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CA Hydrogen Hub

CEC IEPR Commissioner Workshop
Role of Hydrogen in CA's Clean Energy Future

June 21, 2022

Gia Vacin
California Governor's Office of Business &
Economic Development (GO-Biz)

Bipartisan Infrastructure Law – H2 Highlights

- **Includes $9.5B for clean hydrogen**:
  - $1B for electrolysis research, development, and demonstration
  - $500M for clean hydrogen technology manufacturing and recycling R&D
  - $8B for at least four regional clean hydrogen hubs
- **Aligns with Hydrogen Shot** priorities by directing work to reduce the cost of clean hydrogen to **$2 per kg by 2026**

President Biden Signs the Bipartisan Infrastructure Law into law on Nov. 15, 2021.
Photo Credit: Kenny Holston/Getty Images

- **Requires developing a National Hydrogen Strategy and Roadmap**

Source: DOE Hydrogen Program Update: 2022 AMR Plenary Session (energy.gov)

Department of Energy Hydrogen Shot

Hydrogen Shot seeks to reduce the cost of clean hydrogen by **80%** to $1 per 1 kilogram in 1 decade ("1 1 1").

1 Dollar

1 Kilogram

1 Decade

Bipartisan Infrastructure Law – Regional Clean Hydrogen Hubs

- $8 billion/five years
- *At least* 4 regional clean hydrogen hubs
  - ***Definition***: a network of clean hydrogen producers, potential clean hydrogen consumers, and connective infrastructure in close proximity
- Hubs must reflect to the maximum extent practical:
  - ***Feedstock Diversity****:* at least 1 hub with hydrogen production from renewables, nuclear, and fossil fuels with CCS
  - ***End-Use Diversity****:* at least 1 hub with hydrogen end-use in the electric power, industrial, residential and commercial heating, and transportation sectors
  - ***Geographic Diversity****:* Each clean hydrogen hub must be located in a different region of the United States and use energy resources that are abundant in that region
  - ***Natural Gas-Producing Regions***: At least 2 hubs located in regions with the greatest natural gas resources

California is Well Positioned

Pacific Northwest

- *Port communities*
- *Tribal communities*
- *Extensive renewables*
- *8 jobs per $1M invested in H_2*

California

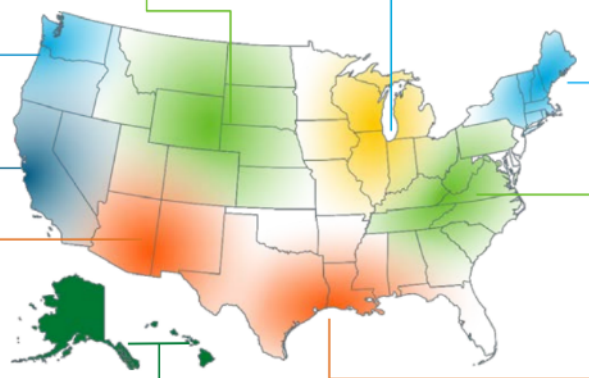
- *Diverse populations*
- *Extensive infrastructure*
- *Emissions regulations*
- *40,000+ jobs*

Southwest

- *Tribal and Hispanic communities*
- *Underutilized solar*
- *Nuclear power*
- *Up to 2B tonnes/yr emission reduction potential*

Central U.S.

- *Ample wind*
- *Geological storage*
- *Railway transport*
- *Nuclear resources*
- *>630,000 tonnes/yr CO_2 reduction*



Alaska and Hawaii

- *Extensive renewables – geothermal, solar, ocean*
- *Backup power*
- *Isolated communities*
- *86,000 tonnes/yr emission reduction*

Great Lakes

- *Major national corridors* • *Nuclear power* • *60,000+ jobs*

New England

- *Offshore wind*
- *Fishing communities*
- *Backup power and winter heating*
- *~120K tons CO_2/year reduction*

Appalachia

- *Retiring fossil plants*
- *Mining, refining transferable skills*
- *Carbon capture and sequestration*
- *70,000 tons/yr H_2 production*

Gulf Coast

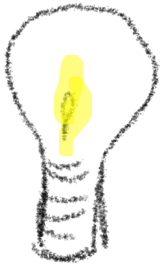
- *Existing infrastructure*
- *Multiple opportunity zones*
- *Renewable resources*
- *1,000s of jobs*
- *Chemical industry*

Target Outcomes from H2Hubs Investment

- Time, money, and innovation:

- *Time Outcome*: Federal money accelerates transition to zero carbon transportation and energy system.

- *Money Outcome*: A financially self-sustaining, and expanding, low carbon hydrogen market.
  - *Industry: CA is the only place this is truly possible.*



- *Innovation Outcome*: California's hub fosters innovation and accelerates global adoption of renewable hydrogen.

Targeted Sectors, from Draft Scoping Plan

Transportation		**H2 as Energy Storage** (cross-sector)
• Light Duty Vehicles = 100% BEV or FCEV sales by 2030 or 2035 • Truck ZEVs = 100% ZEV sales by 2030, 2035, 2040, or 2045	• Freight and Passenger Rail (50% of line haul sales = ZEV by 2030, 100% by 2035/45) • Line Haul and Passenger Rail primarily H2, others primarily e- by 2035	
• Aviation (10-25% met by e- or H2 by 2035/45)	• Ocean Going Vessels (10-25% of OGVs use H2 by 2035/45)	
Electrical Power		
• Electricity Generation: H2 fuel cells provide firm capacity		
Industrial		

• Chemicals and Allied Products, Pulp and Paper
  • H2 for 25-50% of process heat by 2035, 100% by 2045 (or 0 and 10%)
	• Low Carbon Fuels for Buildings and Industry
	  • H2 blended in NG Pipeline at 7% energy (30% by volume), ramping up from 2030 to 2040
	  • Dedicated H2 pipelines to serve certain industry clusters in 2030s or 2040s	

Source: [Revised PATHWAYS Scenario Modeling Assumptions (ca.gov)]

CA H2 Hub Principles

1. Prioritize renewable hydrogen (Green Hydrogen).
2. Invest in the energy system, taking a multi-sectoral approach.
3. Public policy enables early-markets, private capital scales them.
4. Prioritize hardest to abate sectors with biggest emissions profiles, focusing on creating economically sustainable markets.
5. Focus effort on communities with largest pollution burden.

Application Principles

- One application, mapped to state goals/principles, with local support
- Federal money might not feed every project, but the resulting system should.
  - Success should breed success – better to go deep to ensure success than spread too wide.
- CA's strongest lead story = Ports and goods movement (hard to abate, multi-sector, big emissions, largest pollution burden, unique to CA).
  - Complemented by strong power sector story

How Are We Organizing Stakeholders?

California Formally Announces Intention to Create a Renewable Hydrogen Hub

May 18, 2022 | *Press Release*

Sacramento, CA – Building from a foundation of nation-leading policies and new hydrogen system market development, Governor Newsom's administration is announcing California's intention to leverage federal investment from the Infrastructure Investment and Jobs Act (IIJA) to establish an environmentally and economically sustainable and expanding renewable hydrogen hub. Administration officials, led by the Governor's Office of Business and Economic Development (GO-Biz), will continue working with public and private stakeholders, including California's legislature and leading municipalities such as Los Angeles, to submit one state co-funded application.

In the May Revise budget, Governor Newsom proposed direct investment in green hydrogen production, in addition to numerous pots of funding that can be leveraged to accelerate hydrogen market development, including zero-emission vehicle market acceleration, industrial decarbonization, and long duration energy storage. Additionally, the administration is committed to collaborating with neighboring states and initiatives to create a resilient supply and delivery chain, helping to facilitate success and learnings across multiple markets.

"California has the market experience, workforce talent, public and private investment base, and renewable resources to partner with the federal government to create an economically resilient, expanding hydrogen hub that helps accelerate national success," said Dee Dee Myers, Director of GO-Biz and Senior Economic Advisor to Governor Newsom. "GO-Biz is leaning in on our deep experience with the hydrogen industry and working with multiple stakeholders to organize a statewide application aimed at one fundamental concept: getting to scale in California and beyond."

"Our recently published draft Scoping Plan Update makes it clear that renewable hydrogen has an important role to play in reaching our economy wide climate and air quality targets," said California Air Resources Board Chair Liane Randolph. "We are committed to collaborating with all stakeholders to continually improve our robust policy framework to enable rapid renewable hydrogen market development."

"The need for renewable hydrogen is clear, especially as we develop systems to store and use renewable electricity," California Energy Commission Chair David Hochschild stated. "We need federal, state, and private investment to accelerate market development to ensure we meet our carbon neutrality goals —and we are excited to work with stakeholders to build a world class hydrogen hub and believe that federal investments in green hydrogen in California will benefit the state and the nation."

"The California Public Utilities Commission is committed to working with stakeholders to help define the role of investor-owned utilities in the hydrogen market ecosystem," said Commissioner Clifford Rechtschaffen. "Renewable hydrogen can play a variety of important roles in a decarbonized economy."

"From public transit to long-haul trucking, low-cost, renewable hydrogen is one of the key components in our efforts to rapidly reduce pollution from the transportation sector," said California State Transportation Agency Secretary Toks Omishakin. "Hydrogen fuel cell vehicles of all types – including cars, heavy-duty trucks, buses, rail and watercraft – are an ideal complement to battery-powered vehicles as part of a diversified and sustainable transportation system. The hydrogen hub will help lower costs and accelerate California's transition to a zero-emission future."

A federally co-funded hydrogen hub in California would accelerate our collective transition to a carbon-neutral economy, creating the scale needed to drive down cost for businesses and consumers alike, all while creating high paying jobs. Near term hub activities will center on deep investments in electrifying port operations, goods movement, transportation, and energy system resilience. Parties interested in submitting project ideas for consideration can add their information in this form.

https://business.ca.gov/california-formally-announces-intention-to-create-a-renewable-hydrogen-hub/

GO-Biz Hosted Stakeholder/Project Intake

- [x] I would like to be contacted about formally joining the CA H2Hub Public-Private Partnership

Which of the following describes your current or near-term hydrogen-related activities? *

- [ ] Clean Hydrogen Producer
- [ ] Hydrogen Consumer
- [ ] Hydrogen Infrastructure Provider/Operator
- [ ] Other

Which sector(s) are you involved with or most intersted in? (check all that apply) *

- [ ] Electricity Generation
- [ ] Emerging Opportunities (Airports, Trains, Maritime, etc.)
- [ ] Hydrogen Supply
- [ ] Industrial Processes
- [ ] Ports/Goods Movement
- [ ] Transportation
- [ ] Other

Are you developing an H2 Project? *

- (•) Yes
- ( ) No
- ( ) Unsure

Project Name *

Describe your H2 Project (1,000 character limit) *

Estimated tonnes of H2 produced/consumed per day at project start

Estimated tonnes of H2 produced/consumed per day after achieving full project buildout

What do you need to make your project successful (e.g., off-takers, capex support, policy changes, etc.)? (1,000 character limit) *

Regions of Interest

- [ ] Bay Area
- [ ] Central & Eastern Sierra
- [ ] Central Coast
- [ ] Central San Joaquin Valley
- [ ] Greater Sacramento
- [ ] Inland Empire
- [ ] Kern County
- [ ] Los Angeles County
- [ ] North San Joaquin Valley
- [ ] North State
- [ ] Orange County
- [ ] Redwood Coast
- [ ] Southern Border
- [ ] Statewide

Click the map for a larger view of California's regions.

https://business.ca.gov/h2hubs-form/

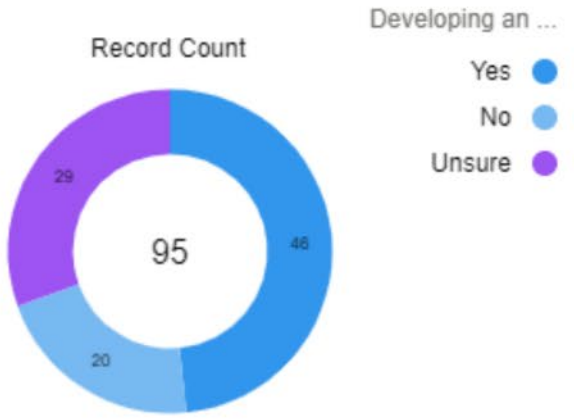
Stakeholder/Project Snapshot (as of 6/20)

H2 Leads this Month

105

View Report (DASHBOARD_H2 Leads by Month)

H2 Stakeholders by Project Status



View Report (H2 Opportunities with Output)

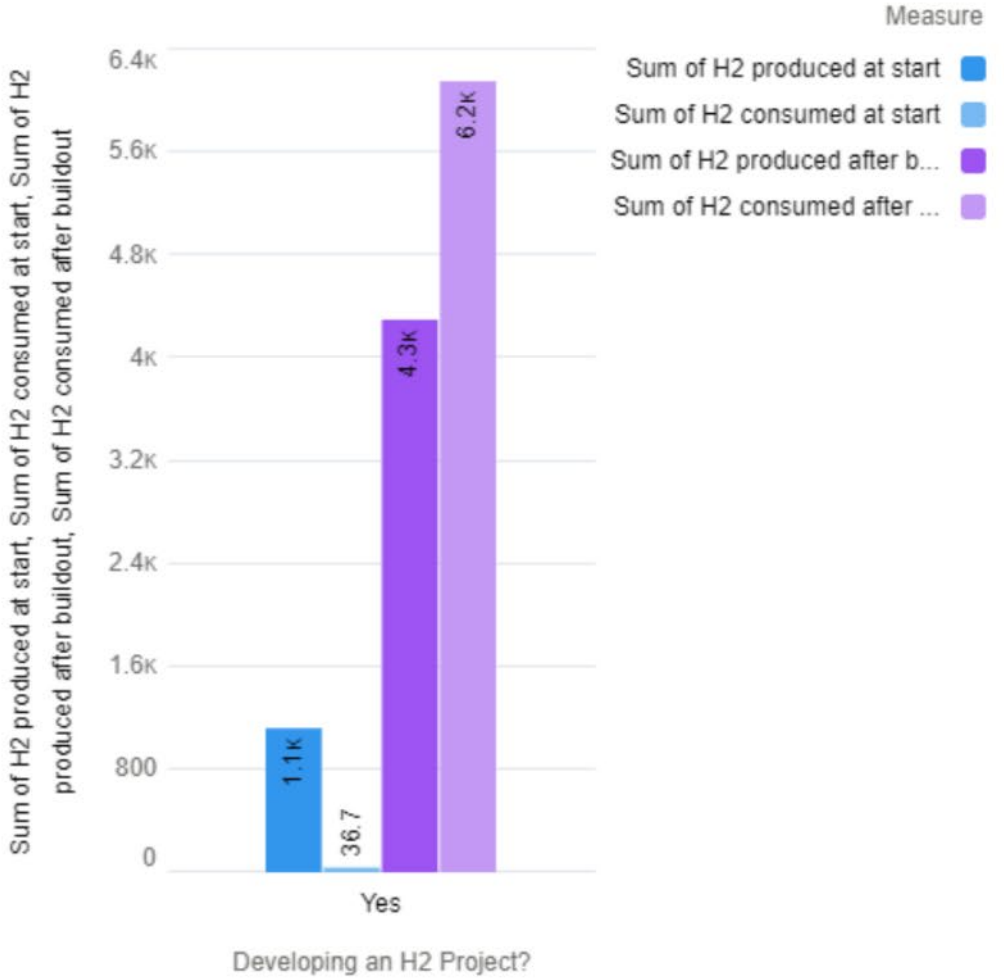
Tonnes H2 Produced per Day, Project Start

View Report (H2 Opportunities with Output)

Tonnes H2 Produced per Day, Full Buildout

View Report (H2 Opportunities with Output)

H2 Opportunities Output

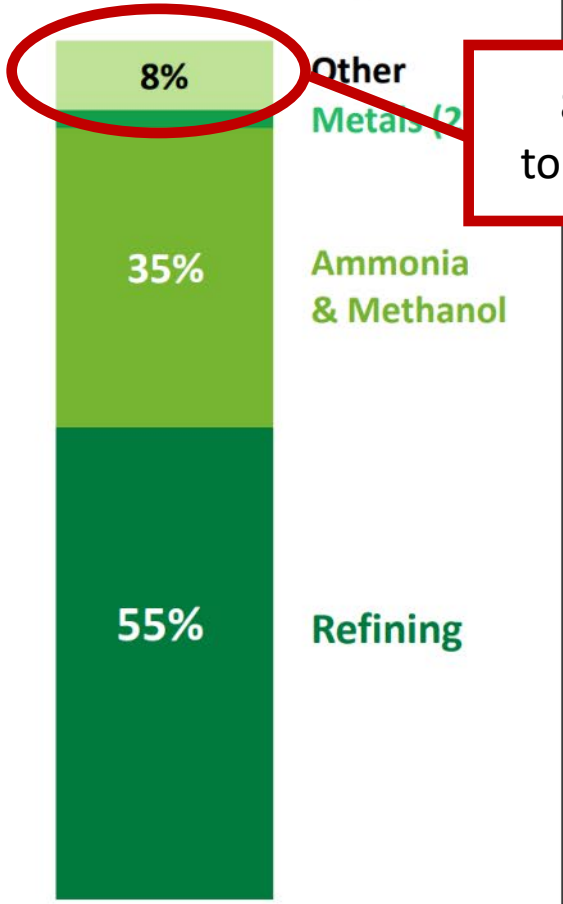


View Report (DASHBOARD_H2 Opportunities Output)

Hydrogen and Fuel Cells in the US

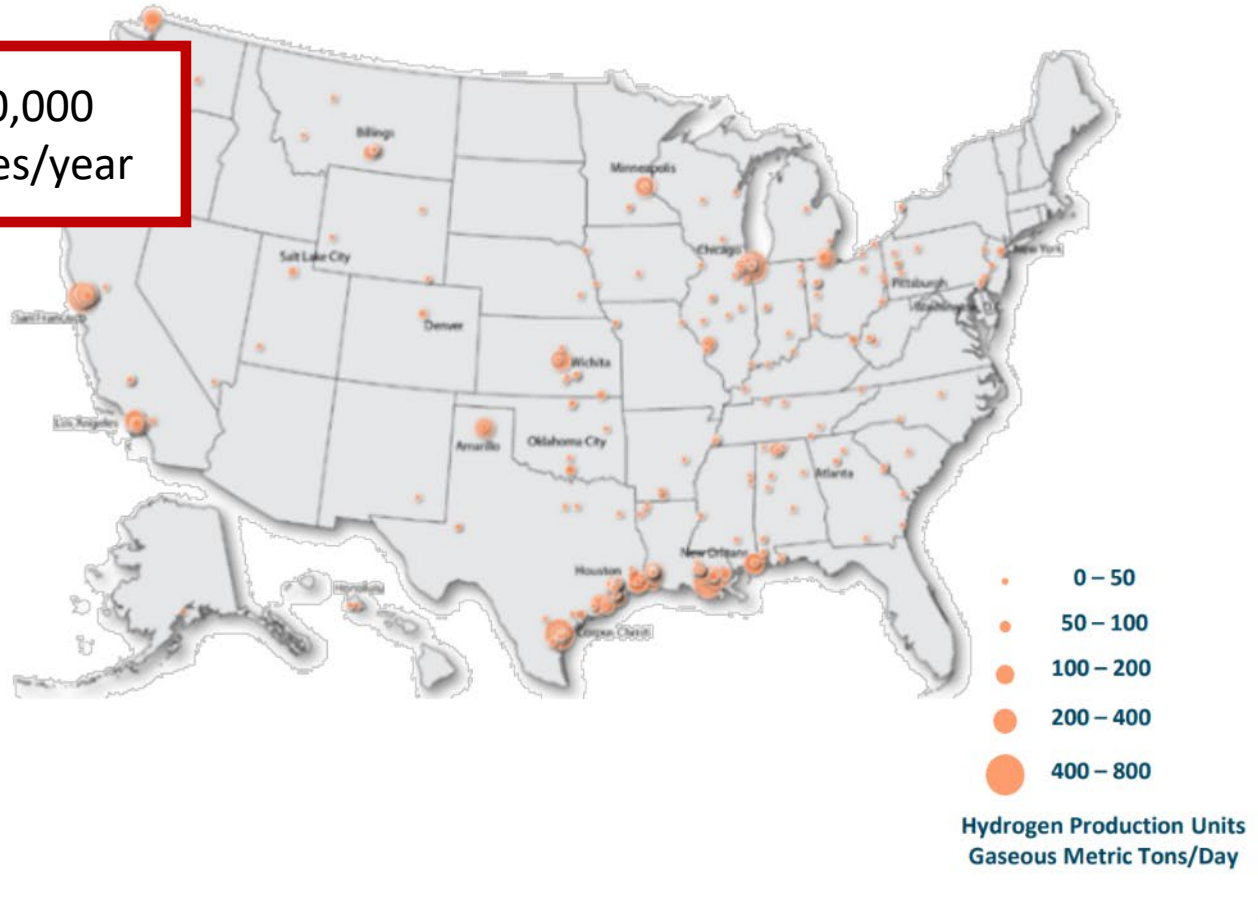
- 10 million metric tons produced annually
- More than 1,600 miles of H_2 pipeline
- World's largest H_2 storage cavern

Use of Hydrogen in the U.S. Today

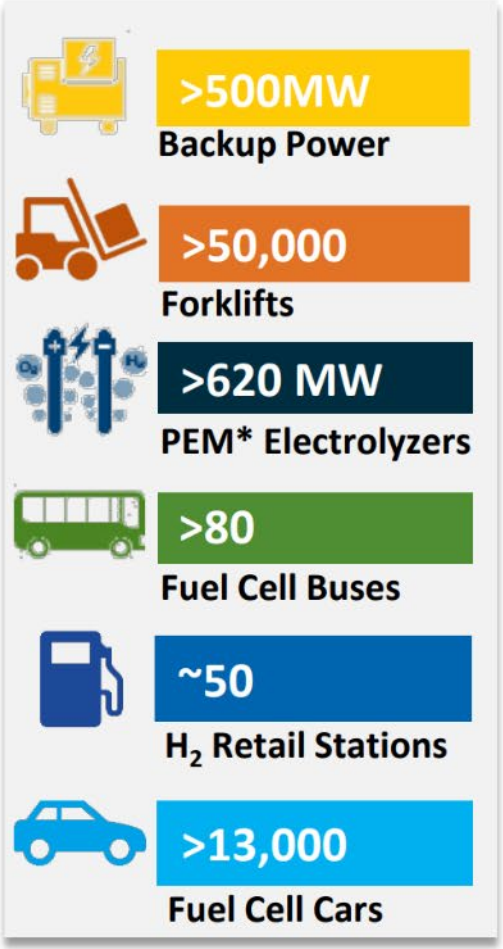


800,000 tonnes/year

Examples of Hydrogen Production Locations



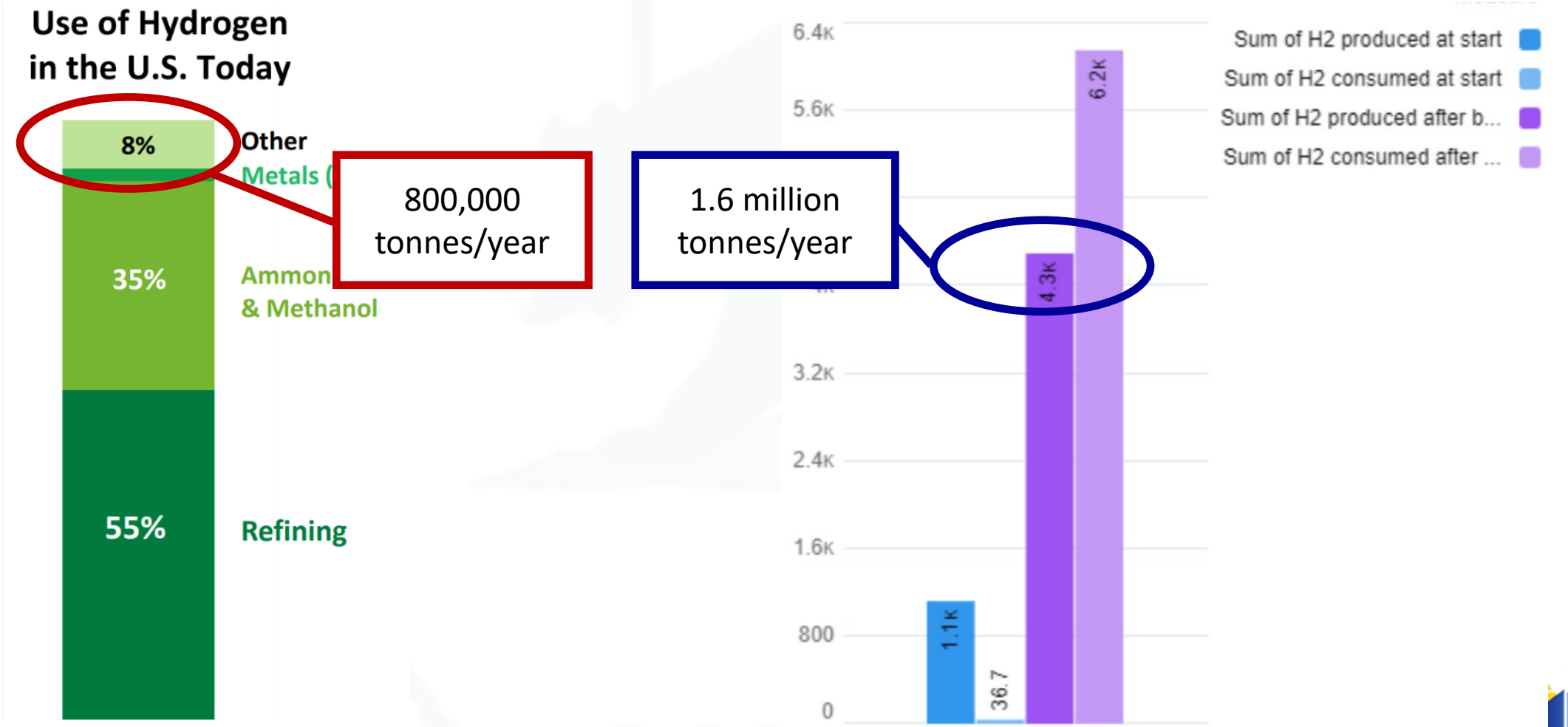
Examples of Deployments



*Proton exchange membrane

Source: DOE Hydrogen Program Update: 2022 AMR Plenary Session (energy.gov)

The Opportunity: A Monumental Shift



Seizing the H2 Opportunity

- Continue supportive state efforts (e.g., IEPR, Scoping Plan, SB 100, SB 643, investments, etc.)
- Focus actions on the North Star: bringing down the cost of renewable hydrogen
  - ≤ $5-6 dispensed hydrogen would be game-changing
- Stay flexible enough to effectively respond to rapidly evolving market forces
- Think outside the box


Let's Keep Thinking BIG!

Thank You!

Gia Vacin

gia.vacin@gobiz.ca.gov

916.730.6107

Sign Up for GO-Biz's H2 on the Move email list:
https://business.ca.gov/h2-on-the-move-sign-up/
H2 Hubs Collaborator Intake form:
https://business.ca.gov/h2hubs-form/