

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

### **Overview of Status of Hydrogen Fueling** Infrastructure in U.S.

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# Multiple H<sub>2</sub> and Fuel Cell Applications in the U.S.



### **Growth in Liquid Stations Planned in California**



Based on data from National Renewable Energy Laboratory

# **Status and Growth of Hydrogen Fueling Network**

#### Current and Projected Hydrogen Fueling Capacity in California<sup>1</sup>



- 1. https://www.arb.ca.gov/msprog/zevprog/ab8/ab8\_report\_2018\_print.pdf
- 2. Source: Applications to CEC GFO-15-1605

- 12 stations planned in Massachusetts, Connecticut, Rhode Island, New Jersey, New York.
  - ✓ 4 currently in "shakedown" testing
- Northeast stations to be supplied by tube trailers, and filled at two 21,000 kg/day liquid terminals located in NYC and Boston.
- California station capacities:
  60 kg/day- 500 kg/day.<sup>1</sup>
  - Average cost of stations >300 kg/day: \$2.6M<sup>2</sup>
- California stations' average utilization rate: 36%.<sup>1</sup>
- Most current stations co-located with gasoline stations.

### **Planned Growth in Fueling Infrastructure**



1. https://cafcp.org/sites/default/files/CAFCR.pdf

- 1,000 H<sub>2</sub> stations could provide coverage for 1 million FCEVs.<sup>2</sup>
- Co-location of stations for light-duty vehicles with stations for medium- and heavy-duty vehicles along freight corridors is of particular interest.<sup>2</sup>
- In core market areas, station with at least 2 fueling positions, and ability to handle at least 3 back-to-back fills are of interest.<sup>2</sup>
- By 2030, average station capacity of 1,200 kg/day expected.<sup>2</sup>

2. https://www.arb.ca.gov/msprog/zevprog/ab8/ab8\_report\_2018\_print.pdf

#### Pathway to Lower Cost of H<sub>2</sub> Distribution and Dispensing



# Data collection on stations helps guide future R&D

#### Data Validation of Real World Applications through the NREL's NFCTEC

• Data products provide insights on technology improvements, issues and gaps



# **Station Reliability**

#### Known Causes of Hydrogen Fueling Station Maintenance Hours<sup>1</sup>



- Dispenser failures (e.g. leaks, design flaws in nozzles, communication errors in nozzles) account for majority of maintenance events.
- Compressor failures (e.g. failed valve parts, failed seal materials) are second highest cause of maintenance.
- Within safety systems, failure of communications and electrical supply, are common.

Source: National Renewable Energy Laboratory Composite Data Products https://www.nrel.gov/hydrogen/infrastructure-cdps-all.html

# **Complementing Retail Stations: H<sub>2</sub> Refuel H-Prize**





### **Hydrogen Fueling Station Footprint**

Current Baseline Hydrogen Fueling Station Footprint (Based on NFPA-2)			
Station Supply Type	Bulk Storage at Station	Land Area	Preli
Gaseous Tube trailer	800 kg	18,480 ft <sup>2</sup>	min
Liquid Tanker	800 kg	21,250 ft <sup>2</sup>	
Onsite Electrolysis	15 kg	12,050 ft <sup>2</sup>	

Source: Sandia National Laboratories

#### Potential Approaches to Reduce Station Footprint:

- Use of tube trailers/liquid tankers with shorter length
- Underground or canopy storage
- Use of quantitative risk analysis to guide station design (performance basis)

# **Collaboration Tools: H<sub>2</sub> Safety Information Sharing**

#### H<sub>2</sub>Tools.org : A one stop resource for hydrogen safety



#### h2tools.org

- Includes resources on safety best practices, first responder training, and H<sub>2</sub> codes & standards
- Site visit tracking shows a global reach:
  50% of visits have been international after launch
- Over 250,000 site visits
- Training resource translated into
  Japanese. Interest in other languages.

### **Opportunities for outreach and to increase awareness**

### Celebrate National Hydrogen & Fuel Cell Day October 8 or 10/8

(Held on its very own atomic-weight-day)

Information and Training Resources to Increase Awareness



#### H2tools.org



INCREASE YOUR

Download for free at: energy.gov/eere/fuelcells/downloads/increa se-your-h2iq-training-resource

#### Learn more at: energy.gov/eere/fuelcells

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# Questions?