Toyota Project PORTAL
[Port Advanced Leadership]

PPCAC Conference, San Pedro Ports

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Presentation Outline

• Toyota Sustainable Mobility Philosophy
• Global Automotive Trend
• MHDV Market pull
• The San Pedro Ports Solution
• Key Elements for Clean Trucks
  • Technology
  • Cost of Ownership
  • Infrastructure
• Benefits and Impacts
Global Automotive Trend

I. Global Automotive Executive Survey 2018
   • Rates FCEVs as the #1 priority in 2018

II. Strong ZEV and emissions goals
   • Countries: Non-EV sales bans
   • Auto Companies: phase out non-EV production and sales
   • Local Regions: Ports and Cities setting more stringent goals
Zero Emission MHDV Market pull

- Zero Emission MDHV: Large market pull
- High mileage, long idle time, low fuel economy

-> Higher emissions.

Numerous Clean MHDV announcements
The San Pedro Ports Solution

Desire to expand while reducing emissions

High impact to disadvantaged communities

Clean Air Action Plan
• 2030: Terminal Trucks ZEV
• 2035: All Trucks ZEV

Requires ZEV solution
Project Unveiling

http://pressroom.toyota.com/video_display.cfm?video_id=34149
Key Elements for Clean Trucks

- **ZEV Technology**
  - Zero Emissions
  - Performance
  - Durability
  - Affordable

- **Cost of Ownership**
  - Fuel Cost
  - Vehicle Cost
  - Maintenance Cost
  - 2nd Life/Resale

- **Infrastructure**
  - Fast re-fueling
  - High Throughput
  - Renewable Fuel
  - Safety

- **ZEV Technology**

- **Cost of Ownership**

- **Infrastructure**
ZEV Technology: BEV and FCEV

Battery EV or BEV

Electricity Charging ➔ Rechargeable Battery ➔ Electric Motor ➔ Applications

Fuel Cell EV or FCEV

Hydrogen Charging ➔ Fuel Cell ➔ Electric Motor ➔ Applications

H₂

Battery EV or BEV

Fuel Cell EV or FCEV
ZEV Technology: BEV and FCEV

BEV is optimized for short-to-mid range applications

FCEV is optimized for mid-to-long range applications
ZEV Technology: BEV and FCEV

- Small delivery vehicles
- Short-distance vehicles
- Delivery trucks
- Buses
- Heavy-duty trucks

Vehicle size:
- BEV
- FCEV

Driving distance:
- Electricity
- Hydrogen
ZEV Technology: Toyota FCEV History

Vehicle size

Driving distance

20+ Years

Hydrogen
Performance: Drag Test

http://pressroom.toyota.com/video_display.cfm?video_id=34150
Achieved significant cost reduction from Mirai development
Leverage Mirai technology in Portal to reduce cost
Cost of Ownership: Vehicle Cost

- Leverage Mirai components from 2 vehicles
- Benchmark current class 8 truck performance

Specifications
- Class 8 truck chassis
- 2 Mirai fuel cell stacks
- 12 kWh of batteries
- 700 bar storage

Performance
- 670 horsepower
- 1375 lb-ft of torque
- 80,000 lbs GVWR
- 200+ miles of range
Cost of Ownership: Fuel

Hydrogen Fuel Cost per mile for Port Drayage Truck

- **Current**
  - **Fuel Cell**
    - $3.00/mile@80,000Lbs

- **Short-term**
  - **Fuel Cell**
    - $1.28/mile@80,000Lbs
  - **Diesel**
    - $1.28/mile@80,000Lbs

- **Mid-term**
  - **Fuel Cell**
    - $0.60/mile@80,000Lbs
  - **Diesel**
    - $0.60/mile@80,000Lbs

Source: NPC, UC Davis study, Toyota study
Infrastructure: Light-Duty and Heavy-Duty

**California Light Duty Station Network**
- Executive Order: 200 stations by 2025
- 32 current open retail
- ~20 additional stations funded

**Heavy-Duty Station in POLB**
- Current Temporary station
- Tri-generation System (announced LA Auto Show 2017)
  - Renewable hydrogen, power, and heat production
  - Located at Toyota’s Port Facility in POLB
Infrastructure: Refueling time

Toyota Fuel Cell Refueling time Reduction

- **2008**: 15 min (300 miles)
- **Mirai**: 3 min (300 miles)
- **1st HDT**: 25 min (200+ miles @ Drayage)

➢ Expect practical refueling time for HDT also
Benefits and Impacts of PORTAL

Benefits of PORTAL

- **ZEV Technology**: ZEV solution capable of high performance, heavy cargo, and long range
- **Cost Of Ownership**: With scale, TCO is competitive with conventional and alternative technologies
- **Infrastructure**: Enables safe, clean, and convenient fueling for customers

Impacts of PORTAL

- **Community**: Directly benefits Disadvantaged Communities near the ports and along major freight corridors
- **Health**: Improved air quality and reduced GHG impact
- **Economic**: Enables Port expansion and local job creation

ZEV Technology

- Improved air quality and reduced GHG impact
- Enables safe, clean, and convenient fueling for customers

Cost Of Ownership

- With scale, TCO is competitive with conventional and alternative technologies

Infrastructure

- Enables safe, clean, and convenient fueling for customers

Community

- Directly benefits Disadvantaged Communities near the ports and along major freight corridors

Economic

- Enables Port expansion and local job creation
Today

7,180 ZERO emission miles as of 3/9/2018 (and counting!)

Alameda Street

Corner of Alameda & Carson Street

YTI Terminal Yard

YTI Terminal Yard Gate
CREATING A ZERO-EMISSIONS WORLD
PIONEERING THE PATH TOWARDS A NEW ERA OF PORT PROGRESS

HEAVY-DUTY PROGRESS POWERED BY TOYOTA HYDROGEN FUEL CELL TECHNOLOGY

Thank you!

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