

Zero and Near-Zero Emission Technologies: Opportunities, Barriers, Paths Forward



*Clean Transportation
Technologies and
Solutions* SM



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Multiple Manufacturers Bring Electric Trucks to Early Market



Navistar E-Star



Smith



Zero Truck



Freightliner CC



EVI



Capacity



US Hybrid



Balqon

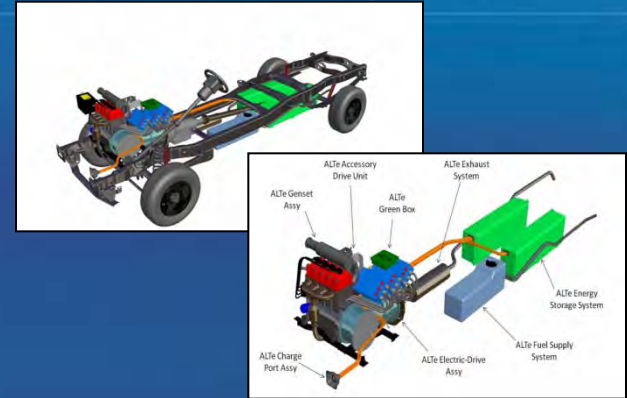


Vision Industries



Next Gen 1: Extended Range EV and Plug-In

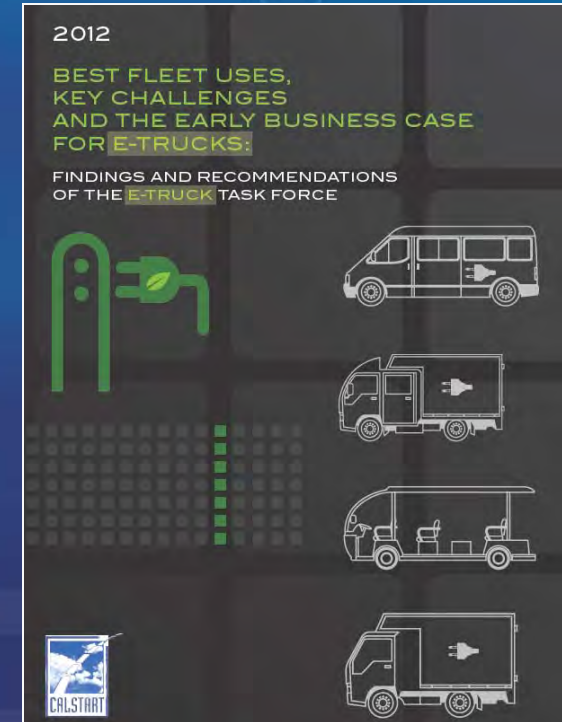
- ALT-e REEP; VIA; Quantum; EVI
- Odyne with medium duty plug in
- F-150 Class (4 cylinder 2 liter engine 25 kwh pack; 52 mile EV range; 32 mpg possible FE)
- Many fleets interested in this capability but OEMs not yet responding





E-Truck Task Force Key Findings

- ✓ Vehicle Cost/Price are Top Issues/Barriers
 - Production/battery costs; need for incentives
 - 50% + funding of incremental cost needed
 - Costs do show decline over time
- ✓ Vehicle Quality/Support Needs to Improve
- ✓ Validation of Performance and Business Case are Key Gaps
- ✓ Infrastructure is a Surprise to Fleets and Important Next Tier Issue
- ✓ Better Guidance on Vehicle Placement, Use Needed



www.calstart.org/Projects/E-Truck-Project/E-Truck-Task-Force-White-Paper.aspx



Best Uses to Achieve Business Case

Place vehicles in best use applications

- Fixed route, return-to-base applications
- Facility vehicles
- High idle, work site applications

Then: to get sufficient payback, drive maximum miles possible (or max use of energy)

- High Utilization/Daily miles (5-7 days a week) important
- 70-100 miles/day seems like an initial “sweet spot” for fuel savings payback (sufficient miles to generate fuel savings needed)



Tools for ZE Trucks

HTUF
Hybrid, Electric & Advanced Truck Users Forum



CALSTART eTruck Business Case Calculator

Conventional Diesel Vehicle Information

Vehicle Life: years

Vehicle Class:
 Driving
 Work Site

Vehicle Daily Range: miles/day

Vehicle Capital Cost: \$

Maintenance Cost: \$ /mile

Diesel Fuel Price: /gallon

Fuel Escalation Rate: %

Electric Vehicle Information

Maximum Charging Power: kW

Maintenance Cost: \$ /mile

Electricity Costs: \$ /kWh

Include Demand Charges?:

Demand Charges Cost: \$ /kW

Electricity Escalation Rate: %

Electric Vehicle Capital Cost: \$

Smart Meters: \$ for 1 vehicle

EVSE: \$ for 1 vehicle

Panel Upgrade: \$ /33 kW

Financial Information

Cost of Capital: %

State EV Incentive (HVIP): \$

Federal EV Incentive: \$

EV Infrastructure Incentive: \$

EV Battery Information

Battery Cost (per vehicle): \$ /kWh

Battery Size: kWh

End of Life Value: \$

Fleet Information

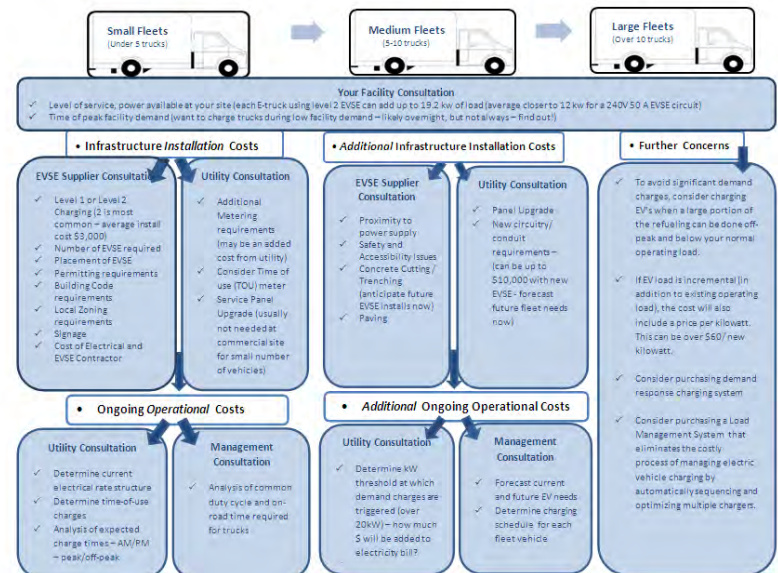
Fleet Size (Number of vehicles):

- eTruck Business Case Calculator
- Infrastructure Planning Guide for Fleets

<http://www.calstart.org/Projects/htuf/E-Truck.php>



E-TTF Infrastructure Planning Guidelines for E-Truck Fleets





Task Force Top 5 Action Recommendations



1. Seek **purchase vouchers** equal to $\frac{1}{2}$ of incremental cost.
2. Establish and agree to **common use profiles** industry-wide.
3. Reduce system design and manufacturing costs via **increased R&D and demonstration**.
4. Create a **commercial EV charging rate**.
5. Eliminate or **reduce demand charge** for commercial EV charging.



ZE Freight Movement: Barrier, Opportunity Assessment

CALSTART ZE Freight Truck Technology report for LA Metro and SCAQMD finds:

- Several promising tech approaches can be demonstrated NOW
- Consistent, focused develop/demo and market development needed over next 10 years
- Key **barriers are economic, not technical** – need economic “eco-system” to support a successful commercial deployment

Tech Options:



Dual-Mode Hybrid
(with ZE mode)



Series Electric/
Range Extender



Full Battery
Electric



Road Connected
Power



Near-ZE NG
Engines

Preliminary Assessment



Technologies, Barriers & Opportunities

I-710 Zero-Emissions Freight Corridor
Vehicle Systems

Based on Technology, Truck and System Designer Interviews

SECOND DISCUSSION DRAFT - VERSION 2.0
June 2011

CALSTART





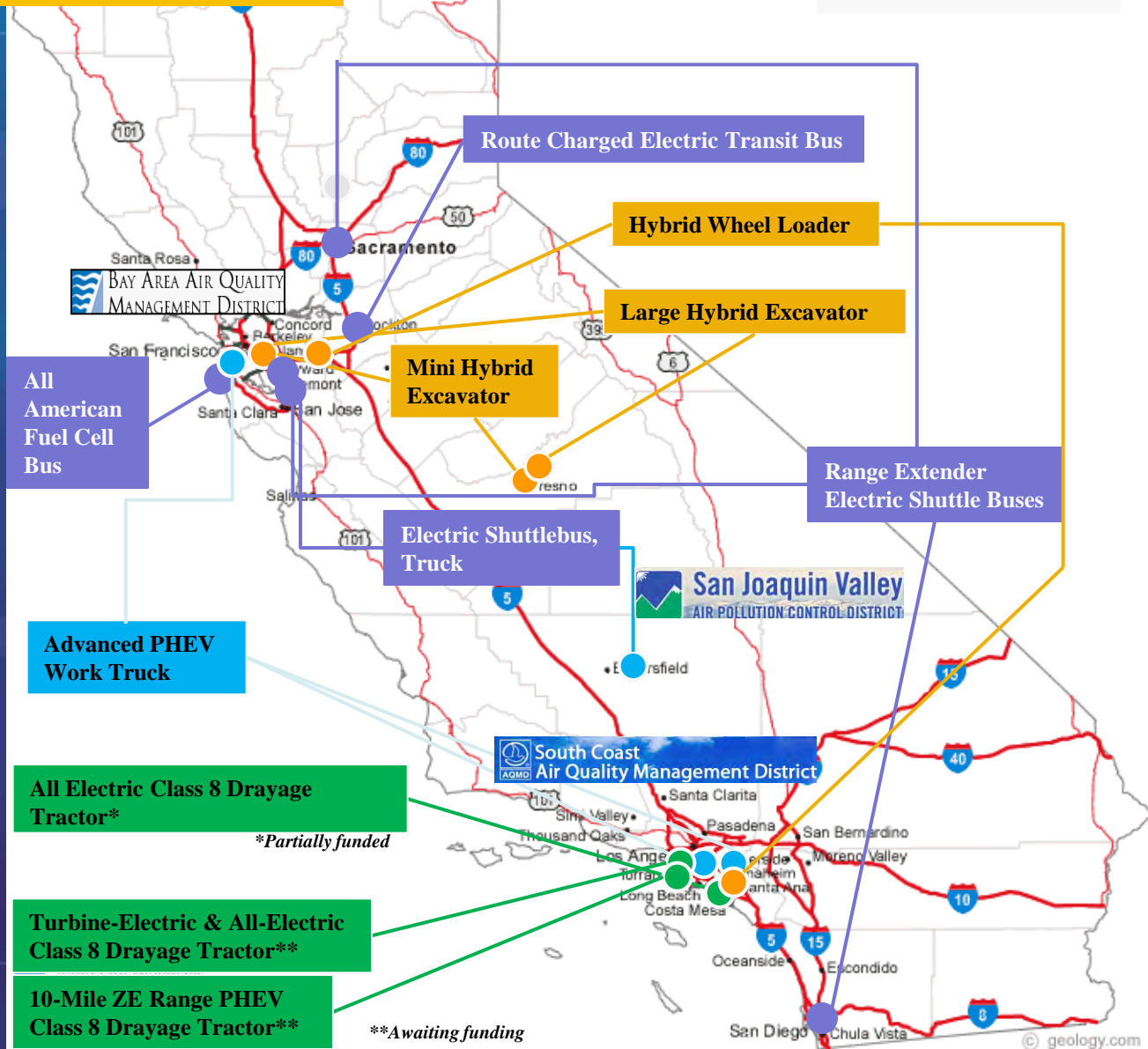
CLEAN Truck

Commercial-path Low-carbon Efficient
Alt-fuel Next-gen (CLEAN)
Truck Demo Program

TECHNOLOGY DEMONSTRATION PORTFOLIO	# Projects
Near and Zero-Emission Pathway Freight Trucks	3*
Advanced Alt-Fuel Transit Vehicles	4
Medium Duty Advanced Alt-Fuel Hybrid Trucks	2
Hybrid and Alt-fuel Off-Road Equipment	3

Example:

- Advanced truck commercialization projects underway, including at state level
- Address areas of technical need and provide “pathways”
- More funding needed in ZE goods movement





Status of Near and Zero-Emission Tech

- Low-volume production zero-emission vehicles moving into medium-duty truck and bus applications
- Zero and near-zero emission freight (Class 8) applications in demonstration
- Need purchase support (incentives) to expand early markets – such as vouchers (Calif., NY)
- Need on-going development and demonstration to move second and third gen capabilities to market over next ten years (*extended range EV, dual-mode hybrids, road-power, near zero engines, reduced cost systems*)
- Need focused market development plan and work to make sure there is a business case and structure for these advanced, clean vehicles

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