



Zero Emission HDV Commercialization

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KEY TOPICS

Vision – Where we Need to Head

Reality – Where we are Now

How We can Achieve the Vision

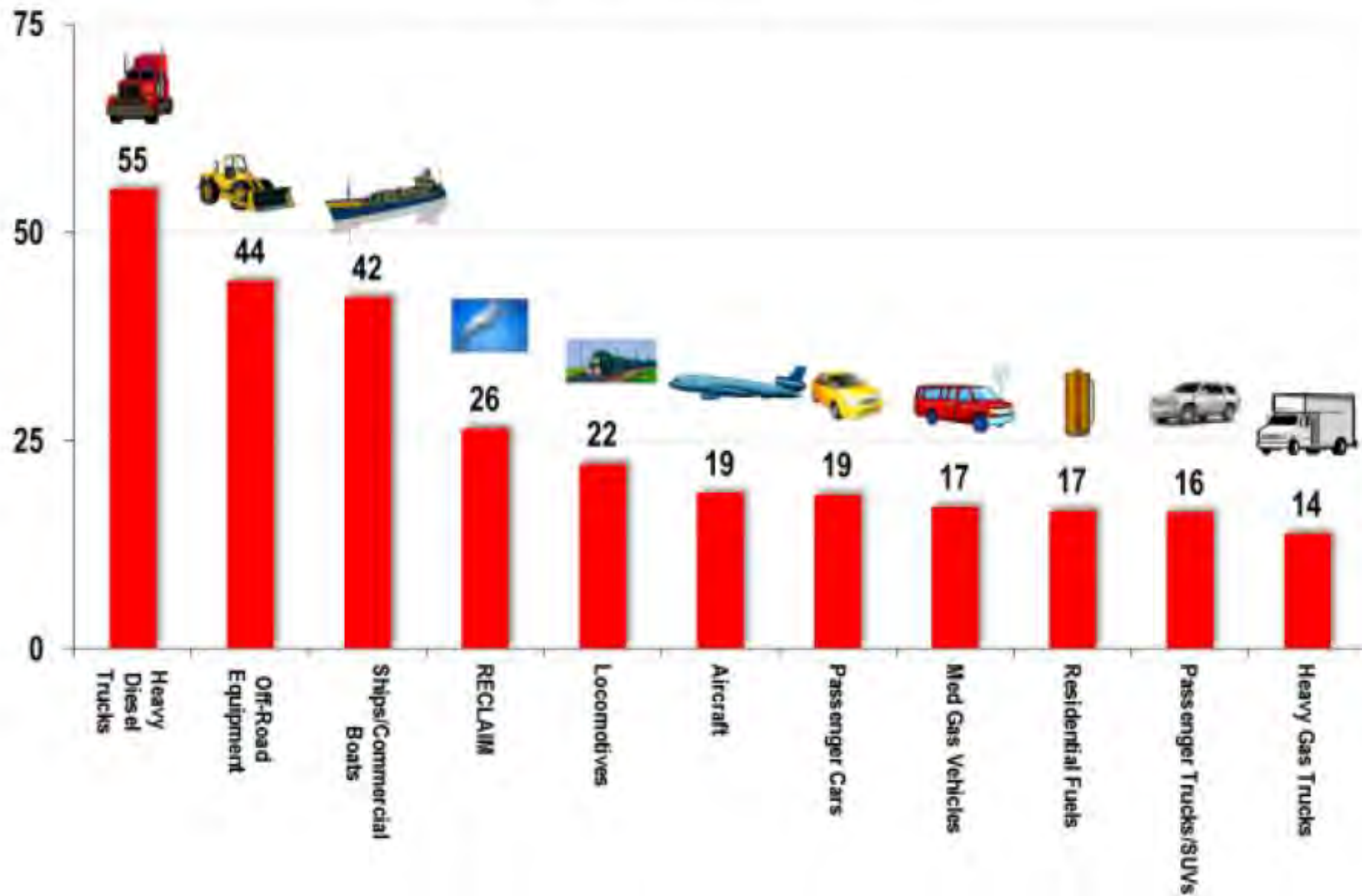
Investments and actions needed in

HD ZE

*WCC Meeting, San Francisco
September 4, 2014*

Largest South Coast NOx Emission Sources

2023 in tons per day



Future: WalMart-Peterbilt WAVE Advanced Concept Truck



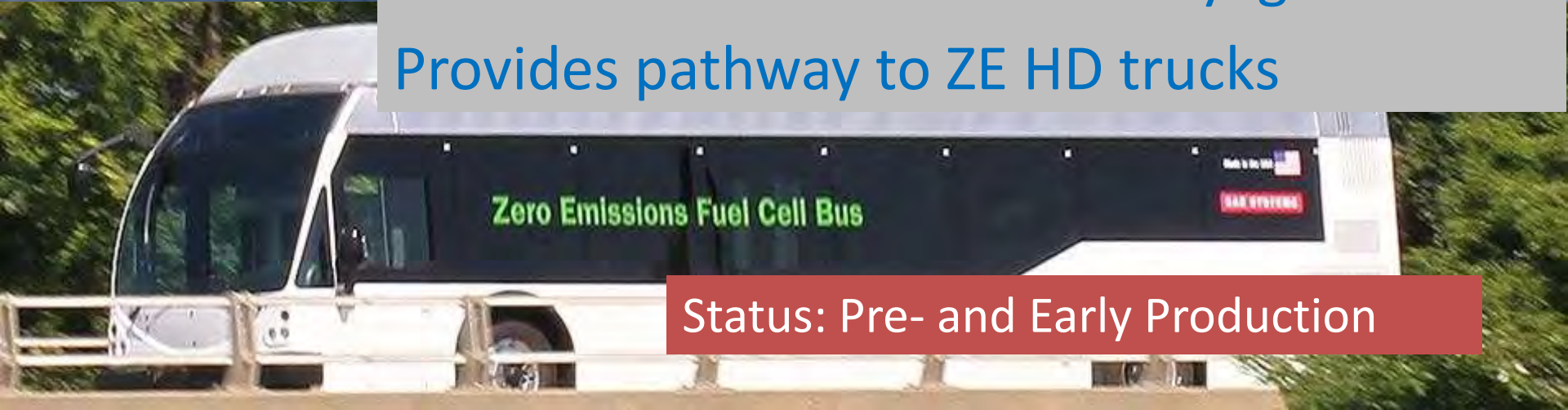


Today:

Zero Emission buses

Similar driveline size to HD drayage trucks

Provides pathway to ZE HD trucks



Status: Pre- and Early Production

Today: Electric Trucks – Current Models MD



Smith



Balqon



EVI



AMP



Motiv



Boulder



Transpower



Zero Truck

Status: Pre- and Early Production
Supply Chain Shaking Out

Best Uses for E-Truck - Business Case

To get sufficient payback, need to drive maximum miles possible (or maximum use of energy)

Dedicated, return-to-base routes with known daily mileage highly valuable

High Utilization/Daily miles (5-7 days a week) important

60-80 miles/day seems like an initial “sweet spot” for fuel savings payback (sufficient miles to generate fuel savings needed)



Expanding Tools: California HVIP Zero-Emission Voucher Amounts

New increased HVIP voucher amounts for electric trucks and buses

August 1, 2014: You can now receive vouchers up to \$110,000 toward the purchase of any zero-emission truck or bus in the HVIP! The California Air Resources has recently increased the voucher levels for electric trucks. Please see the table below (Table 2 on page 12 of the HVIP Implementation Manual).

GVWR (lbs)	Base Vehicle Incentive		
	1 to 100 vehicles ¹		101 to 200 vehicles
	Outside DC ²	Within DC ²	
5,001 – 8,500	\$20,000	\$25,000	\$10,000
8,501 – 10,000	\$25,000	\$30,000	\$12,000
10,001 – 14,000 ³	\$50,000	\$55,000	\$20,000
14,001 – 19,500	\$80,000	\$90,000	\$25,000
19,501 – 26,000	\$90,000	\$100,000	\$30,000
> 26,000	\$95,000	\$110,000	\$35,000

1 - The first three vouchers received by a fleet, inclusive of previous funding years, are eligible for the following additional funding amount: \$2,000/vehicle if below 8,501 lbs; \$5,000/vehicle if 8,501 to 10,000 lbs; and \$10,000/vehicle if over 10,000 lbs.

2 - 'DC' refers to a disadvantaged community.

3 - This weight range is not intended for vehicles utilizing a pick-up truck chassis/platform typically found in vehicles below 10,001 lbs GVWR. Vehicles at the lower end of the 10,001 to 14,000 lbs weight range will be evaluated on a case-by-case basis to determine eligibility for the full Base Vehicle Incentive.

U.S. CLEAN VEHICLES INCENTIVE PROGRAM

- US VIP – new CALSTART 5-year campaign to triple the number of voucher programs in US
- Supported by core industry and fleet membership
- Investigating potential markets in TX, FL, NJ, GA, WA, MA and elsewhere
- Additional steering committee seats still available



\$500,000,000

MORE VOUCHERS – MORE MARKETS

The time is **NOW** to create **\$100M PER YEAR** in Nationwide Voucher Funding that drives **SCALE** in clean commercial vehicles.



Medium Term – Achievable Zero Emission Freight Haul



All-electric;
Range
extended EV;
PHEV; Roadway
power

Hybrid Dual-Mode Drivetrain Below 48 MPH - Zero Emission/Battery Electric



Status: Prototype, Early Demonstration Phase

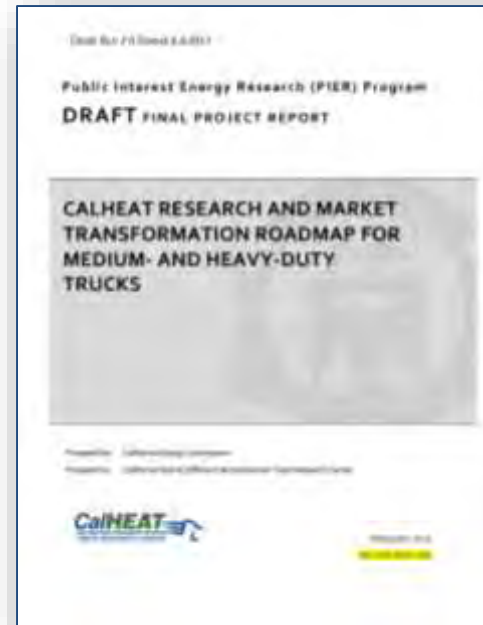
Guidance Reports

CalHEAT Roadmap being used by CEC, ARB for advanced truck and freight planning.

Roadmap result briefings provided to National Academy of Sciences/DOT Truck Fuel Economy Committee; US Army TARDEC

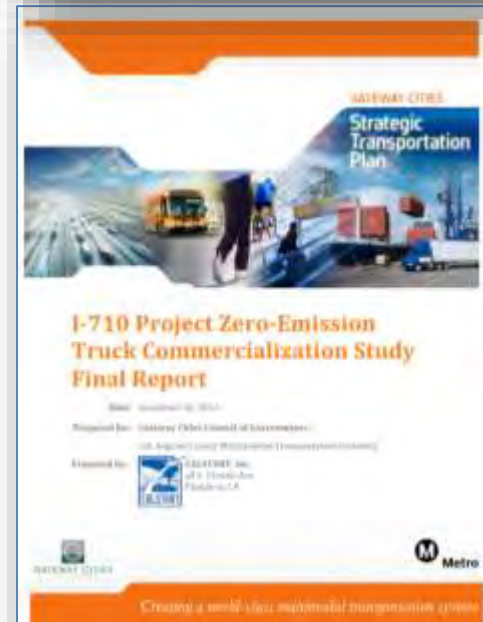
710 ZET Commercialization Report providing guidance to ARB, CEC, used by LA Metro/Gateway Cities

Provided input/framework for ZE Freight/Transit discussions at Governor's ZEV Summit 3/7



[CalHEAT Roadmap](#)

www.calstart.org/Projects/CalHEAT/Research-and-Market-Transformation-Roadmap.aspx



[710 Zero Emission Truck Report](#)

www.calstart.org/Projects/I-710-Project.aspx

Identified Technology Strategies in Roadmap

Advanced Electrification

- Hybrid-electric
- Electrified accessories
- Full electric powertrains
- Electrified Power take-off (PTO)
- Plug-in hybrid-electric
- External power to electric powertrain for ZEV Corridors
- AF/Hybrid Combinations

Engine and Driveline Efficiency

- Hydraulic hybrid
- Optimized engines for alternative fuel (AF)
- Energy recovery
- Engine efficiency improvements
- Alternative power plants and combustion cycles
- Transmission and driveline improvements

Chassis, Body, and Roadway Systems

- Light weighting
- Aerodynamics
- Lower rolling resistance
- Intelligent vehicle technologies, e.g. forecasting, adapting
- Corridors and platooning
- Longer, heavier single trucks

**Key CalHEAT
Roadmap
Findings: There is
a pathway for at
least 70% GHG
emission
reductions by
2050 – and
needed NOx
reductions.
What's needed?
Strong standards,
targeted public
investment.**

CalHEAT: Next Key Major Steps

STEP 1 :Zero emissions goods movement in Los Angeles County and the South Coast Related to the Ports ; (CY2013 to 2016)

- » **Expand Tech Capability Beyond Prototype:** building off the CalHEAT Roadmap Steps , implement a multi-year development plan with goals for technology stages and for entering pre-production; production intent and early production
- » *Focus Areas.*
 - » **ZE Drayage Demonstrations** (transition to multiple vehicles, not just single vehicle prototypes)
 - » **ZE Yard Hostlers Demonstrations**
 - » **Core Tech Enabling/Supporting Projects**
 - » Electrified accessories, Optimized alt fuel and low NOx engines, Alt fuel hybrids, Battery pack modularity, lower cost hydrogen and natural gas storage



Are ZE Drayage Trucks Possible?

YES!



What will it take?

What will it take to make zero emission trucks (ZETs) a viable option for drayage companies? CALSTART asked truck makers and industry leaders, and came up with these 5 critical steps:

INITIATE

PLAN

DEVELOP

DEFINE

SUPPORT

1

Initiate a focused truck development effort to move prototype designs toward production

2

Plan, develop and roll-out infrastructure for recharging and refueling the trucks

3

Work with Federal, State, and Local agencies to develop guidelines for ZETs

4

Define the business case, ownership models and incentives to make ZET solutions cost-effective and

5

Build supporting markets for zero-emission technologies for vehicles other than drayage trucks

I-710 Zero-Emission Drayage Truck Commercialization & Phase-In Process

