



U.S. DEPARTMENT OF  
**ENERGY**

# U.S. DOE Hydrogen and Fuel Cell Remarks

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U.S. Department of Energy

October 10, 2022

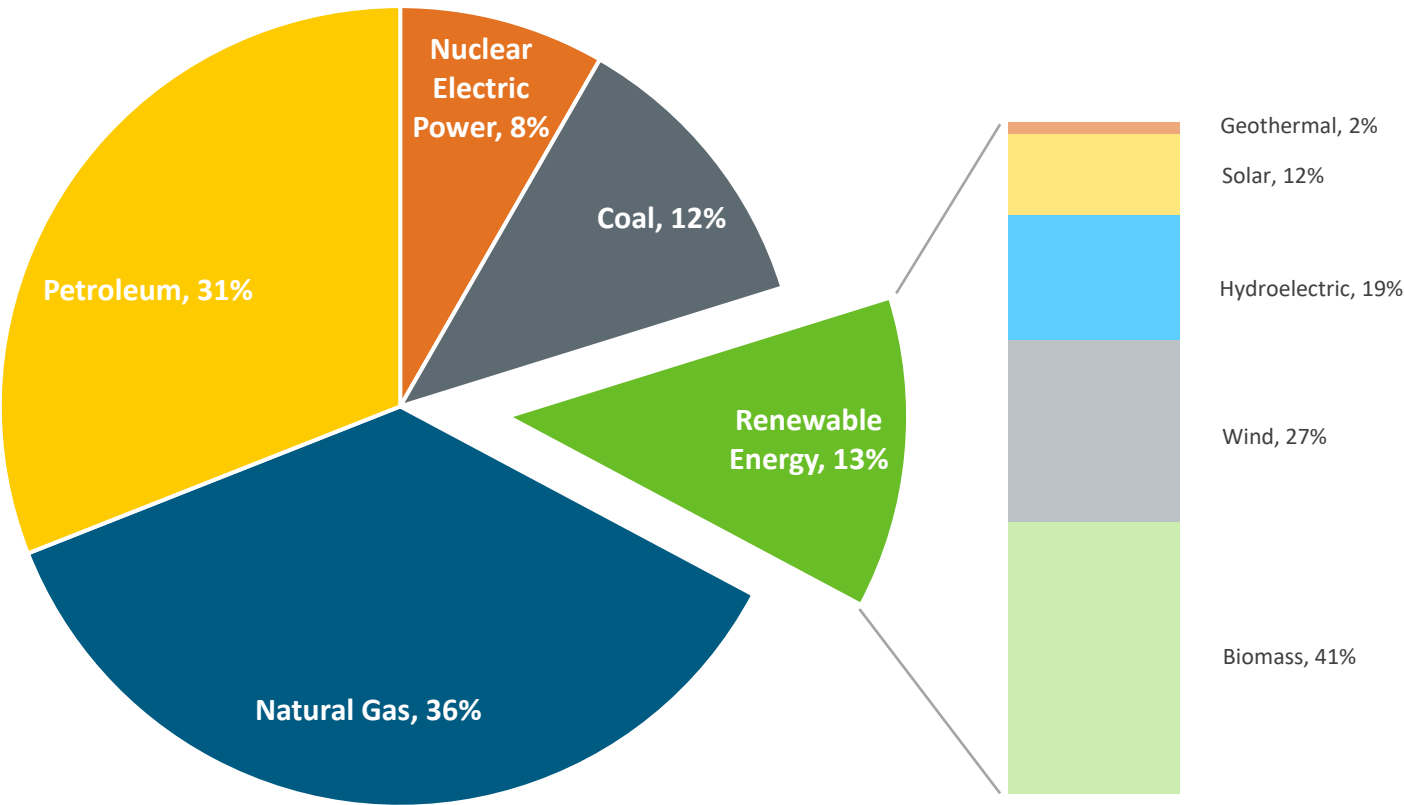


# U.S. Energy Landscape and Key Goals

## U.S. primary energy consumption by energy source, 2021

Total = 97.8 quadrillion  
British thermal units (Btu)

Total = 12.3 quadrillion Btu



**Source:** Data collected from U.S. Energy Information Administration, April 2022, *Monthly Energy Review*, preliminary data. Note: Sum of components may not equal 100% due to rounding.

## Administration Goals include:

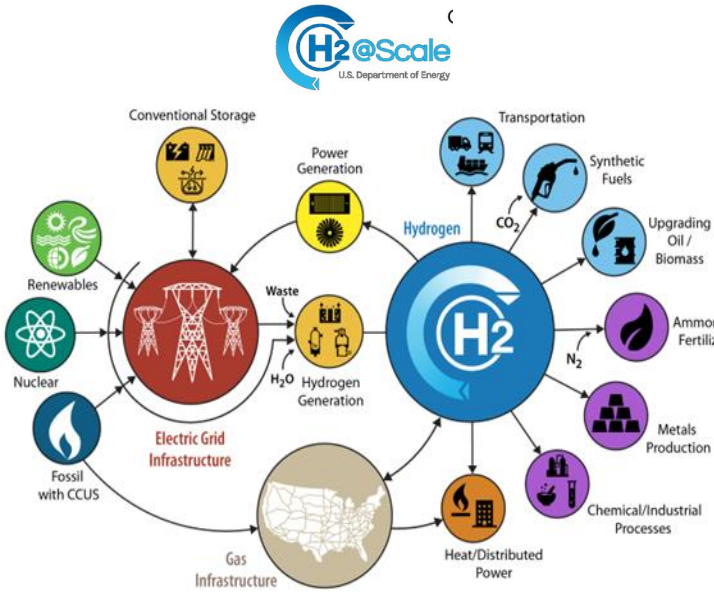
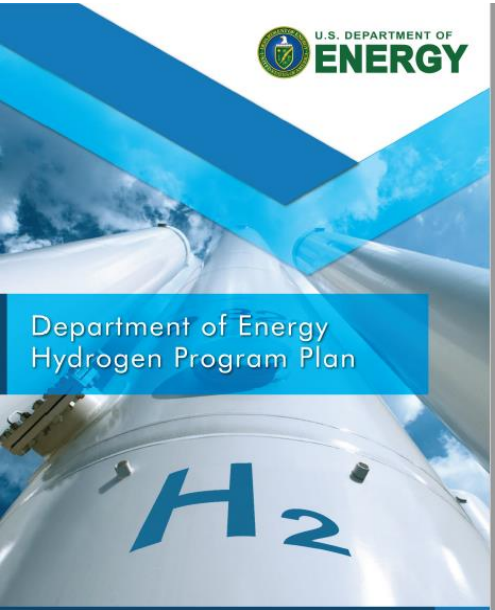
- Net-zero emissions economy by 2050 and 50–52% reduction by 2030
- 100% carbon-pollution-free electric sector by 2035

**Priorities:** Ensure benefits to all Americans, focus on jobs, EJ40: 40% of benefits in disadvantaged communities

EJ: Environmental Justice

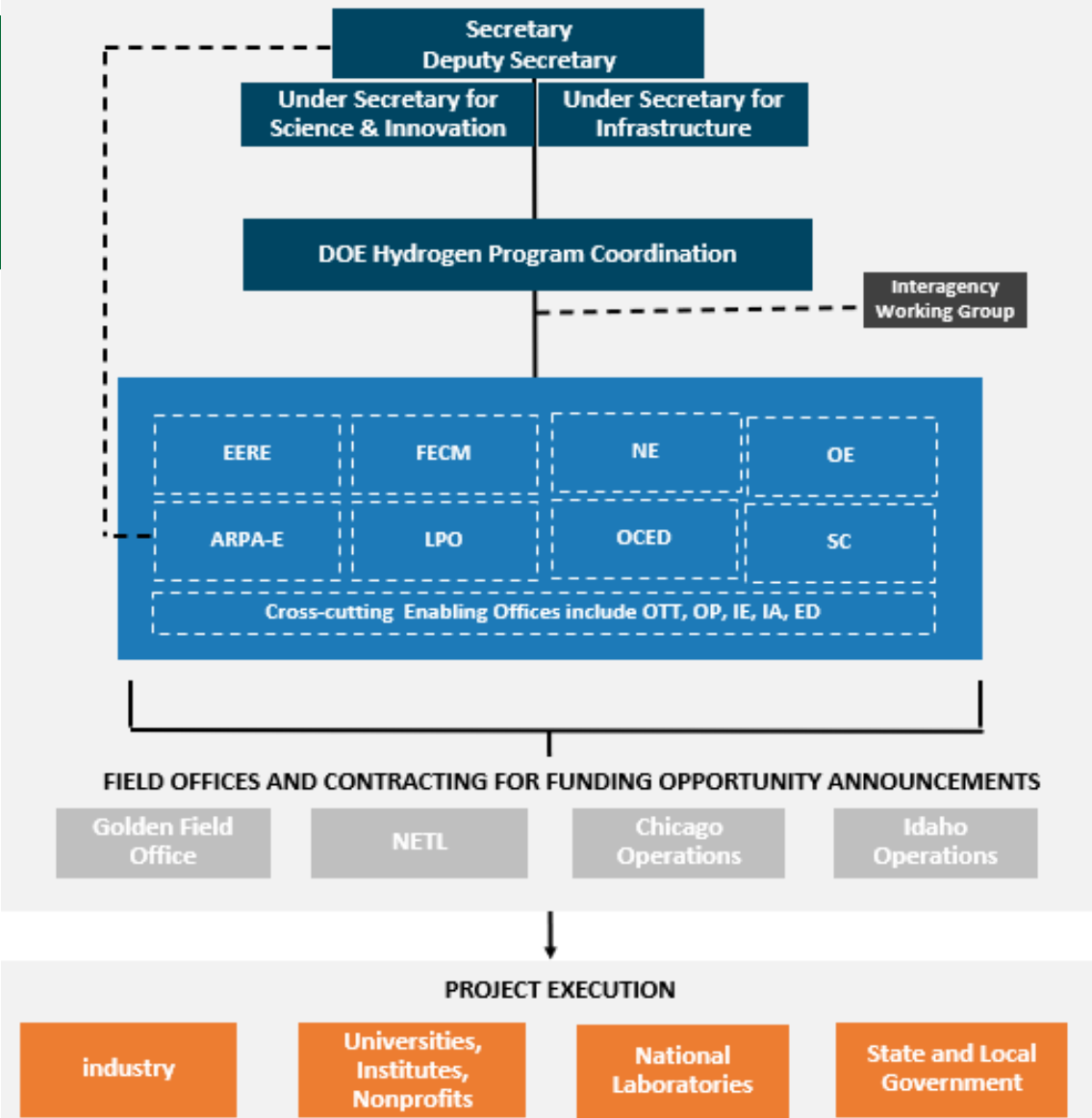
# U.S. DOE Hydrogen Program

Hydrogen is one part of a broad portfolio of activities  
Includes multiple offices and the entire RDD&D value chain from production through end use



[www.hydrogen.energy.gov](http://www.hydrogen.energy.gov)

Includes multiple offices across DOE, led by DOE’s Hydrogen and Fuel Cell Technologies Office

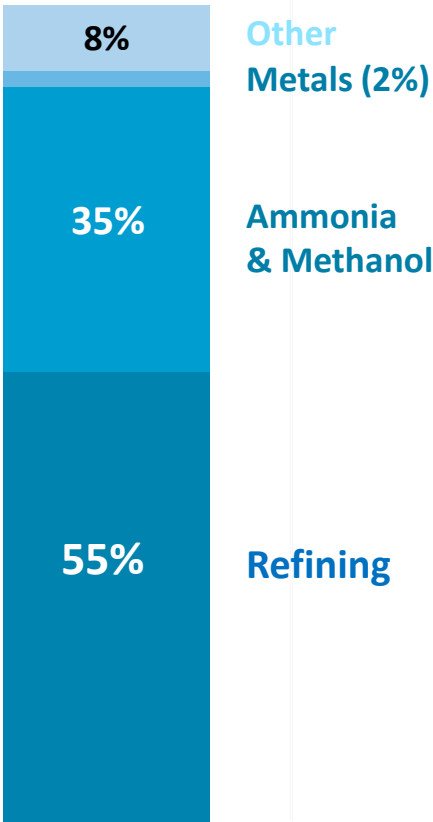




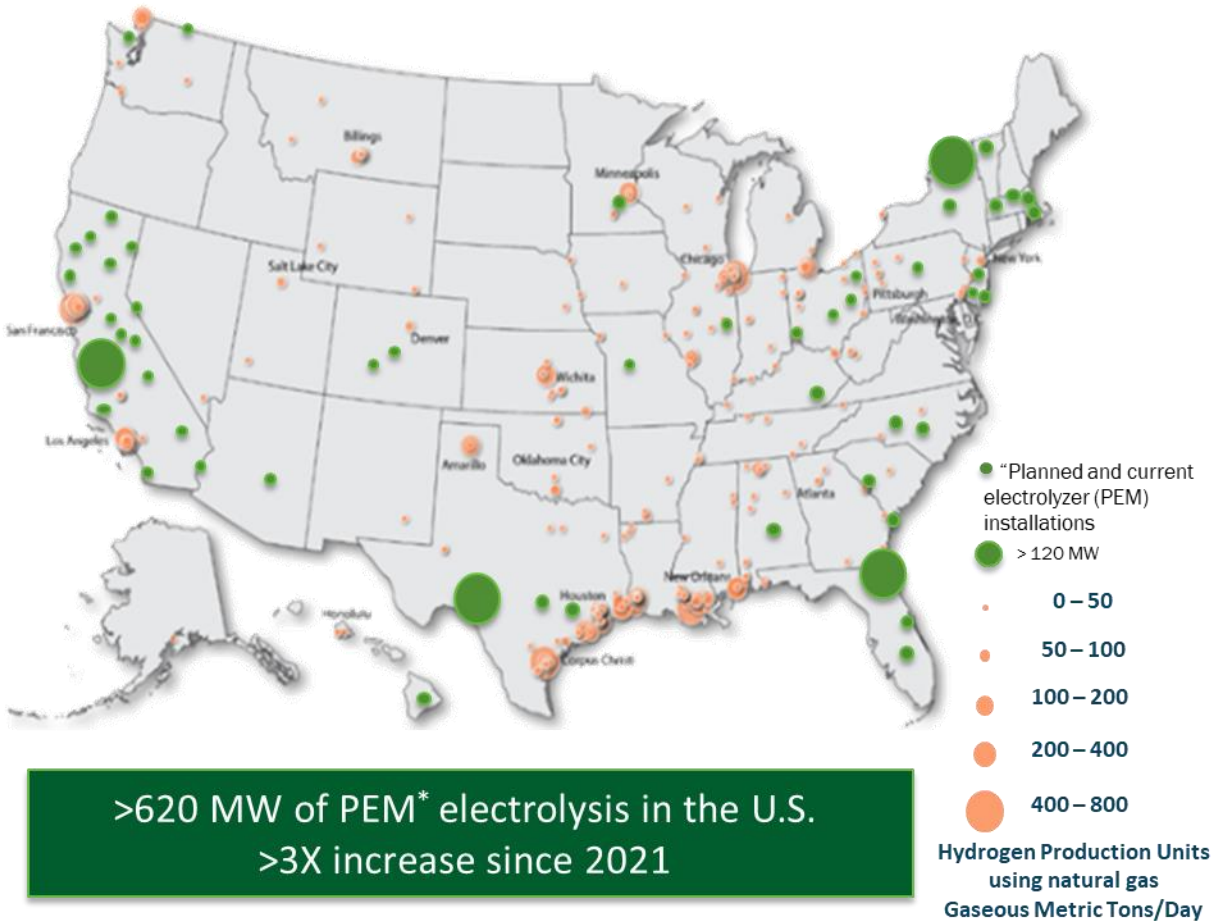
# Snapshot of Hydrogen and Fuel Cells in the U.S.

- 10 million metric tons produced annually
- More than 1,600 miles of H<sub>2</sub> pipeline
- World's largest H<sub>2</sub> storage cavern

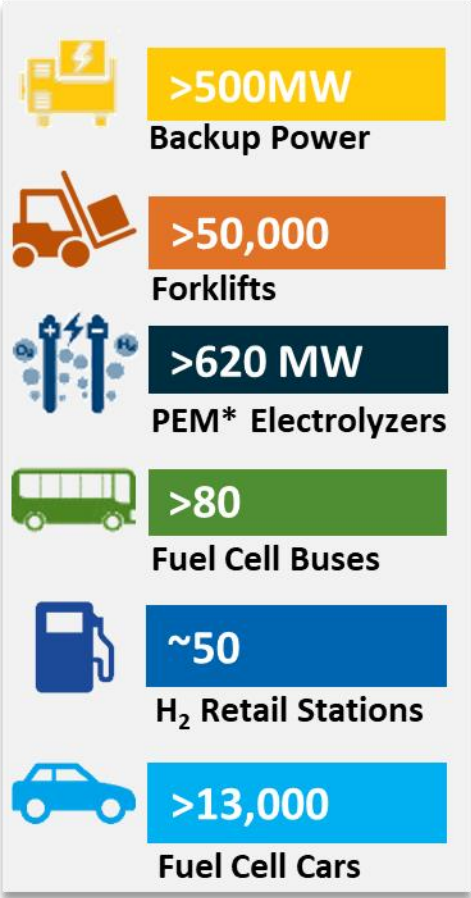
## Use of Hydrogen in the U.S. Today



## Examples of Hydrogen Production Locations

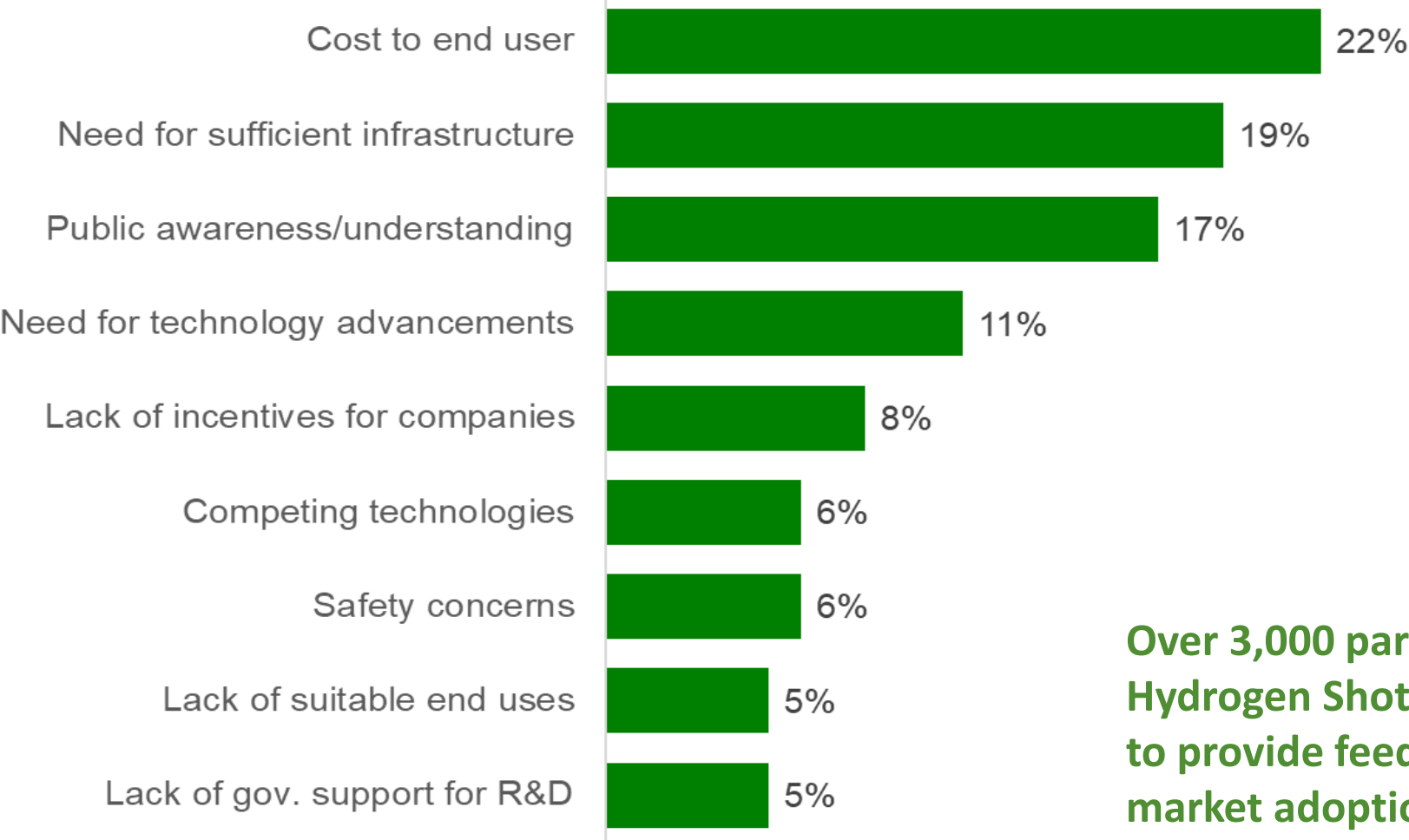


## Examples of Deployments



\*Proton exchange membrane

# There are Still Significant Challenges: Stakeholder Reported Barriers to Hydrogen Market Adoption



Over 3,000 participants at DOE Hydrogen Shot Summit were requested to provide feedback on key barriers to market adoption of hydrogen

Source: Hydrogen Shot Summit, Sept 2021

<https://www.energy.gov/eere/fuelcells/hydrogen-shot-summit>



Hydrogen

## Hydrogen Energy Earthshot

**“Hydrogen Shot”**

**“1 1 1”**

**\$1 for 1 kg clean hydrogen in 1 decade**



# Bipartisan Infrastructure Law and Inflation Reduction Act - Highlights

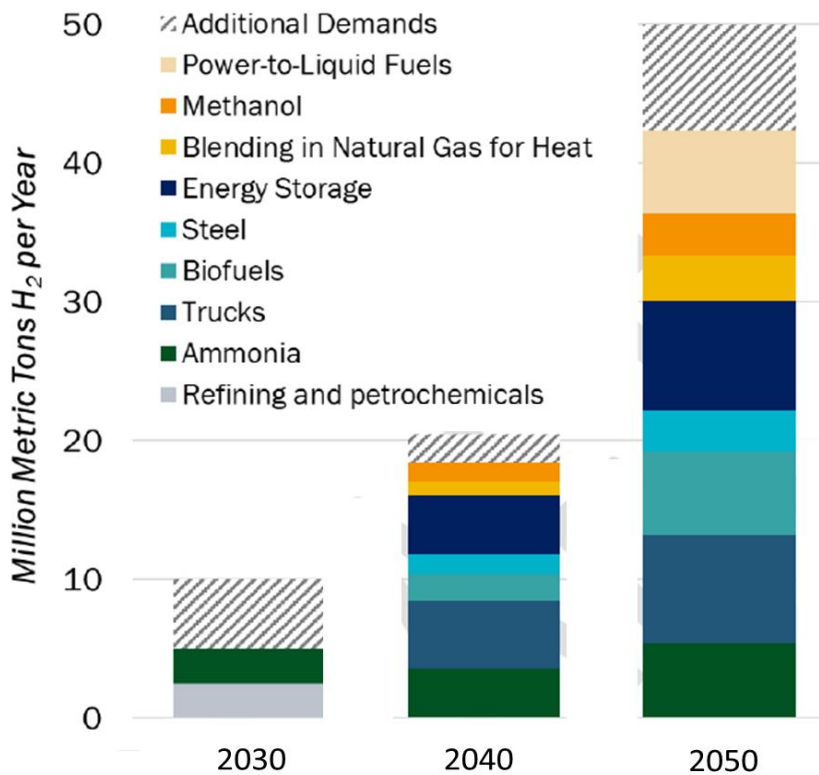
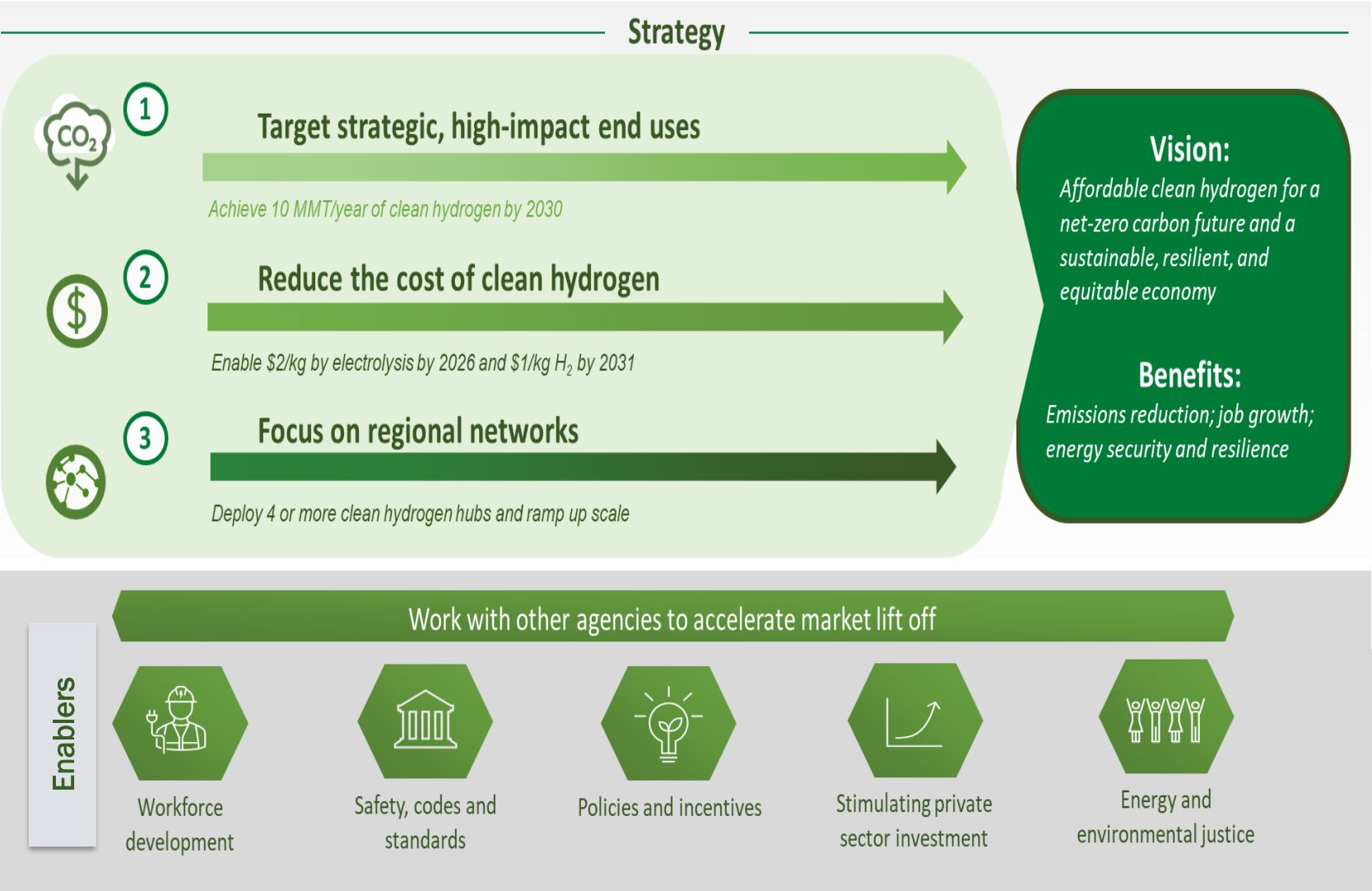
- Includes \$9.5B for clean hydrogen:
  - \$1B for electrolysis RD&D
  - \$0.5B for manufacturing and recycling R&D
  - \$8B for at least four regional clean hydrogen hubs



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

- **Inflation Reduction Act – includes significant tax credits** (max. 4 kg CO<sub>2</sub>/kg H<sub>2</sub> carbon intensity)
- BIL requires developing a National Hydrogen Strategy and Roadmap

# DOE National Clean Hydrogen Strategy and Roadmap



**Opportunity:**

**10 MMT/yr by 2030**

**20 MMT/yr by 2040**

**50 MMT/yr by 2050**

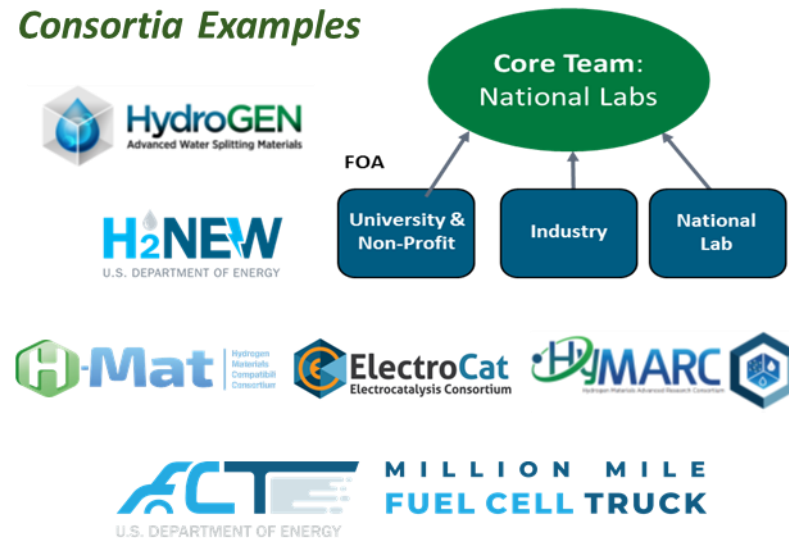


# DOE Hydrogen Activities across RDD&D

## Research and Development

Basic and applied research through individual projects and consortia

### Consortia Examples

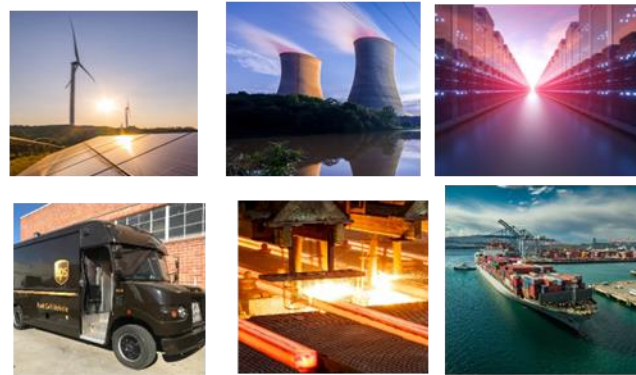


*Basic science user facilities, theory, modeling*

## Technology Integration, Validation, Demos

1<sup>st</sup> of a kind demonstrations and systems integration to de-risk deployments

### Examples:



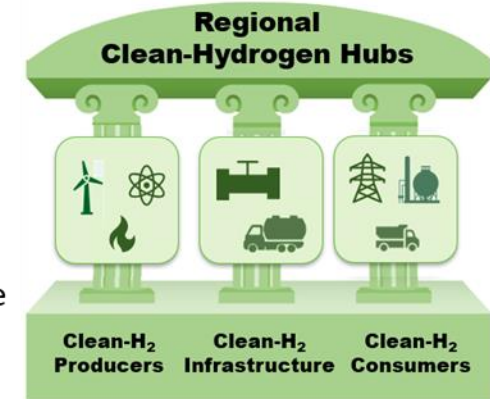
*Renewables and nuclear to H<sub>2</sub>, 15 delivery trucks in disadvantaged area, 3 Super Truck projects, data center, fueling for passenger ferry, energy storage, H<sub>2</sub> for steel*

## Deployment and Financing

H2 Hubs, loan guarantee program, workforce development

### Example:

\$8 billion for at least 4 hubs: Renewables, fossil w/CCS, nuclear; multiple end-uses



*2 new loan guarantee projects (\$1.5B total) on pyrolysis and large-scale electrolysis, H<sub>2</sub> energy storage and power generation*

## Enabling Activities

- Analysis and tools
- Safety, codes & standards
- Manufacturing
- Workforce development



**H<sub>2</sub>EDGE**  
Hydrogen Education for a Decarbonized Global Economy

**CENTER FOR Hydrogen SAFETY**  
Connecting a Global Community

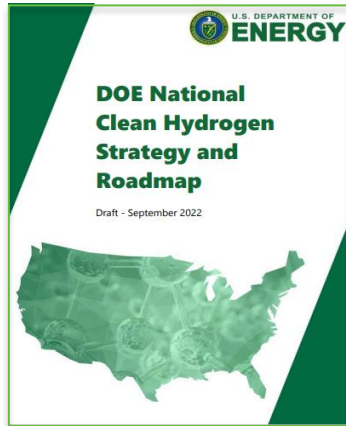
**HyBlend**  
U.S. DEPARTMENT OF ENERGY

**H2 Matchmaker**

# Recent DOE Announcements and BIL Deliverables

## DOE National Clean Hydrogen Strategy and Roadmap

**Draft Document Released**



**Provide feedback by 12/1/22:**  
[hydrogenfuelcells@ee.doe.gov](mailto:hydrogenfuelcells@ee.doe.gov)

## H2 Hubs Funding Opportunity Announcement (FOA)

**FOA Released**

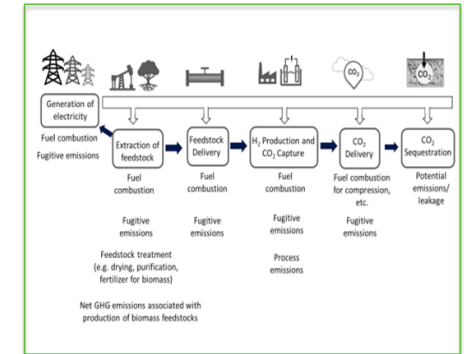
**6 to 10 H2 Hubs for a combined total of \$6B to \$7B**

**Concept papers due 11/7/22**  
**Full applications due 4/7/23**

**Submit any questions:**  
[h2hubs@hq.doe.gov](mailto:h2hubs@hq.doe.gov)

## Clean Hydrogen Production Standard (CHPS)

**Draft Guidance Document Released for Initial Standard**



**Provide feedback by 10/20/22:**  
[Cleanh2standard@ee.doe.gov](mailto:Cleanh2standard@ee.doe.gov)

**Stay Tuned: DOE Life Cycle Emissions Analysis and GREET tool webinars and outreach planned**  
**[www.hydrogen.energy.gov](http://www.hydrogen.energy.gov)**

A top-down view of several hands of different skin tones stacked together in a circle, symbolizing unity and teamwork. The hands are wearing white dress shirt cuffs. The background is dark and slightly blurred.

# **Collaboration & Diversity, Equity, Inclusion**



**“No one can whistle a symphony. It takes a whole orchestra to play it.”**

***- H. Luccock***

# Examples of International Collaborations

## Collaborating through multiple partnerships – prioritization of gaps and key activities underway



Common analytical framework for GHG emissions footprint and facilitating international trade

Regulations, codes, standards, harmonization gap analysis

Hydrogen Infrastructure						Hydrogen for Mobility/Tr	
Hydrogen injection at transmission level	Hydrogen injection at distribution level	Methanol and injection of Methanol (Methanol) via hydrogen at transmission/distribution level	H2 refilling stations (HRS)	Maritime infra		Mobility infra (buses, trucks, underground parking...)	Heavy duty vehicles
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Breakthrough Agenda in collaboration with other partnerships is mapping activities across global H<sub>2</sub> initiatives to identify gaps, focus areas, and prioritized workstreams

Hydrogen Breakthrough Agenda for the Hydrogen Economy									
LEADERSHIP INITIATIVES	Hydrogen for Power Generation	Hydrogen for Industry	Hydrogen for Transport	Hydrogen for Buildings	Hydrogen for Agriculture	Hydrogen for Aviation	Hydrogen for Shipping	Hydrogen for Maritime	Hydrogen for Other
Hydrogen for Power Generation	Hydrogen for Industry	Hydrogen for Transport	Hydrogen for Buildings	Hydrogen for Agriculture	Hydrogen for Aviation	Hydrogen for Shipping	Hydrogen for Maritime	Hydrogen for Other	Hydrogen for Other
Hydrogen for Power Generation	Hydrogen for Industry	Hydrogen for Transport	Hydrogen for Buildings	Hydrogen for Agriculture	Hydrogen for Aviation	Hydrogen for Shipping	Hydrogen for Maritime	Hydrogen for Other	Hydrogen for Other
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[www.iphe.net](http://www.iphe.net)

CEM Global Ports Coalition with EC Numerous Bilaterals on Hydrogen Hydrogen Council, IRENA, G7, UNIDO, and more

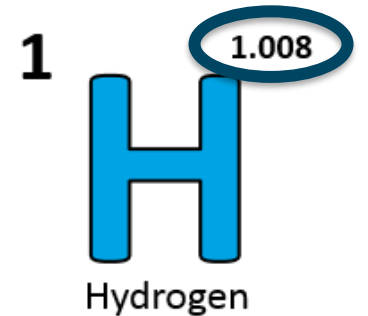
# Resources and Opportunities for Engagement



**Save the date!**  
**2023 DOE Annual  
Merit Review and Peer  
Evaluation Meeting**  
**June 5-8, 2023**

**Hydrogen and Fuel Cells Day  
October 8**

- Held on hydrogen's  
very own atomic  
weight-day



**Join Monthly  
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Connecting a Global Community  
**[www.aiche.org/CHS](http://www.aiche.org/CHS)**



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[www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-newsletter](http://www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-newsletter)

**Learn more at: [energy.gov/eere/fuelcells](http://energy.gov/eere/fuelcells) AND [www.hydrogen.energy.gov](http://www.hydrogen.energy.gov)**



# Thank You

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U.S. Department of Energy

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