Agenda

- CALSTART Background
- Status of Clean, Advanced Technology for Trucks
- National HTUF Process Commercializing Hybrids and High Efficiency Trucks
- Creating a 710 Zero Emission Freight Corridor
CALSTART is a unique California-based national, non-profit, member-supported organization. Founded in 1992 as a public-private partnership to help launch and grow a clean transportation industry.

Mission: via programs and services, supporting and expanding the growth of a clean transportation technologies industry that will:

• Create high-quality jobs;
• Clean the air;
• Reduce dependence on foreign oil; and
• Reduce global warming emissions
CALSTART Has Broad Industry/Public Sector Support (partial list)
CALSTART: A Strategic Broker for Advanced Transportation

2010
130+ Worldwide Participant Network

3 Offices in US

Four focus areas:
- Tech Commercialization
- Fleet, Port Consulting
- Industry Services
- Policy Development

National and International in Project Areas
Truck World is Changing

• Significant improvement in emissions – but big increase in cost

• Large push to improve fuel efficiency because of fuel price shocks (but without increasing emissions) – DOT rules coming

• Carbon (global warming) emissions of rising importance because of large fuel use in trucks – EPA rules coming
  – One efficient truck can cut 24X more fuel than a car

• Ports and California pressure driving force for rapidly upgrading trucks (on emissions but so far not efficiency)

• All this has led to a blossoming of new lower-emitting, higher-efficiency technology and fuels – some entering early production NOW
Every truck here is: Hybrid Electric, Hybrid Hydraulic, Plug-in Hybrid or all-Electric – and 70% Are in early production.
Hybrid and High Efficiency Truck Technology is Critical to U.S.

- Hybrids provide significant immediate benefits
  - **ENERGY SECURITY**: Reduced fuel consumption (30-50%)
  - **EMISSIONS/CLIMATE**: Reduced criteria (NOx) and GHG emissions (10-60%)
  - One of few strategies to improve on 2010 emissions reductions
  - **ECONOMY**: North American leadership in technology, manufacturing – Green Jobs of today and tomorrow

Reductions come just from hybrid system, no additional after-treatment
CO2 reductions closely tracked fuel reduction percentages

### Table 10 and Figure 9. Percent Decrease in Rate of Emissions (g/hr) and Percent Increase in Fuel Economy (mpg) Obtained by Using the HEV Truck Compared to the Baseline using Four Eaton-Specified Mission Cycles

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<th>CO (g/ml)</th>
<th>NOx (g/ml)</th>
<th>PM (g/ml)</th>
<th>Fuel (mpg)</th>
<th>% (Increase)</th>
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Criteria Emissions – New Ozone Rules Coming

• EPA announces in January it will strengthen ozone rules to meet health standards
  • Would replace standards from Bush Admin which were not as protective of health as science advisors had recommended
  • 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
    – Would include a “secondary” yearly standard for cumulative exposure
  • 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 – will issue final standards by Aug 31, 2010 – states would need to outline plans to meet standards by 2013 which go into effect in 2014
  • Most impacted regions receive to 2031 to comply
Regional Impact of Ozone Rules
Example: Southern California

• LA region still has worst air quality in nation
• SCAQMD supports the new ozone levels, but estimates to achieve them will require reducing NOx in region by additional 88-91%!
• Could mean transition away from fossil fuel combustion
• District believes it cannot achieve standards if federal emission sources (ships, trains, planes) do not significantly reduce their impacts

We calculate that to demonstrate attainment of the proposed standard range would require 88 to 91% reductions in NOx emissions. This preliminary analysis means that we need to essentially transition out of fossil fuel combustion and move toward zero-emission technologies.

- Dr. Barry Wallerstein, SCAQMD Executive Officer, in comments to EPA on proposed rule
Hybrid Trucks: U.S. Competitive Advantage that Touches 30+ States

CALSTART estimates job creation and retention of at least 40,000 – 55,000 industry jobs by 2020 if hybrid and advanced tech in trucks supported.

Map: Center on Governance, Globalization and Competitiveness, Duke University
High Efficiency Trucks Create US, California Jobs

- New report from Union of Concerned Scientists and CALSTART shows **124,000 economy-wide jobs** and **$24B in economic savings** can be created if policies support high-efficiency trucks.

- All states show gains – California has biggest gains.

- Fleets benefit and have substantial savings from reduced fuel over vehicle life.
Regional Heavy and Line Haul
Advanced Trucks

- Kenworth, Peterbilt, Navistar and Freightliner all have Class 8 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
Advanced Class 8 Demo Vehicles

• ArvinMeritor – Navistar testing unique dual-mode hybrid design
• 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
• Vision Industries demonstrating a fuel cell – hybrid electric drayage truck
• Zero emission operation potential in regional applications
• Hydrogen fueling
All Electric Drive Trucks Emerging

- Oshkosh HEMMT military heavy transport and support truck
  - Series hybrid electric drive system with ultracap energy buffer
- Capacity “PHETT”
  - Plug-in, series hybrid design
- Balqon all-electric port trucks
  - Up to 40-60 miles range
- Freightliner Custom Chassis and Enova electric parcel truck (in testing)
- Smith “Newton” electric truck (in early production)
- Navistar/Modec electric truck (in early production Q1 2010)
FedEx EV to Hit LA Routes

- All-electric FedEx parcel delivery vans now on Los Angeles routes
- Two from Navistar-Modec
- Two from another supplier to be named
- Took US Route 66 Tour in Spring, ended in LA
- First wave of early production electric trucks
All Electric Heavy Transit Buses
(comparable systems to heavy trucks)

• LA Metro and ISE Corporation all-electric bus (Zero-emission Bus) proposed
  – Supported by the California Air Resources Board (CARB), the South Coast Air Quality Management District (SCAQMD) and LACMTA
  – 45-foot bus expected range - 150 miles before recharging
• Foothill Transit Plans Revenue Operations for all-electric, rapid-recharge bus
  – 30 mile range
  – On-route charging
  – Composite bus, all conventional subsystems off-the-shelf
Expanding Choice of Natural Gas Engines, Trucks

- CARB/EPA certified Westport’s High Pressure Direct Injection (HPDI) NG technology for Cummins heavy-duty engine
- Kenworth expands to LNG vehicles with T800 LBG trucks
- Freightliner producing CNG version of its Business Class M2
- Mack brings natural gas refuse truck back to market
Renewable Natural Gas – Lowest Carbon Fuel

- Trucks driving on natural gas produced from dairy manure operating in San Joaquin Valley
- Process produces and refines manure biogas to “biomethane” – essentially renewable (green) natural gas
- Very low in overall carbon emissions
- Natural gas-hybrids becoming possible

Dairy partners – Hilarides Dairy, Hilmar Cheese
Market Transformation Example: HTUF

- Hybrid Truck Users Forum: User-driven process to commercialize med- and heavy-duty hybrid trucks
- Joint CALSTART-U.S. Army program (RDECOM-TARDEC-NAC)
  - With support from DOE, DOT
- HTUF focuses on commercializing hybrid trucks with dual-use benefits
  - Speed commercialization and cut costs by creating common fleet requirements, joint purchase commitments, increasing volumes

All Major Truck Makers and System Suppliers involved (partial list)
• HTUF Forums are North America’s primary hybrid and high efficiency truck industry meetings
• The HTUF process has sped market introduction by 2-5 years (5 years according to fleets)
• The Forums uniquely bring together the full range of key stakeholders in one place:
  – fleet vehicle users (commercial and military)
  – vehicle manufacturers
  – suppliers and technology developers
  – regulators
  – researchers
  – NGOs
• The Forums provide the clearest window on industry status and reality; technology developments; field-test data and real-world performance evaluations; hands-on experience via ride-and-drives; and developing the action agenda for the industry.
Clean, High Efficiency Low Carbon Trucks and Buses:

- REAL; AND IN FIRST PRODUCTION
  - EXPANDING IN TYPE AND APPLICATION
  - PURCHASE INCENTIVES EMERGING

- NEXT GENERATION CAPABILITIES ARE BUILDING ON FOUNDATION OF HYBRID, NATURAL GAS, MILITARY AND TRANSIT CAPABILITIES

- ULTRA-LOW CARBON AND NEAR/ZERO EMISSION MEDIUM- AND HEAVY-DUTY TRUCKS TECHNICALLY ACHIEVABLE

- CHALLENGE IS DEVELOPING SUSTAINABLE MARKET – BUT THERE ARE SUCCESSFUL PROCESSES TO DO THAT
Metro has engaged CALSTART to examine the commercial viability of zero-emission freight movement – and to launch a process to commercialize zero-emission freight movement vehicles and infrastructure.

The structure: a multi-year public-private program involving partners and stakeholders serving, using and living along the I-710 corridor.

Goal: develop, validate and commercialize market-sustainable, zero-emission goods movement vehicles - and supporting infrastructure – to service the I-710 freight corridor (and additional uses).
What is Process Needed to Create a Zero Emission Freight Corridor?

- Multi-year, coordinated plan; aligned investments, requirements, incentives and policies

- Need coordinated approach for targeted commercialization from requirements, prototypes and rapid testing through incentives and early production

- Market “pull” from users, support and market development critical
Tech Commercialization Processes

Structure Used for First Gen Electric Vehicles

Utilities
Fuel Providers

Government
Air Needs

Infrastructure
Construction, Design

Manufacturers
Product Viability

Zero-Emission Vehicles and Infrastructure
Proposed Market Transformation Process

Builds on Proven Structure, Industry Relationships

710 Stakeholders

Government
Regional Air Needs

Infrastructure
Construction, Design

CALSTART
Coordinate process

Fleet Users
Market Pull

Manufacturers
Product Viability

Zero-Emission
Freightway Vehicles
and Infrastructure
Working with Metro, CALSTART has developed a four-stage process – proceeding along three parallel commercialization tracks - to achieve technology and market commercialization for a zero-emission corridor. The process is now beginning with support from the South Coast Air Quality Management District.

Stage 1 Outline core technical and market barriers/opportunities; begin three parallel commercialization working groups to identify vehicle, corridor and user’s requirements; launch proof of capability demos with partners.

Stage 2 Begin early pre-production deployments and capabilities assessments; finalize infrastructure requirements and business case for corridor; validate user requirements with OEMs and technology suppliers.

Stage 3 Next stage pre-production deployments from several OEMs put into test use for data collection, analysis and data sharing through user group forums; secure economic sustainability requirements for users and corridor to ensure market viability.

Stage 4 Deploy early-production vehicles based on previous improvement steps. First suite of user and corridor incentives and benefits in place Phase in new vehicles and capabilities as corridor and infrastructure is completed.
Proposed Parallel Path to Zero-Emission Corridor Commercialization

Commercialization “Continuum” – the Steps to Commercialization

Research & Development → Tech Develop & Demonstrate → Pre-production Deploy & Assessments → Early Production Deployments

Stage 1 → Stage 2 → Stage 3 → Stage 4

710 FWY
EIR - EIS Draft → Engineering Design → Design Complete → Property/Right of Way Acquire → Construction

710 Clean Corridor
Barriers Assessed → Working Groups Ph1 → ZET Capabilities Demo 1 → ZET Pre-Production 1
Infrastructure Reqs 1 → Corridor Structure Reqs → Assess & Validate
ZET Pre-Production 2 → Assess → User Incentives
Early Production 1 → Early Production 2

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What You Can Do Now: Hybrid Truck & Bus Voucher Incentive Program (HVIP)

- Program recommended by CALSTART/HTUF – based on what needed to change purchase decision for fleet, speed market
- CARB staff crafted extremely simple program – incentives target half the incremental cost of today’s hybrids
- $19.4M invested for year 1 – over 90% of vouchers already requested!
- $1.6M still available (working to add a bit more)
- CARB planning $25M for 2011 – don’t wait, plan now!!

What You Can Do Now: Hybrid Truck & Bus Voucher Incentive Program (HVIP)

Vehicle Weight | Base Vehicle Incentive
---|---
10,001 – 14,000 lbs. | $10,000
14,001 – 26,000 lbs. | $20,000
26,001 – 33,000 lbs. | $25,000
> 33,000 lbs. | $35,000

www.californiahvip.org
Summary

• Advanced low-emitting, high-efficiency technology now emerging in trucks and in early production
  – Addresses growing national and region emissions/energy needs
  – Creates and retains jobs

• Technology shows real pathways to achieve near-zero and zero-emission operations (from bus and truck) – particularly in corridor applications

• Targeted, fast-track market transformation processes have been proven

• With policy and funding support, such processes can drive commercialization of zero emission vehicles for the 710 freight corridor – and the work is starting
Clean Transportation Technologies and Solutions℠

www.calstart.org

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