



Briefings for State of Colorado

# California Vehicle and Fuels Programs

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California Air Resources Board

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# Program Components

- Low Emission Vehicle program
  - LEV II
  - ZEV
  - GHG
- Reformulated fuels
- Low Carbon Fuel Standard



# LEV I

- Adopted 1990
- Applicable to light- and medium-duty vehicles
- Four emission categories
  - TLEV, LEV, ULEV and ZEV
- LDT2 standards slightly higher than PC
- Declining fleet average requirement
- Implemented successfully



## LEV II

- Sport Utility Vehicles (SUVs) and pickup trucks must meet passenger car standards
- Lower emission standards for all categories
  - NO<sub>x</sub>
  - NMOG fleet average
- Standards are fuel neutral based on lowest emission (gasoline) technology
- Near-zero evaporative standards
- Successful implementation underway

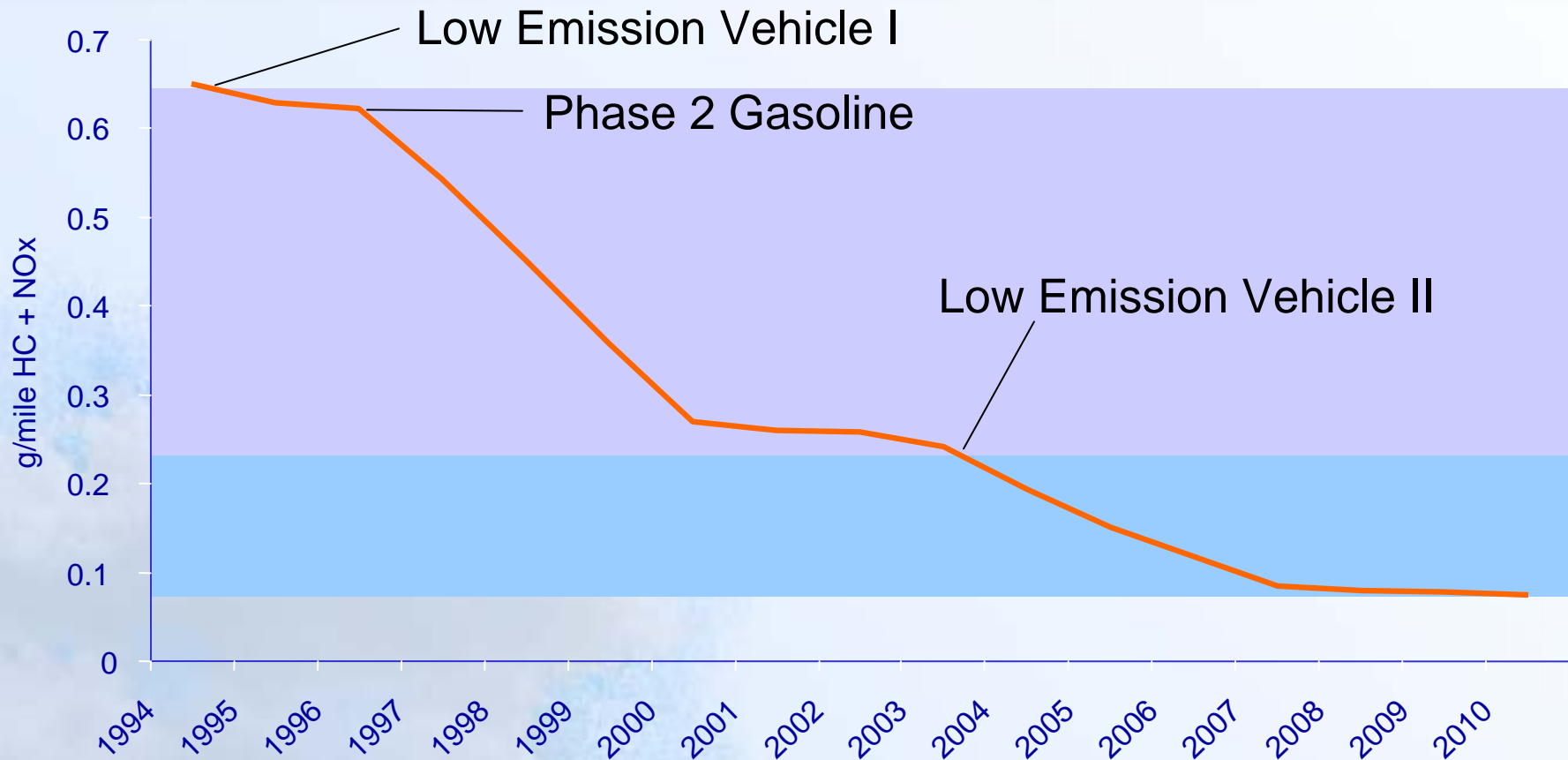


# LEV II Plus

- Adopted December 27, 2000
- Requirements
  - If a federal vehicle is cleaner than a California vehicle, manufacturer must sell the cleaner federal vehicle in California
  - Vehicles must comply with California evaporative, OBD II, warranty, and label requirements



# Declining Fleet Average Emissions





# Zero Emission Vehicle (ZEV) Program

## Category

## Typical Vehicles

Pure ZEV (“gold”)

H2 fuel cell, battery EV

AT PZEV (“silver”)

CNG, hybrid, hydrogen ICE,  
grid connect hybrid, methanol  
fuel cell

PZEV (“bronze”)

Extremely clean gasoline ICE



# PZEV Criteria

- SULEV (most stringent) exhaust emissions
- Zero evaporative emissions
- 15 year/ 150,000 mile emissions warranty
- On-board diagnostics (OBD)



# AT PZEV Criteria

- PZEV emissions plus “ZEV-enabling” technology
  - Zero emission range
  - Low fuel cycle emissions
  - Advanced ZEV componentry (electric drive)



# When Other States Adopt California Program

- PZEV, AT PZEV
  - Manufacturers must meet percentage requirements in each state
- ZEV
  - Through 2012, the requirement applies cumulatively across all LEV II states (additional states do not increase manufacturer obligation)



# GHG Reduction Regulation

- Authorized by Legislature July 2002
  - Maximum feasible and cost-effective reduction in greenhouse gas emissions
- Adopted by Board September 2004
- Legislative review completed 2005
- Regulations apply to 2009 and later model years
- Stringency increases through 2016



# Strong Technical Basis for Regulation

- International Vehicle Technology Symposium
- Comprehensive technical and economic studies
  - Technology evaluation by auto industry consultants
  - Economic modeling by UC professors
- Independent academic peer review



# Extensive Public Process

- September 26, 2002 Board Meeting
- December 3, 2002 Workshop (Emission Inventory)
- March 11-13, 2003 Vehicle Technology Symposium
- September 18, 2003 Workshop (Standards, Economics)
- October 14, 2003 Workshop (Alternative Compliance)
- November 20, 2003 Board Meeting
- February 18, 2004 Workshop (Environmental Justice)
- April 20, 2004 Workshop (Technology Assessment)
- July 6, 2004 Workshop (Environmental Justice)
- July 7, 2004 Workshop (Draft Staff Report)
- July 8, 2004 Workshop (Environmental Justice)
- July 13, 2004 Workshop (Environmental Justice)
- September 23-24, 2004 Board Meeting



# Structure of Regulation

- Fleet average standards
- Two categories (as in LEV II)
  - PC/LDT1
  - LDT2
- Exemption for work trucks
- Credit trading allowed
- Less stringent requirements for small volume manufacturers



# Regulated Pollutants and Sources

- Standard applies to:
  - Combined GHG emissions (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs)
  - All vehicular GHG sources (tailpipe, air conditioner)
- Standard expressed as “CO<sub>2</sub>-equivalent”
  - Emissions weighted according to global warming potential



# Standards Designed So All Models Can Comply

- Standards set to be feasible for manufacturer with heaviest fleet
  - Ensures all manufacturers can comply without altering their fleet mix
- Even the largest SUVs able to comply
- Consumer choice maintained
  - All models remain available to consumers



# Fleet Average Emission Standards

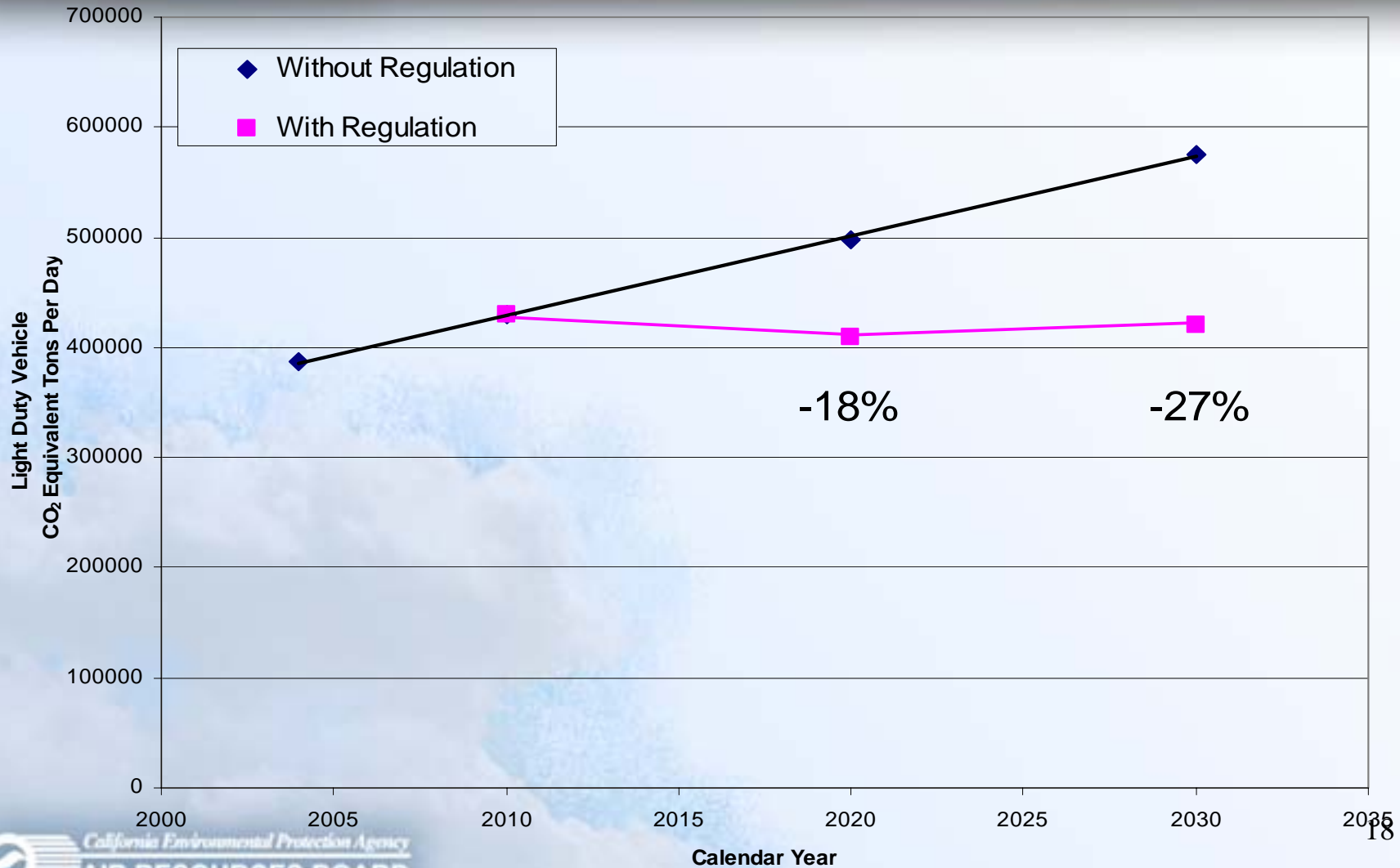
Tier	Year	CO <sub>2</sub> -equivalent emission standards (g/km)	
		PC/LDT1	LDT2
Near-term	2009	202	274
	2010	188	262
	2011	167	244
	2012	146	226
Mid-term	2013	142	222
	2014	139	219
	2015	133	213
	2016	128	208

~22% reduction in 2012

~30% reduction in 2016



# Effect on Climate Change Emissions





# Available Technologies (Near-Term)

- Variable valve timing and lift
- Turbocharging
- Cylinder deactivation
- Improved multi-speed transmissions
- Electric power steering
- Improved alternator
- Gasoline direct injection
- More efficient, low-leak air conditioning



# Available Technologies



Cylinder Deactivation

6%\*

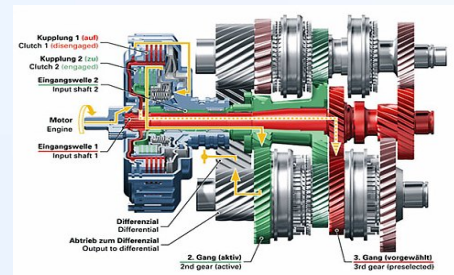


2005 Chrysler 300C Hemi



Audi TT 3.2 V6

7%\*



Automated Manual Transmission

\* % CO<sub>2</sub> reduction, large car



# Available Technologies



**Acura RSX**



**Variable valve timing and lift**



**Honda Accord**

**4%**

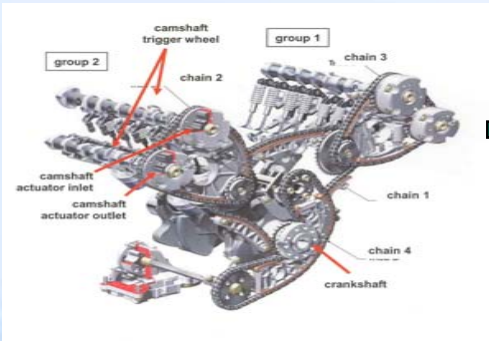


**Toyota Matrix**



# Available Technologies

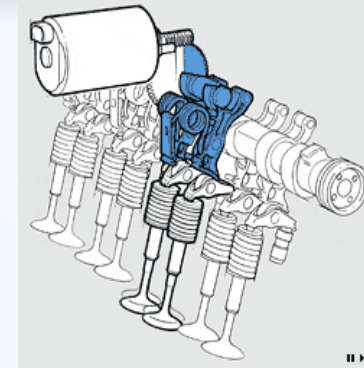
## Gasoline Direct Injection w/dual cam phasers



5%



2005 Audi A4



## BMW Valvetronic

(continuously variable valve timing and lift)

6%



BMW 5 Series



Volvo S60

8%



Turbocharger

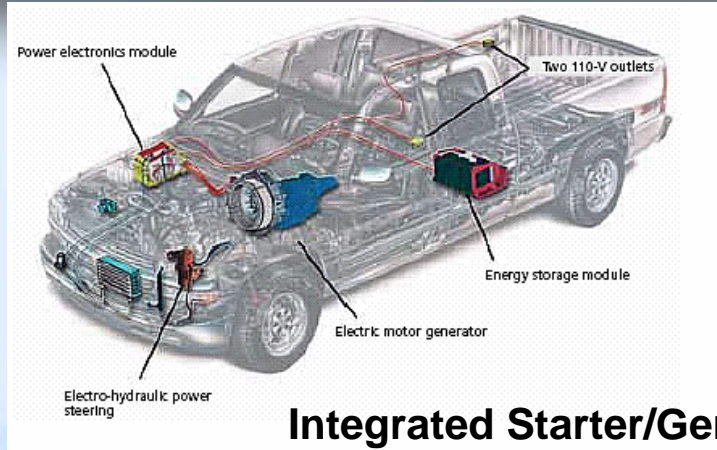


# Emerging Technologies (Mid-Term)

- Integrated starter/generator
- Camless valve actuation
- Gasoline homogeneous charge compression ignition
- More efficient, low-leak R-152a air conditioning system



# Emerging Technologies

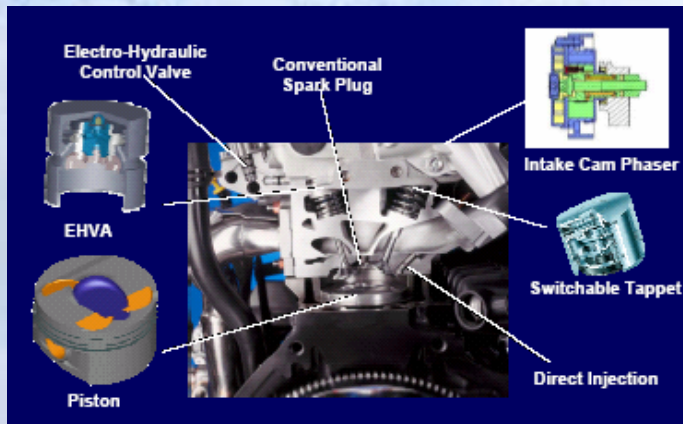


**Integrated Starter/Generator**

4%  
→

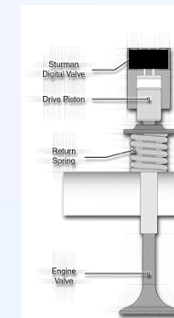


**2005 Chevrolet Silverado**



**Homogeneous Combustion Compression Ignition**

6%



16%

**Camless Valve Actuation**



# Available Technologies Not Considered

- Gasoline hybrids
  - Prius, Escape, Civic
- Diesel
  - E320, Jetta TDI
- Not considered in setting stringency of GHG standard
  - HEV: Not yet widely available
  - Diesel: Emission compliance not certain



# Average Price Increase of New Low GHG Vehicles

	Retail Vehicle Price Increase	
	Passenger Cars Light Trucks/SUVs	Large Trucks/SUVs
Near Term 2012	\$367	\$277
Mid Term 2016	\$1064	\$1029



# Net Savings for Consumer (Passenger Cars and Small Trucks)

	Near Term (2012)	Mid Term (2016)
Monthly Payment Increase	\$7	\$20
Monthly Operating Cost Savings	\$18	\$23
<b>Monthly Net Savings</b>	<b>\$11</b>	<b>\$3</b>

Assumes fuel price of \$1.74 per gallon

The logo for the California Reformulated Gasoline Program features a stylized sun on the left, composed of a large circle with a smaller circle inside, and a series of horizontal lines on the right that resemble the stripes of the American flag. The text "California Reformulated Gasoline Program" is centered over the logo in a bold, yellow, sans-serif font.

# California Reformulated Gasoline Program

# California Reformulated Gasoline Program

- First approved in 1990
- CaRFG program designed in 2 phases
  - Phase 1 implemented in 1992
    - lowered the RVP limit, eliminated lead, and required deposit control additives
  - Phase 2 implemented in 1996
    - Set Limits on:

Sulfur	RVP (Summertime)
T50	Benzene
T90	Aromatic Hydrocarbons
Olefins	Oxygen Content

# California Reformulated Gasoline Program

- ➡ Phase 3 approved on December 9, 1999
  - Implemented the MTBE ban
  - Provided flexibility to produce MTBE-free gas
  - Enhanced emission benefits
  - Led to increased ethanol use
- ➡ Phase 3 Amendments recently approved in June 2007
  - Requires the permeation increase associated with ethanol use from on-road motor vehicles to be mitigated
  - lowered the sulfur cap



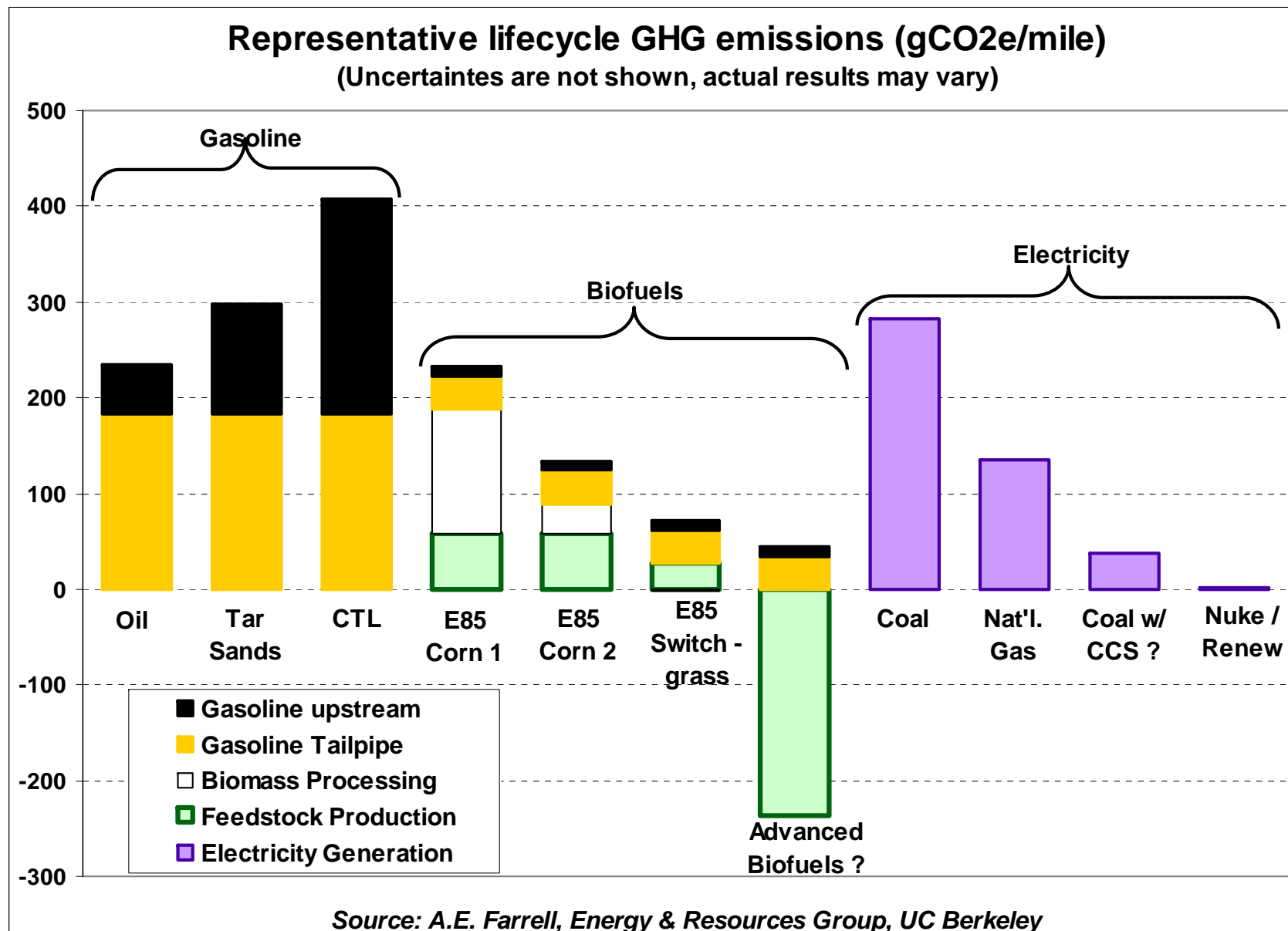
September 13, 2007



*California Environmental Protection Agency*

**AIR RESOURCES BOARD**

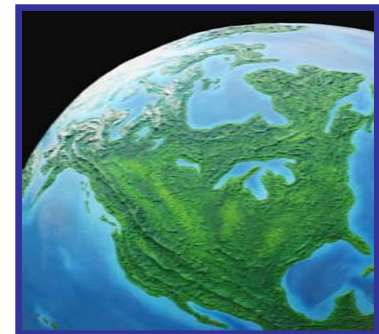
# GHG emissions depend on how the fuel is made





# Benefits of LCFS

- Help to meet the GHG reduction goals of AB32
- Reduce dependency on petroleum-based fuels by displacing 20% gasoline consumption
- Diversify California's options for transportation fuels





## LCFS Benefits (Cont')

- Create a market for low carbon fuels and a stable investment environment
- Enlarge renewable fuels market by expanding California's alternative fuels markets by 3 to 5 times, while reducing GHG emissions
- Promote direction of technology innovation with lower carbon foot-print
- Promote more alternative fuel and hybrid vehicles



# Development of LCFS: Key Principles

- **Governs intensity.** Not amount of fuel sold
- **Measured on lifecycle basis.** Fuel providers must decrease overall greenhouse gas emissions
- **Market-based.** Allows averaging, banking and trading to lower cost and provide flexibility
- **Performance-based.** Sets carbon reduction standards and methods to calculate compliance
- **Fuel-neutral.** Fuel providers can choose which fuels to sell and in what volumes



# Development of LCFS: Flexible Options for Compliance

Fuel providers will have different options by which to comply, including:

- Only produce fuels that meet the standard
- Selling a mix of higher and lower carbon fuels that on average meet the standard
- Using previously banked credits
- Purchasing credits from other fuel providers who earned credits by exceeding the standard



# LCFS Schedule

<b>2007</b>	University of California completes LCFS study with CEC & ARB
<b>2007-2008</b>	Conduct LCFS workshops
<b>Early 2008</b>	Initiate draft regulatory language
<b>Fall 2008</b>	Regulatory package completed
<b>End of 2008</b>	LCFS regulation submitted to the Board for consideration
<b>2009</b>	Regulation submitted to Office of Administrative Law
<b>2010-2020</b>	Implementation