U.S. DEPARTMENT OF ENERGY

Accelerating Progress from the Hydrogen Shot to Hydrogen Hubs

Moderated by Eric L. Miller, Chief Scientist, Hydrogen and Fuel Cell Technologies Office

Hydrogen Program Annual Merit Review and Peer Evaluation Meeting, May 6, 2024, Arlington VA


It's
H2 HAPPENING!
Research, Development, Demonstration, &
Deployment –And Beyond!

Our Distinguished Panelists!

Jennifer Arrigo
Director
Science and Energy Crosscuts
Office of the Under Secretary for Science and Innovation

Jason Marcinkoski
Program Manager
Integrated Energy Systems
Office of Nuclear Energy

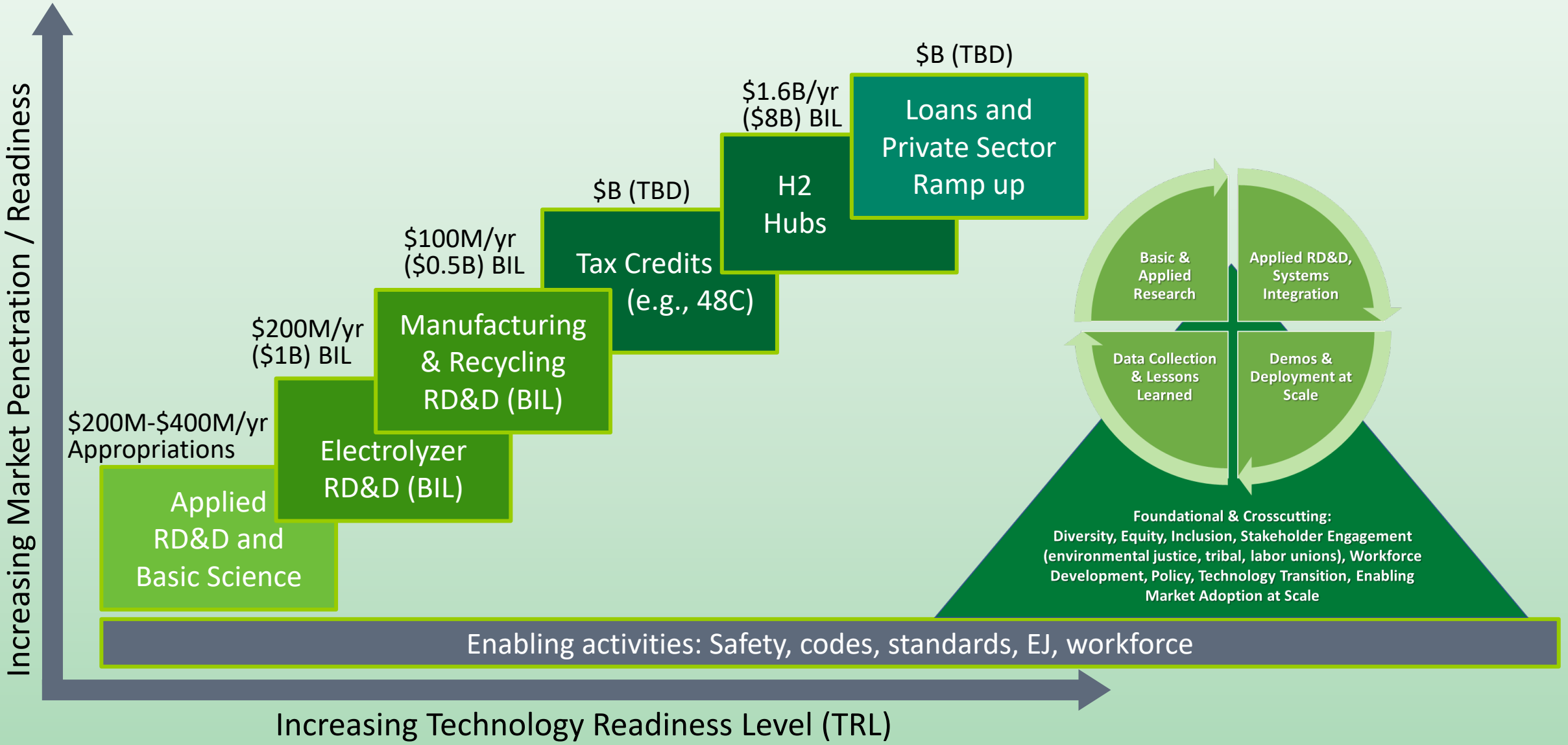
Gail McLean
Division Director, Chemical Sciences, Geosciences and Biosciences
Office of Basic Energy Sciences
Office of Science

Bob Schrecengost
Division Director
Hydrogen with Carbon Management
Office of Fossil Energy and Carbon Management

Nichole Fitzgerald
Deputy Director
Hydrogen and Fuel Cell Technologies Office
Office of Energy Efficiency and Renewable Energy

Crystal Farmer
Hydrogen Hubs Program Manager
Office of Clean Energy Demonstrations

DOE's Comprehensive Hydrogen Portfolio



U.S. DEPARTMENT OF ENERGY

Office of the
UNDER SECRETARY
FOR SCIENCE & INNOVATION

Intro to Science and Energy Crosscuts and the Energy Earthshot Initiative

Jennifer Arrigo,
Director, Science and Energy Crosscuts
Office of the Under Secretary for Science and Innovation

Office of the Under Secretary of Science and Innovation (S4)

Crosscut Team Mission: Spur innovation and accelerate progress towards 2030, 2035 and 2050 climate and energy goals through fully integrated science and applied energy research, development, demonstration, and deployment (RDD&D) within and across key mission-critical domains in DOE.

- Science and Technology areas that are critical to achieve a fully transformed and decarbonized energy economy
- Address identified needs for research and development (R&D) breakthroughs that will lead to transformational technologies deployed at scale
  - *Innovation today = Infrastructure tomorrow*
- Unique DOE capabilities, leadership, and mission space
- Develop and execute integrated goal-driven RD&D plans aligned to DOE mission.

Energy Earthshots™ Portfolio

The frontiers of the clean energy transition

Hydrogen

ENERGY earthshots U.S. DEPARTMENT OF ENERGY | Hydrogen™

Goal: The Hydrogen Shot™ seeks to reduce the cost of clean hydrogen by 80% to $1 per 1 kilogram in 1 decade.

1 Dollar

1 Kilogram

1 Decade

Key RDD&D Efforts Targeting Goals

ENERGY earthshots
U.S. DEPARTMENT OF ENERGY

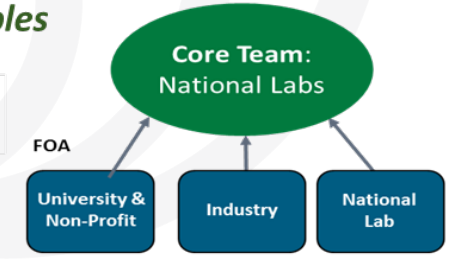
Research and Development

Basic and applied research through individual projects and consortia

Consortia Examples

HydroGEN Advanced Water Splitting Materials

H2NEW U.S. DEPARTMENT OF ENERGY



H-Mat Hydrogen Materials Compatibility Consortium

ElectroCat Electrocatalysis Consortium

HyMARC Hydrogen Materials Advanced Research Consortium

MILLION MILE FUEL CELL TRUCK
U.S. DEPARTMENT OF ENERGY

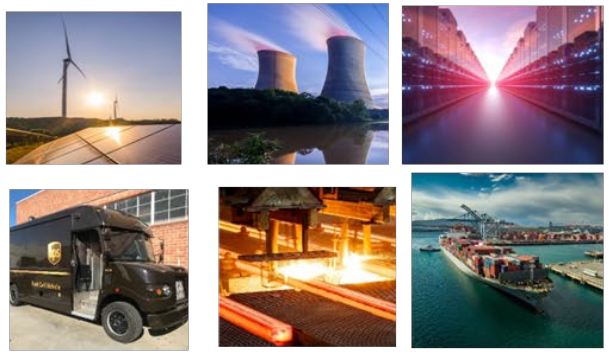
SHASTA Subsurface Hydrogen Assessment, Storage, and Technology Acceleration

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 H_2, 15 delivery trucks in disadvantaged area, 3 Super Truck projects, data center, fueling for passenger ferry, energy storage, H_2 for steel

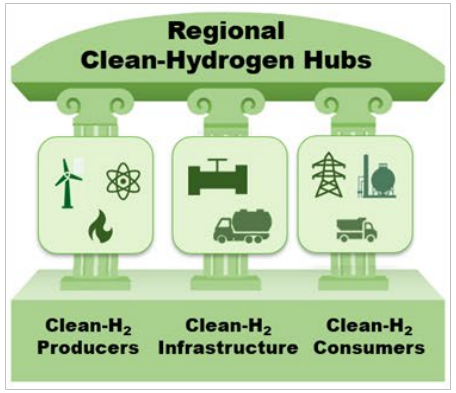
Deployment and Financing

H2 Hubs, loan guarantee program, workforce development

Example:

$7 billon for 7 hubs:

Renewables, fossil w/CCS, nuclear; multiple end-uses



2 new loan guarantee projects ($1.5B total) on pyrolysis and large-scale electrolysis, H_2 energy storage and power generation

Enabling Activities

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

H2EDGE Hydrogen Education for a Decarbonized Global Economy

CENTER FOR Hydrogen SAFETY Connecting a Global Community

HyBlend U.S. DEPARTMENT OF ENERGY

H_2 Matchmaker

Coordination across Earthshots

EXAMPLES

- Analysis of long-duration storage options using clean H_2, including sub-surface

- Assessment of affordable clean H_2 as a primary fuel or chemical intermediary

- Investigation of H_2 as an emerging viable option for energy transport from offshore wind

- Assessments of the role of affordable clean H_2 in diverse carbon negative technology options

Office of Science, Basic Energy Sciences: Accelerating Progress from Hydrogen Shot to Hydrogen Hubs

Gail McLean
Chemical Sciences, Geosciences and Biosciences Division Director
Basic Energy Sciences
Office of Science

U.S. DEPARTMENT OF ENERGY | Office of Science

Our Mission:

Deliver scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States.

More than **34,000 r**esearchers supported at more than **300** institutions and **17** DOE national laboratories

Steward **10** of the 17 DOE national laboratories

More than **37,000** users of **28** Office of Science scientific user facilities

$8.1B (FY 23 enacted)

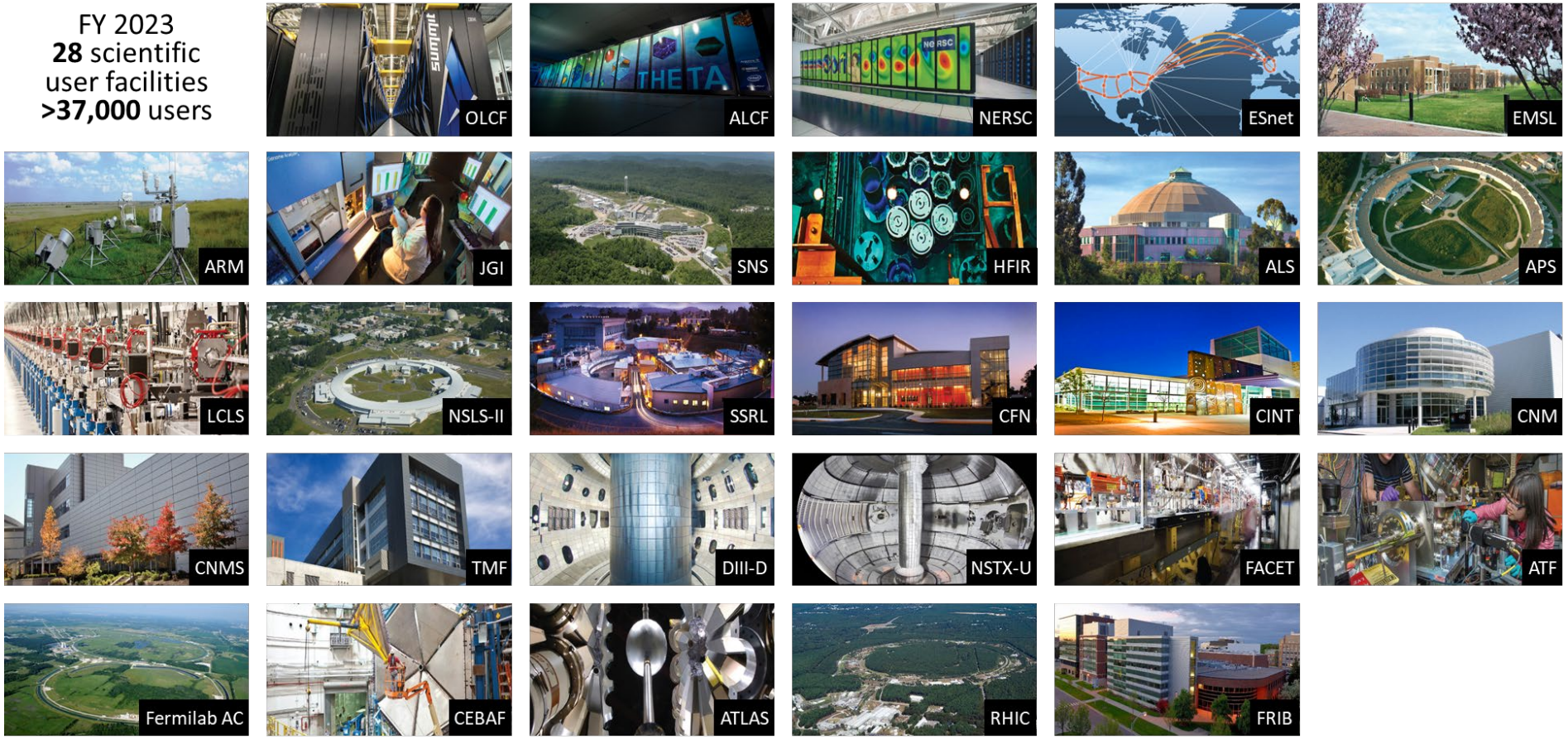
Office of Science Research Portfolio

Advanced Scientific Computing Research	• Delivering world leading computational and networking capabilities to extend the frontiers of science and technology
Basic Energy Sciences	• Understanding, predicting, and ultimately controlling matter and energy flow at the electronic, atomic, and molecular levels
Biological and Environmental Research	• Understanding complex biological, earth, and environmental systems
Fusion Energy Sciences	• Supporting the development of a fusion energy source and supporting research in plasma science
High Energy Physics	• Understanding how the universe works at its most fundamental level
Nuclear Physics	• Discovering, exploring, and understanding all forms of nuclear matter
Isotope R&D and Production	• Supporting isotope research, development, production, processing and distribution to meet the needs of the Nation
Accelerator R&D and Production	• Supporting new technologies for use in SC's scientific facilities and in commercial products

SC User Facilities Have Important Roles in Hydrogen Research

- **Advanced Scientific Computing Research** leadership class computers across disciplines to accelerate transformative progress
- **Biological and Environmental Research** user facilities bring bioanalytical instrumentation, genomic sequencing, and systems biology tools for innovative approaches for biological hydrogen generation
- **Basic Energy Sciences** light, neutron, and nanoscience facilities provide advanced synthesis and characterization to enable next-generation energy technologies

FY 2023
28 scientific user facilities
>37,000 users



Collaboration between SC-BES User facilities and hydrogen-related consortia have resulted in joint publications in peer reviewed journals.

SC Energy Earthshots Initiative

Joint initiative between BES, ASCR, and BER to address key basic research challenges in support of the DOE Energy Earthshots stretch goals for the first 6 DOE Energy Earthshots.

Two complementary programs:

Energy Earthshot Research Centers (EERCs): Multi-disciplinary, multi-institutional teams led by DOE laboratories focused on fundamental research that addresses key research challenges for the Energy Earthshots.

Scientific Foundations for Energy Earthshots: Small group awards led by academic or private sector institutions focused on use-inspired foundational science addressing knowledge gaps limiting achievement of Earthshot goals.

SC announced 29 awards in FY 2023, 11 EERCs (recommended ~$4.8 M/yr/EERC) and 18 scientific foundations grants (~$2-5 M/award over 3 years).

EERC and Science Foundation Awards on Hydrogen

CIWE · Center for Ionomer-based Water Electrolysis, Lawrence Berkeley National Laboratory, Adam Weber

Partners – Univ of California Berkeley, Univ of Oregon, Colorado School of Mines, Texas Tech, ORNL, Univ of California Merced, Univ of California Irvine

Analyzes structure, evolution, and chemistry of ion-conducting polymers (ionomers) for low-temperature electrolysis for hydrogen generation

PEHPr · Center for the Science of Plasma-Enhanced Hydrogen Production, Princeton Plasma Physics Laboratory, Yiguang Ju

Partner – Princeton Univ

Focuses on basic understanding of energy flow and chemistry in plasmas and plasma-surface interactions as a foundation for efficient plasma-mediated catalytic processes for low-cost electrified hydrogen production.

Proton and Ion Management in Bipolar-Membrane-Based Electrochemical Systems, University of Pennsylvania, Thomas Mallouk

Partners: Univ of Oregon, Univ of California Berkeley, Florida International Univ, LBNL

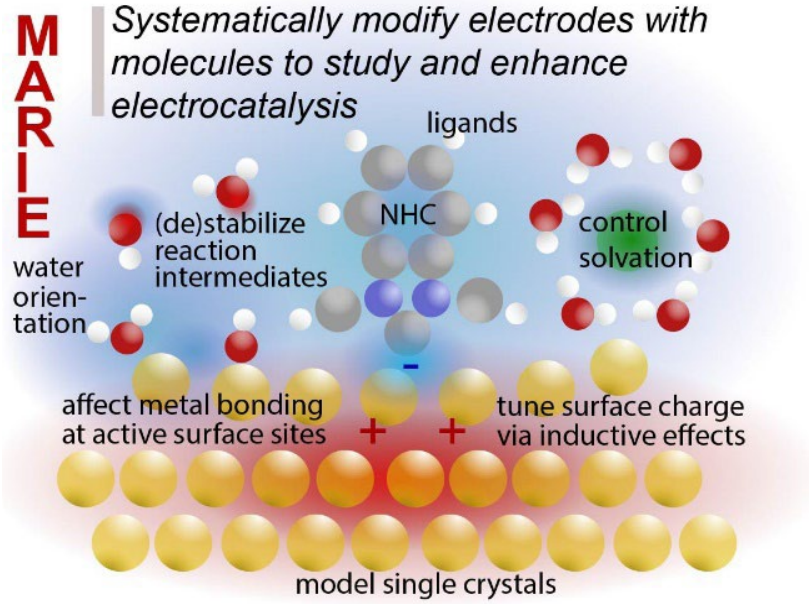
Investigates the fundamental reactions of water and the transport of ions in bipolar membranes and related electrochemical systems

EERC and Science Foundation Awards on Hydrogen

Molecular and Atomic EngineeRing of Interfacial Electro-catalytic Environments (MARIE), University of Minnesota Twin Cities, Kelsey Stoerzinger

Partners: Univ of Minnesota Morris, Univ of Oregon, Queen's University

Understand and design the local reaction environment at an atomically-precise solid surface (active site) by functionalizing it with designer molecules, potentially advancing electrochemical conversion of hydrogen & CO_2



Atomic Level Compositional Complexity for Electrocatalysis (Atomic-C2E), Georgia State University, Gangli Wang

Partners: Carnegie Mellon Univ, Georgia Institute of Technology, ORNL, Univ of Utah

Integrate fundamental electrochemistry, ab initio quantum chemical and multi-scale simulations, and materials chemistry to develop a mechanistic understanding of the CO2 reduction reaction (CO2RR) and the limiting step/s during water electrolysis in the O2 evolution reaction (OER).

BES EFRCs: Hydrogen-Related Research

Hydrogen in Energy and Information Sciences (HEISs), Northwestern Univ, Sossina Haile

Understand hydrogen transport in inorganic solids of earth-abundant elements and its transfer along and across interfaces within such materials (all charge states of the element: H+ (proton), H0 (atom), and H- (hydride ion))

Center for Electrochemical Dynamics and Reactions on Surfaces (CEDARS), North Carolina A&T State Univ, Dhananjay Kumar

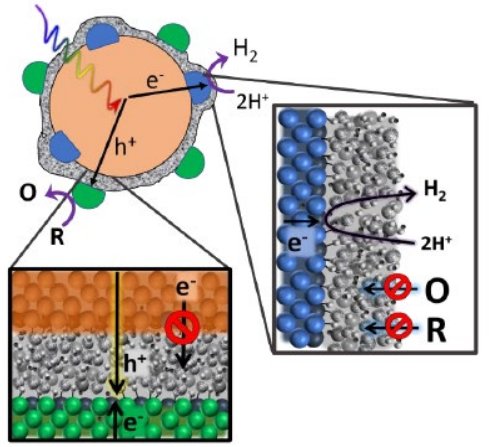
Understand electron and proton transfer process and surface bond formation and dissociation during the hydrogen production from water splitting.

Catalyst Design for Decarbonization Center (CD4DC), Univ of Chicago, Laura Gagliardi

Discover and develop reticular metal-organic framework materials as catalysts for the decarbonization energy transition, including superior hydrogen transfer catalysis.

Ensembles of Photosynthetic Nanoreactors (EPN), University of California Irvine, Shane Ardo

Understand, predict, and control the activity, selectivity, and stability of solar water splitting nanoreactors in isolation and as ensembles for solar-to-hydrogen conversion.



BES Roundtable: Priority Research Opportunities to Advance Foundational Science *for Carbon-Neutral Hydrogen Technologies*

Priority Research Opportunities:

- Discover and Control Materials and Chemical **Processes to Revolutionize Electrolysis** Systems
- Manipulate Hydrogen Interactions to Harness the Full Potential of **Hydrogen as an Energy Carrier**
- **Elucidate** the Structure, Evolution, and Chemistry of **Complex Interfaces** for Energy and Atom Efficiency
- Understand and **Limit Degradation Processes** to Enhance the Durability of Hydrogen Systems

https://science.osti.gov/bes/Community-Resources/Reports

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

HFTO & EERE: Clean Hydrogen from Renewable Resources

Nichole Fitzgerald

Deputy Director, Hydrogen and Fuel Cell Technologies Office

Office of Energy Efficiency and Renewable Energy

This is a Historic Time for HFTO and EERE

Energy Efficiency and Renewable Energy (EERE)

The EERE Mission: accelerate RD&D to equitably transition America to net-zero emissions by 2050, and ensure the clean energy economy benefits all Americans…

The HFTO Mission: RD&D to enable affordable clean hydrogen and fuel cell technologies for a sustainable, resilient, and equitable net-zero emissions economy.

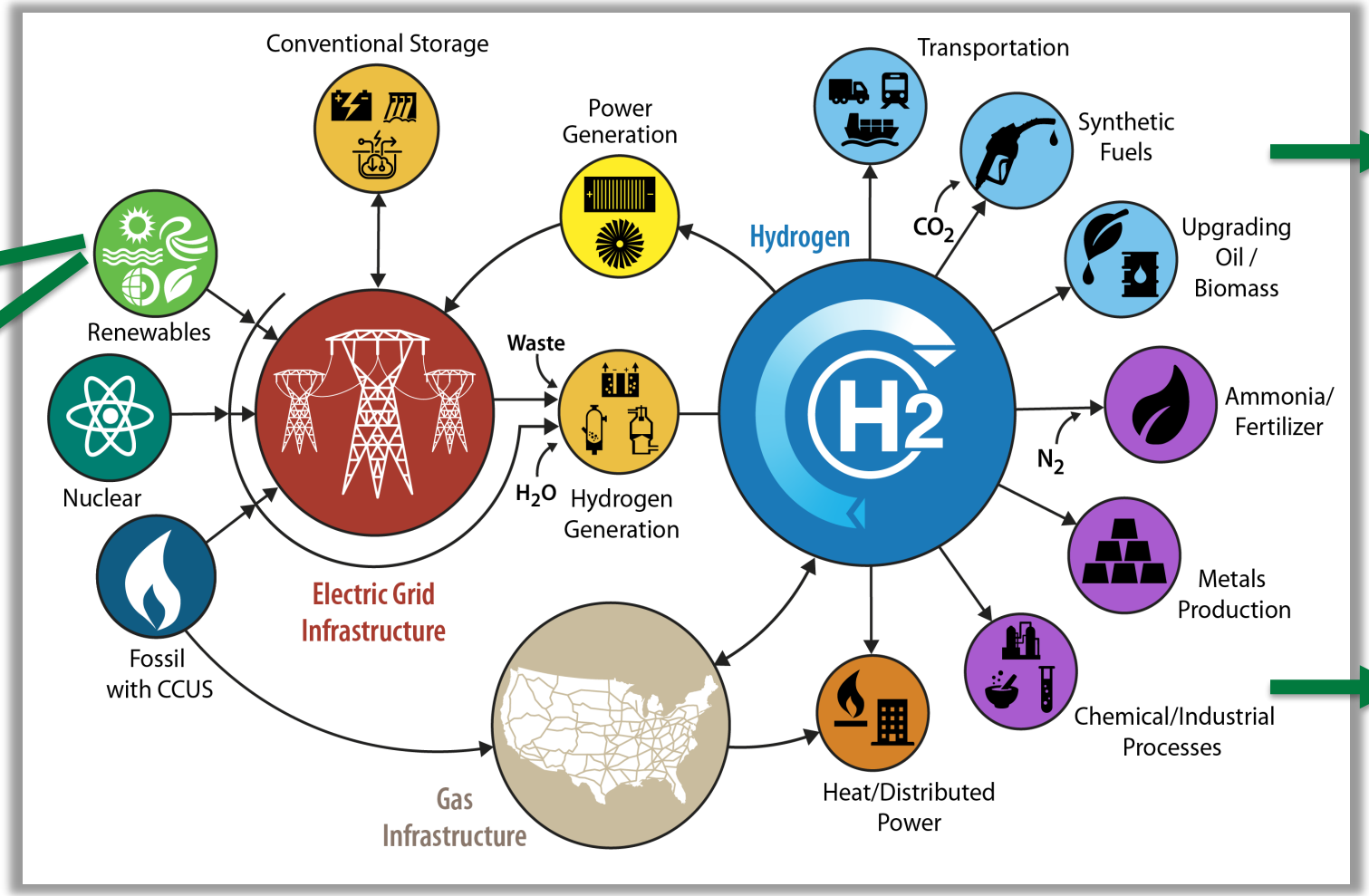
President Biden Signs the Bipartisan Infrastructure Bill into law on November 15, 2021. Photo Credit: Kenny Holston/Getty Images

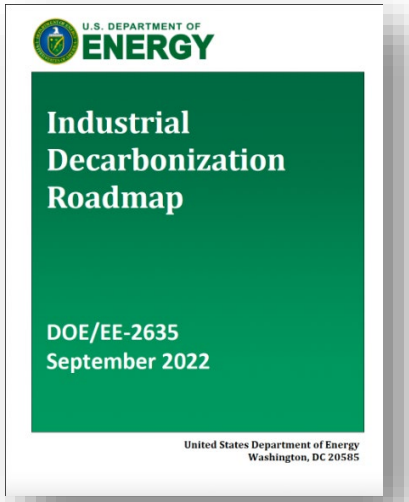
EERE collaborates to achieve ambitious goals in decarbonization, including hydrogen production and use

EERE Clean Hydrogen Mission & Portfolio

This presentation:

- **Clean Hydrogen from Biomass**
- **Clean Hydrogen from Renewables:** Water, Wind, and Solar





Clean Hydrogen Can Be Produced From Biomass

Generalized Biomass with Carbon Removal (BiCRS) Pathway

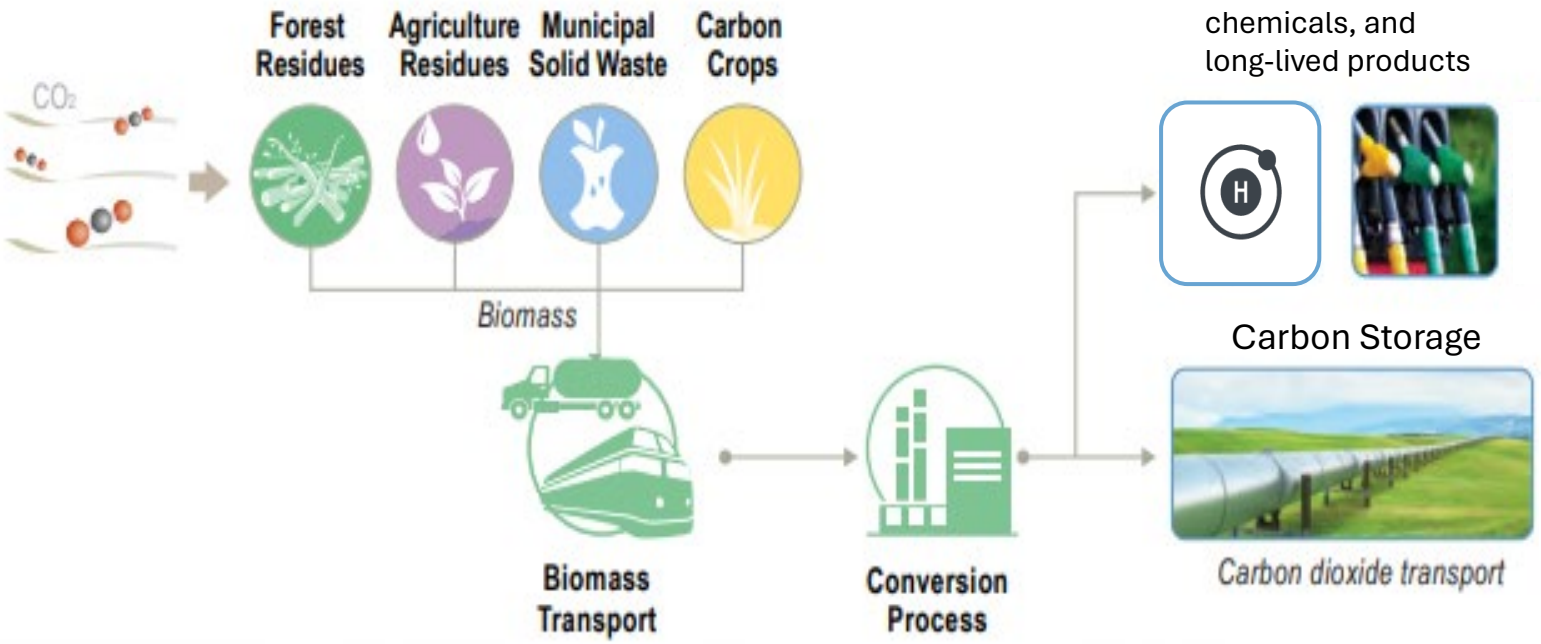


Figure adapted from *Roads to Removal 2023*

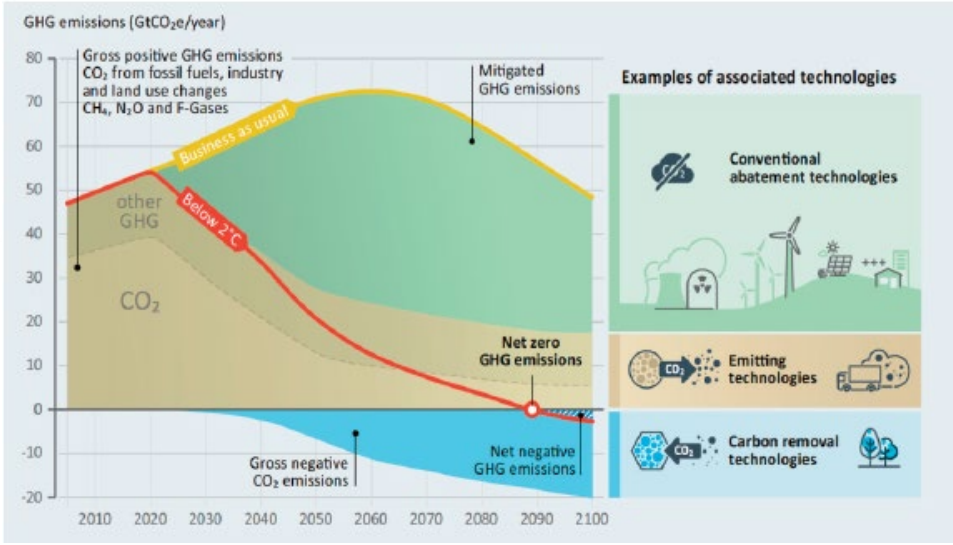
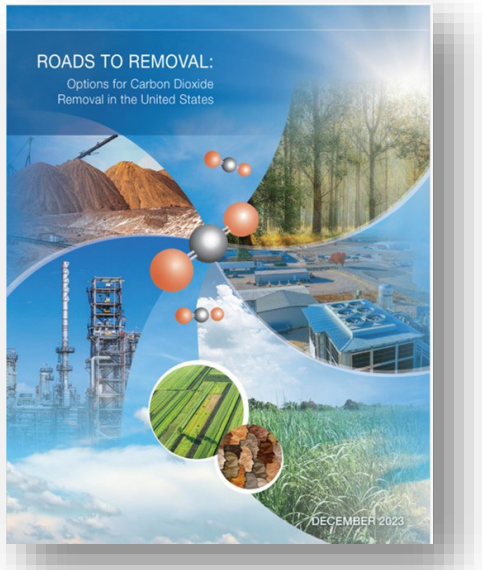


Figure adapted 2017 UNEP Emissions Gap Report



A Key Finding from Roads to Removal:

BiCRS pathways that produce H_2 are favorable for maximizing CO_2 removal at low net cost per tonne CO_2 due to high CO_2 removal per ton of biomass and revenue streams from the sale of H_2

Clean Hydrogen from Renewable Electrolysis

Levelized costs of hydrogen (in 2022$) produced from current PEM electrolyzer technology

Scenario *Based on Electricity Source*	Capacity Factor *(%)*	Electricity Price *(¢/kWh)*	Electrolyzer Installed Capital Cost *(2022$/kW)*		
			$1,500	**$2,000**	$2,500
			Levelized H_2 Production Cost *(2022$/kg)*		
Grid – Average Scenario	**97%**	**8.3¢**	**$6.80**	**$7.50**	**$8.20**
Renewable Electricity Scenarios					
Hydropower	**50%**	**3.4¢**	**$5.50**	**$6.70**	**$7.90**
Land-Based Wind *(Class 1)*	**51%**	**2.9¢**	**$5.20**	**$6.40**	**$7.50**
Optimized Hybrid Wind-PV	**74%**	**3.3¢**	**$4.40**	**$5.20**	**$6.00**

*Co-location is critical to achieving low-cost renewable electricity

DOE Hydrogen Program Record "Clean Hydrogen Production Cost Scenarios with PEM Electrolyzer Technology" 2024

Today
$5-$7/kg clean H_2 scenarios*

2026
BIL target: $2/kg clean H_2

2031
H_2 Shot target: $1/kg clean H_2

*across multiple renewable energy scenarios

Lowering the cost of electrolyzer technologies while integrating with co-located renewable electricity production will be key to achieving BIL and H_2 Shot goals

GreenHEART Project

- Green Hydrogen Economy and Renewable Technologies (GreenHEART) integrates EERE technologies- wind, water, solar, and electrolysis
- Explores increased efficiency and reduced capital costs through co-location
- Identify best siting locations when considering regional resources (e.g., wind, solar, H_2 storage, water, etc.)
- Provide alternative path to decarbonization for hard-to-abate industries

Check out the GreenHEART presentation on Wednesday at noon (SDI001 Track)

U.S. DEPARTMENT OF ENERGY | Office of NUCLEAR ENERGY

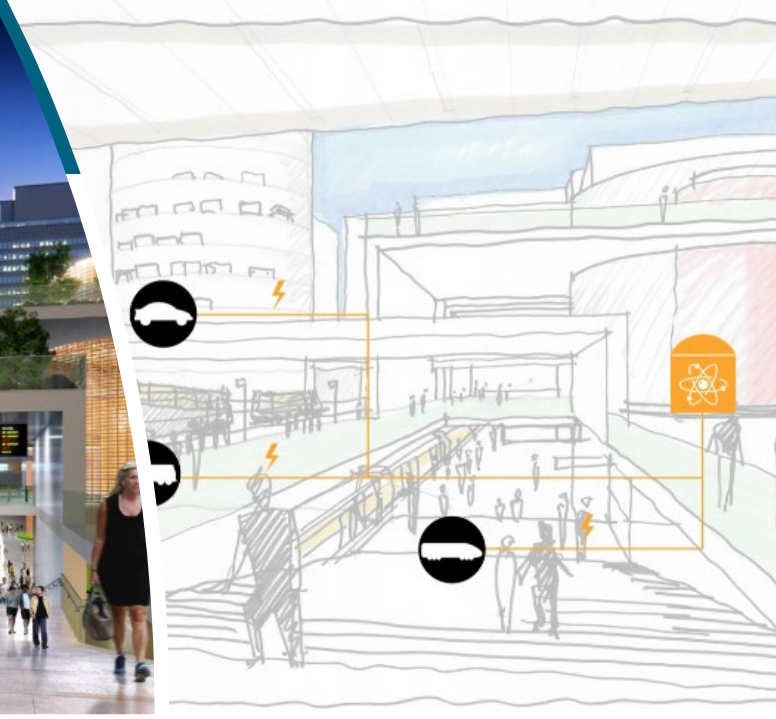
Nuclear Integrated Energy Systems

Jason Marcinkoski
Program Manager,
Integrated Energy Systems
Office of Nuclear Energy

Nuclear Reimagined

(images from thirdway)

- Liquid coolants enable low pressure cooling systems. (e.g. molten salt, liquid metal)
- Higher temperature reactors enable more efficient and broader industrial use, as well as dry cooling. (e.g. molten salt, liquid metal, high temperature gas)
- Fast reactors can be technically capable of making their own fuel inside the reactor core, and burning high-level waste.
- Passive cooling and reactivity control enable walk-away safety.
- Smaller Emergency Planning Zone allows close proximity to industrial applications
- High power density results in low land-use and low embodied emissions.
- High availability and reliability– high capacity factor / good economics.
- 200 GW new nuclear expected by 2050 (DOE Nuclear Liftoff Report).



The Future Landscape for Nuclear Energy Systems

Nuclear Reactor

Thermal Storage

Electricity Generation

Industrial Chemical System

Thermal Transport

Data Centers

Grid Flexibility

Refineries / Oil production

Fertilizer / Ammonia

Fuels

Polymers

Chemicals

Metals

Paper / pulp

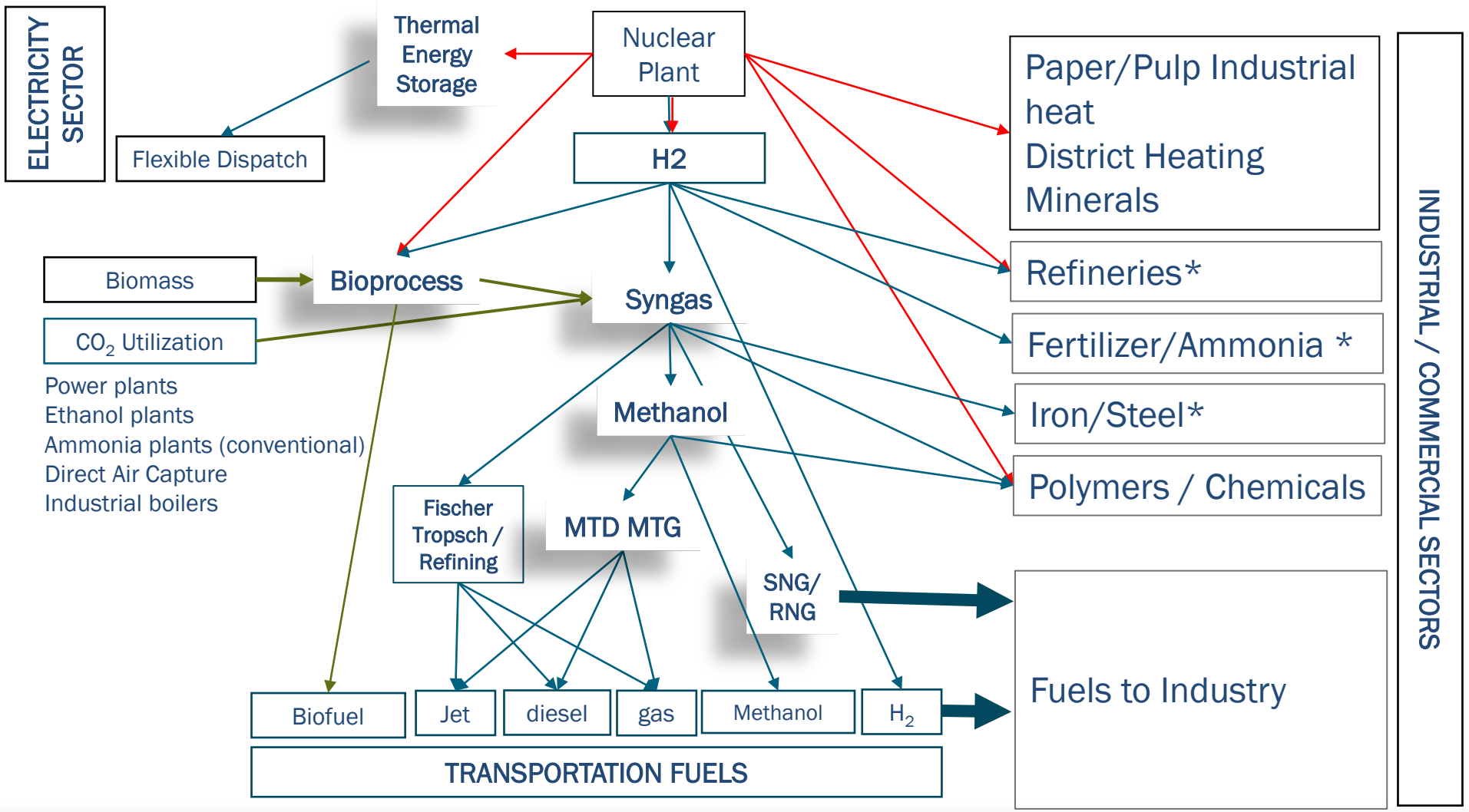
District heating

Minerals

Industrial heat

Advanced Nuclear Energy Pathways by Sector

Future Nuclear Energy Currencies are Chemical Feedstocks (Syngas, FT liquids, Methanol, H2)



* significant additional electricity use not shown to simplify diagram

The Office of Nuclear Energy is Preparing to Power Large-scale Electrolysis up to 1,000 MW

First of a kind Nuclear-H_2 production demonstration projects

Nine Mile Point Nuclear Power Plant

Constellation.

1.25 MWe Low Temperature Electrolysis

H2 production began February 2023

Davis-Besse Nuclear Power Plant

VISTRA

1-2 MWe

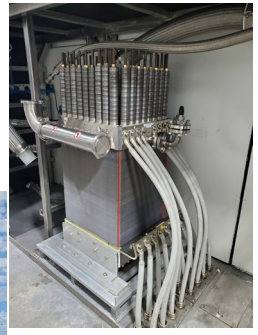
345kV plant upgrade with new switch gear at the plant transmission station

Prairie Island Nuclear Power Plant

Xcel Energy™

150 kWe High Temperature Electrolysis

Tie into plant thermal line



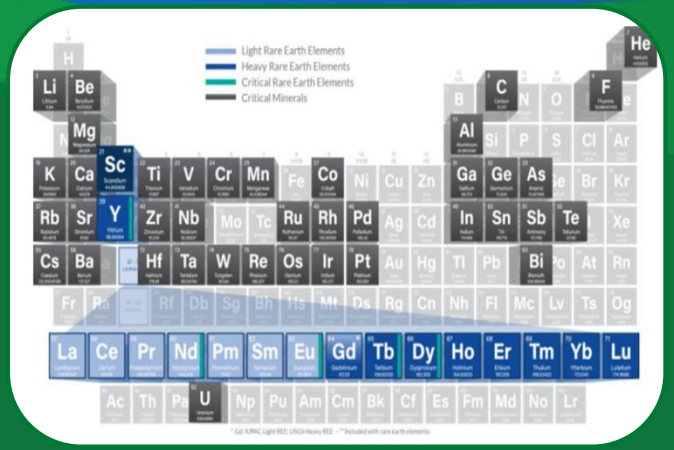
Scale-up

Hazards, PRAs, human factors, full-scope simulation for 100, 500, 1000 MW_e

U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

FECM: Hydrogen Program

Bob Schrecengost
Division Director
Hydrogen with Carbon Management
Office of Fossil Energy and Carbon Management

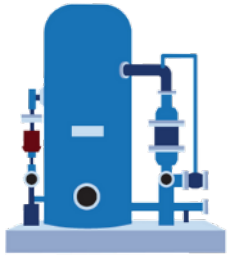


Fossil Energy and Carbon Management

FECM Role in Clean Hydrogen/Energy Earthshots

Focus is on clean hydrogen production from fossil resources, waste (e.g., plastics), and sustainable biomass, along with CCUS, to achieve net-zero carbon hydrogen at $1/kg H_2, power generation/energy storage using reversible solid oxide cells and/or turbines, hydrogen transport, and large-scale/geological hydrogen storage.

Carbon Management Approaches toward Deep Decarbonization



Technologies that Lead to Sustainable Energy Resources

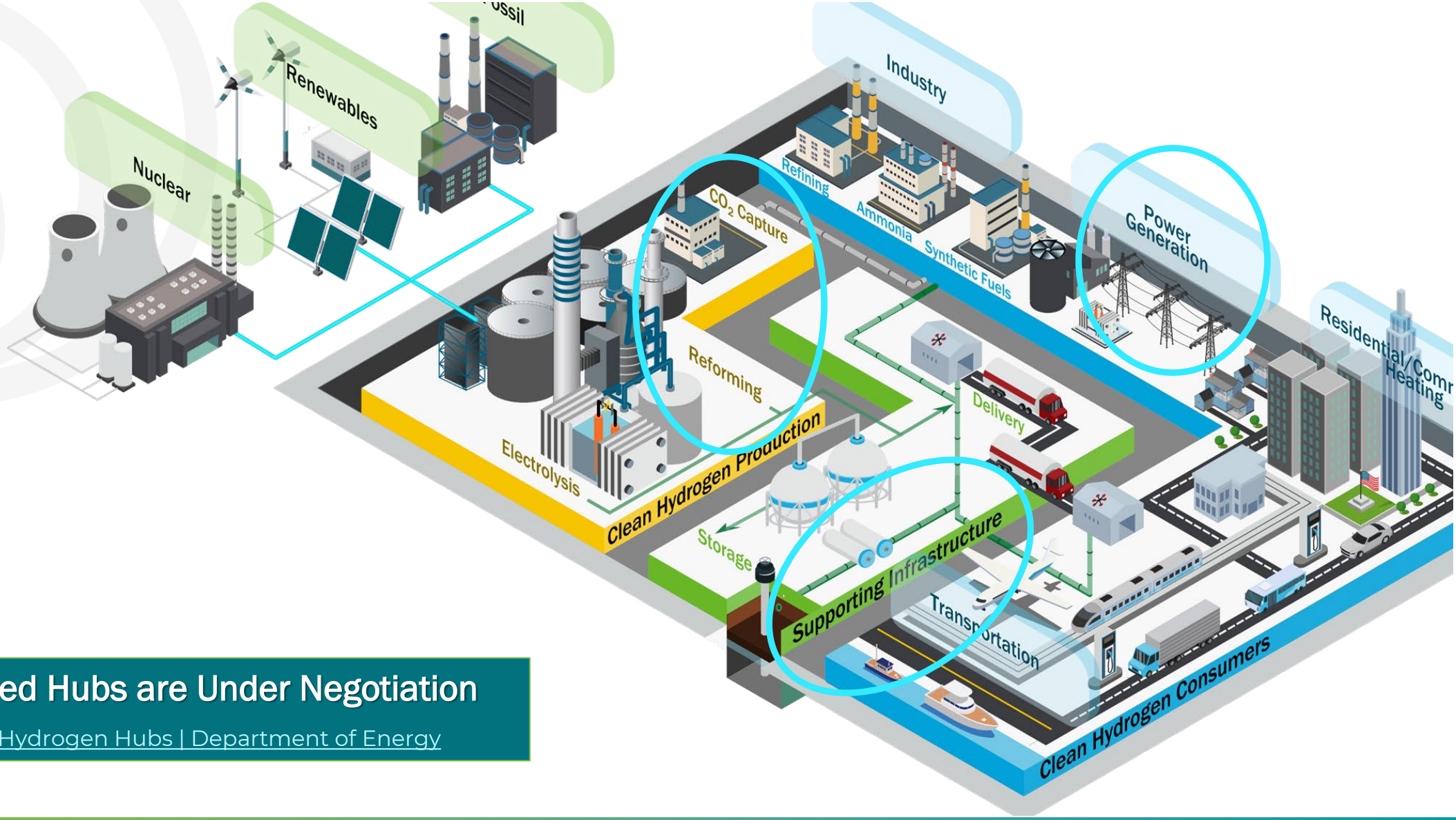
Justice, Labor, and Engagement

FECM Strategic Vision

Read FECM's Entire Strategic Vision

by Scanning the Code Above

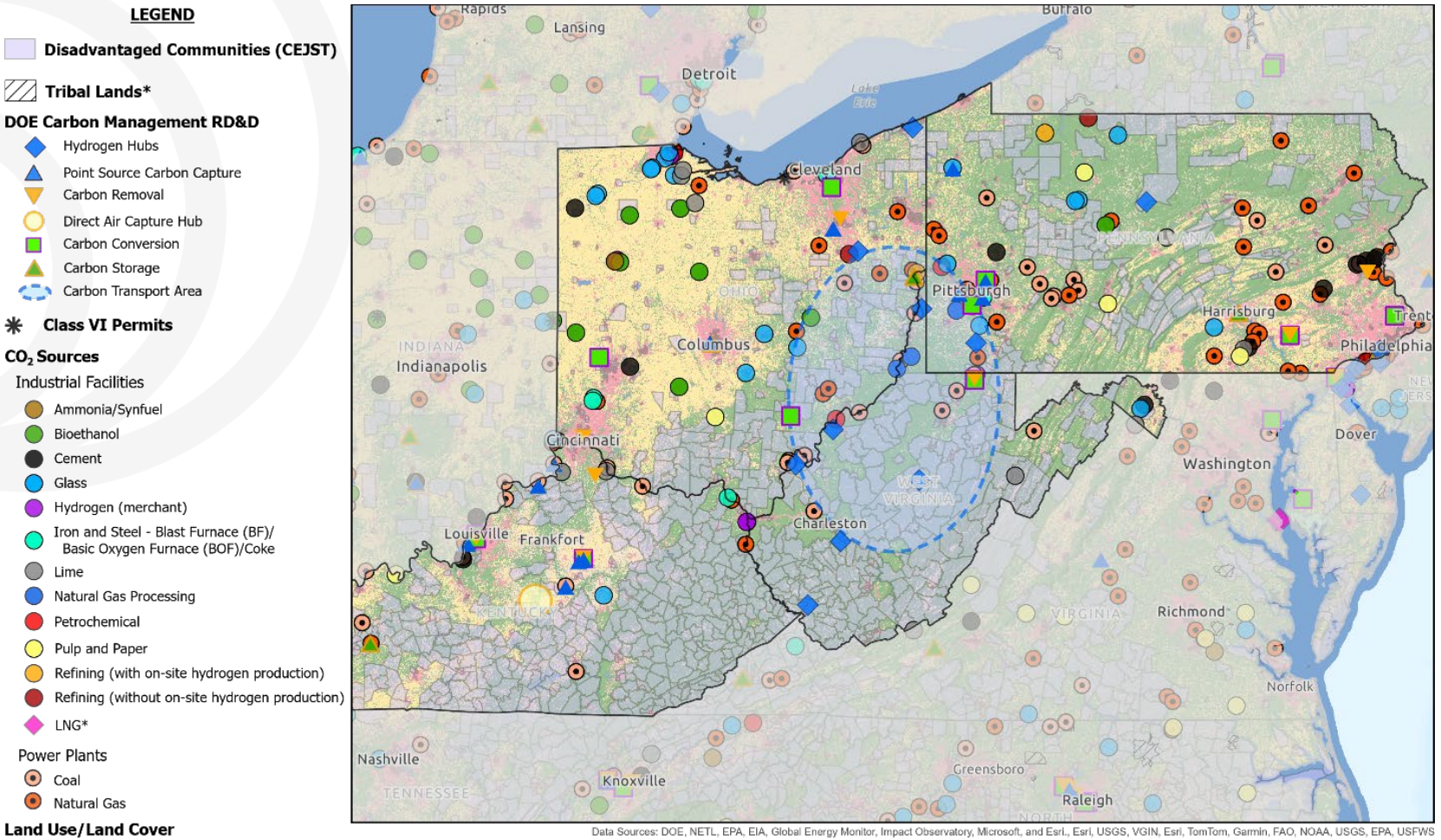
Hydrogen Hubs Selected



Announced Hubs are Under Negotiation

Regional Clean Hydrogen Hubs | Department of Energy

Appalachian Hub-Adjacent Industries



Regional Clean Hydrogen Hubs | Department of Energy

Appalachian Hub-Adjacent FECM Projects

Point Source Carbon Capture Industrial Sources | Power Sources

- **$5M for University of Kentucky to lead small-pilot testing of carbon capture at the Nucor Steel Gallatin Plant**
- **$4M for Wood Environnent & Infrastructure Solutions to lead a FEED study for capturing CO_2 from a petrochemical plant**
- **$6M for a FEED study for capturing CO_2 from LG&E-KU's Cane Run Power Plant Unit 7**

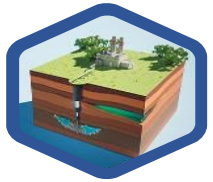
Hydrogen with Carbon Management Hydrogen Fuel | Gasification | Solid Oxide Fuel Cells & Gas Turbines

- **$18M to CONSOL Energy, Inc. to Design Development and System Integration Design Study for an Advanced Pressurized Fluidized Bed Combustion Power Plant with Carbon Capture**
- **$11M to Pennsylvania State University (PSU) for Improving Turbine Efficiencies Through Heat Transfer and Aerodynamic Research in the Steady Thermal Aero Research Turbine (START)**
- **$9M to PSU for Advancing Turbine Technologies for Relevant Inlet Temperature Profiles in the Steady Thermal Aero Research Turbine (START) Lab**
- **Appalachian Hydrogen Hub***

Carbon Dioxide Removal Direct Air Capture with Storage

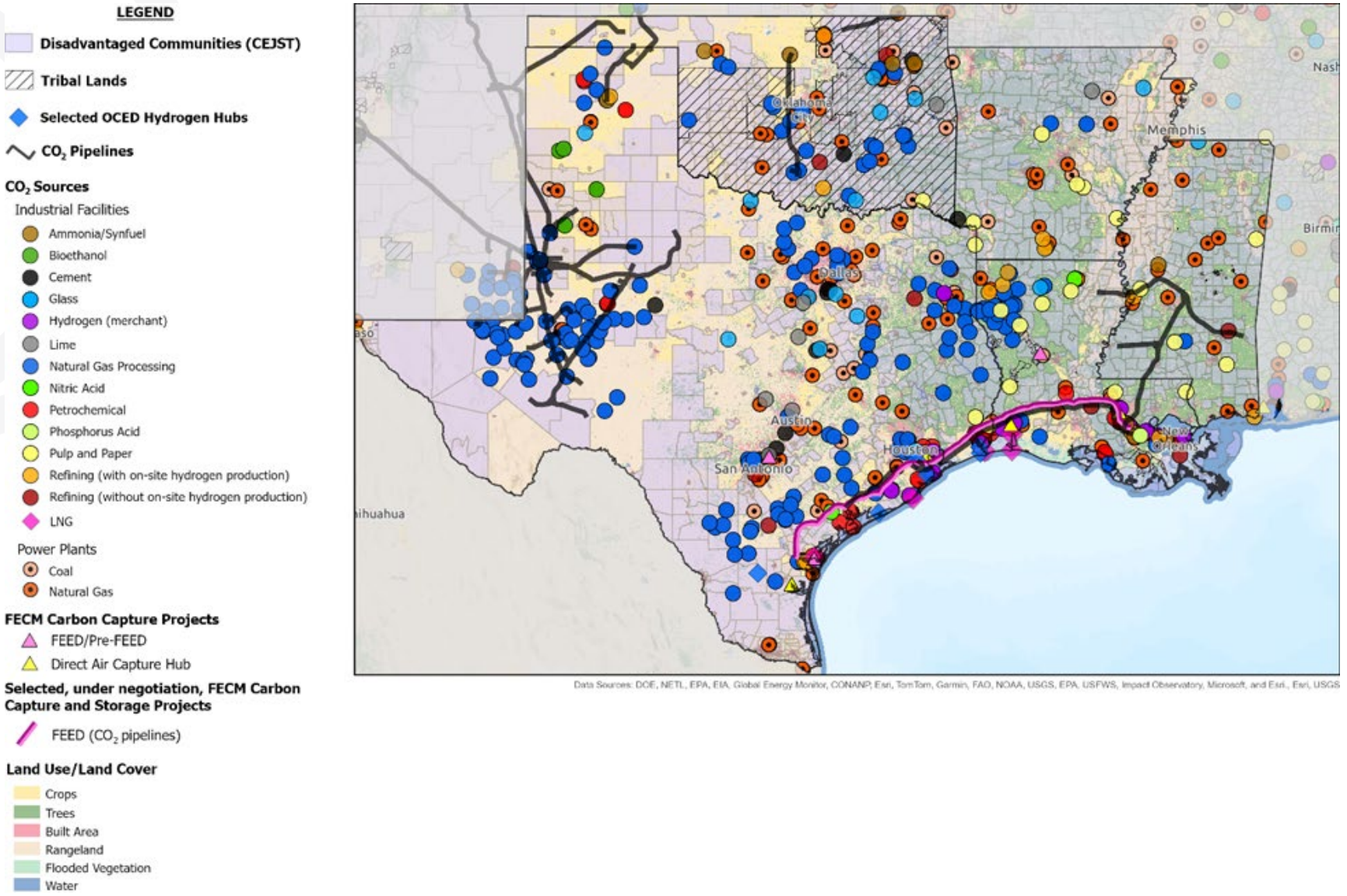
- **$3M to University of Kentucky to determine the feasibility of a distributed direct air capture hub that is powered by solar and biomass energy sources, and stores the carbon dioxide in a depleted natural gas field**

Carbon Transport and Storage Monitoring, Verification, Accounting, & Assessment of Long-Term Storage | Storage Infrastructure Demonstration | Accelerating Regional Initiatives | CarbonSAFE



- **$11M to Batelle, Carbon Storage Complex Feasibility for Commercial Development in Paradise, Kentucky – CarbonSAFE Phase II**
- **$23.7M, Batelle Memorial Institute, Regional Initiative to Accelerate CCUS Deployment in Midwestern and Northeastern USA**

Gulf Coast Hub-Adjacent Industries



Gulf Coast Hub-Adjacent FECM Projects

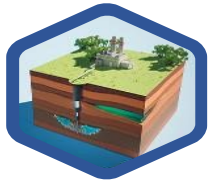
Point Source Carbon Capture Industrial Sources | Power Sources

- $6M for a FEED study for capturing CO2 from hydrogen production at Air Liquide's La Porte facility
- A total of $4M for Linde / Phillips 66 to lead pre-FEED studies for capturing CO2 from hydrogen production at Linde's facilities in Port Arthur and Sweeny and Air Liquide's Rodeo Plant
- $5M for FEED/pre-FEED studies for carbon capture at CEMEX's New Braunfels Balcones Cement Plant
- $4M for a FEED study for carbon capture at ArcelorMittal's hot briquetted iron facility
- A total of $14M for FEED studies for carbon capture at Calpine's Deer Park Energy Center and Cleco Power's Madison Power Plant Unit 3

Hydrogen with Carbon Management Hydrogen Fuel | Gasification | Solid Oxide Fuel Cells & Gas Turbines

- $6M Dastur International, INC,
- $1.5M Praxair, Inc. Pre-FEED
- $1.5M Linde Inc. Pre-FEED
- Gulf Coast Hydrogen Hub*

Carbon Transport and Storage Monitoring, Verification, Accounting, & Assessment of Long-Term Storage | Storage Infrastructure Demonstration | Accelerating Regional Initiatives | CarbonSAFE



- $12M to Port of Corpus Christi Authority, Coastal Bend Carbon Management Project: CarbonSAFE Phase II
- $9M to Port of Corpus Christi Authority, CarbonSAFE Phase II – Storage Complex Feasibility: Coastal Bend Offshore Carbon Storage
- $48M to Projeo Corporation, The Phoenix Project: Demonstration of the feasibility of the Safe, Reliable Conversion of a Mature Oilfield for Dedicated CO2 Storage, Block 31 Unit, Permian Basin
- $1.4M to The University of Texas at Austin, Integrated CCS Pre-Feasibility in the Northwest Gulf of Mexico

University Training & Research (UTR) Awardees

- Prairie View A&M, Texas State University, University of Texas, Rio Grande Valley, Oklahoma Statue University, University of Texas (Dallas), University of Texas (El Paso), Southern University and A&M College system, Texas A&M Engineering Experiment Stations, University of North Texas, University of Texas (San Antonio), University of Texas (Arlington)

Office of Clean Energy Demonstrations

THE OFFICE OF

CLEAN ENERGY DEMONSTRATIONS

Regional Clean Hydrogen Hubs

Crystal Farmer
Hydrogen Hubs Program Manager
Office of Clean Energy Demonstrations

OCED Mission

Deliver clean energy technology **demonstration projects at scale** in partnership with the **private sector** to **accelerate deployment**, **market adoption**, and the **equitable transition** to a decarbonized energy system.

Whole of Government Approach to Clean Hydrogen

U.S. National Clean Hydrogen Strategy and Roadmap

Clean Hydrogen Standard

IRA tax incentives

Hydrogen Interagency Task Force (HIT)
a collaboration among 11+ U.S. federal agencies to further advance a whole-of-government approach to executing the national clean hydrogen strategy

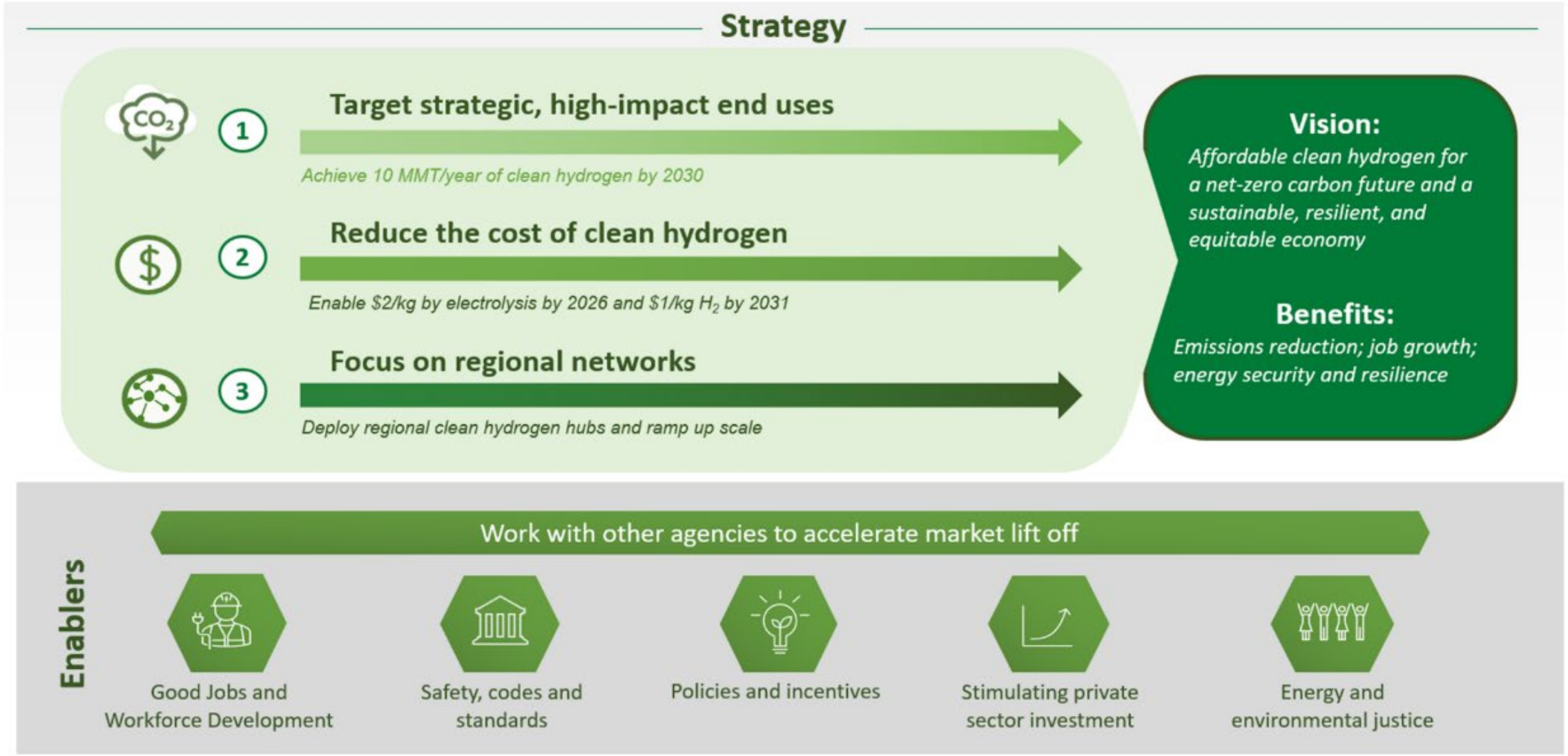
Hydrogen Shot
($1/kg by 2031)

H2Hubs Demand-Side Support Initiative

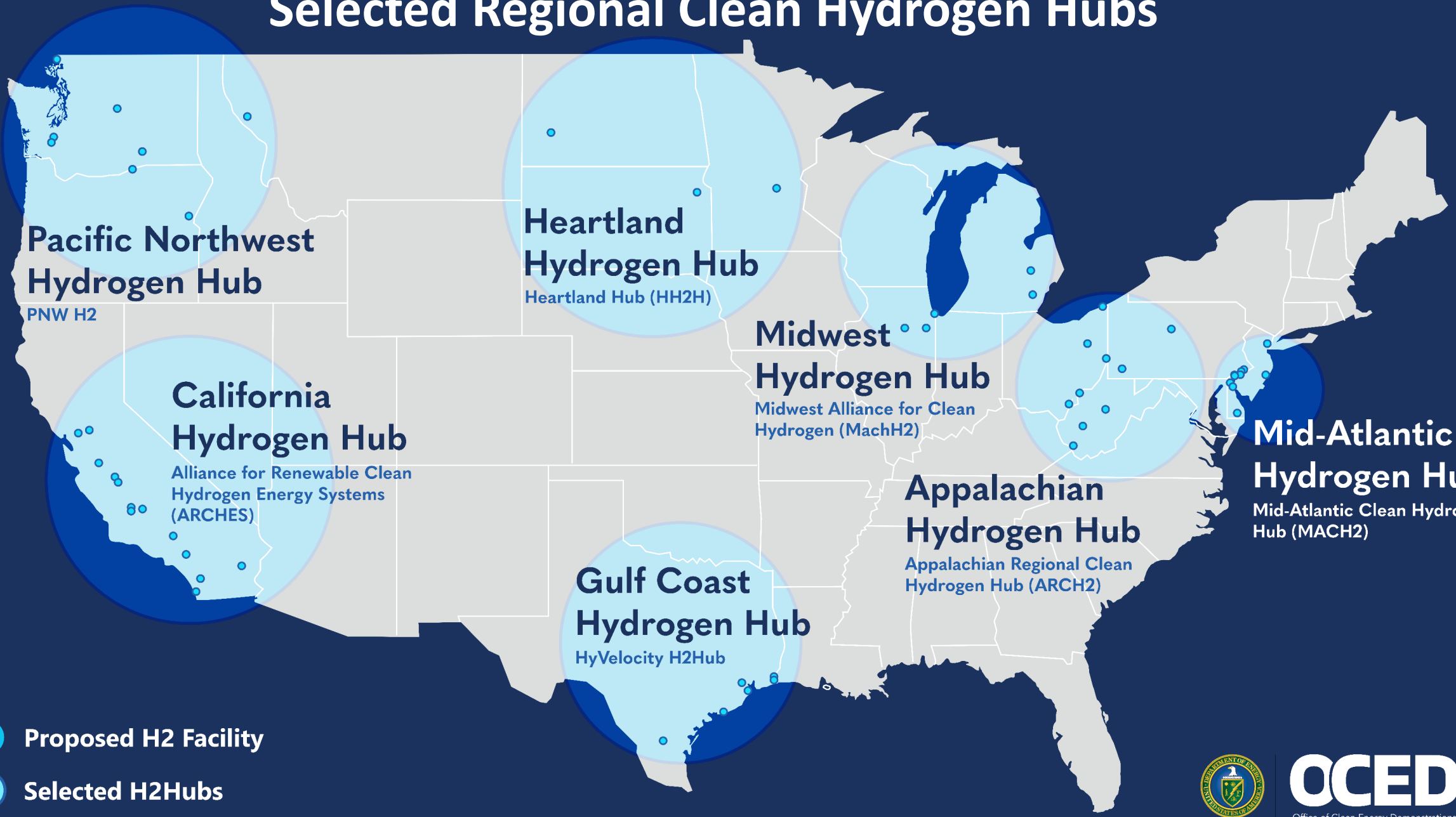
Clean Hydrogen Pathways to Commercial Lift-Off Report

Additional DOE funding:
Clean H2 Electrolysis
Clean H2 Manufacturing and Recycling
(additional $1.5B)

U.S. National Clean Hydrogen Strategy and Roadmap



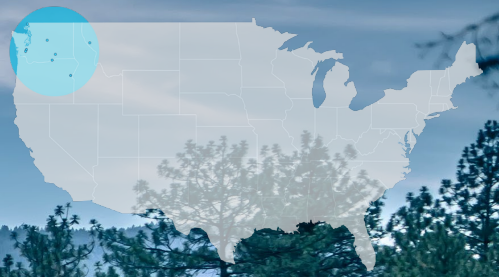
Selected Regional Clean Hydrogen Hubs



OCED
Office of Clean Energy Demonstrations

Pacific Northwest Hydrogen Hub

Hub: PNW H2



Project Overview

Prime Applicant:
Pacific Northwest Hydrogen Association

Locations:
Montana, Oregon, and Washington

Federal Cost Share:
Up to $1 Billion*

*Pending negotiations

Production

- Electrolysis

Connective Infrastructure

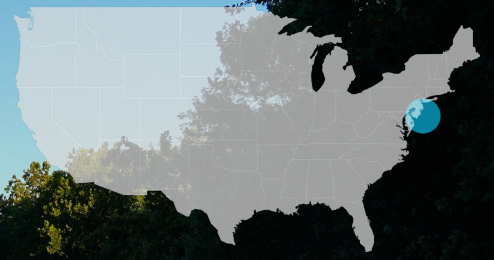
- Hydrogen pipeline
- Hydrogen refueling stations

End Uses

- Medium Duty/Heavy Duty trucking, transit buses, mining vehicles
- Ports
- Peaking plants / generators
- Refineries
- Data centers

Mid-Atlantic Hydrogen Hub

Hub: Mid-Atlantic Clean Hydrogen Hub (MACH2)



Project Overview

Prime Applicant:
Mid-Atlantic Clean Hydrogen Hub, Inc.

Locations:
Delaware, New Jersey, Pennsylvania

Federal Cost Share:
Up to $750 Million*

*Pending negotiations

Production

- Electrolysis
- Biomass with carbon capture and storage

Connective Infrastructure

- Hydrogen pipeline infrastructure
- Hydrogen refueling stations
- Truck loading facility

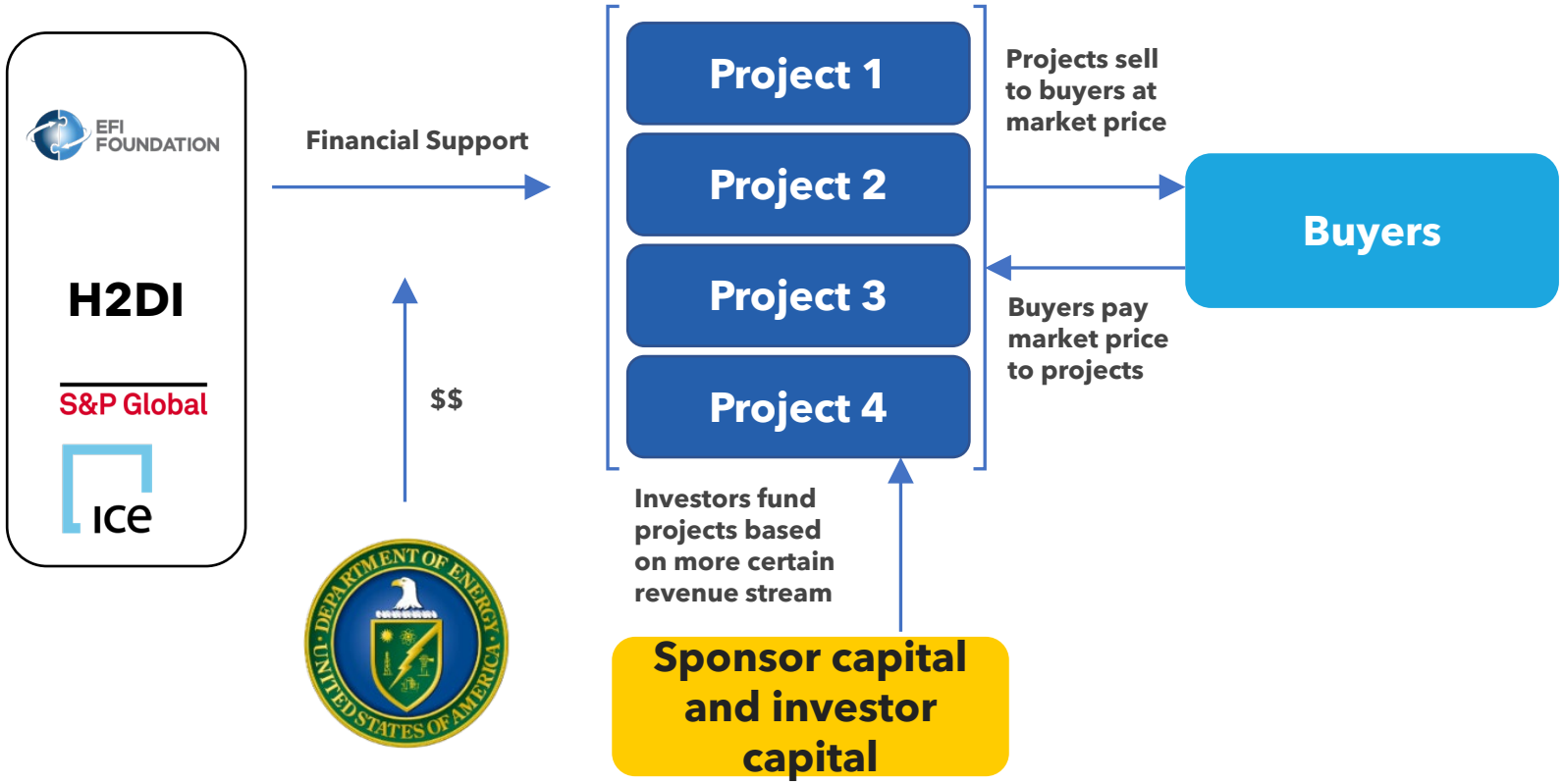
End Uses

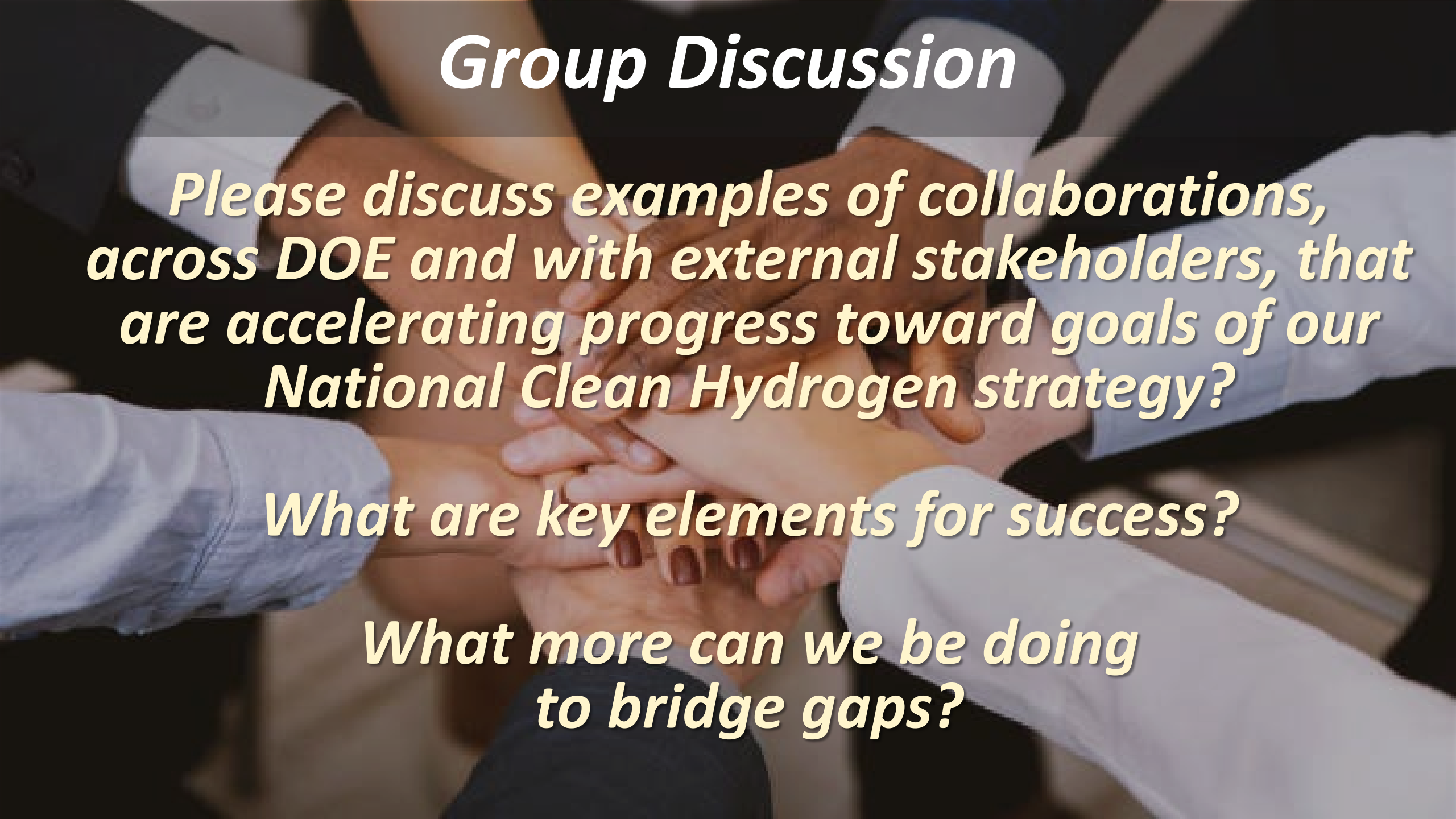
- Heavy duty vehicles
- Material and cargo handling
- Power generation
- Combined heat and power

Demand Signal Needed for Market Certainty

January 2024, OCED announced the selection of the H2DI consortium, led by EFI Foundation, S&P, and ICE to support design of a demand-side program

Announcement kicks off a 6–9-month Design Phase to determine most catalytic demand-side mechanism





Group Discussion

Please discuss examples of collaborations, across DOE and with external stakeholders, that are accelerating progress toward goals of our National Clean Hydrogen strategy?

What are key elements for success?

What more can we be doing to bridge gaps?

Mahalo Nui Loa from Planet Earth…

Special thanks to all our Panelists, & to our Audience:

And Welcome to AMR!