

Zero Emission Hydrogen Fuel Cell Vehicles

DOE Electricity Advisory Committee

*Working Together Towards a Sustainable and Resilient Zero
Carbon Emission Future: Hydrogen, Batteries, & Natural Gas*

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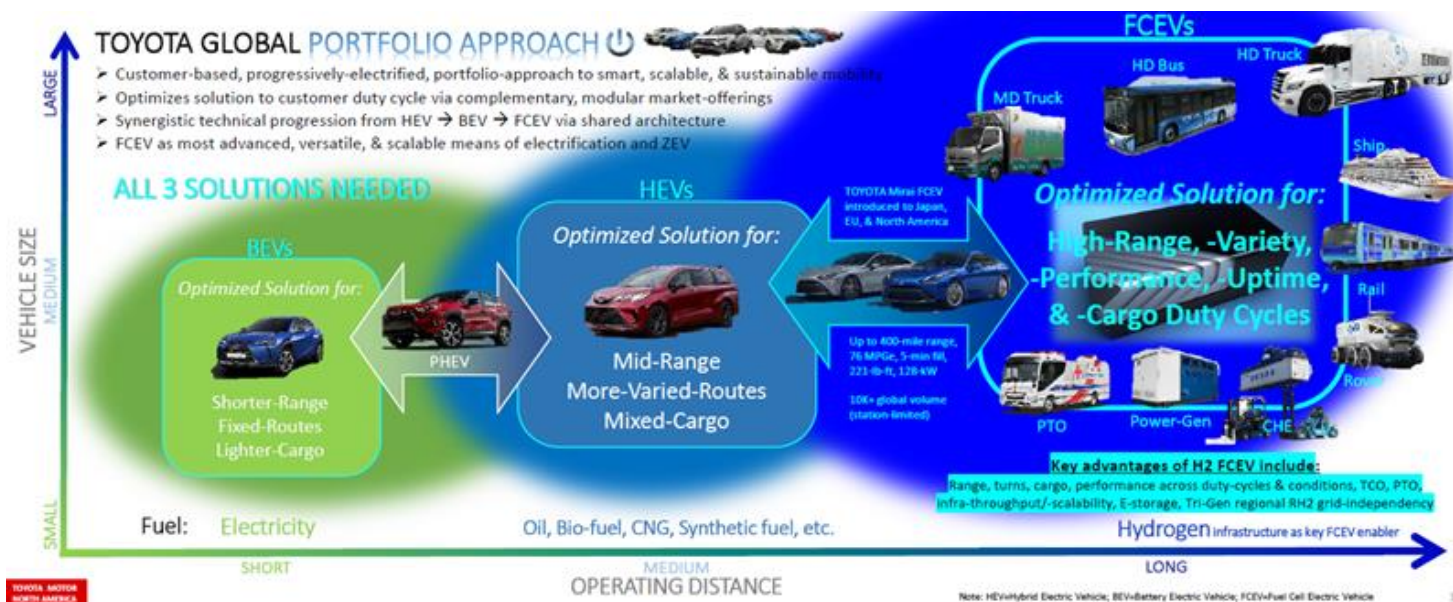
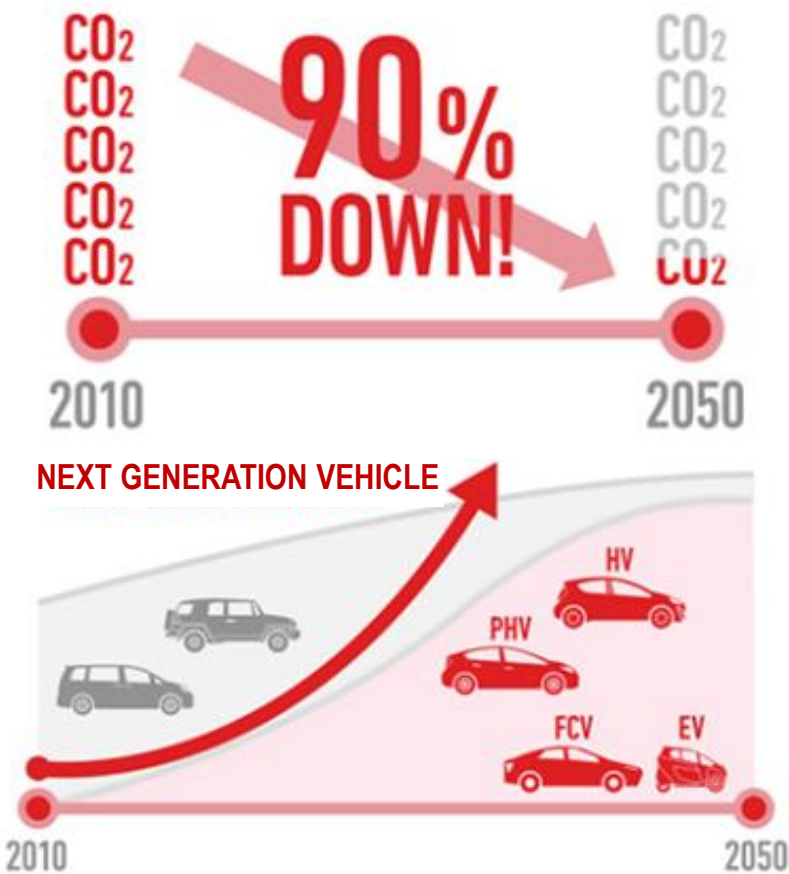
Toyota Motor North America

June 9, 2021

Toyota Motivation

- Seek a **90% reduction in tailpipe emissions by 2050**, from 2010 levels, on a global basis
- Meet customer transport needs anywhere in the world with a portfolio of electrified vehicle options

Toyota 2050 Environmental Challenge



- Accelerate vehicle electrification globally to achieve by 2025
 - **All Toyota and Lexus models will have an electrified option**
 - **~50% of new vehicle sales will be electrified**

Toyota US Electric-Drive Portfolio

Compact/
Medium



Large/
Premium



SUV



Minivan



Plug-In Electric

Hydrogen Fuel Cell



Mirai FCEV

Electrification Progress Takes Time

- 1st Prius hybrid launched in US in 1999
- +4M electric-drive Toyota & Lexus sold in US
- ~23% of current Toyota & Lexus sales electrified
- Expect 70% electrified by 2030

Fuel Cell Vehicle Advantage & Status

No change in behavior needed

Public Infrastructure
No need for home refueling

Rapid Refueling
3-5 minute

Long Range
+400 miles

Excellent performance
in cold weather



Honda Clarity

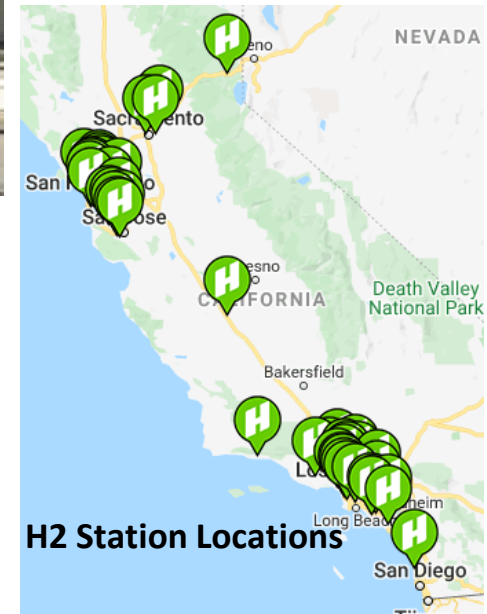


Toyota Mirai



Hyundai Nexo

• +10,000 FCEVs sold in US, ~8000 Toyota Mirai



- 48 retail H2 stations open in CA
- +60 under construction or in design
- Also deploying stations in Boston area

A Single Hydrogen Station Can Support Many ZEVs



An FCEV requires 3-5 minutes to refuel

→ A single nozzle can fuel ~10 FCEVs / hour



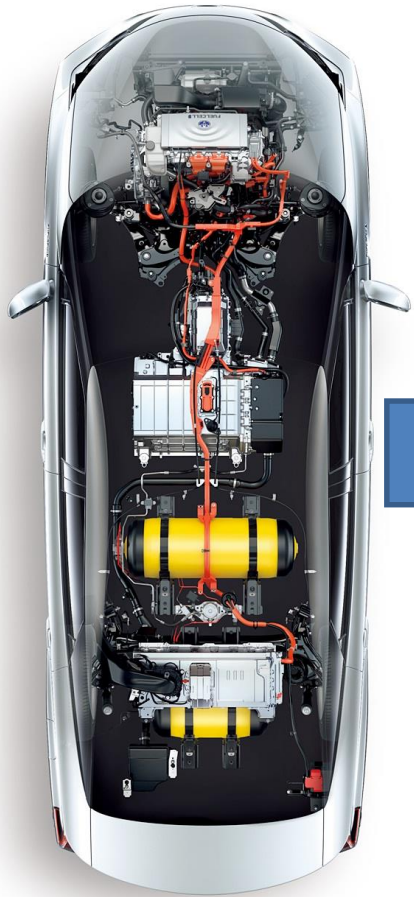
New stations typically have two dispensers with 4 nozzles

→ ~480 FCEVs can be refueled in a 12-hour day

→ **A single 4 nozzle station can support up to 1500 individual FCEVs**
(Assuming twice a week refueling)

Station Capacity = ~ 1 ton of H₂ / day

Scalability of FC Technology



Modular
Fuel Cell
Power System



2X Systems

Heavy-Duty Applications



Plus Additional

- Batteries
- H2 Storage

Medium-Duty Applications



Marine, Industrial, Rail and Stationary Applications

Toyota Heavy-Duty Fuel Cell Vehicles



Class 8 Fuel Cell Tractor



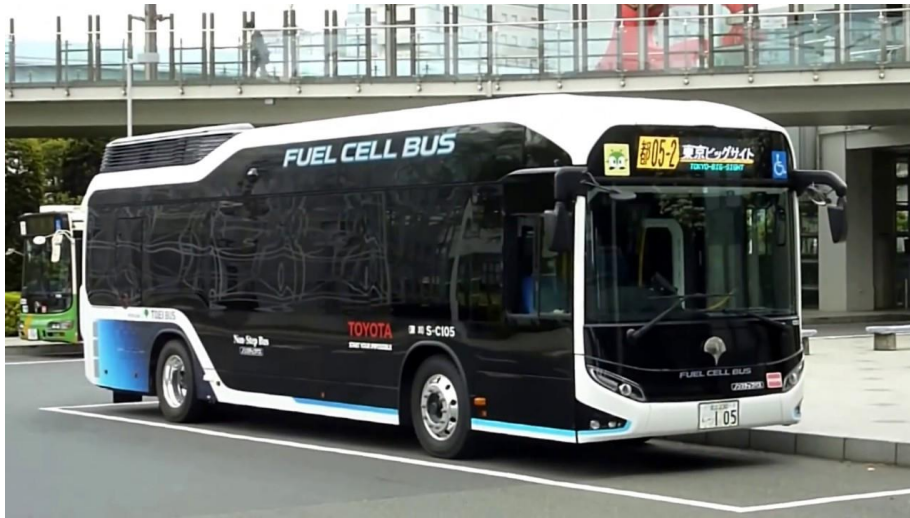
Medium Duty Fuel Cell Trucks with Hino Japan



Fuel Cell Power Supply Vehicle Japan



FC Fork Truck



Sora Fuel Cell Bus



Heavy Duty Fuel Cell Trucks with Hino US



UNO FC Utility Tractor

Commercial Class 8 Truck Project with PACCAR

10

CLASS 8 TRUCKS

4

UNIQUE OPERATORS

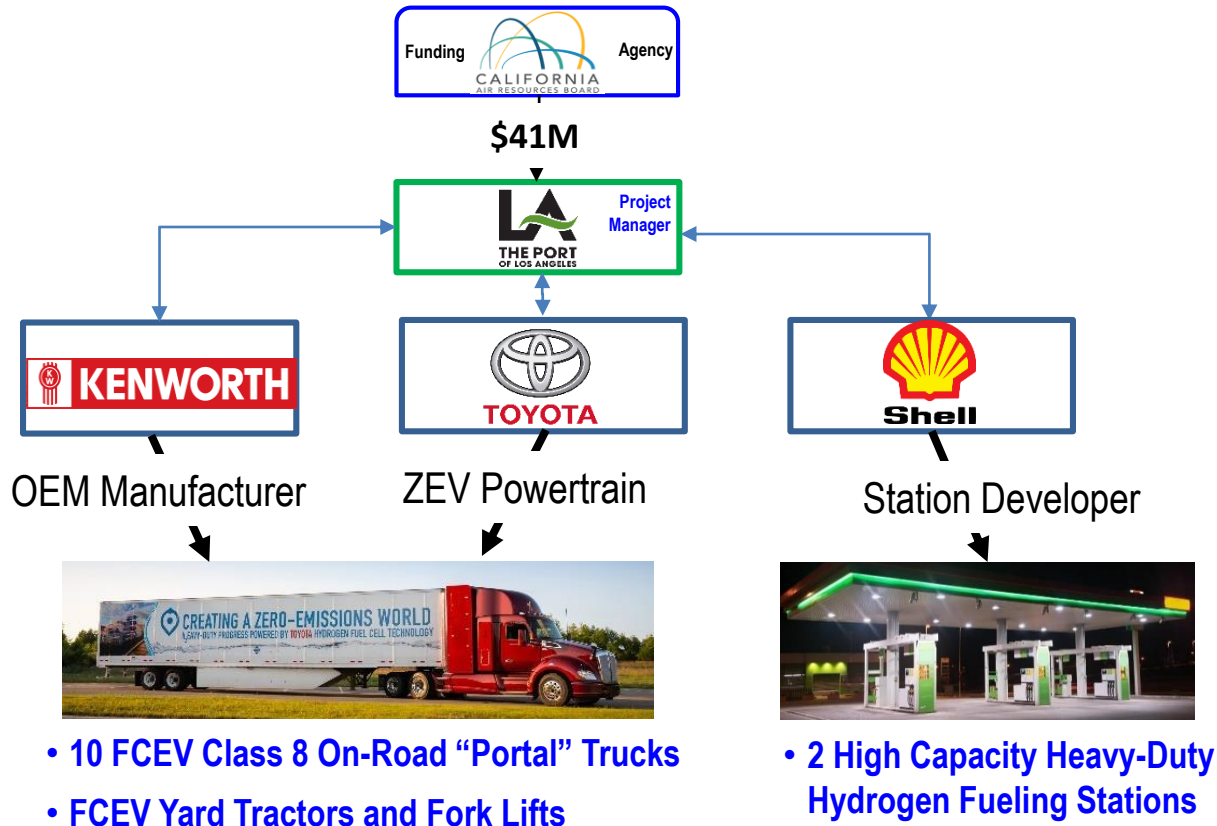
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NEW HD H2 FUELING STATIONS



Toyota Zero Emission HD Truck Drayage Project

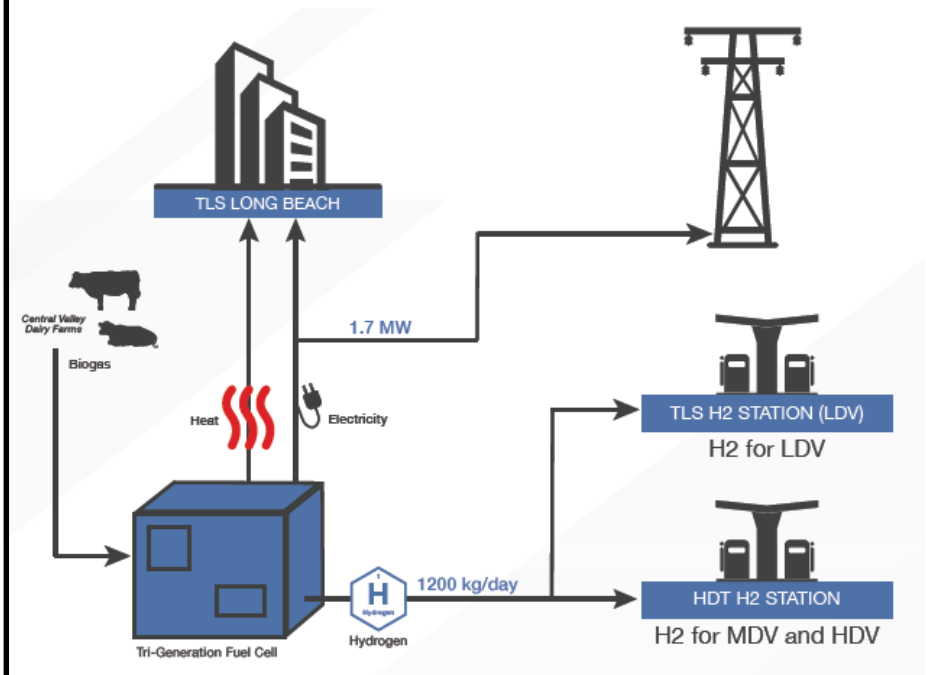
\$82M "Shore-to-Store" ZANZEFF* Project



* Zero-Emission & Near Zero-Emission Freight Facilities

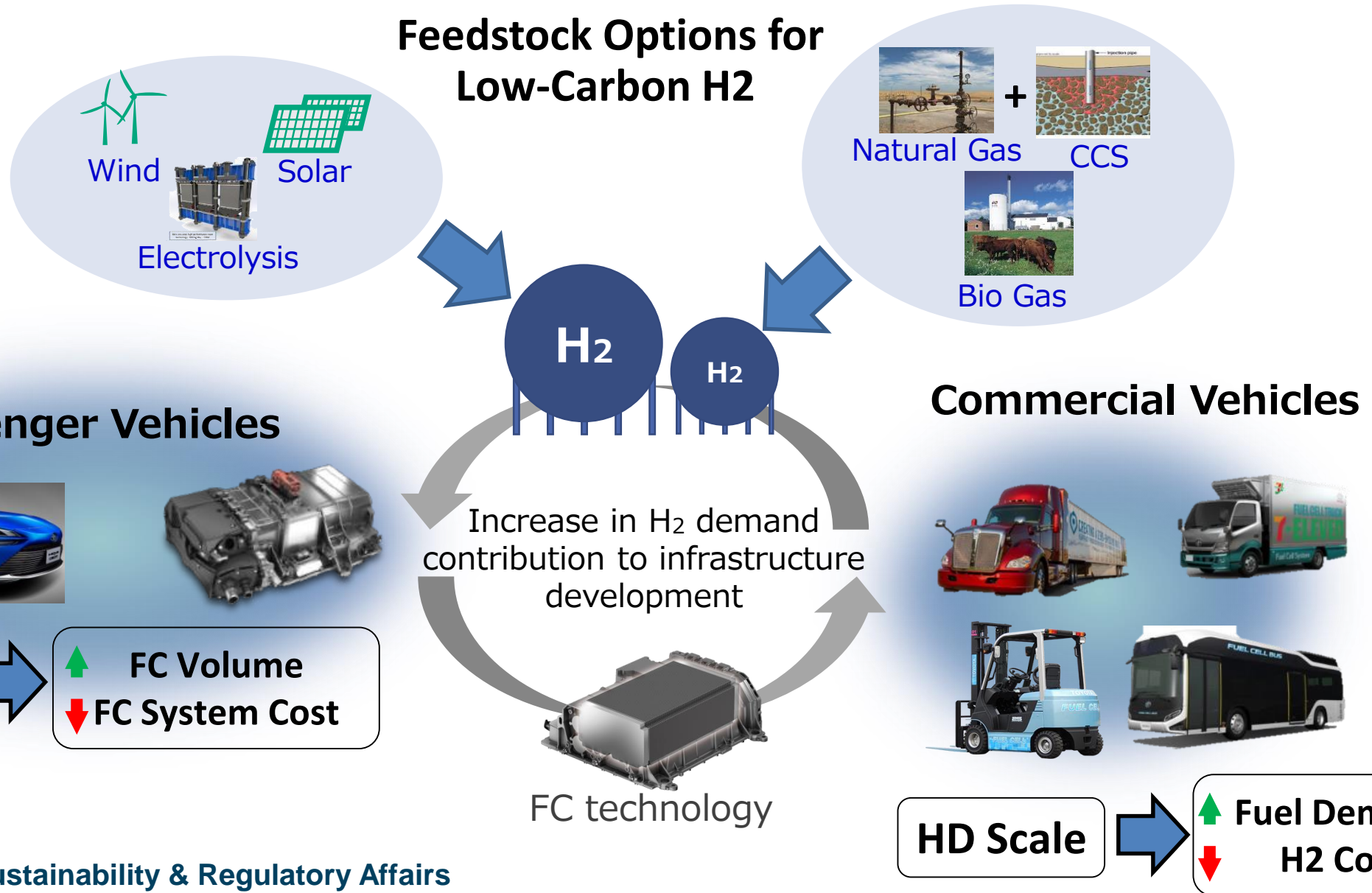
Toyota "Tri-Gen" Project

- Renewable hydrogen, power, and heat production
- Located at Toyota's Port Facility in Port of Long Beach
- Will fuel "Portal" trucks and new Mirai



Elimination of HD truck emissions will greatly benefit air quality in nearby disadvantaged communities

Feedstock and Vehicle Diversification Necessary for Success





2021 Prius



2021 RAV4 Hybrid

Thank You For Your Attention



2021 GR Hybrid Hypercar



2021 Mirai