



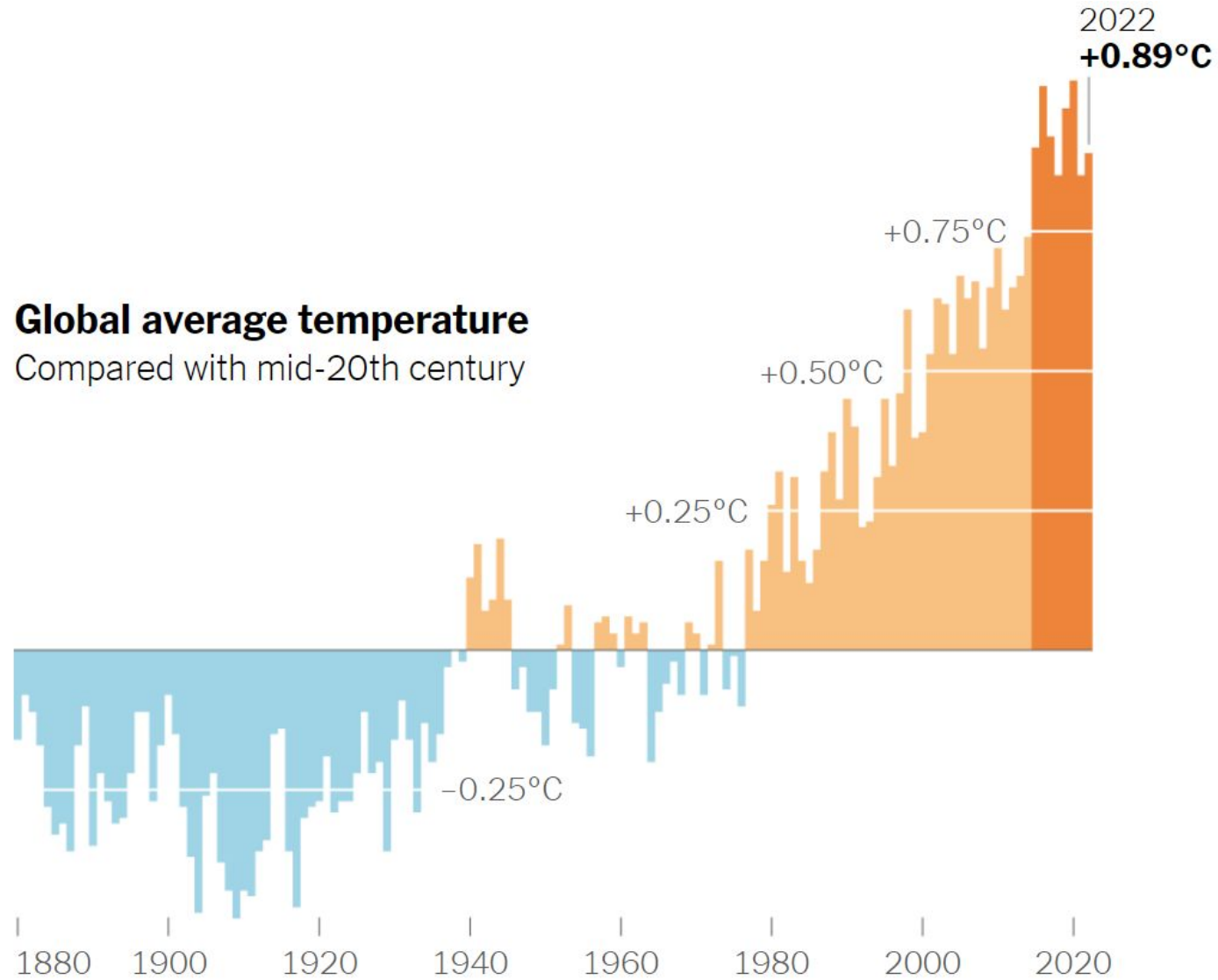
U.S. DEPARTMENT OF
ENERGY

Innovation and Inclusion in DOE's Hydrogen Program

**Dr. Sunita Satyapal, Director, Hydrogen and Fuel Cell Technologies Office
and DOE Hydrogen Program Coordinator**
U.S. Department of Energy
ASES Conference Plenary, Boulder, CO
August 10, 2023



The Global Challenge....

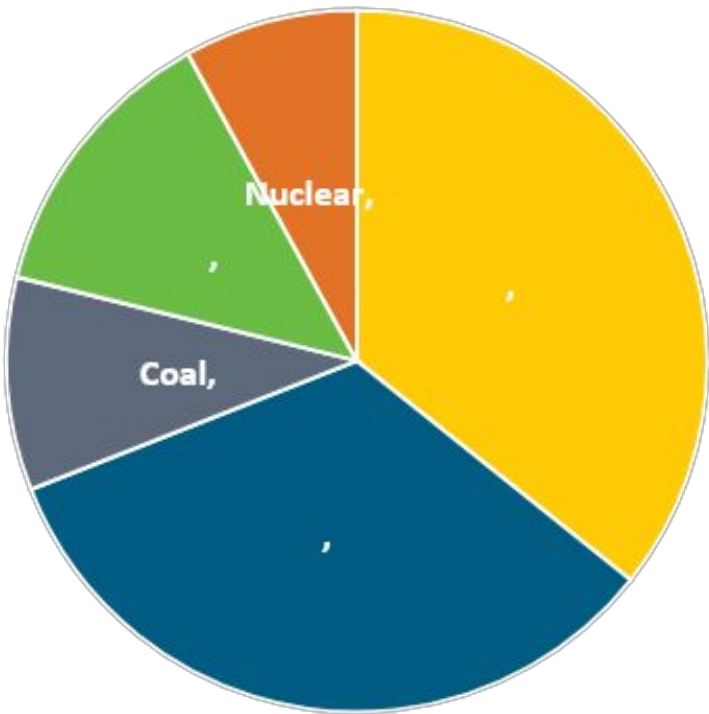


Source: NASA Goddard Institute for Space Studies

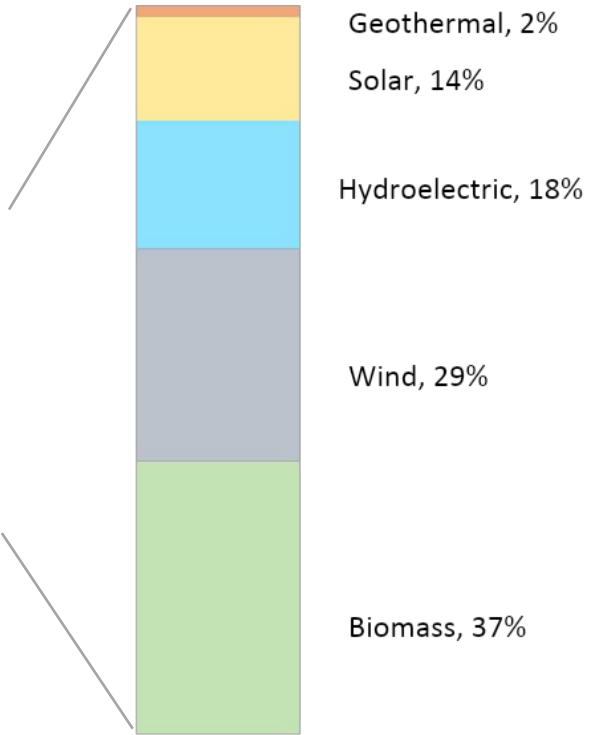
U.S. Energy Landscape and Key Goals

U.S. primary energy consumption by energy source, 2022

Total = 100.4 quadrillion
British thermal units (Btu)



Total = 13.1 quadrillion Btu



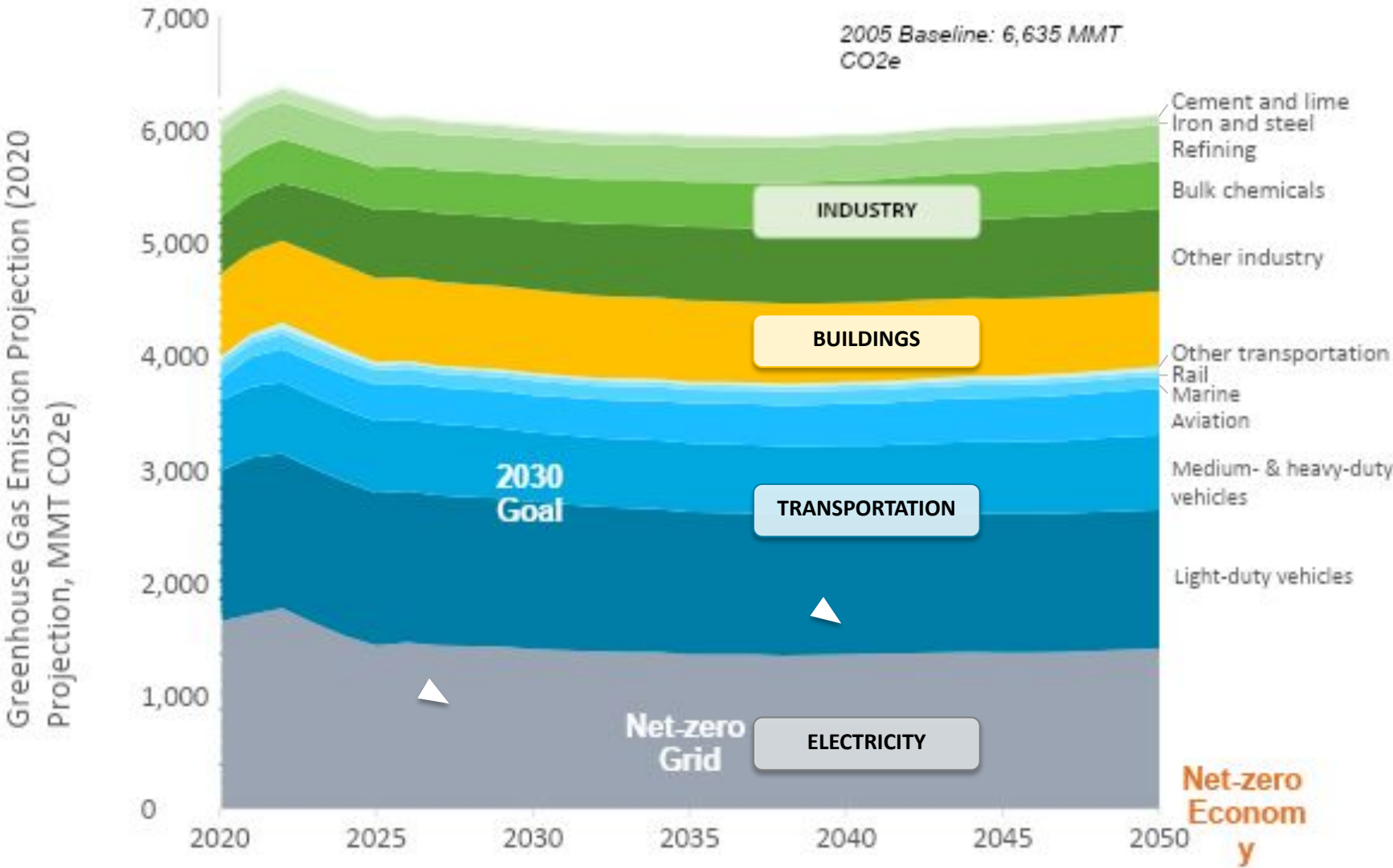
Note: Sum of components may not equal 100% because of independent rounding
Source: Data collected from U.S. Energy Information Administration, May 2023, *Monthly Energy Review*, preliminary data

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

Carbon Dioxide Emissions by Sector

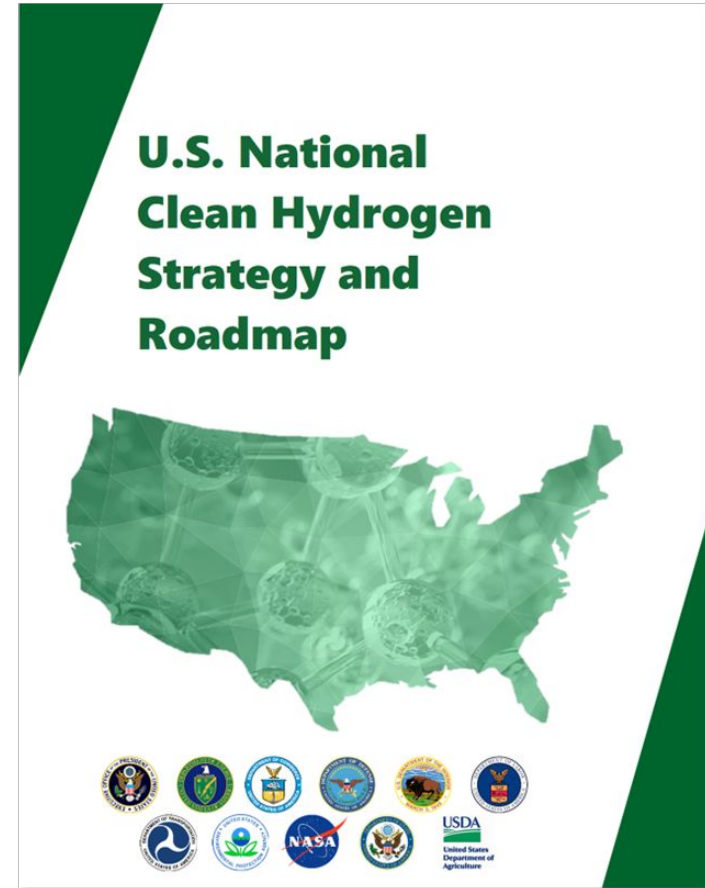
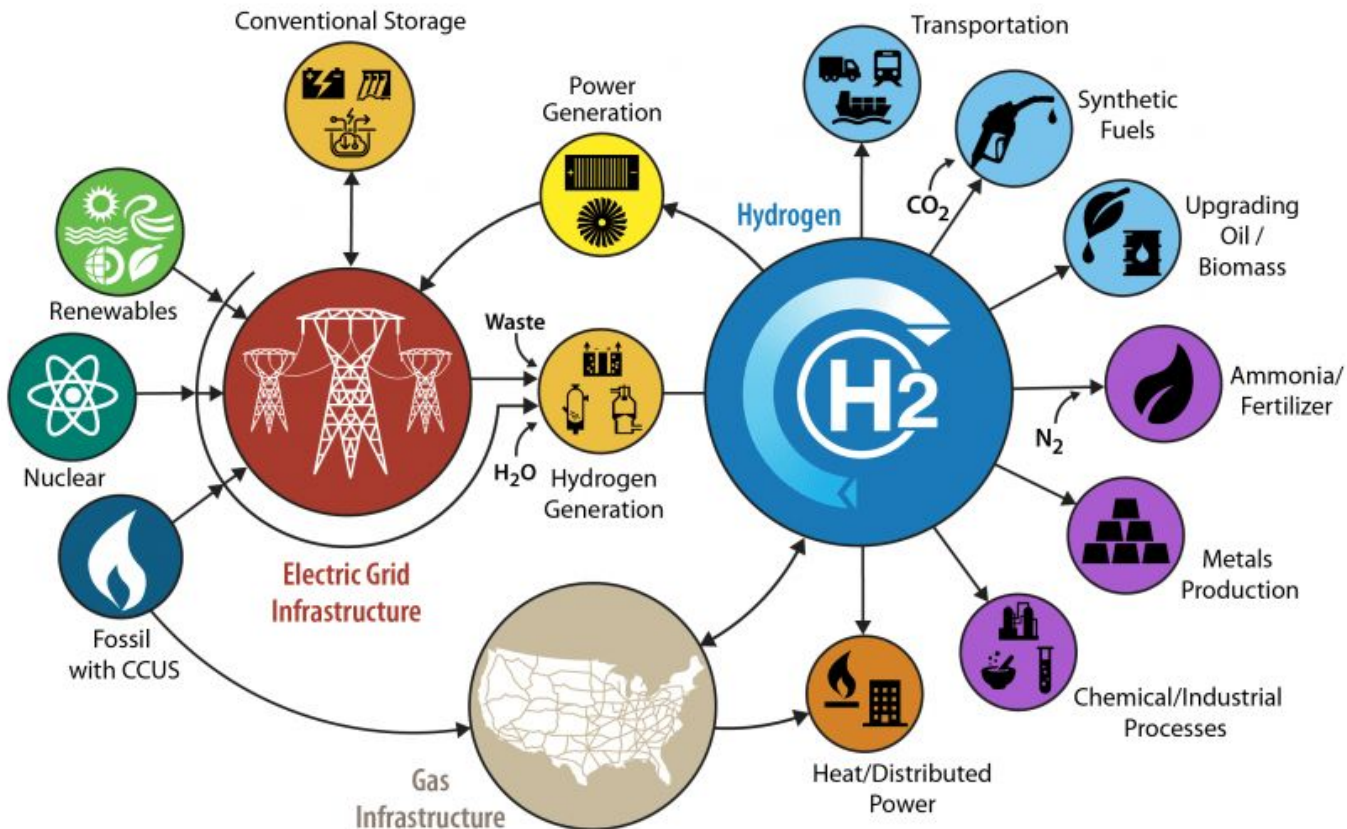


Source: Annual Energy Outlook 2021, DOE National Clean Hydrogen Strategy and Roadmap

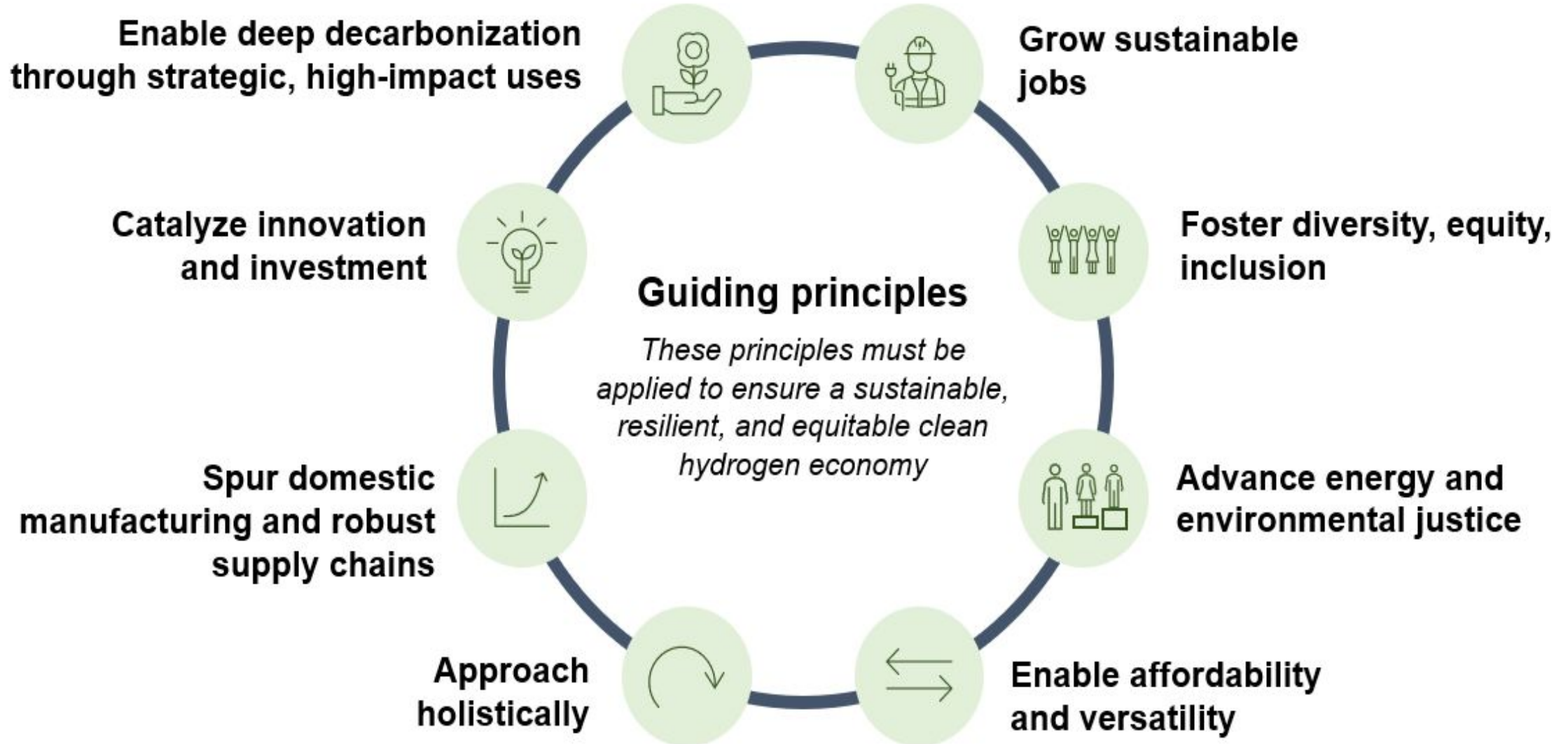
Hydrogen as a clean and versatile energy carrier

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

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



Guiding Principles



U.S. 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 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

Work with other agencies to accelerate market lift off

Enablers



Good Jobs and Workforce Development



Safety, codes and standards



Policies and incentives



Stimulating private sector investment



Energy and environmental justice

I. Listening,
Engaging &
Increasing
Transparency

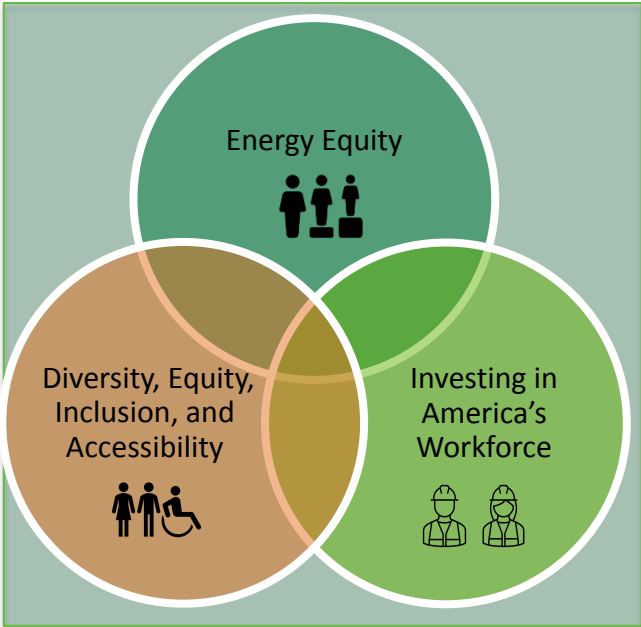
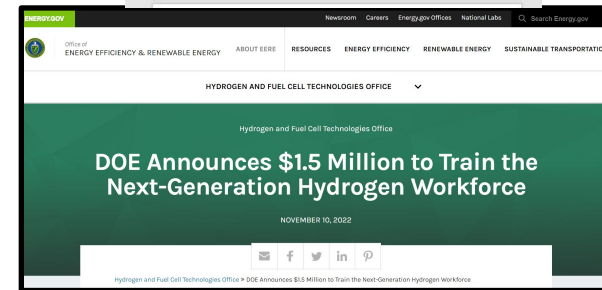
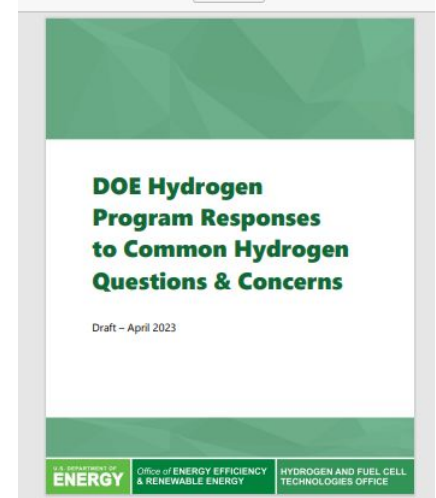
II. Prioritizing
Safety and Positive
Impacts

III. Lowering
Barriers

IV. Diversifying the
Clean Hydrogen
Workforce

V. Building
Capacity & Skills

Examples of EJ Activities



Opportunities for zero emissions resilient stationary power

Fuel cells provided backup power during Hurricane Sandy in the U.S. Northeast



Fuel cell power for maritime ports demonstrated in Honolulu, Hawaii



Fuel cells included for power to new World Trade Center in NYC



Over 500 MW of fuel cell stationary power installed across more than 40 US states



Zero Emissions Transportation Applications

Several companies developing long haul Class 8 fuel cell trucks



Fuel cell buses in CA surpass 20M passengers



High-speed fuel cell ferry under development in the US



Over 60,000 fuel cell forklifts at warehouses



H2Rescue – power, heat and water for disaster mitigation



Fuel cell rail in Europe, and Asia-first planned in the US



Example of DOE-funded Project in a Disadvantaged Community

DOE project with CTE for UPS Fuel Cell Delivery Vans in Ontario, CA



UPS truck at hydrogen fueling station



Commercial service in disadvantaged communities!

Key Accomplishments and Status:

- 15 trucks built; validation testing complete on 10
- Training complete. First package delivered!

Project impact per year: Savings of

- 285 metric tons of CO2-eq
- 280,000 grams of criteria pollutants
- 56,000 gallons of diesel



Justice 40 & Disadvantaged Communities



Communities are considered disadvantaged:

- If they are in a census tract or geographically dispersed groups that share a common characteristic and meet the thresholds for at least one of the tool's categories of burden listed below, or
- If they are on land within the boundaries of Federally Recognized Tribes

INDICATORS:

CLIMATE CHANGE

ENERGY

WATER & WASTERWATER

HEALTH

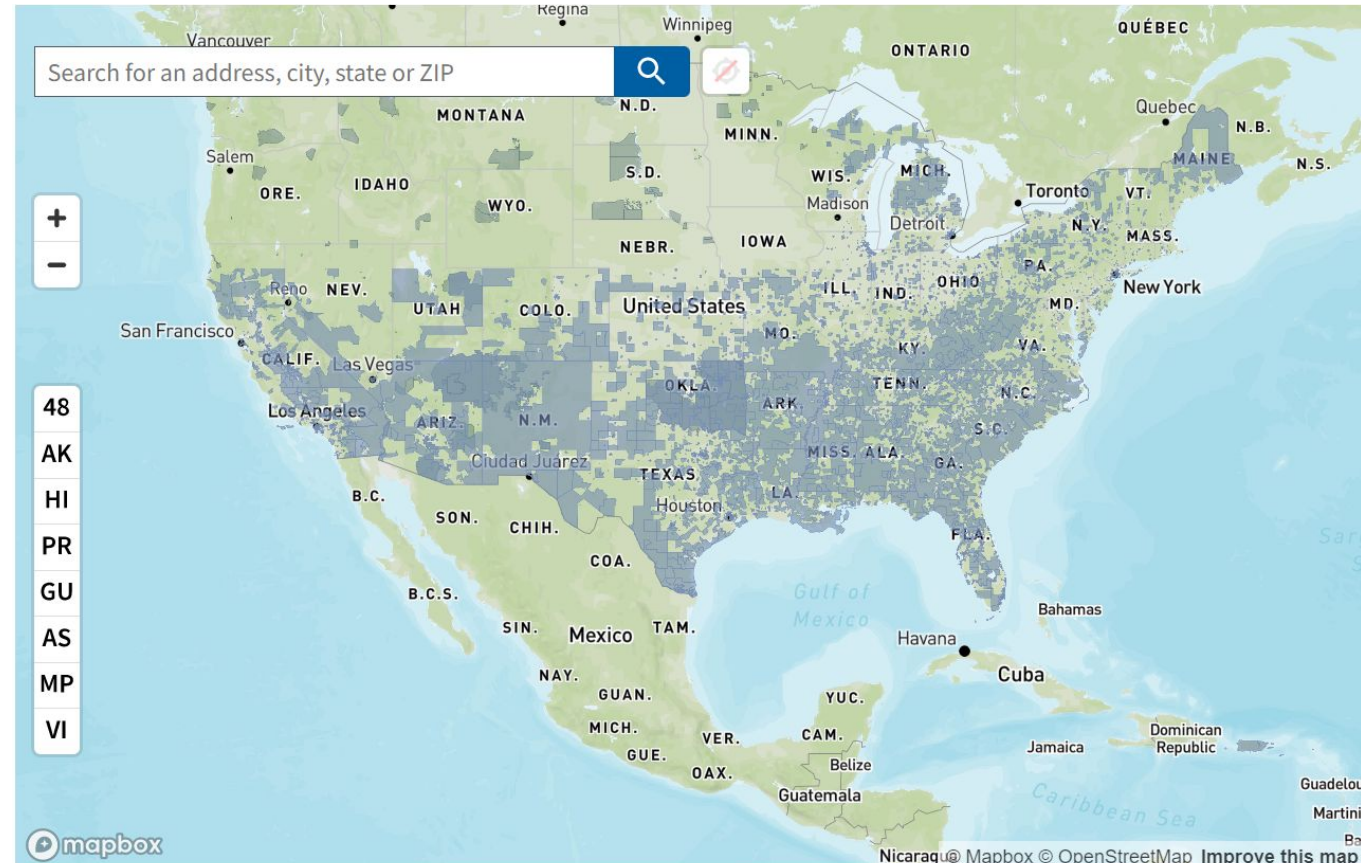
HOUSING

TRANSPORTATION

LEGACY POLLUTION

WORKFORCE DEVELOPMENT

Distribution of census tracts identified as DACs



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.

[Explore the map - Climate & Economic Justice Screening Tool \(geoplatform.gov\)](https://www.geoplatform.gov)



Advancing Diversity, Equity, Inclusion, Accessibility - Examples

Examples of Engagements and Initiatives from local to global... across 40 countries



Minority Serving Institution Partnership Program (MSIPP) at LANL.
Mentored >100 minority students, enabling fuel cell jobs

Funding for MSIs and HBCUs

DOE Announces \$1.5 Million to Train the Next-Generation Hydrogen Workforce | Department of Energy



H2IQ Hour webinars to learn more



Workforce and STEM focused initiatives

ORISE and GEM Fellowships, webinars



Tribal Clean Energy Summit



Industry Days

Connecting communities across continents



IPHE Early Career Network with over 40 countries (www.iphe.net)

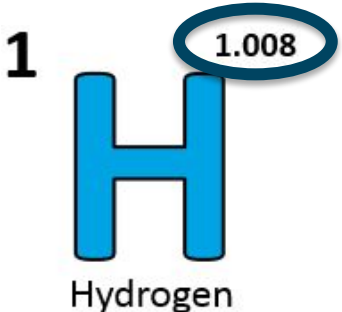
Resources and Opportunities for Engagement

Save the date!

**2024 DOE Annual Merit Review
and Peer Evaluation Meeting
May 6-9, 2024**

**Hydrogen and Fuel Cells Day
October 8**

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



INCREASE YOUR
H₂IQ
hydrogen.energy.gov

Join Monthly
H2IQ Hour Webinars

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H2IQ For Free



Visit [H2tools.Org](https://h2tools.org/) For
Hydrogen Safety And
Lessons Learned

<https://h2tools.org/>

CENTER FOR
Hydrogen
SAFETY
Connecting a Global Community
www.aiche.org/CHS



Sign up to receive hydrogen and fuel cell updates

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

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

Thank You

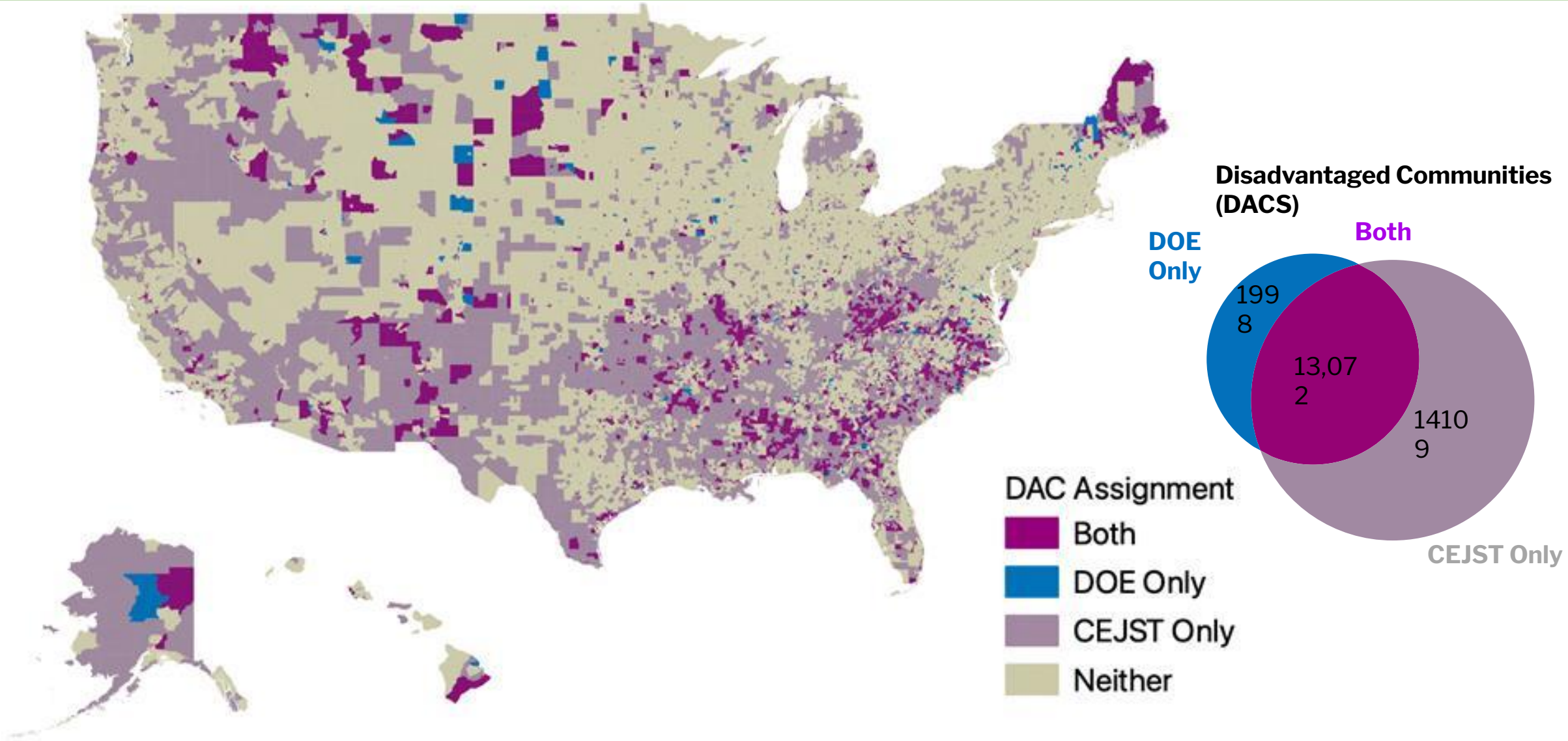
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U.S. Department of Energy

www.hydrogen.energy.gov

Additional Information

www.hydrogen.energy.gov

Measuring Impact: DOE and CEJST DAC Census Tracks



New Selection: The University Research Consortium for Grid Resilience

Partners

Stanford University (Prime Recipient)

Iowa State U. of Science & Technology

Massachusetts Institute of Technology

North Carolina State University

Northwest Indian College*

Princeton University

Tec de Monterrey (Mexico)

University of Alaska Fairbanks*

University of Calgary (Canada)

University of California San Diego*

University of Hawaii at Manoa*

University of Michigan Ann Arbor

University of Tennessee Knoxville

University of Texas at Austin*

University of Waterloo (Canada)

Washington State University

EPRI

NRECA

Argonne National Lab

Lawrence Livermore National Lab

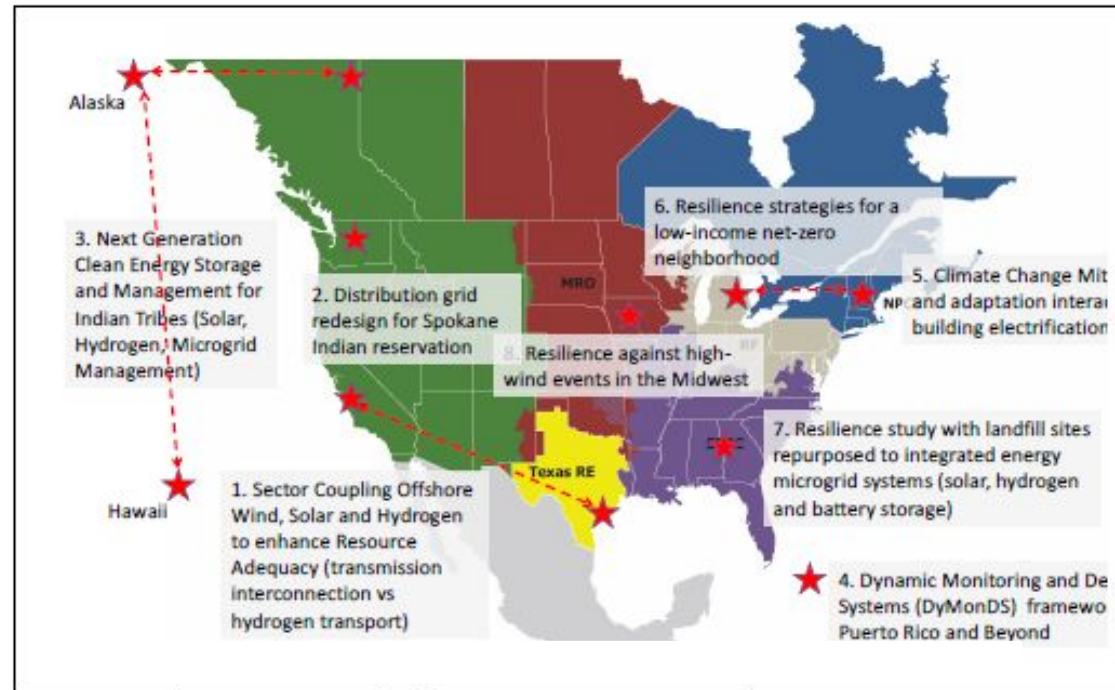
National Renewable Energy Lab

Pacific Northwest National Lab

*Minority Serving Institution

EARNEST CONSORTIUM (\$20M DOE investment)

Eight pilot projects leveraging multiple regional partnerships focus on resilience and environmental justice



Pilot projects include clean hydrogen integration

Impacts

The first-ever baseline of the current state of resilience, equity, and energy-related emissions and damages

A standard set of grid resilience and equity metrics

Open-source data products, tools, & models that support grid investment decisions in the North America

Supporting 100 National Grid Resilience Fellows

Training an interdisciplinary highly skilled workforce

Opportunities for Clean Hydrogen – National Goals

U.S. Opportunity:

10MMT/yr by 2030

20 MMT/yr by 2040

50 MMT/yr by 2050

-10% Emissions Reduction

-100K Jobs by 2030

Clean Hydrogen Use Scenarios

- Catalyze clean H₂ 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

Opportunities for Clean Hydrogen Across Applications

