



**CALIFORNIA HYDROGEN
BUSINESS COUNCIL**

EIN Renewable Hydrogen Roadmap Webinar

Hosted by the California Hydrogen Business Council

November 14, 2018



Quick Notes

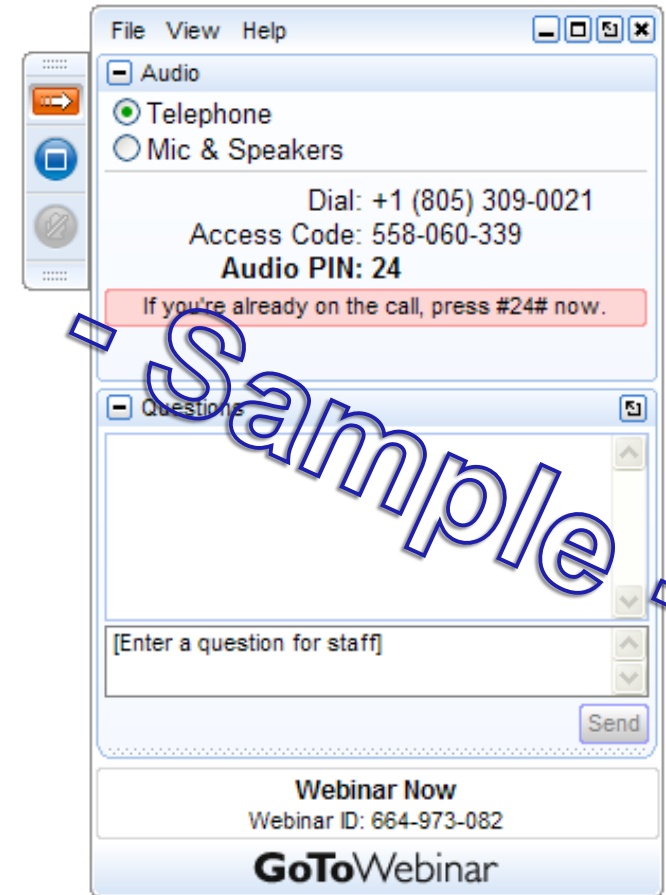
- Two Audio Options: Streaming Audio and Dial-In.

- Streaming Audio/Computer Speakers (Default)

- Dial-In: Use the Audio Panel (right side of screen) to see dial-in instructions. Call-in separately from your telephone.

- Ask questions using the Questions Panel on the right side of your screen.

- The recording of the webinar and the slides will be available after the event. Registrants will be notified by email.





Webinar Agenda and Speakers

- Welcome
 - **Emanuel Wagner, Deputy Director, CHBC**
- EIN Renewable Hydrogen Roadmap
 - **Brian Goldstein, Executive Director, EIN**
 - **Justo Robles, Deputy Director, EIN**
- Discussion/Q&A



CALIFORNIA HYDROGEN
BUSINESS COUNCIL

Welcome and Overview



Emanuel Wagner

Deputy Director

California Hydrogen Business Council



Purpose and Activities

■ CHBC Overview

- The California Hydrogen Business Council (CHBC) is comprised of over 100 companies, agencies and individuals involved in the business of hydrogen. Our mission is to advance the commercialization of hydrogen in the energy sector, including transportation, goods movement, and stationary power systems to reduce emissions and dependence on oil in California.

■ CHBC Activities

- Advocacy
- Communications & Business Expansion
- Goods Movement, Heavy-Duty Transportation, and Clean Ports
- Hydrogen Energy Storage and Renewable Hydrogen
- Public Transport
- Infrastructure & Vehicle Deployment

MEMBER ORGANIZATIONS

Platinum



Gold



Silver



Innovators



Affiliates



Our Members include:

- Hydrogen producers and distributors
- Automotive companies
- Public transit systems and suppliers
- Fuel cell, electrolyzer, compressor and storage manufacturers
- Fueling station developers
- Engineers and consultants
- Municipal, state and federal agencies
- Component suppliers



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2018 Events

California HYDROGEN & FUEL CELL SUMMIT and California Hydrogen Business Council Member Day

December 10 - 12, 2018 | Sheraton Grand | Sacramento, CA



CHBC Signature Events

- CHBC Member Day, Tour, Hydrogen 101 for Policy Makers, Board Meeting: December 10, 2018 – Sheraton Grand, Sacramento, CA
- California Hydrogen and Fuel Cell Summit: December 11-12, 2018 – Sheraton Grand, Sacramento, CA
- More information at: <https://www.californiahydrogen.org/california-hydrogen-and-fuel-cell-summit-2018/>



Who We Are



EIN engages in comprehensive research, strategic policy advocacy and public outreach to ensure the widespread adoption of FCEVs as a key part of the zero-emission transportation future.

- + Drafted the California Hydrogen Highway Blueprint
- + Successfully Fought for Hydrogen Infrastructure Funding Under AB118
- + Successfully Advocated for Inclusion of Hydrogen Fuels in the Low Carbon Fuel Standard
- + Successfully Promoted Inclusion of Renewable Hydrogen Mandate
- + Helped Develop the CEC Plan to Fund CA's First 100 H2 Stations
- + Promoted O&M Funding for Station Developers



Core Programs

EIN is the only nonprofit environmental organization dedicated to advancing the hydrogen electric vehicle marketplace with particular emphasis on the following three programs:

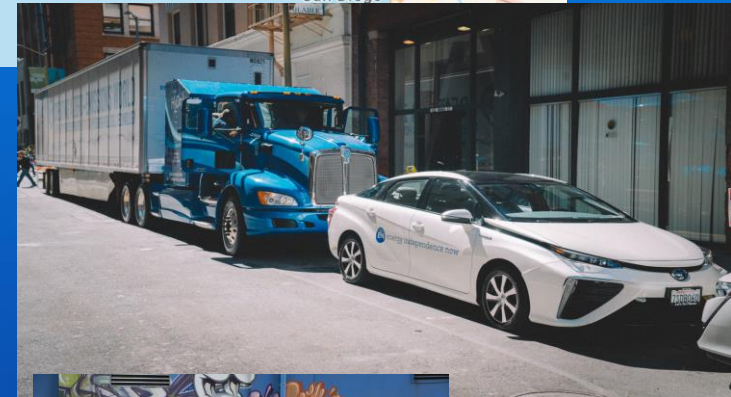
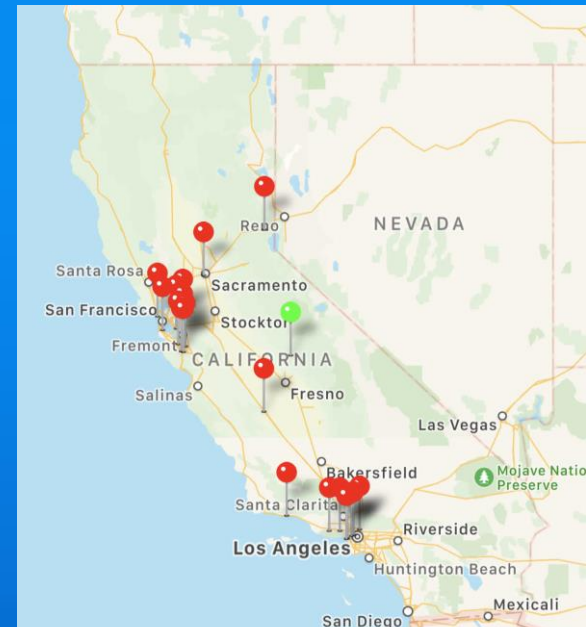
Education & Outreach

Infrastructure Finance

**Renewable Hydrogen
(RH2)
Research & Advocacy**

Hydrogen Today

- 5,463 Cars in the US
- 25 Fuel Cell Buses in California
- 35 Hydrogen Stations in California
- 29 Hydrogen Stations in Development
- SB100: 100% Renewable Energy/Zero Carbon Resources by 2045. Needs Energy Storage.
- EO B-48-18: 200 Stations by 2025 and 5M Zero-Emission cars by 2030
- Hydrogen Council announced 100% decarbonized hydrogen for transportation by 2030



energy independence now

Renewable Hydrogen Research and Advocacy



EIN Roadmap to Renewable Hydrogen

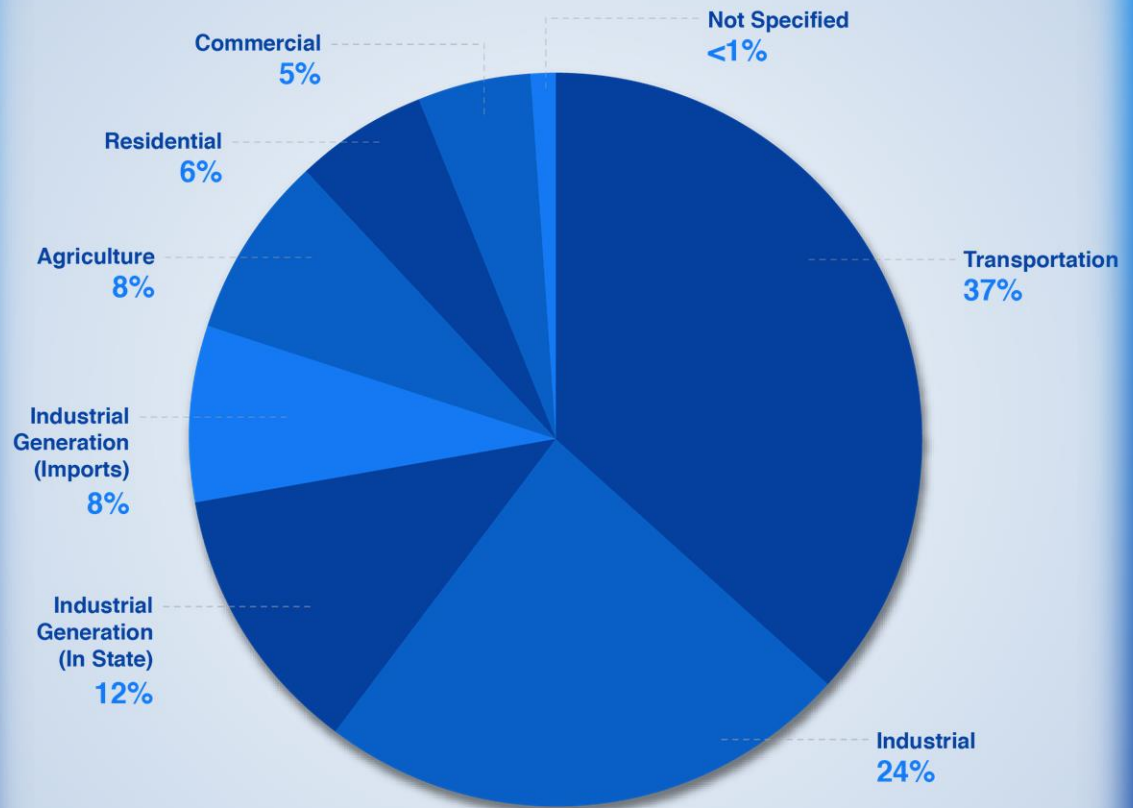
Objectives:

- Analyze RH2 pathways & economics
- Identify POLICIES to accelerate development of RH2
- Develop an educational platform about RH2
production, demand and pathways

Why RH2 - 1.0

California GHG Emissions by Sector

The transportation sector is the largest source of emissions in the state due to combustion of fuels used in vehicles, aviation, rail and others (CARB, 2016)



California Hydrogen Production

Supply: The state's oil refinery industry produces and utilizes large amounts of hydrogen through natural gas steam reforming to meet stricter environmental regulations of petroleum

Demand for FCEVs: CARB projects that by 2022 the hydrogen capacity of the statewide station network needs to be 16,580 kg/day in “business-as-usual” scenario



RH2 Production Technologies

Steam Methane Reform (SMR):

Biogas from Landfills
Biogas from Dairies
Biogas from Wastewater
Treatment Plants

Tri-Generation:

RH2 Production Process from
Natural Gas can produce: Heat,
Power, Water, and Renewable
Hydrogen

Electrolysis:

Electricity to break the H₂O
Bond. Energy Storage for
Renewable Energy (Solar +
Wind)



California Hydrogen Production

Producer	City	Technology	Capacity (kg/day)	Type	Industry
Air Products	Sacramento	SMR	5,542	Liquid H2	Multiple
Praxair	Ontario	SMR	20,483	Liquid H2	Multiple
Air Liquide	El Segundo	SMR	207,240	Gaseous H2	Oil Refining
Air Liquide	Rodeo	SMR	289,172	Gaseous H2	Oil Refining
Air Products	Carson	SMR	240,976	Gaseous H2	Oil Refining
Air Products	Martinez	SMR	212,059	Gaseous H2	Oil Refining
Air Products	Martinez	SMR	84,342	Gaseous H2	Oil Refining
Air Products	Sacramento	SMR	unknown	Gaseous H2	Food
Air Products	Wilmington	RFG SMR	385,562	Gaseous H2	Oil Refining
Praxair	Ontario	SMR	28,917	Gaseous H2	Multiple
Praxair	Richmond	SMR	626,539	Gaseous H2	Oil Refining
Total			2,100,832		



Why RH2 - 2.0

Curtailment

California has made great strides toward a low-carbon electric grid. However, the rapid rise in solar and wind resources coming onto the system has created a new operating paradigm, in which the system frequently has too much renewable energy, without adequate customer demand to use it. This is called “oversupply.”

- California ISO



Why RH2 - 2.0

Curtailment



- California curtailed 80 GWh of renewables in March 2017

- That's enough to make about 1.3m kg of 100% RH2



- ...that would support over 100,000 FCEVs for a month OR over 9,000 FCEVs for the entire year



Recommendations

1. Begin the Journey at 100% RH2 Now

- Policymakers and the hydrogen stakeholder community should immediately support renewable production projects that are scalable well beyond one station.
- California would need to start with 10 production facilities (1,000kg/day) just to meet the 33.3% requirement by 2022 and up to 30 production facilities, at the same time, to achieve a 100% renewable hydrogen fuel supply in 2022.
- Hydrogen Council announced 100% decarbonized hydrogen for transportation by 2030



2. Fund Scalable Projects RH2 Production

- In 2017, the California Energy Commission recognized this challenge and responded by issuing a competitive grant solicitation for up to \$4M per project to support renewable hydrogen production for FCEVs.
- These projects will generate valuable data on cost, scalability and challenges while educating the public about the role of renewable hydrogen in achieving zero-emission transportation and energy systems.

3. Improve Low Carbon Fuel Standard Incentives

- Extend the LCFS Program for 10+ Years.
- Establish a Market Floor.
- Establish New Pathways for Renewable Hydrogen.
- Consider Existing Pathways that Currently Do Not Qualify for LCFS Credits.

4. Promote Tools to Lower the Cost of Electricity for RH2 Producers

- Maximizing and expanding Time-of-Use (TOU) incentives.
- Negotiating access to wholesale rates or preferential pricing.
- Increasing LCFS electrolyzer pathway allowances to include renewable content from the grid.
- Coordinating electrolyzer firms, utilities, utility commission representatives, California Energy Commission leaders and other relevant parties to discuss challenges and explore potential resolutions.
- Researching how to maximize Green Tariff and Shared Renewables (GTSR) impacts on the price of electricity and the levelized cost of hydrogen for electrolyzer projects.



5. Address Hydrogen Distribution and Storage Challenges

- Fund Research & Development for Hydrogen Storage Technologies.
- Fund Studies and Demonstration Projects Focusing on Increasing Levels of Hydrogen in Existing Natural Gas Pipelines and Support Increased Hydrogen Injection Standards.
- Support Dedicated Hydrogen Pipelines.

6. Expand the US EPA's Renewable Fuel Standard (RFS) Program

Add Hydrogen as a Pathway to the RFS Program, Making RIN Credits Available to Renewable Hydrogen Producers. This will lower the cost of hydrogen fuel for consumers and offset the expense of developing renewable hydrogen production projects that use biogas or renewable electricity feedstocks.



7. Incentivize Consumers and Stakeholders

- **Reward Consumers.** These incentives must remain in place for more than five years in order to allow enough time for consumer awareness to build and allow the automotive industry the necessary time to ramp up development, production and marketing efforts for the vehicles.
- **Look Beyond the FCEV Community.** Outreach campaigns should target new users while leveraging the massive existing community of hydrogen consumers.



8. Broaden the Hydrogen Community Through Education and Outreach

- Engage officials in positions of influence related to the hydrogen sector.
- Identify the most effective policy actions for the sector and ensure that the hydrogen community is prepared, responsive and present.
- Target policymakers with outreach materials that illustrate the benefits of renewable hydrogen, background information on the sector and key issues.



Policy Recommendations

1. **Begin the Journey to 100% Renewable Hydrogen Now**
2. **Fund Scalable Projects for Renewable Hydrogen Production**
3. **Improve Low Carbon Fuel Standard (LCFS) Incentives**
4. **Promote Tools to Lower the Cost of Electricity for Renewable Hydrogen Producers**
5. **Address Hydrogen Distribution and Storage Challenges**
6. **Expand the US EPA's Renewable Fuel Standard (RFS) Program**
7. **Incentivize Consumers and Stakeholders**
8. **Broaden the Hydrogen Community Through Education & Outreach**



For more information...

The Renewable Hydrogen Roadmap Report:

<https://einow.org/rh2roadmap/>

California Hydrogen Business Council

<https://www.californiahydrogen.org/>

California Fuel Cell Partnership

<https://cafcp.org/>



Thank you...

South Coast Air Quality Management District (SCAQMD)

Honda Motor Company

Toyota Motor Company

Southern California Gas Company

Pacific Gas & Electric Company

The Linde Group

Nel Hydrogen

Hydrogenics Corporation

ITM Power Plc.

Fuel Cell Energy Inc.

Proton OnSite

California Hydrogen Business Council

Leonardo DiCaprio Foundation



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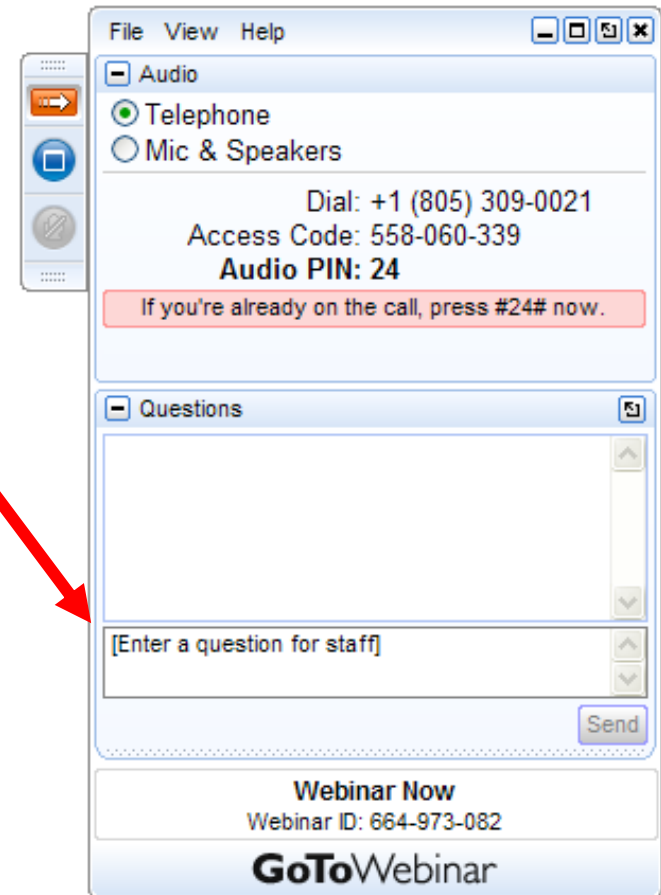
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Question and Answer Session

Ask questions using the
Questions Panel on the
right side of your screen.

The webinar slides and
recording will be made
available after today.
Please fill out survey
upon leaving.





Thank you!

Thank you for attending today's webinar and remember to fill out attendee survey. Slides and Recording will be made available within a few days.

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Join us and help shape the industry in CA!

www.californiahydrogen.org