



Benefits for Hydrogen for Trucks



Sustainability

At TTSI, we are committed to leaving as small a footprint as possible on our precious environment. That's why we are committed to several ecological goals designed to drastically reduce our operational emissions and subsequent environmental pollution.

Our goal is to operate a zero emission fleet that services our customers while being a steward to the environment.





2007 CAAP Announcement

LB News | 08.03.07 | publishers@lbpost.com

Coalition Funds Green Trucks

Long Beach Mayor Bob Foster and LA Mayor Antonio Villaraigosa were on hand to support the Clean Trucks Program to address the impact of diesel-related emissions on the surrounding communities by 2012.

The program places truck drivers into environmentally friendly vehicles by providing them with financial support which allows them to remain as independent owner operators.

The program will fund 100 "clean" trucks into service over the next 12 months.

The retail store, Target, has partnered with Total Transportation Services, Inc (TTSI) and NYK Logistics and identified an innovative solution which meets both industry and independent owner/operator needs.

This group, along with other beneficial cargo owners and trucking companies, has also formed a coalition for the sole purpose of developing and implementing solutions to address the issues of truck emissions. The Coalition for Responsible Transportation will use the framework from TTSI, NYK and Target as a starting point for encouraging discussions and partnership as companies identify possible solutions.



TTSI announced during the press conference that it would convert its entire fleet to comply with the provisions of the CAAP



Clean Air Action Plan

On July 11, 2011, TTSI takes possession of the 1st Class 8 Hydrogen Fuel Cell Truck for a drayage application

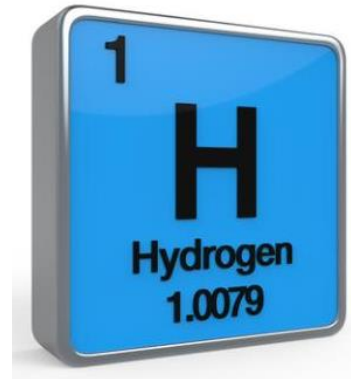




Why Hydrogen?

■ Offers several benefits over diesel and natural gas

- ❑ Cheaper operating cost per mile
- ❑ ZERO Greenhouse Gas Emissions
- ❑ No noise pollution
- ❑ No idling
- ❑ Substantial increase of torque
- ❑ Domestic and secure energy source
- ❑ Renewable and non-depleting
- ❑ Can be made from a wide variety of resources
- ❑ Hydrogen fueling at several locations in Southern CA available



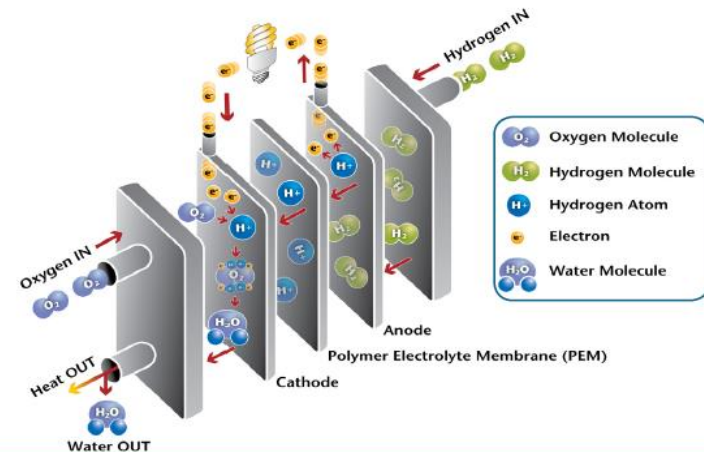
■ OEM show interest in this technology

■ State and federal support available



What is a Hydrogen Fuel Cell

- An electrochemical engine that converts hydrogen fuel and oxygen into electrical energy
- Twice as efficient as gasoline internal combustion engine
- A battery that runs on hydrogen fuel
- No emissions (exhaust = H_2O)
- Endgame for transportation industry



Fuel cells directly convert the chemical energy in hydrogen to electricity, with pure water and potentially useful heat as the only byproducts. Hydrogen-powered fuel cells are not only pollution-free, but also can have more than two times the efficiency of traditional combustion technologies.



Fuel Price Comparison

■ As of 07/19/2018 in Southern CA:

- Hydrogen \$9.99 (Per kilogram*)
- Diesel \$3.66 (US/Gallon)
- Natural Gas \$3.81 (US/Gallon)

*per Air Products (03/06/2017)

** Hydrogen Price at SCAQMD - \$13.99/Kilogram



Cost of Ownership

Vehicle Metrics	Fuel Type		
	Diesel	LNG/CNG	Hydrogen*
Initial Vehicle Cost	\$140,000	\$204,000	\$270,000
Tax Credit for Qualified Alternative Fuel Vehicle	\$0	\$0	\$0
Funding (Grant/Subsidy) Incentive Programs	\$0	\$100,000	\$200,000
Initial Net Vehicle Costs	\$140,000	\$104,000	\$70,000
Service Life Fueling Costs	\$292,800	\$270,933	\$256,428
Service Life Maintenance Costs	\$49,920	\$49,920	\$30,720
Salvage Value	(\$20,000)	(\$20,000)	\$0
Total Ownership Cost	\$362,720	\$340,853	\$287,148

Assumptions

Vehicle Service Life (Years)	8	8	8
Miles/Year	48,000	48,000	48,000
Fuel Cost (Per gallon Diesel, LNG, H2)	\$3.66	\$3.81	\$4.54
MPG or MPP (H2) (50/50 Duty Cycle)	4.8	5.4	6.8
Maintenance Cost per Year	\$6,240	\$6,240	\$3,840

** Based on data from Vision Motors*



Hydrogen Solution

Fleet Needs:

- Dependable Class 8 Truck that can support our operation 20 Hours per day, 6 days per week
- Heavy Duty, Class 8, zero emissions trucks with hydrogen fuel cells for range extension
- Available fuel infrastructure



Drive/Duty Cycle of Hydrogen Fuel Cell Trucks: Drayage Application

■ Drive Cycle - How we will use the vehicles

□ Vehicle speed against time

- Operational Goal to get as many dray moves/turns in an 8 Hour Shift
- Power to move loads efficiently
 - Grade
 - Container Weight

■ Duty Cycle - How much we will use the vehicles

□ Vehicle Usage

- Dependability
- Fueling infrastructure Availability
- Distance – How far can I operate from fuel source
- Number of trips performed before fueling required



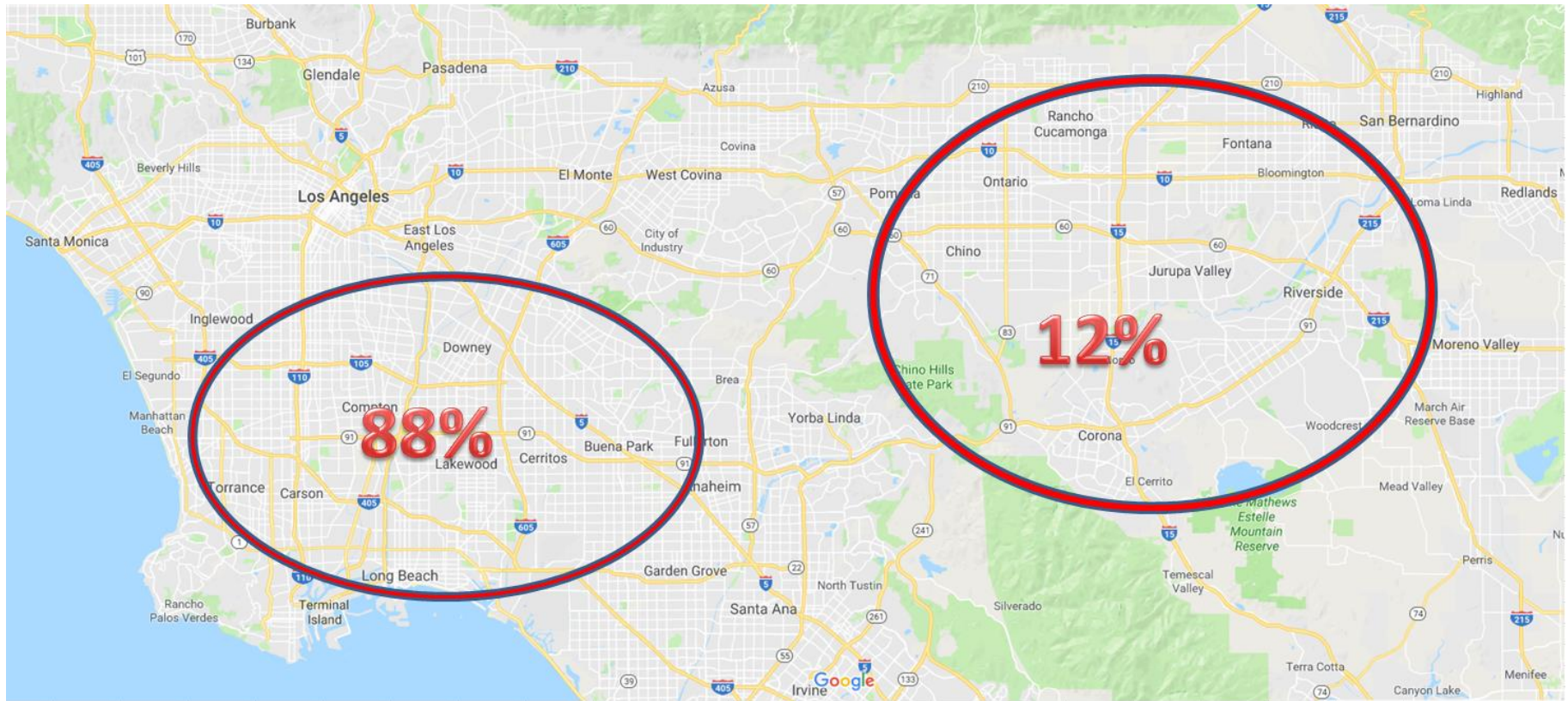
Drayage Operations

Largest Port Complex in US – Long Beach & Los Angeles





Drayage Operations

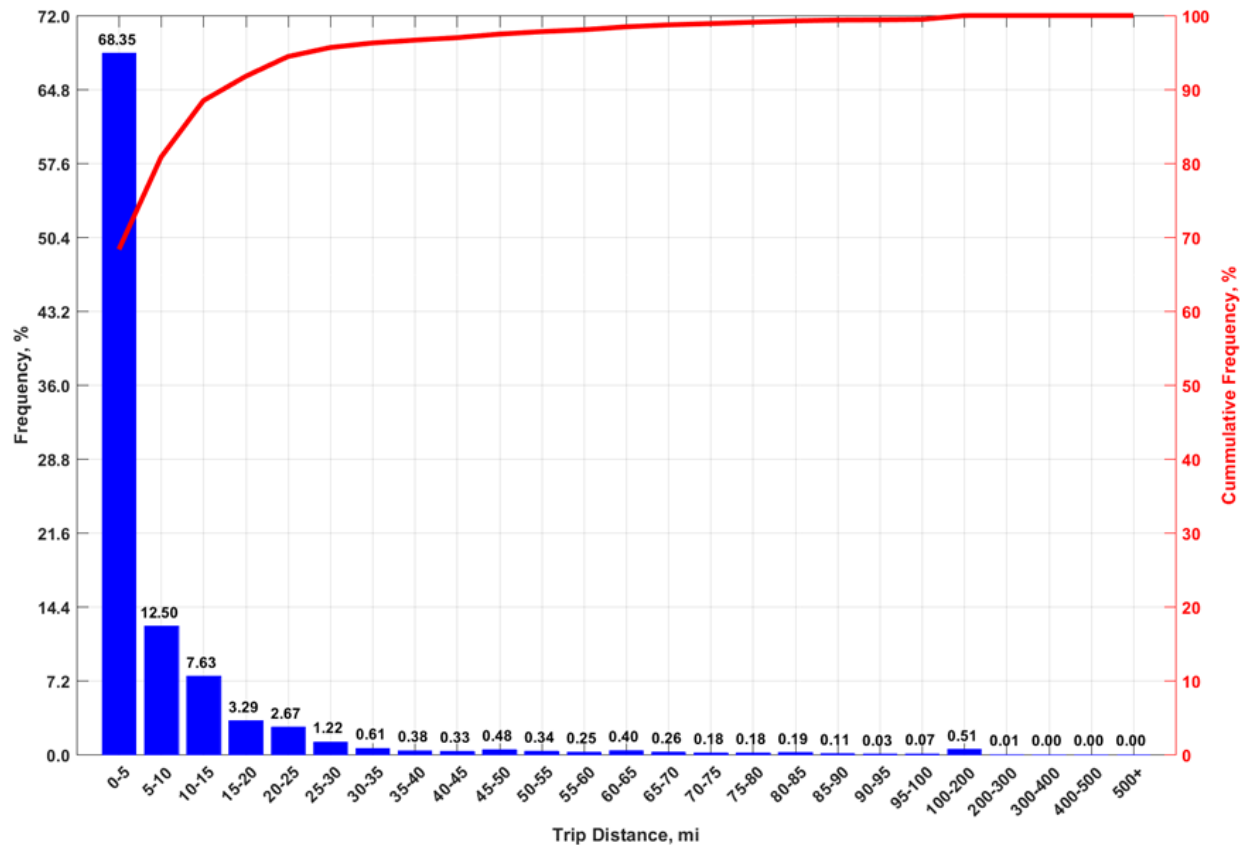


Southern CA Basin



Drayage Operations

Trip Distance Distributions of All Trips for Fleet





Range: 150 Miles

Fuel Capacity: 20kg

Horsepower: 442



Range: 200 Miles

Fuel Capacity: 25kg

Horsepower: 429



Range: 130 Miles

Fuel Capacity: 25kg

Horsepower: 560

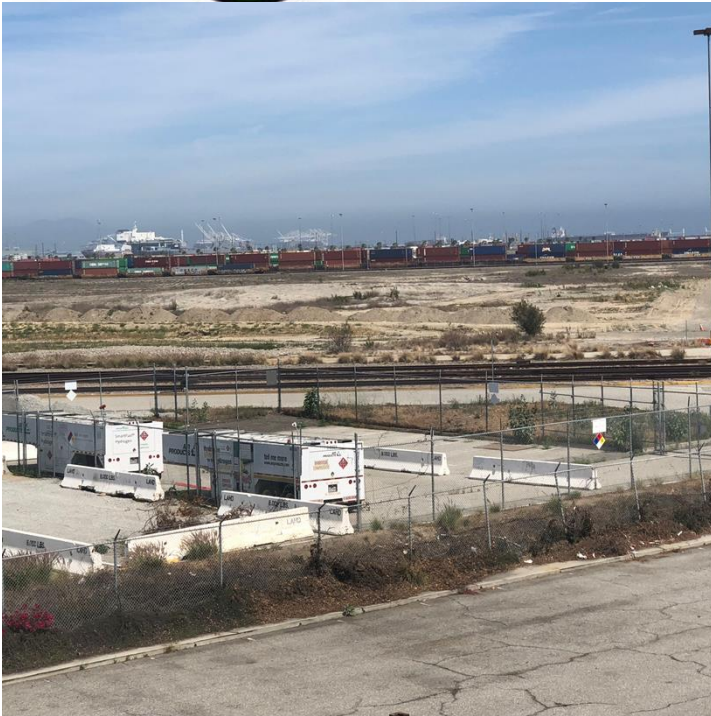


Hydrogen Fueling Station

Hydrogen Fueling Equipment

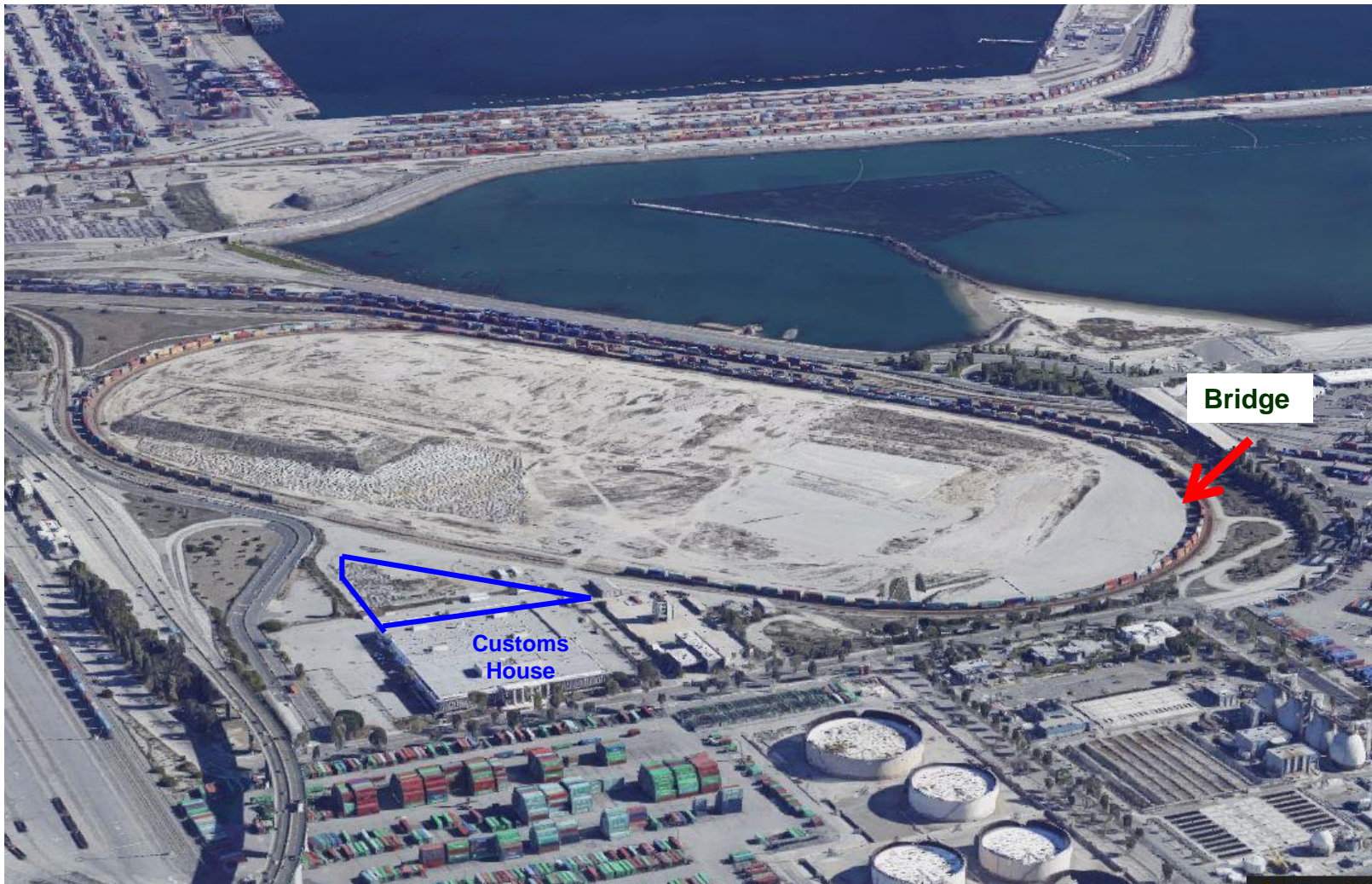
The HF-150 Hydrogen Fueler is a self contained, 5,076 psig (350 bar) hydrogen fueling station that holds 150 kg (63,450 SCF) of compressed, gaseous hydrogen [not liquid, cryogenic hydrogen].

The HF-150 requires no utilities and only needs to be connected to a grounding rod at the site.





Future - HPEC





Future - HPEC



KEYNOTES

- ① EXISTING CUSTOMS HOUSE - HISTORICAL BUILDING
- ② ADMINISTRATION BUILDING (EXISTING STRUCTURE)
- ③ CELL PHONE HOLDING YARD / BOBTAILS
- ④ TERMINAL ACCESS
- ⑤ PROPOSED GRADE SEPARATION
- ⑥ ENTRY / EXIT GATE (4 LANES EACH DIRECTION)
- ⑦ SECURITY BOOTH
- ⑧ WHEELED CONTAINER STORAGE, TYP
- ⑨ CHASSIS POOL (FLEXIBLE)
- ⑩ POTENTIAL SECONDARY AISLE

LEGEND

- CONTAINER TERMINAL SUPPORT FACILITIES BOUNDARY - 120 ACRES
- FUTURE PROPOSED LIQUID BULK AREA - PORT MASTER PLAN - 55 ACRES
- WHEELED STORAGE (DRY) 3,551 SLOTS
- CHASSIS POOL (FLEXIBLE)
- GATE FACILITY
- PROPOSED GRADE SEPARATION
- ENTRY TRAFFIC FLOW
- EXIT TRAFFIC FLOW



For more information on TTSI, please
visit our website at: www.tts-i.com

Thank You

