

U.S. DOE Hydrogen and Fuel Cell Remarks

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U.S. Department of Energy**

November 2022

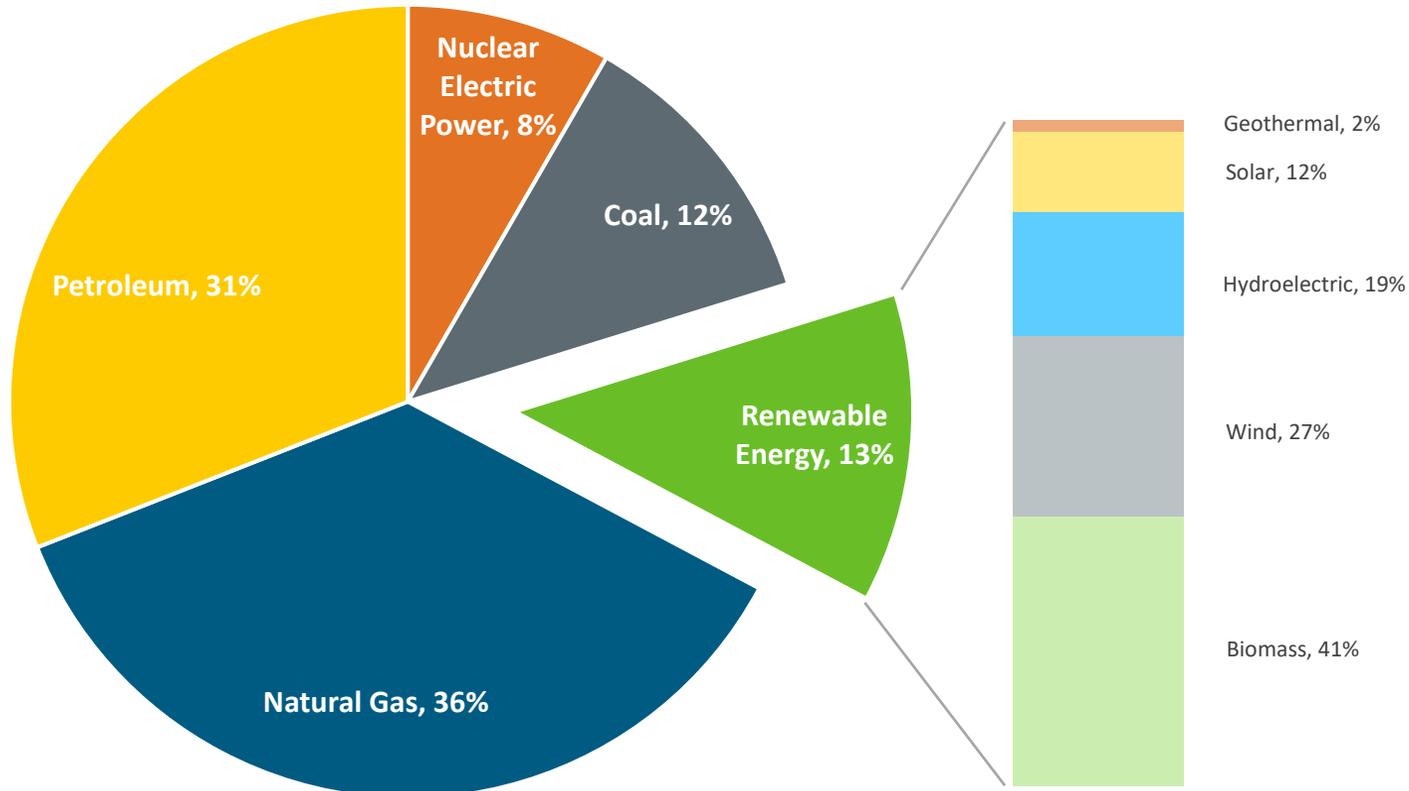


U.S. Energy Landscape and Key Goals

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

Total = 97.8 quadrillion
British thermal units (Btu)

Total = 12.3 quadrillion Btu



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

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, Justice40: 40% of benefits in disadvantaged communities

EJ: Environmental Justice

The U.S. DOE Hydrogen Program

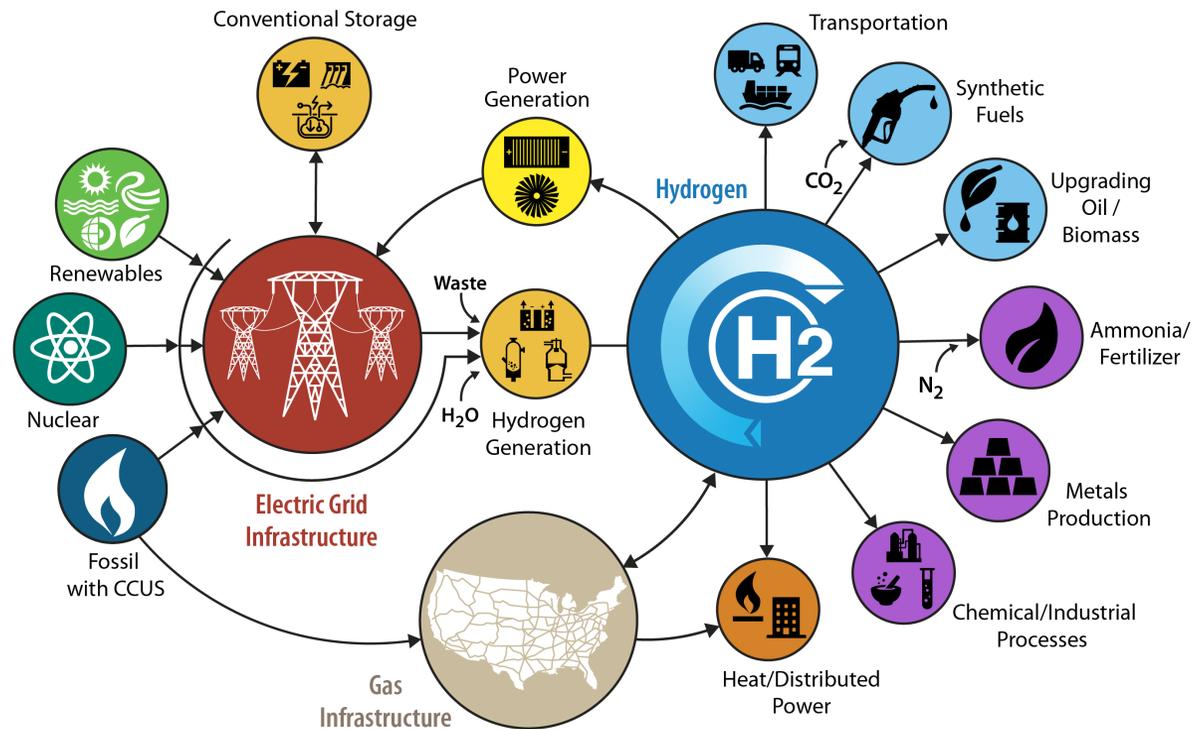
Hydrogen is a key element of a portfolio of solutions to decarbonize the economy.

Hydrogen Program

Coordinated across DOE
Focuses on research,
development, demonstration,
and deployment (RDD&D) to
address:

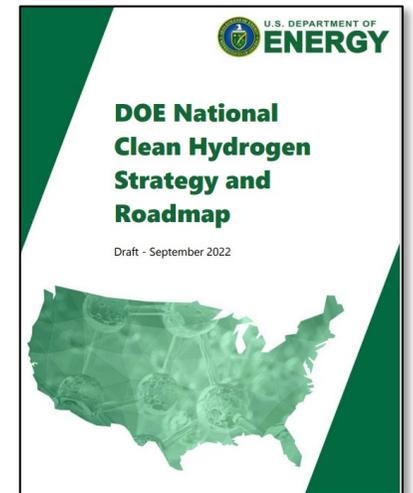
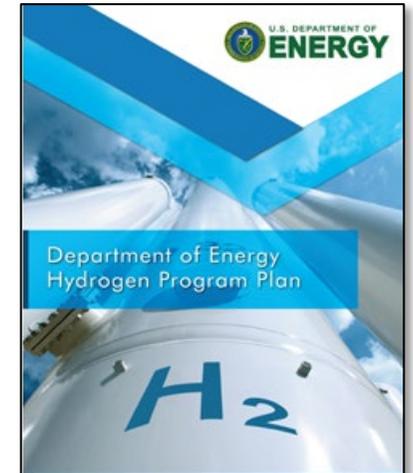
- The entire H₂ value chain from production through end use
- H₂ production from all resources (renewables, nuclear, and fossil + CCS)

H2@Scale provides vision to guide how hydrogen can enable clean-energy pathways across applications and sectors



www.hydrogen.energy.gov

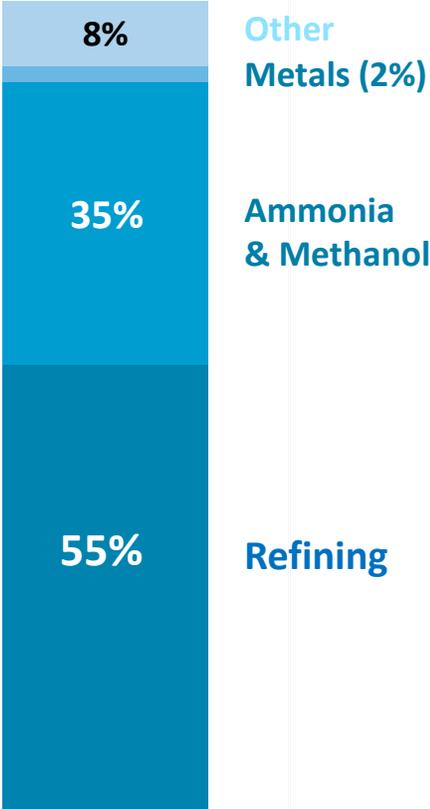
Coordinated across Offices by DOE Hydrogen and Fuel Cell Technologies Office (HFTO)



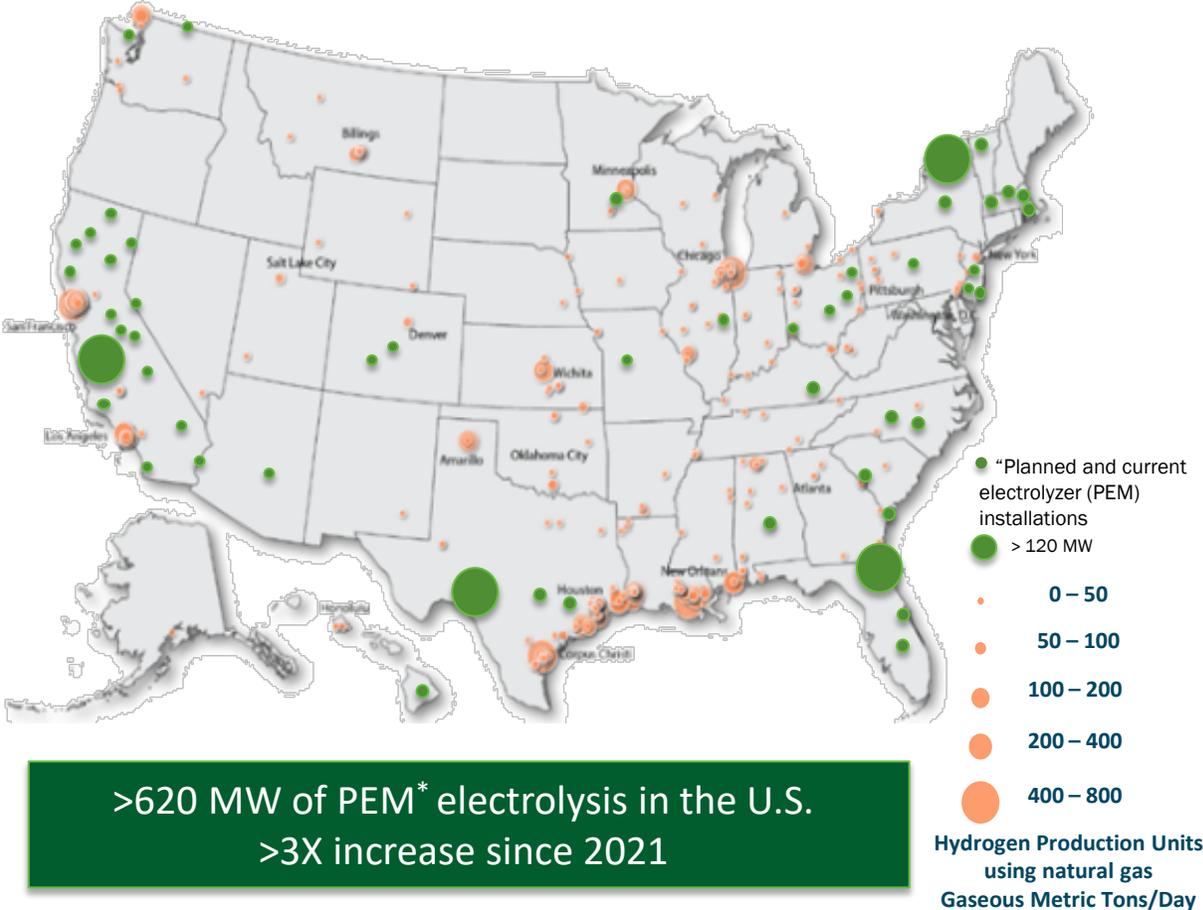
Snapshot of Hydrogen and Fuel Cells in the U.S.

- 10 million metric tons produced annually
- More than 1,600 miles of H₂ pipeline
- World's largest H₂ storage cavern

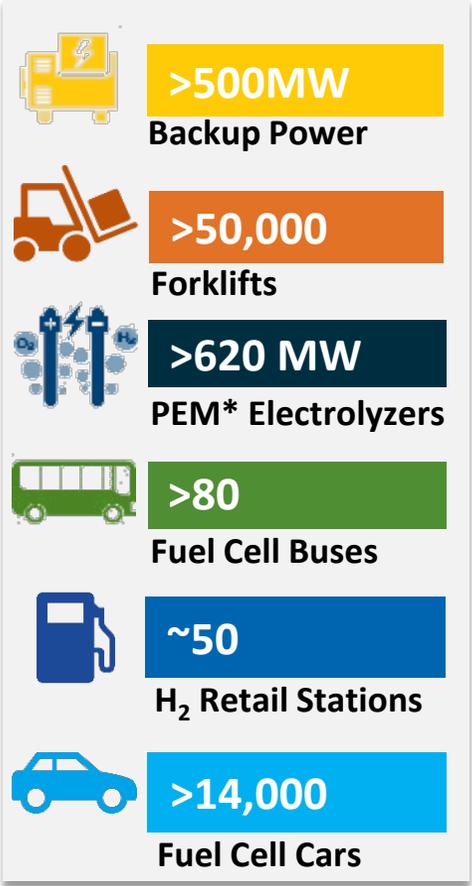
Use of Hydrogen in the U.S. Today



Examples of Hydrogen Production Locations



Examples of Deployments



*Proton exchange membrane

Key Hydrogen Provisions in Recent Legislation

Bipartisan Infrastructure Law

- **Covers \$9.5B** for clean hydrogen:
 - \$1B for electrolysis RD&D
 - \$500M for manufacturing and recycling R&D
 - \$8B for at least four regional clean hydrogen hubs
- **Requires developing a National Clean Hydrogen Strategy and Roadmap**



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

Inflation Reduction Act

- **Includes production tax credit** for clean Hydrogen

DOE National Clean Hydrogen Strategy and Roadmap

Strategy

- 
1

Target strategic, high-impact end uses

Achieve 10 MMT/year of clean hydrogen by 2030
- 
2

Reduce the cost of clean hydrogen

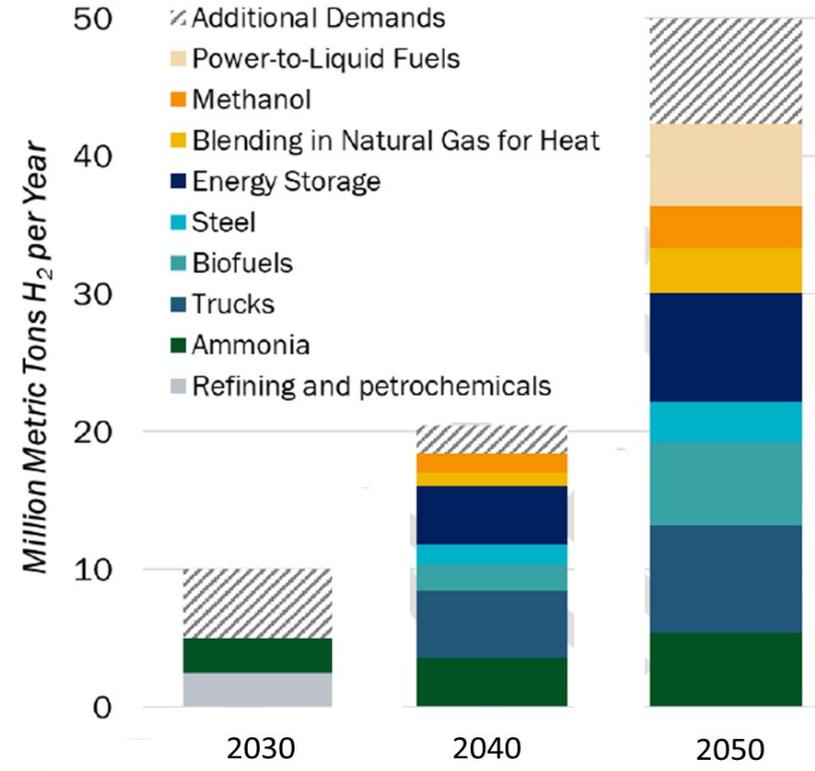
Enable \$2/kg by electrolysis by 2026 and \$1/kg H₂ by 2031
- 
3

Focus on regional networks

Deploy 4 or more clean hydrogen hubs and ramp up scale

Vision:
Affordable clean hydrogen for a net-zero carbon future and a sustainable, resilient, and equitable economy

Benefits:
Emissions reduction; job growth; energy security and resilience



Opportunity:
10MMT/yr by 2030
20 MMT/yr by 2040
50 MMT/yr by 2050

Work with other agencies to accelerate market lift off

- Enablers**
-  Workforce development
 -  Safety, codes and standards
 -  Policies and incentives
 -  Stimulating private sector investment
 -  Energy and environmental justice



ENERGY
earthshots
U.S. DEPARTMENT OF ENERGY

Hydrogen

Hydrogen Energy Earthshot

“Hydrogen Shot”

“1 1 1”

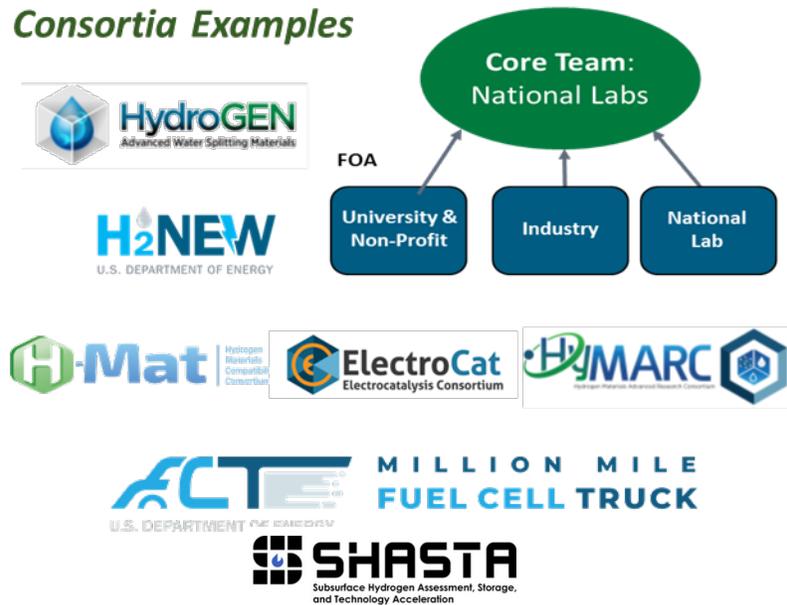
**\$1 for 1 kg clean hydrogen in 1
decade**

DOE Hydrogen Activities across RDD&D – Examples

Research and Development

Basic and applied research through individual projects and consortia

Consortia Examples

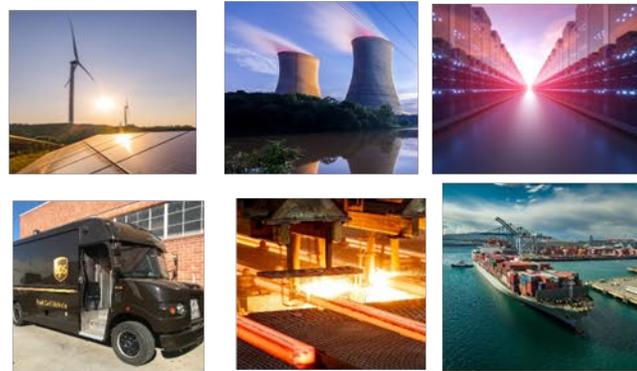


Basic science user facilities, theory, modeling

Technology Integration, Validation, Demos

1st of a kind demonstrations and systems integration to de-risk deployments

Examples:



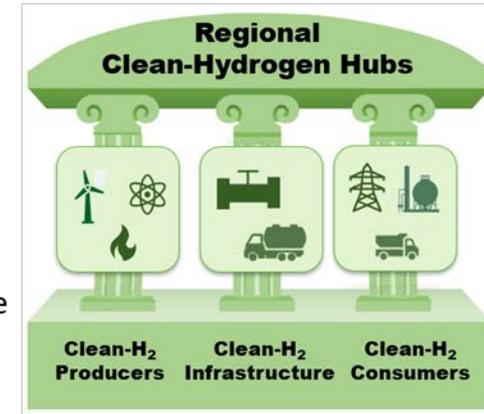
Renewables and nuclear to H₂, 15 delivery trucks in disadvantaged area, 3 Super Truck projects, data center, fueling for passenger ferry, energy storage, H₂ for steel

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, H₂ energy storage and power generation

Enabling Activities

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



H2 Matchmaker

Diversity, Equity, Inclusion, and Accessibility (DEIA)

Funding for DEIA Activities

Guidance for Community Benefits Plan for H2Hubs Funding:

- Community and Labor Engagement
- Investing in the American Workforce
- Diversity, Equity, Inclusion, and Accessibility (DEIA)
- Justice40 Initiative

Hydrogen and Fuel Cell Technologies Office

DOE Announces \$1.5 Million to Train the Next-Generation Hydrogen Workforce

NOVEMBER 10, 2022

DEIA Outreach During Hydrogen and Fuel Cell Week

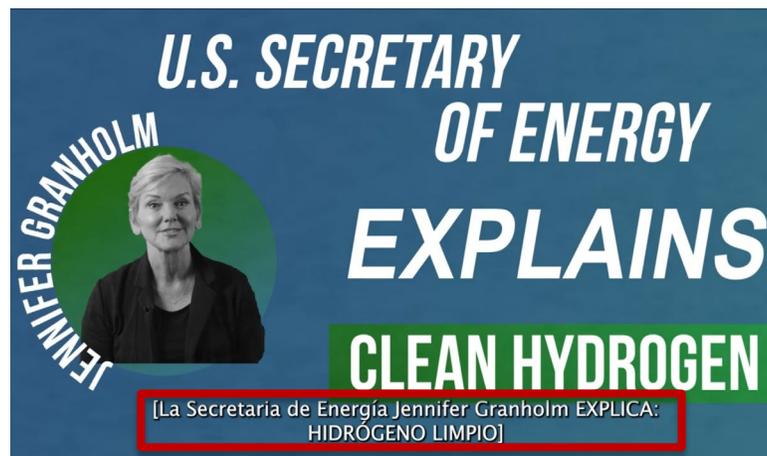
Hydrogen and Fuel Cell Technologies Office

Five Ways HFTO and the Hydrogen Program are Incorporating Environmental Justice and Diversity, Equity, Inclusion, and Accessibility

OCTOBER 7, 2022

Resources and hashtags in Spanish:

#DíaNacionaldelHidrógeno
#CeldasdeCombustible
#Hidrógeno



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

Recently Released!
IPHE Working Paper on Methodology for Determining the Greenhouse Gas Emissions Associated with the Production of Hydrogen
<https://www.iphe.net/iphe-wp-methodology-doc-nov-2022>



Breakthrough Agenda in collaboration with other partnerships is mapping activities across global H₂ initiatives to identify gaps, focus areas, and prioritized workstreams

LEADER CONTRIBUTOR	Participating in the Glasgow Breakthroughs	Involved in the Glasgow Breakthroughs	IPHE Hydrogen Hub					
U.S. Department of Energy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
European Union	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Japan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
South Korea	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
China	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
India	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UAE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other countries	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

H2 Twin Cities 2022 Winners Announced!



H2 Twin Cities 2022 Winners Announced

Connecting Communities Around the World to Deploy Clean Hydrogen Solutions



H2 – TRANS – PACIFIC Team

Mentor-Mentee Cities

Lancaster, CA (US), County of Hawaii, HI (US),
and Namie Town (Japan)



Hydrogen is Here! Team

Sibling Cities

Aberdeen (UK) and Kobe (Japan)



- **Announced at COP27 on Nov 16** by US DOE Sec. Granholm in collaboration **with UK, Japan and CEM H2I**

- H2 Twin Cities 2023: To be **launched early 2023** and to focus on **Mentor-Mentee partnerships**

Learn more about the winners: www.energy.gov/eere/h2twincities/h2-twin-cities-2022-winners

IPHE Early Career Network



Calling all hydrogen-enthusiast **STUDENTS**
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230+ members from
37 countries

www.iphe.net/early-career-chapter



2022-2023 Leadership Team

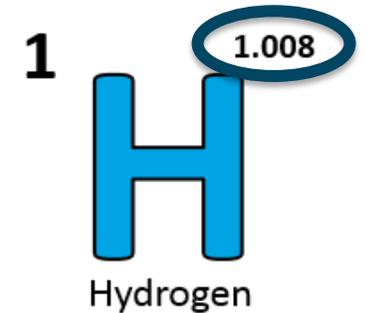
Resources and Opportunities for Engagement



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



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<https://h2tools.org/>



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www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-newsletter

Learn more at: energy.gov/eere/fuelcells AND www.hydrogen.energy.gov

Thank You

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www.energy.gov/fuelcells
www.hydrogen.energy.gov

Handoff from Current Chair and Vice-Chairs for New Term



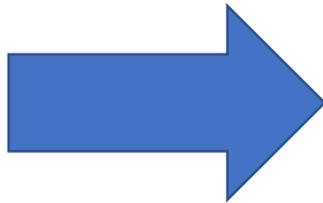
Chair
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Vice-Chair
Gaurav Shukla (India)



Vice-Chair
Kendall Parker (USA)



Chair: Gaurav Shukla (India)



Vice-Chair
Sookyung Kang
(France/Korea)



Vice-Chair
Tomas Green
(USA)



Vice-Chair
Manan Prathak
(India)