

#### 26 June 2019

# The California Fuel Cell Revolution: Activating the Commercial Market

The National Academies of Sciences, Engineering & Medicine

Bill Elrick, Executive Director
California Fuel Cell Partnership

# California Emissions Challenge



## California's Advanced Clean Cars (ACC) Program

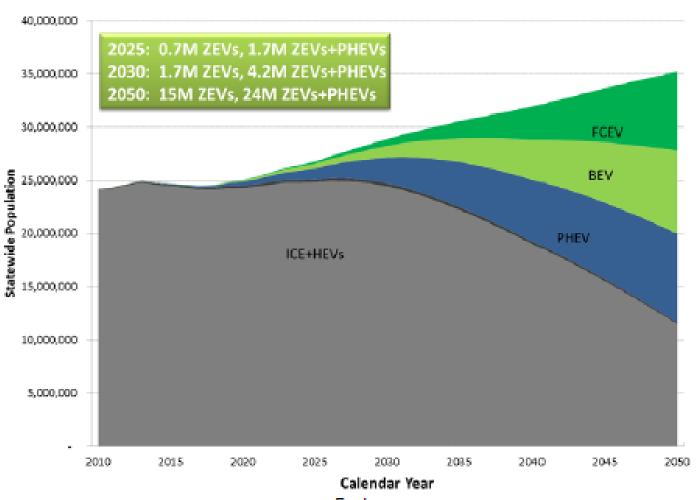


- Approved as an integrated regulatory package in 2012
  - Comprehensive approach of carrots and sticks
- LEV III Criteria and GHG standards
  - o 75% reduction in fleet avg NMOG + NOx emissions
  - o 90% reduction in PM emission standards
  - o 34% reduction in GHG emissions
- ZEV Regulation
  - o More ZEVs and PHEVs
- Additional programs and activities
  - Low Carbon Fuel Standard
  - Cap and Trade program
  - Renewable Portfolio Standards

# ZEV Regulation and Future of Light-duty Mobility



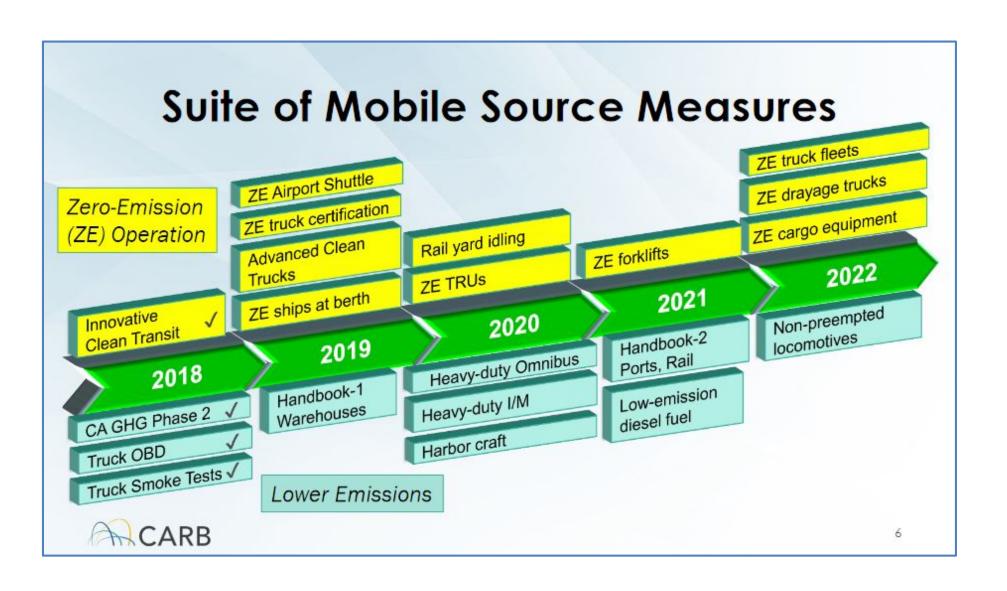
- Complimentary nature of BEVs and FCEVs
  - Hydrogen and electricity system enables larger decarbonized energy transition in all sectors
- Provides consumer choice
- Analysis = both are necessary!
  - Acknowledges the magnitude of the reductions needed
  - Acknowledges highly segmented vehicle market and wide array of use cases
  - Acknowledges 50% or greater
     GHG reductions WTW with
     today's hydrogen; more in future



<sup>\*</sup>Vehicle populations in the *Cleaner Technologies and FUEI Scenario* does not include the additional ZEVs from Further Deployment measures

# Heavy Duty Regulations – Electric Drive Everywhere





### California Fuel Cell Partnership (CaFCP)





AngloAmerican















**TOYOTA** 













































































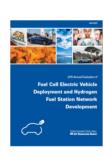


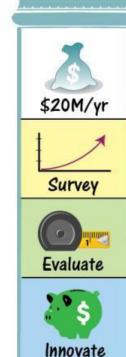
## Launching California's Retail Market



- Stations come first
- Establish initial network coverage
- Clusters in big cities
- "Connectors" and "destination" stations
- Consensus vision for commercial launch

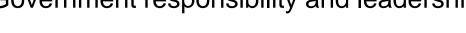






#### 2013 AB8 – ARFVTP Support

- \$20M annually through 2023
- Co-funding for first 100 stations
- Annual survey, evaluation and reporting
- Government responsibility and leadership





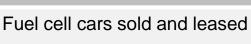












Fuel cell buses in operation in California

Retail hydrogen stations open in California



6,830

31

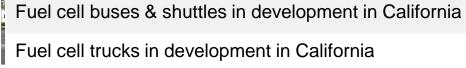
40

25

35+







Retail hydrogen stations in development in California











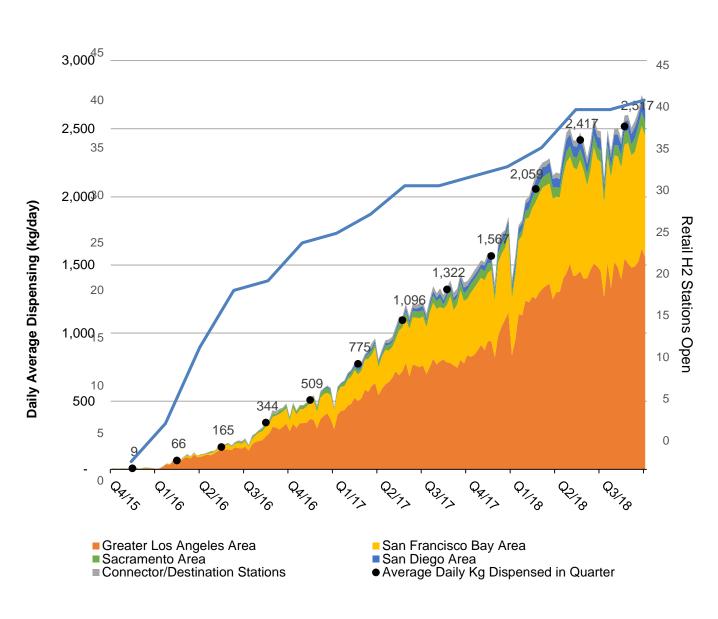


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- The technology works <u>customers are coming!</u>
- Need to know where, when and if hydrogen is available
- Tools for customers & stakeholders; quarterly webinars, Station Status (SOSS), reports











- "Normalization" of HRS process
- HRS development time >18 months
- Greater industry investment and building larger stations
- ER and permit peer support

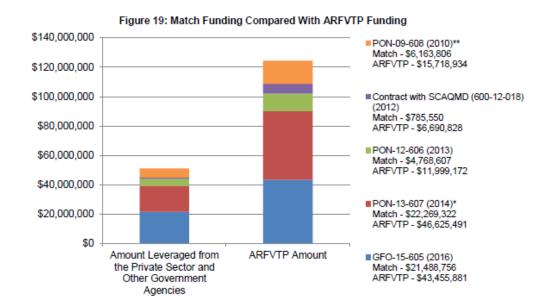
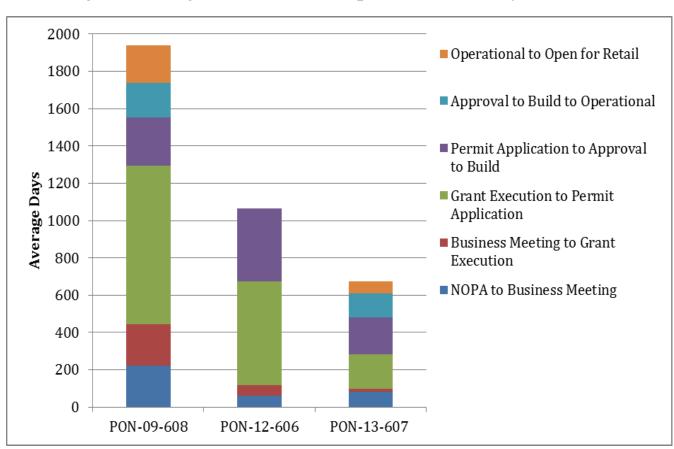
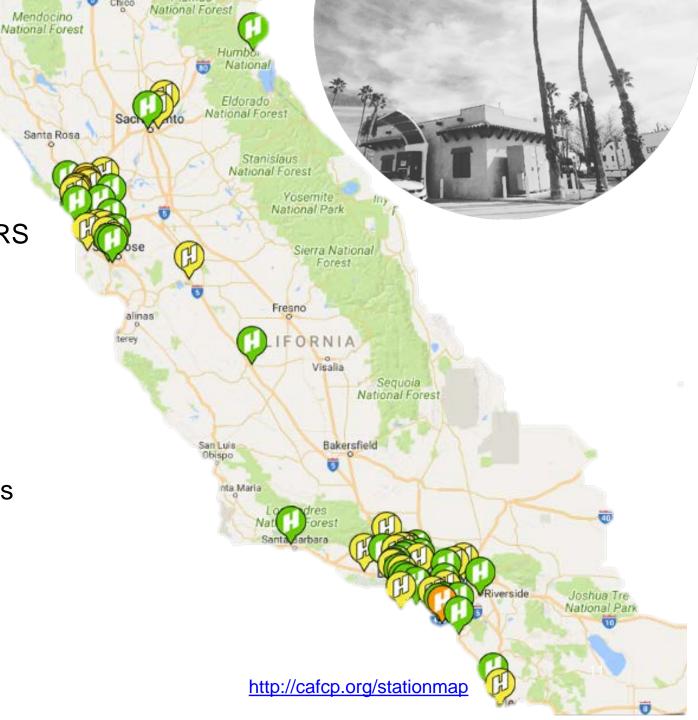


Fig 8: Average Station Development Time (days)



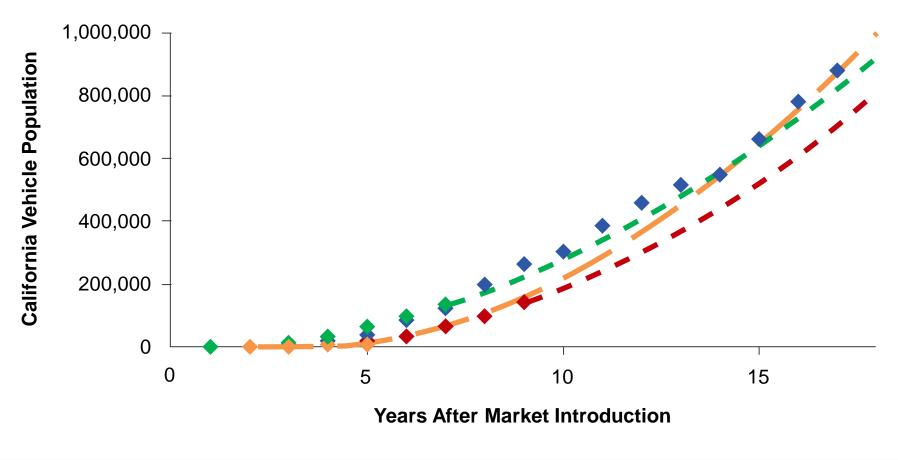
#### California Activities

- Executive Order B-48-18 targets 200 HRS by 2025 and 5MM ZEVs by 2030
- New H2 production facilities
- New heavy duty fuel cell truck projects
- Innovative Clean Transit regulation
- Low Carbon Fuel Standard Amendments
- CaFCP publishes new 2030 vision for a self-sustaining California market



# Bending the ZEV Curve



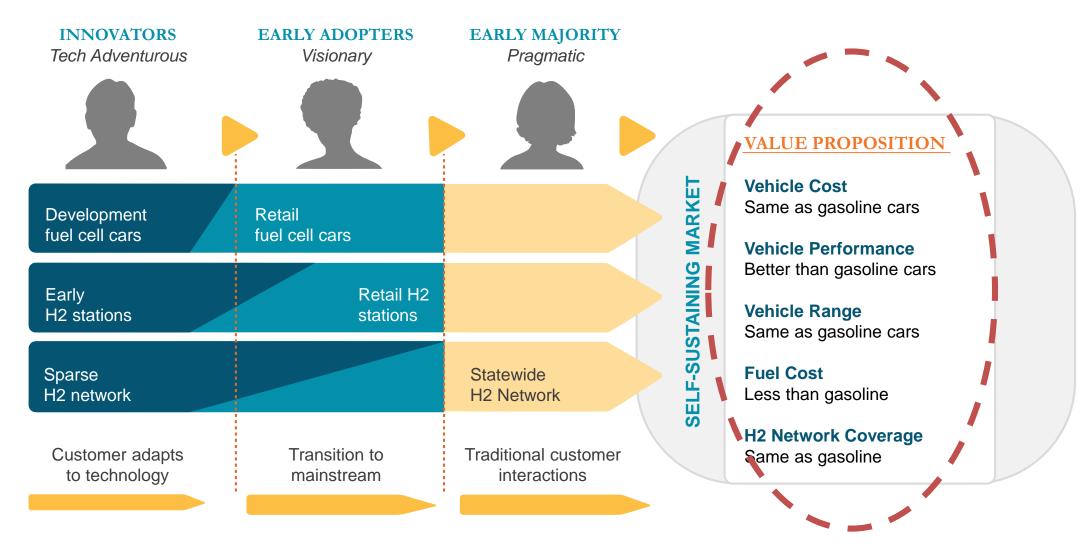














#### —California Fuel Cell Revolution—

Enable market conditions to support:

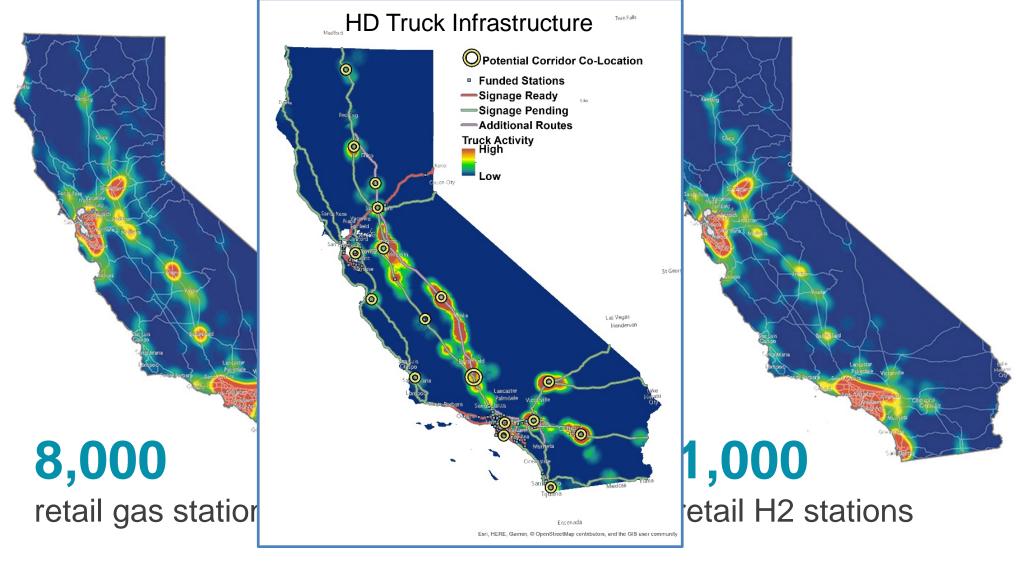
1,000 hydrogen stations

and

1,000,000 fuel cell vehicles by 2030









Enable the market by attracting capital investment in infrastructure





Establish the market with a competitive value proposition to increase consumer demand



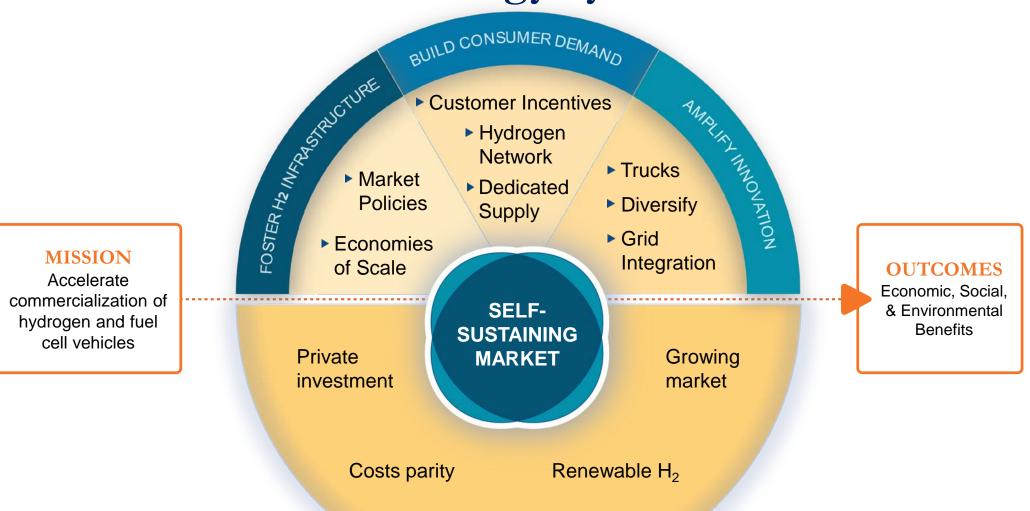


 Expand the fuel cell and hydrogen market across the transportation and energy spectrum



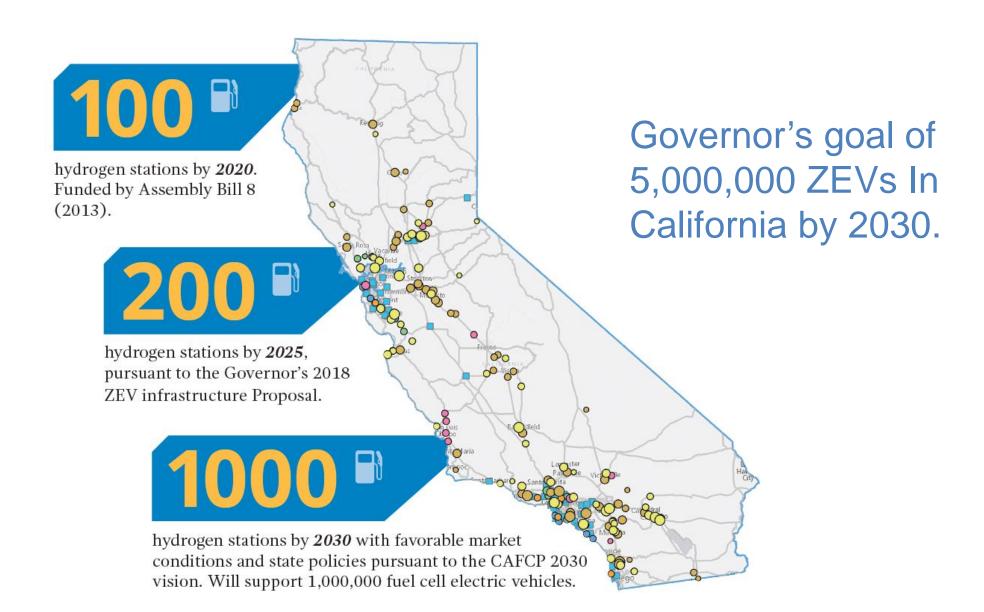
# Transforming California's Transportation and Energy Systems







#### A Vision for 2030 in California



# Scale Creates Cost-Competitiveness & Consumer Adoption





### — Next for California —

- ✓ Policies that encourage investment
- Addressing cost challenges
- Renewable production pathways
- Expanding Stations across and beyond CA
- Sustainable freight

