The #H2IQ Hour

Welcome!

The #H2IQ Webinar will start shortly

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Learn more about the DOE Hydrogen Program

www.hydrogen.energy.gov

The #H2IQ Hour

Today's Topic: Overview of DOE Requests for Information Supporting Hydrogen Bipartisan Infrastructure Law Provisions, Environmental Justice, and Workforce Priorities

Sunita Satyapal, Dave Peterson, Colin Gore, Jesse Adams, Zac Taie, Monisha Shah,
Kendall Parker, Betony Jones

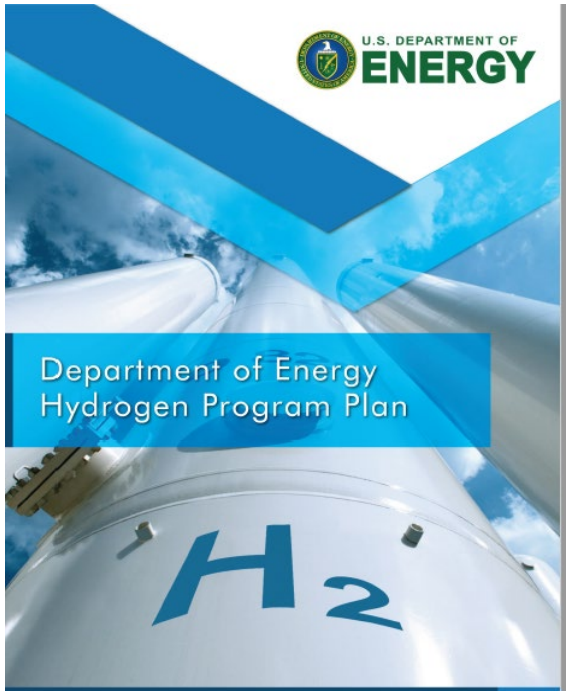
February 24, 2022

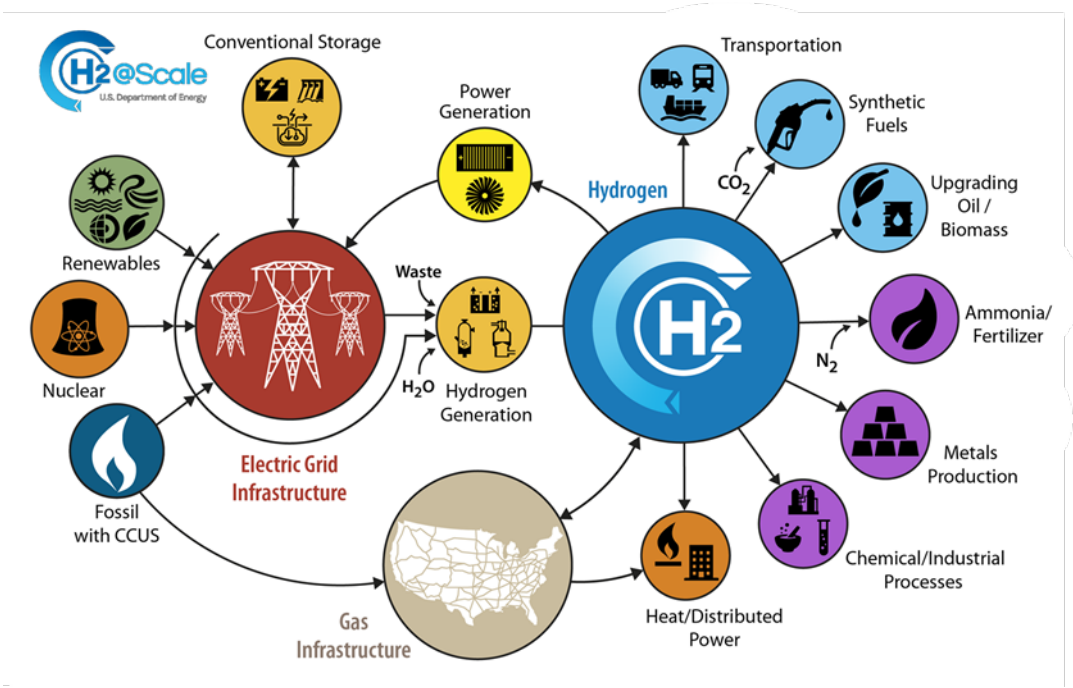
Agenda

1) DOE Hydrogen Program Background
2) Brief Overview of Bipartisan Infrastructure Law (BIL) Provisions
    - Electrolysis
    - Manufacturing, and Recycling RD&D
    - Hydrogen Hubs
3) Request for Information (RFI) Announcement Overview
    - Clean Hydrogen Manufacturing, Recycling, and Electrolysis RFI
    - Hydrogen Hubs Implementation Strategy RFI
    - H2 Matchmaker
4) Environmental Justice and Workforce Priorities
5) Summary and Next Steps

The U.S. DOE Hydrogen Program

Hydrogen is one part of a broad portfolio of activities





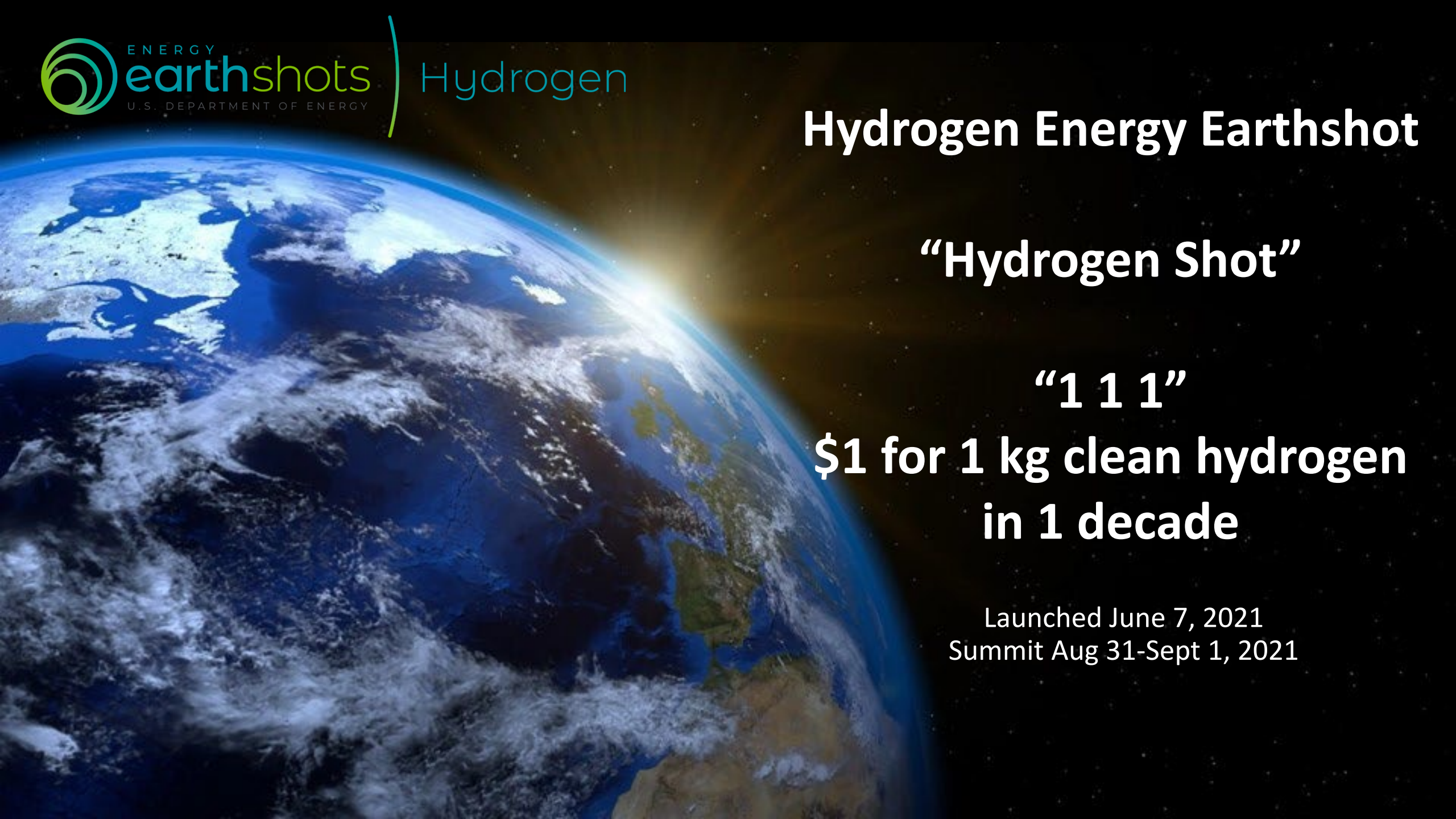
www.hydrogen.energy.gov

Coordinated across all relevant DOE Offices. Interagency Working Group coordinates across Agencies.

Priorities

1. **Low cost, clean hydrogen**
2. **Low cost, efficient, safe hydrogen delivery and storage**
3. **Enable end use applications at scale for impact**

Workforce development, safety, codes, standards, and Environmental Justice priorities



ENERGY earthshots | Hydrogen
U.S. DEPARTMENT OF ENERGY

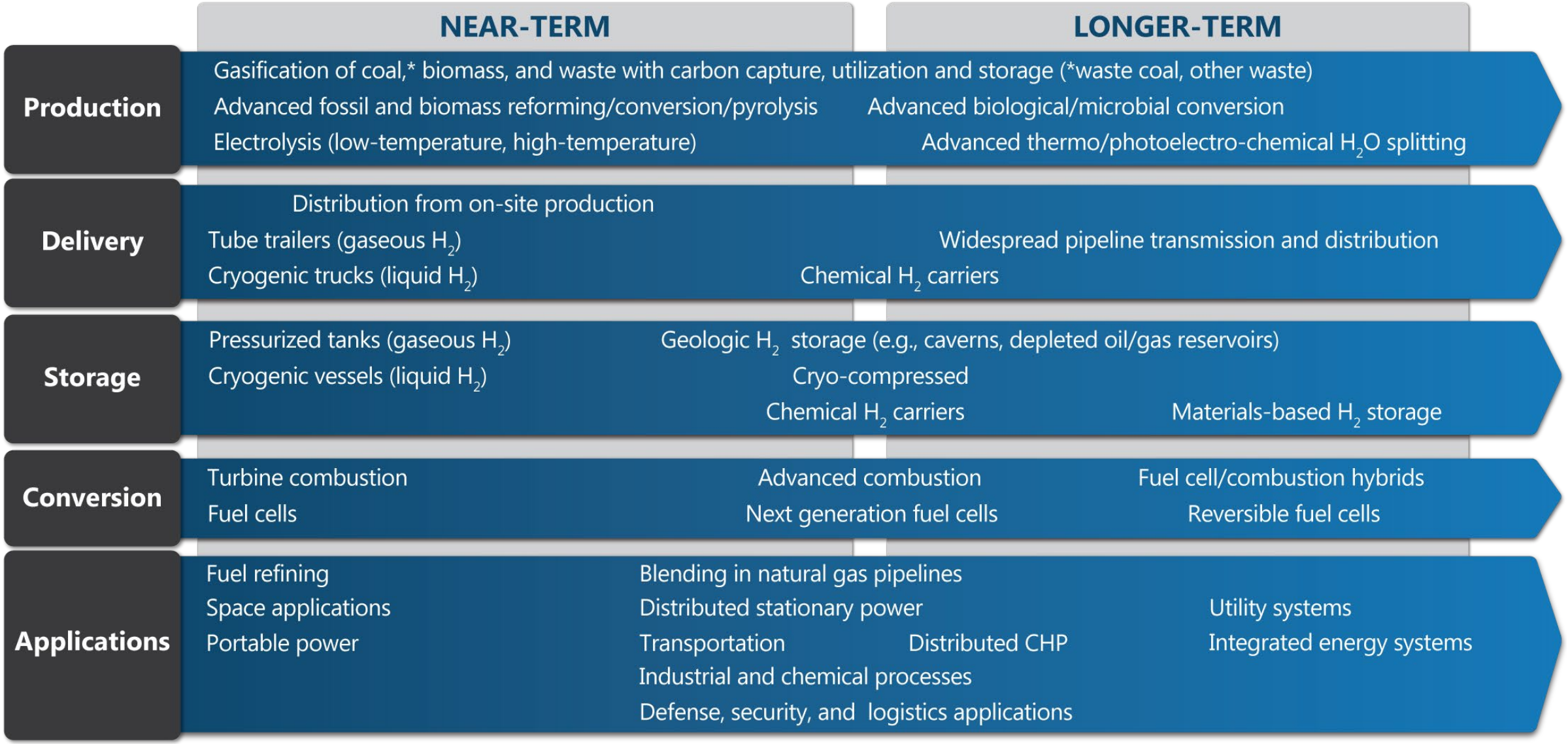
Hydrogen Energy Earthshot

"Hydrogen Shot"

"1 1 1"
$1 for 1 kg clean hydrogen in 1 decade

Launched June 7, 2021
Summit Aug 31-Sept 1, 2021

Hydrogen Program Areas of Focus across Multiple Offices



Bipartisan Infrastructure Law - Hydrogen Highlights

- **Covers $9.5B** for clean hydrogen:
  - $1B for electrolysis research, development and demonstration
  - $500M for clean hydrogen technology 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

- **Aligns with Hydrogen Shot priorities by directing work to reduce the cost of clean hydrogen to $2 per kilogram by 2026**
- **Requires developing a National Hydrogen Strategy and Roadmap**

Key BIL Sec. 40314 Hydrogen Provisions – Overview

Sec. 40314 (EPACT Sec 816): Clean Hydrogen Electrolysis Program; **$1 Billion over 5 years. Goal $2/kg by 2026**

“Clean Hydrogen Manufacturing and Recycling”

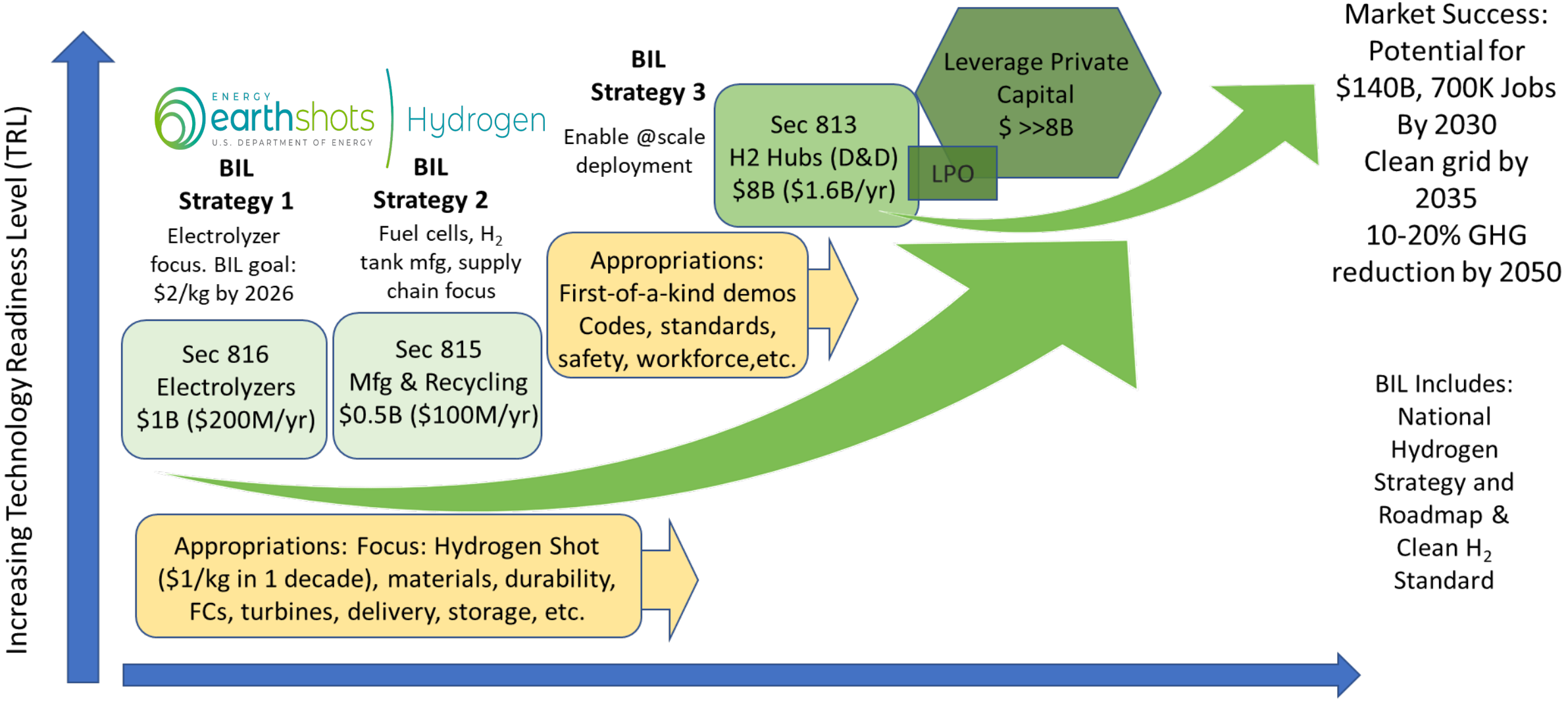
Focus on manufacturing and end of life/recycling RD&D

Sec. 40314 (EPACT Sec 815): Clean Hydrogen Manufacturing & Recycling **$0.5 Billion over 5 years**

Sec. 40314 (EPACT Sec 813): Regional Clean Hydrogen Hubs; **$8 Billion over 5 years**

Sec. 40314 (EPACT Sec 814: Strategy & Roadmap and **Sec. 40315 (EPACT Sec 822)**: Clean Hydrogen Production Qualifications)

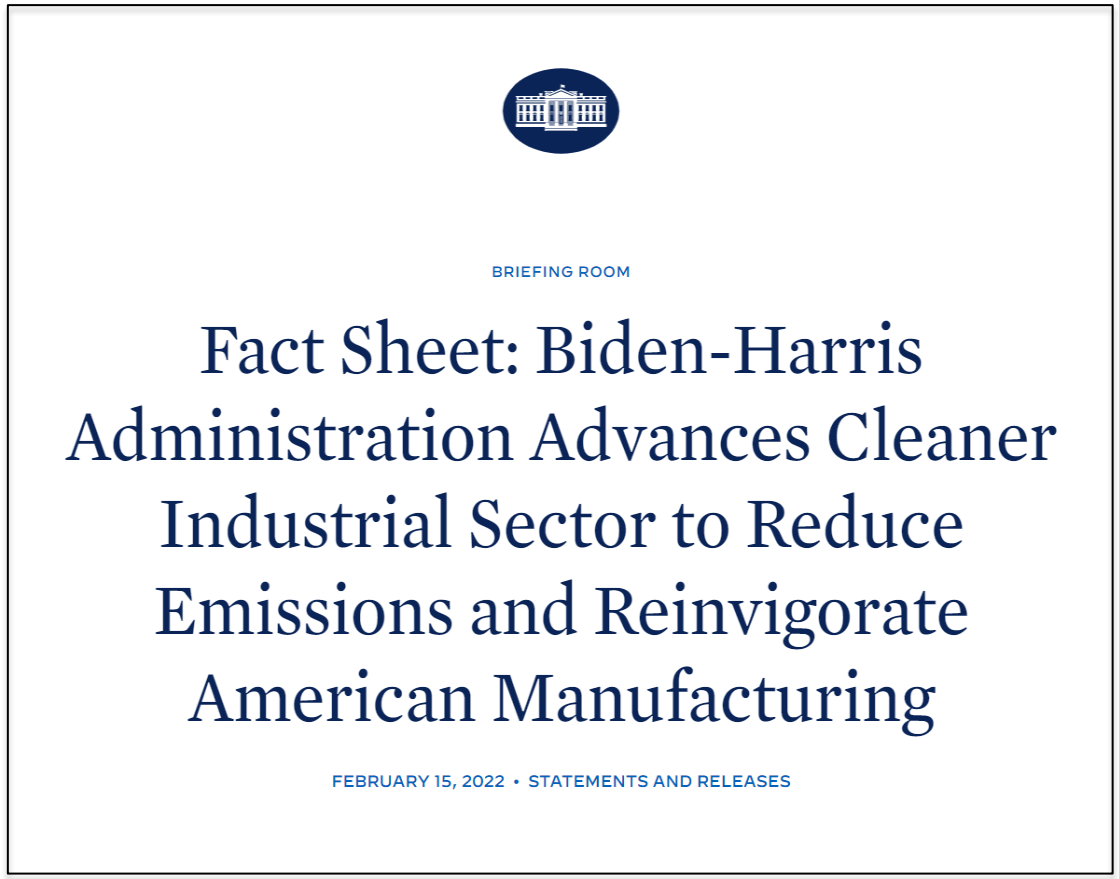
Strategy: BIL and Appropriations



LPO: Loan Prograı
D&D: Demonstration and Deployment
FCs: Fuel Cells

* Industry analysis; DOE analysis ongoing

White House Factsheet released February 15, 2022



BRIEFING ROOM

Fact Sheet: Biden-Harris Administration Advances Cleaner Industrial Sector to Reduce Emissions and Reinvigorate American Manufacturing

FEBRUARY 15, 2022 • STATEMENTS AND RELEASES

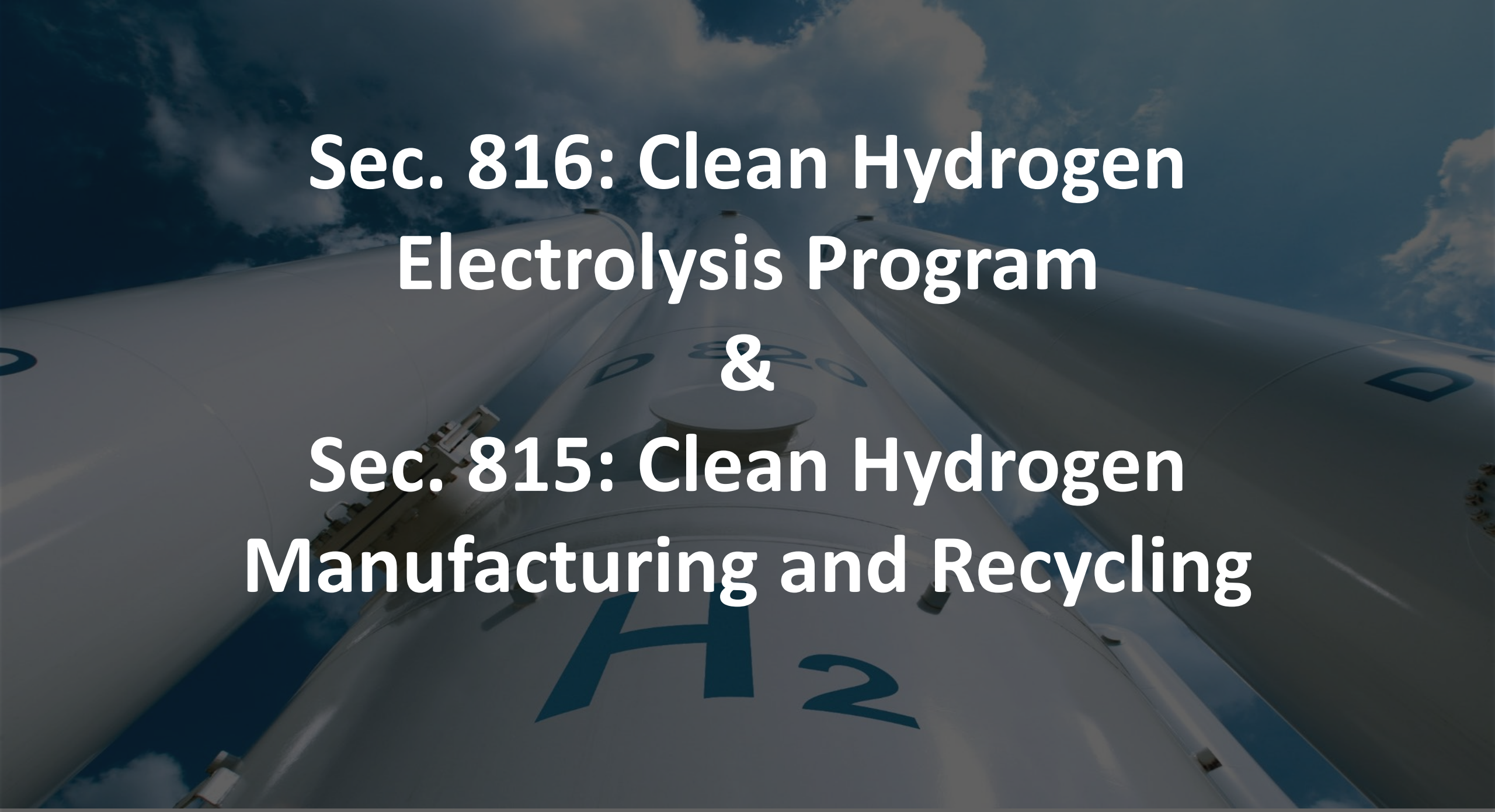
Covers "New Pro-Climate, Pro-Worker Actions Create Jobs and Harness the Bipartisan Infrastructure Law, Federal Purchasing Power, and Trade Policy", including:

- The Department of Energy is launching **major clean hydrogen initiatives of the Bipartisan Infrastructure Law**: $8 billion for Regional Clean Hydrogen Hubs that will create jobs to expand use of clean hydrogen in the industrial sector and beyond; $1 billion for a Clean Hydrogen Electrolysis Program to reduce costs of hydrogen produced from clean electricity; and $500 million for Clean Hydrogen Manufacturing and Recycling Initiatives to support equipment manufacturing and strong domestic supply chains.

Available at: www.whitehouse.gov/briefing-room/statements-releases/2022/02/15/fact-sheet-biden-harris-administration-advances-cleaner-industrial-sector-to-reduce-emissions-and-reinvigorate-american-manufacturing/

RFIs Supporting Hydrogen BIL Provisions

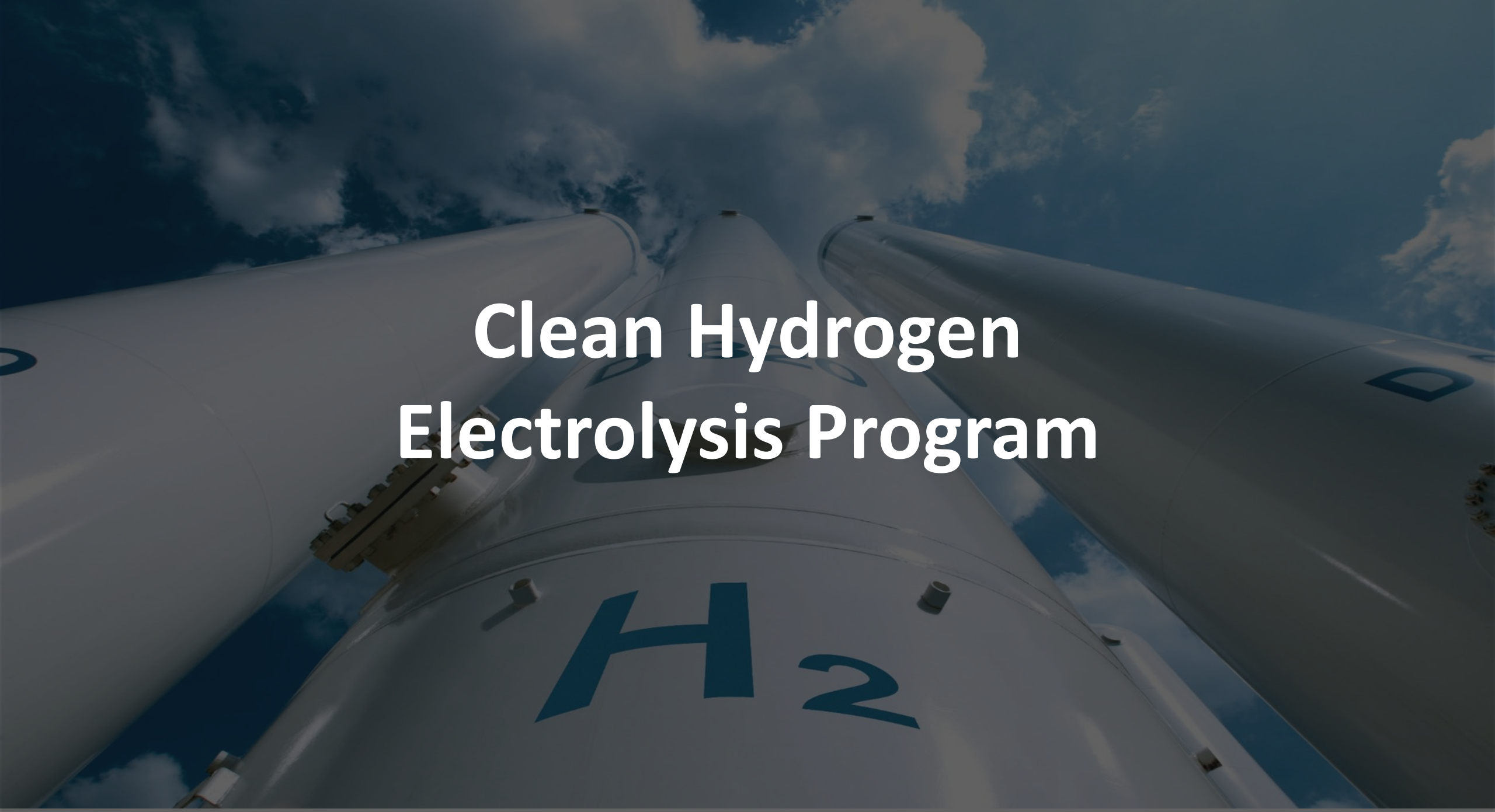
- Two Requests for Information Announced
  - Hydrogen Hubs Implementation Strategy RFI
    - Seeks public input on Regional Clean Hydrogen Hub Provisions and Requirements, Solicitation Process, FOA structure, and Implementation Strategy, Equity, Environmental and Energy Justice (EEEJ) Priorities, and Market Adoption and Sustainability of the Hubs
    - RFI (DE-FOA-0002664) available at https://eere-exchange.energy.gov/
    - **Due March 8, 2022, by 5pm ET**
  - Clean Hydrogen Manufacturing, Recycling, and Electrolysis RFI
    - Seeks input on priority areas that will advance domestic manufacturing and recycling of clean hydrogen technologies, including fuel cells, storage equipment, and other hydrogen related components
    - RFI (DE-FOA-0002698) available at https://eere-exchange.energy.gov/
    - **Due March 29, 2022, by 5pm ET**



Sec. 816: Clean Hydrogen Electrolysis Program
&
Sec. 815: Clean Hydrogen Manufacturing and Recycling

RFI: Clean Hydrogen Manufacturing, Recycling, and Electrolysis

- **RFI available at https://eere-exchange.energy.gov/ (DE-FOA-0002698)**
  - Clean Hydrogen Manufacturing Initiative and Clean Hydrogen Recycling RD&D Program (BIL Sec. 815)
  - Clean Hydrogen Electrolysis Program (BIL Sec. 816)
  - Buy American requirements and related employment considerations
- **Responses due no later than 5:00pm (ET) on March 29, 2022**
  - Responses must be submitted electronically to H2RFI@ee.doe.gov, with subject line "**Clean Hydrogen Manufacturing, Recycling, and Electrolysis RFI Response.**"
  - Responses must be provided as a Microsoft Word (.docx) or Adobe PDF (.pdf) attachment to the email, and no more than 15 pages.
  - Please copy and paste the RFI questions, including the question numbering, and use them as a template for your response.
  - **Respondents may answer as many or as few questions as they wish.**
- Information collected from this RFI will be used by DOE for planning purposes
- Information collected will not be published, but confidential/proprietary information should not be submitted



Clean Hydrogen Electrolysis Program

SEC. 816. Clean Hydrogen Electrolysis Program

(a) DEFINITIONS.—In this section:

(1) ELECTROLYSIS.—The term ‘electrolysis’ means a process that uses electricity to split water into hydrogen and oxygen.

(2) ELECTROLYZER.—The term ‘electrolyzer’ means a system that produces hydrogen using electrolysis.

(3) PROGRAM.—The term ‘program’ means the program established under subsection (b).

(b) ESTABLISHMENT.—**Not later than 90 days** after the date of enactment of the Infrastructure Investment and Jobs Act, the Secretary **shall establish a research, development, demonstration, commercialization, and deployment program** for purposes **of commercialization to improve the efficiency, increase the durability, and reduce the cost of producing clean hydrogen using electrolyzers**.

SEC. 816. Clean Hydrogen Electrolysis Program continued

(c) GOALS.—The goals of the program are—

(1) to **reduce the cost of hydrogen produced using electrolyzers to less than $2 per kilogram of hydrogen by 2026**; and

(2) any other goals the Secretary determines are appropriate.

(d) DEMONSTRATION PROJECTS.—In carrying out the program, the Secretary shall fund demonstration projects—

(1) to demonstrate technologies that produce clean hydrogen using electrolyzers; and

(2) to **validate information on the cost, efficiency, durability, and feasibility of commercial deployment** of the technologies described in paragraph (1).

SEC. 816. Clean Hydrogen Electrolysis Program continued

(e) FOCUS.—The program shall focus on research relating to, and the development, demonstration, and deployment of—

(1) low-temperature electrolyzers, **including liquid-alkaline electrolyzers, membrane-based electrolyzers, and other advanced electrolyzers**, capable of converting intermittent sources of electric power to clean hydrogen with enhanced efficiency and durability;

(2) **high-temperature electrolyzers** that combine electricity and heat to improve the efficiency of clean hydrogen production;

(3) advanced **reversible fuel cells** that combine the functionality of an electrolyzer and a fuel cell;

(4) new highly active, selective, and durable electrolyzer **catalysts and electro-catalysts** that—

(A) greatly reduce or eliminate the need for platinum group metals; and

(B) enable electrolysis of complex mixtures with impurities, including seawater;

(5) modular electrolyzers for distributed energy systems and the bulk-power system (as defined in section 215(a) of the Federal Power Act (16 U.S.C. 824o(a)));

SEC. 816. Clean Hydrogen Electrolysis Program continued

(6) **low-cost membranes or electrolytes and separation materials** that are durable in the presence of impurities or seawater;

(7) improved component design and material integration, including with respect to **electrodes, porous transport layers and bipolar plates, and balance-of-system components**, to allow for **scale-up and domestic manufacturing** of electrolyzers **at a high volume**;

(8) clean hydrogen **storage technologies**;

(9) technologies that **integrate hydrogen production with**—

(A) clean hydrogen **compression and drying technologies**;

(B) clean hydrogen **storage**; and

(C) **transportation or stationary systems**; and

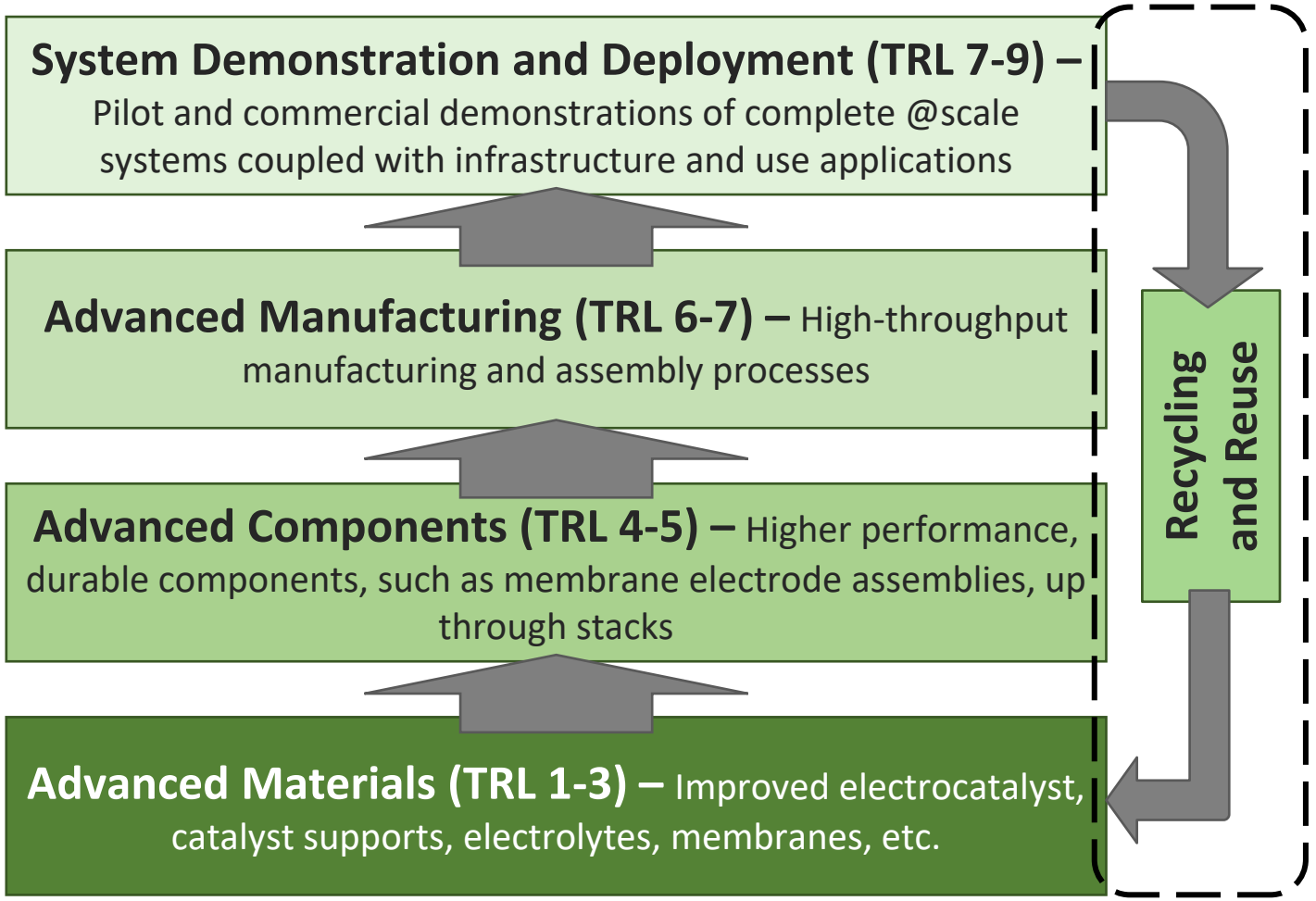
(10) **integrated systems** that combine hydrogen **production with renewable power or nuclear power** generation technologies, including **hybrid systems with hydrogen storage**.

RFI: Clean Hydrogen Electrolysis Program

- This RFI seeks input on:
  - Innovations needed for electrolyzer materials and components and their integration into cells/stacks for the various electrolyzer technologies
  - Balance-of-system components needs including hydrogen storage, power electronics, etc.
  - Electrolyzer demonstration projects, including systems integrated with different clean power sources and end-use applications
  - Domestic electrolyzer manufacturing
  - National electrolyzer testing facilities
  - Environmental justice, diversity, equity, and inclusion
  - Program structure
  - Buy American requirements (Part III of RFI)
- Information collected will be used by DOE for planning purposes to develop the Clean Hydrogen Electrolysis Program. The information collected will not be published.

Feedback requested across RDD&D

The Clean Hydrogen Programs within the Bipartisan Infrastructure Law allow for inclusion of the complete development and deployment lifecycle for electrolysis technologies



Sec. 815. Clean Hydrogen Manufacturing and Recycling Program

TRL: Technology Readiness Level

Clean Hydrogen Manufacturing and Recycling

Section 815a: Clean Hydrogen Manufacturing Initiative

Research, development and demonstration projects to advance new clean H_2 delivery**, storage and use equipment <u>manufacturing technologies and techniques</u>**.

The Secretary, to the maximum extent practicable, shall give priority to clean hydrogen equipment manufacturing projects that—

A. Increase efficiency and cost-effectiveness in—

i. the **manufacturing process**; and

ii. the use of resources, **including existing energy infrastructure**;

B. Support **domestic supply chains** for materials and components;

C. Identify and incorporate nonhazardous **alternative materials** for components and devices;

D. Operate in partnership with tribal energy development organizations, **Indian Tribes, Tribal orgs., Native Hawaiian community**-based organizations, **or territories or freely associated States**; or

E. Are located in **economically distressed areas** of the major natural gas-producing regions of the US

Section 815b: Clean H_2 Tech Recycling RD&D Program

Multiyear grants will be awarded for RD&D projects **to create innovative and practical approaches to increase the reuse and recycling** of clean H_2 tech.

Including by:

A. Increasing the efficiency and **cost-effectiveness of the recovery of raw materials** from clean hydrogen technology components and systems, including enabling technologies such as electrolyzers and fuel cells;
B. **Minimizing environmental impacts** from the recovery and disposal processes
C. addressing any barriers to the research, development, demonstration, and commercialization **of technologies and processes for the disassembly and recycling of devices** used for clean hydrogen production, processing, delivery, storage, and use
D. Developing **alternative materials, designs, manufacturing processes,** and other aspects of clean H_2 tech.
E. Developing alternative **disassembly and resource recovery** processes that enable efficient, cost-effective, and environmentally responsible disassembly of, and resource recovery from, clean hydrogen technologies; and
F. Developing strategies to increase consumer acceptance of, and participation in, **the recycling of fuel cells**.

Independent review of project progress no later than 3 years after H.R. 3684 is enacted, and at least every 4 years after that.

RFI: Clean Hydrogen Manufacturing and Recycling

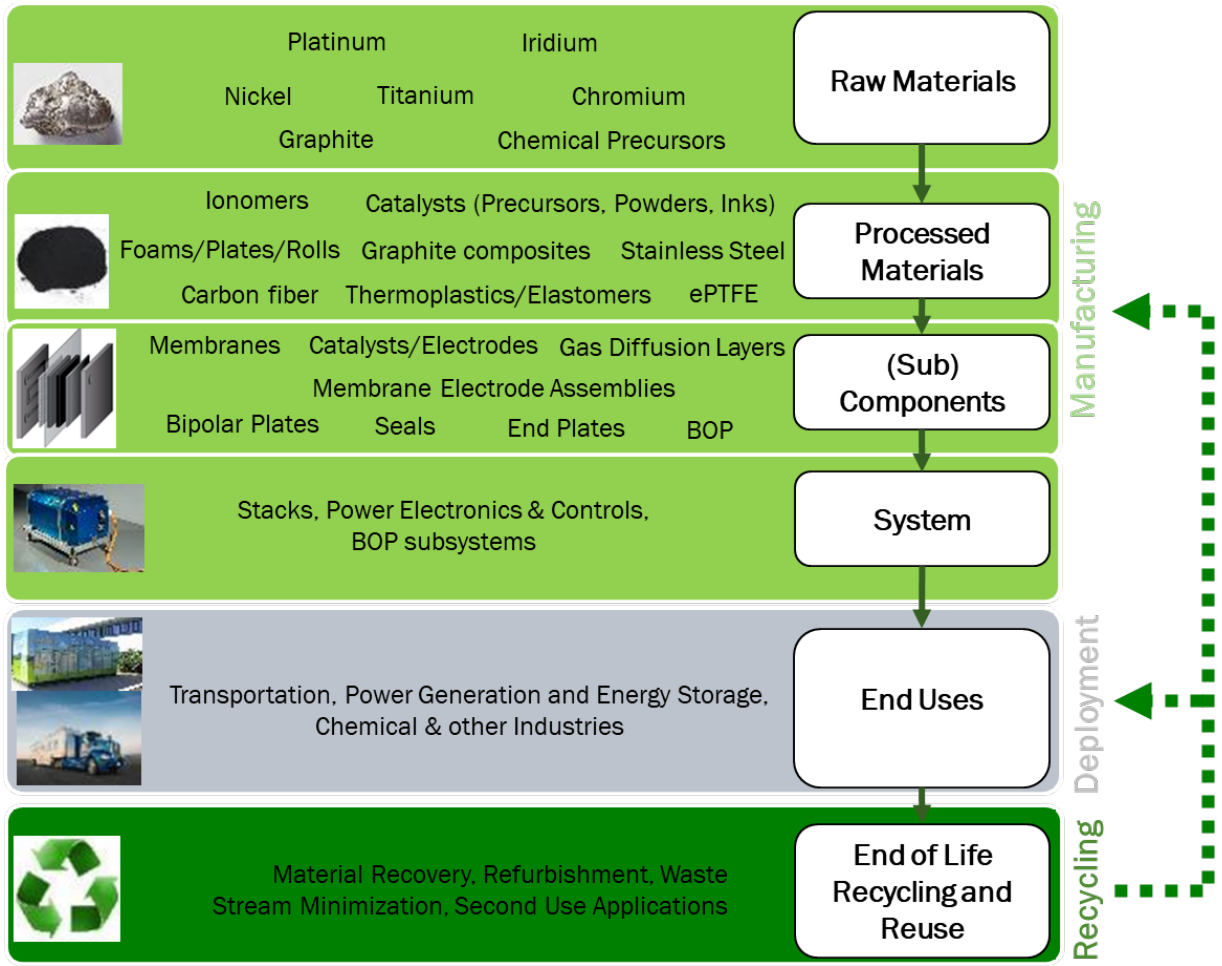
RFI seeks feedback from industry, academia, research laboratories, government agencies, community groups, labor unions, energy users, environmental justice organizations, and other stakeholders regarding RD&D needs, critical barriers, or other activities needed in the following areas:

- New manufacturing technologies and techniques for clean hydrogen processing, delivery, storage and use equipment, including fuel cells
- Innovative and practical approaches to increase the reuse and recycling of clean hydrogen technologies
- Environmental justice, diversity, equity, and inclusion strategies, including significant and meaningful community engagement plans and workforce education and training strategies
- Buy American requirements and related employment considerations (in Part III of RFI)

Feedback Requested on Addressing Supply Chain Challenges

To meet 2050 decarbonization goals, clean H_2 technologies need to significantly grow (e.g., 1000 GW of electrolyzers vs. ~0.17 GW today) across the supply chain

Example: PEM fuel cell & electrolyzer supply chain



Key Manufacturing & Recycling Program opportunities:

- Reducing cost and increasing commercialization of clean H_2 technologies
- Development of domestic material supplies – including recycling and alternative non-hazardous materials
- Development of manufacturing capacity to meet projected H_2 demand
- Leadership on energy and environmental justice issues for a new industry

Request for Information – Clean Hydrogen Manufacturing, Recycling, and Electrolysis

- **RFI available at https://eere-exchange.energy.gov/ (DE-FOA-0002698)**
  - Clean Hydrogen Manufacturing Initiative and Clean Hydrogen Recycling RD&D Program (BIL Sec. 815)
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Regional Clean Hydrogen Hubs

Sec 40314 (EPACT Sec. 813): Regional Clean Hydrogen Hubs

Definition of Regional Clean Hydrogen Hub: "a network of clean hydrogen producers, potential clean hydrogen consumers, and connective infrastructure located in close proximity."

BIL's Stated Purpose: "Establish a program to support the development of at least 4 regional clean hydrogen hubs that -

(1) demonstrably aid the achievement of the **clean hydrogen production standard** developed under section 822(a);

(2) demonstrate the **production, processing, delivery, storage, and end-use** of **clean** hydrogen; and

(3) can be **developed into a national clean hydrogen network** to facilitate a clean hydrogen economy."

* Section 40315 of the BIL, amends EPACT 2005 to add Section 822 – Clean Hydrogen Production Qualifications
- Defines the term 'clean hydrogen' to mean hydrogen produced with a carbon intensity ≤ 2 kg CO_2e/kg H_2 at the site of production
- Following development of the initial standard, DOE (in consultation with the EPA and accounting for input from industry and other stakeholders) will determine whether the standard should be adjusted below 2 kg CO_2e/kg H_2.

Sec 40314 (EPACT Sec. 813): Regional Clean Hydrogen Hubs

- (A) FEEDSTOCK DIVERSITY —
  - at least 1 regional clean hydrogen hub using fossil fuels; 1 using renewables; 1 using nuclear
- (B) END-USE DIVERSITY — at least 1 with end use in
  - electric power generation sector;
  - industrial sector;
  - residential and commercial heating sector; and
  - transportation sector.
- (C) GEOGRAPHIC DIVERSITY —
  - be located in a different region of the United States; and
  - use energy resources that are abundant in that region.
- (D) HUBS IN NATURAL GAS-PRODUCING REGIONS—
  - at least 2 regional clean hydrogen hubs shall be located in the regions of the United States with the greatest natural gas resources.
- (E) EMPLOYMENT—
  - Prioritize those likely to create opportunities for skilled training and long-term employment to the greatest number of residents of the region.
- (F) ADDITIONAL CRITERIA—The Secretary may take into consideration other criteria that, in the judgment of the Secretary, are necessary or appropriate to carry out this title.

RFI: Regional Clean Hydrogen Hubs Implementation Strategy

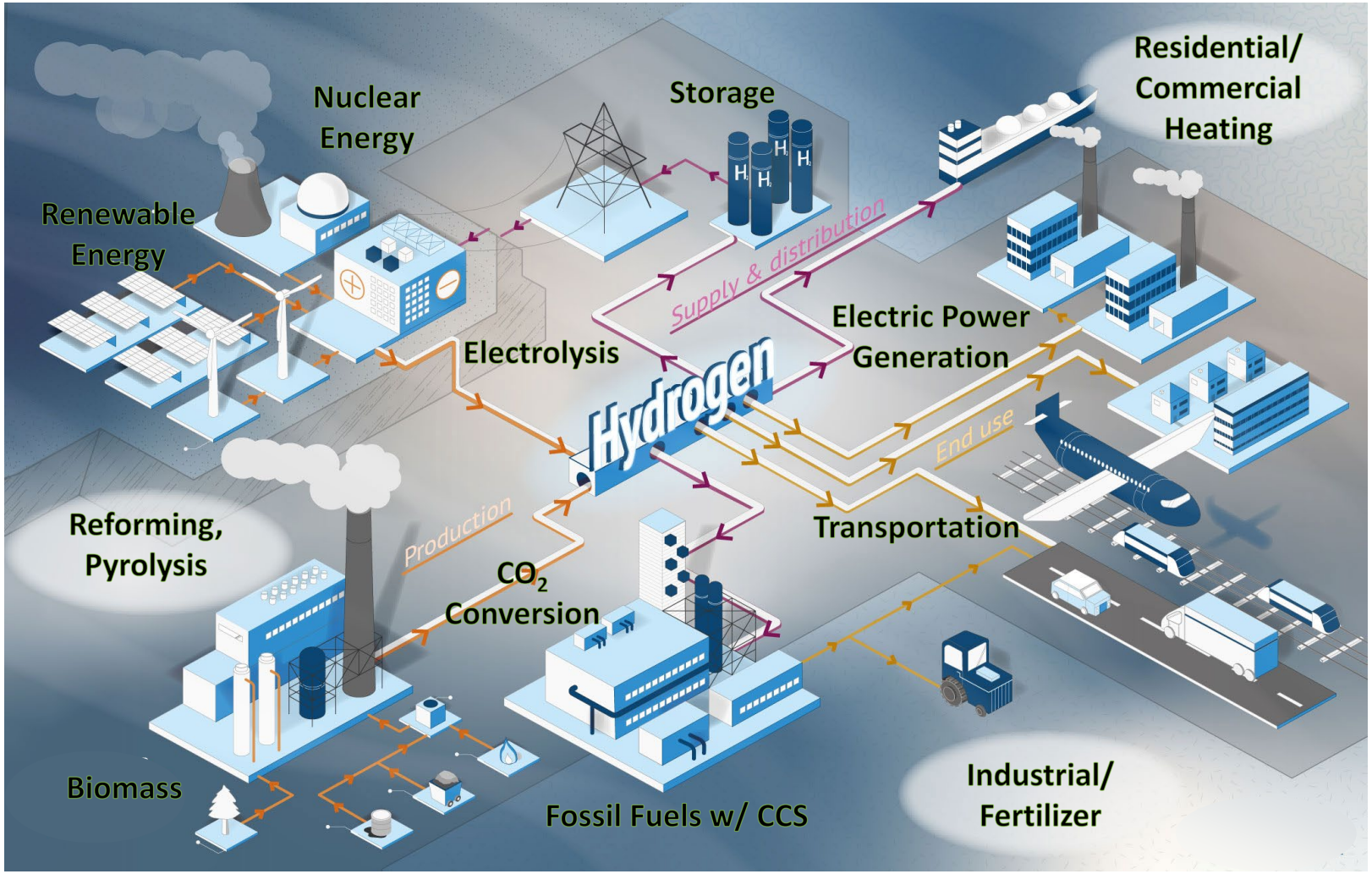
U.S. DEPARTMENT OF ENERGY

Purpose: Solicit feedback on issues related to the Regional Clean Hydrogen Hub Funding Opportunity Announcement (FOA) strategy

40 questions across key categories including:

- Regional Clean Hydrogen Hub Provisions and Requirements
- Solicitation Process, FOA structure, and Implementation Strategy
- Equity, Environmental and Energy Justice (EEEJ) Priorities
- Market Adoption and Sustainability of the Hubs

Hubs Enable Multiple Feedstocks and End Uses



H_2 Ecosystem: Potential for different clean H_2 production methods, end uses, and necessary infrastructure all in close proximity

Additional Key Items beyond H_2 Technology:

- Environmental Justice
- Community Engagement
- Job Creation
- Workforce Development
- Labor Standards
- Diversity, Equity, Inclusion
- Commercial Sustainability
- U.S. Manufacturing

H2 Hub FOA Concept Strategy

Provides flexibility and maximizes potential for success, recognizing regions are at different stages of development, providing opportunity for EJ, and Disadvantaged Communities (DAC) engagement

Launch #1: $4-5B

Phase 1: Hub Planning FY22-23

Analysis, Design, Financing, and NEPA planning*

- 8-12 awards ($1-$4M each)
- Go/no-go to advance to Phase 2

Phase 2: Hub Deployment (5+ years)

- 4-6 awards; $4-5B total DOE funding

Launch #2: $2-3B

Phase 1: Hub Planning FY23-24

Analysis, Design, Financing, and NEPA planning*

- 5-10 awards
- Go/no-go to advance to Phase 2

Phase 2: Hub Deployment (5+ years)

- 2-4 awards; $2-3B total DOE funding

Launch #3 & 4: $1-2B

Launch #3: >FY24

Launch #4: >FY25

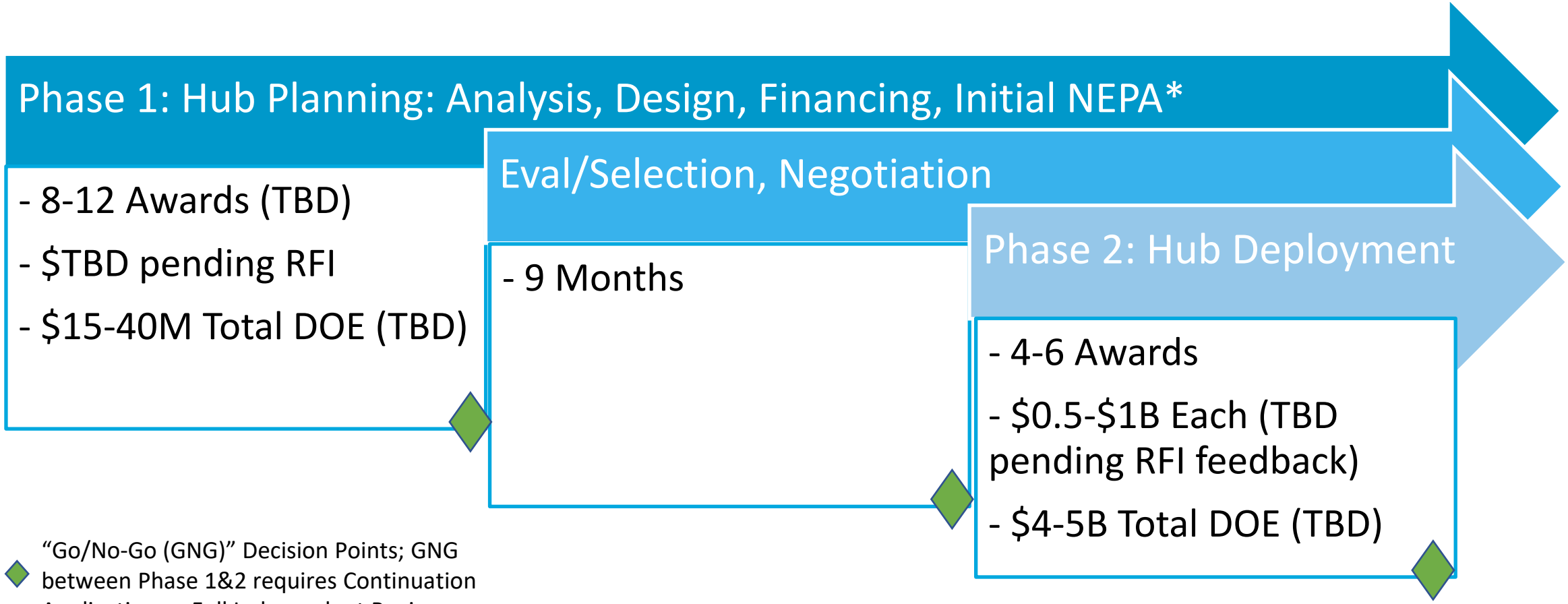
Add Supplemental Technologies to Existing Hubs

Total Funding: $8B (FY 2022 – FY 2026) in Office of Clean Energy Demonstrations

*Hub design phase supports DEI by providing funds for pre-hub planning and analysis

NEPA: National Environmental Policy Act

H2 Hub FOA Strategy: Launch #1, $4-5B (pending stakeholder input)



◆ "Go/No-Go (GNG)" Decision Points; GNG between Phase 1&2 requires Continuation Applications + Full Independent Review

Timeline allows flexibility for each project to be on own timeframe

*Hub design phase supports Diversity, Equity and Inclusion (DEI) – longer timeline option if needed

Potential H2 Hub FOA Strategy (DRAFT)

**All funding amounts are approximate and subject to change

"Go/No-Go" Decision Points

Stakeholder Engagement: Webinars, Workshops, H2 Matchmaker, RFI, Pre-Solicitation Meeting, etc.

H2 Hub Open FOA with annual close

Launch #1 $4-5B DOE Share

Phase 1: Hub Planning (3-18 months) → Eval/Select, Negotiation (9 months) → Phase 2: Hub Deployment (5+ years)

Phase 1: 8-12 awards; $1-4M DOE Share each (Total DOE funding $15-40M); non-Federal cost share % TBD

Phase 2: 4-6 awards $0.5-$1B each (Total DOE funding $4-5B); 50% non-Federal cost share required (i.e., $0.5B-$1B per project)

Launch #2 $2-3B DOE Share

Phase 1: Hub Planning (3-18 months) → Eval/Select, Negotiation (9 months) → Phase 2: Hub Deployment (5+ years)

Phase 1: 5-10 awards; $1-4M each (Total DOE funding $10-35M); non-Federal cost share % TBD

Phase 2: 2-4 awards $0.5-$1B each (Total DOE funding $2-3B); 50% non-Federal cost share required (i.e., $0.5B-$1B per project)

Launch #3 & 4 $1-$2B DOE

Add Supplemental Technologies to existing Hubs

Cross-cutting Support

Hub Implementation & Management (e.g., Data Collection / Impact Reports, Independent Engineering Firm, Reviewers, Lab Technical Assistance, etc.)

Other Potential Funding Mechanisms to Leverage Funds (e.g., Engagement with State & Local Gov., Tribes, etc.)

*Notional timeline – allows flexibility for each project to be on own timeframe

RFI - Regional Clean Hydrogen Hubs Implementation Strategy

- RFI (DE-FOA-0002664) available at https://eere-exchange.energy.gov/
- Responses due no later than 5:00pm (ET) on **March 8, 2022**
  - Submit responses to H2Hubs@hq.doe.gov (subject line "**H2Hubs RFI response**")
  - Provide as a Microsoft Word (.docx) or Adobe PDF (.pdf) attachment (no more than 15 pages – plus any additional pages necessary to include the original questions)
  - Please copy and paste the RFI questions, including the question numbering, and use them as a template for your response
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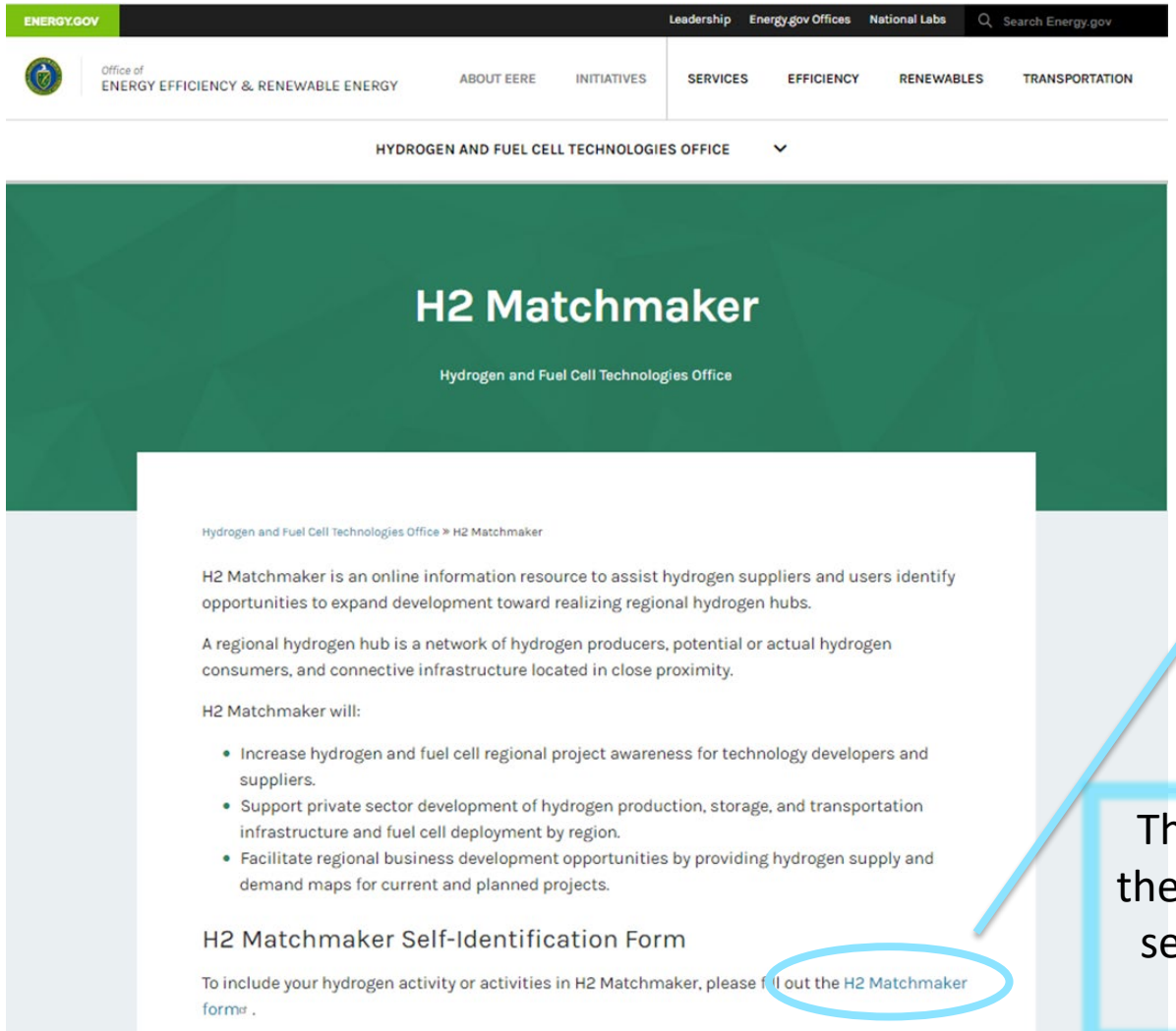
H2 Matchmaker

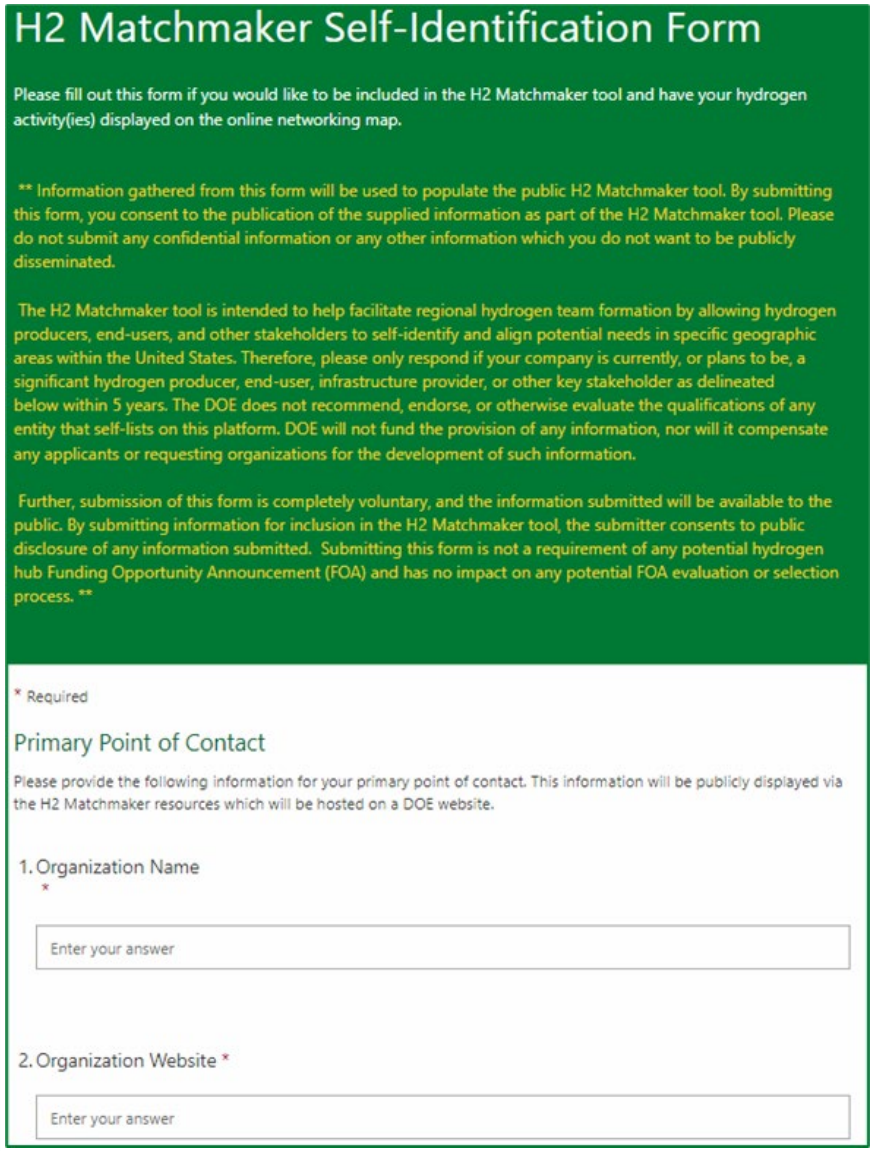
H2 Matchmaker

U.S. DEPARTMENT OF ENERGY

[Available at: www.energy.gov/eere/fuelcells/h2-matchmaker](www.energy.gov/eere/fuelcells/h2-matchmaker)

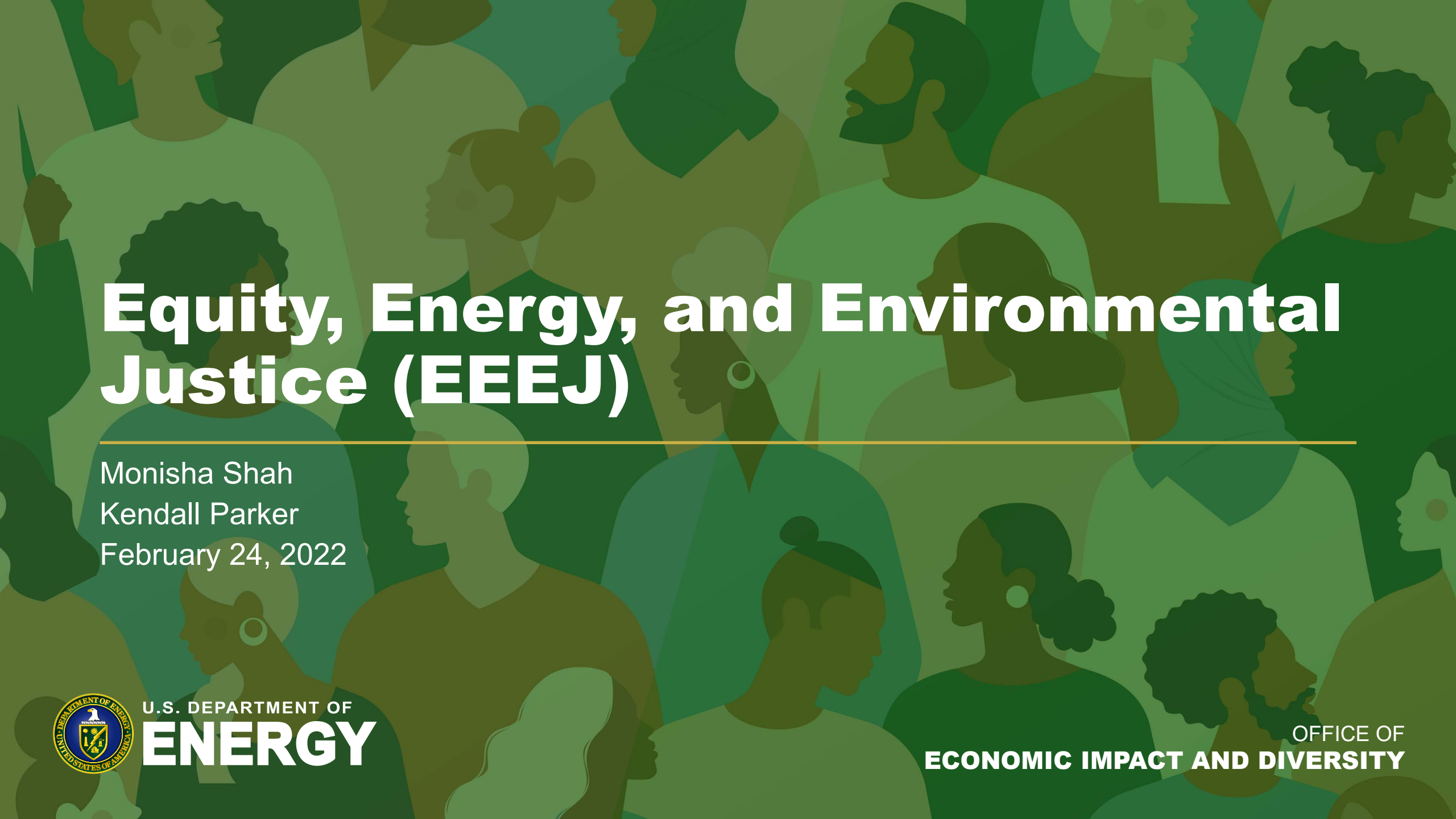


This link will open the H2 Matchmaker self-identification form.



H2 Matchmaker

Environmental Justice & Workforce Priorities



Equity, Energy, and Environmental Justice (EEEJ)

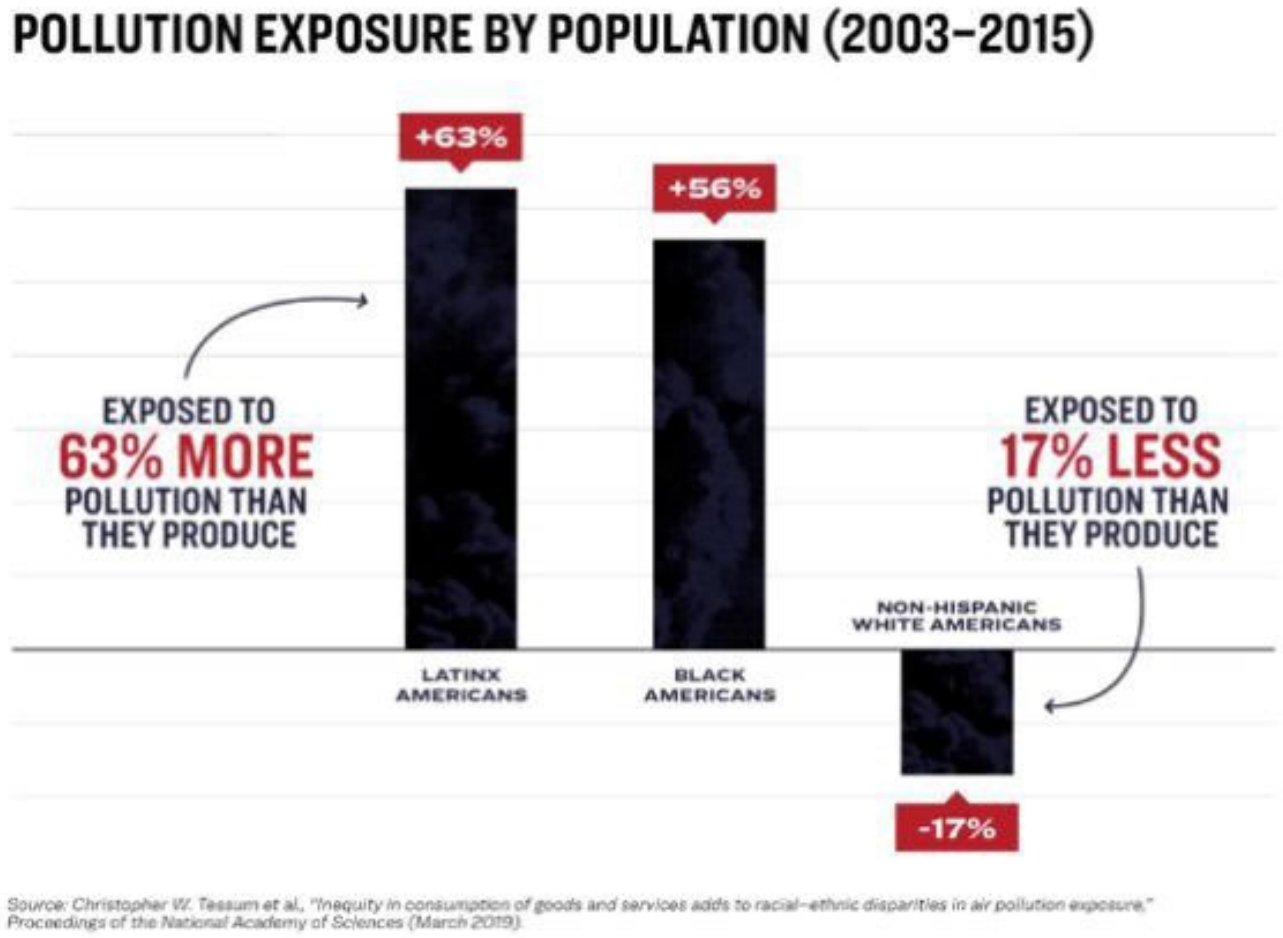
Monisha Shah
Kendall Parker
February 24, 2022

U.S. DEPARTMENT OF ENERGY

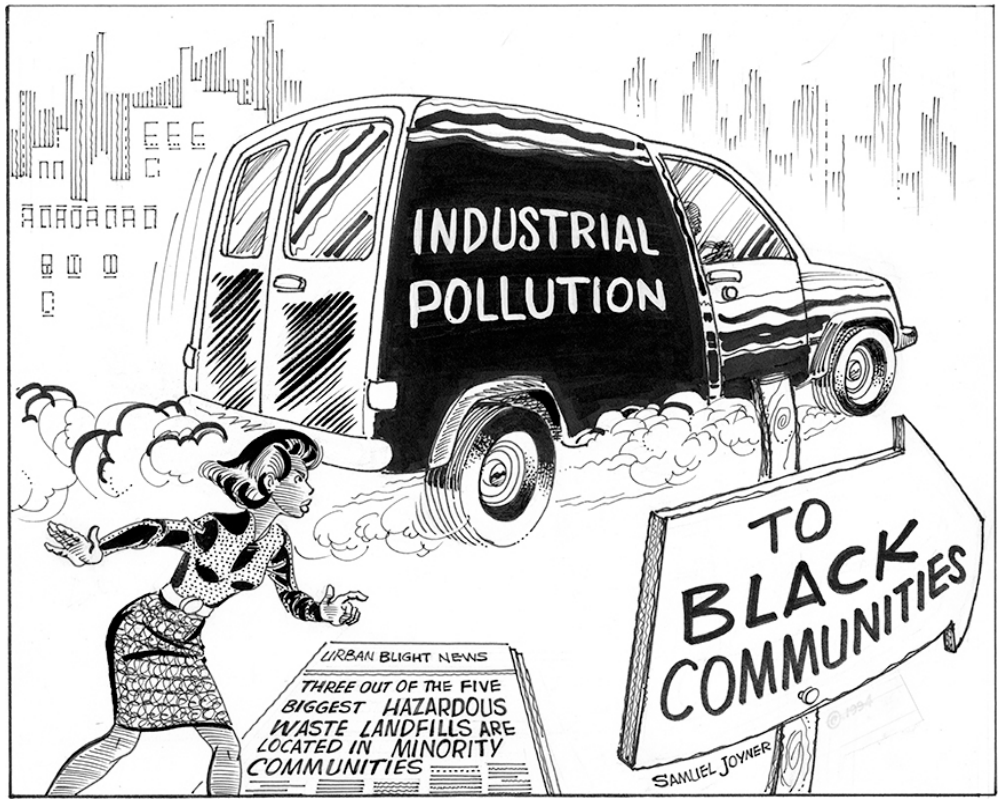
OFFICE OF ECONOMIC IMPACT AND DIVERSITY

Our Energy System Is Inequitable

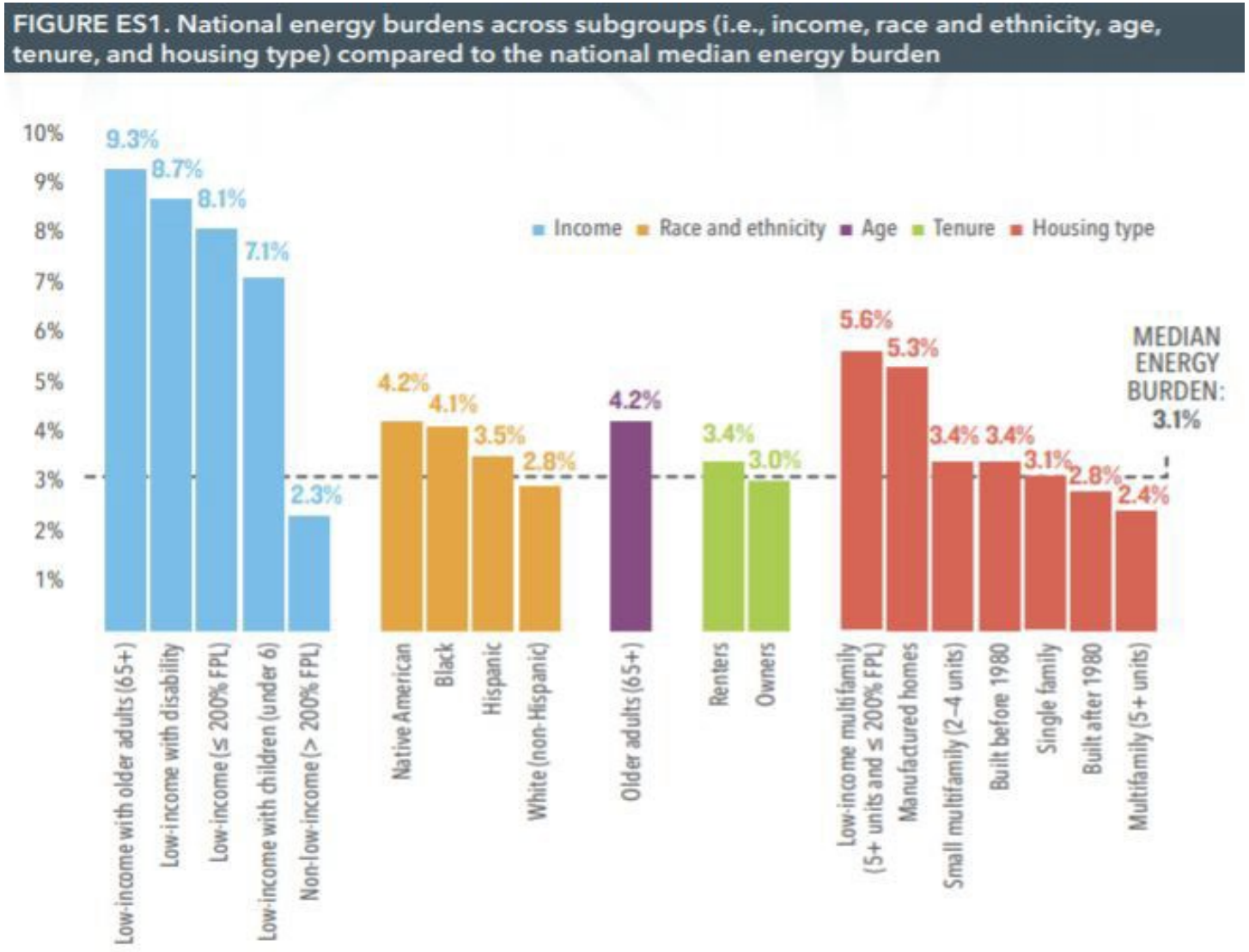
Black and Latino Communities are Exposed to More Pollution Than They Produce



Source: Christopher W. Tessum et al., "Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure," Proceedings of the National Academy of Sciences (March 2019).

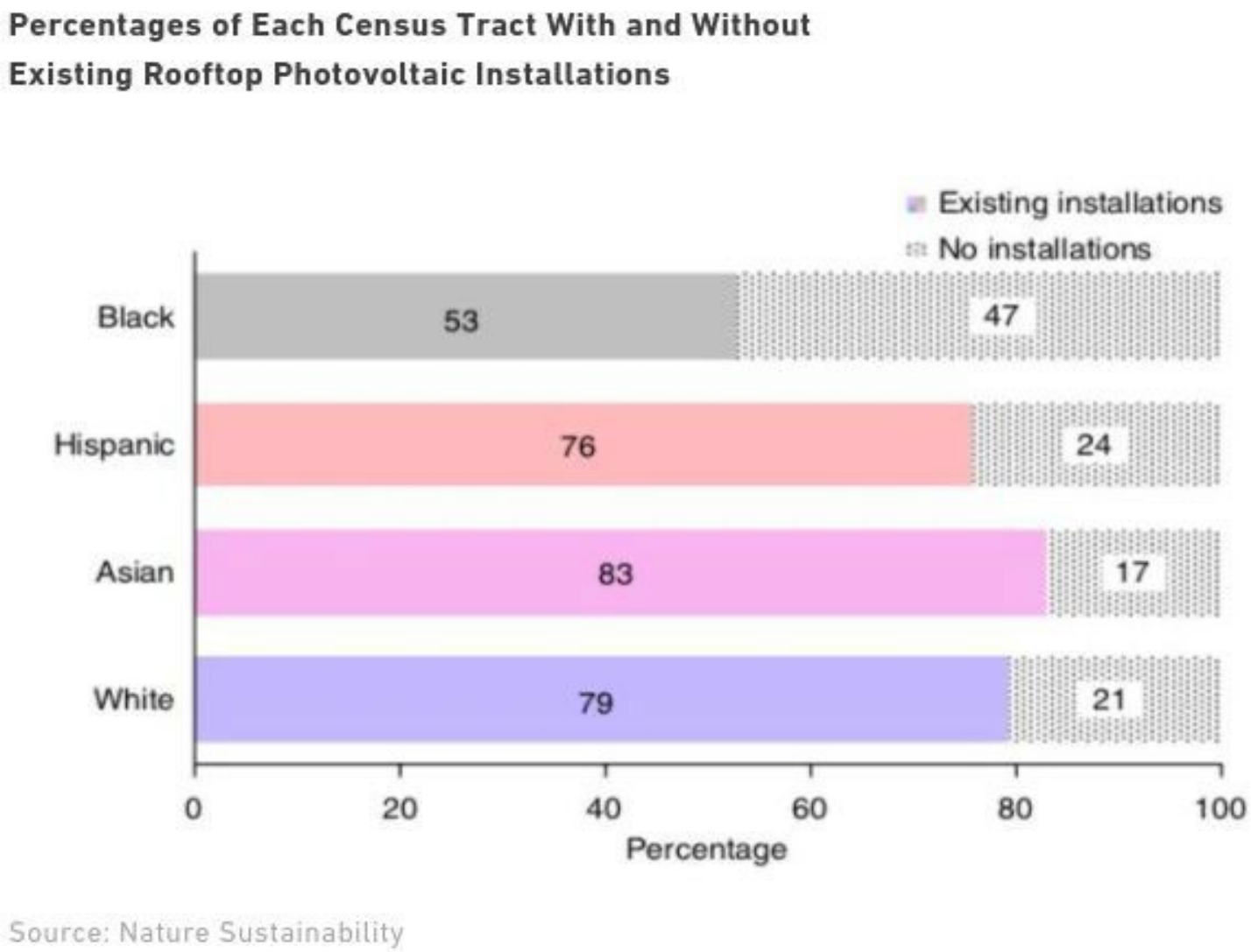


Energy is Also a Financial Burden on People of Color

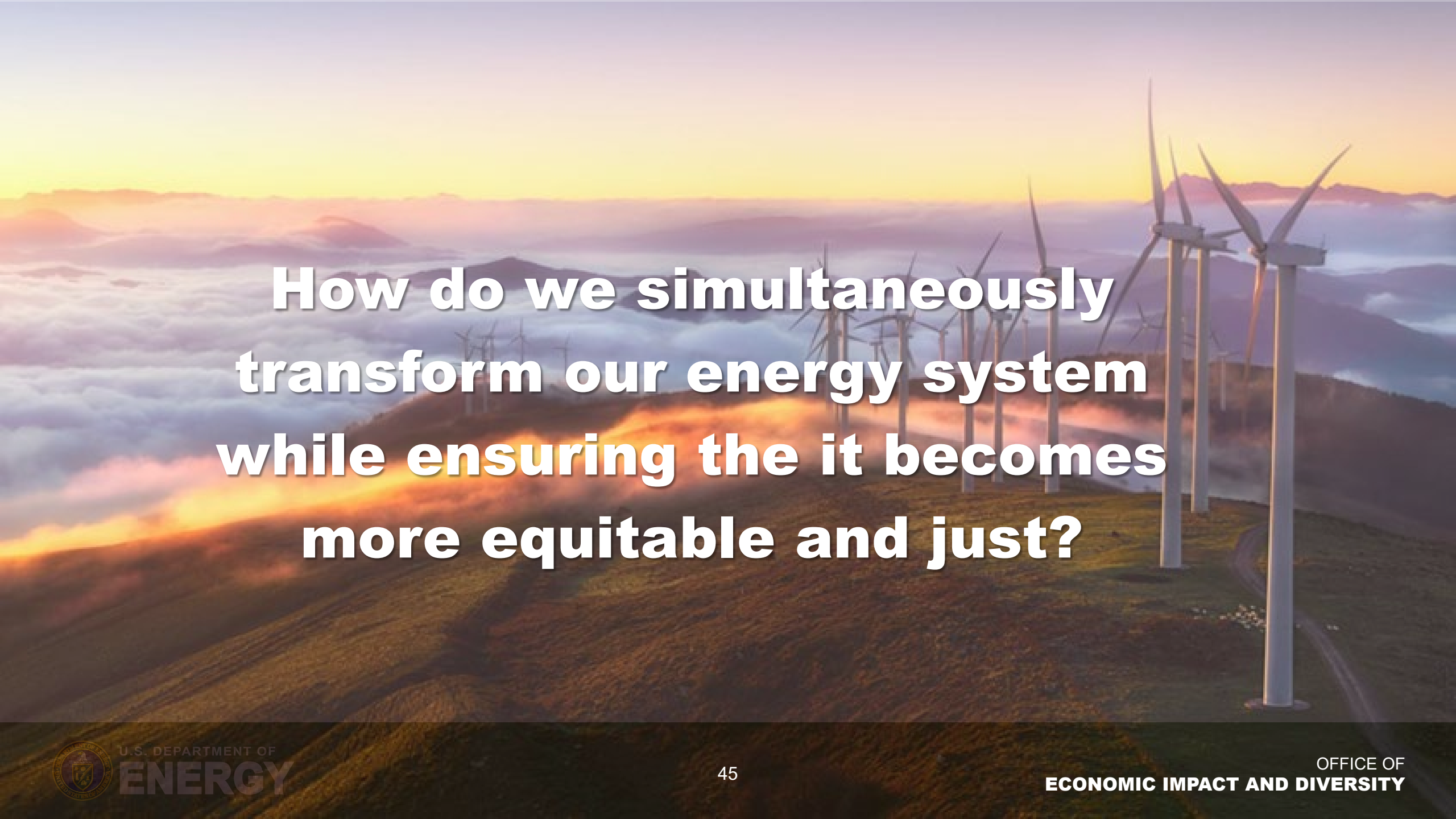


Source: "How High are Household Energy Burdens?" (Sep. 2020) - American Council for an Energy Efficient Economy

Means of Secure, Clean Energy are Inaccessible

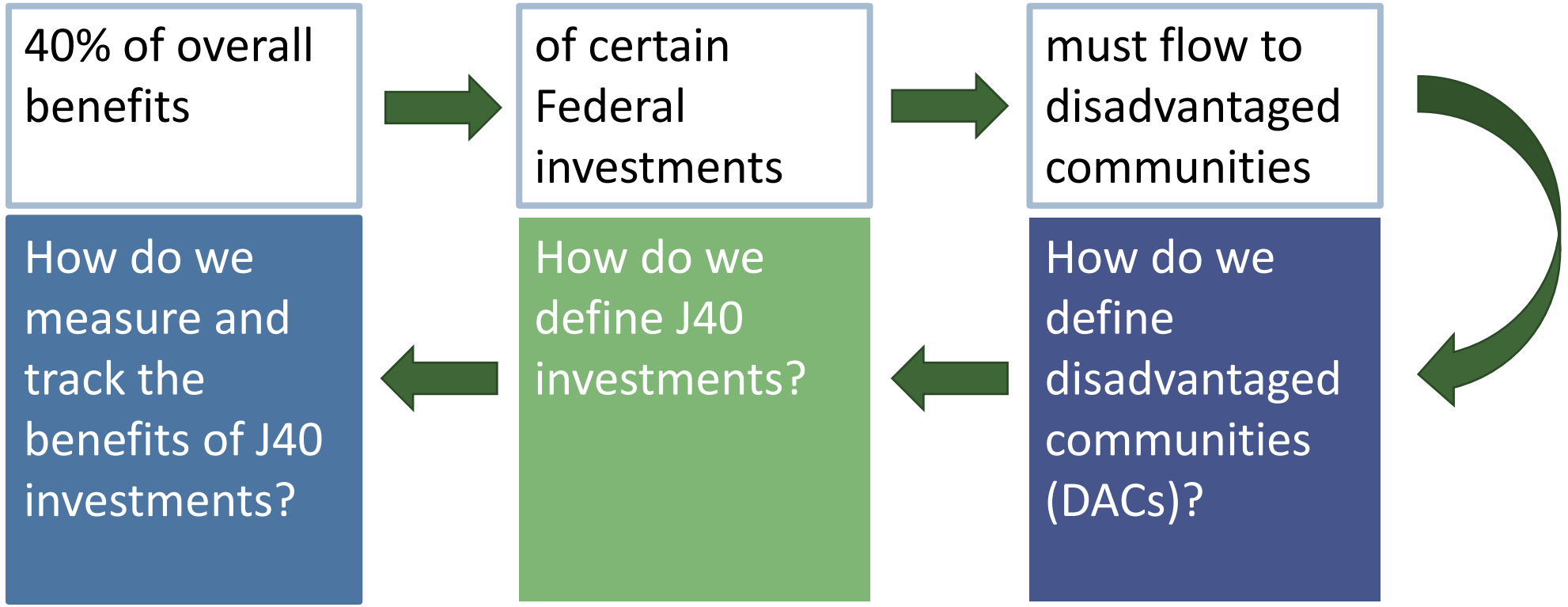


Source: Deborah, S; Castellanos, S. Kamen, D. M. "Disparities in rooftop photovoltaics deployment in the United States by race and ethnicity" (Jan. 2019)


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

Primary Elements of DOE Justice40

E.O. 14008, s. 223 - 40% of the overall benefits of certain Federal investments must flow to disadvantaged communities.
Interim Implementation Guidance for the Justice40 Initiative. https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf



What is covered in Justice40?

Covered Program

A Federal Government program that makes investments in one or more of the following seven areas:

- ✓ Climate change
- ✓ Clean energy and energy efficiency
- ✓ Clean transportation
- ✓ Affordable and sustainable housing
- ✓ Training and workforce development (related to climate, environment, clean energy, clean transportation, housing, water and wastewater infrastructure, and legacy pollution reduction, including in energy communities)
- ✓ Remediation and reduction of legacy pollution
- ✓ Critical clean water and waste infrastructure

Covered Investment

A Federal investment in one or more of the following categories:

- ✓ Federal grant and procurement spending (including discretionary budget authority, direct/mandatory spending, and formula funding);
- ✓ Financing (including credit, loans, and guarantees);
- ✓ Programmatic Federal staffing costs (e.g. federal pay for staff that provide technical assistance)
- ✓ Direct financial benefits (including provision of goods and services); and
- ✓ Additional federal investments under covered programs as determined by OMB.

DOE Interim DACs Definition

Disadvantaged communities

Current Thoughts:

- Census Tract Level
- 36 Indicators

VULNERABIILITY

FOSSIL DEPENDENCE

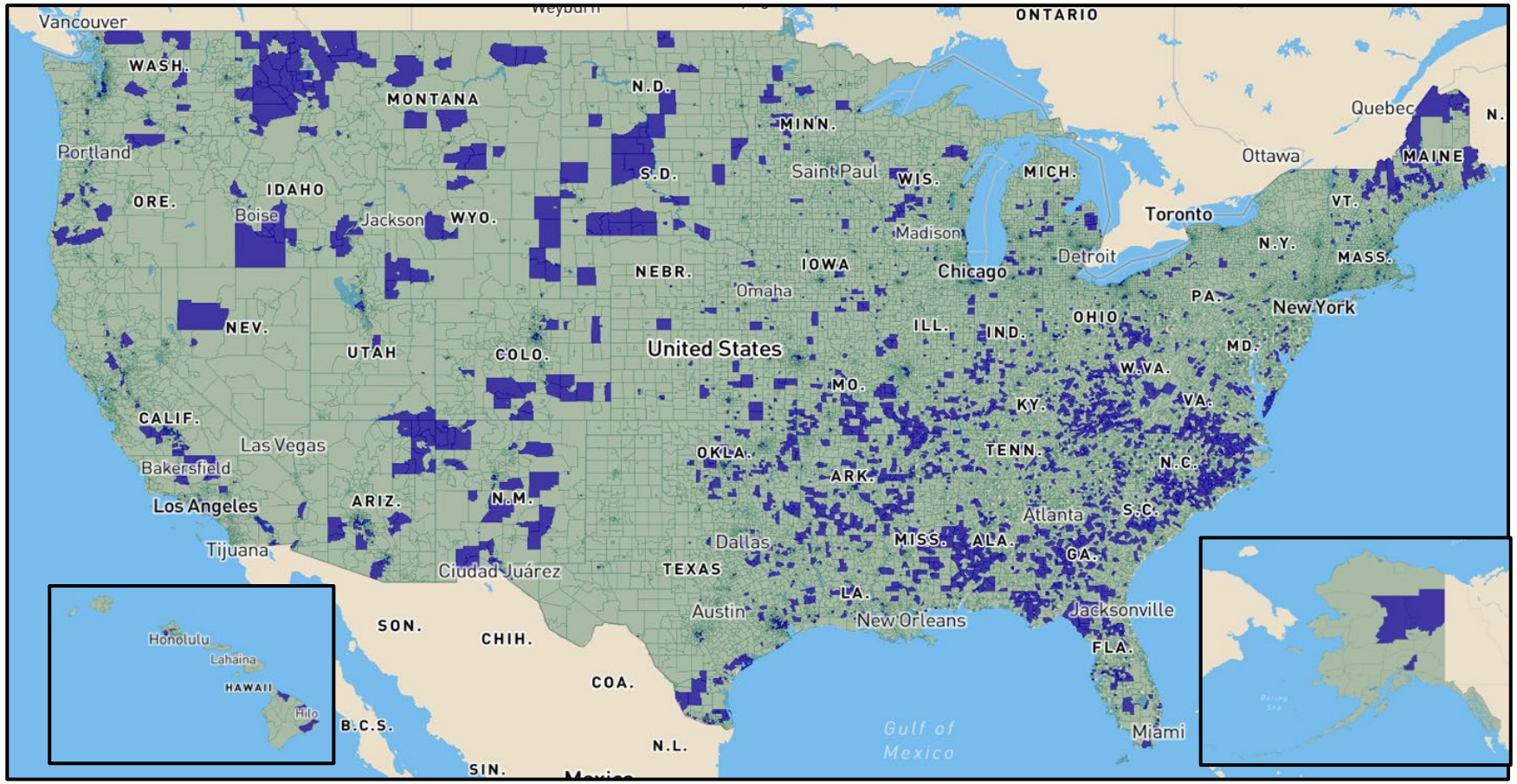
ENERGY BURDEN

ENVIRONMENTAL HAZARDS

Can also identify non-geographic DACs – groups that share a common characteristic

Distribution of census tracts identified as geographic DACs

DAC



DOE Justice40 Policy Priorities

1. Decrease energy burden in disadvantaged communities (DACs).
2. Decrease environmental exposure and burdens for DACs.
3. Increase parity in clean energy technology (e.g., solar, storage) access and adoption in DACs.
4. Increase access to low-cost capital in DACs.
5. Increase clean energy enterprise creation (MBE/DBE) in DACs.
6. Increase the clean energy job pipeline and job training for individuals from DACs.
7. Increase energy resiliency in DACs.
8. Increase energy democracy in DACs.

Justice40 and Hydrogen Provision in the BIL

- EEEJ Priorities are considered in hydrogen BIL implementation
  - Hub deployment will focus on both reducing harm and increasing benefits to DACs
- RFI responses will help gauge what strategies, policies, and practices will support EEEJ goals, including Justice40
- H2 Matchmaker is a tool for meaningful, sustainable stakeholder engagement
  - Stakeholders will be included in planning, decision-making, and implementation processes

U.S. DEPARTMENT OF ENERGY

Workforce Goals: Job Quality & Job Access

Betony Jones, Senior Advisor for Workforce

Office of Energy Efficiency and Renewable Energy

Executive Orders on Job Quality

1. White House Task Force on Worker Organizing and Empowerment Report to the President identifies executive branch policies, practices, and programs that can be used to support for worker power, worker organizing, and collective bargaining.
2. Made in America EO 14005 increases domestic content requirements on federal procurement, thus creating more manufacturing jobs.
3. Executive Order 14025 proclaims that the policy of the United States is to encourage worker organizing and collective bargaining and promote equality of bargaining power between employers and employees.
4. Executive Order 14008 on the whole of government approach to addressing the climate crisis, declares 9 times that it is the administration's policy to create well-paying union jobs. The EO also requires agencies to apply and enforce the Davis-Bacon Act and prevailing wage and benefit requirements.
5. Executive Order 14063 requires the federal government to require a project labor agreement ("PLA") before awarding any "large-scale construction contract"
6. Also working with the U.S. Department of Labor (DOL) to link diversity, equity, inclusion and access to job quality in the implementation of BIL.

Prioritize DOE hydrogen activities and hubs that create opportunities for skilled training and employment

U.S. DEPARTMENT OF ENERGY

"In keeping with the administration's goals, and as an agency whose mission is to help strengthen our country's energy prosperity, the Department of Energy strongly supports investments that expand union jobs, improve job quality through the adoption of strong labor standards, increase job access, strengthen local economies, and develop a diverse workforce for the work of building and maintaining the country's energy infrastructure and growing domestic manufacturing."

Labor Standards

How do we succeed in meeting DOE's Hydrogen Energy Earthshot goal of $1 per 1 kilogram in 1 decade, while ensuring high labor standards and good job quality?

DOE's hydrogen activities, including the regional clean hydrogen hubs, aim to support the creation of good-paying jobs with the free and fair choice to join a union, the incorporation of strong labor standards, and training and placement programs, especially registered apprenticeship.

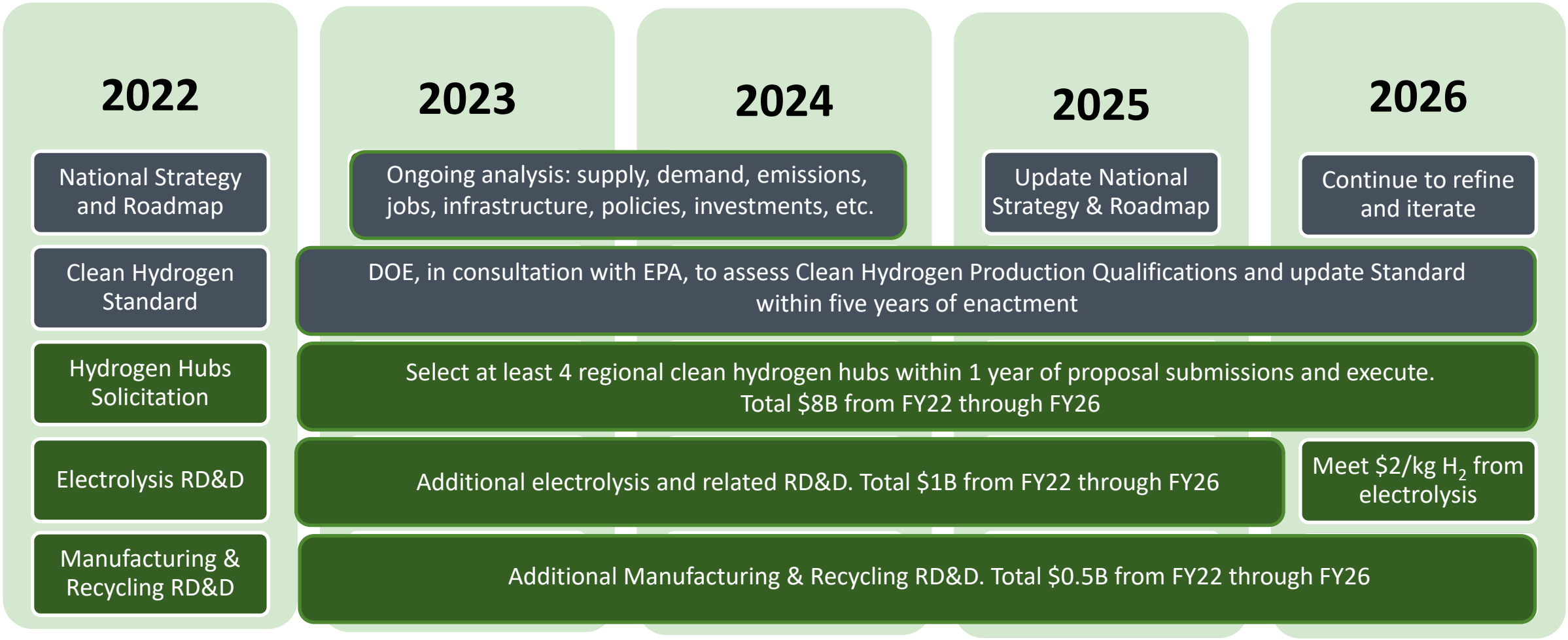
Jobs-related Phase I planning activities

Phase 1 planning activities and analysis, which may include, but are not limited to:

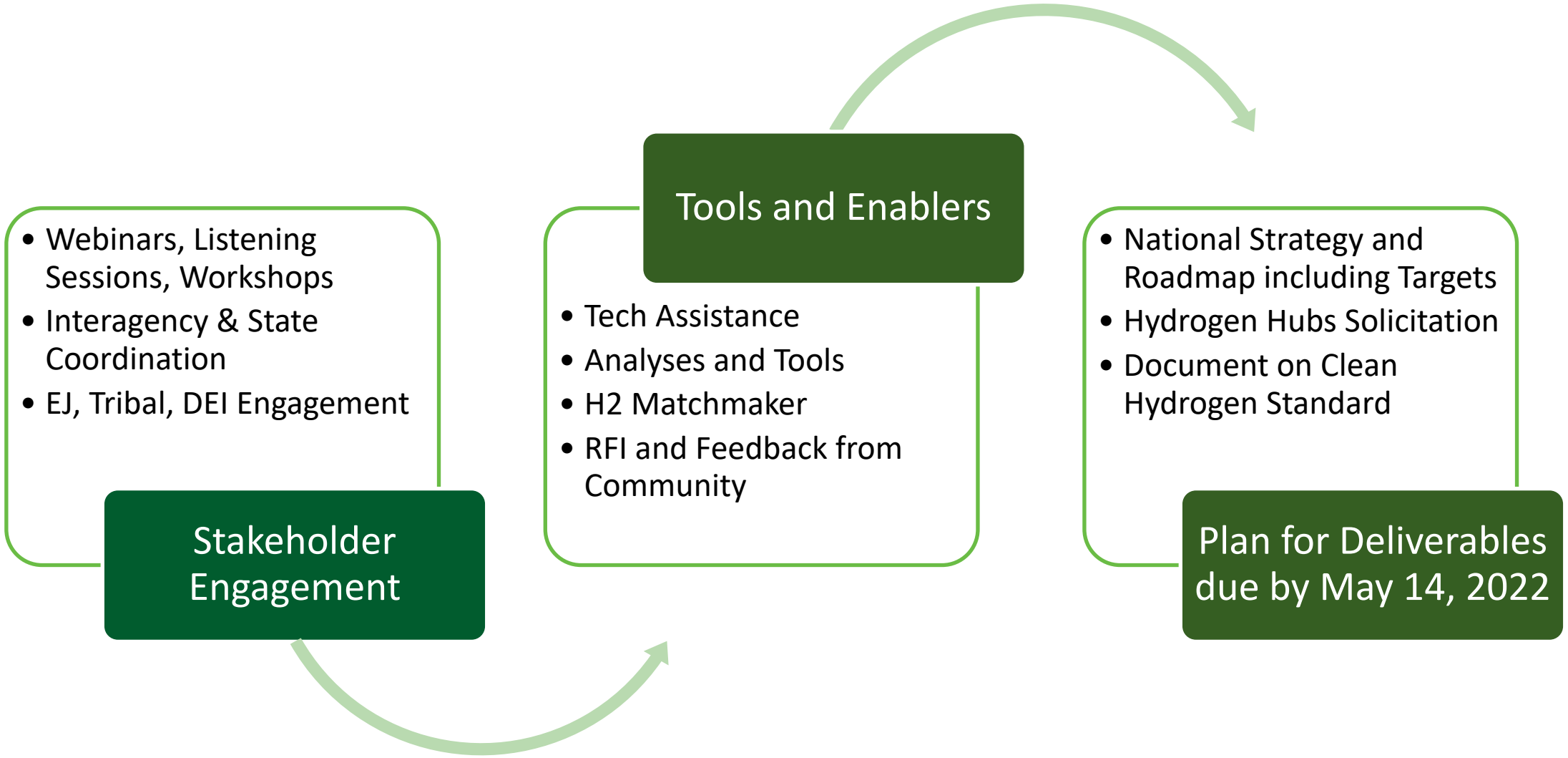
- Ability to create and sustain jobs, particularly high paying union jobs, and support long-term jobs for local residents
- Ability to employ workers currently employed in the fossil industry or those that may no longer have jobs as a result of the clean energy transition, in regions where applicable
- Creation of clear workforce education and training pathways, including registered apprenticeships, into high quality jobs (including union jobs)
- Formal partnership with and support from relevant local labor unions, where applicable
- EEEJ strategy, including significant and meaningful community engagement plans, connection to hubs and post-hub benefit, to ensure EEEJ goals are achieved

Summary and Next Steps

Timeline for Key Hydrogen Provisions

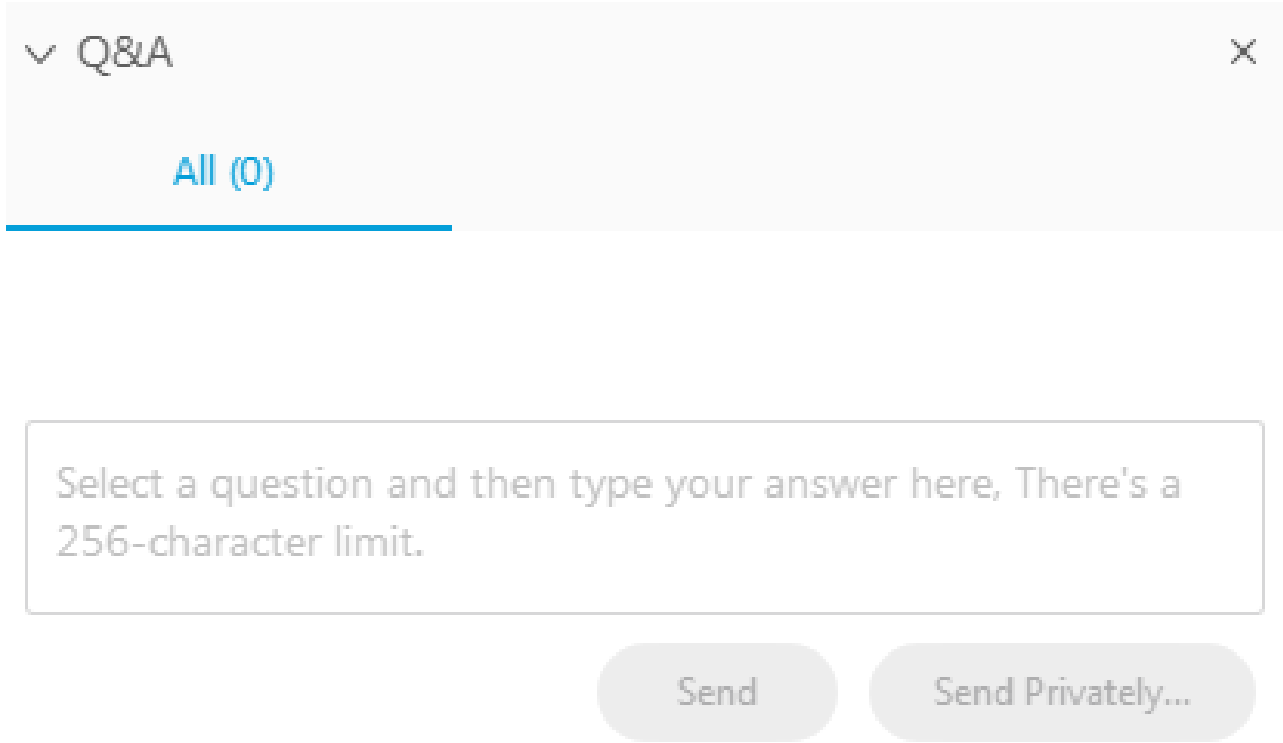


Stakeholder Engagement and Enablers



The #H2IQ Hour Q&A

Please type your questions into the **Q&A Box**



The #H2IQ Hour

Thank you for your participation!

Slides & recording will be available online

https://www.energy.gov/eere/fuelcells/hydrogen-and-fuel-cell-technologies-office-webinars

Link to RFI(s):

https://www.energy.gov/articles/doe-establishes-bipartisan-infrastructure-laws-95-billion-clean-hydrogen-initiatives

Sign up to receive hydrogen and fuel cell updates

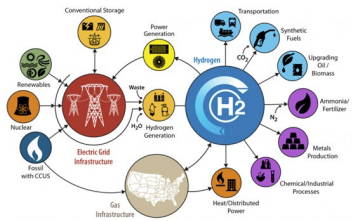
www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-newsletter

Backup Slides

National Strategy and Roadmap

U.S. DEPARTMENT OF ENERGY

Utilize DOE H2 Program Plan Industry Roadmap H2@Scale and regional analysis



Stakeholder Engagement & Listening Sessions

National and regional coalitions, industry, states, labs, etc.

EJ, tribal and broad community engagement

Analysis:

Policies, Decarbonization Scenarios, Jobs, etc.

Global roadmap assessments; updates of H2@Scale and industry analysis

Scenario analysis to meet Administration priorities

Interagency and State Government Coordination

Interagency coordination and strategy development

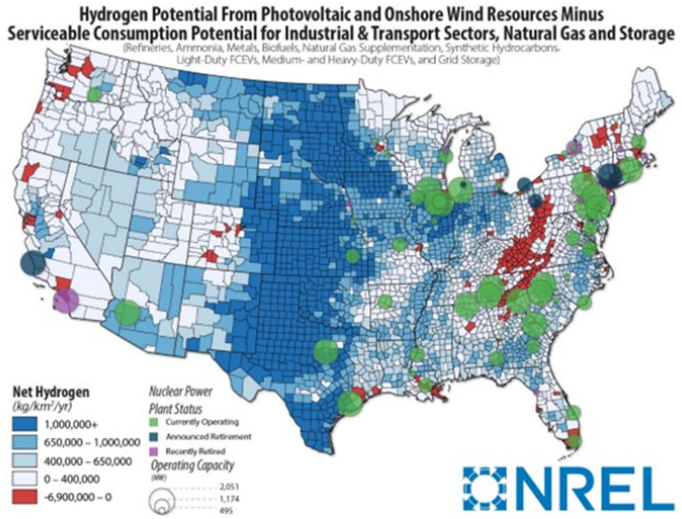
Iterations based on stakeholder feedback

Plan to develop roadmap by May 14 2022

Will leverage existing analysis

3 analysis reports completed in 2020-2021

- Determined **regional technical potential** of H2 supply. [1]
- Assessed **price points and market potential** for H2 in 8 sectors. [2]
- Assessed **growth potential for H2 supply and demand** in 5 scenarios. [3]

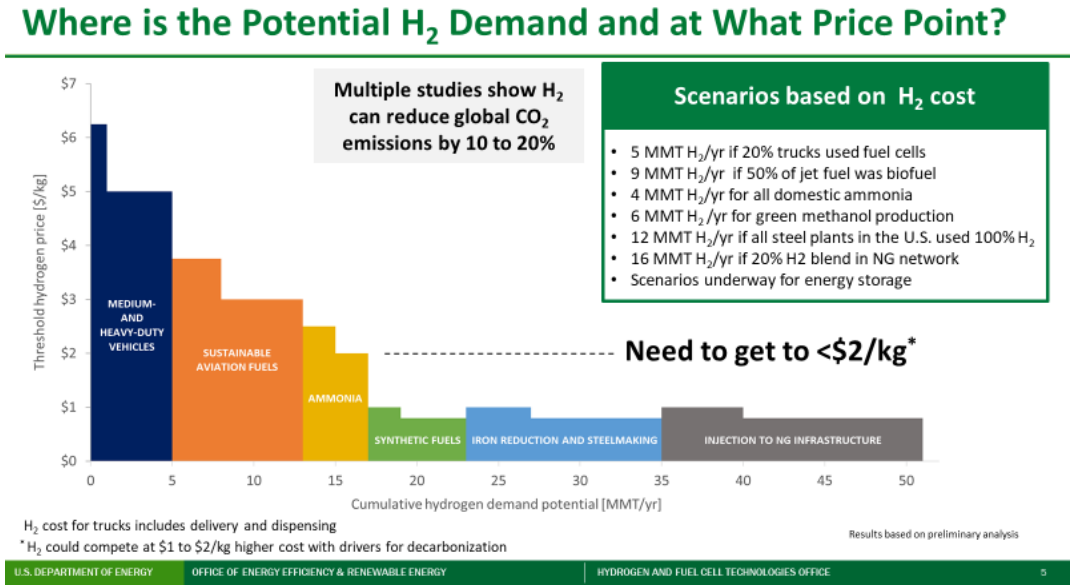


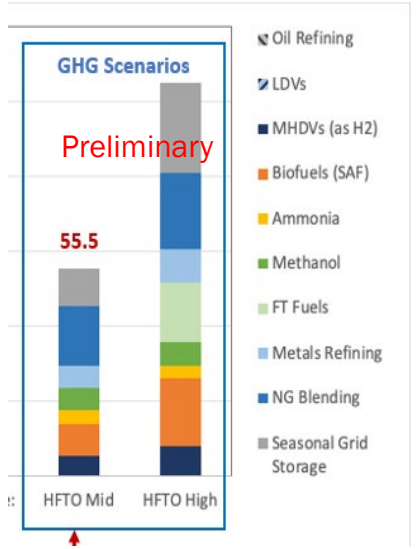
Most regions have sufficient resources to meet even aggressive increase in hydrogen demand

1. https://www.nrel.gov/docs/fy20osti/77198.pdf
2. https://greet.es.anl.gov/publication-us_future_h2
3. https://www.nrel.gov/docs/fy21osti/77610.pdf
4. https://greet.es.anl.gov/greet.models

Scenarios for H_2 and GHG potential and focus on actions and targets planned

"No later than 180 days after the date of enactment of the Infrastructure Investment and Jobs Act, the Secretary shall establish targets for the program to address near-term (up to 2 years), mid-term (up to 7 years), and long-term (up to 15 years) challenges to the advancement of clean hydrogen systems and technologies."





Sec. 40314 (EPACT Sec. 814): National Clean Hydrogen Strategy and Roadmap

U.S. DEPARTMENT OF ENERGY

(a) DEVELOPMENT.—

(1) IN GENERAL.—In carrying out the programs established under sections 805 and 813, the Secretary, in consultation with the heads of relevant offices of the Department, shall develop a technologically and economically feasible national strategy and roadmap to facilitate widescale production, processing, delivery, storage, and use of clean hydrogen.

(2) INCLUSIONS.—The national clean hydrogen strategy and roadmap developed under paragraph (1) shall focus on—

(A) establishing a standard of hydrogen production that achieves the standard developed under section 822(a), including interim goals towards meeting that standard;

(B) (i) clean hydrogen production and use from natural gas, coal, renewable energy sources, nuclear energy, and biomass; and

(ii) identifying potential barriers, pathways, and opportunities, including Federal policy needs, to transition to a clean hydrogen economy;

National Clean Hydrogen Strategy and Roadmap - continued

(C) identifying—

(i) economic opportunities for the production, processing, transport, storage, and use of clean hydrogen that exist in the major shale natural gas-producing regions of the United States;

(ii) economic opportunities for the production, processing, transport, storage, and use of clean hydrogen that exist for merchant nuclear power plants operating in deregulated markets; and

(iii) environmental risks associated with potential deployment of clean hydrogen technologies in those regions, and ways to mitigate those risks;

(D) approaches, including substrategies, that reflect geographic diversity across the country, to advance clean hydrogen based on resources, industry sectors, environmental benefits, and economic impacts in regional economies;

(E) identifying opportunities to use, and barriers to using, existing infrastructure, including all components of the natural gas infrastructure system, the carbon dioxide pipeline infrastructure system, end-use local distribution networks, end-use power generators, LNG terminals, industrial users of natural gas, and residential and commercial consumers of natural gas, for clean hydrogen deployment;

National Clean Hydrogen Strategy and Roadmap - continued

(F) identifying the needs for and barriers and pathways to developing clean hydrogen hubs (including, where appropriate, clean hydrogen hubs coupled with carbon capture, utilization, and storage hubs) that—

(i) are regionally dispersed across the United States and can leverage natural gas to the maximum extent practicable;

(ii) can demonstrate the efficient production, processing, delivery, and use of clean hydrogen;

(iii) include transportation corridors and modes of transportation, including transportation of clean hydrogen by pipeline and rail and through ports; and

(iv) where appropriate, could serve as joint clean hydrogen and carbon capture, utilization, and storage hubs;

(G) prioritizing activities that improve the ability of the Department to develop tools to model, analyze, and optimize single-input, multiple-output integrated hybrid energy systems and multiple-input, multiple-output integrated hybrid energy systems that maximize efficiency in providing hydrogen, high-value heat, electricity, and chemical synthesis services;

National Clean Hydrogen Strategy and Roadmap - continued

(H) identifying the appropriate points of interaction between and among Federal agencies involved in the production, processing, delivery, storage, and use of clean hydrogen and clarifying the responsibilities of those Federal agencies, and potential regulatory obstacles and recommendations for modifications, in order to support the deployment of clean hydrogen; and

(I) identifying geographic zones or regions in which clean hydrogen technologies could efficiently and economically be introduced in order to transition existing infrastructure to rely on clean hydrogen, in support of decarbonizing all relevant sectors of the economy.

(b) REPORTS TO CONGRESS.—

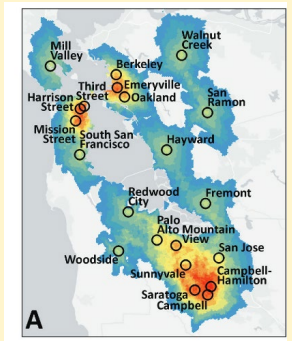
(1) IN GENERAL.—Not later than 180 days after the date of enactment of the Infrastructure Investment and Jobs Act, the Secretary shall submit to Congress the clean hydrogen strategy and roadmap developed under subsection (a).

(2) UPDATES.—The Secretary shall submit to Congress updates to the clean hydrogen strategy and roadmap under paragraph (1) not less frequently than once every 3 years after the date on which the Secretary initially submits the report and roadmap.

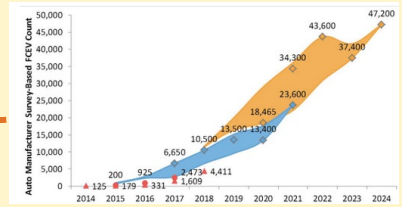
Supply, Demand, and Infrastructure Analysis

- National Roadmap process to be implemented over time to improve decision making
  - Updates every 3 years per statute
- National planning tools integrated with local and regional plans, policies, tools
- Will focus on actions

Infrastructure Planning & Coordination Process

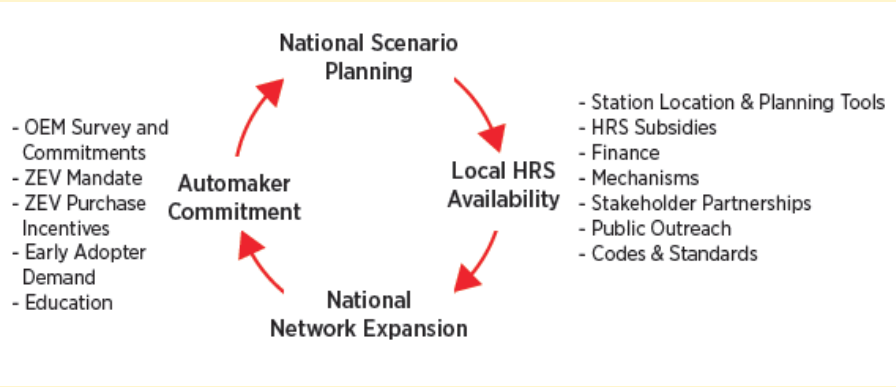


Station Coverage

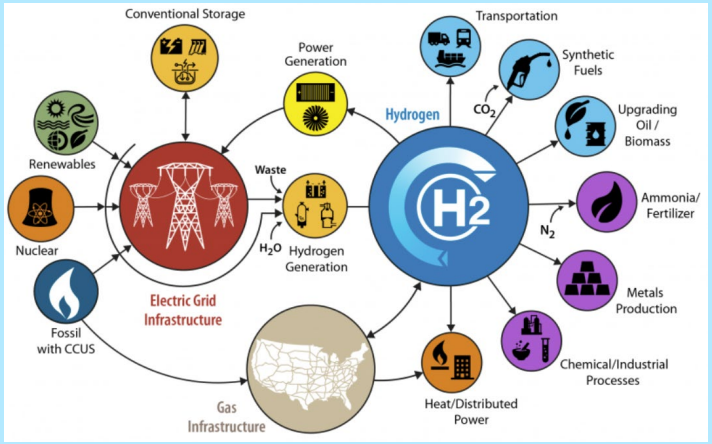


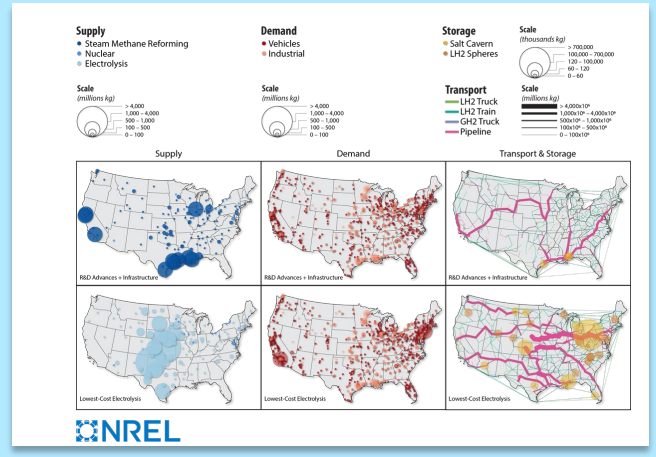
Annual Survey

Example by CARB



Hub Infrastructure Planning & Coordination Process





Sec 40315 (EPACT Sec. 822): Clean Hydrogen Production Qualifications

U.S. DEPARTMENT OF ENERGY

(a) IN GENERAL.—Not later than 180 days after the date of enactment of the Infrastructure Investment and Jobs Act, the Secretary, in consultation with the Administrator of the Environmental Protection Agency and after taking into account input from industry and other stakeholders, as determined by the Secretary, shall develop an initial standard for the carbon intensity of clean hydrogen production that shall apply to activities carried out under this title.

(b) REQUIREMENTS.—

(1) IN GENERAL.—The standard developed under subsection (a) shall—

(A) support clean hydrogen production from each source described in section 805(e)(2);

(B) define the term 'clean hydrogen' to mean **hydrogen produced with a carbon intensity equal to or less than 2 kilograms of carbon dioxide-equivalent produced at the site of production per kilogram of hydrogen produced;** and

(C) take into consideration technological and economic feasibility.

Clean Hydrogen Production Qualifications - continued

(2) ADJUSTMENT.—Not later than the date that is 5 years after the date on which the Secretary develops the standard under subsection (a), the Secretary, in consultation with the Administrator of the Environmental Protection Agency and after taking into account input from industry and other stakeholders, as determined by the Secretary, shall—

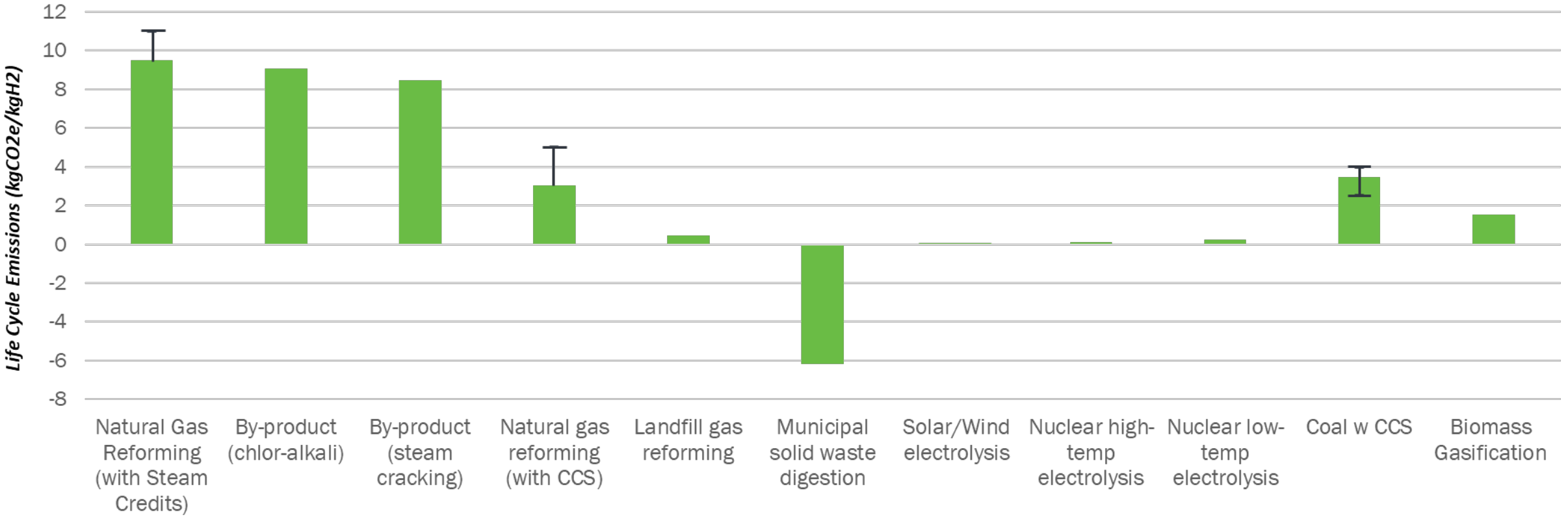
(A) determine whether the definition of clean hydrogen required under paragraph (1)(B) should be adjusted below the standard described in that paragraph; and

(B) if the Secretary determines the adjustment described in subparagraph (A) is appropriate, carry out the adjustment.

Sec. 40313: Goals include “to demonstrate a standard of clean hydrogen production in the transportation, utility, industrial, commercial, and residential sectors by 2040.”

GREET GHG Emissions

Identifies life cycle GHG emission from multiple hydrogen pathways



Ranges shown reflect potential variability in upstream leak rates, CCS efficiency, and capture rates. Baseline assumes 90% capture.

Source: Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies Model 2021, https://greet.es.anl.gov/

For more information, see GREET documentation or the October H2IQHr: https://www.energy.gov/eere/fuelcells/2021-hydrogen-and-fuel-cell-technologies-office-webinar-archives#date10282021

CCS: Carbon Capture and Sequestration
GHG: Green House Gas
GREET: Greenhouse gases, Regulated Emissions, and Energy use in Technologies Model