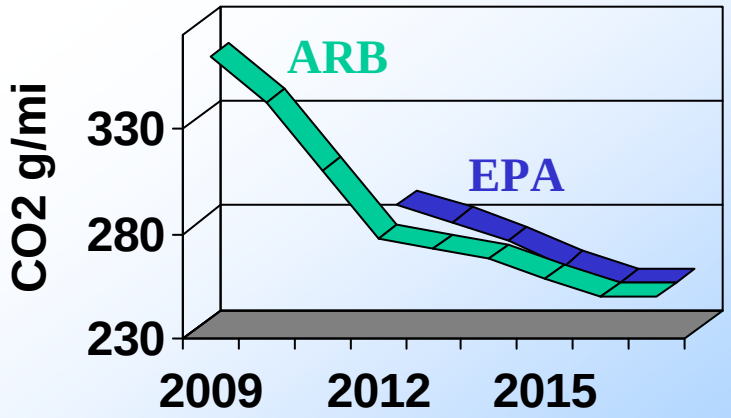
Staff Update on Recent Activities to Support Development of More Stringent GHG Emission Standards for Model Year 2017-2025 Passenger Vehicles

Meeting of the Air Resources Board

October 21, 2010

Current GHG Standards in California

- Adopted 2004
- EPA waiver received 2009
- Standards began w/ 2009 models
- EPA adopted similar standards for 2012-16 models
  - Auto manufacturers agree standards feasible
- ARB allows Federal compliance to satisfy CA requirements
  - 2012-2016 models
  - One fleet meets both state and federal requirements



Greenhouse Gas Standards:
2017+ Passenger Vehicles

- In May, President directs EPA & NHTSA to develop GHG and fuel economy standards for 2017-2025 model passenger vehicles
  - Requests CA participate in technical assessment
    - Report by Sept. 30
  - Governor accepts
  - ARB requests report evaluate a range of annual GHG improvements
    - 3% to 6% per year

GHG Standards Evaluated - 2025 Models

Scenario (Improvement/yr)	CO2 gpm	MPGe* (test)	~ MPGe* (on-road)
0% - 2016	**250**	35	28
3%	**190**	47	37
4%	**173**	51	41
5%	**158**	56	45
6%	**143**	62	50

*** Average of passenger vehicles, national fleet mix. MPGe assumes all reduction is from tailpipe.**

Information Used

- Meetings with stakeholders
- Drivetrain modeling (Ricardo)
- Mass reduction study (Lotus)
- Vehicle teardowns - cost (FEV)
- Battery cost (DoE)
- OMEGA Compliance model (EPA)
  - Selects optimum approach given costs and GHG reduction achieved by various technologies
  - Assumed industry average company

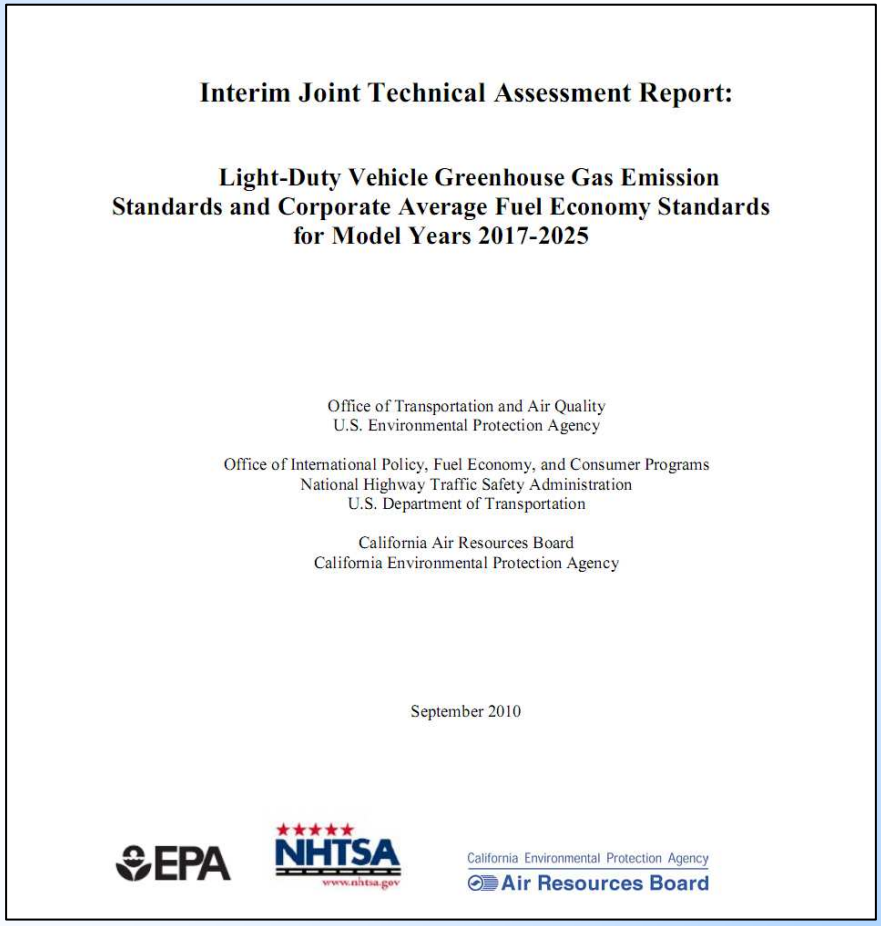
Primary Technologies Evaluated
(relative to 2016 models)

- Mass reduction (~15 to 25%)
  - 10% reduction → 6% FE increase
- Improved gasoline engines
  - Downsized, cooled EGR, high turbo boost
- Strong hybrids (P2 and 2 mode)
- Plug electric vehicles
  - Plug hybrid and pure battery EV

4 Technology Pathways Evaluated

- Manufacturers may choose different approaches to reduce GHG emissions
  A. Hybrid focus (e.g. Prius)
  B. Mix of A and C
  C. Advanced engines and mass reduction focus
  D. Electric vehicle focus
- Each pathway evaluated for 3-6% annual improvement in GHG emissions
- Results for Pathway B presented today

Results



Interim Joint Technical Assessment Report:

Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards for Model Years 2017-2025

Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Office of International Policy, Fuel Economy, and Consumer Programs
National Highway Traffic Safety Administration
U.S. Department of Transportation

California Air Resources Board
California Environmental Protection Agency

September 2010

EPA NHTSA www.nhtsa.gov California Environmental Protection Agency Air Resources Board

Technology Needed for Compliance - 2025 Models

Stringency, % GHG change/yr	Mass Reduction*		Advanced engine, %	HEVs, %	Plug EV, %
	#s	%			
3%	658	18	52	3	0
4%	733	20	63	18	0
5%	733	20	49	43	1
6%	712	19	44	47	9

*** Limited to a maximum 20% in this Scenario B**

Technology Observations for this Scenario

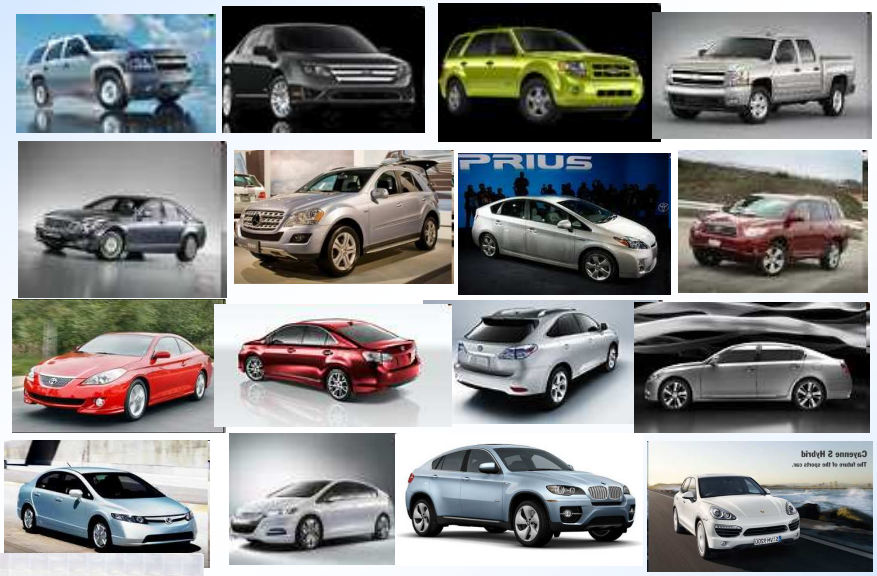
- Technology is available to meet up to 6%/year GHG improvement
- Mass reduction is most cost effective
- Highly efficient gasoline engines important for reducing GHG
- Significant growth in hybrids needed except at lowest annual improvement
- Plug EVs only necessary if standards require 6% annual GHG reduction

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


GM


Toyota


Ford Transit


Toyota IQ

New Vehicle Price Increase

Stringency, % GHG change/yr	Incremental Price*	
	Cars	Trucks
3%	$753	$1,047
4%	$1,070	$2,465
5%	$1,748	$3,335
6%	$2,698	$4,327

* Scenario B

Life Cycle Costs*

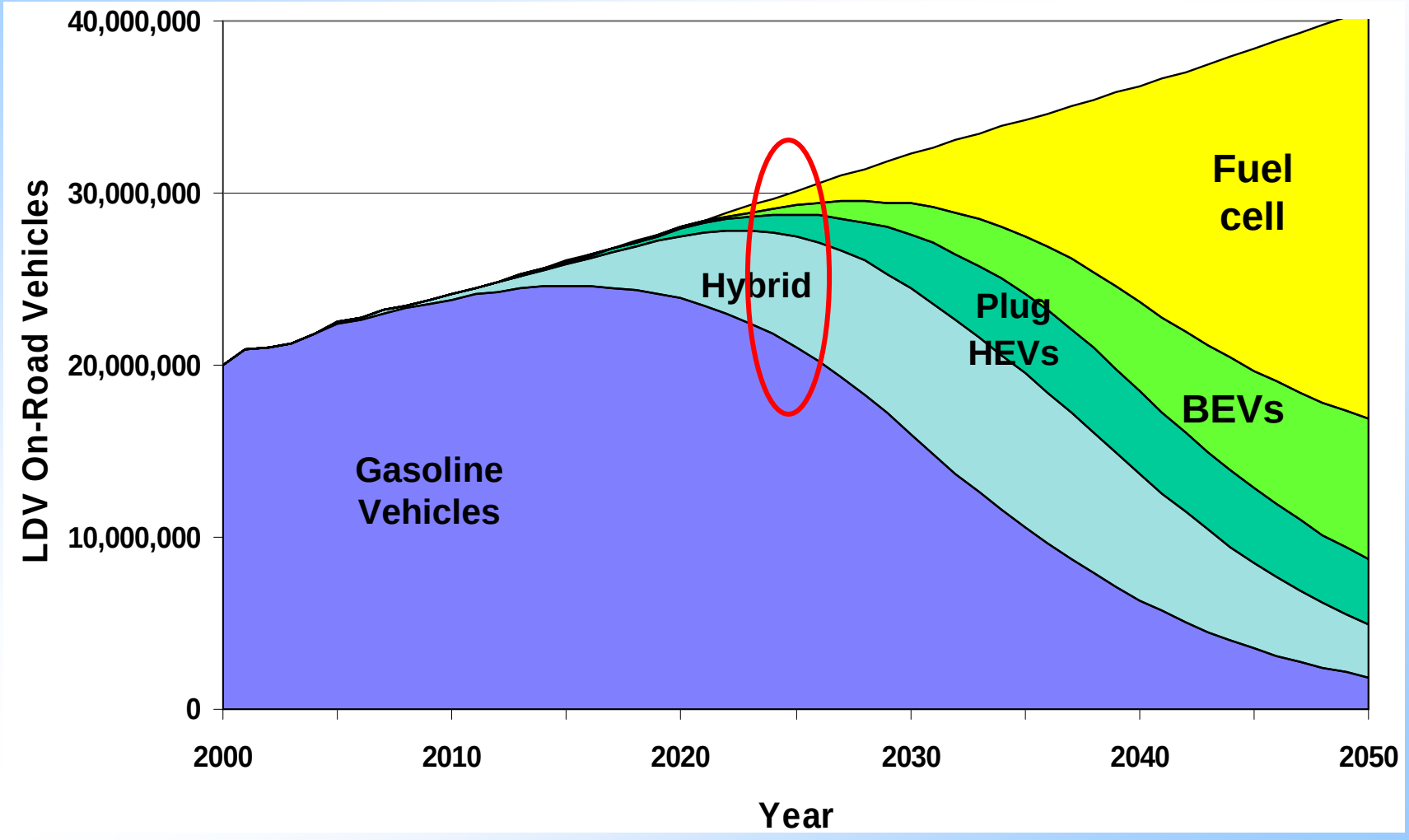
Stringency, % GHG change/yr	Incremental vehicle price, fleet	Fuel savings	Breakeven point, years
3%	$849	$5,933	1.5
4%	$1,522	$7,563	2.2
5%	$2,263	$9,222	2.8
6%	$3,227	$10,606	3.7

* Scenario B

Cost Observations for this Scenario

- Lifetime fuel savings far exceed new vehicle price increase
- First owner breaks even on net cost
  - 4 years or less

Roadmap to Reduce GHG by 80% by 2050*



* One possible scenario

On the Path to 2050 Goal?

	Cum. # Adv. Veh's. in 2025, millions	
	6% annual GHG ↓	"2050" plan, (in 2025)
HEVs	4 M	5.9 M
EVs (Plug-EVs/FCVs)	0.5 M	2.7 M

Observations re: 2050 Plan

- GHG standards for 2017-25 need to be at upper end of stringency evaluated
- The ZEV program is needed to help jumpstart commercialization of advanced, electric drive vehicles
- Beyond 2025 rapid change to electric drive vehicles with low carbon intensity fuels is needed to meet 2050 goal

Next Steps

- Continue to work with EPA/NHTSA
  - Complete on-going studies
- Refine technical and economic assessments needed for ISOR
- Proposal to Board in early 2011
- EPA/NHTSA standards in late 2012
  - One national standard possible?