce p[redacted] up to 50%
  - Double energy efficiency achieved at existing buildings & make heat fuels cleaner

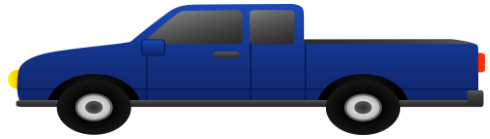
Source: CCPM (March 2015)

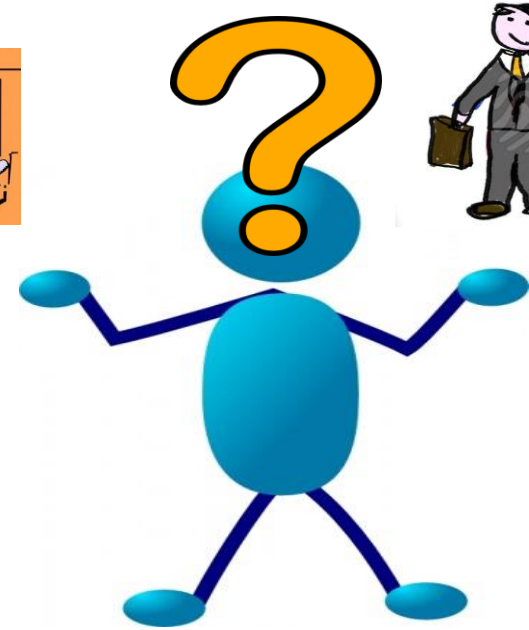
The Big Gap between Scenario Analysis and Consumer Preferences

Scenario Model: If we do everything technically feasible…

+ 6-7 million ZEVs and PHEVs on the road by 2030

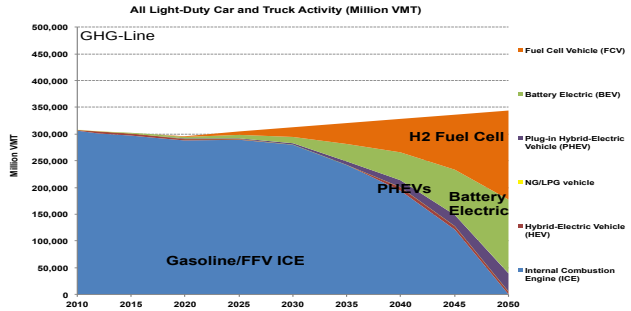






Optimization Model: If we need to meet the policy objective, the least cost pathway is….

2.4 million vehicles (~1.1M BEV/PHEV, 1.3MFCV) in 2030



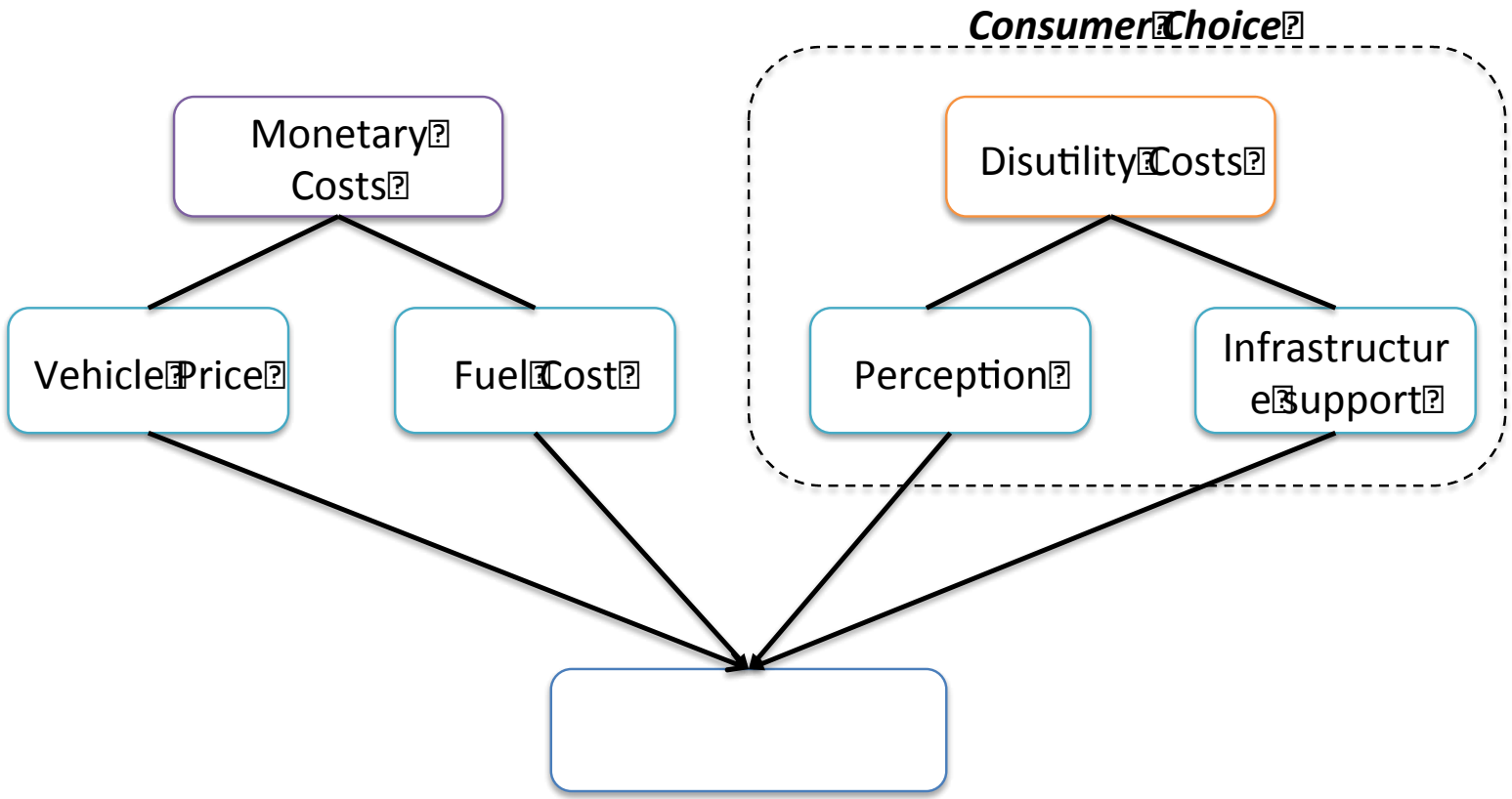
CGEs: If we shock the system with climate policies, what would be the direct and indirect economic impacts…

Efficacy of Policy and Incentive Strategies

- California Energy Commission provides $100 million/yr to promote alternative fuels and vehicle programs (A portion of $1Billion cap-and-trade revenues)
  - Support and complement regulatory programs that establish policy requirements
    - Zero Emission Vehicle mandate
    - Low Carbon Fuel Standard

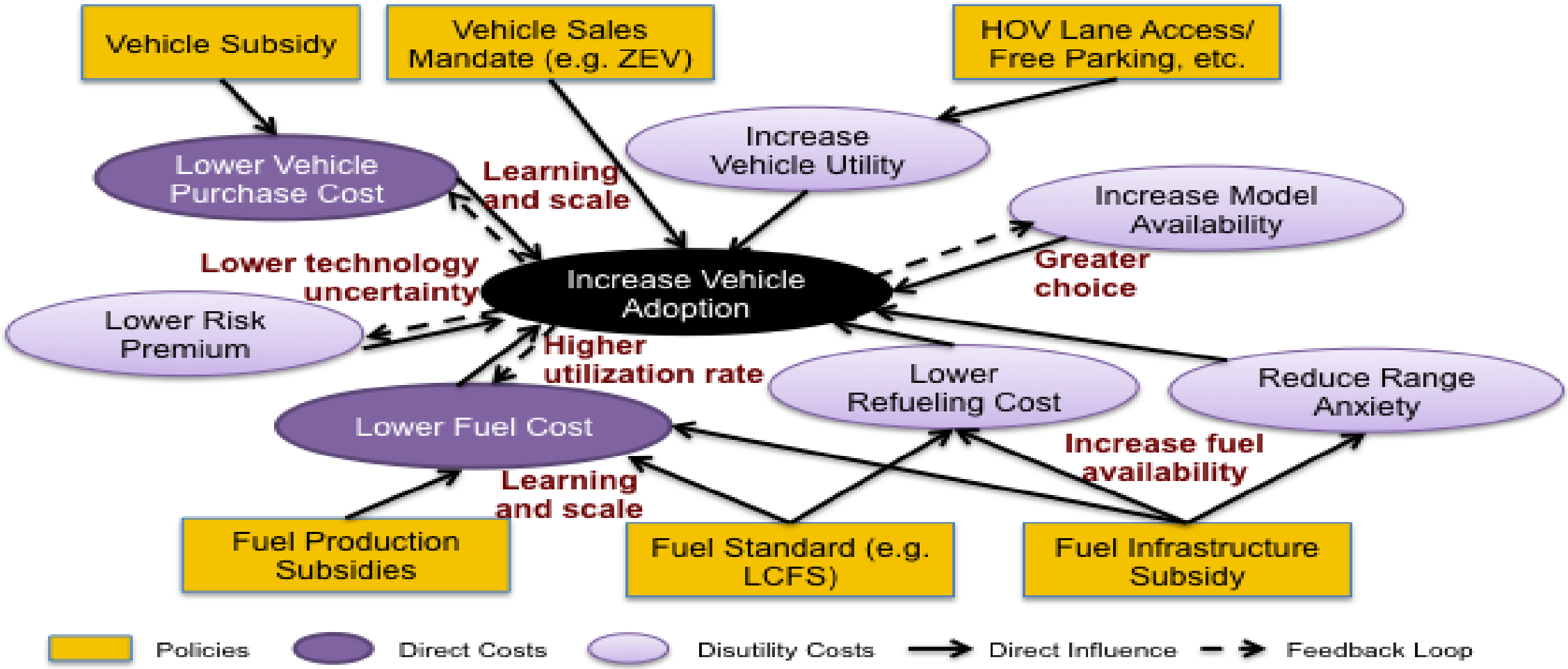
- What is the relative efficacy of **non-regulatory** policies and programs for supporting a successful transition to alternative vehicles and fuels
  - How do these non-regulatory policies and programs can be used to help lowering barriers to develop markets for new alternative fuel vehicles and clean fuels

Need for Consumer Choice in Policy Analysis



Consumers make decisions based on monetary costs, such as vehicle price, fuel cost, as well as the 'disutility' costs, such as their perception of a technology on various issues, and the infrastructure support available.

Relations between Policies and Vehicle Adoptions



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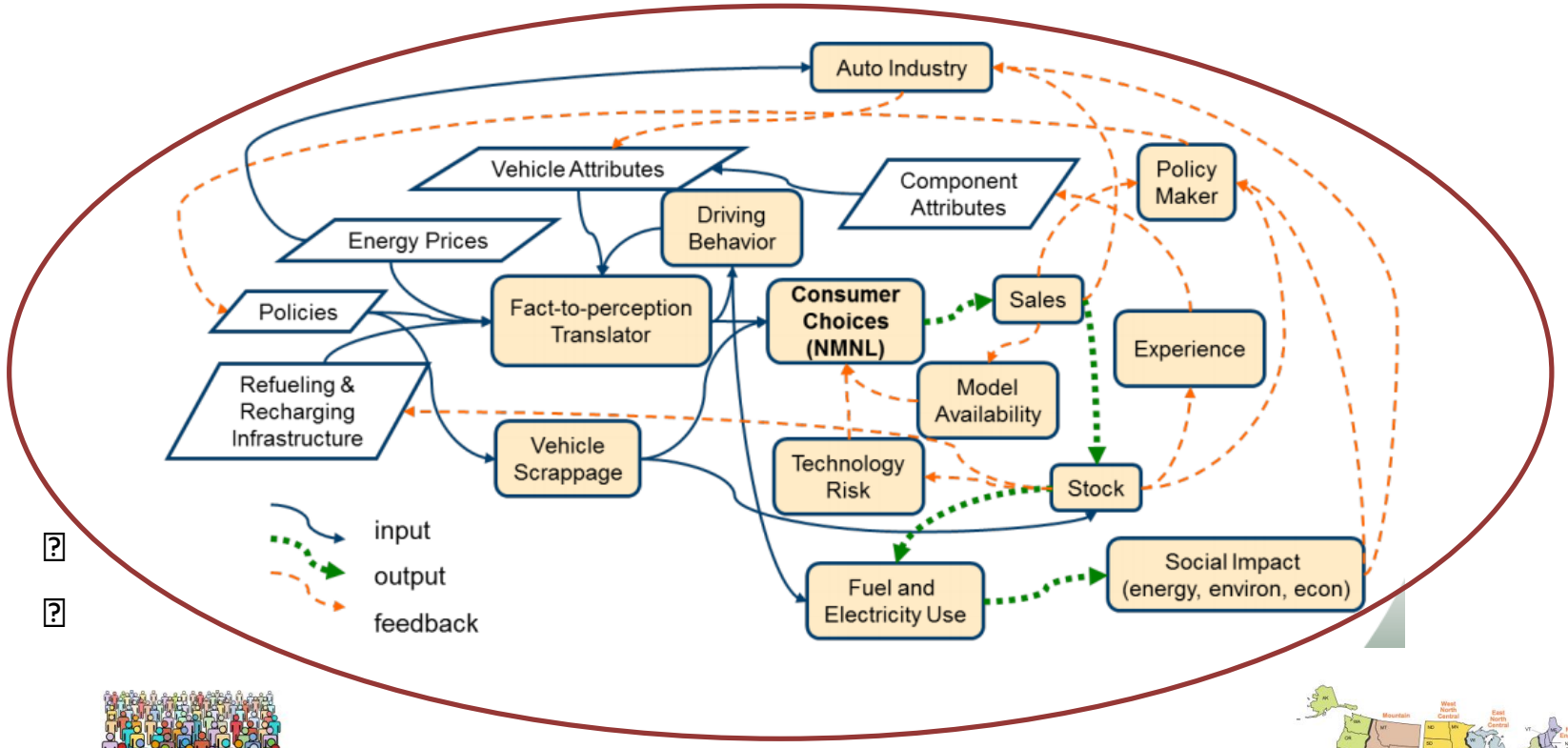
MA³T Consumer Choice Model

- MA³T (Market Allocation of Advanced Automotive Technologies), nested multinomial logit model developed by Oak Ridge National Laboratory



1458 consumer groups (Regions, driving behavior, risk attitude, charging infrastructure)

OAK RIDGE National Laboratory

Nationwide Model (9 regions in the US)

Direct and Indirect Cost

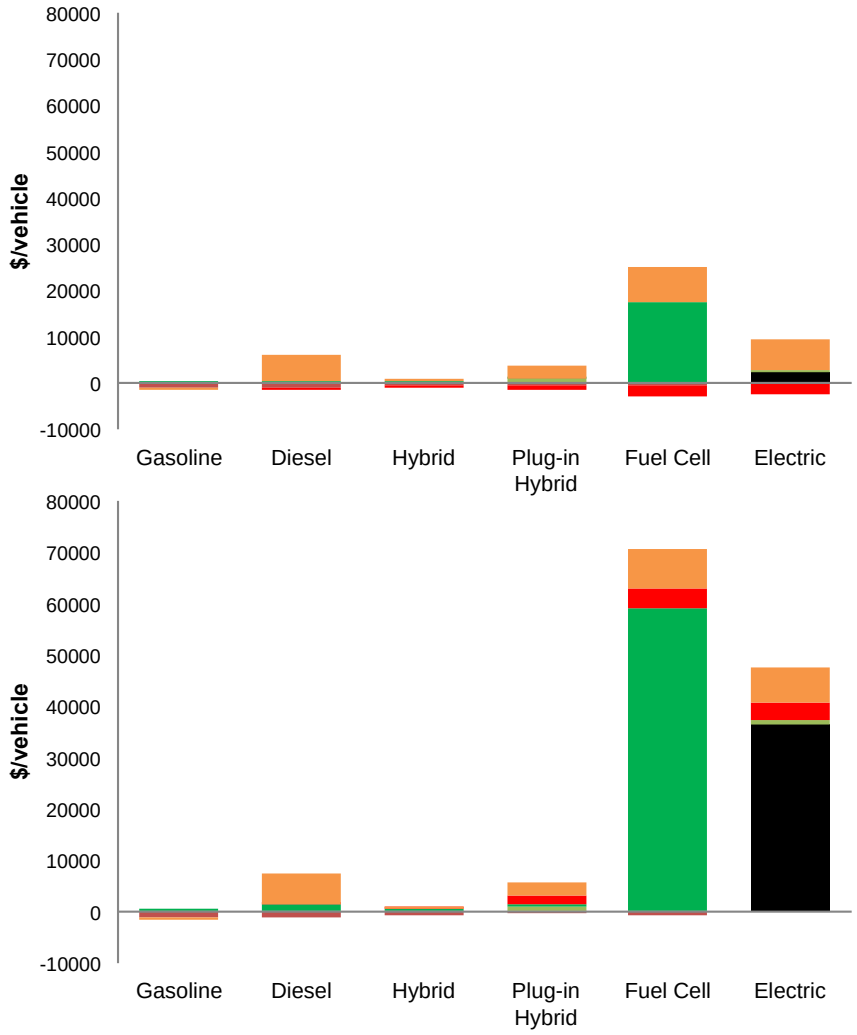
- MA^{3}T model generates a cost term called “generalized cost” that has the direct and indirect cost components
  - Direct costs: Vehicle prices, fuel costs
  - Indirect costs or **disutility cost** components:
    - Refueling station availability
    - Range Anxiety cost
    - Model availability
    - New technology risk premium
    - Towing capability

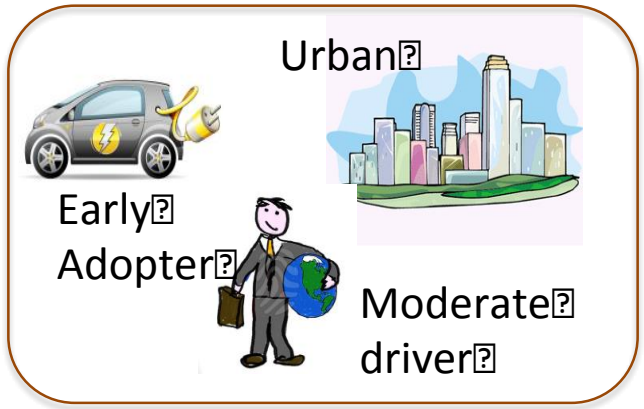
Infrastructure

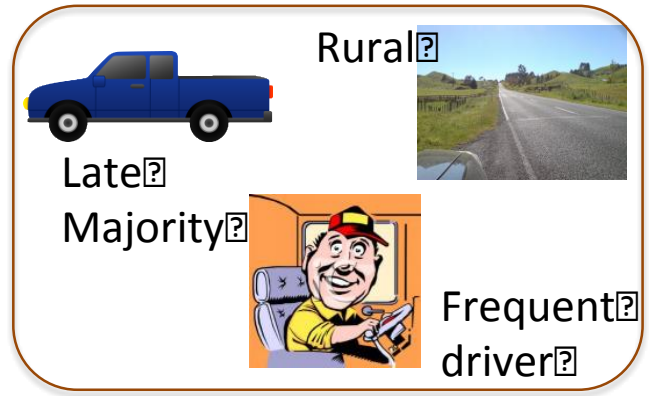
Vehicle attributes

These barriers translate to real and perceived costs to consumers

- Model Availability Cost
- Risk Premium
- Refueling Inconvenience Cost
- Charger Refueler Cost
- Towing Cost
- Range Anxiety Cost







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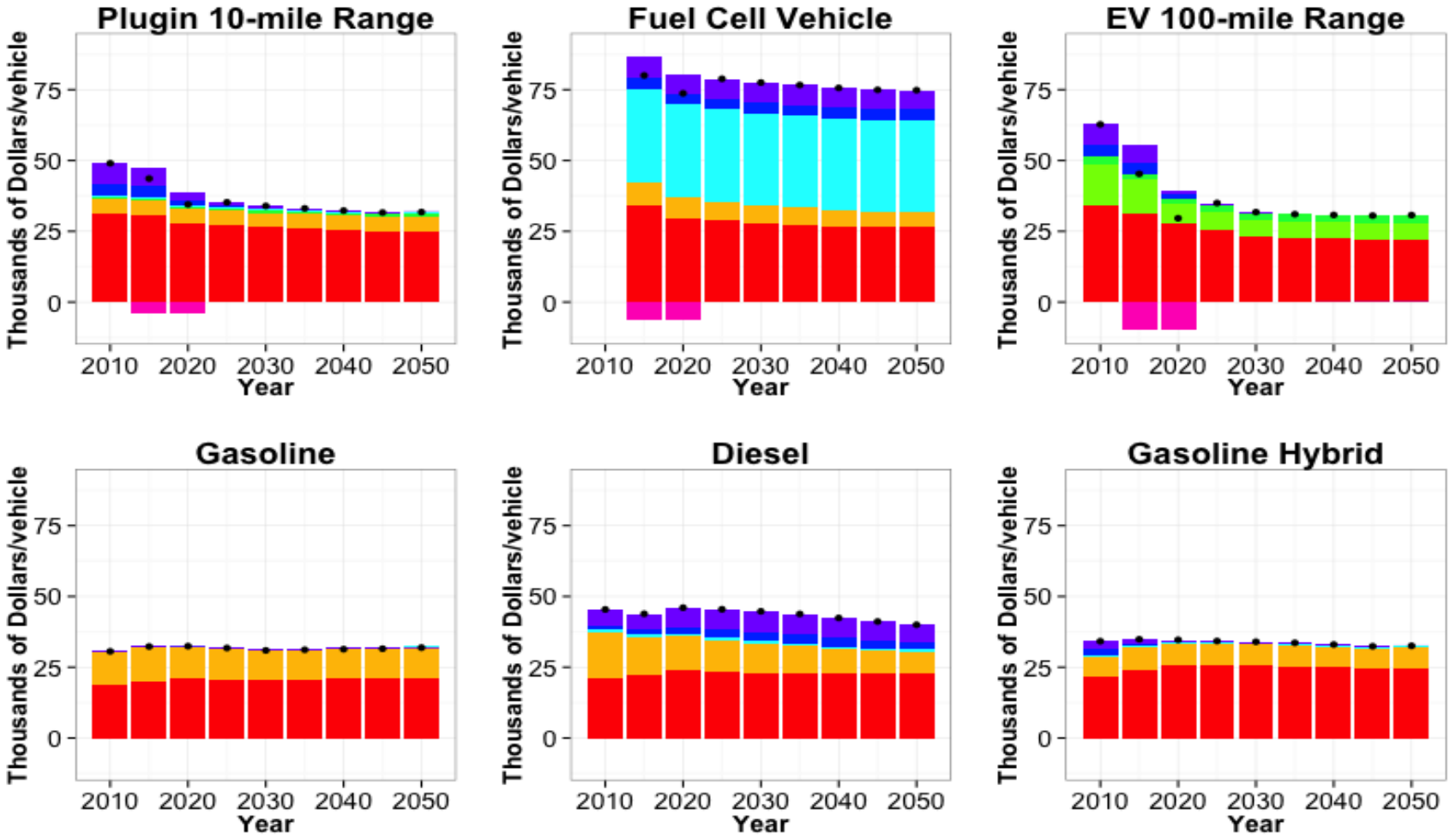
Cost Components: Late Majority, High Annual VMT



Yeh, Bunch et al. Policy and Incentive Strategies to Incentivize PEV adoptions in California

Summary of Scenario Results

	ZEVs on the Road in CA (Millions)		
Scenario Name	2020	2025	2050
Reference	0.437	0.813	

Preliminary Estimates of Return on Investments

- Scenario 2 (subsidies): $5,300 per additional vehicle
  - the size of this figure (which is larger than the per-vehicle subsidy amounts) is due to the fact that some ZEV sales would have occurred anyway, without the subsidies.
- Scenario 3 (charging stations): $950 per additional vehicle
  - an estimated increase of 15,000 ZEVs in 2025, versus an estimated cost of $13.5M (from adding 500 recharging locations),
- Scenario 5 (H2 station): $6,500 per additional vehicle
  - hydrogen station option involves an increase of 40 hydrogen stations between 2020 and 2025 at an estimated cost of $60M.
  - We assume the average cost of hydrogen refueling station is $1.5 million per station.

Key Observations

- Reference scenario (includes currently planned infrastructure, federal tax credits and state-sponsored vehicle purchase subsidies through 2017) suggest that meeting the 1.5 million ZEV on the road target by 2025 would likely not occur, and that extending state vehicle subsidies to 2025, while very helpful, could also fall short
- The infrastructure levers we considered had marginal impact on meeting the 2025 goal.
  - Important to recognize that the levers specified were small-to-moderate extensions of current programs. More case studies needed
- Potentially critical role played by factors related to technology legitimation, and the dominating influence of the larger vehicle market.
- **Major importance of recent and future multistate efforts intended to address all aspects of market formation for clean fuel vehicles, and legitimation of new vehicle technologies**

Sources of Prediction Errors

1. Non-optimizing consumer behavior (omitted variable biases)
2. Aggregate MNL model applied to heterogeneous consumers
3. Errors in MNL model structure
4. Errors in MNL parameters (disutility terms and how they change over time)
5. Omitted variables (including manufacturer pricing decisions)
6. Changes in consumers' behaviors and preferences over time
7. Inaccurate representation of learning (learning rate, spillover between California markets and the national markets)
8. Regional differences in consumer choices and consumer behaviors

Adapted from EPA, U. S. (2012). Consumer Vehicle Choice Model Documentation, Prepared for U.S. Environmental Protection Agency by Oak Ridge National Laboratory EPA Contract No. DE-AC05-00OR22725.