The Path to Low Carbon Passenger Vehicles

Tom Cackette

California Air Resources Board

DEER 2010 – Detroit

September 27, 2010

Outline

- Progress to date
- Next step – GHG standards for 2017-2025 models
- Achieving an 80% GHG reduction by 2050
- Need for low carbon fuels

GHG Standards Though 2016

- National program adopted in 2010
  - Starts w/ 2012 models
  - 250 g/mi GHG in 2016 (34.1 mpg)
- CARB Program adopted in 2004
  - Started w/ 2009 models
  - Achieves same GHG stringency in 2016 (~250 g/mi)
  - 14 states have adopted CA standards
    - ~40% of national sales affected
  - Compliance with EPA rule counts as compliance with CA standards

GHG Standards for 2017-2025
Next Steps

- Technical Assessment Report (TAR) nearing completion (EPA, NHTSA, CARB)
  - Presidential directive
  - Reflects extensive input from OEMs and other stakeholders
  - Also independent assessment by agencies
- Notice initiating national rulemaking ~Oct. 1
  - Final national rule likely in 2012
- CARB adoption of standard planned early 2011
  - Based on TAR
  - Would allow for 1 national program if federal rule is of same stringency

GHG Standards Being Evaluated – 2025 Models

Scenario (Improvement/yr)	CO2** gpm	MPGe* (test)	~ MPGe* (in-use)
3%	190	47	37
4%	173	51	41
5%	158	56	45
6%	143	62	50

* Average of passenger vehicles. MPGe assumes all reduction is from tailpipe. **2016 standard is 250 gpm

Preliminary Observations by CARB*
of Ability to Further Reduce GHG Emissions

- Weight reduction is most cost effective
- Further GHG reduction from conventional ICE achievable, and cost effective
- HEVs necessary
  - Ranges from current levels (few % sales) at less stringent standards to ~50% sales at higher annual CO2e improvement.
- Plug EVs only necessary by 2025 for higher annual improvement scenarios

* CARB assessment, not necessarily reflective of the final joint Technical Assessment Report

More Electric Drive Vehicles Coming Soon

HYBRIDS

Today

>15 Models

2011-12

Lincoln MKZ

Honda Fit

Honda CR Z

Hyundai Sonata

Infinity M

Kia Optima

VW Toureg

VW Jetta

Mercedes E300

Audi A8

Audi Q5

BMW 5

Advanced Electric Drive Vehicles Coming Soon

Plug-in Hybrids


Fiskar Karma


Chevy Volt


Ford Escape


Prius


Audi A1


BYD F3DM


Volvo V70


Fiskar Nina

All-electric


Audi e-Tron


Nissan Leaf


BMW Megacity


BYD E6


Coda


Ford Focus


Mitsu. iMEV


Smart


Tesla S

Fuel Cell Electric (2015-16 Intro.)


Honda Clarity

Mercedes B


GM


Toyota


Ford Transit


Toyota IQ

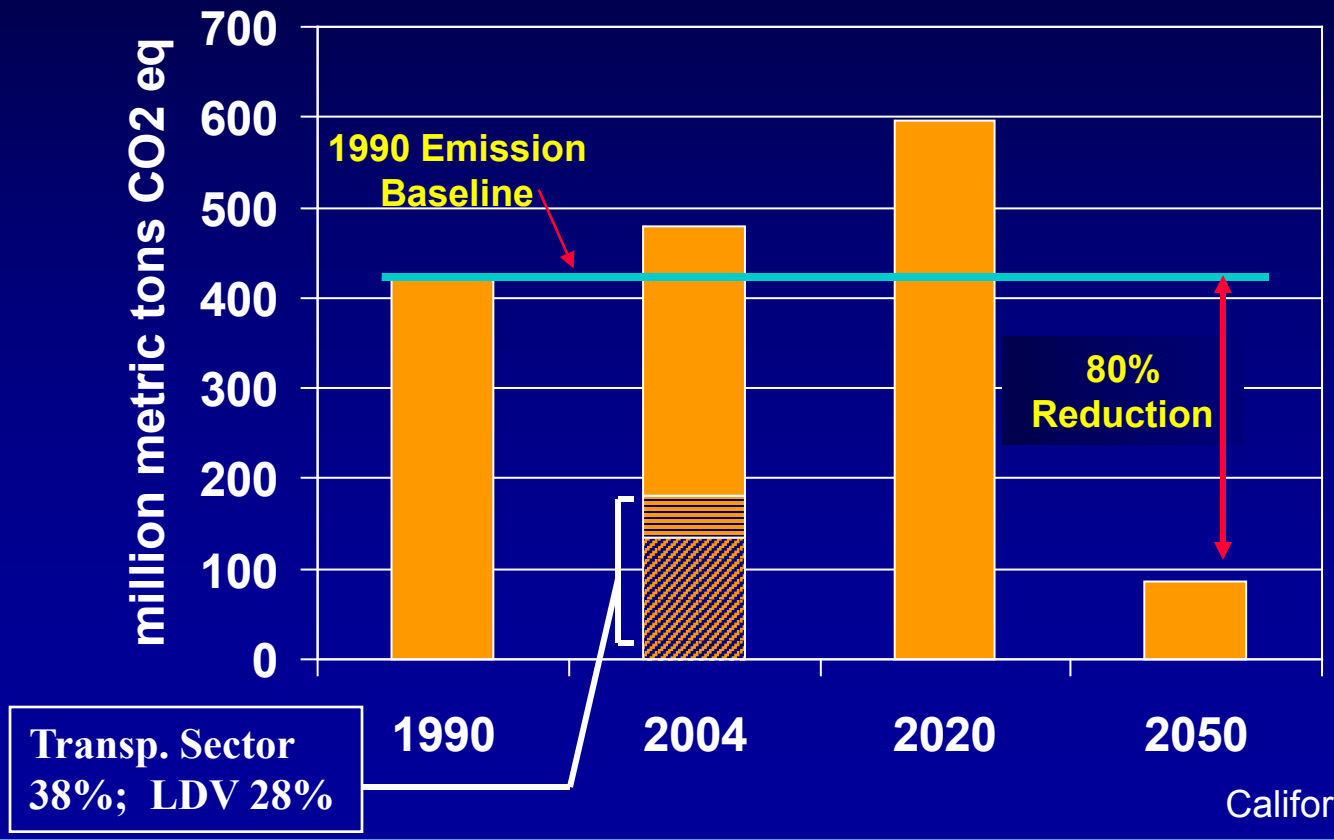
Preliminary Observations by CARB*
of Ability to Further Reduce GHG Emissions

- Lifetime fuel savings larger than higher initial cost of vehicle
  - By 3 to 7 times
- Breakeven point is 2 to 4 years

* CARB assessment, not necessarily reflective of the final joint Technical Assessment Report

Achieving an 80% GHG Reduction by 2050

Magnitude of the Challenge - All Sources

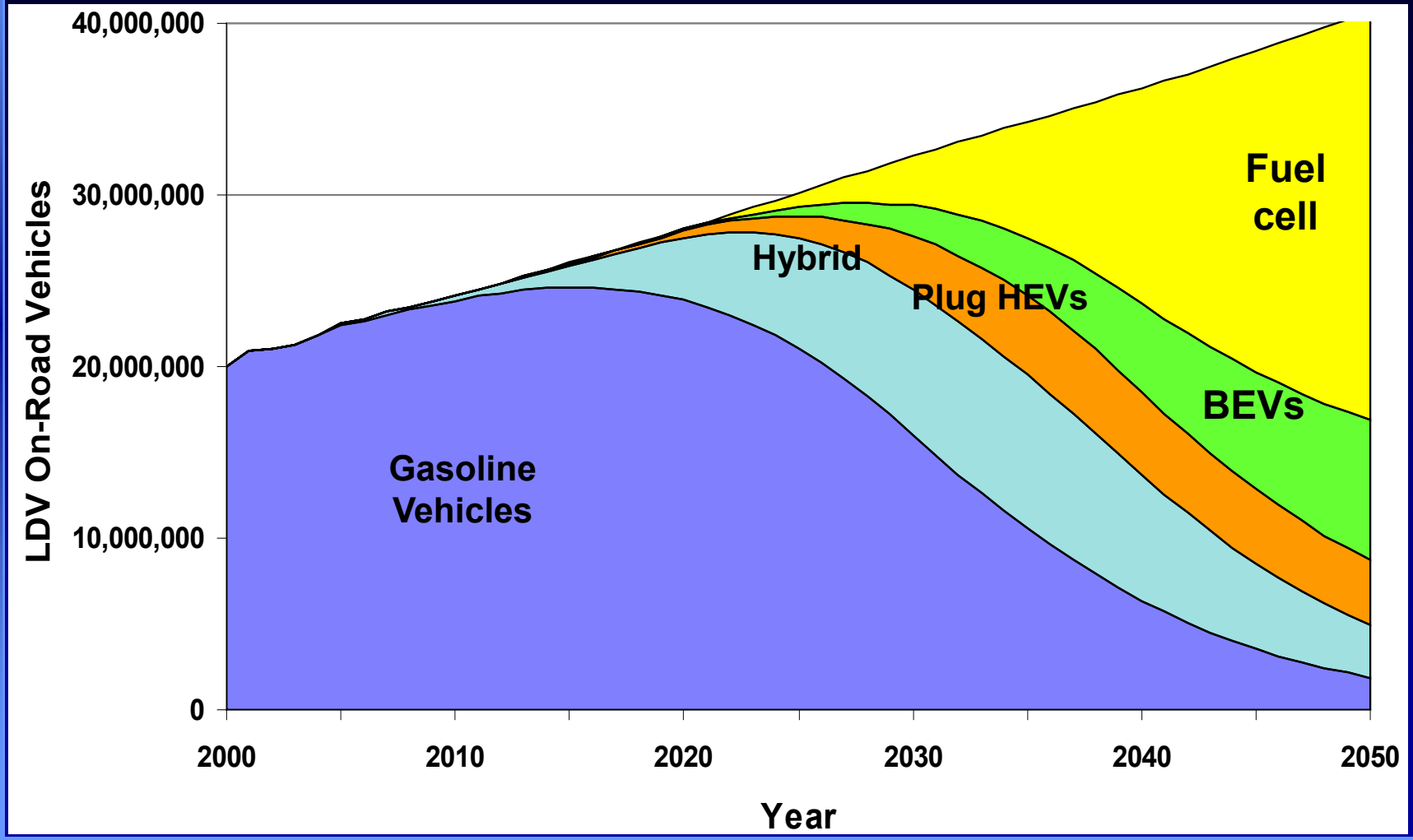


Formula for an 80% Reduction
in Passenger Vehicle GHG Emissions by 2050

- Extremely efficient vehicles
  - ~3X improvement
- Low carbon fuels
  - 50+% lower carbon content
  - Electricity and H2: renewable or w/ CCS
  - Renewable bio-fuels likely used for “other” transportation sources
- Reduce VMT
  - ~15% reduction target for local govt. by 2035

On-Road Passenger Vehicles

One Scenario to Achieve 80% Reduction by 2050



Steps by CA to Reduce Carbon Intensity of Fuels

- Low Carbon Fuel Standard
  - 10% reduction by 2020
- Alternative fuel investment: ~$120M/yr
- Renewable Electricity Standard
  - 33% renewable by 2020
- Hydrogen renewable standard:
  - 33% GHG reduction
- Nation needs similar, comprehensive energy policy for transportation fuels

Summary

- Technology to reduce GHG emissions by ~40%* (nearly double mpg) available by 2025, and cost effective
- Further GHG reductions will require widespread commercialization of Plug EVs and FCVs
- Low carbon transportation fuels essential
- National transportation energy policy and action needed
  - Infrastructure development for H2 and EVs needed
- Extremely challenging, but possible – and necessary
  - Will take a long time – need to start now

* Compared to 2016 models