

I-710 Freight Corridor & Zero-Emission Trucks: Technologies, Opportunities, & Barriers



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Question

- Can Zero Emission Trucks be commercially available if a Zero Emission Freight Corridor is built?



Approach

- Research
- Confidential Delphi Interviews
- CALSTART Expertise
- Examination of Technology Options
- Identification of Barriers
- Define Opportunities





Findings

Trucks CAN Deliver Zero Emissions Goods Movement in the I-710 Corridor, **within the time frame of the project**

- Several Options for Zero Emissions
 - Hybrid with Dual-Mode Operation (ZEV Mode)
 - Range Extender EV (Fuel Cell or Turbine w/ZEV mode)
 - Full EV (with fast charging or infrastructure power)
 - Road-Connected Power
- Additional Options for Near-Zero Emissions
 - Alt Fuel Hybrids
 - Zero NOx dedicated fuel engines (CNG, RNG, H2 ICE)
 - Range Extender EV (turbine)



Examples: Dual-Mode Hybrids (w/ Zero Emissions Mode)

Meritor – Navistar

- Electric drive at lower speeds (up to 48 mph), blended mode at higher speeds
- Can greatly reduce fuel use, cut idle emissions, provide partial zero emissions



Eaton

- Electric drive for short range, low speeds (prototype)

Transit (buses)

- Long Beach Transit
- King County Metro





Examples: Series Electric/Hybrid – Range Extender

Artisan–Parker

- Electric drive system with turbine range extender (with ZEV mode)
- Much development in turbines, focus on NG



Vision Industries

- Electric with fuel cell range extender (zero-emissions)





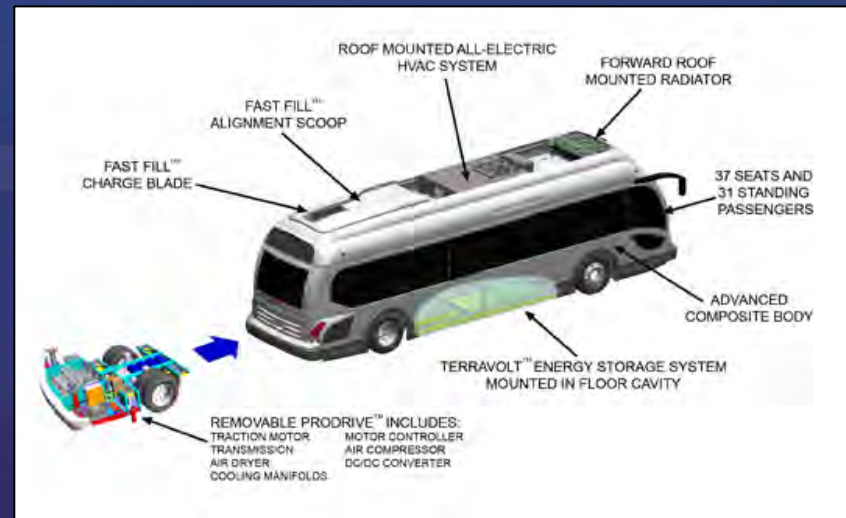
Examples: Full Battery Electric

Balqon

- Drayage trucks

Proterra

- All-electric bus operating with Foothill transit
- Reduced battery pack size augmented with fast charge





Examples: Road-Connected Power

- Well known in transit industry (electric trolley-bus)
- Used widely in mining with extremely heavy equipment
- Now beginning testing in Europe (Siemens) for heavy-haul trucks
- Other tests looking at in-road power alternative



Siemens eHighways Concept



Opportunities

- Multiple technologies available
- Variations in feasibility
 - Dual Mode Hybrid Vehicles have “multiple” uses (not just corridor)
 - Fuel Cells and Full-EV require Infrastructure
- **Pathway Trucks (near zero emissions)**
 - Can test and validate a production “pathway” to reach zero in succeeding model generations



Barriers

- Design Factors
 - Durability
 - Weight/Volume
 - User Needs
 - Development Resources
- Infrastructure
 - Fuels
 - Corridor Design
 - Costs
- Costs
 - Development Cost
 - Materials/Component Cost
 - Vehicle Cost
- Business Case
 - Corridor Economics
 - Market Demand & Volume Potential
 - Regulations & Legislation
 - Fuel (Oil) Prices



Conclusions

- Zero Emission Trucks are Technically feasible within the timeframe of the project
- Barriers need to be addressed (Esp. Business Case)
- **Pathway Trucks (Near-Zero emission)** can help validate zero emission technology

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