

# THANK YOU TO OUR 2021 SPONSORS



# Slido – For Polls/Q&A

- Most of you will see a Q&A/Polls panel on the right side of your screen. You can just participate in the Polls and Q&A there.
- Some of you won't see that so either go to [slido.com](https://www.slido.com) and enter meeting ID# XXXX (see next slide)
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23rd California Unified Program Annual Training Conference  
February 2 through March 18, 2021

LIVE 162

Designated facility must submit all manifests to e-Manifest system w/i 30 days.

Electronic only after 06.30.21

EPA's e-Manifest System

VOID

Q&A Polls

Bahram+Kavousi 1:03 PM  
Hi everyone.

Earl+Thomas 1:49 PM  
ISHP

Brandon+Vineyard 2:01 PM  
You can make it "Non-RCRA Hazardous Waste Liquid (spent catalyst)" putting the type of waste at the end.

THOMAS+EDMO... 2:11 PM  
nick vent

Daide+Minuzzo 2:12 PM  
Maybe some connection issue

Erica+Olaquez 2:38 PM  
To confirm, would the "generator" be required to provide "copy" of e-manifest to transporter? (is it typical)

Support Chat

© 2021 eventPower



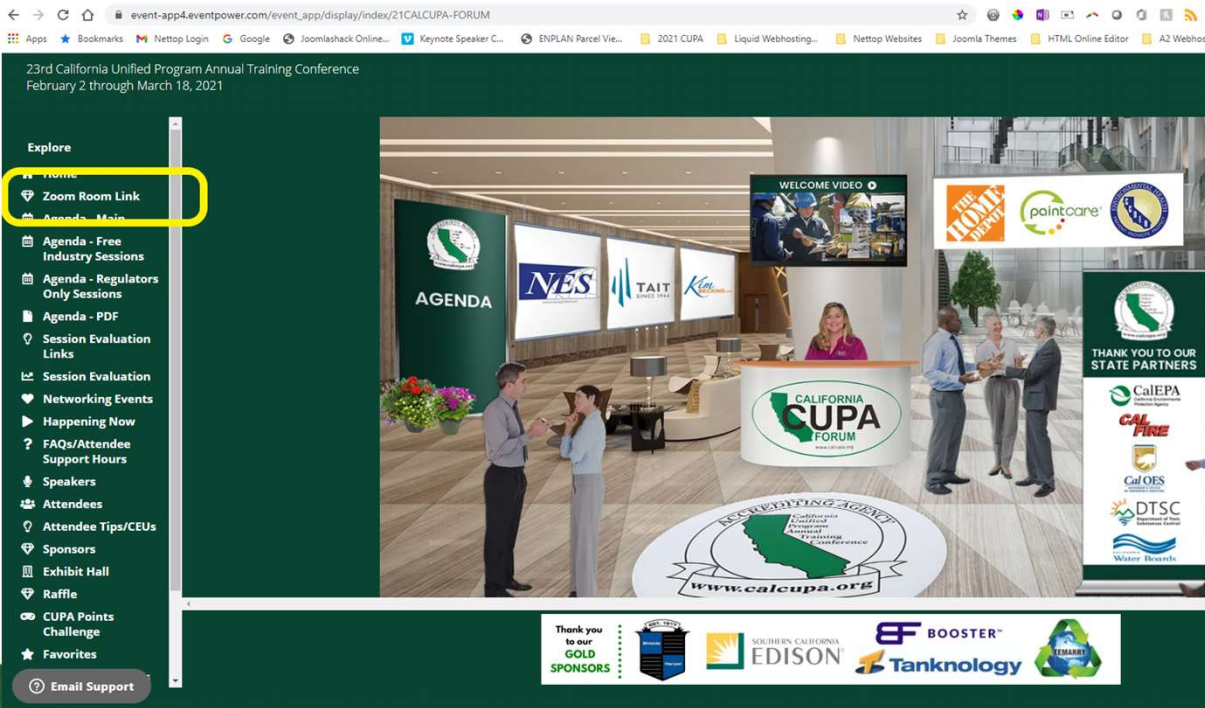
# Your Unique Slido Meeting Info

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- This info is helpful for those that choose to use their smartphone or browser for Q&A/Polls



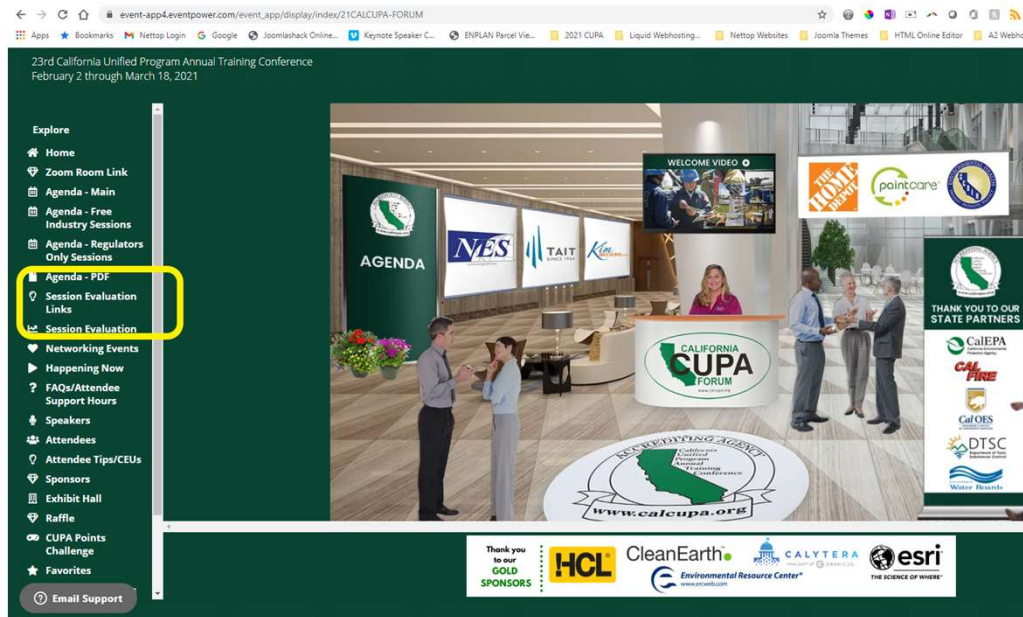
# Post Session Zoom Rooms Reminder (Most Sessions)



- After our Session is over, we are offering a NEW Zoom Room opportunity for you to continue the conversation started in this Session
- Near the end of the Session in the Q&A box, we will post the Zoom Room link
- To access the Zoom Room link, you can also click on the link below Home on the left menu
- In this Zoom Room, you may meet with the Speaker, Moderator and/or fellow Attendees for a 'post meeting de-brief'



# Session Evaluation Codes Reminder



- After our Session is over, if you want to earn CEUs or offer feedback, please click on the Session Evaluation link at the top of the Session Screen before “Leaving the Session”
- To complete the evaluation later, come back to the “Session Evaluation Links” menu item, find your session and click on the link to complete the Session Evaluation





# Hydrogen and Fuel Cells for First Responders and AHJs/#947

Presented by  
Jennifer Hamilton

[jennifer.hamilton@cafcp.org](mailto:jennifer.hamilton@cafcp.org)

March 16, 2021

**23<sup>Rd</sup> Annual California CUPA Training Conference**

**February 2 thru March 18, 2021**

**Virtual Conference**



[www.calcupa.org](http://www.calcupa.org)

# CaFCP Members



Alameda-Contra Costa Transit District (AC Transit)  
 BAE Systems  
 Ballard Power Systems  
 Bay Area Air Quality Management District  
 California Department of Food and Agriculture  
 California State University - Los Angeles  
 The Center for Energy Efficiency and Renewable Technologies (CEERT)  
 Center for Transportation and the Environment (CTE)  
 Chart Industries, Inc.  
 City of Lancaster

City of San Francisco  
 Comdata  
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 Energy Independence Now  
 FASTECH  
 FirstElement Fuel, Inc.  
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 Institute of Transportation Studies, UC Davis  
 Ivys Energy Solutions  
 Kobelco  
 Liberty Utilities  
 Linde North America, Inc.

Look, Inc.  
 National Fuel Cell Research Center, UC Irvine  
 National Renewable Energy Laboratory (NREL)  
 Nel Hydrogen  
 New Flyer of America  
 NICE America Research, Inc.  
 PDC Machines  
 Plug Power  
 Sandia National Laboratories  
 SPI, ESI, and North America Smart Energy Week  
 SunLine Transit Agency  
 Tatsuno North America, Inc.  
 TLM Petro Labor Force, Inc.  
 University of California, Berkeley



# California H2 stations in 2020, 2025 and 2030

**100** 

hydrogen stations by **2020**.  
Funded by Assembly Bill 8 (2013).

**BY 2020**

Funded  
*Light Duty*

**200** 

hydrogen stations by **2025**,  
pursuant to the Governor's 2018  
ZEV infrastructure Proposal.

**BY 2025**

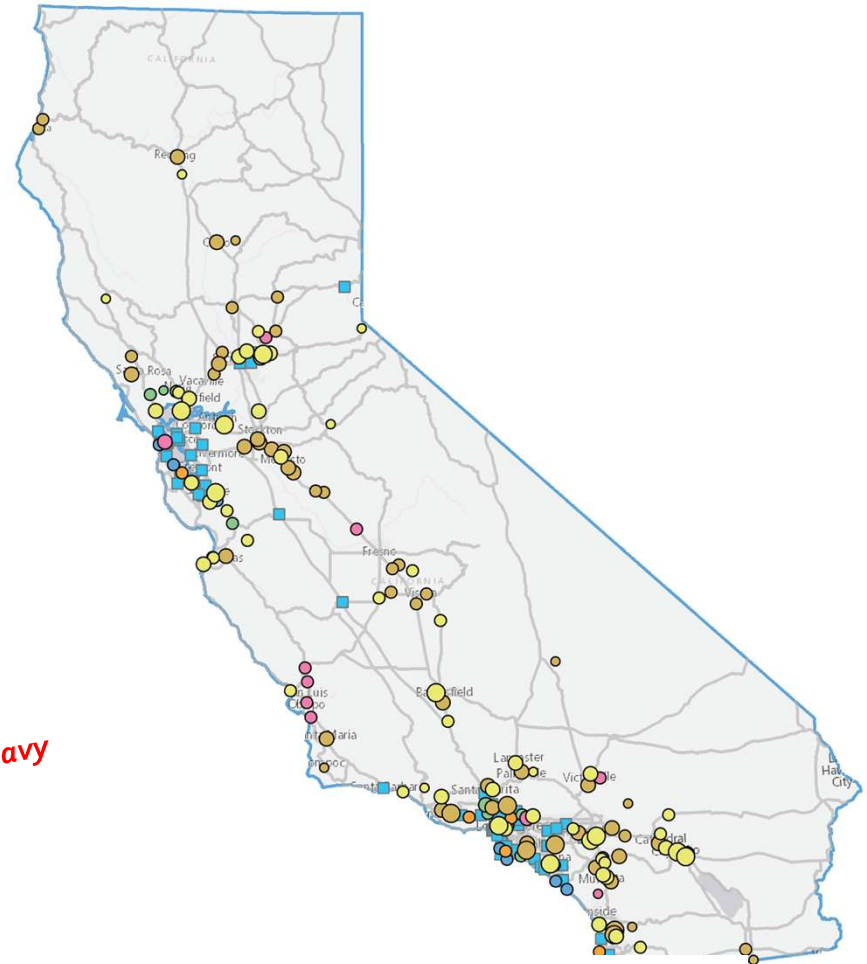
Planned  
*Light Duty*

**1000** 

hydrogen stations by **2030** with favorable  
market conditions and state policies pursuant  
to the CAFCP 2030 vision. Will support  
1,000,000 fuel cell electric vehicles.

**BY 2030**

Envisioned  
*Light, Medium and Heavy*



Governor's goal of 5,000,000 zero-emission vehicles by 2030.



# Governor's Executive Order on ZEVs

- **100% zero emission goal**
- **Zero-Emissions Vehicle Market Development Strategy by January**
- New passenger cars and trucks by 2035
- Medium- and heavy-duty vehicles by 2045 where feasible
- Drayage trucks by 2035
- Off-road vehicles and equipment by 2035 where feasible

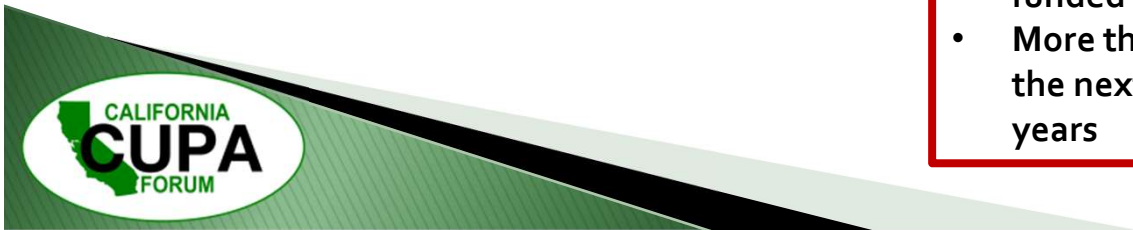


# By the Numbers

The table shows how many fuel cell cars have been sold and leased, how many fuel cell buses are on the road, and how many hydrogen stations are open in California.

	Numbers as of February 12, 2021	Total
*FCEVs—Fuel cell cars sold and leased in US		9,063
FCEBs—Fuel cell buses in operation in California		48
***Hydrogen stations available in California		44
Fuel cell buses in development in California		7
**Retail hydrogen stations in development in California		43

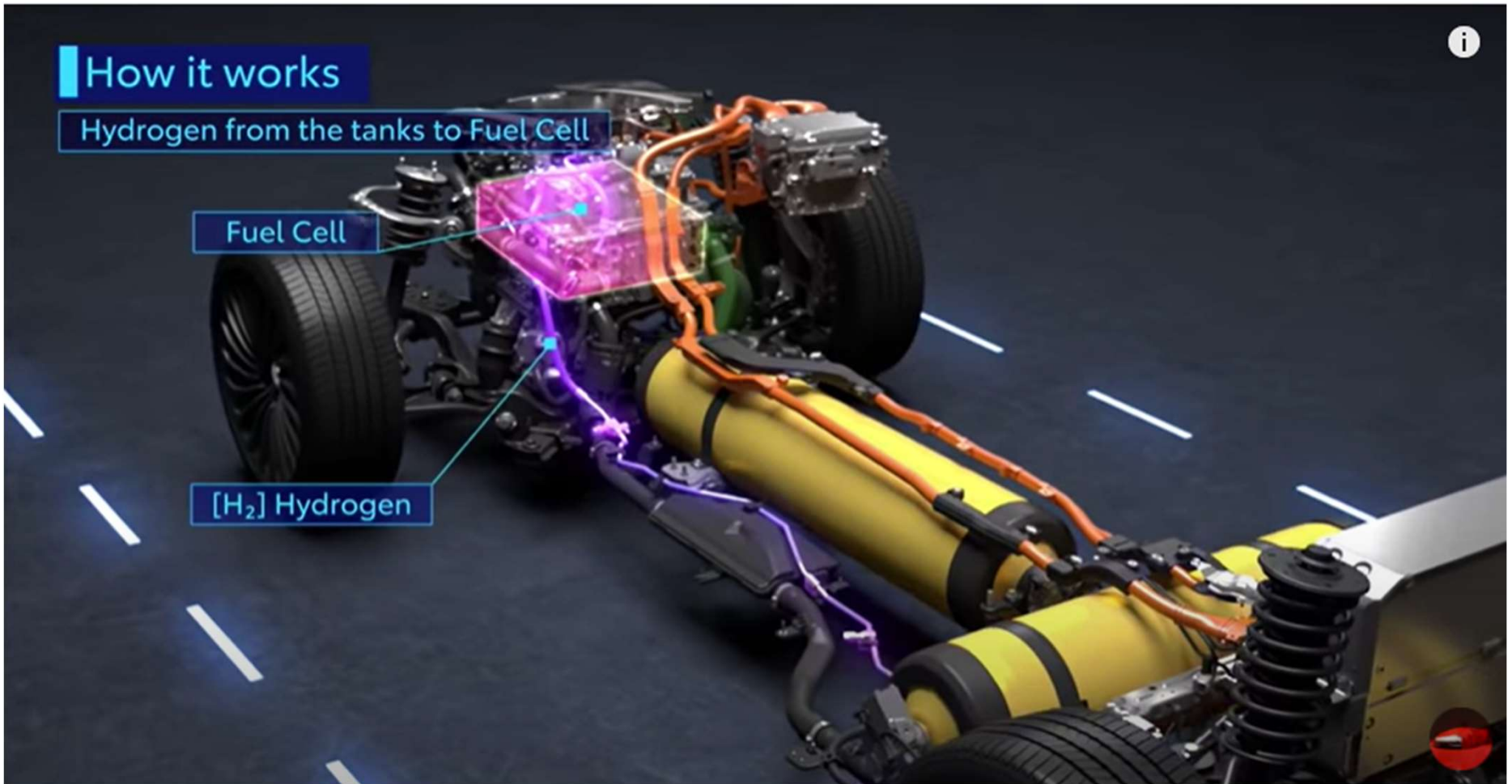
- +36 new stations funded
- More than 100 over the next several years



# Fuel cell passenger cars on the road



# New generation



Video download URL:

<https://www.youtube.com/watch?v=8YtfRvllloY>

# Benefits of fuel cell electric cars

- 312-380 miles
- 3-to-5 minute fill
- Makes electricity on board vehicle
- Extreme temperature performance
- Multi-unit dwellers and on-street parkers
  
- Meet all global safety specifications
- Most automakers have fuel cell tech



# And more cars on the way



## Hyperion XP-1

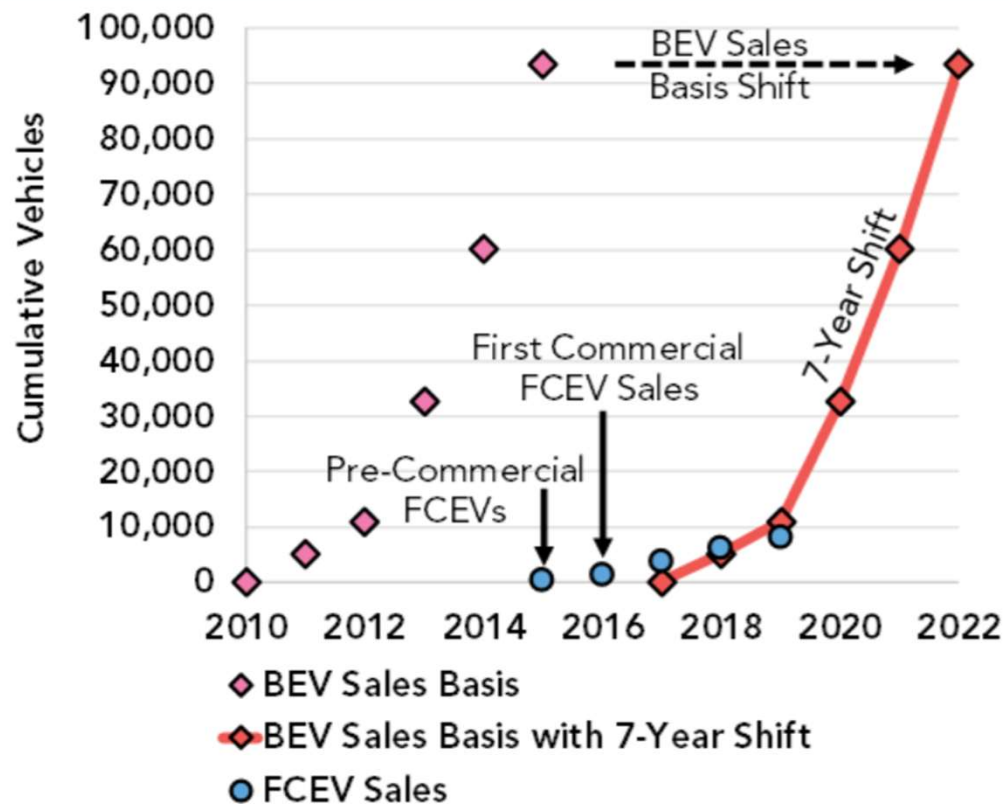
- Prototype
- 1,016-mile range
- 0 to 60 mph in 2.2 seconds
  - Fueling in 5 minutes
  - 300 units available



# FCEV adoption in California mirrors BEV history

## Finding 5

Historical FCEV deployment data appear to follow a similar new technology adoption trend as battery electric vehicles and validate State efforts to continue funding hydrogen fueling stations



# Hydrogen stations in California



La Canada Flintridge hydrogen station

23rd Annual California CUPA Training Conference  
February-March 2021



# Next-generation stations coming online



Fountain Valley True Zero



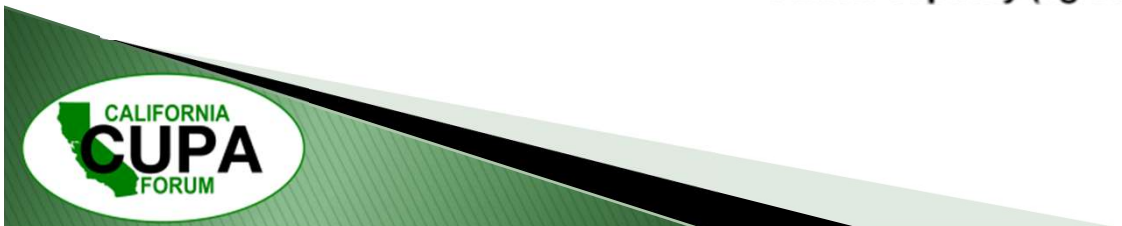
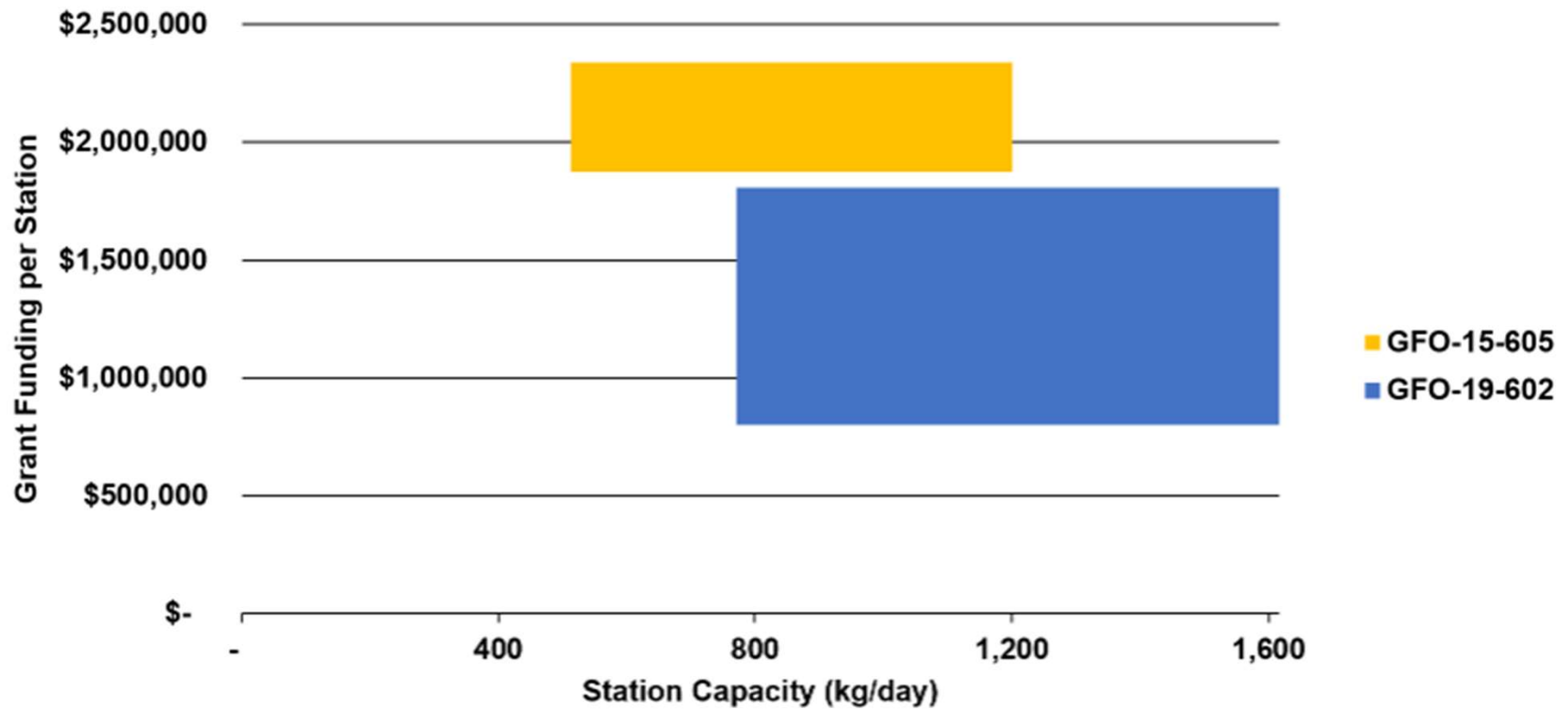
Oakland True Zero



San Francisco Shell

- Stations 2-to-8 times larger than the earliest stations
- Station costs coming down
- Station development timelines decreasing

# Stations Getting Bigger, Costing Less

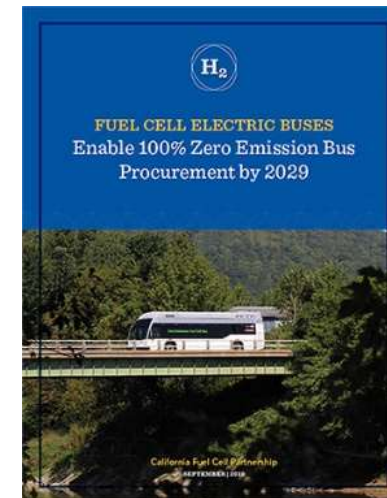
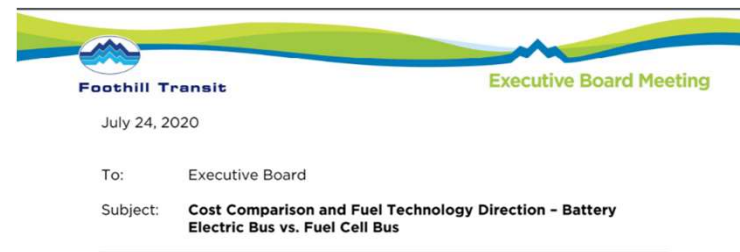


# The Other Electric Bus

## Advanced Clean Transit regulation

- Transit buses on zero-emission pathway
- First wave of Zero Emission Bus Rollout Plans submitted

## Foothill Transit cost comparison of BEBs and FCEBs



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# Heavy Duty Trucks

*Light duty needs heavy duty; heavy duty needs light duty*

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## Fuel Cell Electric Trucks

- Advanced Clean Truck rule
- Fueling infrastructure projects
  - 3 heavy duty H<sub>2</sub> stations
    - More being announced
  - Ontario, Wilmington and Port of Long Beach
  - 1-2 temporary fuelers
- CARB & CEC heavy duty funds
  - Include heavy duty infrastructure



## Truck automakers & others

- Toyota-Hino alliance
- Daimler-Volvo alliance
- Nikola Motor
- Hyundai
- Cummins

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# Hydrogen & Fuel Cell Activity – California



Project 800 seeks to put 800 zero-emissions heavy-duty trucks into service at California's ports. (Photo courtesy of Toyota)

ENVIRONMENT

California Launches Project 800 to Get Hundreds of Electric Semis on the Road in 2021



BY SUSAN CARPENTER | SACRAMENTO  
PUBLISHED 7:54 PM ET JAN. 21, 2021

## STADLER

2019/11/14

GREEN-TECH FOR THE US: STADLER SIGNS FIRST EVER CONTRACT FOR HYDROGEN-POWERED TRAIN



# Hydrogen & Fuel Cell Activity – U.S.



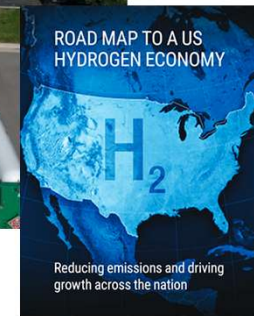
- GTI, EPRI lead
- Launched with 18 utilities, including SoCalGas, SoCal Edison and Los Angeles Dept of Water and Power.
- Now, 33 participants.
- Already reached \$100M in funding.

## HYDROGEN FORWARD

Air Liquide, Anglo American, Bloom Energy, CF Industries, Chart Industries, Cummins Inc., Hyundai, Linde, McDermott, Shell and Toyota

Microsoft tests hydrogen fuel cells for backup power at datacenters

July 27, 2020 | John Roach



"We very much see ourselves as a catalyst in this whole hydrogen economy."

### Microsoft

- U.S. Hydrogen Road Map contributor
- Record of 48 hours powering data center servers



# Hydrogen & Fuel Cell Activity - Global

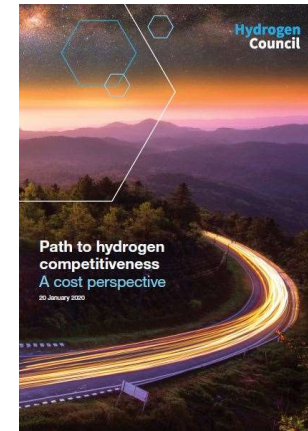
## Europe

- German H2 Strategy
  - South Korean investment response
- European H2 Strategy
- Increase in H2 chatter on European utilities earnings calls, from Q1 to Q2

Hydrogen gains airtime during Q2 utility results calls

Mentions on Q1 call			Mentions on Q2 call	
Executives	Analysts		Executives	Analysts
0	0	E.ON SE	17	6
0	0	Enel SpA	7	2
1	0	Engie SA	8	4
1	0	Iberdrola SA	8	1
0	0	Naturgy Energy Group SA	9	4
10	0	Ørsted A/S	21	7
0	0	RWE AG	8	3
6	0	Snam SpA	54	25
3	0	Uniper SE	75	9

Data compiled on Aug 14, 2020.  
 Frequency of mentions of the word "hydrogen" during quarterly earnings calls for the first and second quarters.  
 Source: S&P Global Market Intelligence analysis



- 91 members, including new member, Microsoft
- Chinese version released

“Economic recovery measures should support large scale initiatives that can accelerate cost competitiveness of hydrogen”

**-Hydrogen Council**

## Headlines...

- Japan Hydrogen Association (JH2A) launches
- Canada releases national hydrogen strategy



## Current Members

### EXECUTIVE MEMBERS



### STRATEGIC PARTNERS



### MEMBERS





# Center for Hydrogen Safety

*Bringing together a global membership to expand the body of safety knowledge*

## Vision

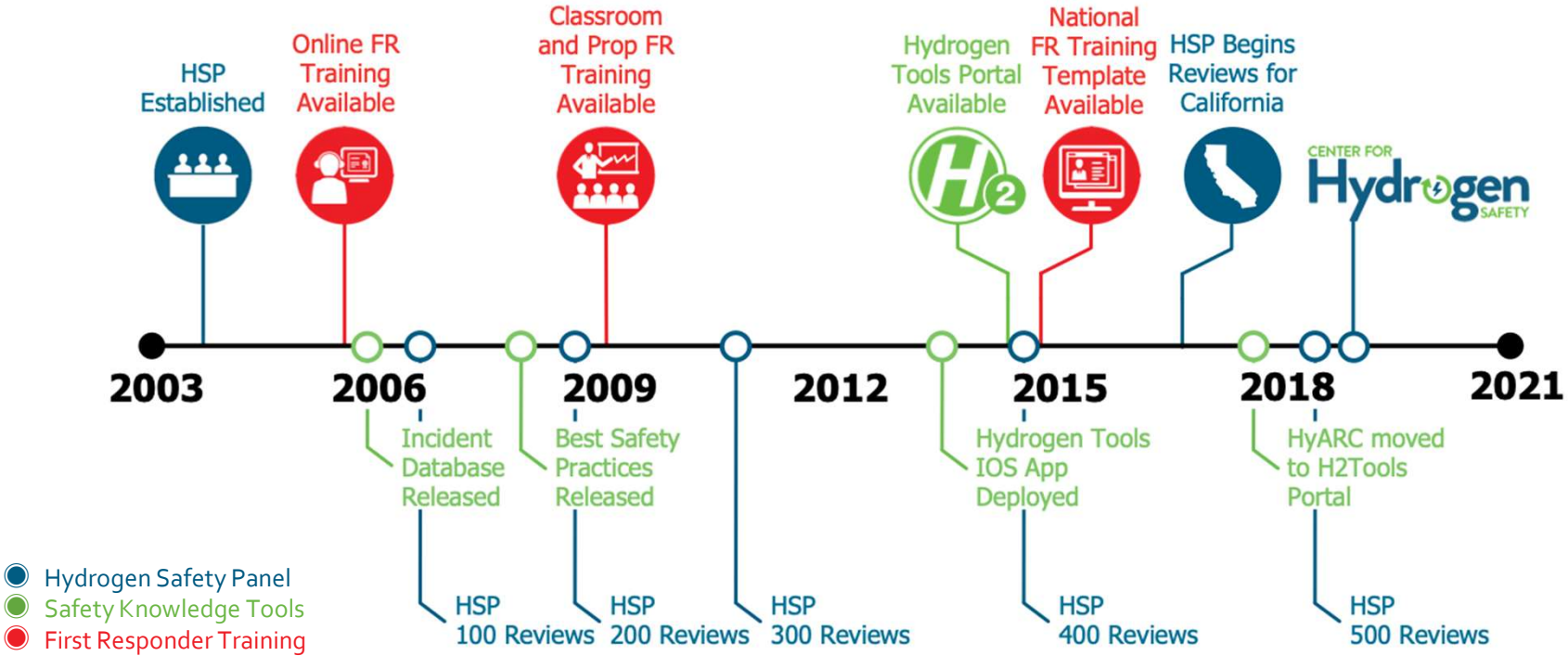
- The Center for Hydrogen Safety (CHS) is a global non-profit dedicated to promoting hydrogen safety and best practices worldwide

## Mission

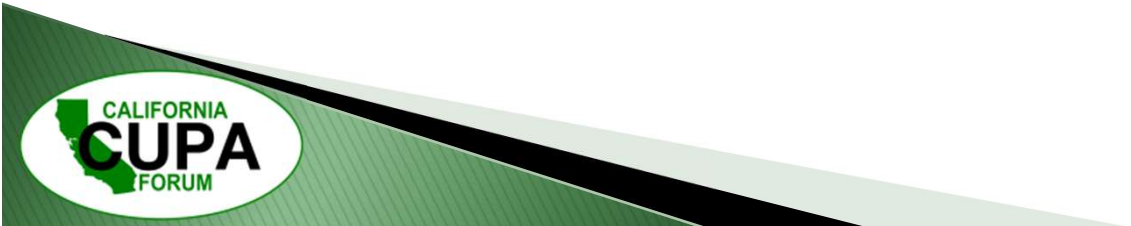
- Support and promote the safe handling and use of hydrogen across industrial/commercial uses and applications in the energy transition
- Provide a common communication platform with a global scope to ensure safety information, guidance and expertise is available to all stakeholders



# Timeline of Our Hydrogen Safety Resources



February 15, 2021



# State of Hydrogen Safety

Safety issues can be a 'deal breaker' and must be addressed for successful hydrogen technology acceptance and deployment

## Its Use as a Fuel is New to Many

- ▶ Users may lack experience or expertise for its safe use
- ▶ Some users have misconceptions... and may not know that they don't know



## Stable Foundation

- ▶ Hydrogen can be used safely... It has been for nearly a century by industry
- ▶ Safety knowledge and best practices exist

## Dangerous Assumptions

- ▶ "We already know how to use hydrogen safety" (apathy - established users)
- ▶ "Hydrogen is like any other flammable gas" (misconceptions - new players)
- ▶ "Hydrogen is too dangerous" (fear - general public/AHJ's)

Hydrogen can be used safely but failing to address the knowledge gaps can result in impactful incidents and industry setbacks

# Implement Regulations, Codes and Standards

*Hydrogen regulations, codes and standards (RCS) are maturing quickly for many mainstream fuel cell applications*

- ▶ RCS provide the information needed to safely build, maintain, and operate equipment, systems, and facilities
- ▶ Ensures uniformity of safety requirements
- ▶ Provides inspectors and safety officials the information needed to approve systems and installations
- ▶ Bolsters public and stakeholder confidence and helps protect investments

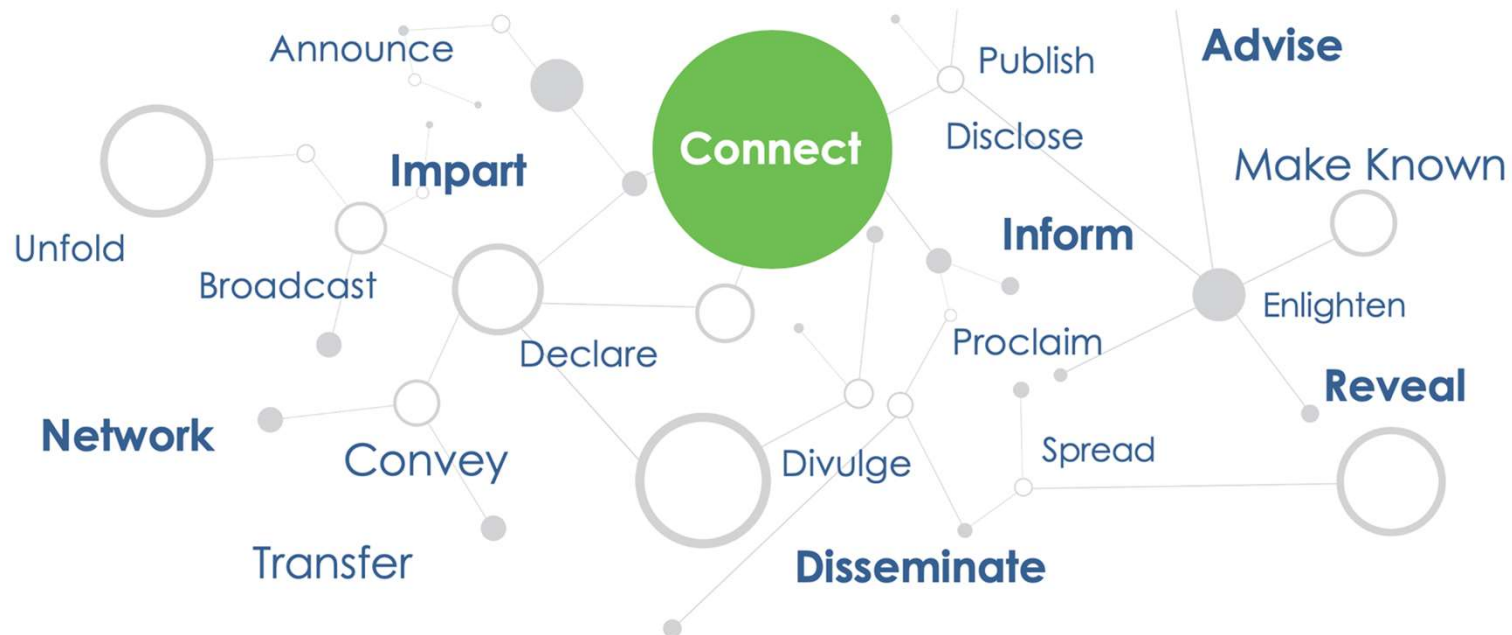


**Did you know?** Many codes and standards were developed using industry best practices.

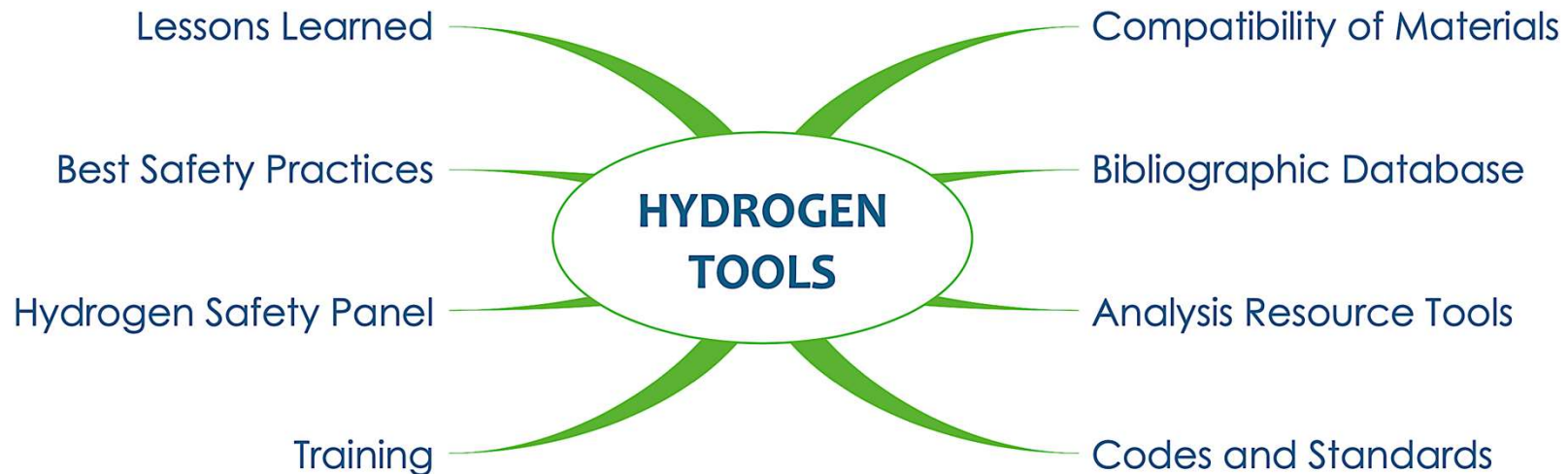
See <http://www.fuelcellstandards.com/>... a database of international codes and standards

# Connecting People to Safety Knowledge

- **Communication of hydrogen specific safety guidance** will be critical to the success of hydrogen as a part of the global energy transition
- Establishing and communicating best practices **from a trusted, independent safety resource** is a valuable part of the hydrogen safety ecosystem



Significant hydrogen safety resources in one location



- ▶ Supports implementation of the safe handling practices and procedures
- ▶ Brings together a variety of tools and web-based content on safety of hydrogen
- ▶ Informs designers, stakeholders and first responders

# First Responder Hydrogen Safety Training

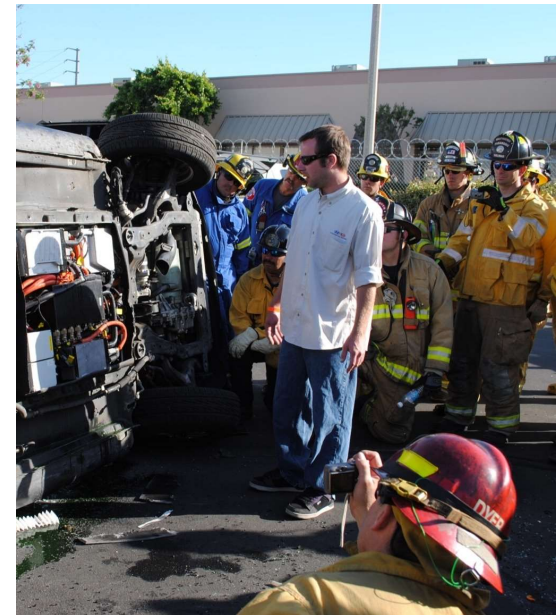
*A properly trained first responder community is critical to the successful introduction of hydrogen fuel cell applications and their transformation in how we use energy.*

## ► Goal

- Educate first responders on unique hydrogen hazards

## ► Integrated Activities

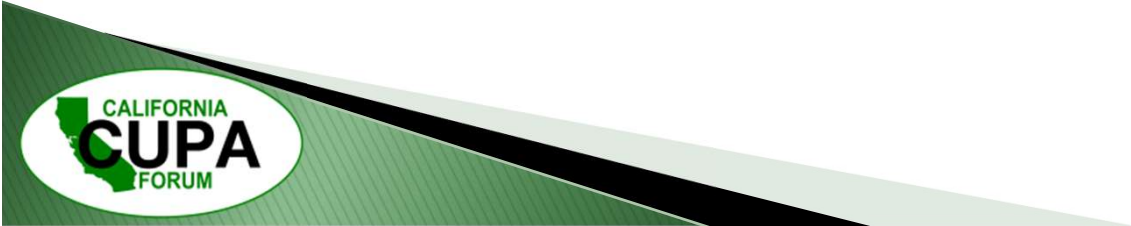
- Online, awareness-level training<sup>1</sup>
- Video-based training courses<sup>2</sup>
- Classroom and hands-on operations-level training
- Trainer material (PowerPoint slides with speaker notes)



(1) <https://tinyurl.com/yxfy66rp>

(2) <https://tinyurl.com/y64q48ck>

# Short Clip from First Responder Training Courses





## New Safety Courses and Updated Best Practices



### Activity Benefits

- ▶ Running start – New courses based on existing best safety practices
- ▶ Extensive review – HSP and CHS members provide feedback and validates content
- ▶ Broad availability – Courses available through AIChE Academy
- ▶ Safety credentialing – Enabling confidence in hydrogen work force
- ▶ Best Practices refresh – Process will lead to new and updated H2Tools BSP content



## Other Courses in Development – CY2021

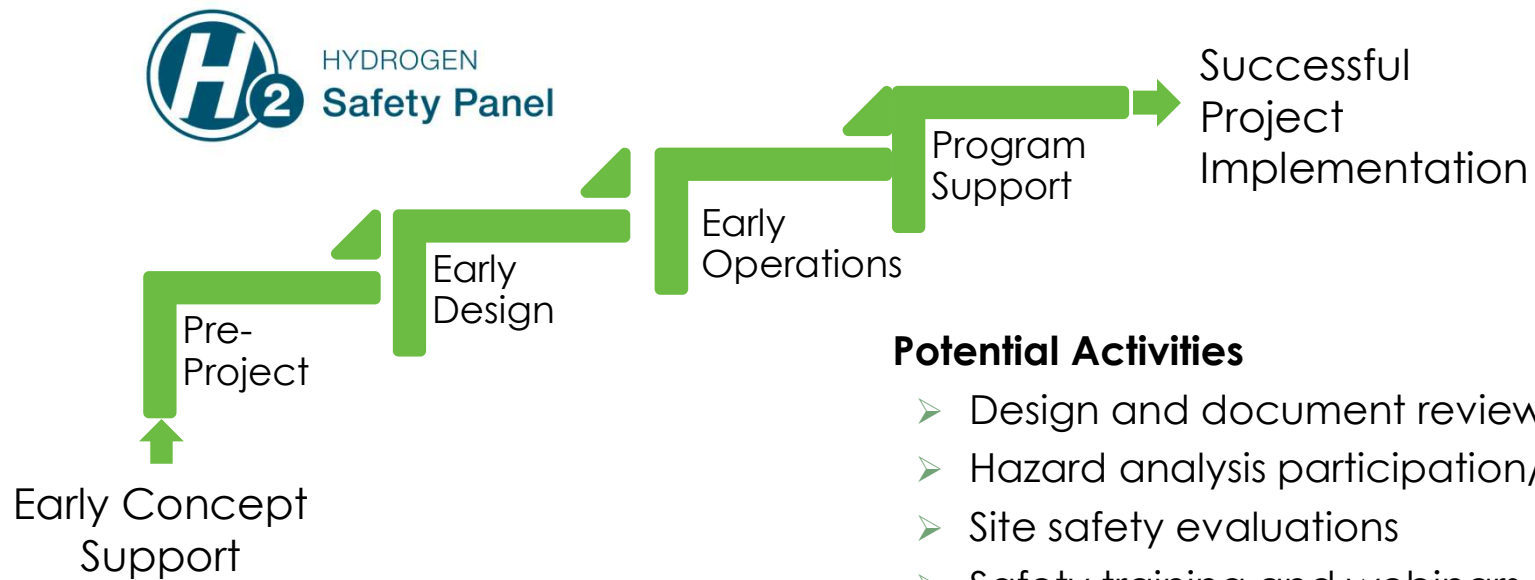
- *Fundamentals Technology*
- *Properties and Hazards*
- *Safety Planning*
- *Facility Design*
- *Compressed System Design*
- *Liquid System Design*
- *Material Compatibility*
- *Operating Systems*
- *Maintenance and Inspection of Equipment*
- *Operating Hydrogen Equipment*
- *Laboratory Safety – Design*
- *Laboratory Safety – Operations*
- *Chemical Hydrogen Storage and Metal Hydrides*
- *Fuel Cell Forklifts and Indoor Refueling*

**AIChE**  
**CREDENTIAL**



As the hydrogen industry grows there is an increased need for workforce development and validation. CHS anticipates the availability of a hydrogen safety certificate in 2021.

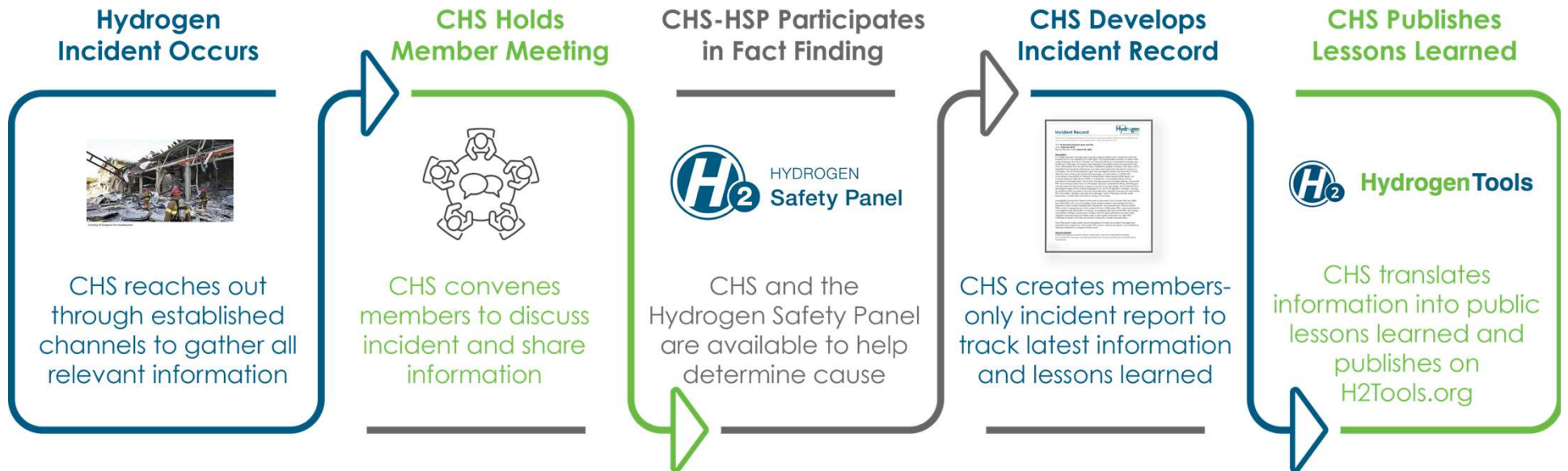
# CHS Use of the Hydrogen Safety Panel



## Potential Activities

- Design and document reviews
- Hazard analysis participation/review
- Site safety evaluations
- Safety training and webinars
- Outreach
- Incident investigation

# CHS Hydrogen Incident Response Activities




## Other resources CHS may use for responding to an incident:

- Education Materials – new courses, revised course content, etc.
- Technical Bulletins – members only and public safety bulletins developed and disseminated
- Working Groups – to address important safety issues and develop learnings for community and industry
- Conferences & Workshops – share incident information and learnings
- Incident Management Guide

# The Elemental

- CHS released its inaugural issue of our technical bulletin titled *The Elemental: Placing Safety at the Center of Hydrogen* on 10/08/2020. This bulletin provides a means to learn about and share hydrogen in an easy-to-access format.
- Available from [www.aiche.org/chs](http://www.aiche.org/chs). You can also subscribe to receive future newsletters and *The Elemental* at [www.aiche.org/chsmailings](http://www.aiche.org/chsmailings).
- Let us know if you have suggestions for *The Elemental*? Email [chs@aiche.org](mailto:chs@aiche.org)



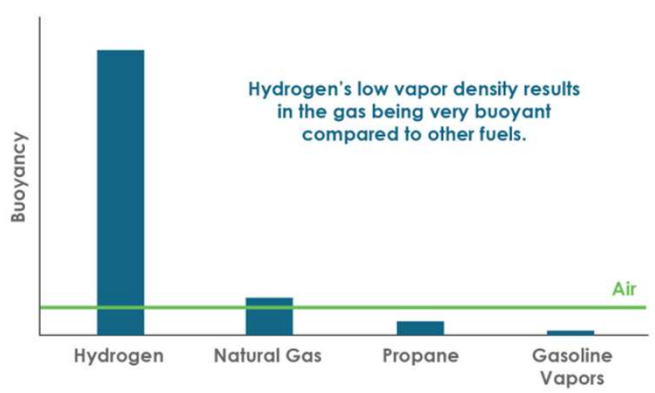
**THE ELEMENTAL**  
Placing Safety at the Center of Hydrogen

CENTER FOR Hydrogen SAFETY

### HYDROGEN'S BUOYANCY

Hydrogen's small molecule size and low vapor density (14 times lighter than air) make it unique compared to many other fuels. It has high buoyancy and diffusivity, and as such, leaking hydrogen will rise and disperse quickly in air. This phenomenon is very different from other common fuels, such as gasoline or propane. The vapors/gases from a release of these materials will pool near the ground.

Hydrogen's ability to rise and disperse quickly can provide a safety advantage in an outside environment. However, in confined spaces, hydrogen can accumulate and reach a flammable concentration near high points, ceilings, and roofs. Proper ventilation and the use of hydrogen detection sensors are essential to mitigate this hazard.



Hydrogen's low vapor density results in the gas being very buoyant compared to other fuels.

Gas	Relative Buoyancy
Hydrogen	Very High
Natural Gas	Low
Propane	Very Low
Gasoline Vapors	Very Low
Air	Baseline

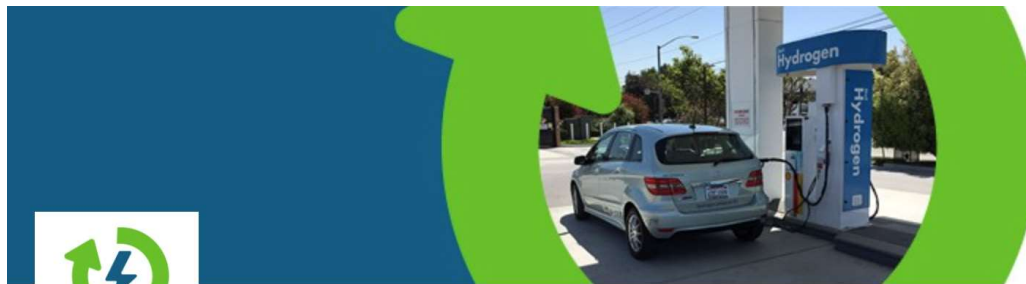
The Hydrogen Tools Portal has a best safety practices resource that provides additional information on this and other related topics pertaining to the safe handling and use of hydrogen ([https://h2tools.org/best\\_practices/best-practices-overview](https://h2tools.org/best_practices/best-practices-overview)).



## Follow Us on LinkedIn

### CHS Showcase Page

- ▶ Follow us at [www.linkedin.com/showcase/center-for-hydrogen-safety/](http://www.linkedin.com/showcase/center-for-hydrogen-safety/)
- ▶ Posts will include member highlights and news, h2tools resources, upcoming events, conference promotion and snapshots, among others
- ▶ Let us know if you have news for us to cross-post



**Center for Hydrogen Safety**

Public Safety · 58 followers

Connecting a global community to enable the safe and timely transition to hydrogen and fuel cell technologies.



✓ Following ...



# Thank you!

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<http://www.aiche.org/chs>

<http://h2tools.org>



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# Any Questions?

