

The Transition to Zero-Emissions Transportation

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PASSENGER CRUISES



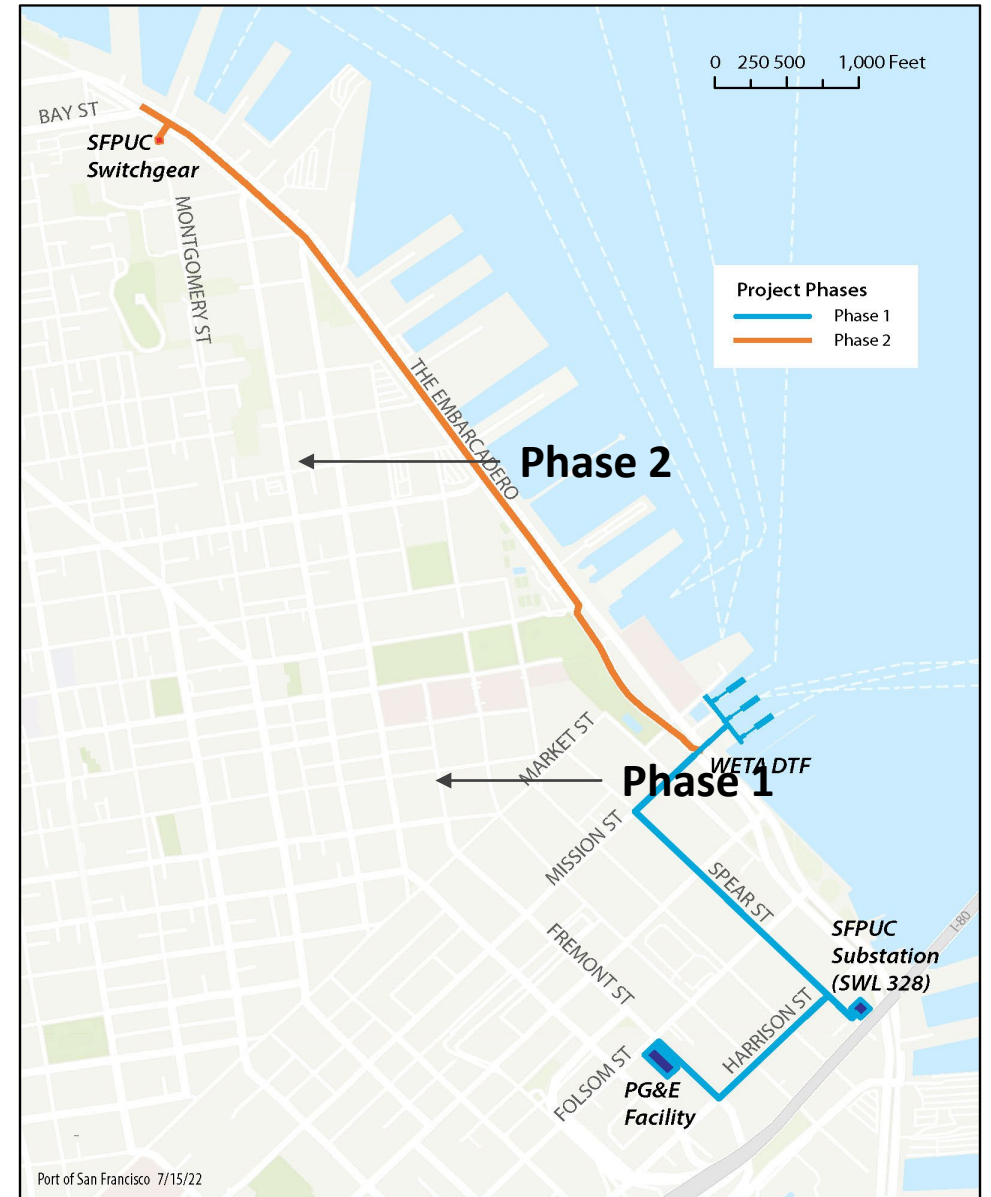
Shoreside Power

- Since 2014
- First on West Coast



Expanding Electrical Infrastructure


- **Port Power needs** – Expected to grow 2.5x in 25-years
- **Sustainability** – Power demand driven by converting **vessels to electric power**, vehicle charging, and changing HVAC from gas to electric
- **Benefits** – Expanded infrastructure will:
 - Reduce time to deliver projects
 - Reduce costs for development partners
 - Provide confidence of available infrastructure



Renewable Diesel in Bay Harbor Craft

Bay Area maritime fleets are switching to

100% RENEWABLE DIESEL



This will reduce greenhouse gas emissions by more than

22,000 metric tons

per year compared to regular diesel

Renewable diesel is functionally the same as regular diesel, but is **made from sustainable sources**

Carbon Footprint

- 60% lower than petroleum diesel

Engine Manufacturers

- Warranties remain valid worldwide.

HYDROGEN – Sea Change



- Aluminum Catamaran
- 78 Passengers + 2 Crew
- 72'7" Length Overall
- 1st in Commercial Vessel in U.S.

ZERO EMISSIONS!

HYDROGEN (H₂) – Applications

BASICS

- Used in Fuel Cells



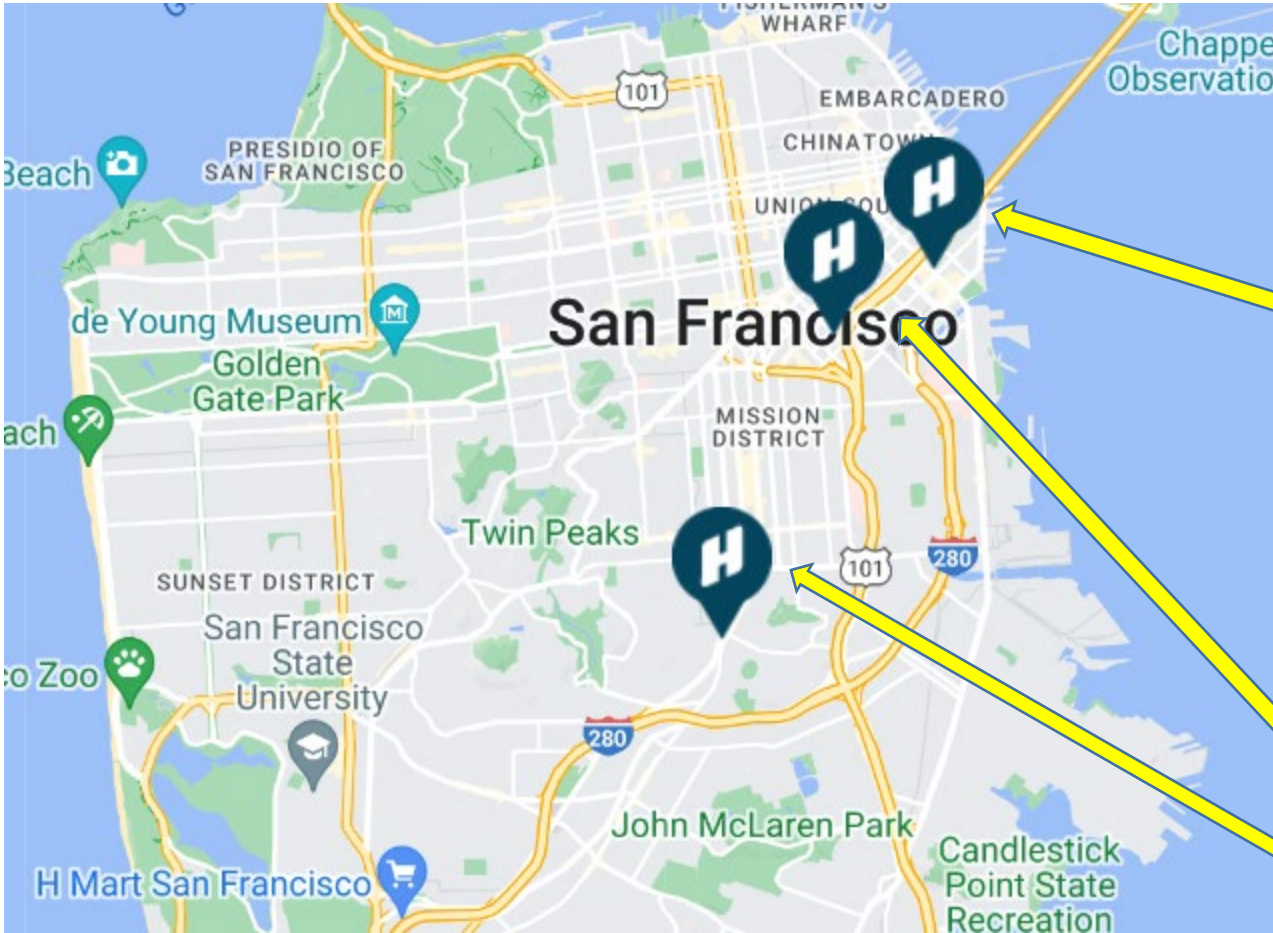
- Powers Electric Motors
- Alternative to Chemical Batteries
- **Advantages for trucks, ships, heavy cargo**

H₂ FUEL CELLS

- Non-Toxic/Non-Polluting
 - Water/Air
- No Carbon
- No Greenhouse Gas Emissions
- No Criteria Pollutants
 - Particulate Matter (PM10/PM2.5)
 - NO_x, SO_x, Ozone

Advantages include: range, fueling time, cargo capacity.
“You can haul cargo or batteries, but not both.”

HYDROGEN – in San Francisco

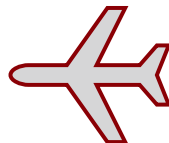


551 Third Street

1201 Harrison Street

3550 Mission Street

In use at SFO since 2013



HYDROGEN (H₂) – Two Ways to Make H₂

ELECTROLYSIS

- Requires Water & Electricity

Potential for:

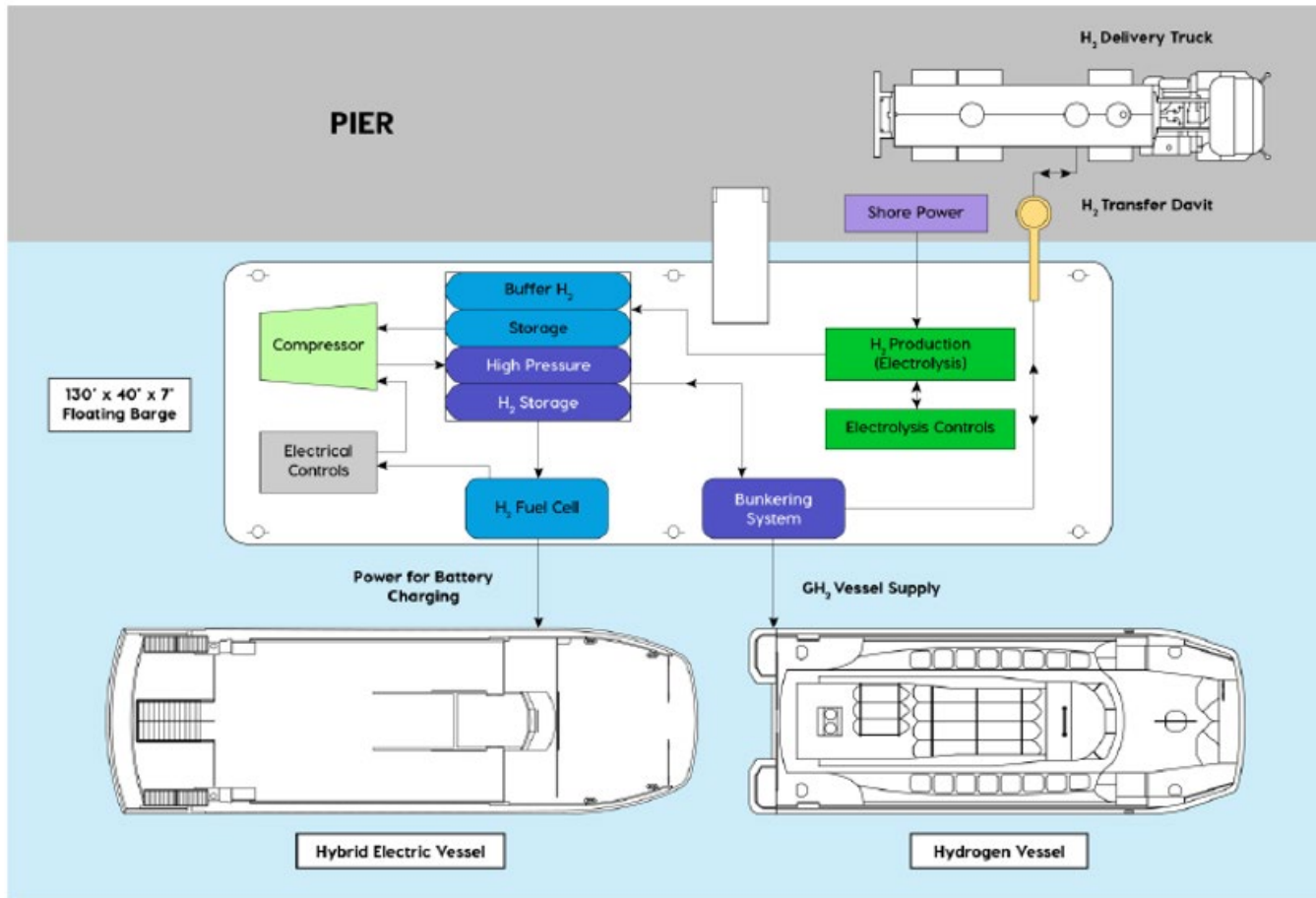
- No Greenhouse Gas Emissions*
- No Criteria Pollutants *

METHANE REFORMATION

- Methane (contains carbon)
- Carbon Footprint
- Greenhouse Gas Emissions
- Criteria Pollutants
- Richmond Plant (Largest in U.S.)

* Depends on source of electricity

Hornblower – H₂ Barge Demonstration Project



PURPOSE

- **Hetch-Hetchy**
 - Zero-Carbon Electricity
 - Water
- **Produce/Store/Dispense H₂**
- **Operate H₂ Fuel Cells**
 - Provide Renewable Electricity
- **Service to Mobile/Stationary**
 - Vessel
 - Land-Based

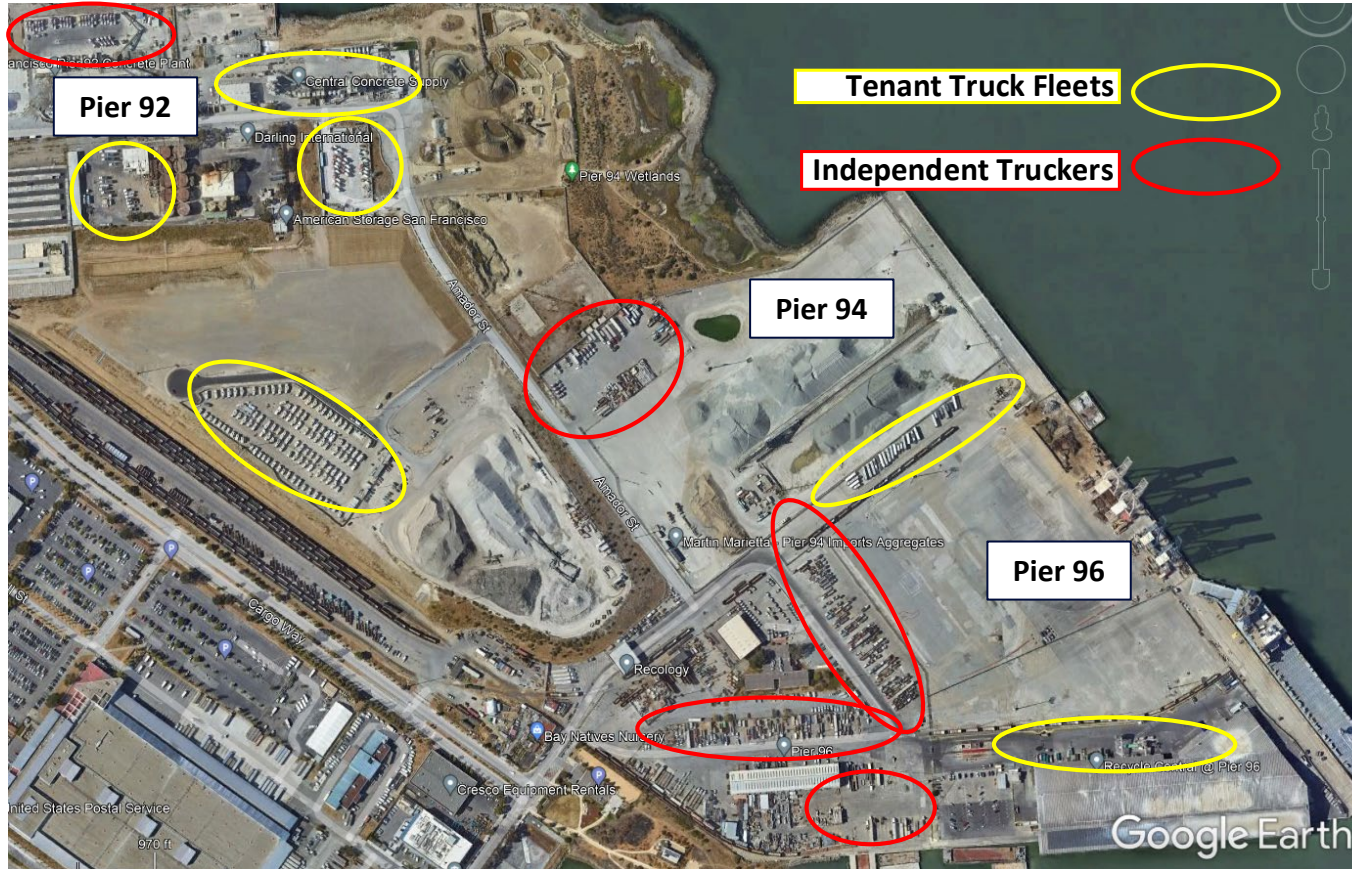
Hornblower – H₂ Barge Demonstration Project



LOCATION

- Builds on 100+ year tradition of the maritime industry.
- H₂ that is produced on site is less expensive.
- Maritime synergies for zero-emission future.

Diesel Emission Reduction Opportunities



Zero-Emission Trucking

- Expand Eco-Industrial Area synergies
- Create a support hub for zero-emission trucks
- Produce H₂ for fuel cell trucks.
- Provide charging infrastructure for battery electric trucks.

The future of Class 8 Trucks → H₂ Fuel Cell & Battery Electric

Thank you