



H2-TECHSOLUTIONS.COM | MAY 18-19, 2021

Driving forward: Hydrogen fuel cells in the U.S.

Morry Markowitz
President



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Join us for the live Q&A with Morry Markowitz from 5:45 – 6:00 a.m. CDT

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▶ 0:00 / 19:57



<https://www.fchea.org/us-hydrogen-study>



KEYNOTE - 18 MAY

Graham Bennett
Vice President and Head of Energy Transition



KEYNOTE - 19 MAY

Jon André Løkke
Chief Executive Officer



KEYNOTE 2 - 19 MAY

Morry Markowitz
President





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KEYNOTE

KEYNOTE: Driving forward: Hydrogen and fuel cells in the U.S.



Morry Markowitz
Fuel Cell and Hydrogen Energy Association
President

5:00 AM - 5:45 AM CDT on Wednesday, May 19
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KEYNOTE: Driving forward: Hydrogen and fuel cells in the U.S.

LIVE Q&A FOR KEYNOTE: Driving forward: Hydrogen and fuel cells in the U.S.



Morry Markowitz
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5:45 AM - 6:00 AM CDT (Wed, May 19)

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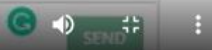
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Driving Forward: Hydrogen and Fuel Cells in the U.S.

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President
Fuel Cell and Hydrogen Energy Association



Fuel Cell & Hydrogen Energy Associati

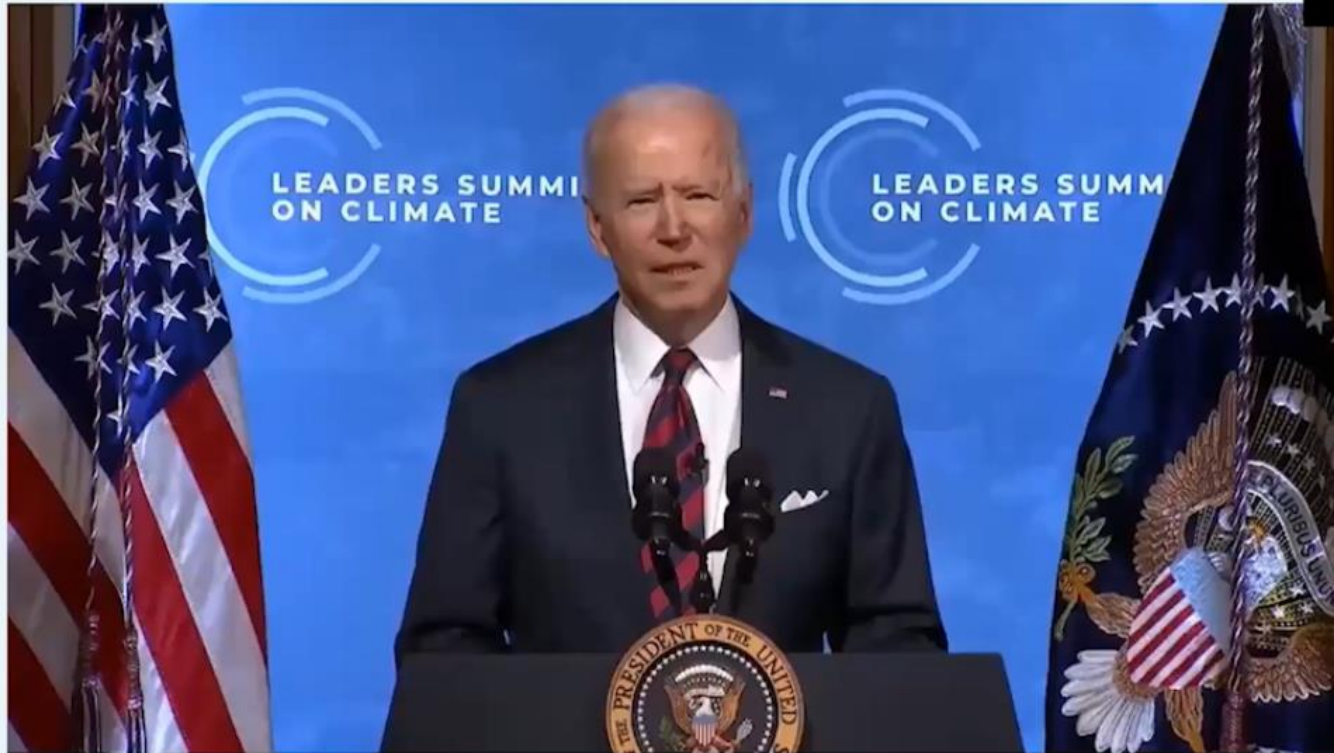


The mission of FCHEA is to advance the commercialization of and promote markets for fuel cell technology and hydrogen energy.

Our Members



Hydrogen in the U.S. is Now Part of the Discussion



Hydrogen in the U.S. is Now Part of the Discussion



THE WHITE HOUSE



- The United States can address carbon pollution from industrial processes by supporting carbon capture as well as new sources of hydrogen—produced from renewable energy, nuclear energy, or waste—to power industrial facilities. The government can use its procurement power to support early markets for these very low- and zero-carbon industrial goods.



Transport Topics

Eleanor Lamb | Staff Reporter
April 23, 2021 10:15 AM, EDT

Secretary Pete Buttigieg Unveils New Alternative Fuel Corridor Designations



Granholm announces goal to make hydrogen power, EV batteries more affordable

BY RACHEL FRAZIN · 04/23/21 09:22 AM EDT

160 COMMENTS



Green hydrogen is a 'jump ball' in Biden climate plan: Kerry

Rachel Koning Beals · 3/3/2021

The Roadmap to a US Hydrogen Economy lays out a plan to develop a hydrogen economy



5 Uses of Hydrogen



Power generation and grid balancing

Centralized power (including storage) and distributed power (off-grid, backup power)

Hydrogen as an energy carrier and storage medium



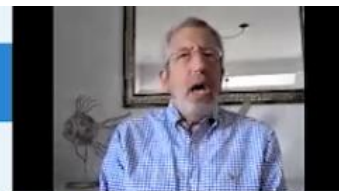
Transportation fuel
(including material handlings, light- and heavy- duty vehicles, captive fleets, rail)

Fuel for residential and commercial buildings
(including blending into the gas grid, combined heat and power)

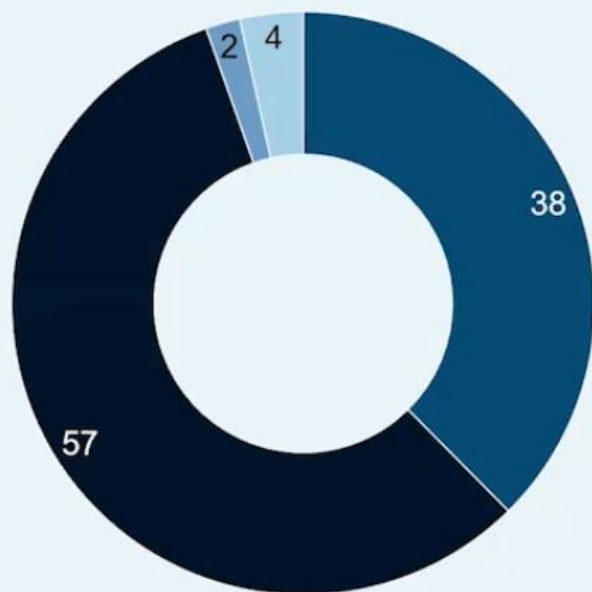
Fuel for **industry**

Feedstock for industry (ammonia, methanol, refineries, steel) and long-distance transport (aviation, marine)

U.S. Hydrogen Market Today



Current consumption in the US H₂ market
Percent



■ Ammonia and methanol ■ Refining ■ Metals ■ Other

11.4 m metric tons

of H₂ is currently consumed annually in the US market

~\$17.6 bn

total value of the H₂ market in the US today¹

77%

steam methane reforming H₂

23%

by-product H₂ from refining

1. Assuming realized price of \$2/kg for hydrogen produced from steam methane reforming (SMR)

Current U.S. Snapshot

Large-Scale Stationary Installations – 550+ MW

Backup Power – 8,500+ installed

Material Handling – 40,000+ deployed

Fuel Cell Vehicles – ~10,000 on roads

Fuel Cell Buses – 50+ in operation, 50+ planned

Hydrogen Fueling Stations – 45 retail open, 135 in development

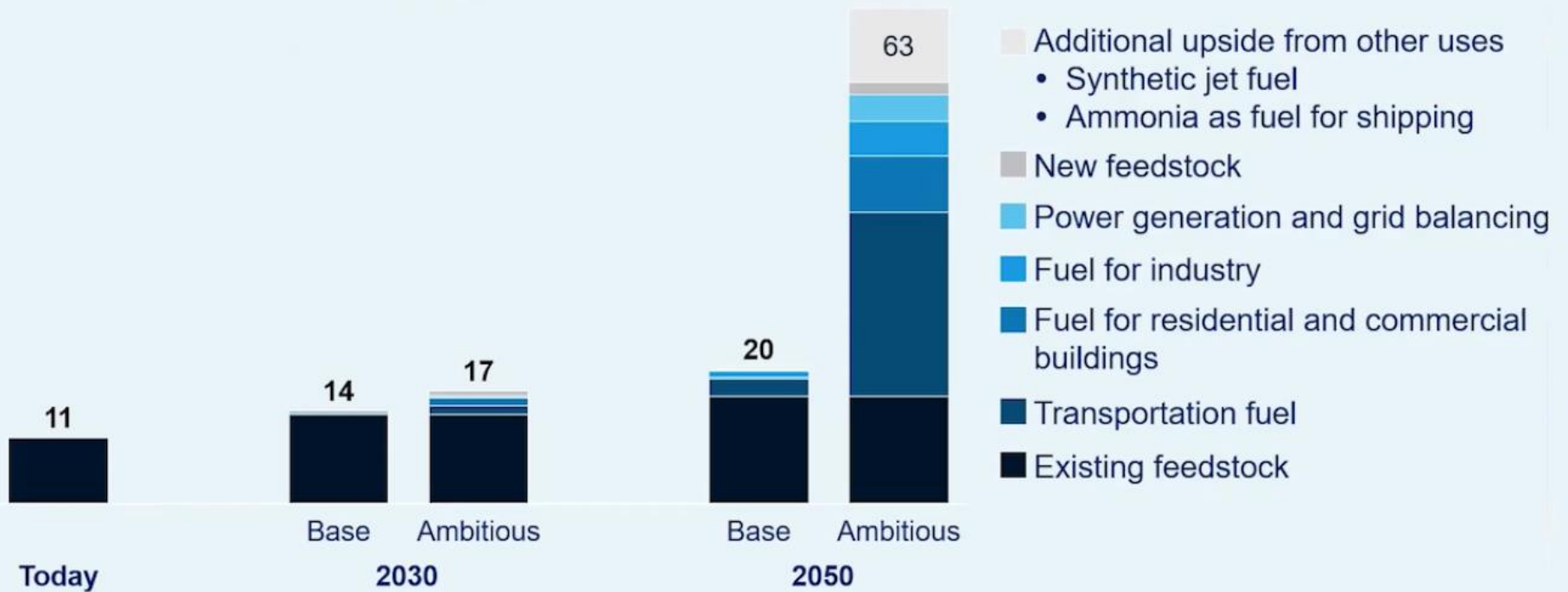
New markets – trucks, trains, marine, aviation, ports (air and water), drones, microgrids, renewable energy grid stabilization, decarbonization of industrial applications



The road map lays out a high-growth pathway for



Million metric tons per year



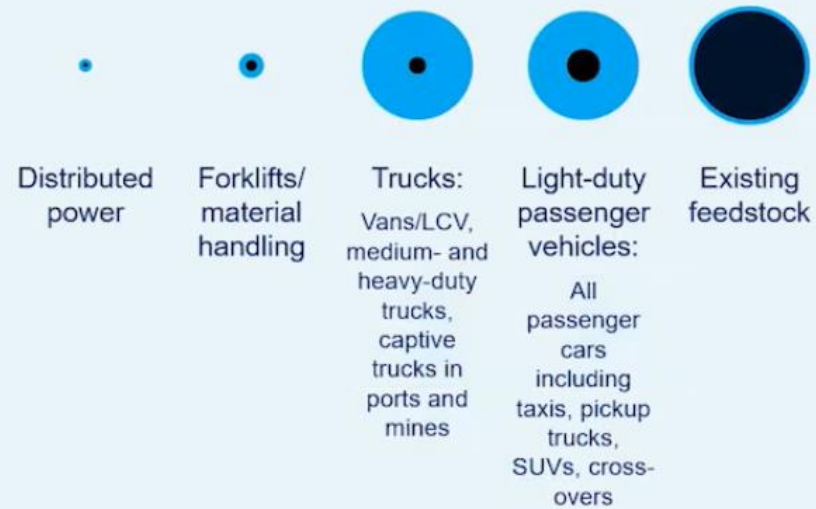
1. Demand excluding feedstock, based on IEA final energy demand for the US
 2. Assuming that 20% of jet fuel demand would be met from synthetic fuel and 20% of marine bunker fuel from ammonia
 Note: Some numbers may not add up due to rounding



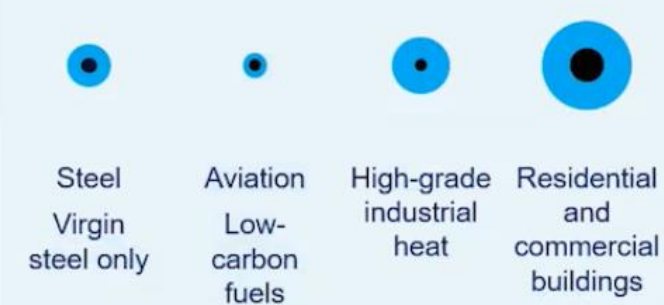
Bubble size in the legend corresponds to 1 million metric tons of hydrogen

- Potential hydrogen demand market size in 2030
- Potential hydrogen demand market size in 2050

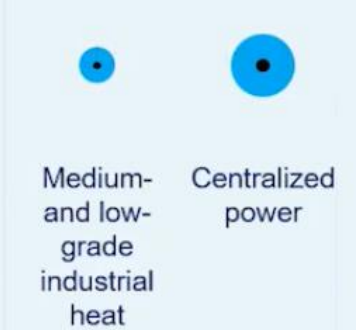
Established and emerging



Decarbonization short-term moves



Decarbonization long-term moves



Scaling up Economic Opportunities: Investments and Jobs



Annual investment



\$1bn

2022

Early scale-up

\$2bn

2025

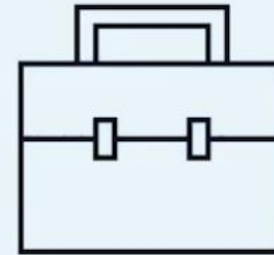
Diversification

\$8bn

2030

Broad rollout

New jobs¹



+50,000

2022

Early scale-up

+100,000

2025

Diversification

+500,000

2030

Broad rollout

1. Includes direct, indirect, and resulting jobs

The US economy would benefit through emissions reduction, growth, jobs, & use of domestic energy resources



Hydrogen in the US could ...



... Strengthen the US economy

~\$750 bn
in revenue

3.4m
jobs



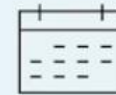
... Create a highly competitive source of domestically produced low-emission energy

~100%
domestically produced



... Provide significant environmental benefits and improve air quality

-16%
CO₂
-36%
NO_x

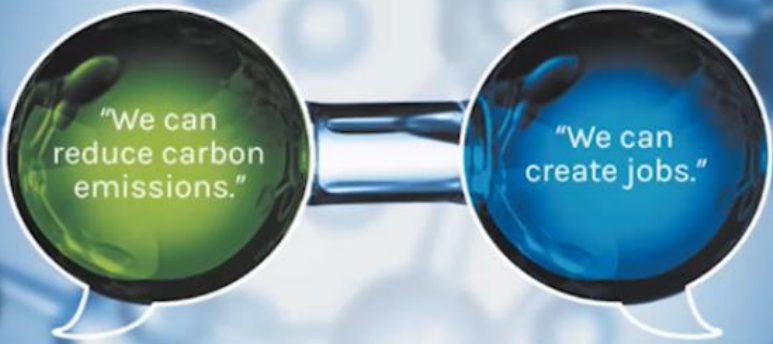


In 2050

Note: Final energy demand excluding feedstock; share of abated CO₂ emissions relative to US emissions in 2050 as forecasted in the IEA Reference Technology Scenario; for NO_x, for tailpipe emissions only, based on EPA current NO_x emissions



Both sides get what they want,



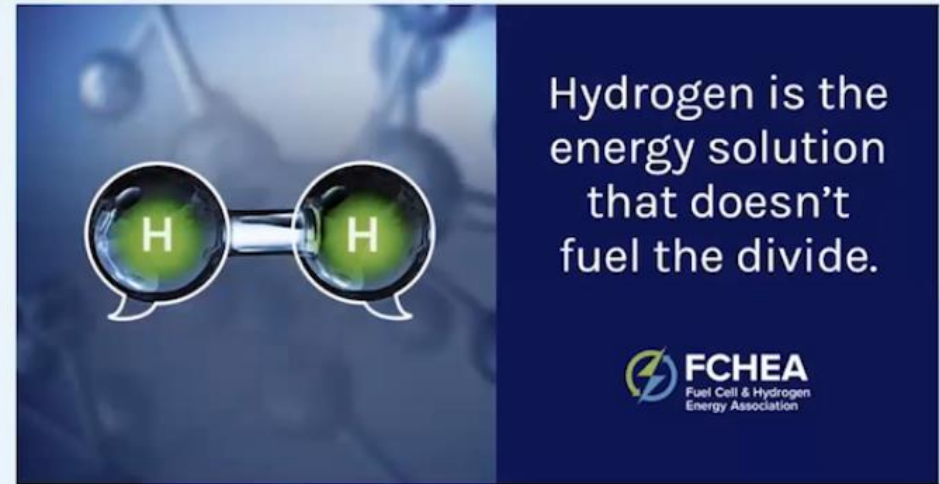
when hydrogen comes together.

Cutting carbon and creating jobs? Hydrogen can do that. Fueling urban and rural communities? Hydrogen can do that too. No matter your point of view, hydrogen is an energy solution ready to meet the aspirations of all Americans. So, let's talk.

See how hydrogen bonds us at fchea.org/hydrogenbonds



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Thank You!



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**Fuel Cell & Hydrogen
Energy Association**

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