



Light Duty Vehicle Survey & Model

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Transportation Forecast

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Presentation Objective

High-level understanding of the LDV models and inputs.



Studies of Future

No Specified Desirable End Point

- **Forecasts** use formal quantitative modelling to predict likely futures from sound projections of inputs and drivers, or current trends.
- **Exploratory scenarios** explore possible futures, emphasizing alternative inputs and drivers.
- **Technical scenarios** explore possible future technological systems based on specific fuel or technology.

Start with a Predetermined Desirable 'End' Point in Future

- **Planning scenarios** describe a specific sequence of actions to meet a specific target at some point in future.
- **Pathways** investigate possible pathways to the desirable end point.
- **Roadmaps** describe a sequence of measures designed to bring about a desirable future.

Source: Adapted from <http://www.retrofit2050.org.uk/sites/default/files/resources/WP20116.pdf>



Light Duty Vehicle Forecast

Light duty vehicle demand forecast is based on:

- The CEC's 2016-2017 residential and commercial surveys of consumer preferences (conducted by Resources Systems Group, RSG).
- Survey is designed around the current models.
- Updated LDV models are based on survey results.
- Latest projections of vehicle attributes, accounting for announced/projected technology developments in 2017 and beyond.



2017 Survey

Survey covers a range of questions, including revealed (RP) and stated (SP) preferences, on:

- Economic/Demographic information
- Vehicle ownership & use (RP)
- Charging behavior (RP) specific to PEV owners
- Choice exercises (SP)

Survey includes both residential and commercial LDV market segments.

- 3600+ Households, including 300+ PEV owners.
- 1700+ Commercial establishments, including 270+ PEV owners



Stated Preferences

Please carefully review each vehicle and all its features below. Assuming these are the only vehicles available to you to purchase, please select the **ONE** vehicle you would most likely purchase.

Vehicle Choice 1	Vehicle A	Vehicle B	Vehicle C	Vehicle D
Vehicle Type	Midsize car	Pick-up truck, small	Van, small	Midsize car
Fuel Type	Hybrid (Gasoline)	Full Electric Vehicle	Compressed Natural Gas (CNG) vehicle	Gasoline-ethanol Flex Fuel vehicle (E85 FFV)
Vehicle Models Available	19	4	2	21
Model Year	Used (2014)	New (2016)	New (2016)	Used (2012)
Vehicle Price	\$12,300	\$23,400	\$17,400	\$7,300
Purchase Incentive	None	HOV Access	None	None
MPG / Fuel Economy	34.2	76.2	26	26.8
Fuel Cost per 100 miles	\$5.11	\$11.00	\$22.08	\$7.95
Refueling Station (Time is takes to get to this type of station)	Refuel at station (10 min)	Plug-in at work (0 min)	Refuel at "fast fill" station (15 min)	Refuel at station (3 min)
Refueling Time	5 min	8 hours	3 min	8 min
Vehicle Range	487 miles	150 miles	150 miles	442 miles
Trunk/Cargo Space	16 cubic feet (4 suitcases)	9 cubic feet (2 suitcases)	20 cubic feet (5 suitcases)	15 cubic feet (3 suitcases)
Annual Maintenance Cost	\$446	\$468	\$473	\$387
Acceleration Rate (0-60 mph)	10.3 secs	9.5 secs	5.9 secs	9.5 secs
Select One:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Vehicle Technology Introduction Schedule

	Class	Gasoline	Hybrid	PHEV	EV	FCV	Diesel	FFV
1	Subcompact						2017	
2	Compact					Mirai		
3	Midsize					Clarity (2017)		
4	Large						2017	
5	Sport		2017		2020		2015	2015
6	Crossover - Small Car			2019	2016			
7	Crossover - Small Truck						2015	
8	Crossover - Mid			2019			2016	
9	Sports Utility - Compact			2020	2019		2017	
10	Sports Utility - Midsize			2020				
11A	Sports Utility - Large							
12	Van Compact		2019	2017				
13A	Van - Large			2020				
14	Pickup - Compact		2020			2023	2016	
15A	Pickup - Standard		2017					

Exists 2015 - 2030



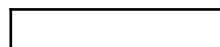
Introduced



Eliminated

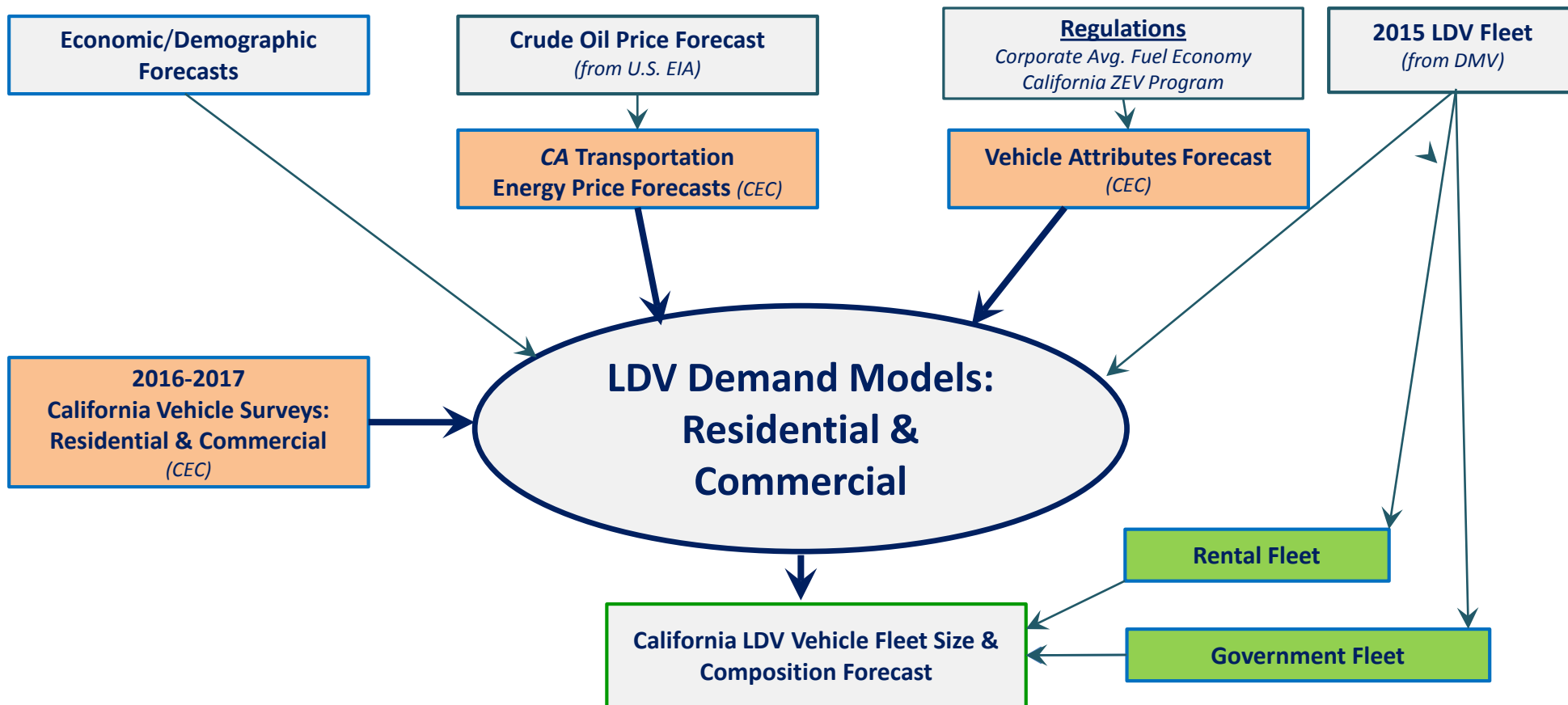


Never Introduced



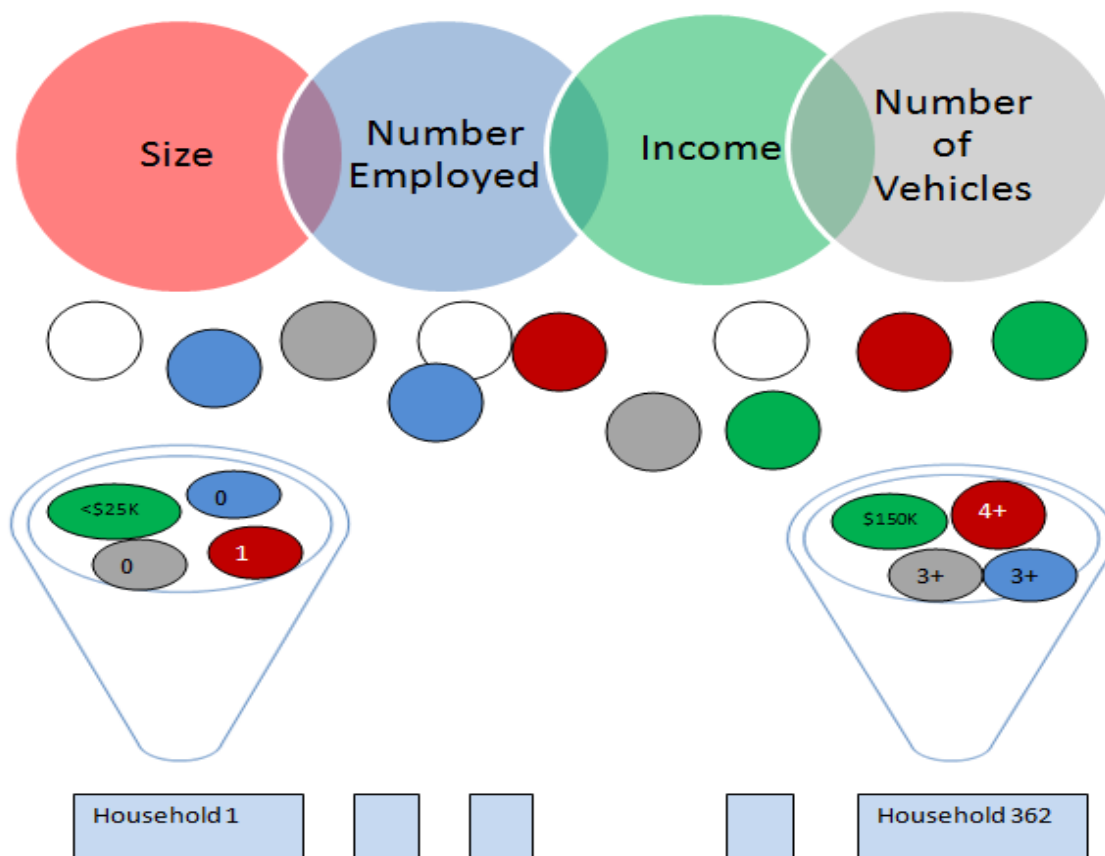


LDV Demand Forecasting Models: Key Inputs & Outputs





362 California Household Types in the Forecasting Model





How Does the Forecasting Model Work for Households?

• Number of Vehicles (t-1)

Yes

• Transaction: Reduce, Replace or Add Vehicle?

• Number of Vehicles (t)

Yes

• Buy a Vehicle (Replace or Add)?

• New or Used?

• What Type of Vehicle?

• Make a choice from 7 fuel /Technology types, in 15 classes of vehicles & each with 10 attributes



Determinants of Technology/Fuel Type Choice

The vehicle choice equation includes the following categories of variables, allowing for substitution between fuel types and between vehicle classes:

Consumer Preferences

- Preferences for Technology/Fuel Types
- Preferences for Vehicle Classes

Government Incentives

- State Rebate (\$1,500 for PHEV, \$2,500 for BEV, \$5,000 for FCV)
- Federal Tax Credits (\$7,500 for BEV & PHEV)
- HOV Lane Access



Determinants of Technology/Fuel Type Choice (continued)

Vehicle Attributes

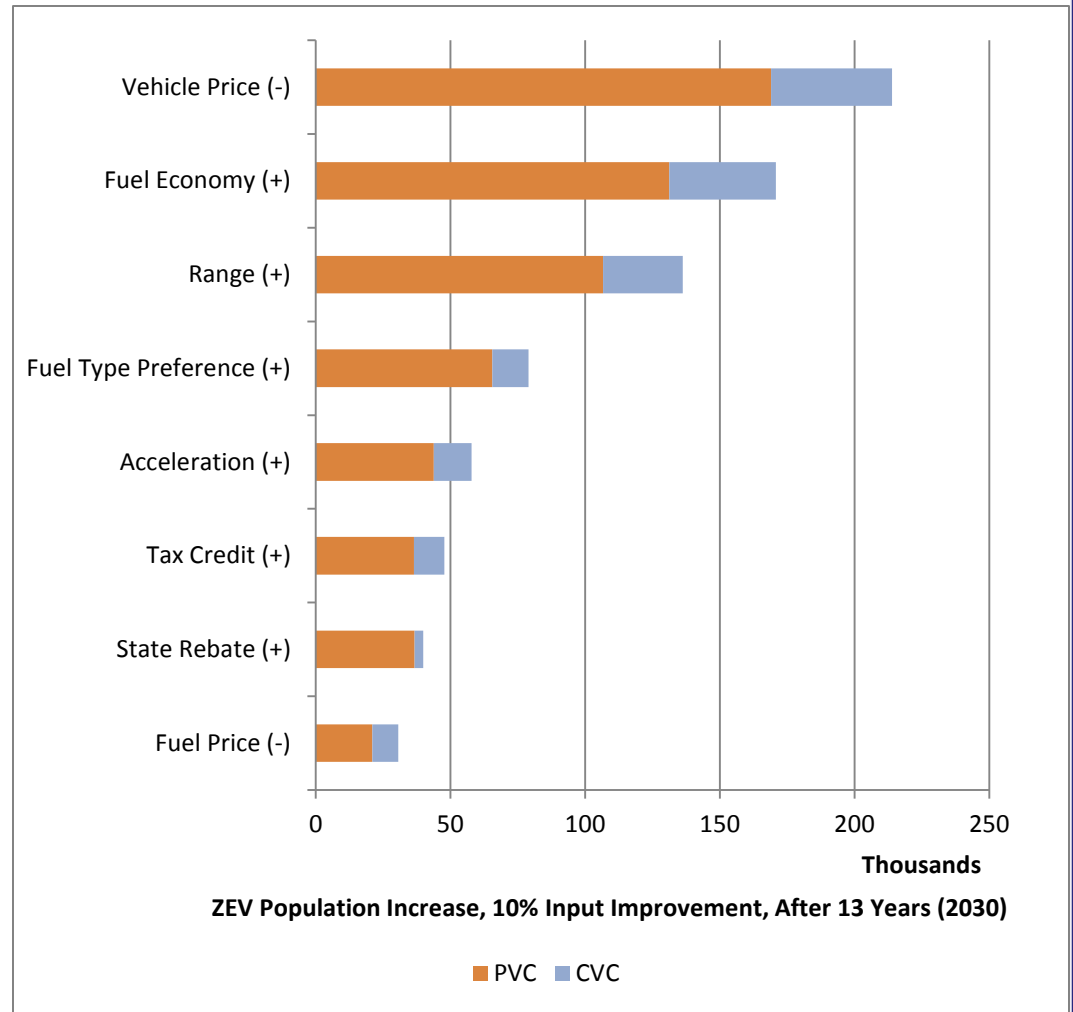
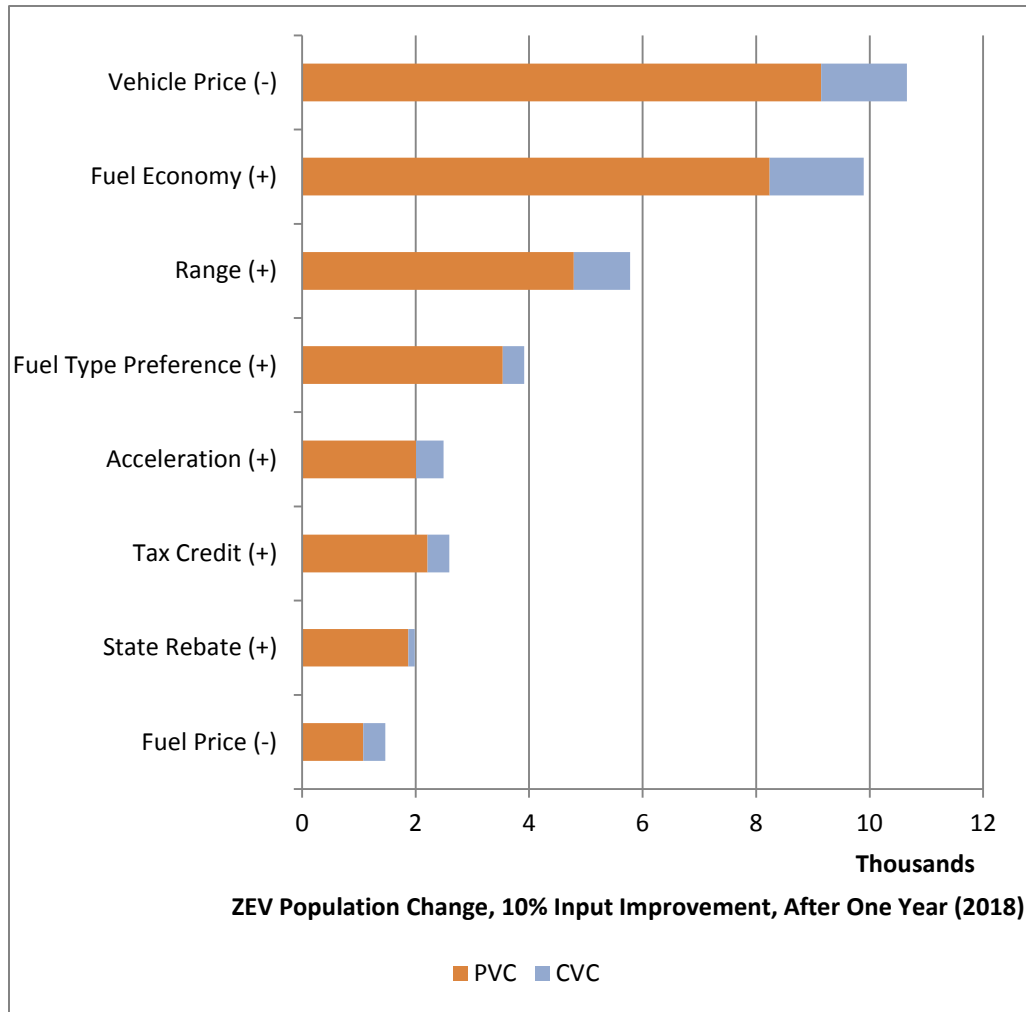
- Vehicle Price
- Fuel Economy
- Fuel Cost per Mile
- Maintenance Cost
- Range
- Acceleration
- Cargo Capacity
- Number of Makes & Models
- Refueling Time

Infrastructure

- Time to Fuel Station



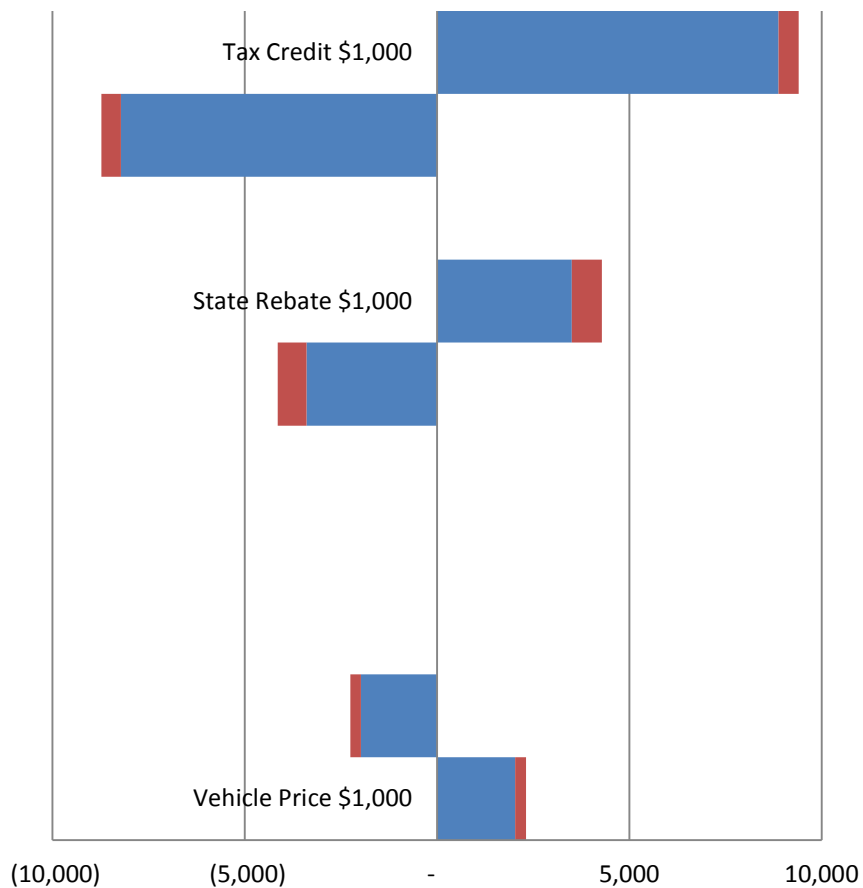
Impact of 10% Improvement on ZEV Fleet Size



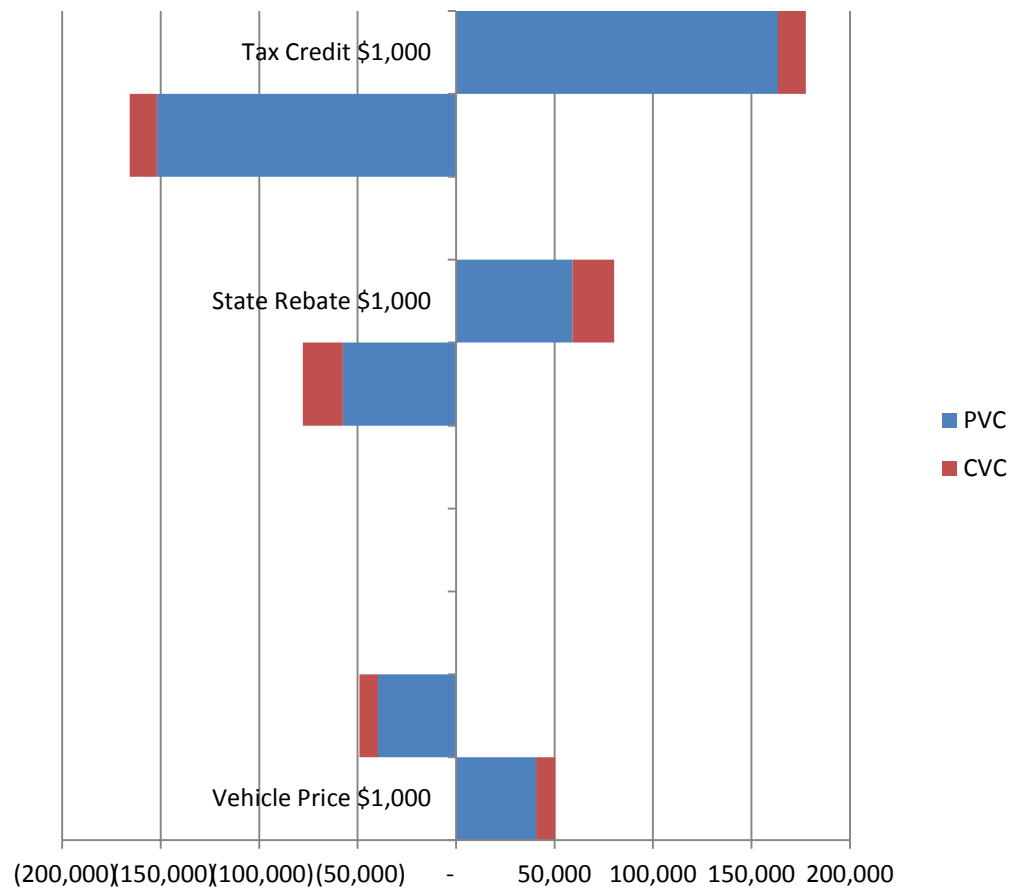


Impact of a \$1,000 Change on ZEV Fleet Size

2018 Changes



2030 Changes





THANK YOU

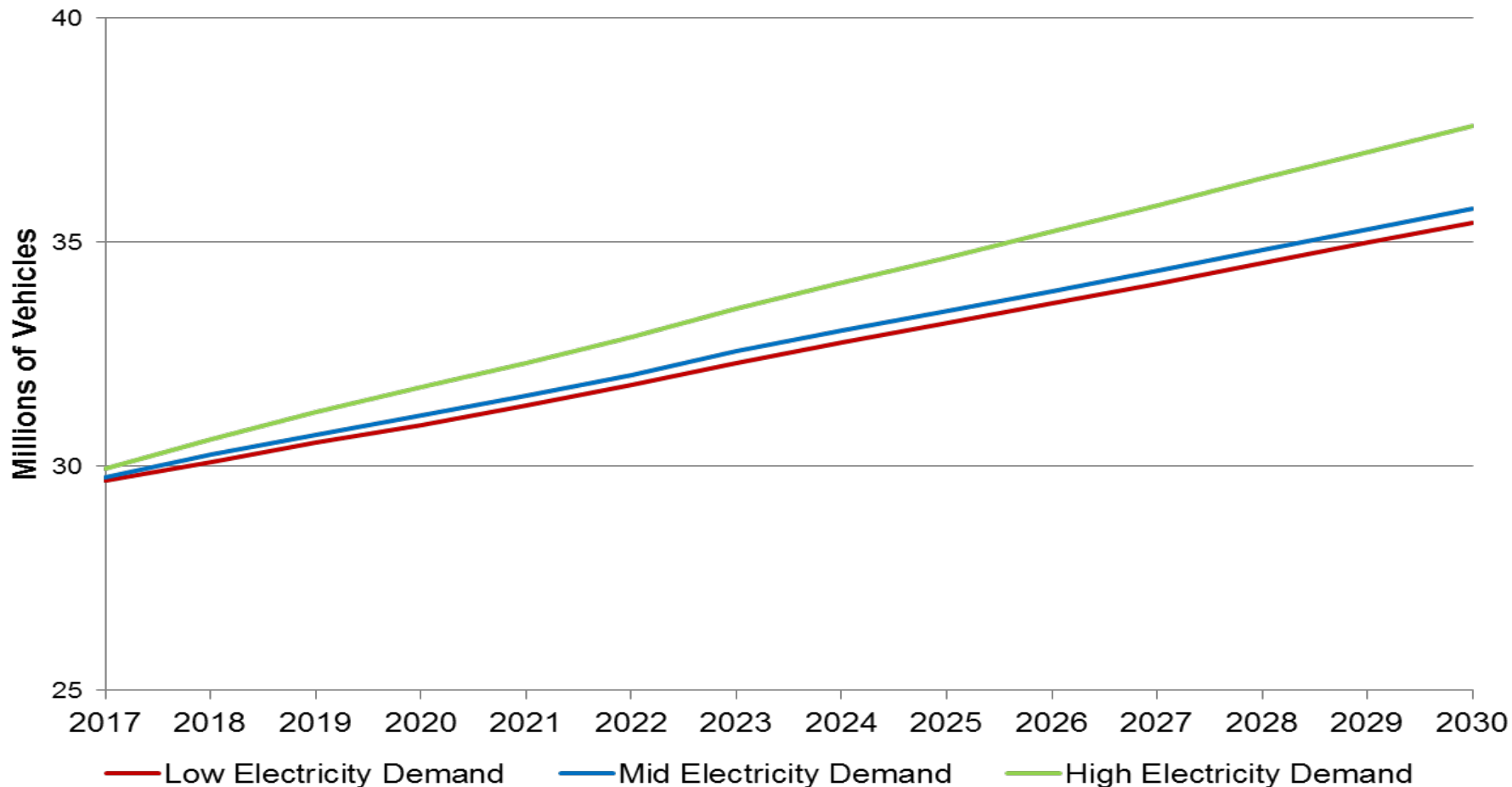


Assumptions

- Forecast by generic vehicle class: Consumers don't care about brand.
- Consumers only care about attributes included: they don't care about comfort, style, safety, luxury ... etc.
- OEMs will produce vehicles with the prices & attributes defined in our model & at quantities consumers demand.
- California demand has no impact on prices.
- Choices do not differ by age & gender.
- Commercial LDVs grow in proportion to GSP.



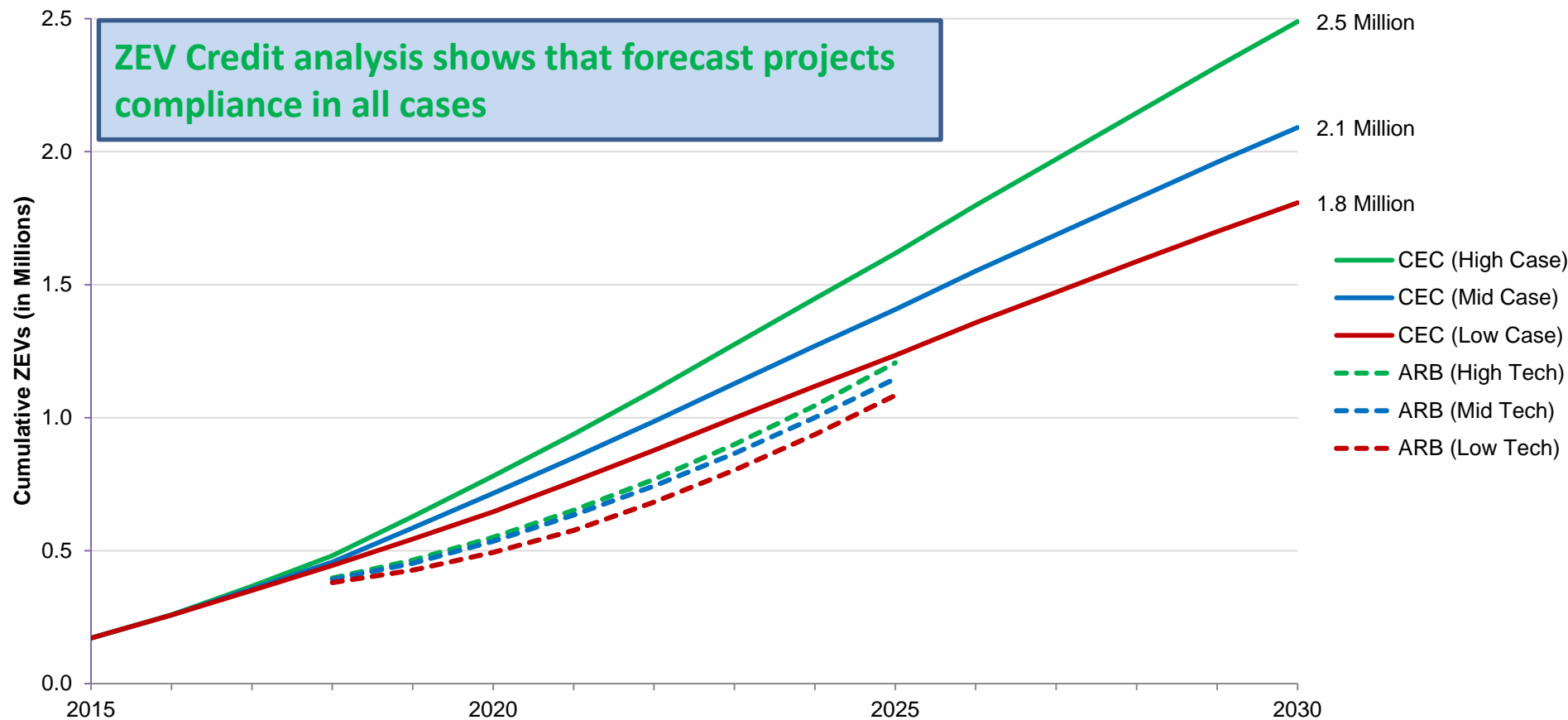
Preliminary Light-Duty Vehicle (LDV) Fleet Size Forecast





ZEV Forecast: CEC ZEV Stock & ARB Cumulative Sales

(2017 Mid Term Review)

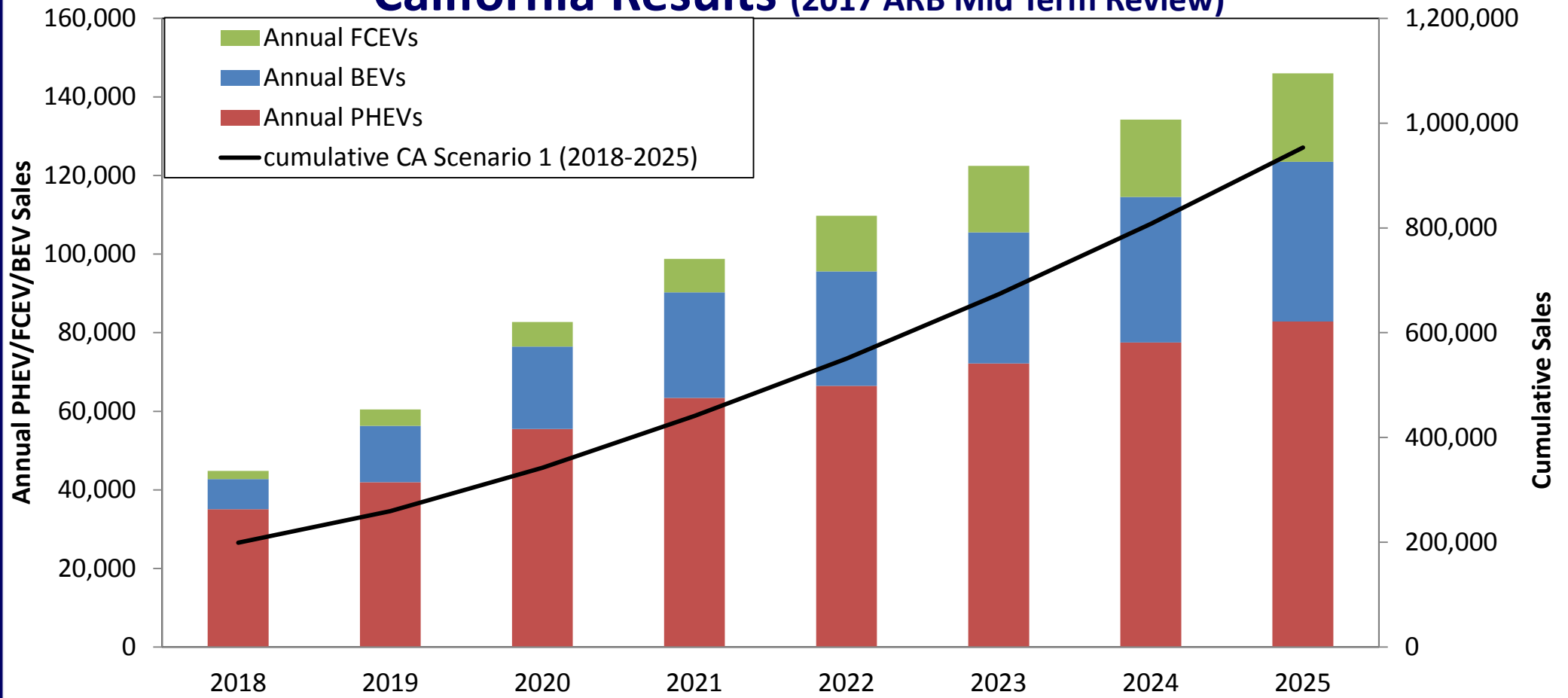


	<u>2015</u>	<u>2020</u>	<u>2025</u>	<u>2030</u>
CEC (Mid Case)	171,601	~715,000	~1.4 Million	2.0+ Million



Mid-Range Case

California Results (2017 ARB Mid Term Review)



Source: ARB Presentation at CEC, June 20th 2017