



CEC Investment Plan Recommendations

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California Energy Commission

DOCKETED

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*Advisory Comm Meeting
Feb 10, 2014*

Areas of Need

- » **LD vehicles** – ZE technology deployment, infrastructure
- » **Medium and HD vehicles** – near and zero emission technology (AB 32/regional air needs)
 - » + **Accelerated Transit Bus** – ZE technology (Zero Emission Bus Rule)
 - » + **Accelerated Goods Movement** – near and zero emission, particularly in environmental justice (EJ) regions (I-710 ZE Drayage)

Context for Commercial Vehicles

- » For trucks, California's needs will require reducing NOx an additional 80+% in the next 18 years, on top of a 90% reduction already made which took 18 years (and used up the cheaper technologies)
- » While - concurrently reducing carbon 20% per decade for the next four decades
- » While – not facing the same urgency on federal air quality regulations
- » California cannot assume the market or federal regulations will drive the change needed on the pace needed – it faces 40 years of market driving activity

Background Documents

California Energy Commission
COMMISSION REPORT

2013-2014 INVESTMENT PLAN
UPDATE FOR THE ALTERNATIVE
AND RENEWABLE FUEL AND
VEHICLE TECHNOLOGY PROGRAM



CALIFORNIA
ENERGY COMMISSION
Edmund G. Brown Jr., Governor

MAY 2013
CEC-600-2012-008-CMF

[CEC Investment Plan](#)

www.energy.ca.gov/2012publications/CEC-600-2012-008/CEC-600-2012-008-CMF.pdf

Draft Rev # 6 Dated 4-4-2013

Public Interest Energy Research (PIER) Program
DRAFT FINAL PROJECT REPORT

CALHEAT RESEARCH AND MARKET
TRANSFORMATION ROADMAP FOR
MEDIUM- AND HEAVY-DUTY
TRUCKS

Prepared for: California Energy Commission

Prepared by: California Hybrid, Efficient and Advanced Truck Research Center



FEBRUARY 2013
CEC-XXX-XXX-XXX

[CalHEAT Roadmap](#)

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

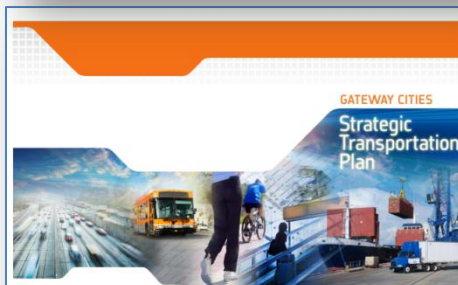
Public Review Draft
June 27, 2012

Vision for Clean Air: A Framework for
Air Quality and Climate Planning

[ARB Vision Plan](#)

www.arb.ca.gov/planning/vision/vision.htm

This document has been prepared by the staffs of the California Air Resources Board, the South Coast Air Quality Management District and the San Joaquin Valley Unified Air Pollution Control District. Publication does not signify that the contents reflect the views and policies of the Air Resources Board, the South Coast Air Quality Management District or the San Joaquin Valley Unified Air Pollution Control District. This document will be presented as an informational item at a noticed public meeting scheduled for June 28, 2012.



**I-710 Project Zero-Emission
Truck Commercialization Study
Final Report**

Date: November 20, 2013

Prepared for: Gateway Cities Council of Governments

Los Angeles County Metropolitan Transportation Authority

Prepared by:  CALSTART, Inc.
48 S. Chester Ave.
Pasadena, CA



Creating a world-class multimodal transportation system

[710 Zero Emission Truck Report](#)

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

CalHEAT: 3 Next Key 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



CalHEAT: 3 Next Key Steps

Step 2: Ultra Low Near Zero Emission Goods Movement thru the San Joaquin Valley (2013-2016)

- » Expand capability beyond Laboratory: Building off the CalHEAT Roadmap implement plan with goals for technology stages and for entering pilot demonstration, pre-production and production intent
- » Focus areas: Class 8 Tractors i.e. line haul and interregional/city deliveries (Represent 60% of CO₂ and criteria emissions statewide
 - » **Optimized engines for alternative fuel (AF)-** test and deploy NG low NO_x engine technology
 - » **Engine efficiency improvements-** Up to 2 time Fuel Economy with new improved engines light weighting and lower rolling resistance
 - » **Energy recovery- Pilot testing of** Turbo compounding & Solid State heat recovery systems
 - » **Alternative power plants and combustion cycles-** Purposefully designed Turbine power Camless Engines and Fuel Cells
 - » **Enabling Technology-** nearer term Electrified Auxiliaries- longer Term Mild Hybridizations- Combined with Waste heat recovery



CalHEAT: 3 Next Key Steps

Step 3: Greater electrification of Goods Movement Vehicles Statewide (2013-2016)

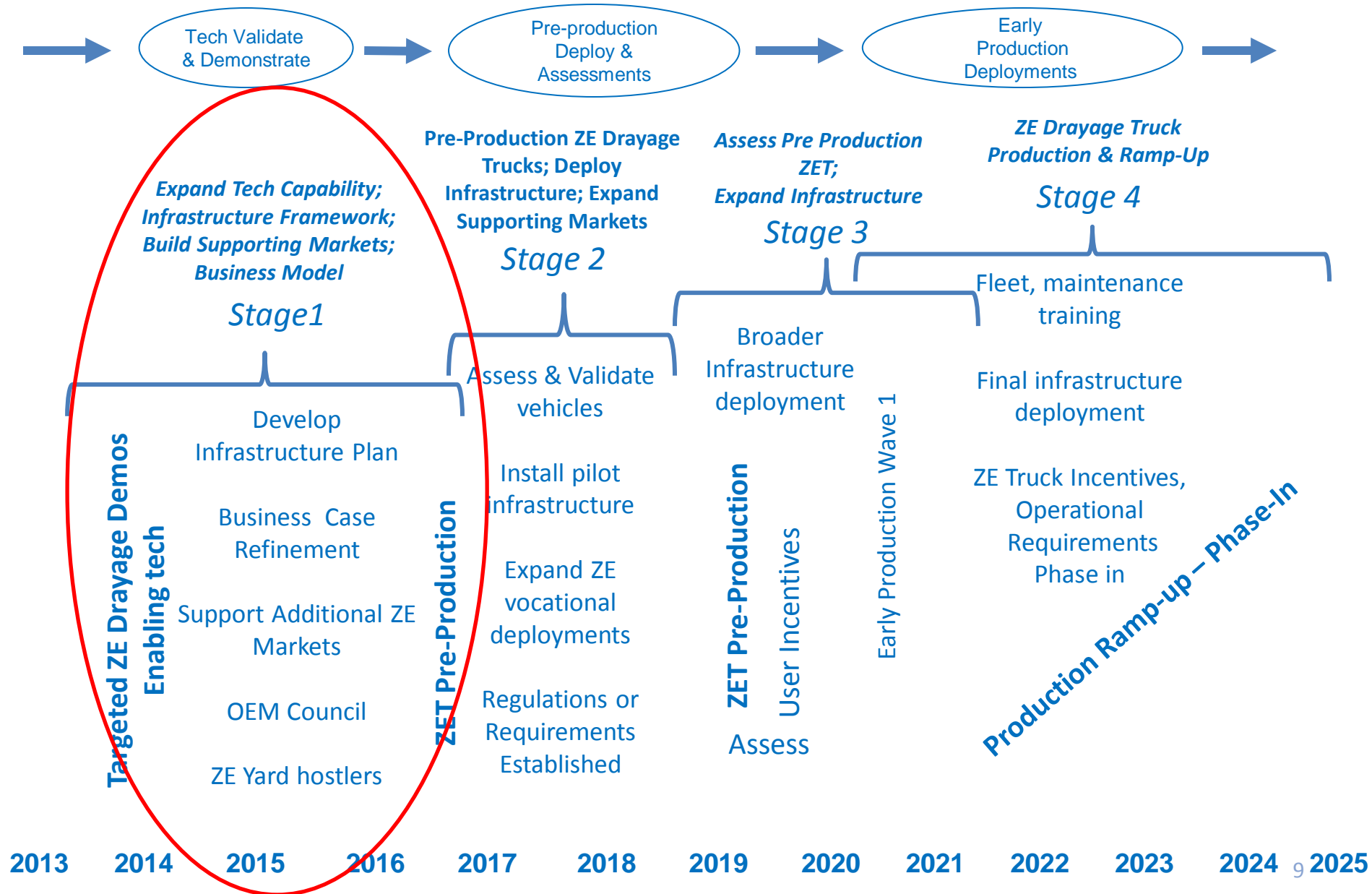
- » **Expand Tech Capability to Pilot Production and Preproduction and Reduce Costs:** building off the CalHEAT Roadmap Steps , implement a multi-year development plan with goals for technology stages and for entering pre-production; production intent and early production
- » Focus area on Vocational Trucks: i.e Parcel Delivery, Beverage Delivery, Utility and Refuse Collection
 - » Testing and deployment of third generation preproduction optimized hybrid electric technology meeting state On Board diagnostics regulations
 - » Testing and deployment of second generation electrics trucks with modular battery pack for matching range requirements as well as smart charging systems e
 - » Pilot demonstrations of hybrid refuse collection trucks
 - » Development of an optimized alternatively fueled NG Hybrid drivetrain



Critical Demos Needed

- » ZE drayage commercial path demos (from I-710 plan – 3 key architectures need focused demonstration/validation to meet needs (EREV; BEV; PHEV – Goal: move to pre-production pilots by 2017)
- » ZE yard hostlers – important early opportunity on a Class 8 platform but less demanding use cycle (in range, speed)
- » Some players ready to go to 20+ trucks, most others still in 2-3 vehicle validation stages (all in EJ regions)
- » Catenary demo support important; CEC already contributing; in road power and/or network-opportunity charging (fast charge, inductive) important

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



Important Supporting Demos/Pilots

- » ZE Bus ready for larger pilots (80-150 buses in next 2-3 years)
- » Targeted volumes at key sites rather than scattergun
- » 40-80 fuel cell; 40-80 BEV (BEV includes remanufactured and new)
- » Goal: 400 ZE buses in CA by 2020 – aligns with ZEB goal (800 nationally – FTA goal)
- » Opportunity for strong match and alignment with federal activities



Zero Emission buses are in pre-production
Similar driveline size to HD drayage trucks
Provides pathway to ZE HD trucks



Line Haul/SJV Demos

- » Go next step on SCAQMD low-NOx engine demonstration program – pilot/demo/validate multiple trucks using new engines (20-50), diverse applications for class 8 trucks
 - » Buttress support for more HD NG engine offerings (competition; segments- industry may need 15L size)
- » Develop & demonstrate additional low-NOx engines for line/haul regional class 8 applications
- » Consider demos of:
 - » limited corridor longer/heavier trucks (mirror tests in Sweden and elsewhere);
 - » platooning;
 - » Look-ahead power train management, other efficiency drivers that can reduce emissions

Technical Support to CEC Needed

- » Because of the complexity of state needs and the growing impact of goods movement, recommend a new role to support and augment CEC staff
- » Medium- and heavy-duty technical evaluation and support, industry connection and pathway assessment, stakeholder coordination

Workplace Charging – Key Enabler for ZEV Success



- » Regional planning important
- » However, there are high level issues that transcend regions – both statewide in nature and align with national efforts
- » Recommend a statewide coordination and planning effort in addition to local/regional

Infrastructure and Incentives

- » E-trucks and buses need infrastructure support on deployment
- » Ideal structure: “bundle” infrastructure with vouchers/incentives – one stop shopping for fleets (recommended by E-truck Task Force Report)
- » Natural gas: key surveys and policy report recommend a more transparent voucher system – more accessible for fleets

An aerial photograph of a car show event. In the foreground, a large, festive arch of red, white, and blue balloons stands next to a red car. Several white cars are parked in the middle ground. A large group of people, mostly in business attire, are walking around the event area. In the background, there is a large, modern building with a flat roof and a parking lot. The scene is set against a backdrop of mountains and palm trees under a clear blue sky.

CALSTART

Clean Transportation Technologies and Solutions