U.S. DEPARTMENT OF ENERGY

The U.S. National Clean Hydrogen Strategy

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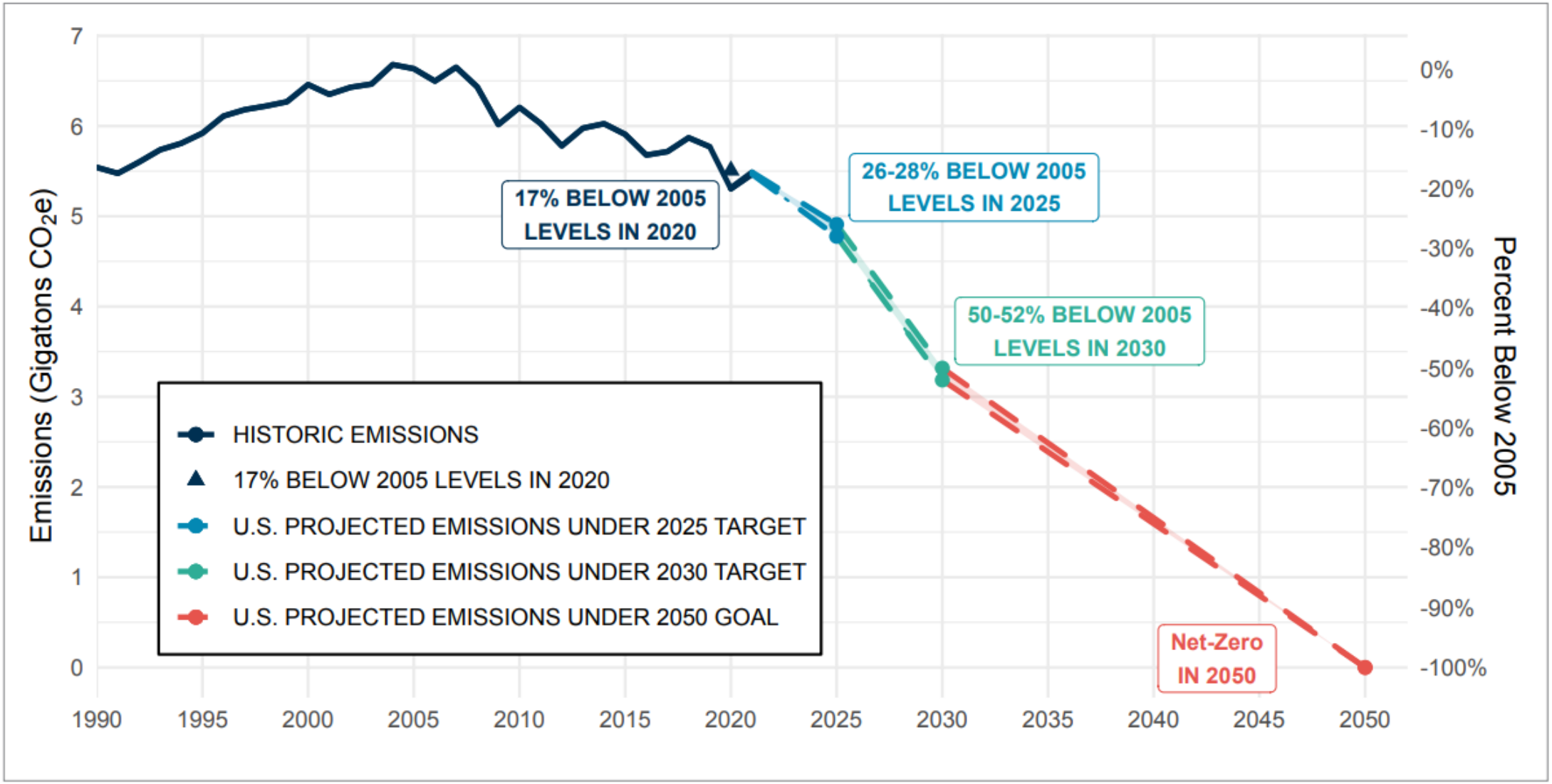
National Renewable Energy Laboratory

NASEO Clean Hydrogen Workshop
January 17, 2024

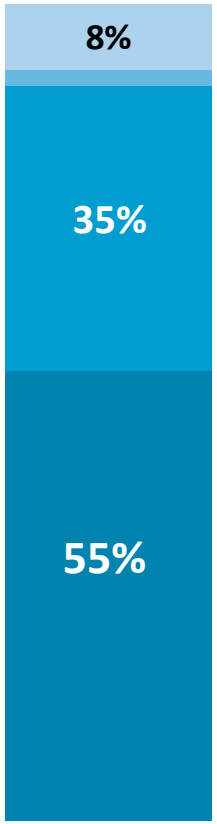
U.S. Decarbonization Goals and Targets vs. Historic Emissions



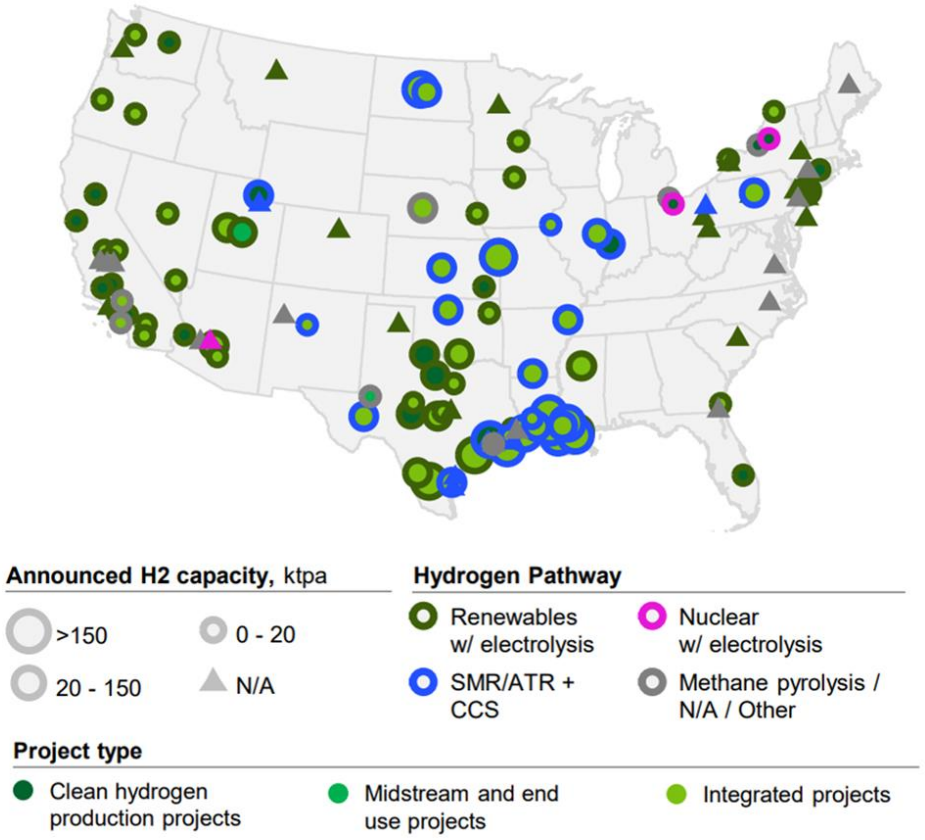
Snapshot of Hydrogen and Fuel Cells in the U.S.

- 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



Current publicly announced clean hydrogen production projects*



*as of EOY 2022, DOE Commercial Liftoff Report

Examples of Deployments

- >500 MW — Backup Power
- >60,000 — Forklifts
- >3.7 GW — Electrolyzers
- ~80 – 150 — Fuel Cell Buses
- ~50 — H_2 Retail Stations
- >16,000 — Fuel Cell Cars

Legislation Highlights: BIL and IRA

Bipartisan Infrastructure Law

- **Includes $9.5B for clean hydrogen**:
  - $1B for electrolysis
  - $0.5B for manufacturing and recycling
  - $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 into law on November 15, 2021. Photo Credit: Kenny Holston/Getty Images

Inflation Reduction Act

- **Includes significant tax credits** (e.g., up to $3/kg for production of clean hydrogen)

U.S. National Clean Hydrogen Strategy

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 H_2 by 2031
3. **Focus on regional networks**
   Deploy regional 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

Enablers

Work with other agencies to accelerate market lift off

- Good Jobs and Workforce Development
- Safety, codes and standards
- Policies and incentives
- Stimulating private sector investment
- Energy and environmental justice

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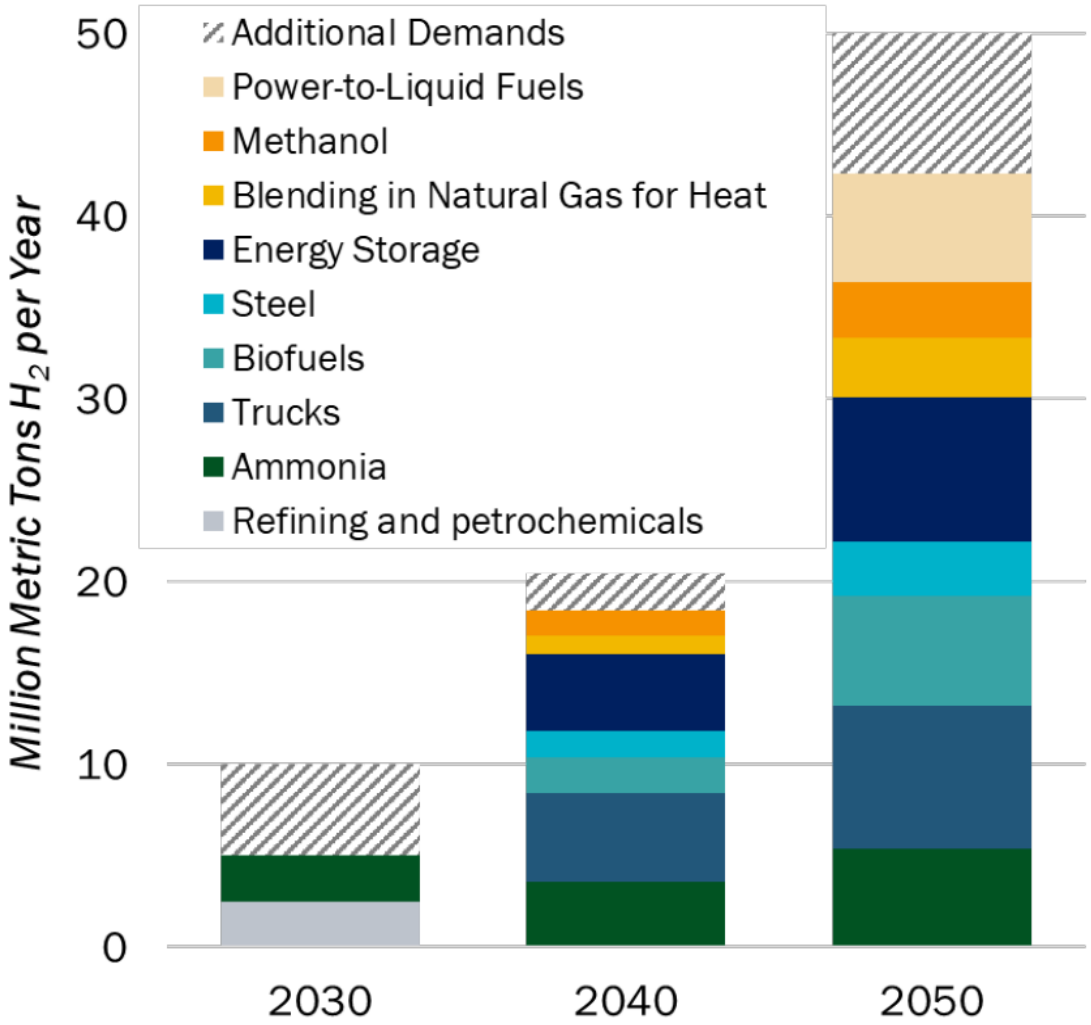
Strategy 1: Target High-Impact Uses of Hydrogen

Opportunities for Clean Hydrogen Across Applications



Clean Hydrogen Use Scenarios

- Catalyze clean H_2 use in existing industries (ammonia, refineries), initiate new use (e.g., sustainable aviation fuels (SAFs), steel, potential exports)
- Scale up for heavy-duty transport, industry, and energy storage
- Market expansion across sectors for strategic, high-impact uses

U.S. Opportunity: 10MMT/yr by 2030, 20 MMT/yr by 2040, 50 MMT/yr by 2050
~10% Emissions Reduction.
~100K Jobs by 2030

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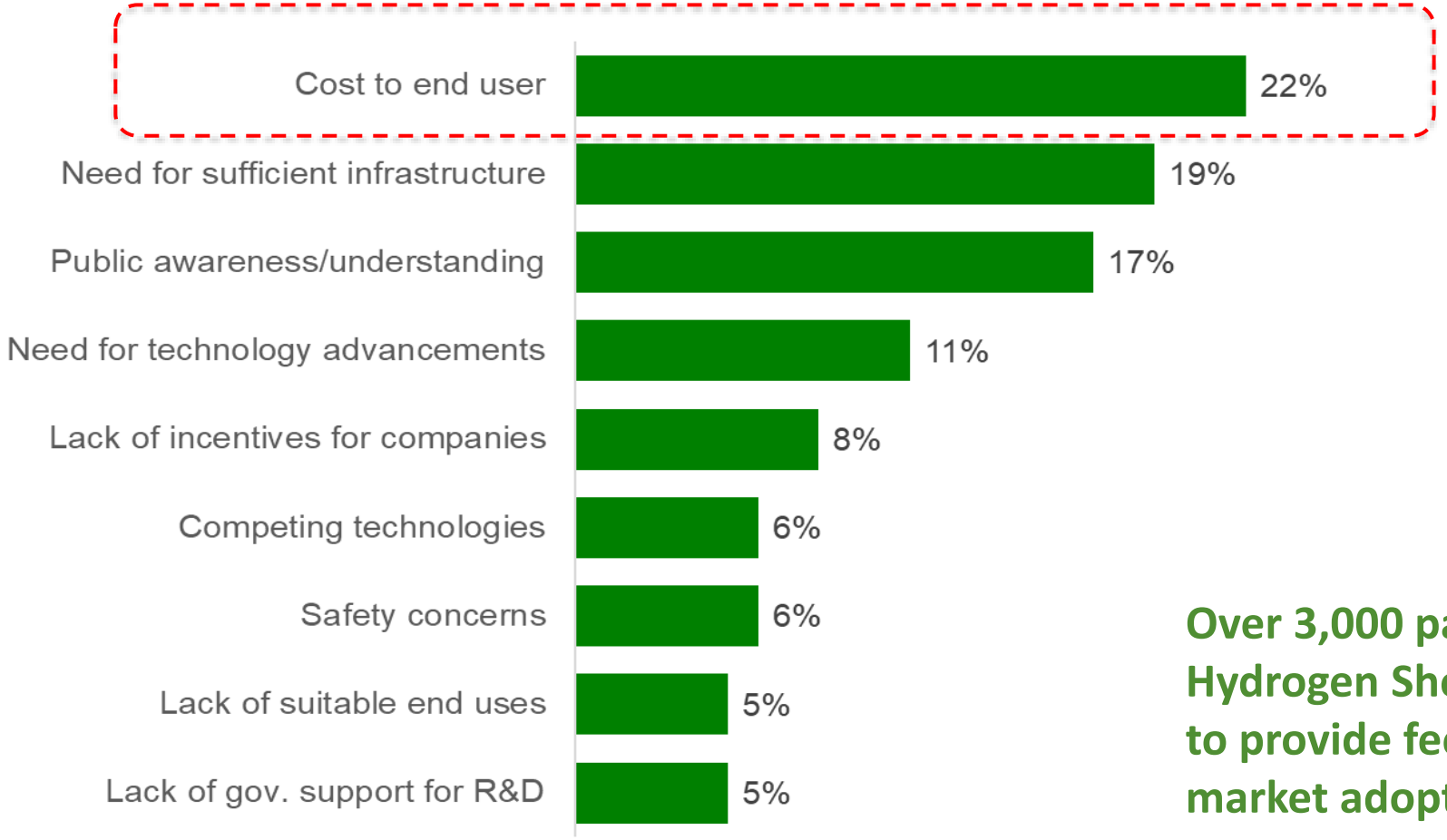
Strategy 2: Focus on Cost-Reduction

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

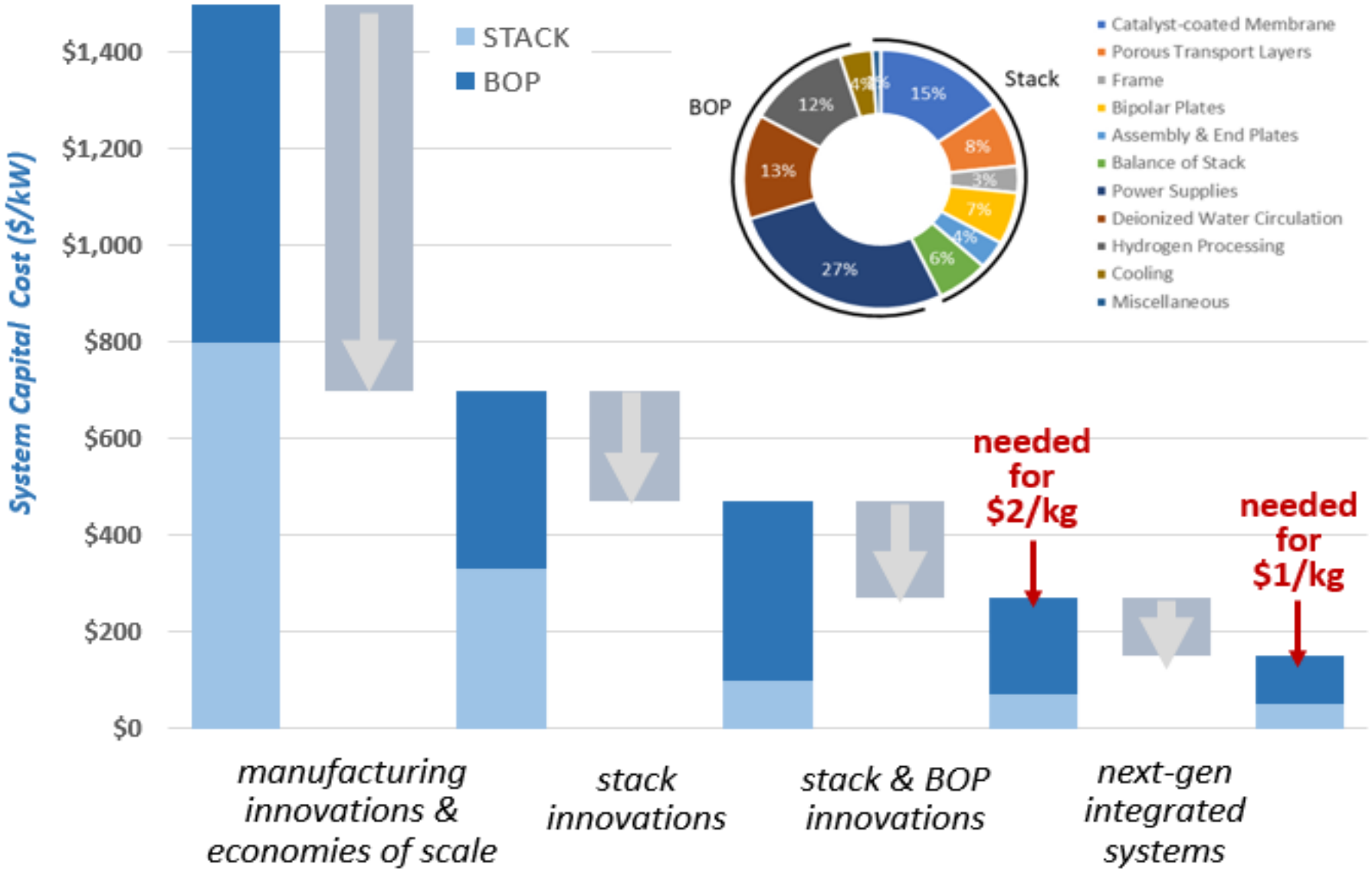
Hydrogen Energy Earthshot

“Hydrogen Shot”

“1 1 1”
$1 for 1 kg clean hydrogen in 1 decade

Launched June 7, 2021

How to reduce cost? Examples across multiple pathways



Analysis shows pathways to reduce cost require <u>both</u> manufacturing scale-up and continued R&D

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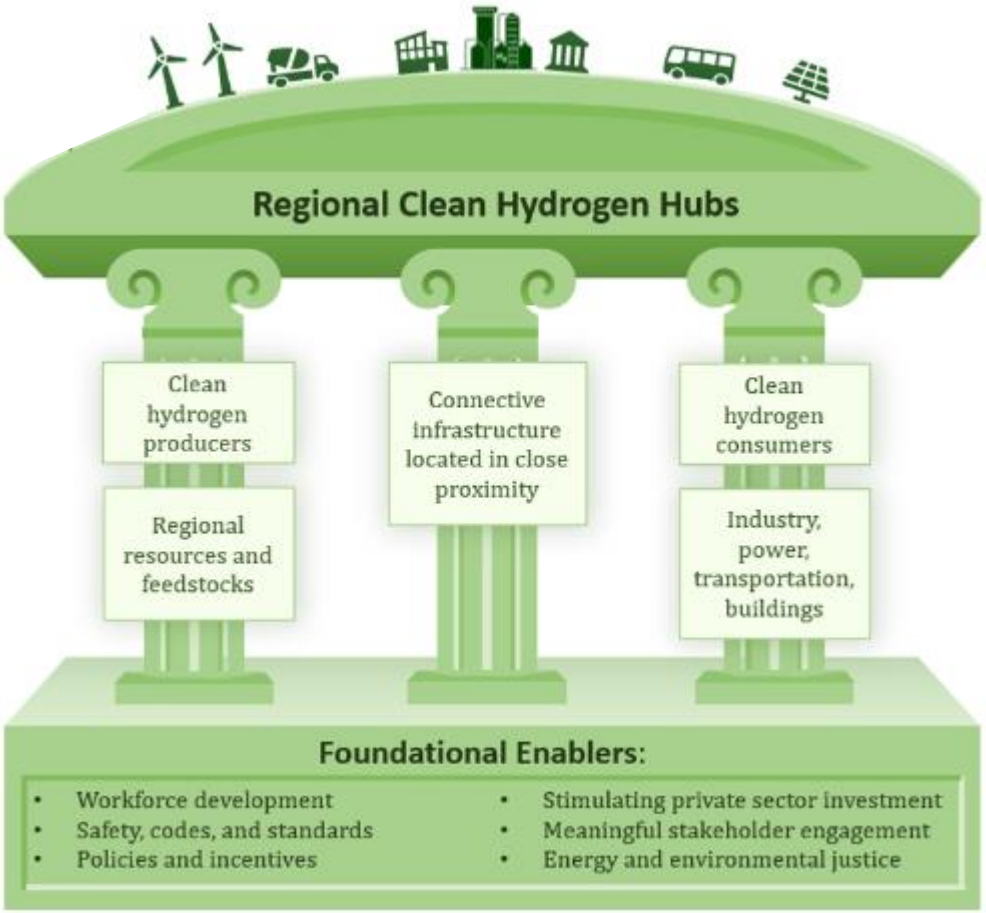
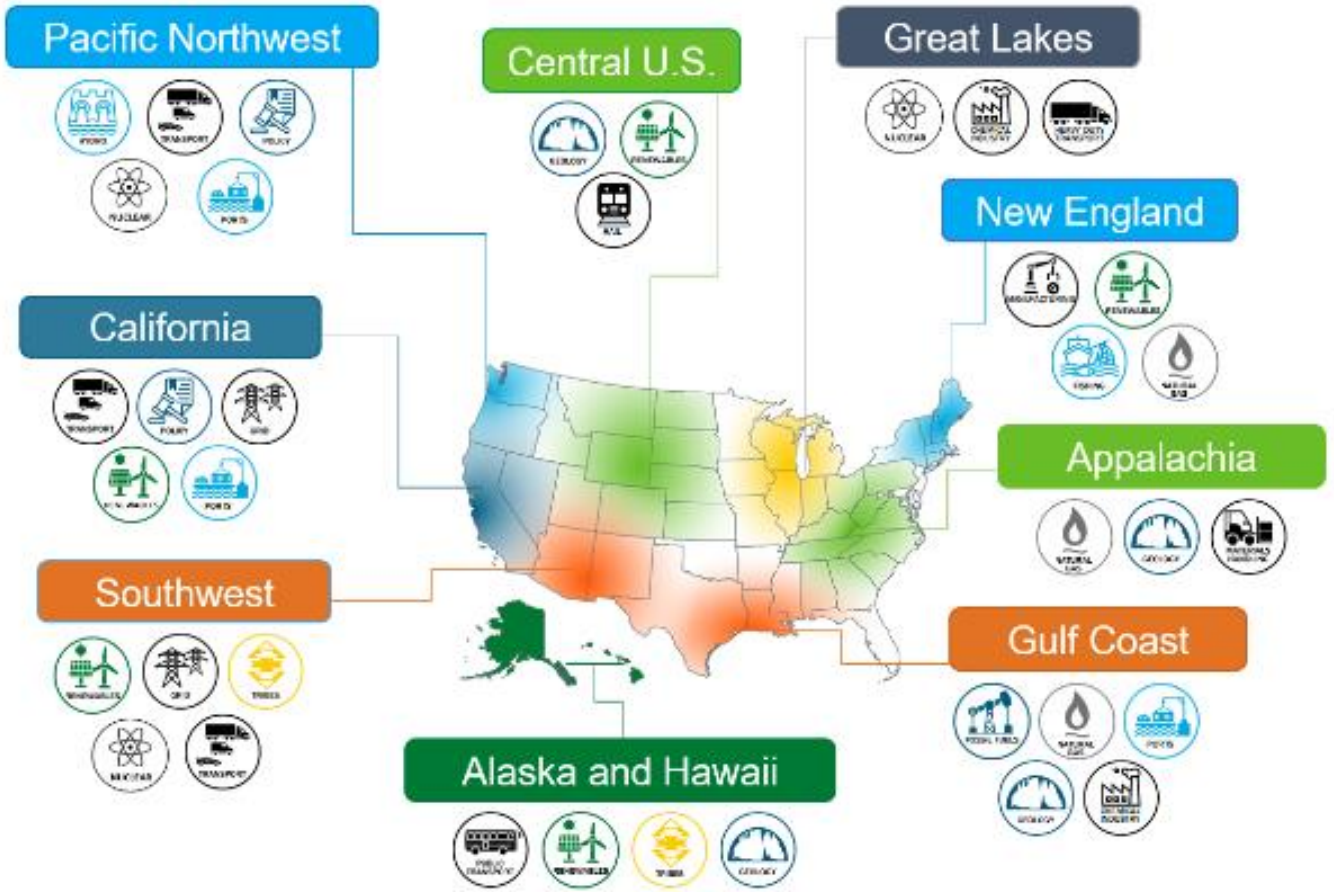
Strategy 3: Focus on Regional Networks and Ramp up Scale

Build Regional Networks through "Clean Hydrogen Hubs"



Examples of Stakeholder and RFI Input



Seven Regional Clean Hydrogen Hubs Selected

Bipartisan Infrastructure Law Clean H_2 Hubs Leveraging:

- Natural gas resources with carbon management;
- Renewable and nuclear power generation coupled with electrolysis
- Other regional resources supporting H_2 production, distribution, and end use

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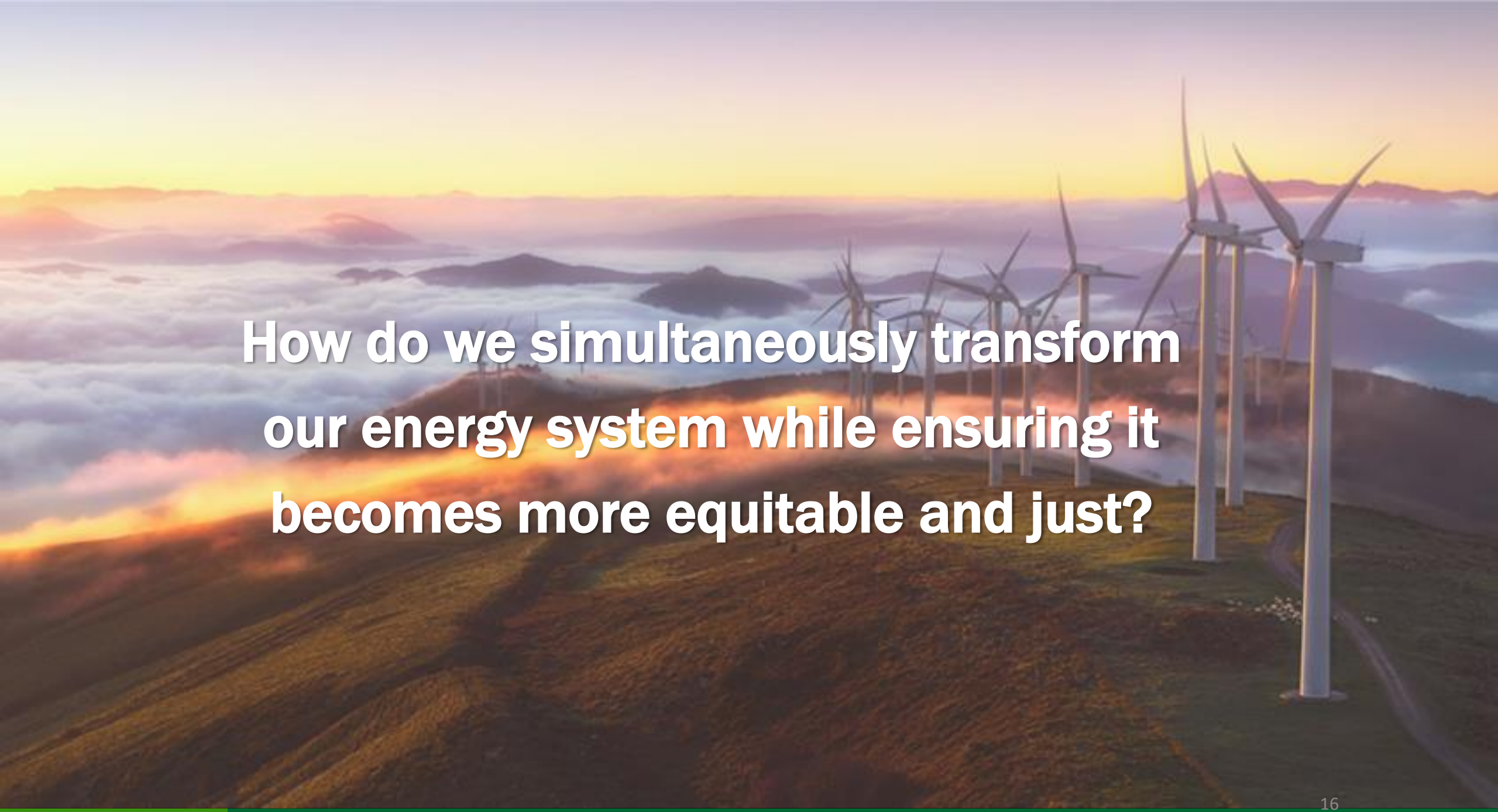

How do we simultaneously transform our energy system while ensuring it becomes more equitable and just?

Equity and Environmental Justice in the Hydrogen Office

Strategy

I. Listening, Engaging & Increasing Transparency

II. Prioritizing Safety and Positive Impacts

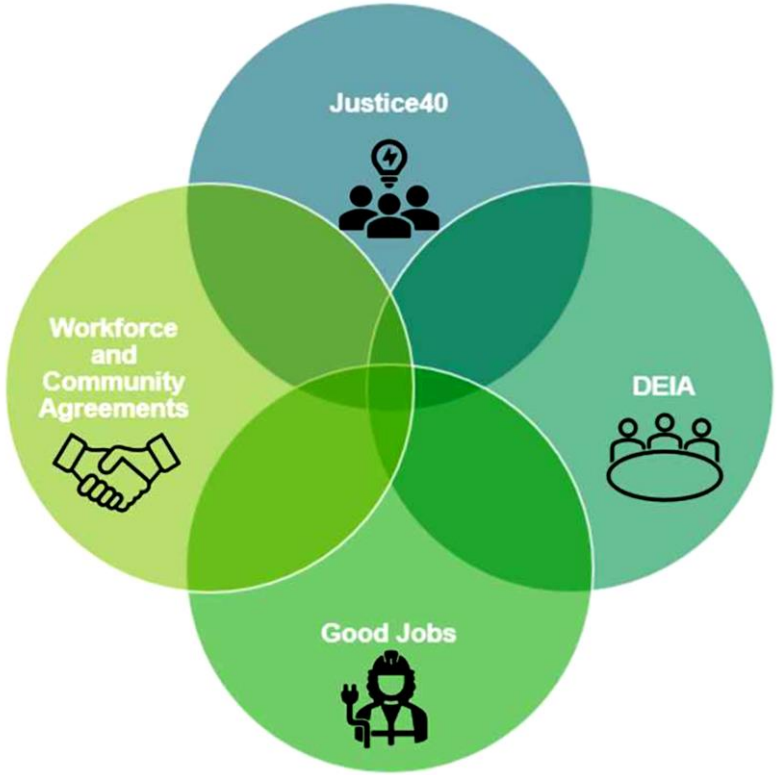
III. Lowering Barriers

IV. Diversifying the Clean Hydrogen Workforce

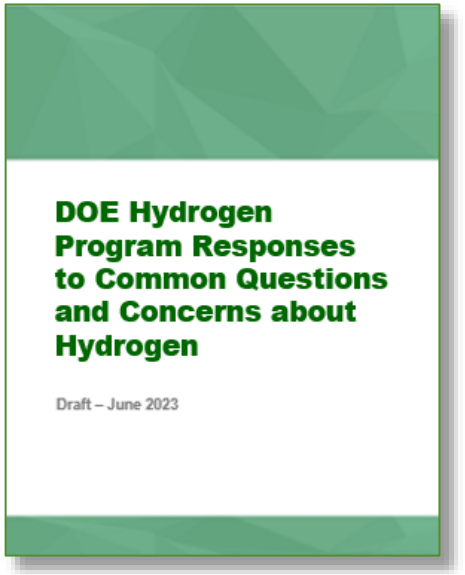
V. Building Capacity & Skills

VI. Environmental Justice in Permitting and Siting

Community Benefit Plans

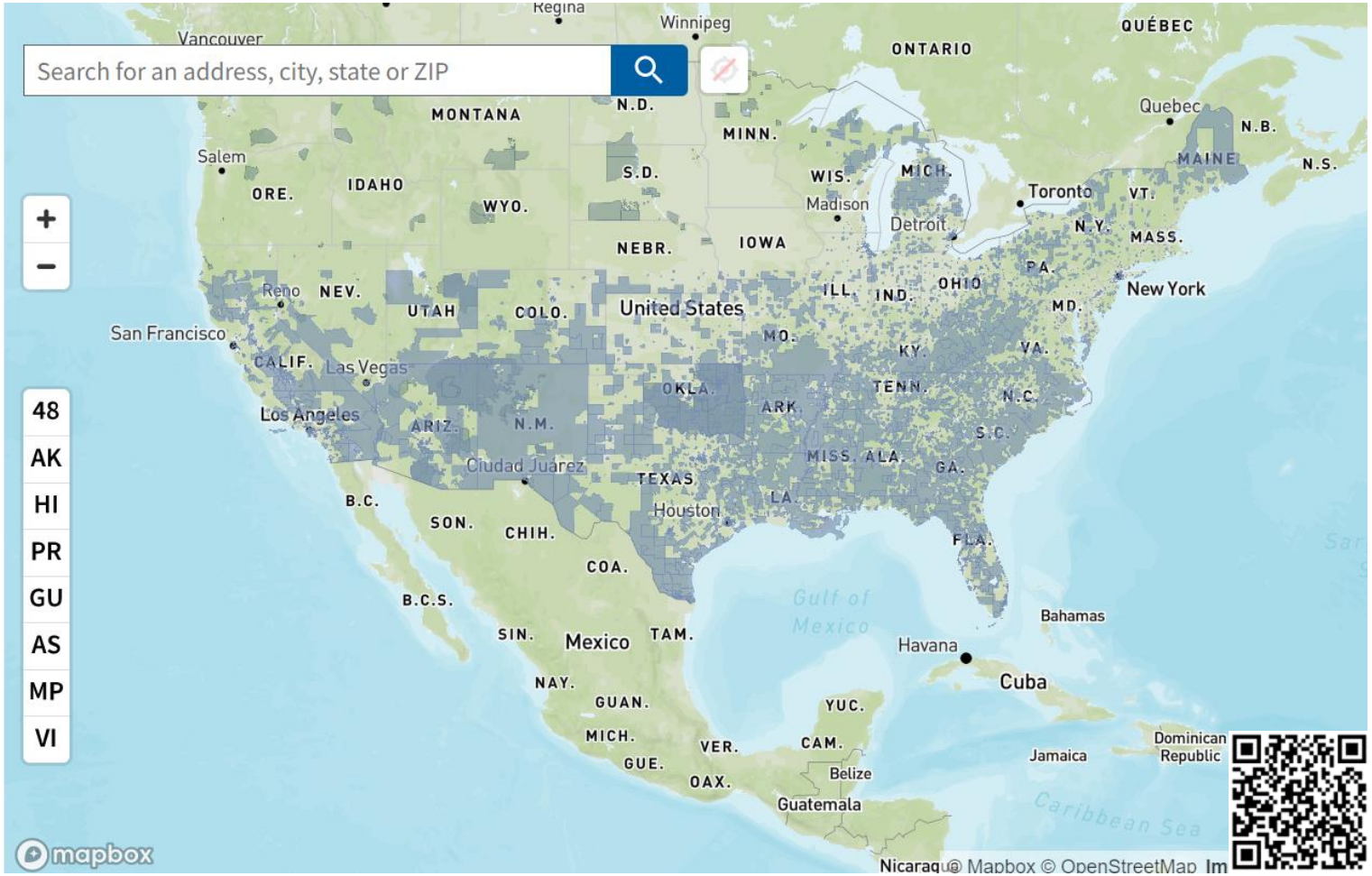


Resources



Justice 40 & Disadvantaged Communities

Distribution of census tracts identified as DACs



Explore the map - Climate & Economic Justice Screening Tool (geoplatform.gov)

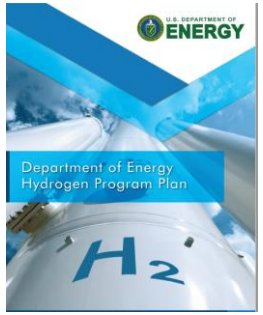
INDICATORS:

- CLIMATE CHANGE
- ENERGY
- WATER & WASTERWATER
- HEALTH
- HOUSING
- TRANSPORTATION
- LEGACY POLLUTION
- WORKFORCE DEVELOPMENT

Census tracts that are overburdened and underserved are highlighted as being **disadvantaged** on the map. Federally Recognized Tribes, including Alaska Native Villages, are also considered disadvantaged communities.

Resources and Opportunities for Engagement

Key Publications



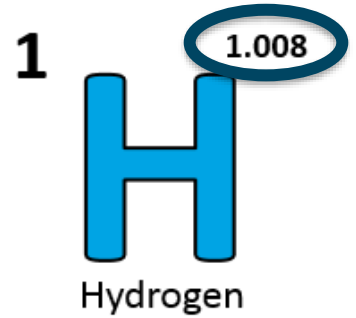
www.hydrogen.energy.gov

Save the date!

2024 DOE Annual Merit Review May 6-9, 2024

Hydrogen and Fuel Cells Day October 8

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



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Thank you

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