ZEV Scenarios and Methods, 2019-2030

DAWG Transportation Meeting

November 14, 2019

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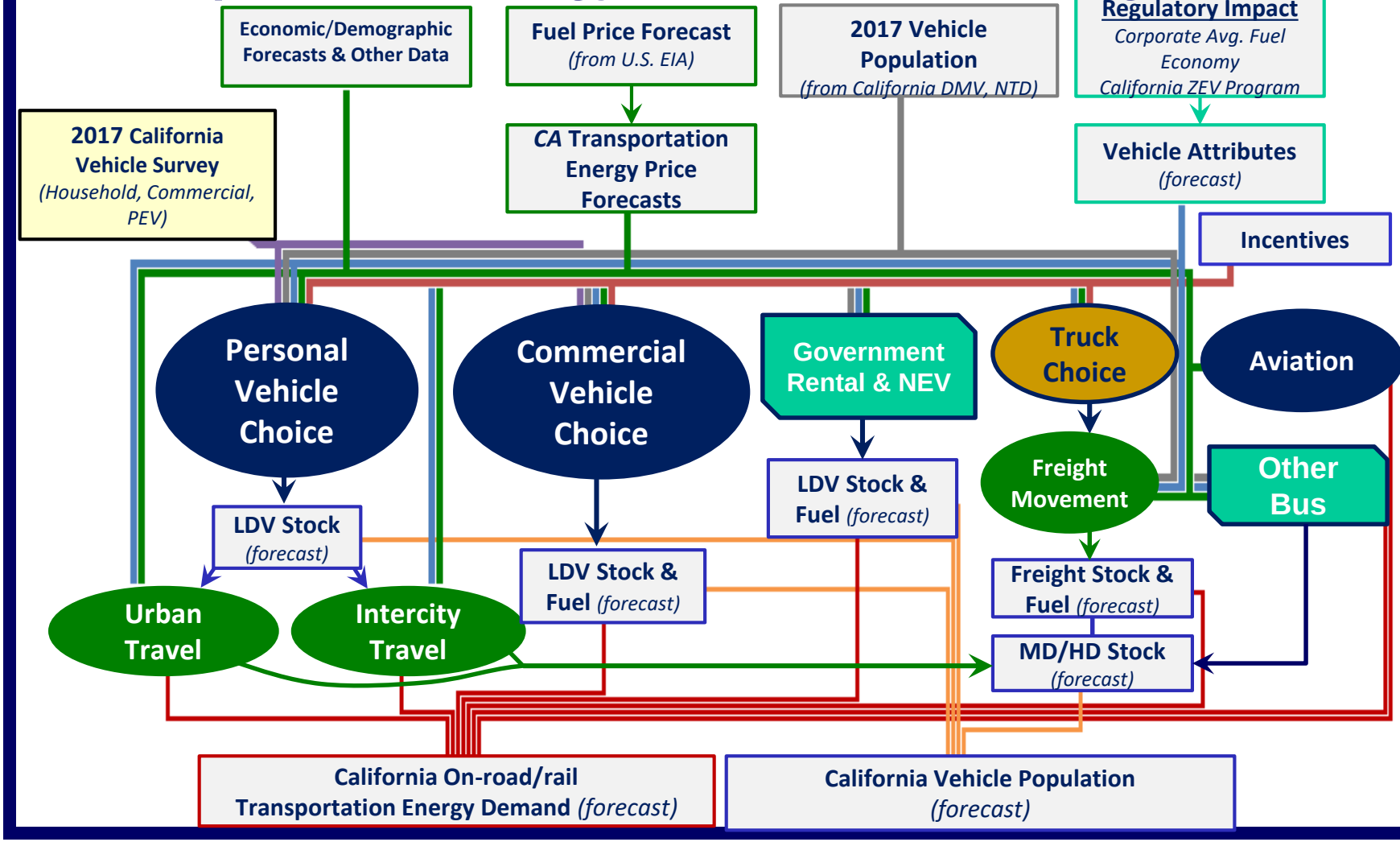
Overview

- CEC Transportation Forecasting Methods and Scenarios
- CEC Revised ZEV Forecasts
- Other Studies & Scenarios
- Pathway Scenarios
- 2030 Comparisons

Transportation Energy Demand Forecasting Models



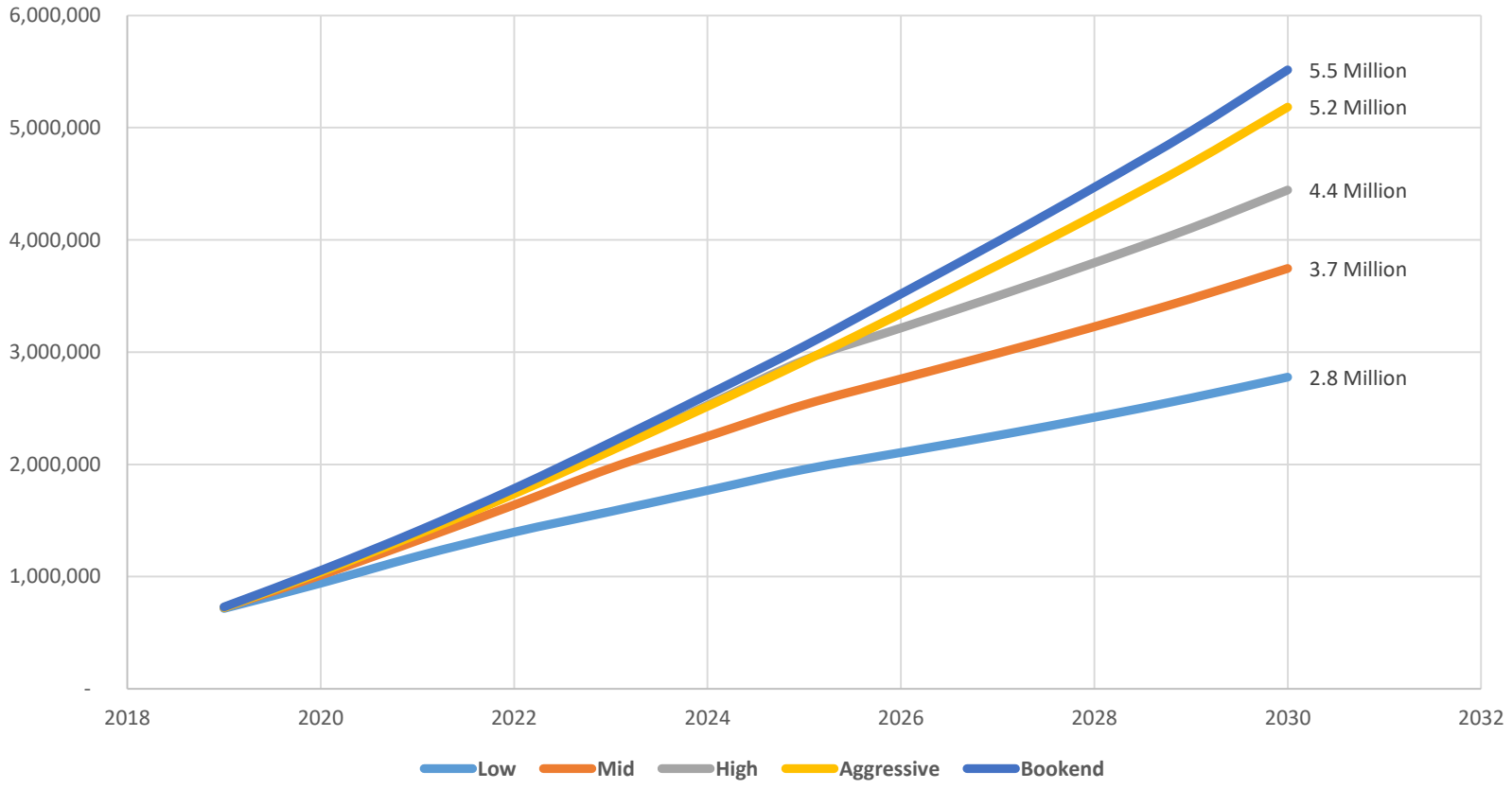
Demand Forecasting Cases: Electricity Centric

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

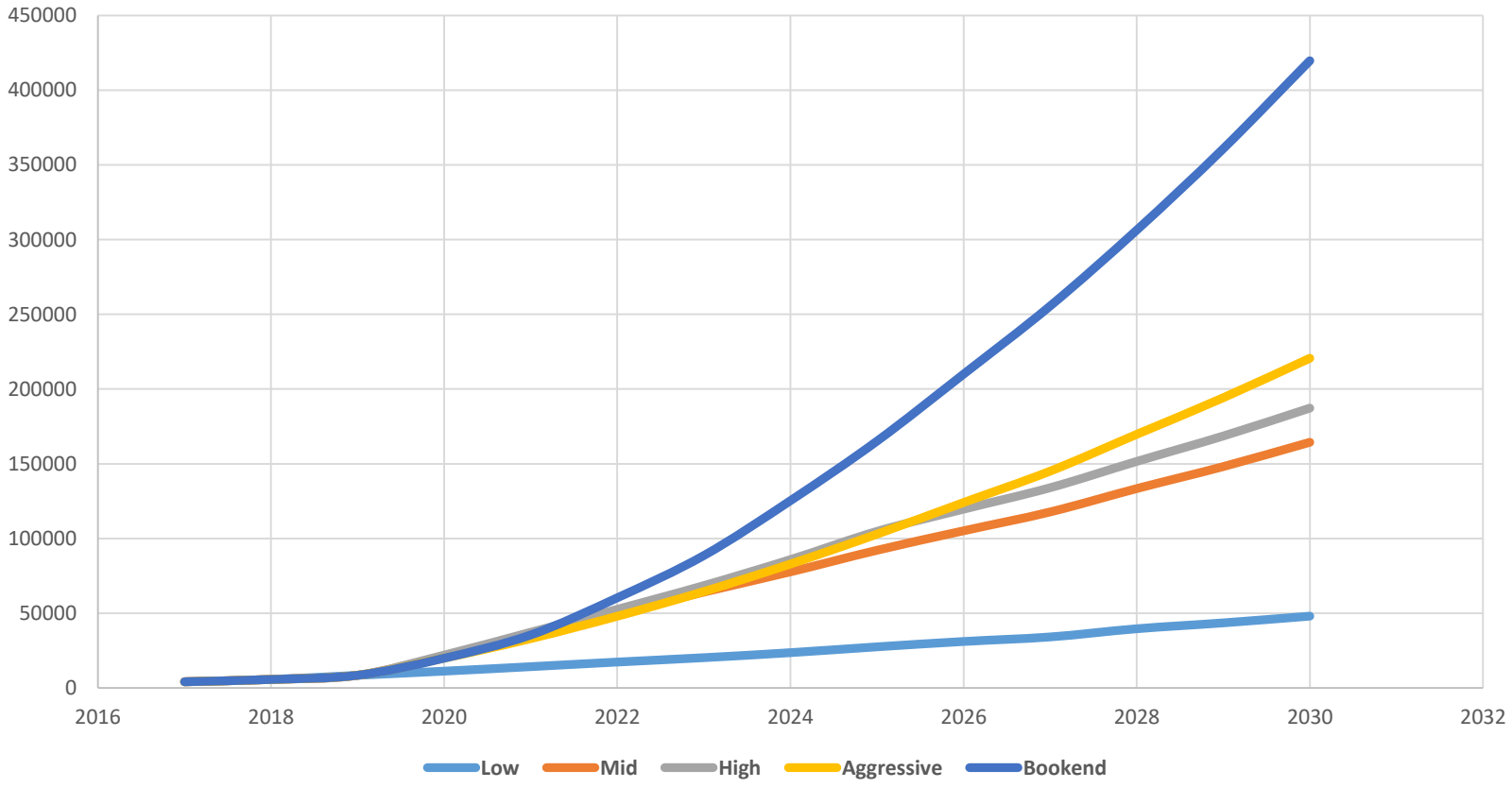
2019 IEPR Light Duty PEV Scenarios

	2019 IEPR Light Duty PEV Scenarios				
INPUTS	**Low**	**Mid**	**High**	**Aggressive**	**Bookend**
PREFERENCES					
Consumers' PEV Preference	Constant at 2017 Level	Increase with PEV market growth	Increase with PEV market growth	Increase with PEV market growth	Increase with PEV market growth
INCENTIVES					
Federal Tax Credit	Eliminated after 2019	Decreasing starting 2019	Decreasing starting 2019	Decreasing starting 2019	Decreasing starting 2019
State Rebate	To 2025	To 2025	To 2025	To 2030	To 2030
HOV Lane Access	To 2021	To 2023	To 2025	To 2030	To 2030
Fuel Prices					
Electricity Rates	Residential & Commercial Rates	Residential & Commercial Rates	Residential & Commercial Rates	Residential & Commercial Rates	Off-Peak rate for Residential
ATTRIBUTES					
Number of Models Available in 2030	PEV models available in 14 of 15 CEC LDV classes	PEV models available in 14 of 15 CEC LDV classes	PEV models available in 15 of 15 CEC LDV classes	PEV models available in 15 CEC LDV classes	Models available: BEV in 15, PHEV in 15, FCV in 8, PHFCV in 7 CEC LDV classes
Vehicle / Battery Price (by 2030)	PEV prices based on battery price declining to ~$120/kWh	PEV prices based on battery price declining to ~$100/kWh	PEV prices based on battery price declining to ~$80/kWh	PEV prices based on battery price declining to ~$70/kWh	PEV prices based on battery price declining to ~$62/kWh
Max EV Range (2030)	~333 miles	~341 miles	~341 miles	~341 miles	~341 miles
Refuel Time (2030)	15 -21 min	15 -21 min	10-16 min	10-16 min	10-16 min
Time to Station (2030)	7-8 min	Same as gasoline	Same as gasoline	Same as gasoline by 2025	Same as gasoline by 2025
Forecast					
ZEV Stock (2030), Millions	**2.8**	**3.7**	**4.4**	**5.2**	**5.5**

2019 IEPR Revised Light Duty ZEV Population Forecast



2019 Revised Light Duty FCEV Forecast



Studies & Scenarios of Future

Start from Present, with No Specified Desirable End Point

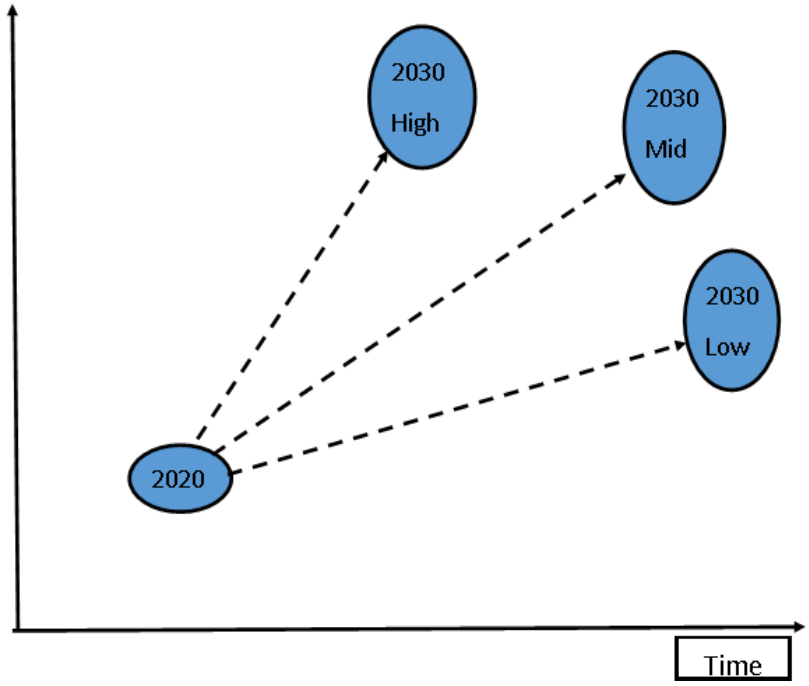
- Forecasts use formal quantitative modelling to predict likely futures based on sound projections of inputs and drivers, or current trends, reflecting uncertainties.
- Managed Forecast makes adjustment to the baseline forecasts to reflect the impact of additional elements for resource planning purpose. Example: CEC's Additional Achievable Energy Efficiency (AAEE) forecast.

Start with a Predetermined Desirable 'End' Point

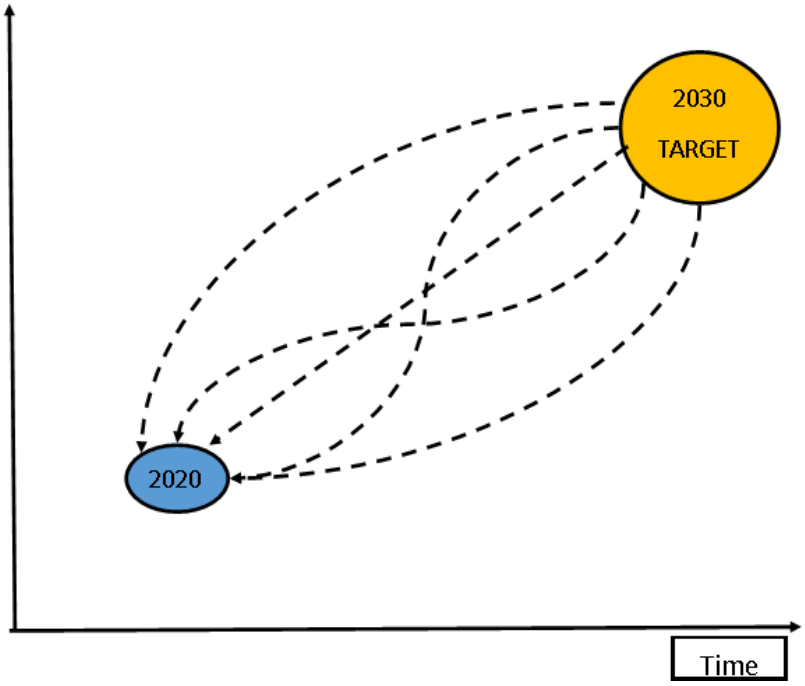
- Planning Scenarios describe a specific sequence of actions to meet a specific target at some point in future. Example: SCAQMD Planning Exercise.
- Pathway Scenarios investigate possible pathways to the desirable end point. Examples: E3 deep decarbonization study, SCE's Pathway 2045.

Forecasts & Pathways

Forecasts



Pathways



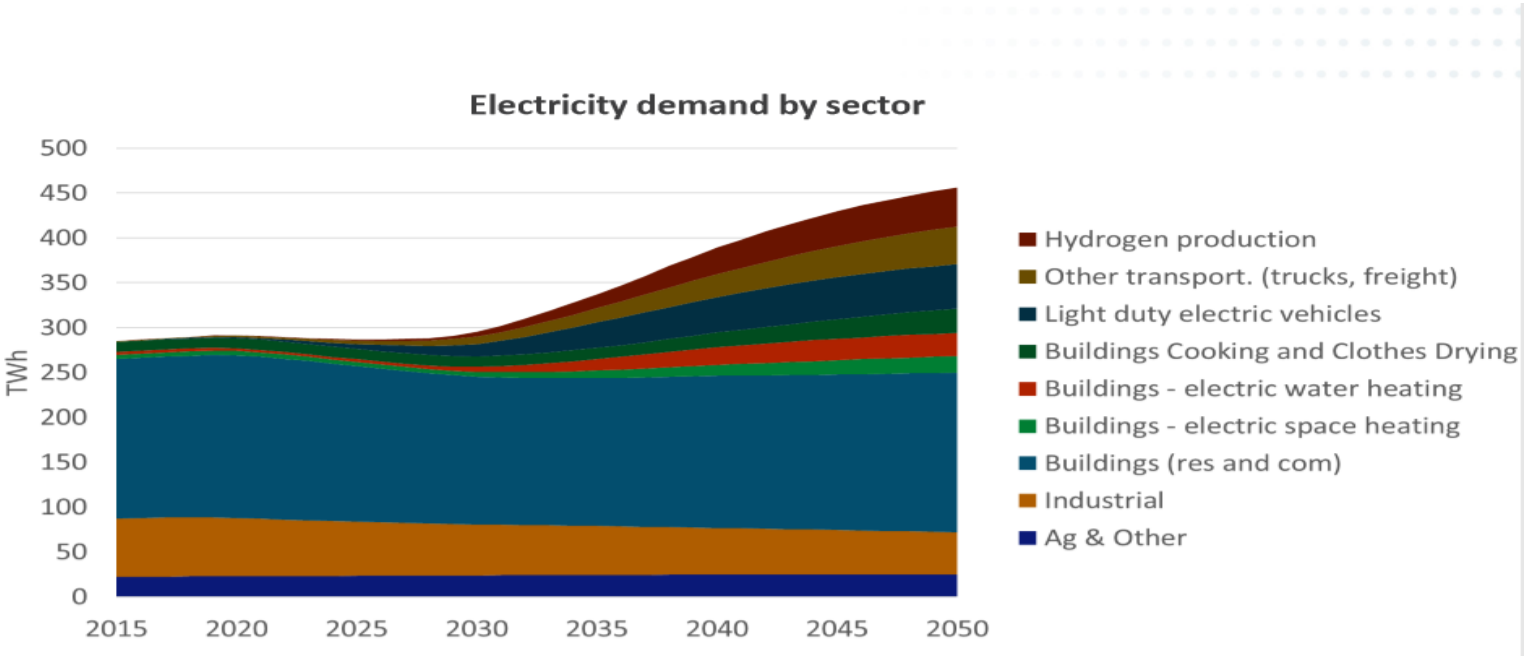
Pathway Scenarios

Same Model, Same Goals, Multiple Pathways

- Energy & Environmental Economics (E3)'s PATHWAY model has been used in multiple analysis for CARB, CEC, SCE and others.

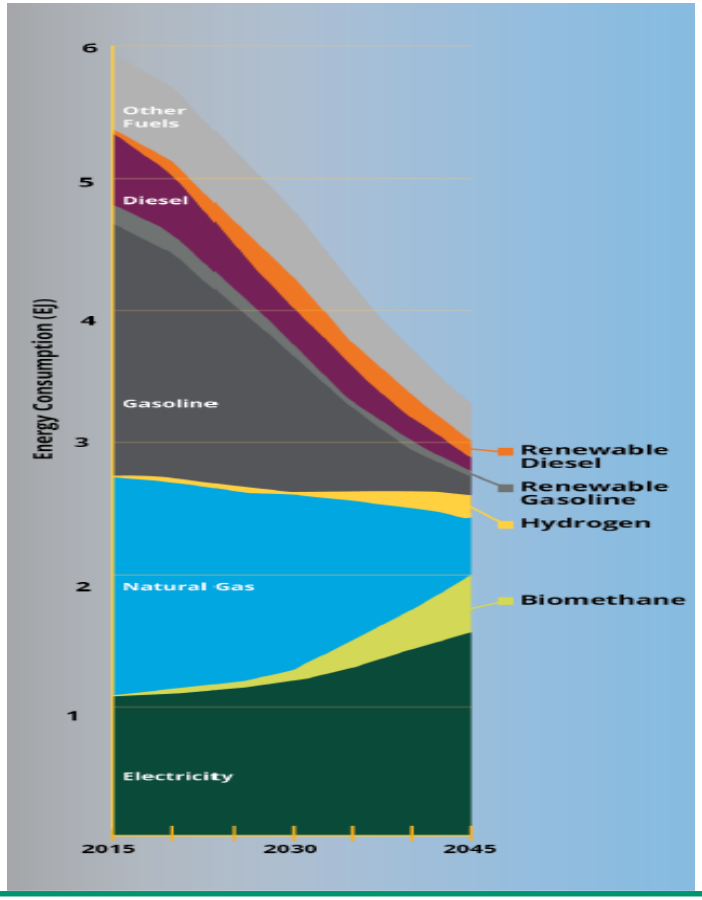
- PATHWAY is an economy-wide energy supply, demand and GHG emissions accounting tool. It can be used to evaluate long-term decarbonization plans for reaching statewide goals.

Electricity Demand by Sector: Transportation Electricity Grows the Load, with a Third Dedicated to Hydrogen Production by 2050.



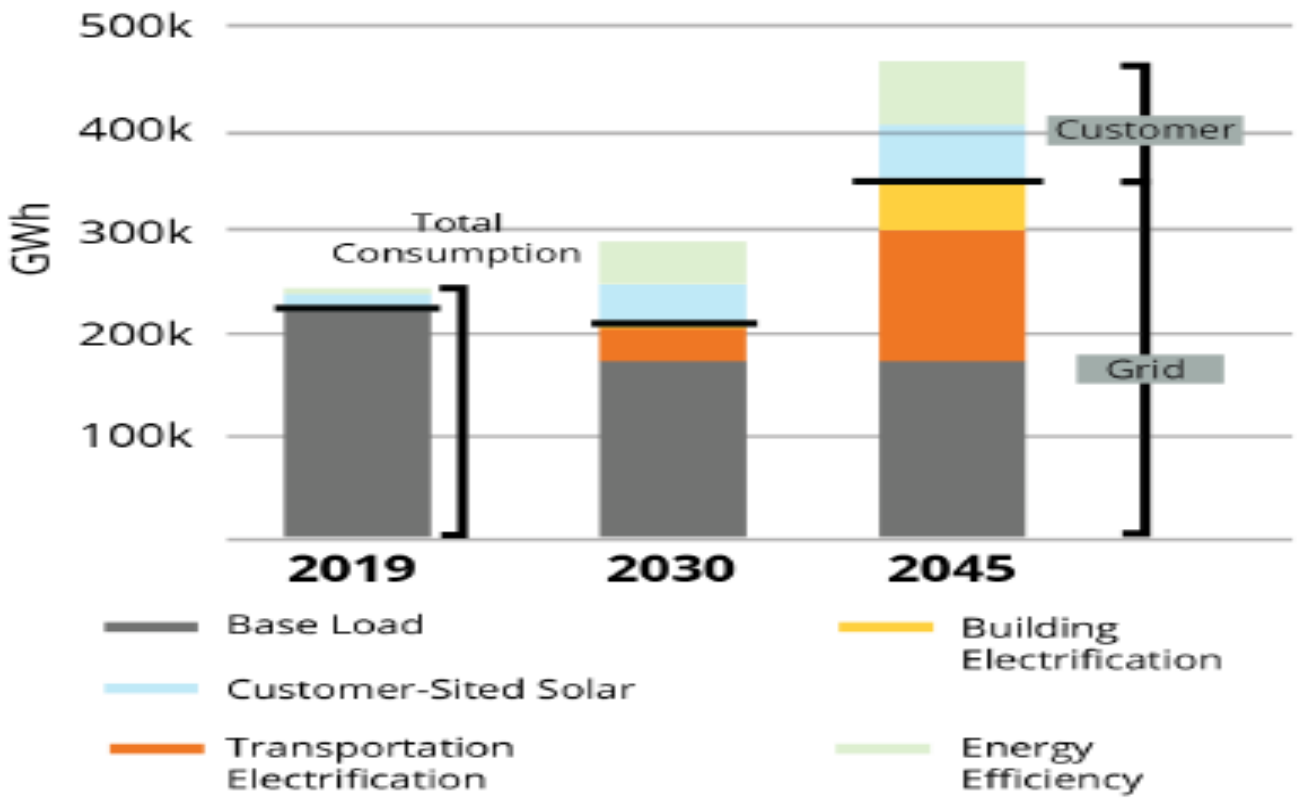
Source: E3 Deep Decarbonization in a High Renewables Future - Implications for Renewable Integration and Electric System Flexibility, June 20, 2018 Energy Commission Workshop

Energy Consumption Pathway by Fuel Type: Energy Efficiency, Clean Energy and Fossil Fuel Reductions to Meet 2045 GHG Goals (SCE, Pathway 2045)



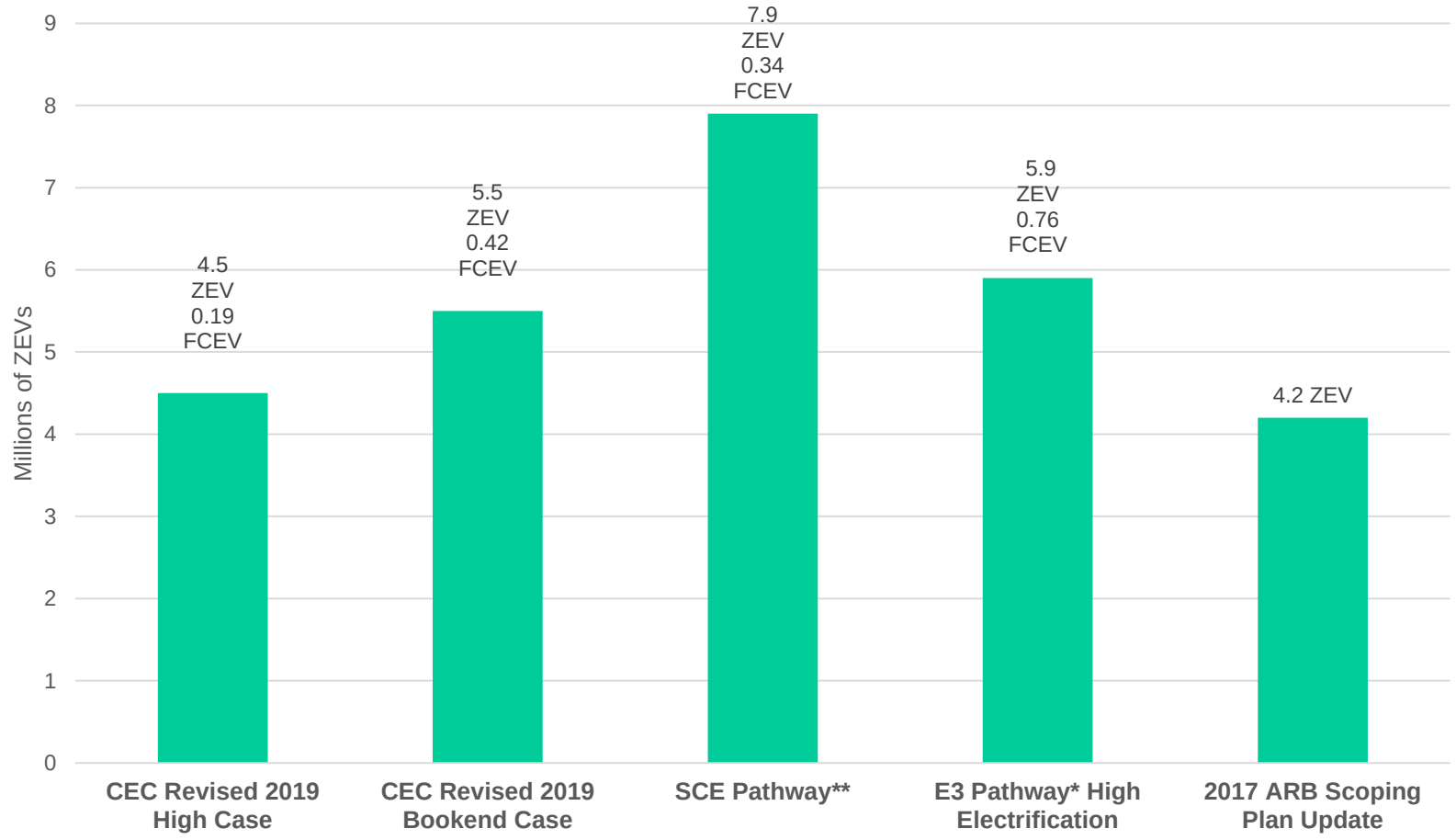
Source: SCE Pathway 2045. November 2019. https://www.edison.com/content/dam/eix/documents/our-perspective/201911-pathway-to-2045-white-paper.pdf

Electricity Consumption Pathway by Sector and Source: Transportation Electrification Growing the Load (SCE Pathway 2045)



Source: SCE 2045 Pathway. November 2019. https://www.edison.com/content/dam/eix/documents/our-perspective/201911-pathway-to-2045-white-paper.pdf

2030 ZEV Population: Goals & Forecasts (Millions of Vehicles)



*Source: E3 Deep Decarbonization in a High Renewables Future - Implications for Renewable Integration and Electric System Flexibility, June 20, 2018 Energy Commission Workshop

**Source: SCE, Pathway 2045. November 2019. https://www.edison.com/content/dam/eix/documents/our-perspective/201911-pathway-to-2045-white-paper.pdf

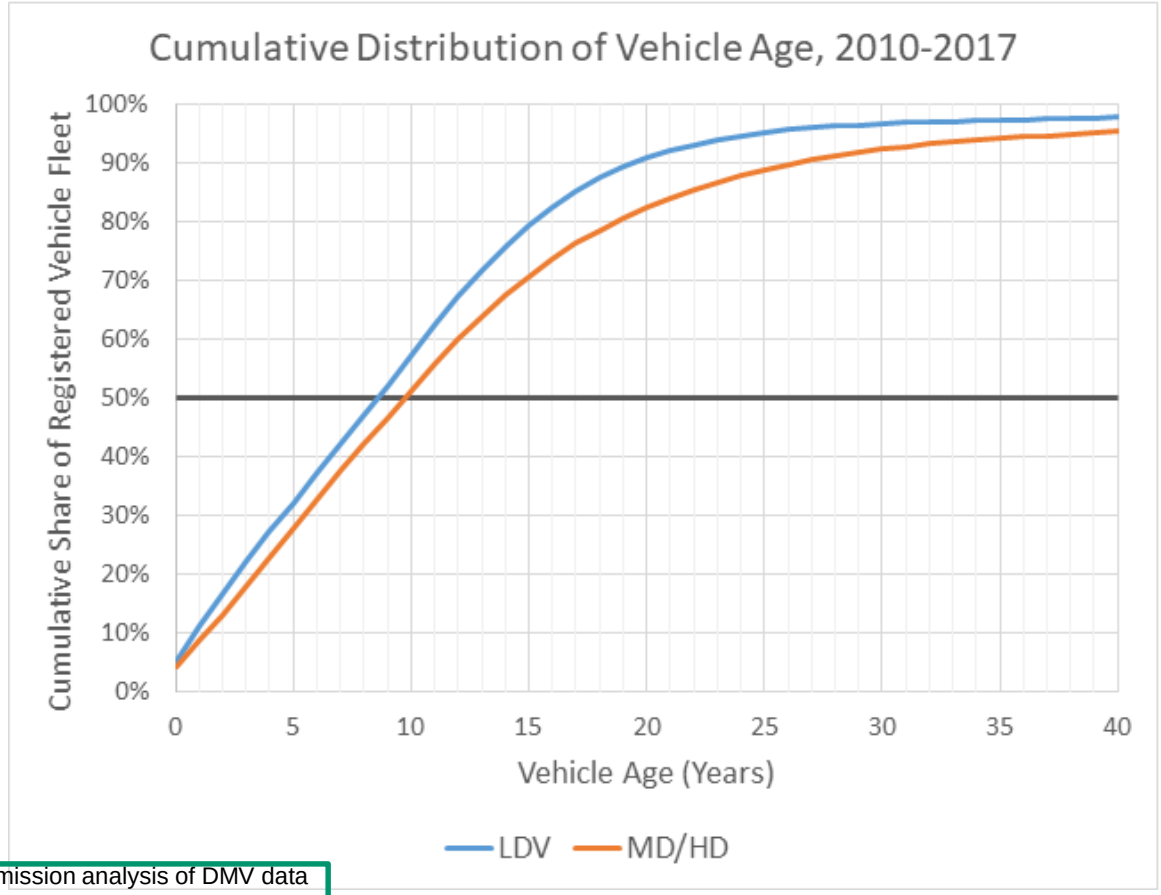
How Many Hydrogen Vehicles?

- With a more advantageous range for long distance travel hydrogen can be used for both LDVs as well as MD/HDV travel.
- E3's 2018 decarbonization pathways included a high electrification scenario, with almost a third of the transportation electricity originating from production of enough hydrogen to supply 0.8 million light duty FCEVs in 2030.
- Light duty FCEVs in the CEC's current high demand forecast shows about 187,000 in 2030, and about 420,000 in the bookend case.
- SCE's Pathway 2045 shows 13% of LDV, 5% of MDV and 20% of HDV trucks will be fueled by hydrogen, in 2045.

Green Hydrogen

- Prior legislation requires 1/3 of hydrogen produced by state-funded station to be made from renewables.
- SB 662 (Archuleta) requires the CPUC and the Energy Commission to consider opportunities to increase grid-responsive production of green electrolytic hydrogen for use in transportation sector, and incorporate "green electrolytic hydrogen" into various transportation electrification definitions.
- All this translates into more electricity demand, as E3 Deep Carbonization Pathway shows, whether the electricity is grid supplied or generated behind the meter.

Age Distribution of Light & Heavy Duty Vehicles



Source: Energy Commission analysis of DMV data

Comments?

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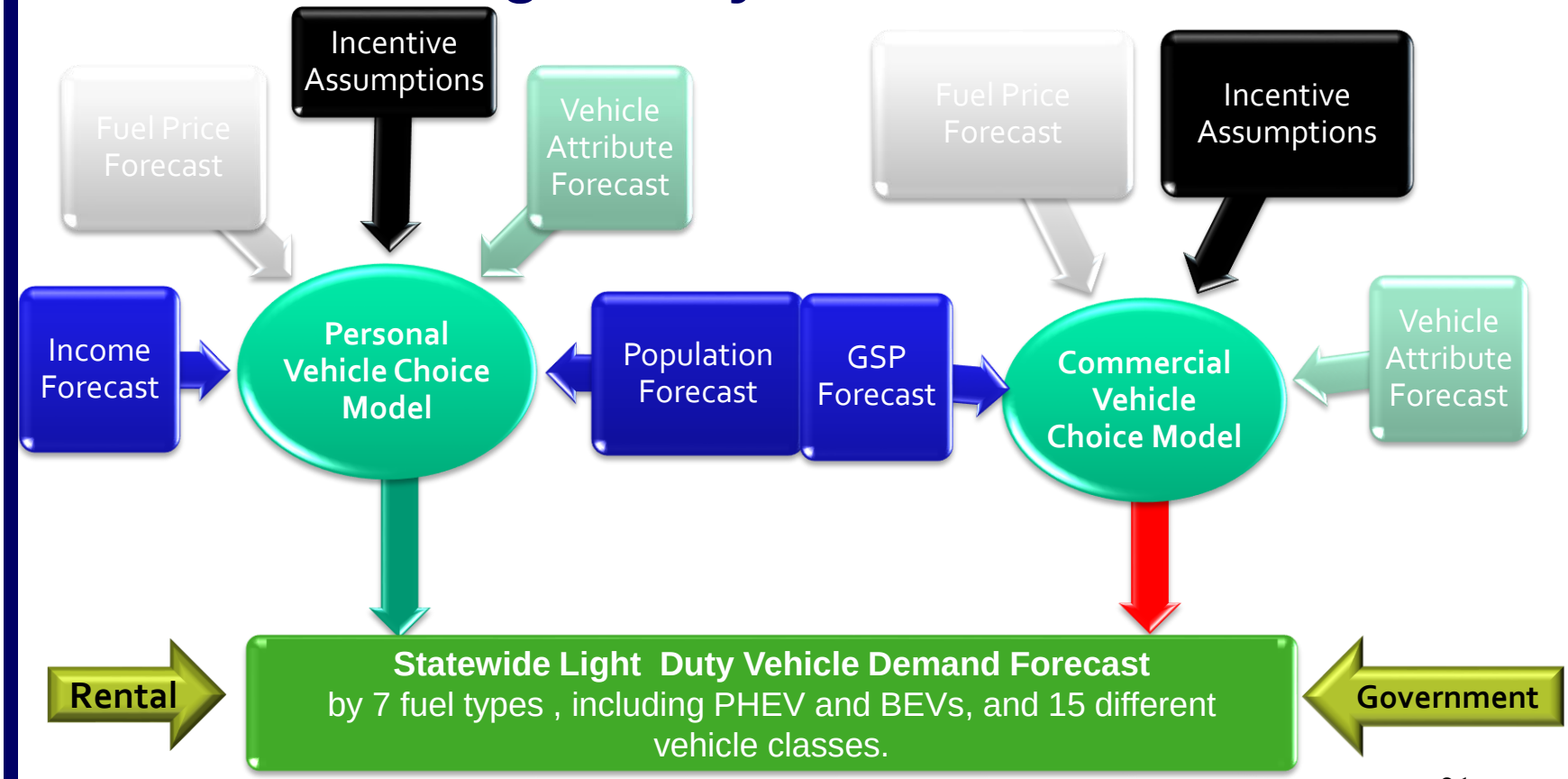
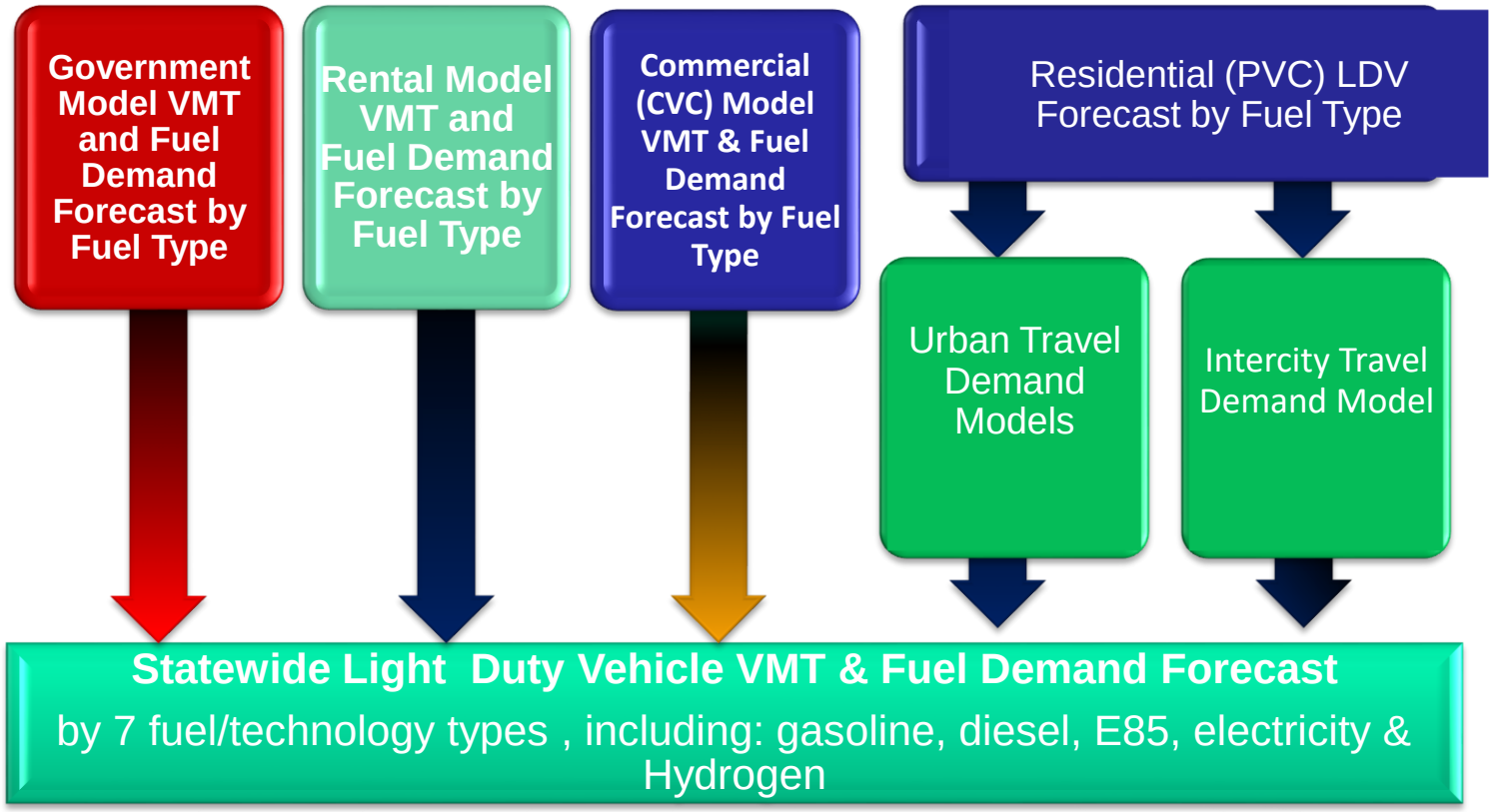
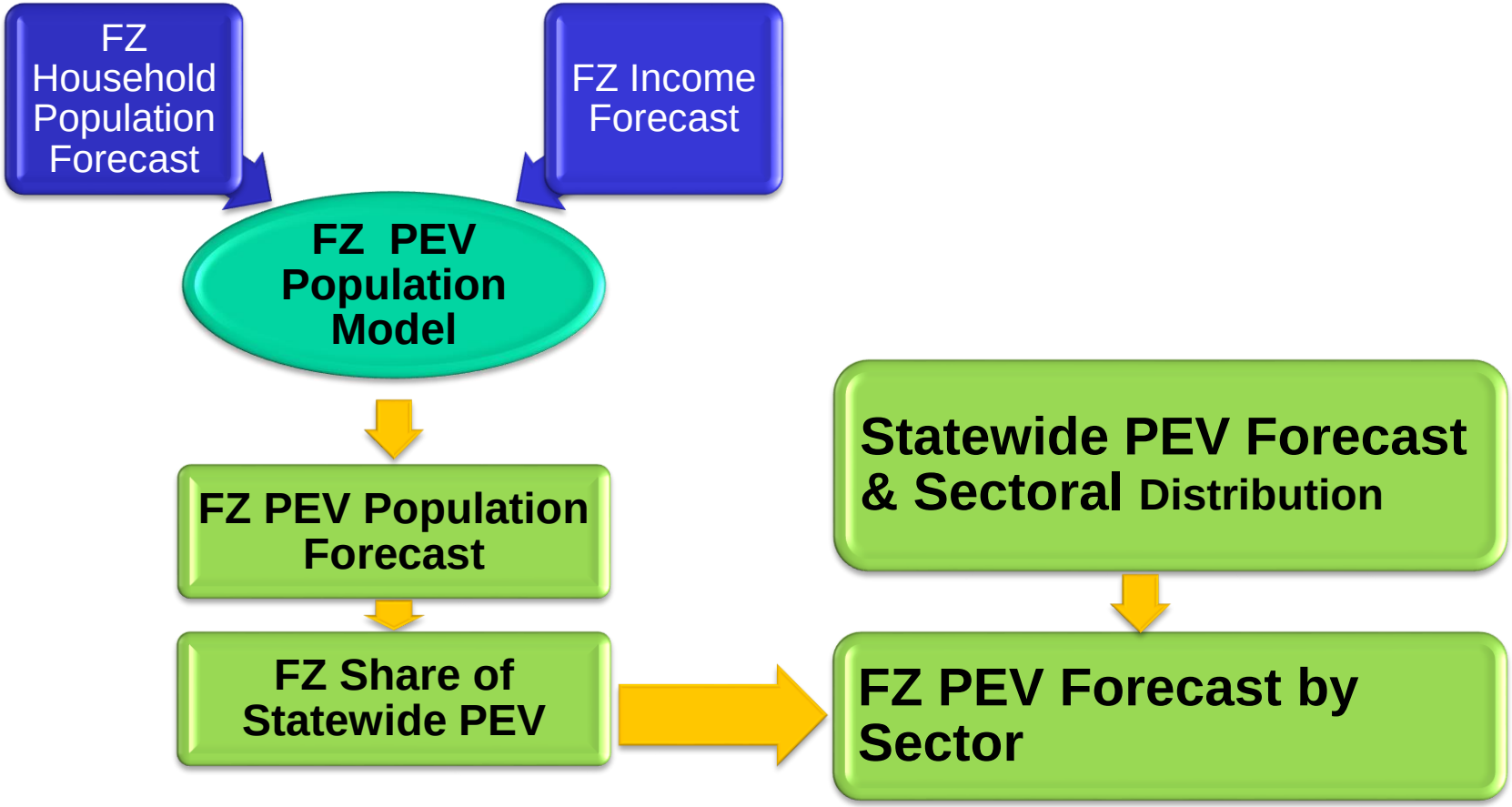
Behavioral Light Duty Vehicle Choice Models



Statewide Light Duty VMT & Energy Demand Forecasting Models



Forecasting Zone (FZ) Distribution of Statewide PEV Population Forecast, by Sector



Forecasting Zone (FZ) Distribution of Light duty PEV electricity Consumption