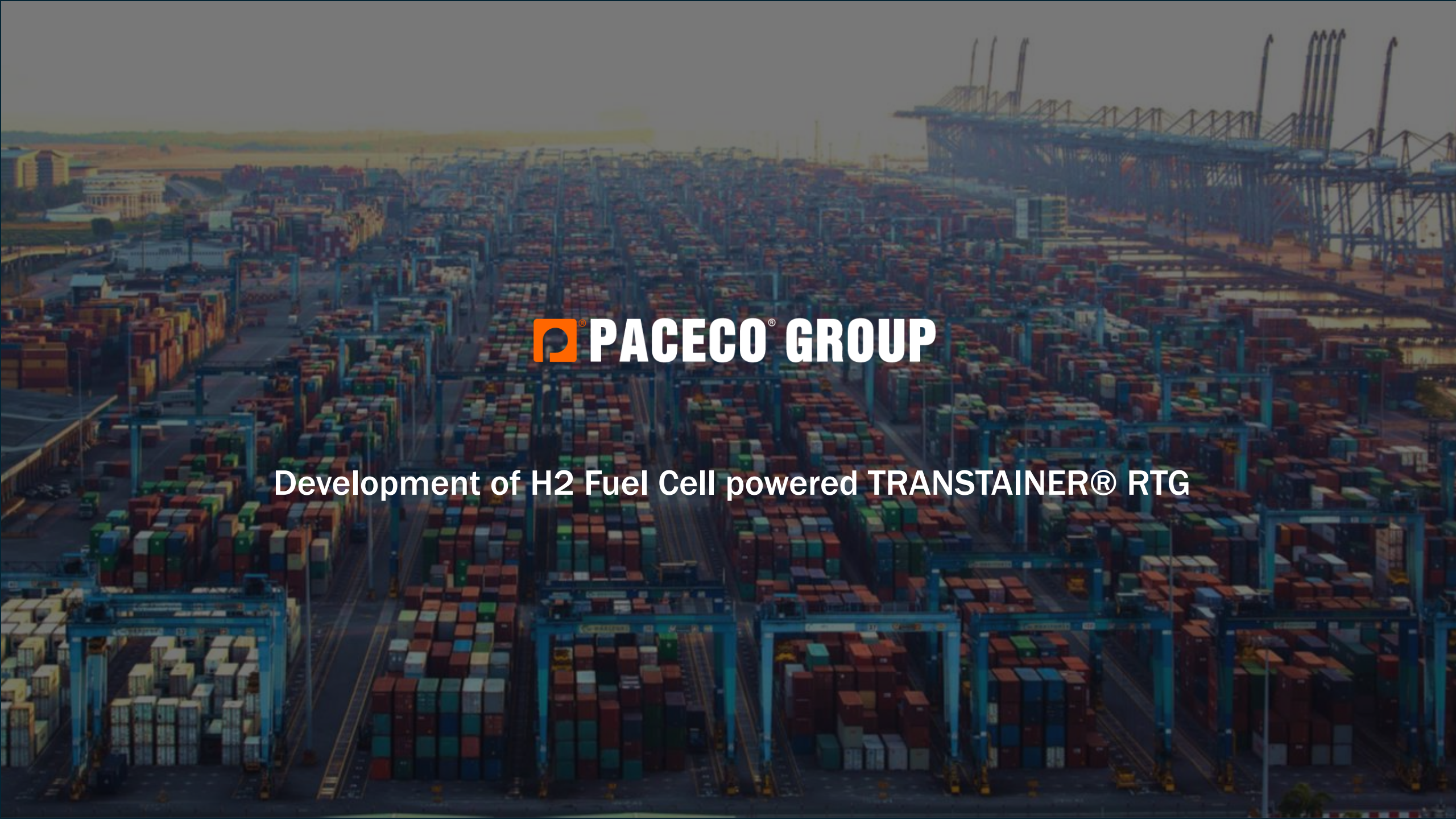
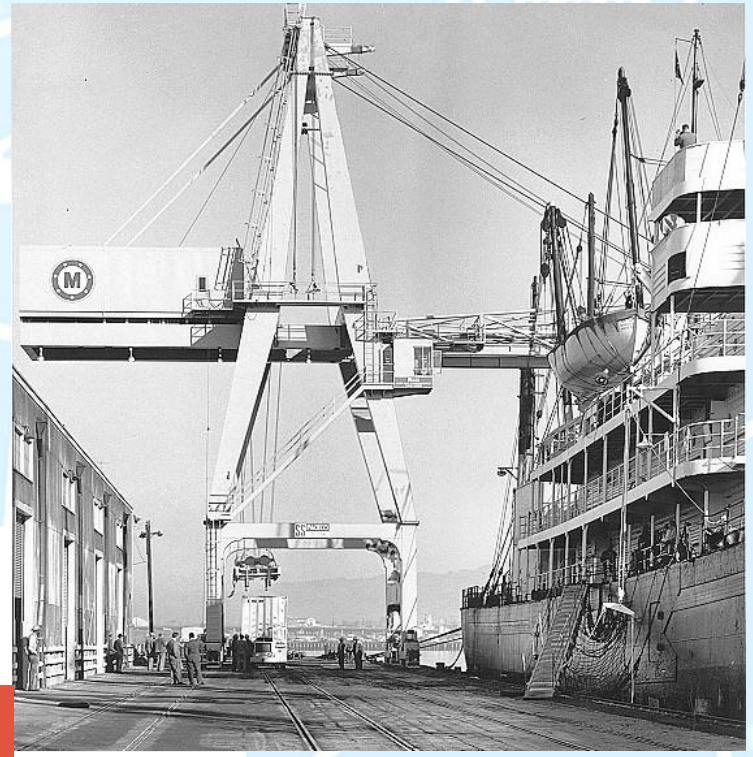

PACECO® GROUP
Development of H2 Fuel Cell powered TRANSTAINER® RTG

History of Paceco

As PACECO Group, we have been pioneers in the container handling equipment industry since the first ship-to-shore crane was designed and manufactured in 1958 for Matson.

Today, we continue to be leaders in container handling equipment and in addition, new technology for Port Systems.

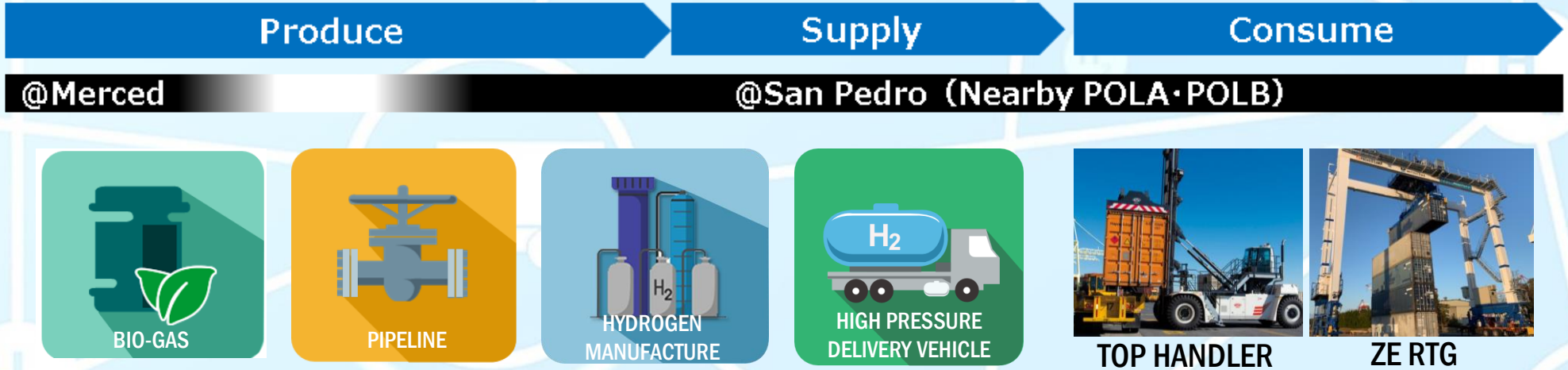


PACECO Group:

- PACECO Corp. (Hayward, CA, USA)
- Mitsui E&S Co., Ltd. (Tokyo/Oita Japan)
- PACECO Momentum & Poseidon (Madrid Spain)

NEDO Grant – Hydrogen from a Clean Supply Chain

Concept: zero emission ports and terminals, powered by hydrogen produced from renewable energy sources, with production and consumption of hydrogen locally at/near the port. Electric sources may not be from renewable energy sources, thus minimizing the benefits of implementing a zero-emission port/terminal.



TOP HANDLER

ZE RTG


YARD TRACTOR

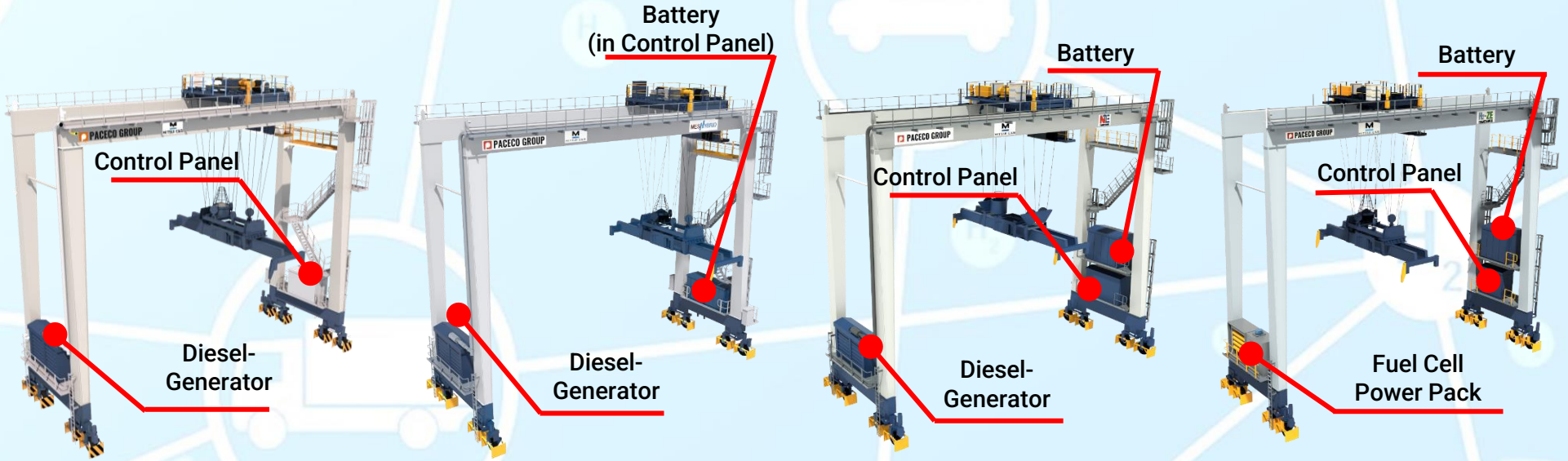

DRAYAGE TRUCK

NEDO, the **New Energy and Industrial Technology Development Organization** ,

Demonstration location: Yusen Terminals at the Port of Los Angeles (POLA)

The project started in February 2022 and will extend to May 2028.

Transtainer RTG Crane Comparison



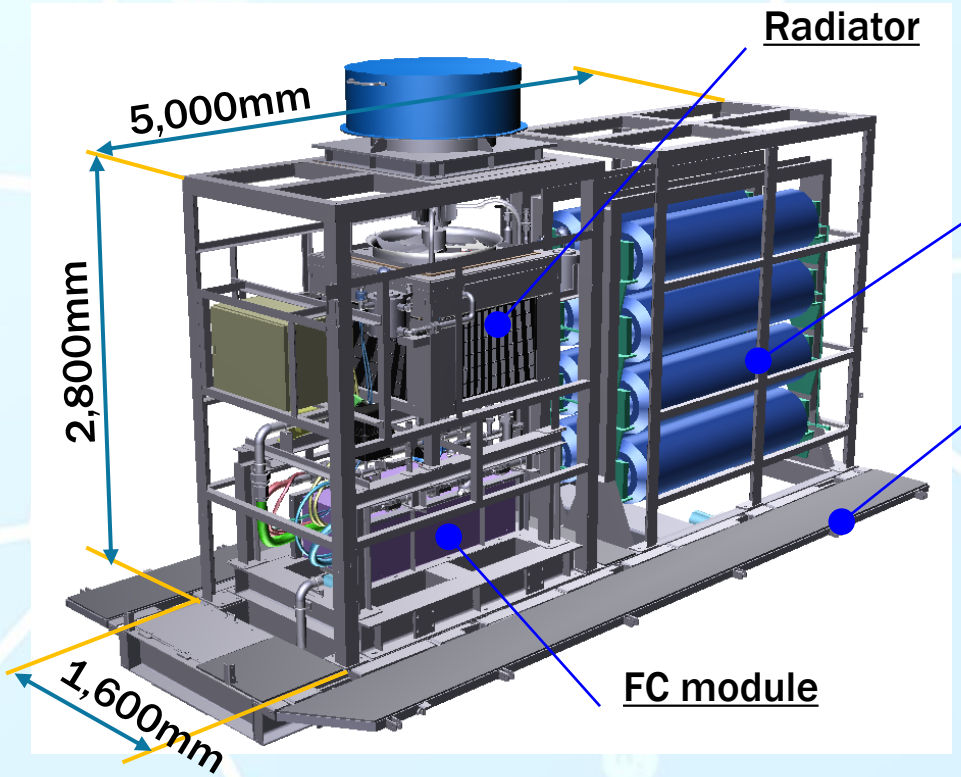
	Conventional Diesel	Diesel Hybrid released 2009	NZE (Near Zero Emission) Released 2021	H2-ZE (Zero Emission FC) 2024
Engine size	500kW, Diesel	220kW, Diesel	100kW class, Diesel	100kVA class, Fuel Cell
Battery	N/A	100% (baseline)	~ 6x diesel hybrid size	~ 6x diesel hybrid size

Key: Advanced battery technology and electronics improved the crane power efficiency to 80kW level

Fuel Cell Power Pack Design

Points of development

- Leveling of output fluctuations
- Design and install in narrow footprint



Rated output FC module	60kW (DC 650V)
Pressure of H_2 Tank	70MPa
Capacity of H_2 Tank	32 kg-H_2 (Trial crane) 64 kg-H_2(Commercial crane, for 16h operation)
Hydrogen gas purity	ISO 14687-2: 201 (Type 1, Grade D)
Filling protocol	SAE J2601-1 , JPEC-S 0003

Testing in Mitsui E&S Oita Factory (Post-Upgrade)

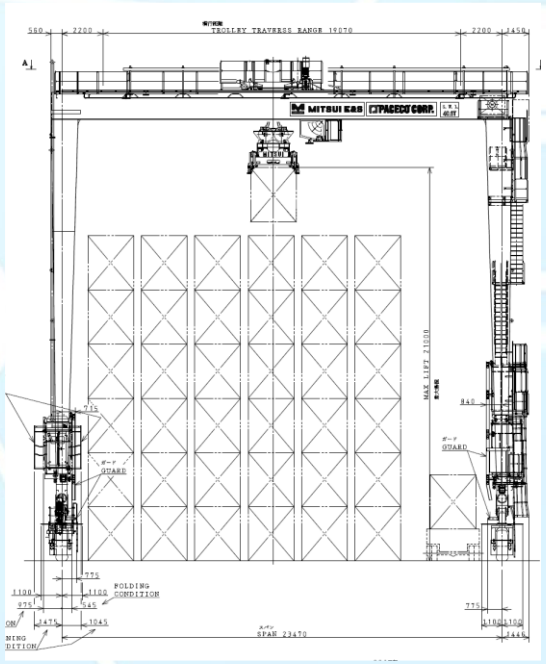
Changed from diesel genset to hydrogen fuel cell power module with hydrogen tanks

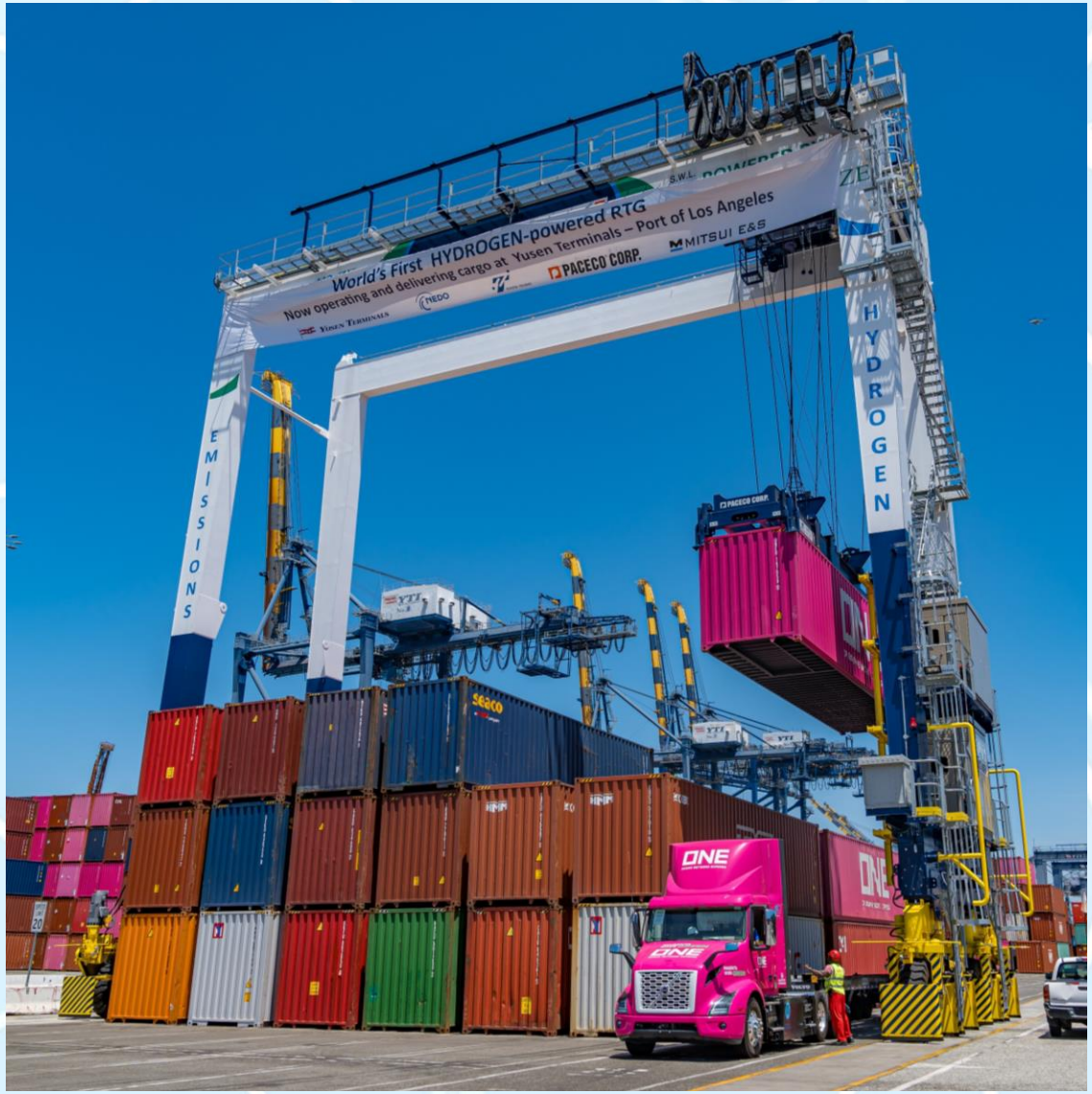
Added battery pack above the electrical house

H2-ZE RTG, Demonstration at YTI

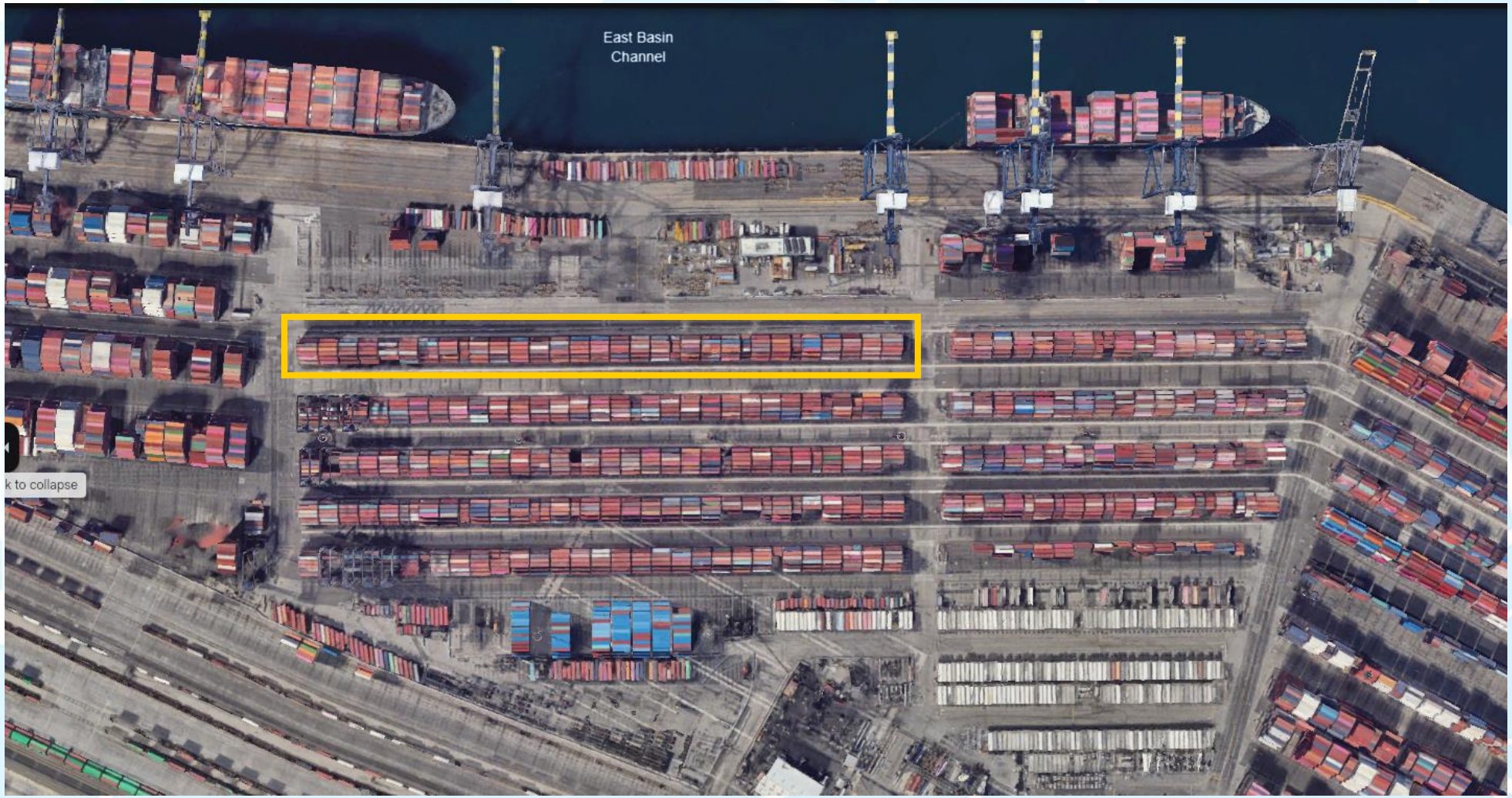
RTG Specification
- Stack 6 containers high plus trolley path
- Stack 6 containers wide plus truck lane
- Hoist speed 23m/min

Fuel Cell Power Pack Specification
- 64 Kg hydrogen capacity
- 60kW power output



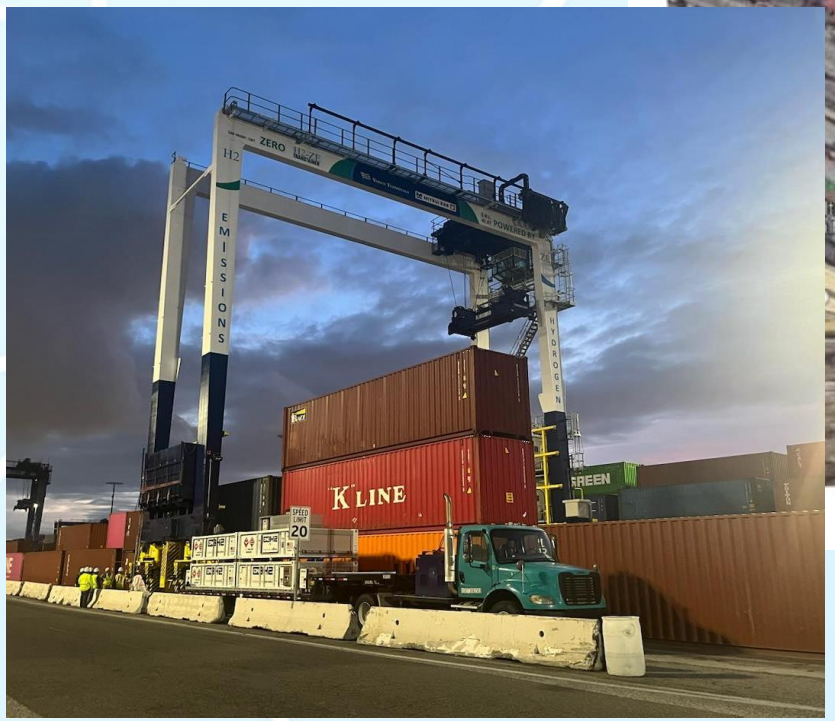


Designated Area of Operation at Yusen Terminals



Designated Area of Operation at Yusen Terminals

- The designated refueling area is at the stack end cap
- Refueling between 0300-0700 hrs.
- The mobile refueler will be inside the K-rail barrier.



Hydrogen Delivery - Toyota Tsusho/OneH2 and Refueling Process

Mobile refueler provided by Toyota Tsusho and manufactured and operated by OneH2

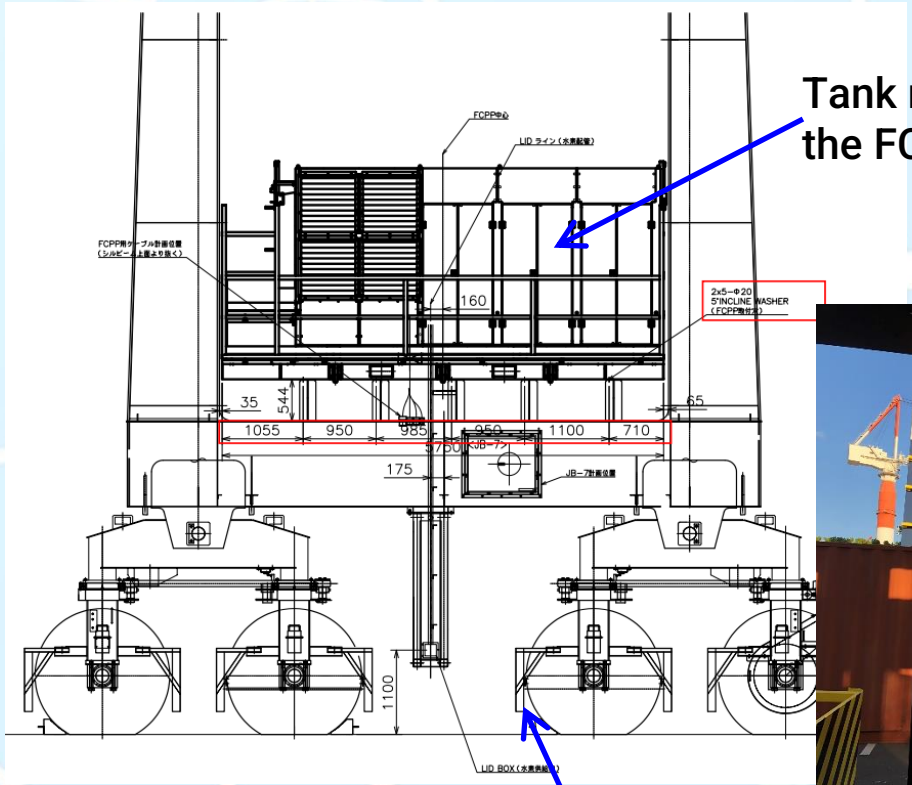
Cascading method of filling

930 bar pressure to fill 700 bar tanks on the RTG

Fill rate: 2 kg/min

247kg @ 930 bar

495kg @ 930 bar



Tank module (inside the FCPP house)

Refuel port: 1100mm from the ground

Hydrogen Advances in the US with Government Funding

Zero emissions is pushed by government policy

Backed by government funding

US Department of Energy announcement of 7 hydrogen hubs in the United States, in total $7 Billion to be deployed to projects spanning production, delivery, and use.

This will drive further adoption of hydrogen in the United States by:

a) Increasing production and decreasing the cost of hydrogen

b) Provide subsidies for equipment and infrastructure

Build America, Buy America Act (BABAA) compliance necessary

Source: Office of Clean Energy Demonstrations.

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Thank you