

Fast Changing Directions in Drivetrains and Emissions



*Advanced Transportation
Technologies*

*Clean Transportation
Solutions* SM

John Boesel
President and CEO
DEER 2010 Conference
Detroit, Michigan
September 28, 2010

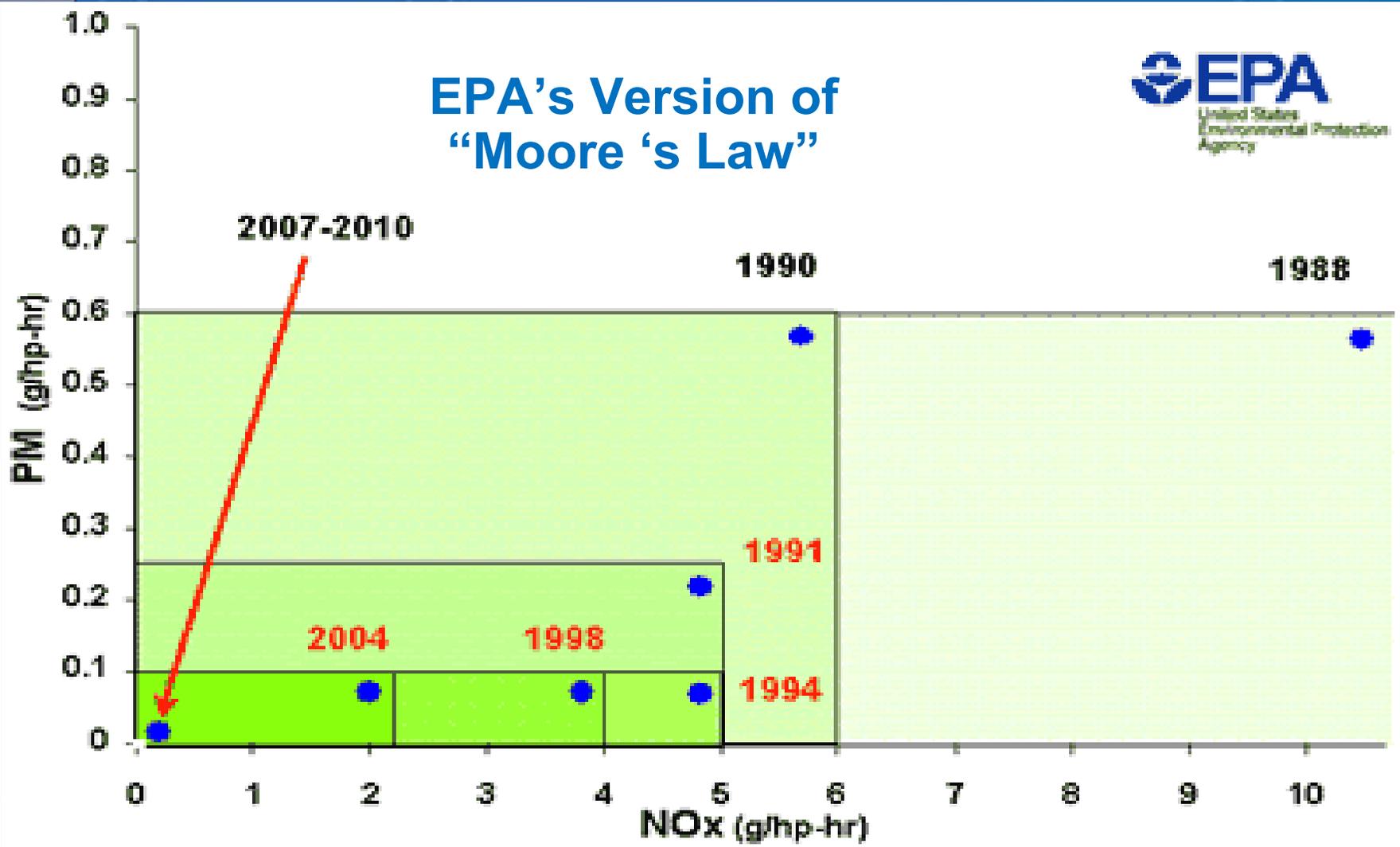


Outline

- **CALSTART - a Brief Overview**
 - **Spotlight on HD Diesel Hybrid Program**
- **Policy and Regulatory Trends Impacting RD&D Investment Decisions**
 - **Identification of opportunities**
- **Few Thoughts on U.S. Energy Policy**
- **Concluding Remarks**



EPA's On-Road Heavy-Duty Vehicle Criteria Emission Program





MISSION STATEMENT

CALSTART is dedicated to *rapidly accelerating* the growth of the clean transportation technology industry in order to:

- **To build companies and create jobs;**
- **Clean the air;**
- **Secure the nation's transportation energy future; and**
- **Reduce greenhouse gas emissions**

CALSTART Has 140+ Members

(*partial list*)





CALSTART's Four-Part Role to Grow the Clean Transportation Technology Industry

Member Services

Providing value-add services to companies: timely information, partnering, new business opportunities, conferences, technology evaluation

Fleet & Port Consulting

Helping ports, property developers, transit districts, and fleets seeking to implement cost-effective customized solutions

Technology Commercialization

Identifying opportunities, building teams, securing funding, and advancing technology, vehicles, fuels, and systems

**Unique
Combination!**

*Fuel &
Technology
Neutral = Honest
Broker*

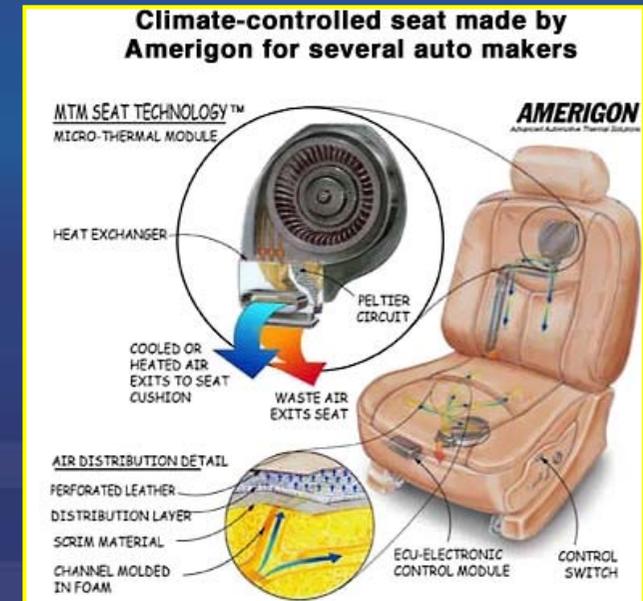
Policy

Advancing key policies, advising policymakers, and helping companies plan for the future



Amerigon/BSST – a CALSTART Success Story

- Amerigon – BSST began operations in CALSTART business incubator in 1993. CALSTART helped Amerigon secure public funding to develop technology.
- A publicly traded company listed on the NASDAQ (ARGN), Amerigon's product is available in 20 different cars with five different automakers
- Amerigon operates with healthy gross margins and positive net income
- Amerigon's subsidiary, BSST, is exploring ways to use the thermo-electric technology to further improve vehicle efficiency





From Zero to Six Since Inception: Getting Closer to Commercial Take-Off



35 Trucks Took HTUF Conference Ride and Drive – South Bend, IN October 2008

- When CALSTART and the U.S. Army launched the Hybrid Truck Users Forum (HTUF) program in 2001 not a single truck manufacturer had a hybrid truck for sale
- By mid-2008, every major truck manufacturer had one or more hybrid offerings



HTUF: Growth Engine for Hybrid Trucks



- HTUF has supported industry growth by:
 - Providing a forum for communication and action among users (fleets)
 - Organized early adopters and given them the resources to develop and test trucks;
 - Collected, analyzed, and shared data and findings
 - Secured passage of important incentives
 - Helped build momentum and interest

Fleet Leadership Has Been Critical to HTUF Success



- **6 Core Working Groups of fleet truck users now operating, plus:**

- *1 WG partnership with NTEA (light truck)*
- *1 new Forum forming (construction equip.)*
- *1 Task Force: Plug-in HE Trucks (PHET)*

- **Main Working Groups:**

- *Utility/Specialty trucks – George Servant, Florida Power & Light, user lead*
- *Parcel Delivery trucks – Jerry Swart, FedEx Ground; Robert Hall, UPS – user leads*
- *Refuse Truck Working Group – Matt Stewart, City of Chicago Sanitation, user lead*
- *Bus Working Group – Tony Bryant, Tri-Met, user lead (launched with support of Federal Transit Administration)*
- *Class 8 Working Group – active*
- *Incentives Working Group – active*





CALSTART Manages \$20 Million Hybrid Truck Incentive Program for CARB

- October 2009 the California Air Resources Board announced award to CALSTART to manage \$20+ million hybrid truck rebate program; incentives go directly to dealer/fleet
- Incentives vary depending on size of vehicle and energy savings
- CARB funding comes from Assembly Bill 118 program that CALSTART helped establish



Hybrid Trucks at CALSTART conference, Atlanta, October 2009



CARB Hybrid Truck Incentive Program a Major Success



HVIP

HYBRID TRUCK AND BUS
VOUCHER INCENTIVE PROJECT

www.californiahvip.org

TOLL-FREE HOTLINE (9am - 5pm Pacific, M-F)
1-888-457-HVIP or - 1-888-457-4847

Wednesday, February 17, 2010

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SOLD OUT 8/30!!!

FOR DEALERS

FOR FLEETS

FOR VEHICLE MAKERS

- More than 650 trucks & buses to be deployed
- > \$19 million in rebates (vouchers) issued in less than 8 months



Regional Heavy Trucks Popular in HVIP – Developers Target Higher Weights



- Kenworth, Peterbilt, Navistar and Freightliner all have Class 8a regional haul hybrid tractors
 - All developing next generation advanced Class 8 – including electric and hybrid configurations
- Mack showcased advanced hybrid line haul Class 8 (full 80,000 lb GVWR); next stages add more electrification; Peterbilt has several in demonstration



HVIP Vouchers by Weight

As of 8/23

• 10,001 – 14,000	0
• 14,001 – 26,000	236
• 26,001 – 33,000	67
• > 33,001	333 (312 – 8A)

Vouchers Requested by Fleet Type:

<i>Public:</i>	38
<i>Private:</i>	597



Advanced Drivetrain + Clean Fuel = Powerful Combination



- Florida Power & Light (FP&L) fuels this hybrid electric truck on B30 (30% biodiesel) resulting in **approximately 70% less oil** used compared to conventional truck
- Biofuels + Hybrids = Real Synergy (hybrid technology makes maximum use of biofuels and acreage dedicated to fuel)



HTUFTM

hybrid truck users forum



National Conference 2010

September 27-30, 2010

Dearborn, MI



HTUF Conference Sponsors

Joint Co-Hosts



HTUF Partners



HTUF Supporters



HTUF Participants

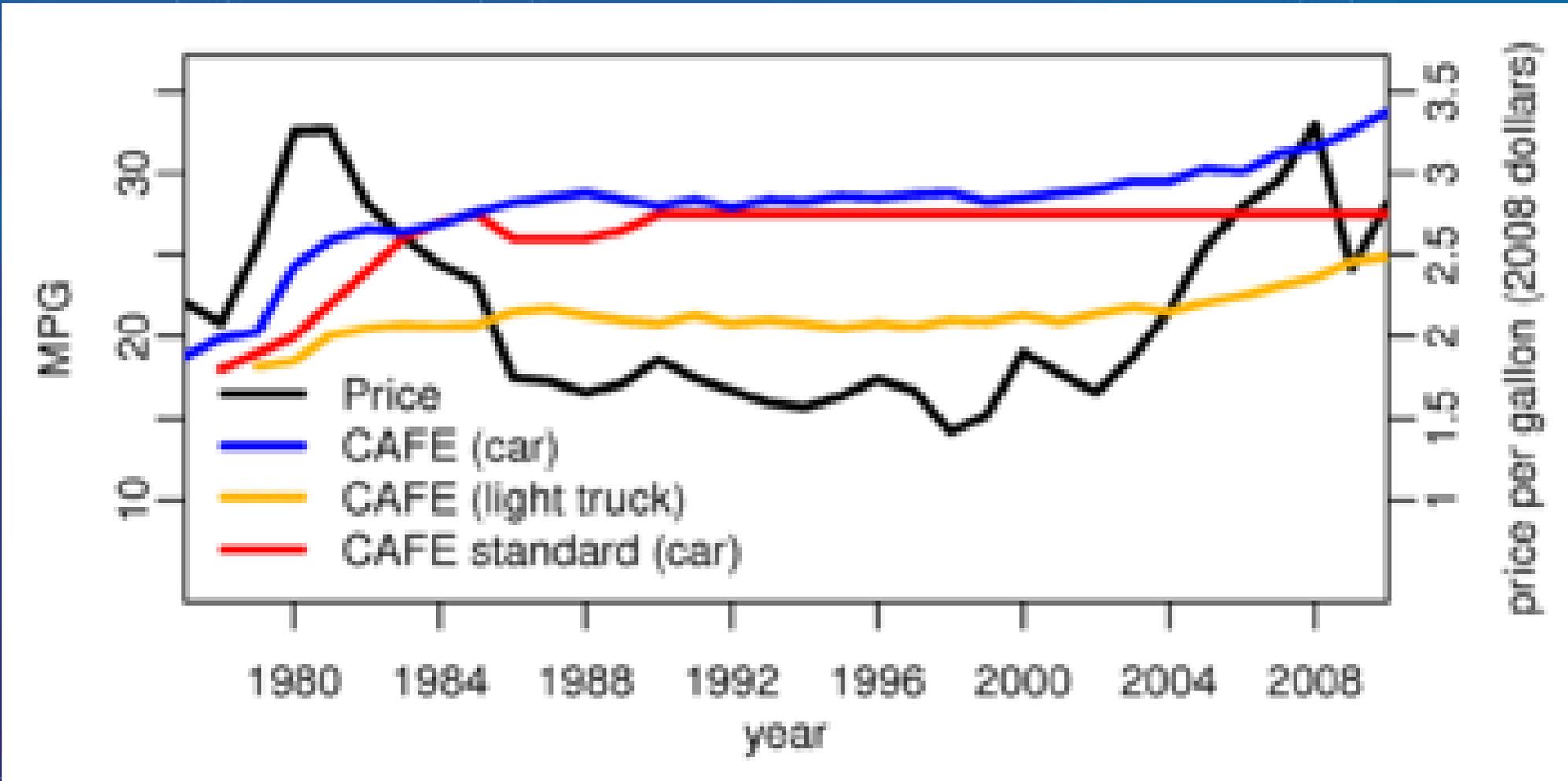




5/20



End of Flat Line Era





President Obama Takes First Action in 25 Years to Boost Veh. Efficiency

May 19, 2009: President Obama announces national fuel efficiency policy modeled after CA's standards

MPG requirements for cars and light trucks will increase from 27.5 to 35 by 2016

Only applies to cars sold between 2012-2016



President with CEO's of Car Companies and Others To Announce New Vehicle Efficiency Standards

Photo: New York Times



MIT Puts Policy into Auto Engineering Formula

Fuel Consumption/Performance/Size Trade-Off

1. A critical question is the extent to which the benefits of improved efficiency technology go to reduce actual fuel consumption.
2. Quantify this with a ***degree of emphasis on reducing fuel consumption*** (ERFC).

ERFC =

$$\frac{\text{Fuel consumption (FC) reduction realized}}{\text{FC reduction attainable with constant performance and size}}$$

Source: Dr. John Heywood Presentation, UCD ITS Asilomar Conference 2007



LEV II LDV Emission Standards

SULEV
New
Minimum
by 2022 –
Draft CARB
Proposal

Vehicle Emission category	Durability basis (miles)	NMOG (g/mi)	NO _x (g/mi)	CO (g/mi)	HCHO (g/mi)	PM (g/mi)
LEV	50,000	0.075	0.05	3.4	0.015	-
	120,000	0.090	0.07	4.2	0.018	0.01
ULEV	50,000	0.040	0.05	1.7	0.008	-
	120,000	0.055	0.07	2.1	0.011	0.01
SULEV	120,000	0.010	0.02	1.0	0.004	0.01
PZEV ^a	150,000	0.010	0.02	1.0	0.004	0.01

^a PZEV has same test emission levels as SULEV but also includes zero-fuel evaporative emission requirement and a 150,000-mile emission warranty

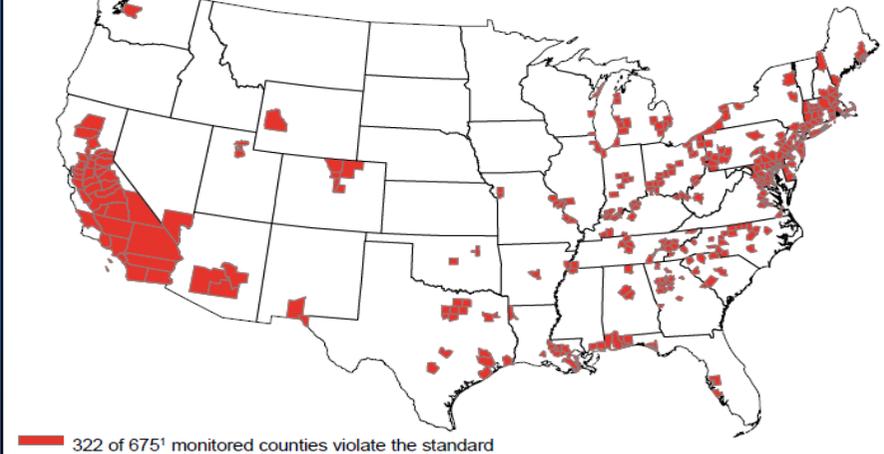


Criteria Emissions – New Ozone Rules Coming

- EPA announces it will strengthen ozone rules to meet health standards
- New rules would drop ozone limits to no more than 0.060 – 0.070 ppm ozone over 8 hours, phased in over up to 20 years
 - Current limit 0.075 ppm
- Hundreds of additional counties will fall into non-compliance (from 322 today up to as many as 650 out of 675 monitored)
- EPA finalizing rule – states would need to outline plans to meet standards by 2013 which go into effect in 2014
- Most-impacted regions would have until 2031 to meet full compliance

Counties With Monitors Violating the March 2008 Ground-Level Ozone Standards

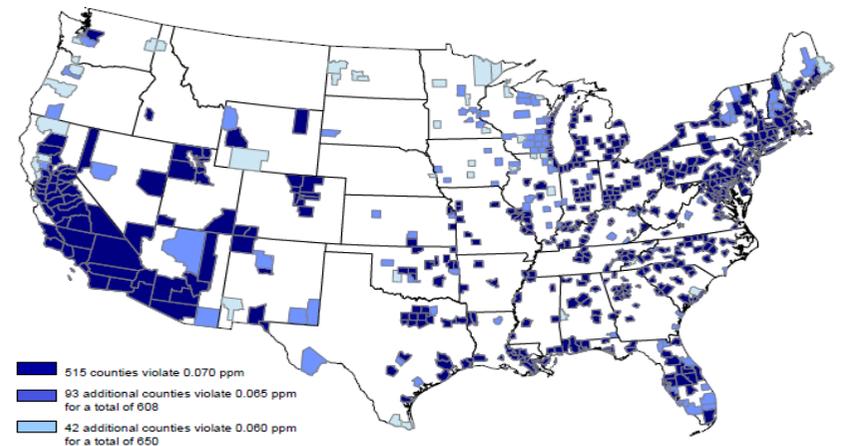
0.075 parts per million
(Based on 2006 – 2008 Air Quality Data)



Counties With Monitors Violating Proposed Primary 8-hour Ground-level Ozone Standards
0.060 - 0.070 parts per million

(Based on 2006 – 2008 Air Quality Data)

EPA will not designate areas as nonattainment on these data, but likely on 2008 – 2010 data which are expected to show improved air quality.





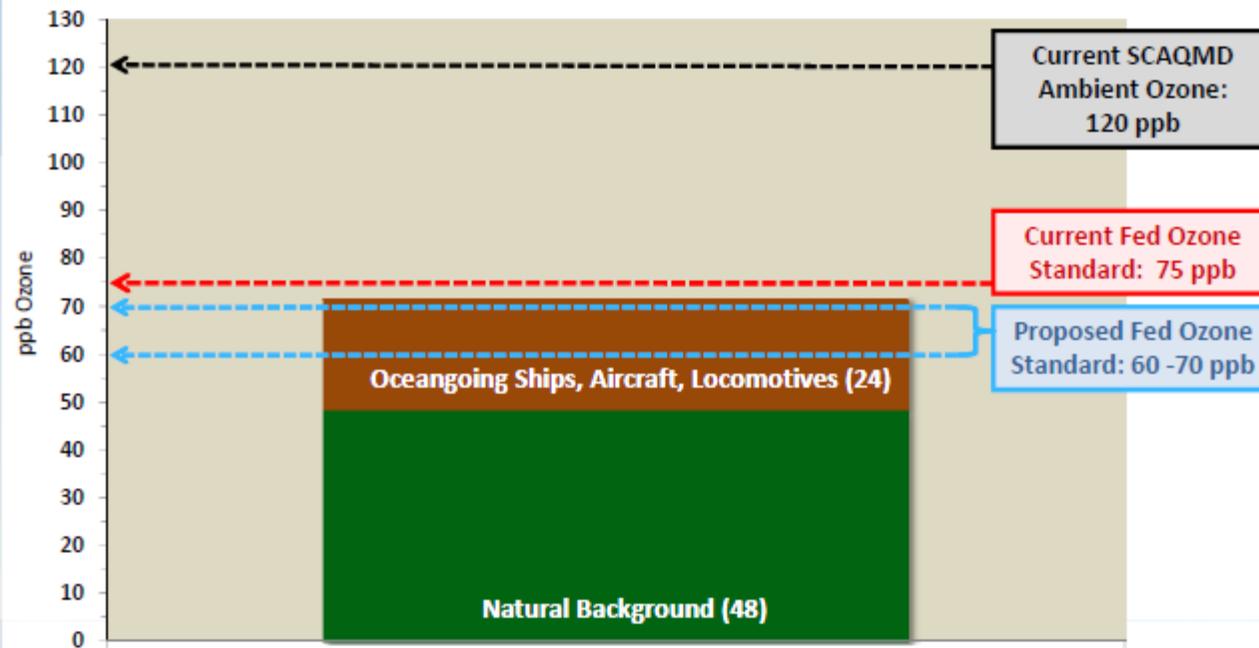
New NAAQS Effectively Would Not Allow For On-Road Emissions in LA Basin

Source:
SCAQMD

2030 Ozone: Source Contributions

Background + Ships + Aircraft + Locomotives = 72 ppb

(With majority Tier 4 Locomotives; Approx 75% Tier 3 Ships)

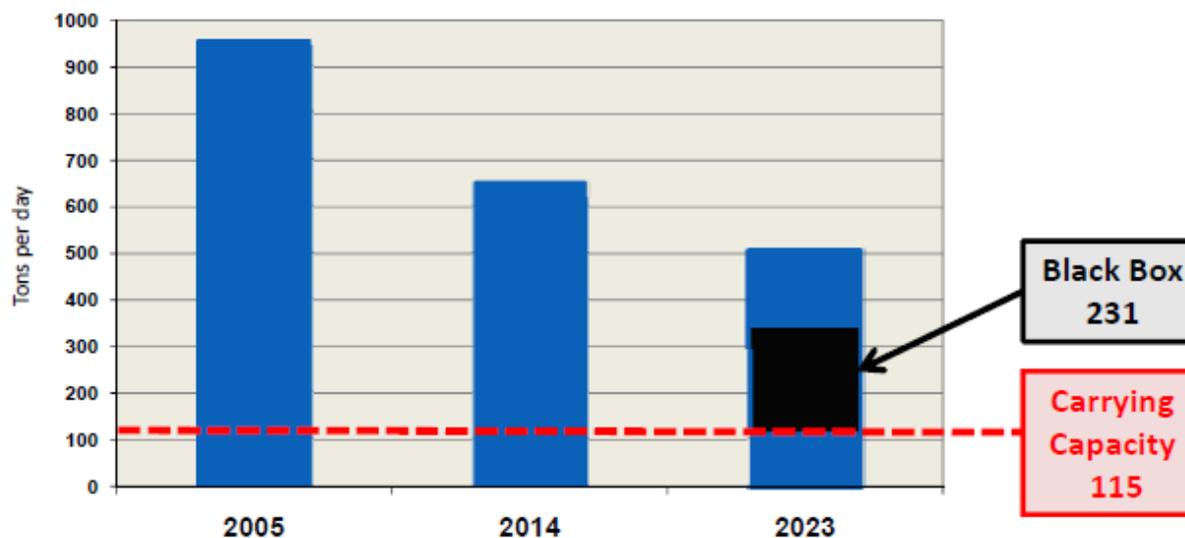




The Black Box = Big Problem Black Goes Away Under New NAAQS

Baseline NOx Emissions and Federal 1997 Ozone Standard Carrying Capacity

*Data from 2007 AQMP
Including benefits of rules adopted to 2007*





Source: SCAQMD

Needed:

75 – 90 percent *additional* NO_x reduction

Timeframe: 2023 - 2030

Requires broad
deployment of zero-emission
technologies, e.g. electric

“Combustion Out”

11

Source: May 2010 Presentation by Peter Greenwald, SCAQMD



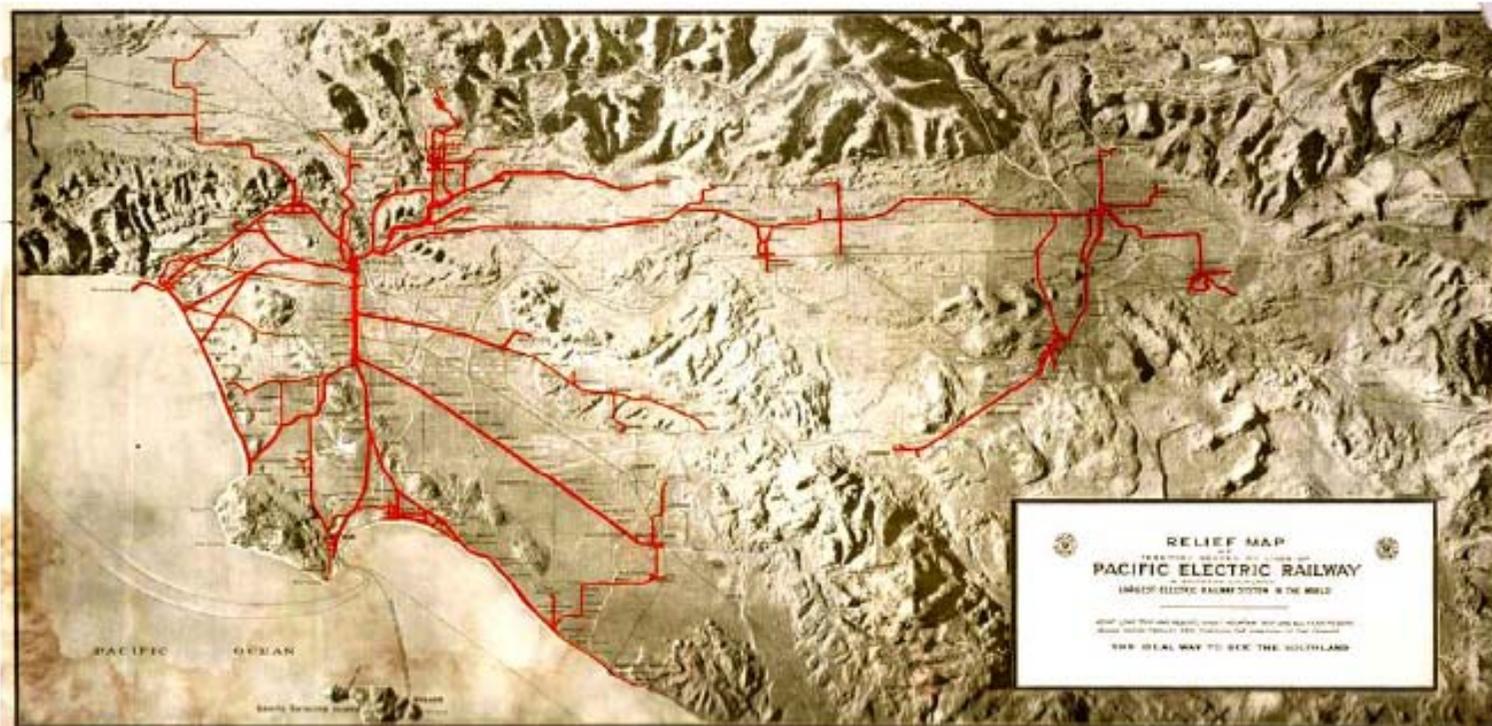
Combustion Out 1944: Electric Regional Rail Transit

Four Counties

1,150 Track Miles

900 Cars

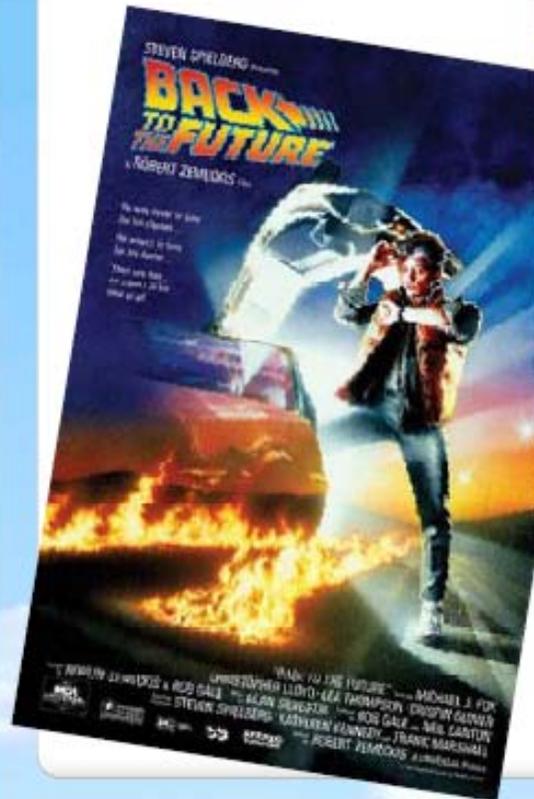
109 Million Passengers



Combustion In



Combustion Out 1948: Electric Transit Buses



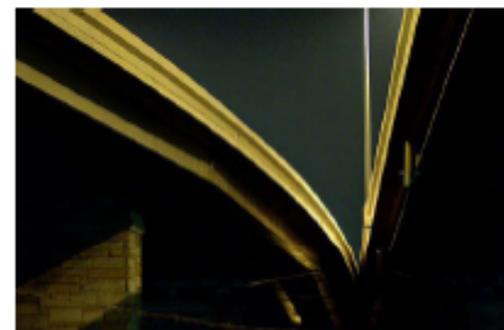
Los Angeles Transit Lines - The Trolley Bus;
One of the final 30 delivered to Los Angeles in '48



Source:
SCAQMD

Use “Convergence” to Build Consensus, cont’d

- Seek design of fed, state, local actions to provide air quality co-benefits
 - E.g. energy, transportation, regulatory
 - More bang for buck; broader support
 - Reduce overlapping regulatory burdens
- Develop local air strategies that also serve national priorities
 - E.g. energy security
- Seek federal funding & support
 - Lead in coordinated solutions





I-710 – The Nation’s Zero Emission Truck Corridor?

- CALSTART is working with Los Angeles County Metro to examine feasibility of zero or near-zero emission & low carbon trucks operating on truck only corridor (18 miles) between ports and rail yards in East Los Angeles
- Air district has signaled expanded capacity only feasible if trucks produce zero emissions
- Corridor has national significance -- 40% of the containers shipped to the U.S. travel through the combined ports of Long Beach and Los Angeles



A zero emission truck only corridor along I-710 could reduce congestion and improve air quality



CA Energy Commission Funds Advanced Truck Research Center

TECHNOLOGY PIPELINE

Research & Development

Vehicle Technologies
Alternative Fuels

PIER
Transportation R&D

Supports

Concept Feasibility
Research Centers
Collaborations
Strategic Partnerships

AB 118
Implementation

Supports

Incentives
Demonstrations
Retrofits
Workforce Training
Workforce Development

Market Transformation

Petroleum Reduction
GHG Reduction
Improved Air Quality

*Cal-HEAT Center Supports PIER
function in Tech Pipeline*

- CALSTART received award from CEC in late 2009 to manage California High Efficiency Advanced Truck (Cal-HEAT) Research Center
- Center will develop roadmap and research agenda for lower carbon, less oil dependent trucks
- Initial grant includes funding for development of 2 prototypes
- Funding from CEC PIER program



CALSTART Played Leadership Role in Establishing AB 118 Program in CA

- **AB 118 (Núñez)** Signed into law by Governor Schwarzenegger in 2007 the program provides \$200 million/year for 7.5 years (\$1.5 billion total) primarily for the purposes of reducing greenhouse gas emissions from the transportation sector
- Program jointly administered by CA Energy Commission (\$120 million) and CARB (\$50 million) – Additional \$30 million for vehicle scrappage program
- Support both research, development, and demonstration of new technologies advanced vehicle incentives, and deployment (incentives) for low carbon fuels and advanced vehicles



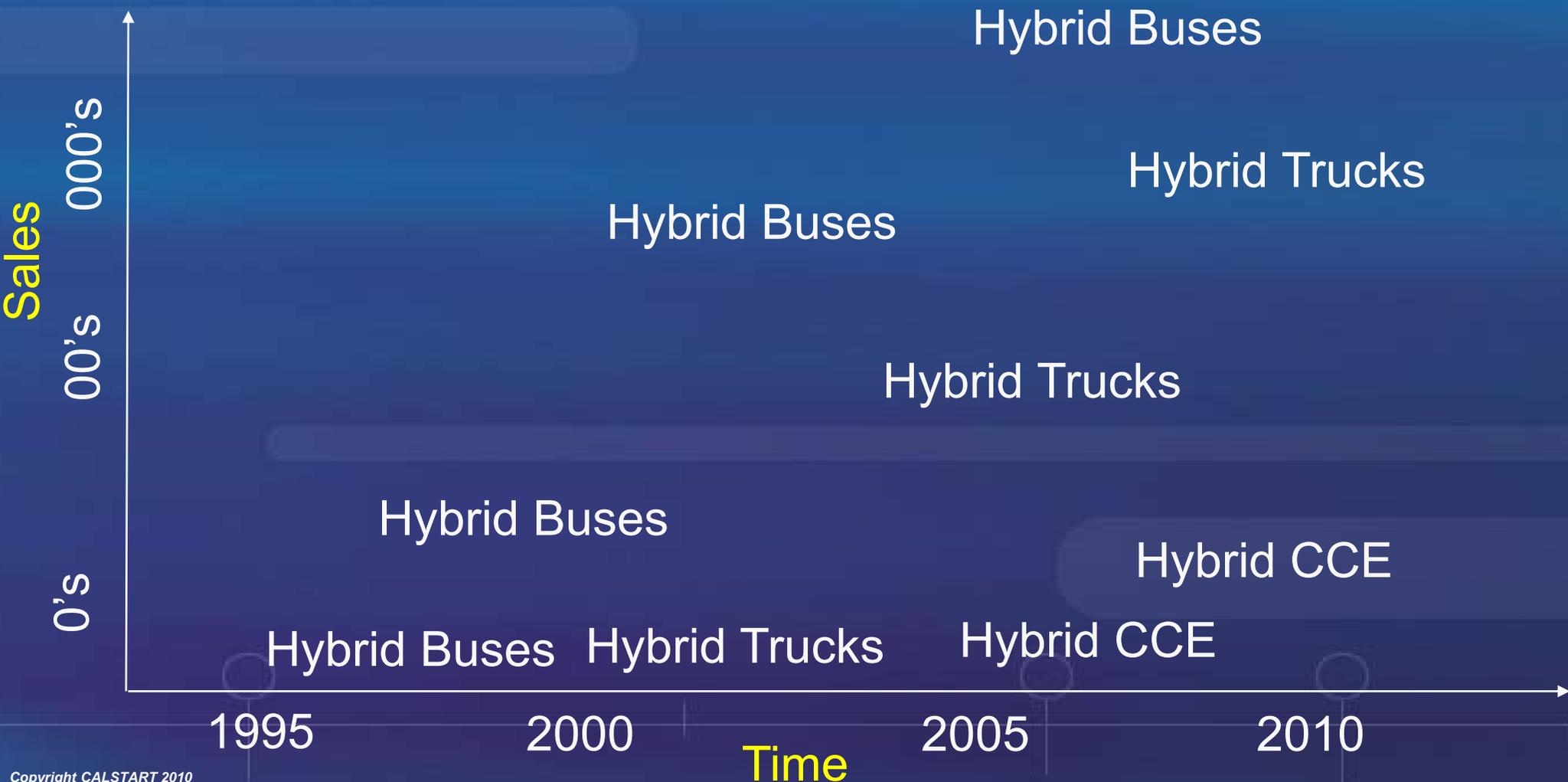
Speaker Núñez



Governor Schwarzenegger



HDV Market Development: Transit Plays Key Role as Early Adopter





CALSTART Leading National Campaign for Fuel Cell & Electric Drive Bus Program

- Existing federal transportation bill includes \$49 million for fuel cell bus research, development, and demonstration
- CALSTART is leading national coalition to expand and augment program to include electric drive and alt fuel hybrids (>50% CO2 reductions versus diesel)
- Add new element to dedicate \$250 million for procurement of zero emission buses
- Total request is for \$400 million
- Contact CALSTART's Fred Silver: (626) 744-5687 or fsilver@calstart.org



SunLine Transit Fuel Cell Bus



Foothill Transit Electric Bus

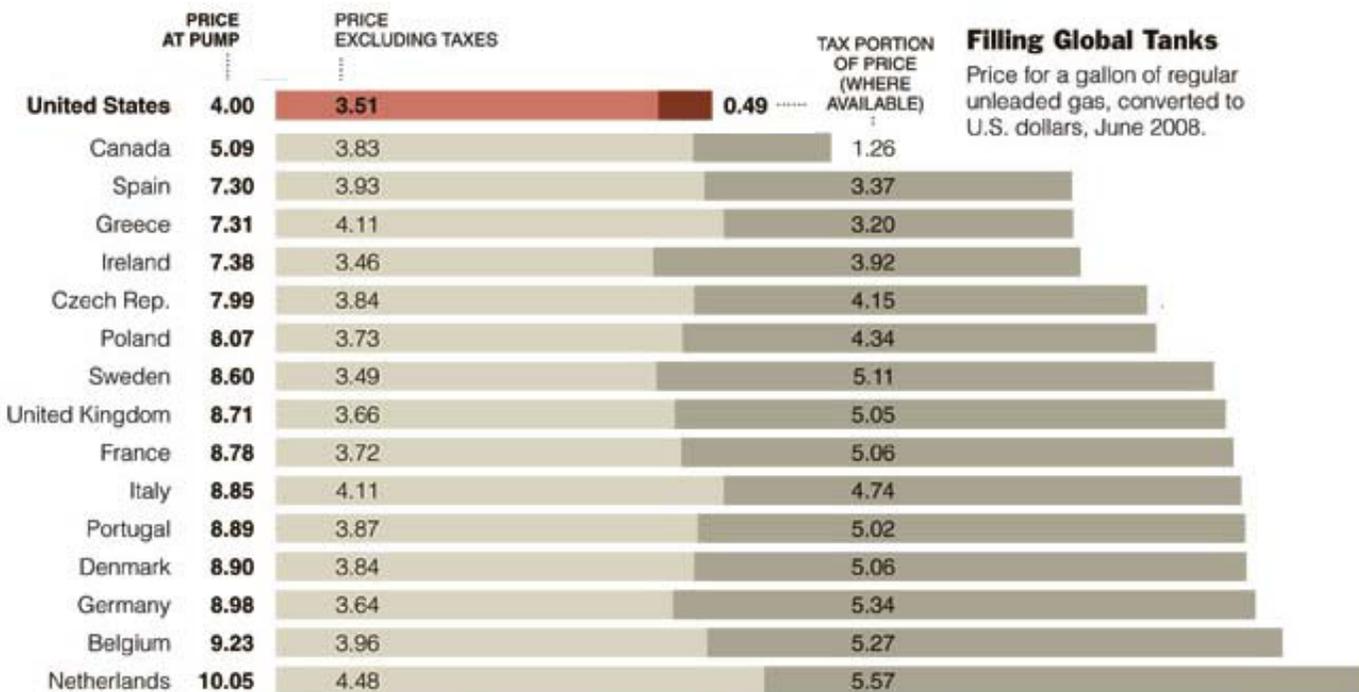


U.S. Energy Policy: Keep Oil Cheap?

The US & California are Failing to Keep up with the World

The New York Times

June 29, 2008



Filling Global Tanks

Price for a gallon of regular unleaded gas, converted to U.S. dollars, June 2008.

Source: Trilby Lundberg, "Energy Defente"/lundbergsurvey.com; fueleconomy.gov

*Iran and Iraq figures from February.

THE NEW YORK TIMES

Can Tax Shifting Be a Policy Option?
Less Income Tax to Offset Higher Fuel Tax?



Navy to Cut Oil from Non-Tactical Vehicles in Half in 5 Years

- The federal government accounts for 2% of U.S. energy use with the DoD responsible for 90% of that total. The Navy and Marine Corps alone consume almost 1% of the energy America uses.
- “Within 10 years, the United States Navy will get one-half of all its energy needs, both afloat and ashore, from non-fossil fuel sources,” Mabus said. **It will cut in half the fossil fuel use of its 50,000 non-combat vehicles within five years.** By 2020, half of its bases will be net-zero energy sites.
 - Excerpts from comments made by Secretary of Navy at Commonwealth Club, August 16, 2010



Navy Secretary
Ray Mabus

September 2010 Navy announced successful phase 1 test of Solazyme diesel – has made order for 7.5X amount for further



Concluding Remarks

- **Suggestions for further research and development:**
 - Optimization of engines in hybrid configurations
 - Optimization of engines running on clean fuels including natural gas and ethanol
 - ZEV only capability – global clean corridor market emerging
 - Advancements could open us new market segments and greater market opportunities for alternative fuels
- **We live in a rapidly changing world – efficiency will be rewarded....successful innovators will thrive**
- **U.S. needs to get serious about energy security**
 - Relatively cheap oil encourages dependence....demand is more elastic than was thought
 - Set a goal, establish a timeline, put someone in charge, make that person accountable

Clean Transportation Solutions SM
Advanced Transportation Technologies SM



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Coordinated Advanced Vehicle Standards

Standards	Timeframe	Objective
Criteria pollutants: HC, NO _x , PM	2014-2022	Cleanest vehicles by attainment date
Greenhouse gas: CO ₂ , CH ₄ , N ₂ O, HFC, BC	2017-2025	50+% reduction from baseline
ZEV: Ultra-low carbon emissions and fuels	2018-2025	Commercialize ZEVs for increased market share 2025 on
Clean fuels outlet	~2015+	Establish fueling infrastructure until market established

California Environmental Protection Agency

 **Air Resources Board**

Source: May 2010 Presentation by CARB Deputy Director Tom Cackette



Draft CARB Proposal

Proposed Revisions to LEV Program (LDVs)

- Phase-in 2014-2022
- Fleet average requirement equivalent to SULEV by 2022
- Additional emission categories provided for flexibility
- Combined NMOG and NOx standards
- Eliminate 50,000 mile intermediate useful life standards
- Increase durability requirement from 120,000 miles to 150,000 miles
- More stringent particulate matter standard
- NMOG+NOx credit 0.005 g/mi for 15 year/150,000 mile emission warranty
- Revised baseline reactivity factor (RFA)