

# Summary of DOE Hydrogen Program RFI Responses Related to Fossil Energy and Carbon Management

September 27, 2021



## **DOE Request for Information (RFI) – FOA-0002529**

- RFI was issued between June 7 and July 7, 2021.
- Encompasses multiple offices within DOE: EERE, FECM, NE, OE, and SC.
- Goal: obtain public input in support of DOE's Hydrogen Energy Earthshot initiative to <u>enable low cost</u>, clean hydrogen at scale.
  - Inputs on viable hydrogen demonstration and deployment projects that enable clean hydrogen production, infrastructure and end uses to reduce emissions, create jobs, and enable a net-zero carbon emissions economy by 2050.
  - Inputs from industry, investors, technology developers, academia, research laboratories, government agencies, and other stakeholders on potential hydrogen demonstration projects in the U.S.



Decade





### **RFI** Topic Categories

- A. Regional Hydrogen Production, Resources, and Infrastructure \*
- B. End Users for Hydrogen in the Region, Cost, and Value Proposition
- C. Greenhouse Gas and Pollutant Emissions Reduction Potential
- D. Diversity, Equity, Inclusion (DEI), Jobs, and Environmental Justice
- E. Science and Innovation Needs and Challenges
- **F. Additional Information**



3











### **Snapshot: Geographic Responses**

#### States mentioned by respondents

Hydrogen

earths



- Nearly 200 RFI responses were received and describe:
  - Diversity of resources, industries, communities, and innovative ideas;
  - Potential for new and expanding end-uses;
  - Considerations for impacts to regions and stakeholders; and
  - Opportunities to produce clean hydrogen across the entire U.S.

# **Snapshot: Sector Responses to Topic Areas**







Topic A: Regional Hydrogen Production, Resources, and Infrastructure

Topic B: End Users for Hydrogen in the Region and Value Proposition

Topic C: Greenhouse Gas (GHG) and Pollutant Emissions Reduction Potential

Topic D: Diversity, Equity, Inclusion (DEI), Jobs, and Environmental Justice

Topic E: Science and Innovation Needs and Challenges



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# **Snapshot: Responses to Specific RFI Questions**



A. Regional Hydrogen Production, Resources, and InfrastructureB. End Users for Hydrogen in the Region and Value Proposition

- C. Greenhouse Gas (GHG) and Pollutant Emissions Reduction Potential D. Diversity, Equity, Inclusion (DEI), Jobs, and Environmental Justice
- E. Science and Innovation Needs and Challenges

# **Snapshot: Responses by Selected FECM Categories**

- Identify any trends, R&D needs, or specific technology areas?
- Major areas of interest:
- Improving the reforming process
- Developing more efficient electrolyzers
- Expanding research on hydrogen storage
- Integrating research on CCS and CCUS, including Cryogenic Carbon Capture (CCC)
- Improved economics across H<sub>2</sub> value chain



### Most Popular Terms for "Regional Hydrogen Production, Resources, and Infrastructure" Responses



### Most Popular Terms without Terms "Hydrogen" & "H2"





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### **RFI findings: Regional clusters and geographic factors**



### **Appalachia Regional Cluster Responses**

#### Regional resources for production and infrastructure

- Overlap with Great Lakes region, especially Western OH
- Primarily fossil resources with CCS, with future transition to renewables
- Access to significant NG and saline storage of CCS
- Salt, limestone, and sandstone formations for potential CCS or H<sub>2</sub> storage throughout

#### **Emissions Reduction Potential**

- 0.9 MT CO<sub>2</sub>/year with NG reforming + 1-4 MT with additional CCS in a single project
- Decarbonization of current processes and possible negative emissions

earthshots

Hydrogen

#### End Users, Cost, Value Proposition

- H<sub>2</sub> for power generation, industry, backup power
- Steel, cement, and chemical industries; decarbonizing refining facilities
- Need for policy incentives to address cost premium versus traditional fossil

#### DEI, Jobs, EJ

- Many distressed communities based on unemployment rates, per capita market income, and poverty rates.
- Coal industry employment in that period has declined 54% in 15 years
- High dependence on mining as a portion of overall economic activity, e.g., one mine closure lost 2000 jobs



#### **Co-location Potential**

- Nuclear plants near transportation arteries, warehouses, and distribution facilities
- Wastewater treatment, ammonia production
- Environmental, architectural, archaeological studies completed; active work site for powerplant and other facility developments

### **Snapshot: Gulf Coast Regional Cluster**

#### End Users, Cost, Value Proposition

- Current: ~ 50 SMR petrochemical/refining plants producing ~3.6 MT/year of H<sub>2</sub>
- Future: city transit, industrial forklifts, phosphate industry supporting agricultural sector, green ammonia for marine fuel
- Oil refining and processing, ammonia and methanol production, metallic ore production, food processing, industrial use

Hydrogen

### Regional resources for production and infrastructure

 Legacy oil and gas wells, reclaimed water sites, natural gas pipelines, saline aquifer, salt domes and caverns

#### DEI, Jobs, EJ

 Creation of 2000+ jobs for Opportunity Zones in Gulf Region

#### **Emissions Reduction Potential**

 Geologic storage accessibility could accommodate >1B tonnes/year in emissions



#### **Co-Location Potential**

- Large electricity capacity, electrolysis and SMR capability with inland marine shipping
- Storage in salt caverns and depleted oil fields

# **Next Steps**

- Evaluate RFI responses (ongoing)
- Present findings through webinars (future)
- Organize a series of workshops (future)
  - $_{\odot}\,$  Include broad stakeholder base in each region

• Foster communication/collaboration between respondents with common regional focus

- Conduct analysis and pathway studies (ongoing)
  - $_{\odot}\,$  Examples of factors to consider:
    - Feedstock, end use, infrastructure, and regional diversity
    - Emissions, economic, and environmental benefit potential
    - Employment and community impact potential
    - Scalability, replicability, and sustainability





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# **Questions?**



