



# Scenarios & Forecasts of Light-Duty Vehicle Stock

Aniss Bahreinian

August 23, 2017

Demand Analysis Working Group

Transportation Forecast

[Aniss.Bahreinian@energy.ca.gov](mailto:Aniss.Bahreinian@energy.ca.gov)



# Types of Future-Analysis

## 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.

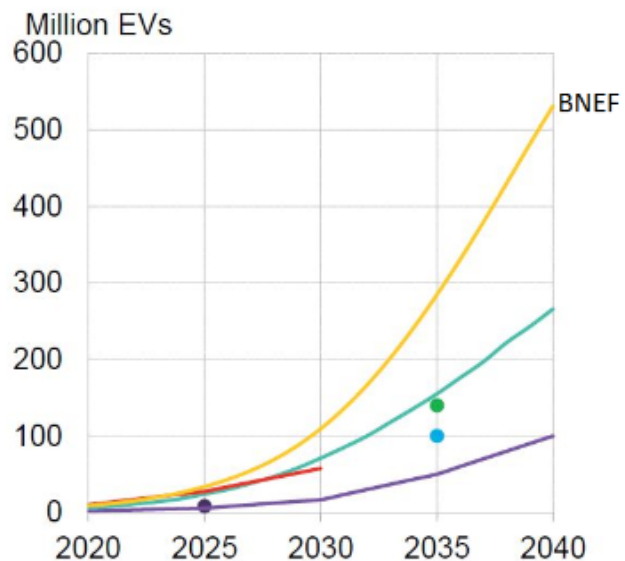
Source: Adapted from <http://www.retrofit2050.org.uk/sites/default/files/resources/WP20116.pdf>



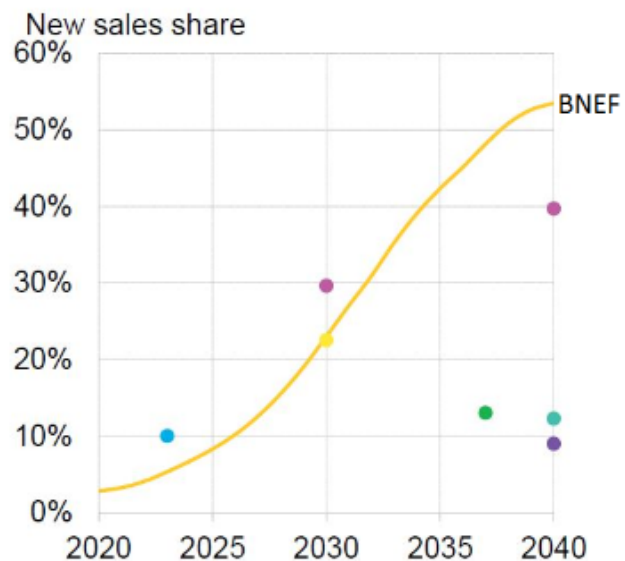
# Global EV Forecast, 2017

## EV forecasts at-a-glance

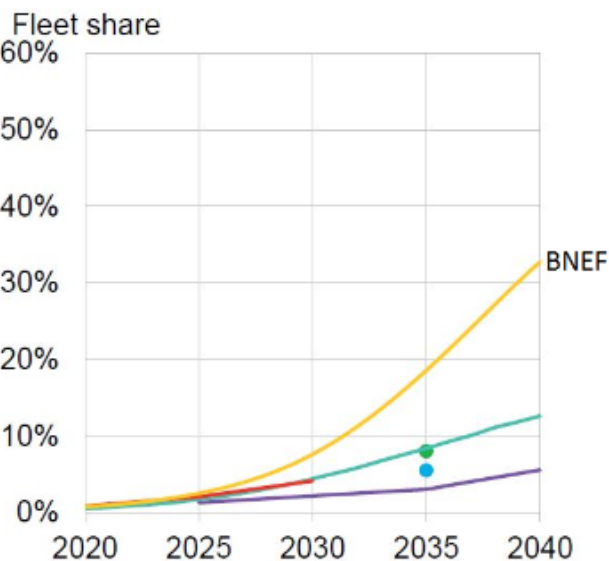
### EV fleet size



### EV share of new sales



### EV fleet share



● BP ● ExxonMobil ● OPEC ● Total SA ● IEA ● BHP Billiton ● Statoil ● Goldman Sachs ● BNEF

Source: Bloomberg New Energy Finance, organization websites.



# California Utilities

Utilities' PEV projections, to varying degrees, rely on:

- Achieving the existing state policies' goals
- Pathway Scenarios (Alternative One) in the scoping plan update
- 2014 CalETC's Transportation Electrification Assessment (TEA) study by ICF
- Navigant's forecast of technology market shares
- 2016 Energy Commission IEPR Update
- TEA study's high PEV scenario is based on 3 times ZEV (2012) growth in 2025.

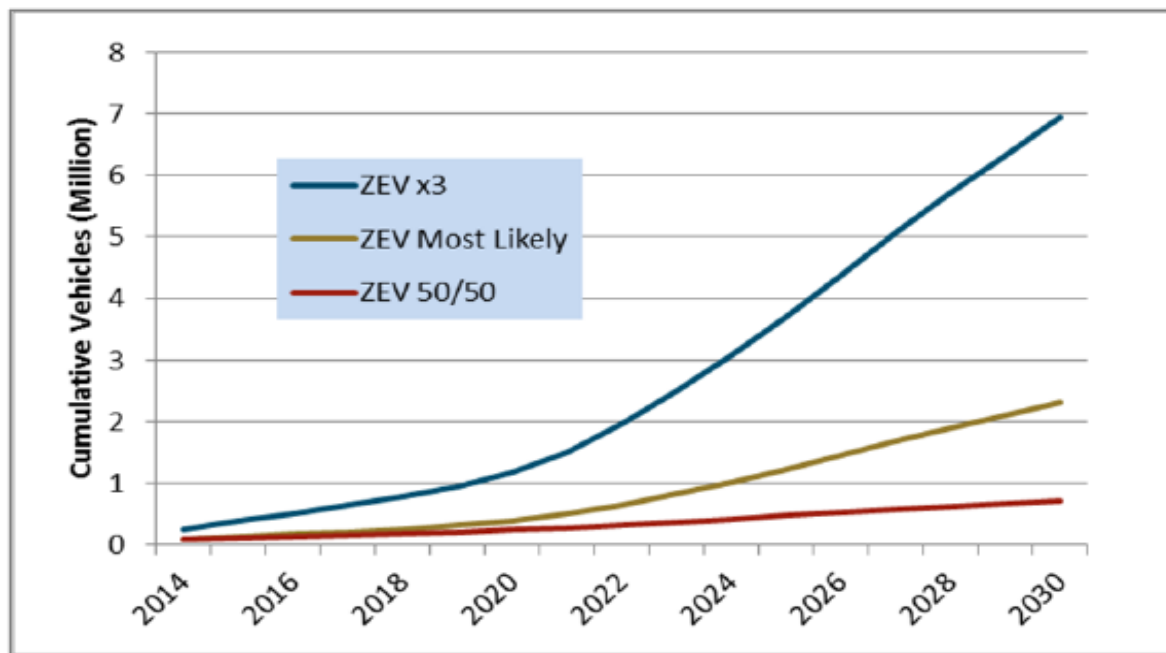


## Transportation Electrification Assessment (TEA) Study: ZEV (2012) Based Scenarios

**In line with Current Adoption (Low): ZEV Compliance** (Assuming a 50/50 split between PEVs and Fuel Cell Vehicles.)

**In Between (Mid): ZEV Program “Most Likely Compliance” Scenario**

**Aggressive Adoption (High): ZEV Program “Most Likely Compliance” Scenario x 3**



Source: ICF, California Transportation Electrification Assessment, September 2014  
[http://www.caletc.com/wp-content/uploads/2014/09/CalIETC\\_TEA\\_Phase\\_1-FINAL\\_Updated\\_092014.pdf](http://www.caletc.com/wp-content/uploads/2014/09/CalIETC_TEA_Phase_1-FINAL_Updated_092014.pdf)



# LDV Fleet Composition, CARB Scoping Plan

- Reference Scenario (3 million ZEV in 2030)

Vehicle Type (millions)	2015	2025	2030
Gasoline	25.3	25.9	26.8
BEV	0.02	0.45	0.78
Hydrogen	0.01	0.20	0.44
PHEV	0.07	1.03	1.75
Total	25.4	27.6	29.7

- Proposed Scoping Plan Scenario (4.2 million ZEV in 2030)

Vehicle Type (millions)	2015	2025	2030
Gasoline	25.3	25.9	25.6
BEV	0.02	0.45	1.09
Hydrogen	0.01	0.20	0.64
PHEV	0.07	1.03	2.44
Total	25.4	27.6	29.7

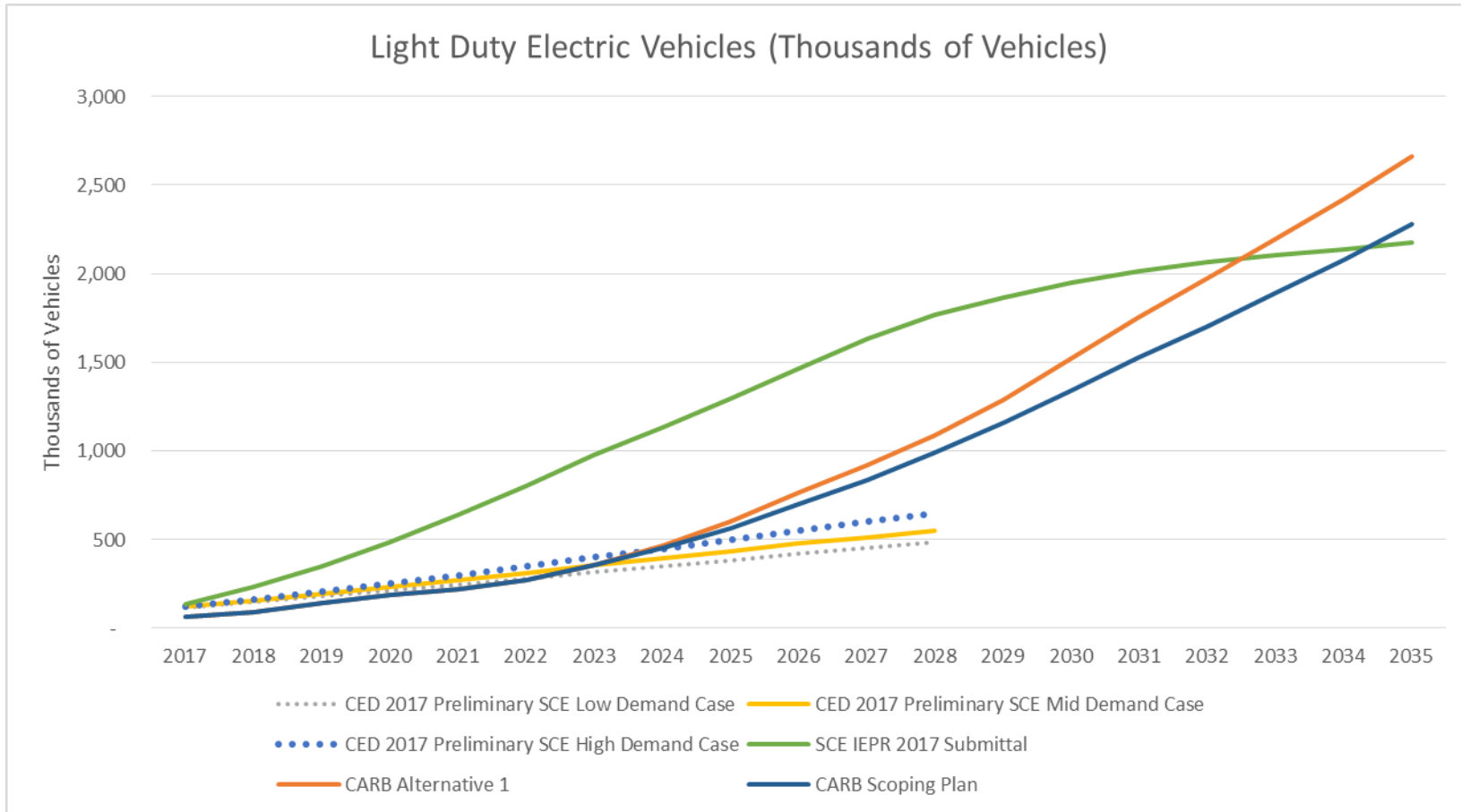
- Alternative 1 (4.8 million ZEV in 2030)

Vehicle Type (millions)	2015	2025	2030
Gasoline	25.3	25.8	25.0
BEV	0.02	0.46	1.23
Hydrogen	0.01	0.21	0.72
PHEV	0.07	1.12	2.77
Total	25.4	27.6	29.7

Source: 2017 CARB Proposed Plan, Appendix D, [https://www.arb.ca.gov/cc/scopingplan/app\\_d\\_pathways.pdf](https://www.arb.ca.gov/cc/scopingplan/app_d_pathways.pdf)



# SCE 2017 Scenarios





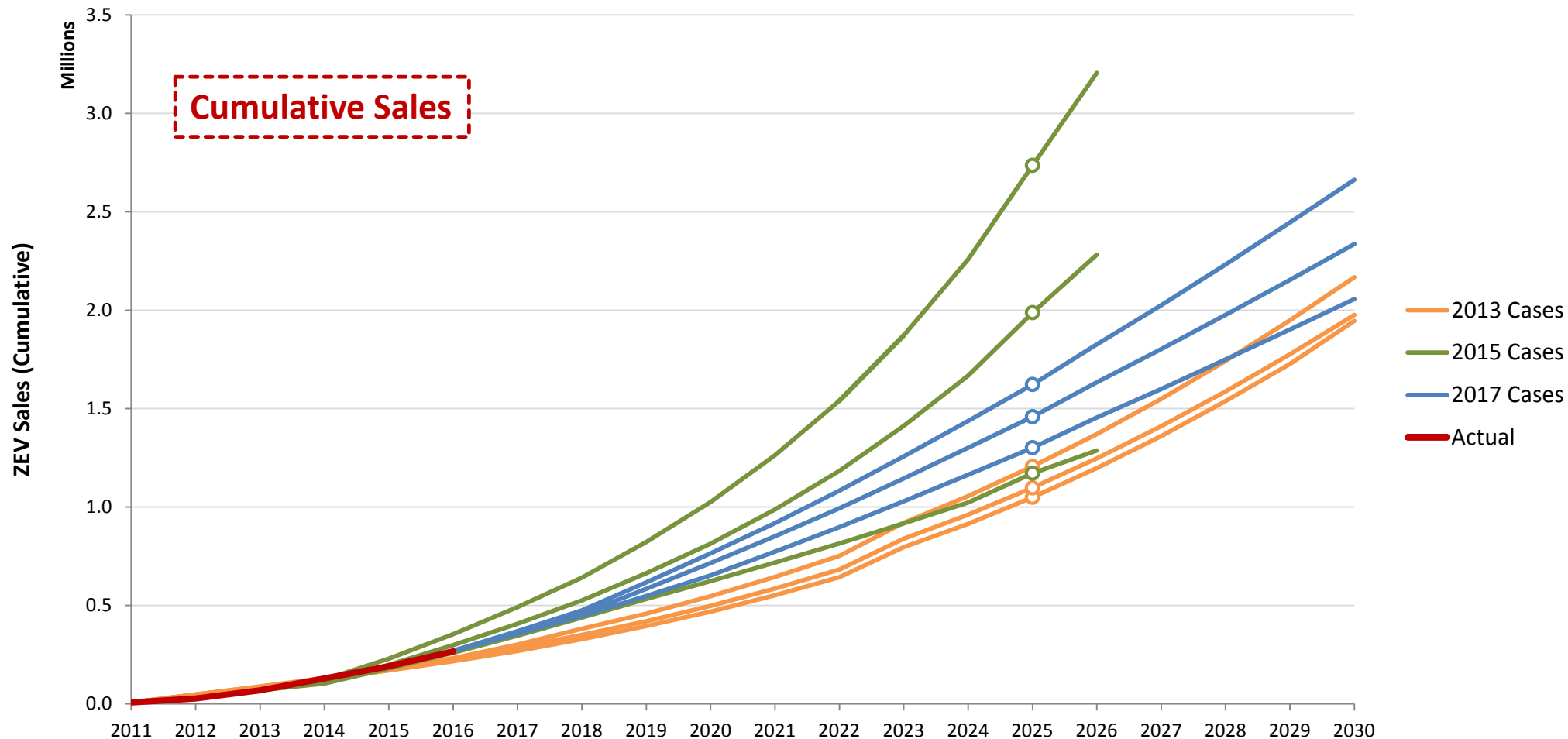
# CEC Forecasts vs Actual





# Cumulative ZEV Sales (through 2030)

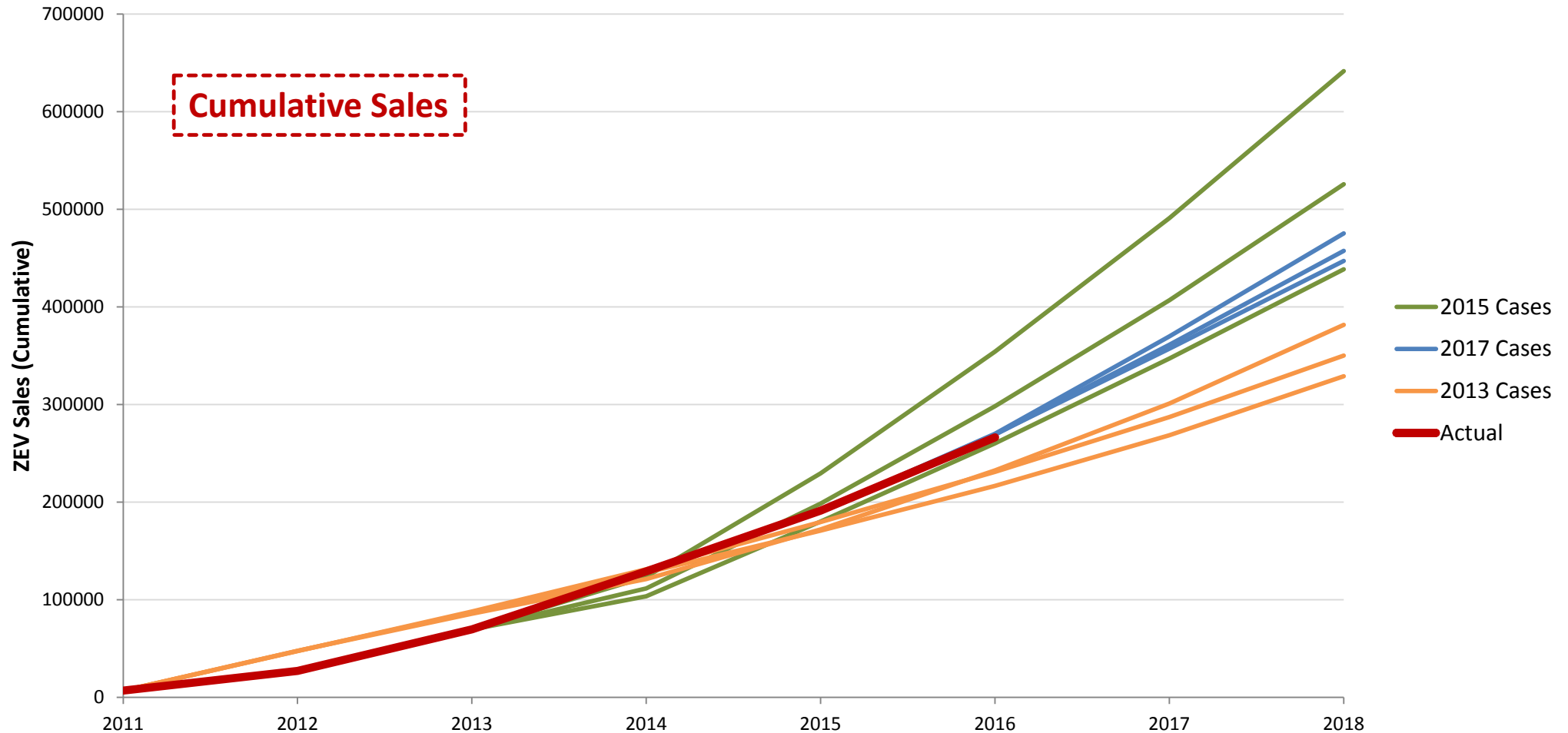
## Cumulative ZEV Sales Forecasts





# Cumulative ZEV Sales (through 2018)

## Cumulative ZEV Sales Forecasts





# CEC 2017 IEPR Scenarios



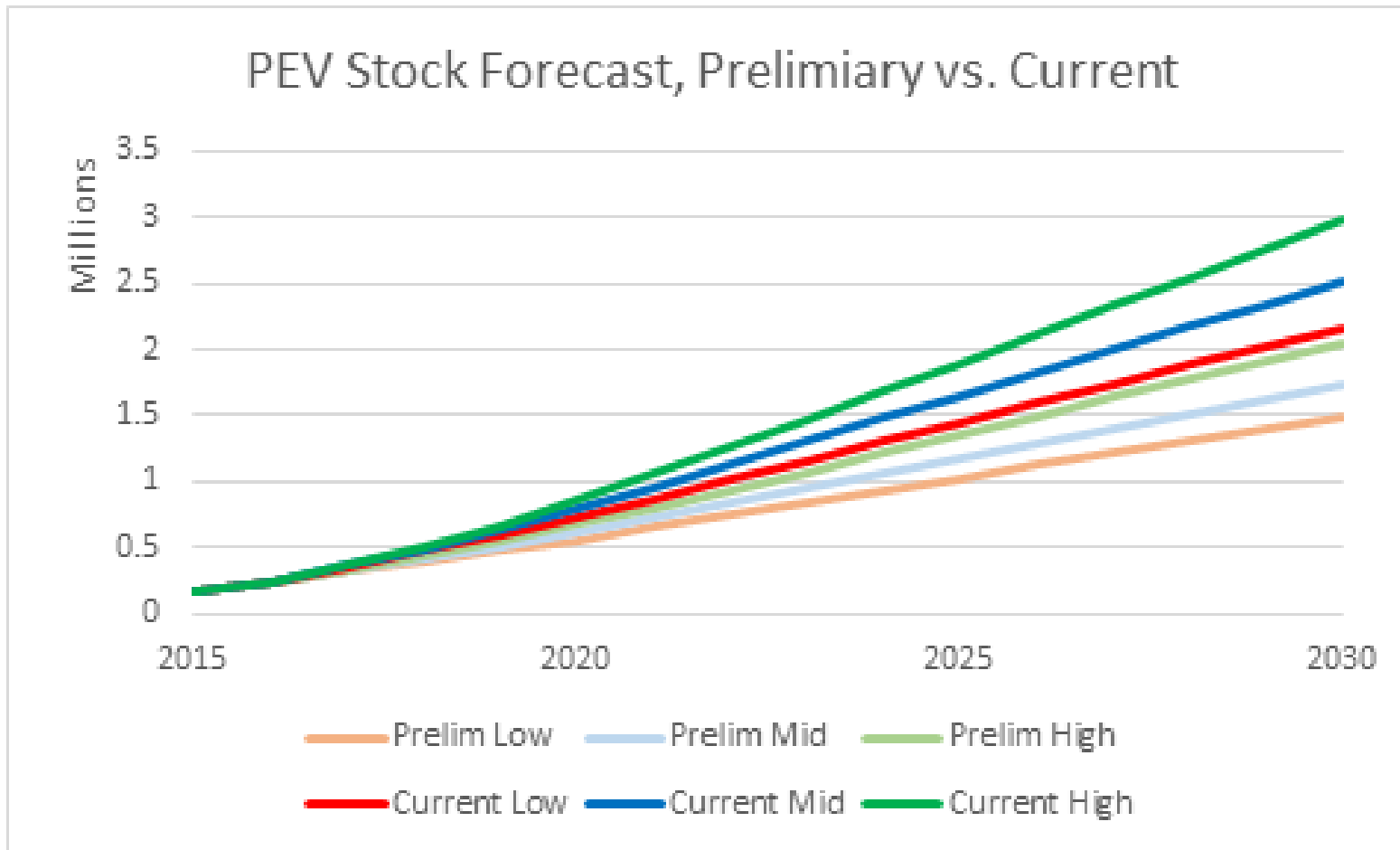
## Energy Commission Transportation Demand Cases

*Cases represent different levels of transportation electricity demand*

Demand Case	Population	Income	Fuel Prices	
			Petroleum Fuels	Electricity / Natural Gas / Hydrogen
High Demand	High	High	High	Low
Mid	Mid	Mid	Mid	Mid
Low Demand	Low	Low	Low	High



# Current Forecast with 2017 ASC (+ 3 additional PHEV classes)



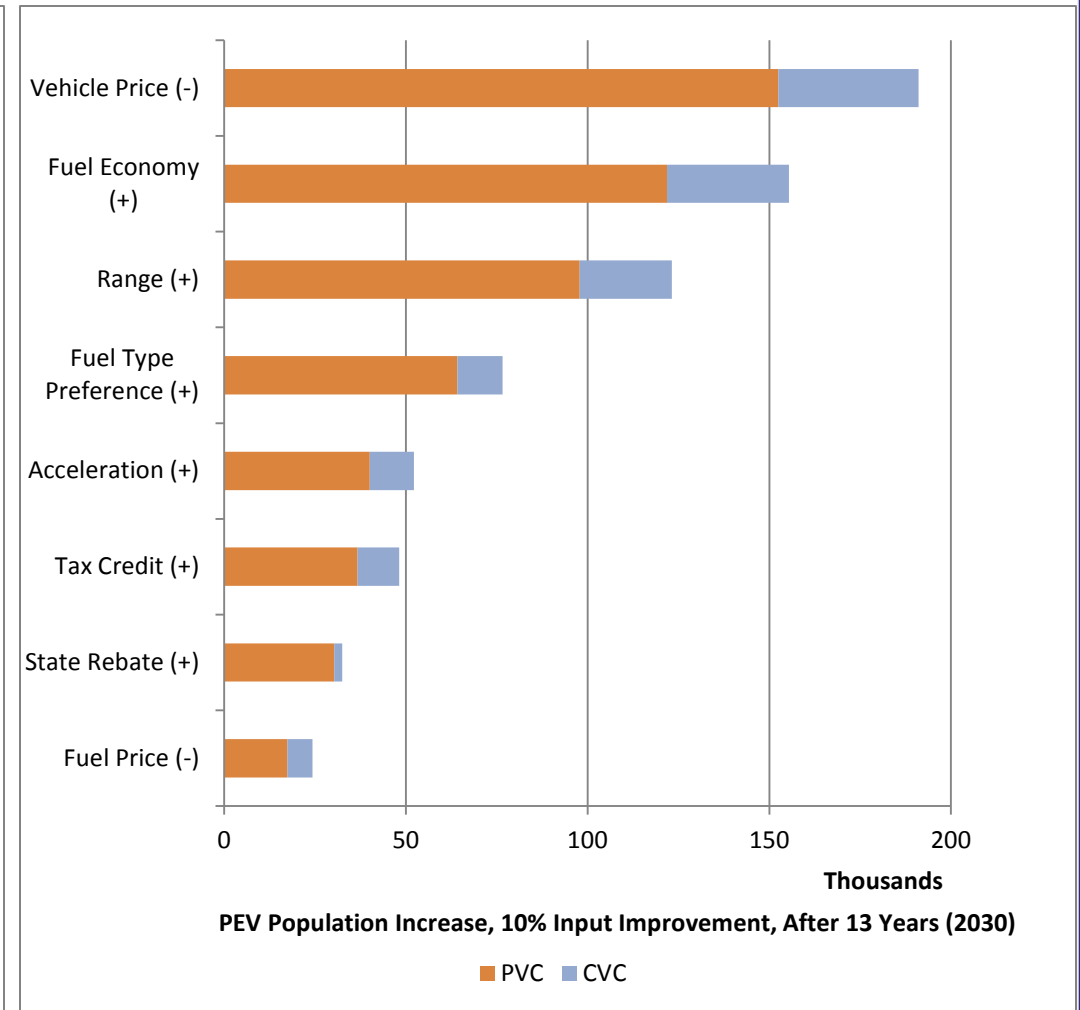
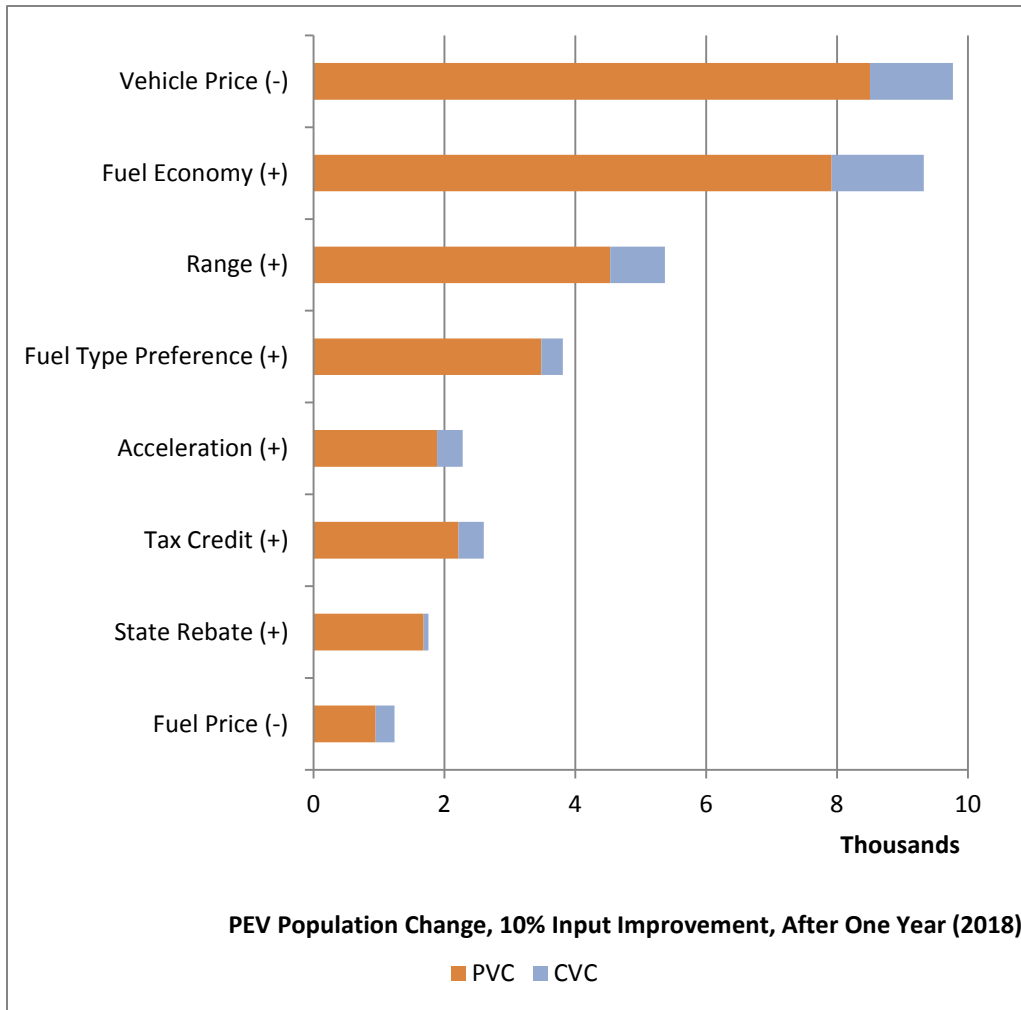


## Alternate Scenarios

Scenario Number	1	2	3	4	5	6	7	8
Scenario Name	Pessimistic PEV	Low PEV	Mid PEV	High PEV	High PEV 2	Aggressive PEV	Aggressive PEV 2	Bookend PEV
Gross State Product	IEPR Low Demand Case	IEPR Low Demand Case	IEPR Mid Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case
Personal Income	IEPR Low Demand Case	IEPR Low Demand Case	IEPR Mid Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case
Number of Households	IEPR Low Demand Case	IEPR Low Demand Case	IEPR Mid Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case	IEPR High Demand Case
Gasoline Prices	Low Prices	Low Prices	Mid Prices	High Prices	High Prices	High Prices	High Prices	High Prices
Natural Gas Prices	High Prices	High Prices	Mid Prices	Low Prices	Low Prices	Low Prices	Low Prices	Low Prices
Electricity Prices	High Prices	High Prices	Mid Prices	Low Prices	Low Prices	Low Prices	Low Prices	Low Prices
Rebates	PEV Rebate to 2020	PEV Rebate to 2020	PEV Rebate to 2025	PEV Rebate to 2030	PEV Rebate to 2030	PEV Rebate to 2030	PEV Rebate to 2030	PEV Rebate to 2030
Tax Credits	PEV Tax Credit to 2020	PEV Tax Credit to 2020	PEV Tax Credit to 2025	PEV Tax Credit to 2025	PEV Tax Credit to 2025	PEV Tax Credit to 2030	PEV Tax Credit to 2030	PEV Tax Credit to 2030
HOV Lane Access	BEV Only	BEV and PHEV	BEV and PHEV	BEV and PHEV	BEV and PHEV	BEV and PHEV	BEV and PHEV	BEV and PHEV
Fuel/Technology Type & Parameter	All	All	All	All	All, Augmented Preference for PEV	All+PHFCV from 2025, Preferences for PEV increase @ 2.5% a year	All+PHFCV from 2022 + Preferences for PEV increase @5% a year	All+PHFCV from 2022 + Preferences for PEV increase @10% a year
Vehicle Class	Most Likely	Most Likely	Most Likely	Number of Classes Augmented for PEV - 1	Number of Classes Augmented for PEV - 1	Number of Classes Augmented for PEV - 2	Number of Classes Augmented for PEV - 2	PEVs in all classes
ZEV/PEV Alternative Specific Constants	As Estimated	Constant After 2017	Constant After 2017	Constant After 2017	Constant After 2017	Constant After 2017	Constant After 2017	Constant After 2017
Vehicle Price	PEV 25% Above Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Bloomberg battery price-based	PEV 25% Below Most Likely	Parity or lower at 2030
Fuel Economy	PEV 25% Below Most Likely	PEV 25% Below Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely
Maintenance Cost	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely
Range	PEV 25% Below Most Likely	Most Likely	Most Likely	Most Likely	ARB High Tech	ARB High Tech	PEV 25% Above Most Likely	PEV 25% Above Most Likely
Acceleration	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely	Most Likely
# of Makes and Models	PEV 50% Below Most Likely	PEV 25% Below Most Likely	Most Likely	Most Likely	Most Likely	PEV 50% Above Most Likely	PEV 50% Above Most Likely	PEV 50% Above Most Likely
Refueling Time	PEV 25% Above Most Likely	PEV 25% Above Most Likely	Most Likely	PEV 25% Below Most Likely	PEV 25% Below Most Likely	PEV 25% Below Most Likely	PEV 25% Below Most Likely	PEV 25% Below Most Likely
Time to Refuel Station	PEV 25% Above Most Likely	PEV 25% Above Most Likely	Most Likely	Most Likely	Most Likely	PEV Same as gasoline	PEV Same as gasoline	PEV Same as gasoline

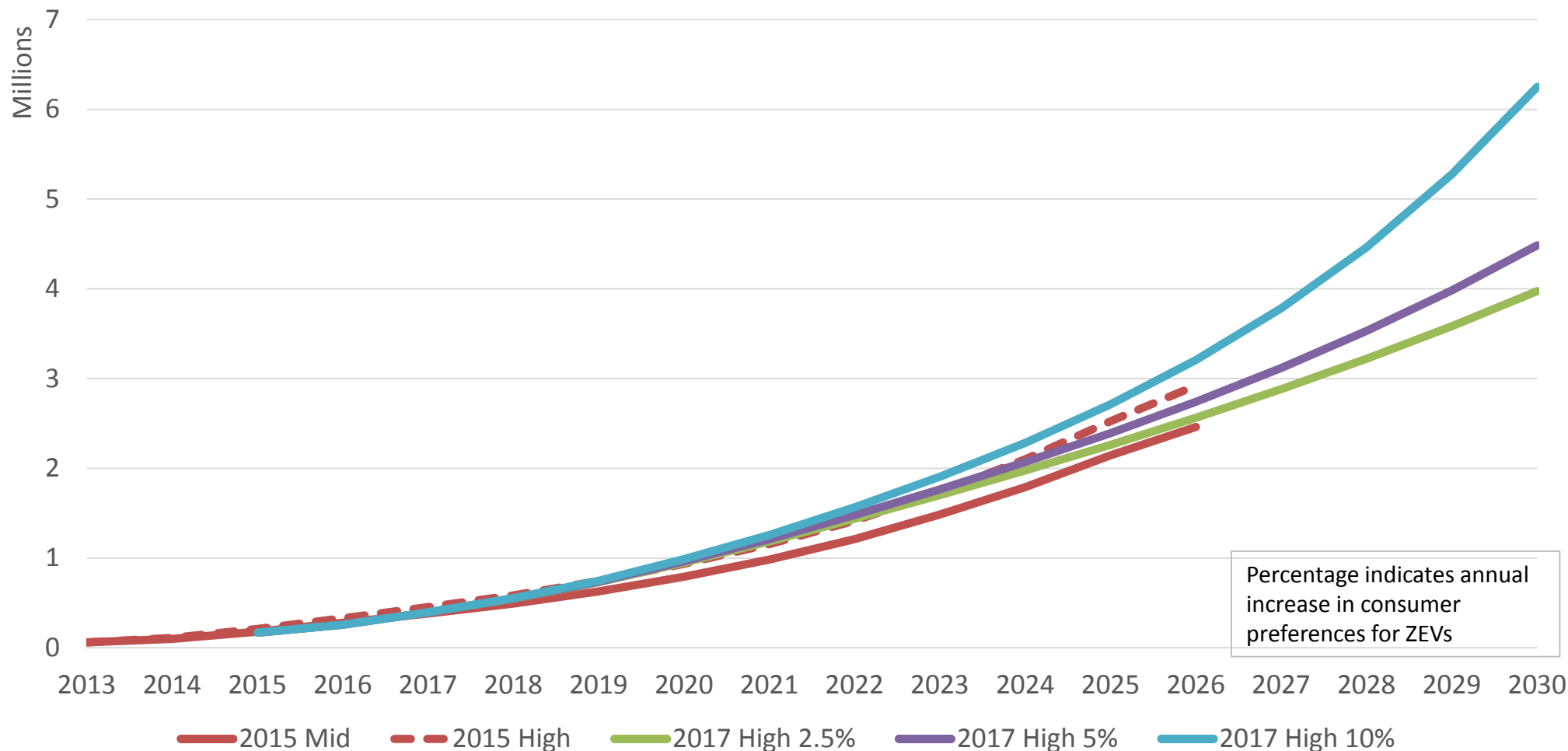


## Impact of 10% Improvement on PEV Fleet Size





# Linear Price Parity in 2030 & Increase in ZEV Preferences







# Annual ZEV Preference Increases

