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<td><strong>Document Title:</strong></td>
<td>Presentation - Heavy-Duty FCEVs Benefits and Challenges</td>
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<tr>
<td><strong>Description:</strong></td>
<td>Presentation by Jaimie Levin, Center for Transportation and the Environment</td>
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<td><strong>Filer:</strong></td>
<td>Raquel Kravitz</td>
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Heavy-Duty FCEVs
Benefits and Challenges

Integrated Energy Policy Report Update
California Energy Commission
July 2, 2020
Fuel Cell Electric and H₂ Projects

• Class 6 UPS Trucks
• Class 8 Drayage Trucks
• Marine Cargo Top Loader
• 40’ and 60’ Transit Buses
• HD and LD H₂ Stations
Operational Efficiency

GOAL: Satisfy End-User Needs

Three Key Performance Objectives
1. Range
2. Passenger/Payload
3. Multiple Duty Cycles

Two Key Fiscal Objectives
1. Affordable CapEX
2. Affordable OpEx
FCEB Advantages

300-350 miles Proven range

Significant reduction in vehicle weight (carry more passengers)

Rapid refueling speeds (6 to 10 minutes)

1:1 replacement of conventional vehicles
ZEB Infrastructure Scalability

➢ FCEB: High initial cost for H2 fueling stations can be leveraged over many buses in larger fleets

➢ BEB: More equipment and infrastructure is needed to support larger fleets

45’ X 56’ (12- to 15-Bus Capacity, Expanded to 60+ Buses)
Infrastructure Challenges

**PRICE**
- Price and delivery of H2 on parity with conventional fuels.
- Also equipment maintenance cost reduction.

**AREA**
- Area of fueling footprint to refuel 50, 100, or 200 buses.

**RENEWABLES**
- Renewables for hydrogen production; Resiliency - Natural Disasters;
- Also Redundancy to ensure near 100% service reliability.

**SPEED**
- Speed of refueling in the normal 8- to 10-hour night window; Also Scalability for future expansion.

**ENTRY-LEVEL STARTUP AND EQUITY**
- (CapEX) needed to build at an affordable price, utilizing baseline components for future scale up.
Asked of 500 attendees at the conclusion of the International Zero-Emission Bus Conference in San Francisco on September 27, 2019

For everyone, in 10 years, which zero emission technology will be the most prevalent on buses?

- Battery Electric: 46%
- Fuel Cell Electric: 40%
- Don't know: 13%
18 California Transit Agencies

Requesting CEC Funding Support for H2 Fueling Stations

- AC Transit
- Big Blue Bus (Santa Monica)
- County Connection (CCCTA - Concord)
- Foothill Transit (West Covina)
- Golden Empire Transit (GET – Bakersfield)
- Golden Gate Transit (Marin)
- Gold Coast (Ventura)
- Long Beach Transit
- Monterey-Salinas Transit
- North County Transit (Oceanside)
- OmniTrans (San Bernardino)
- San Diego Metropolitan Transit System
- San Joaquin Regional Transit District
- Santa Cruz Metropolitan Transit District
- Shasta Regional Transportation Agency
- SunLine Transit District (Thousand Palms)
- Tri-Delta Transit (ECCTA – Antioch)
- Victor Valley Transit (Hesperia)