U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

DOE Hydrogen Shot Summit and Request for Information Summary

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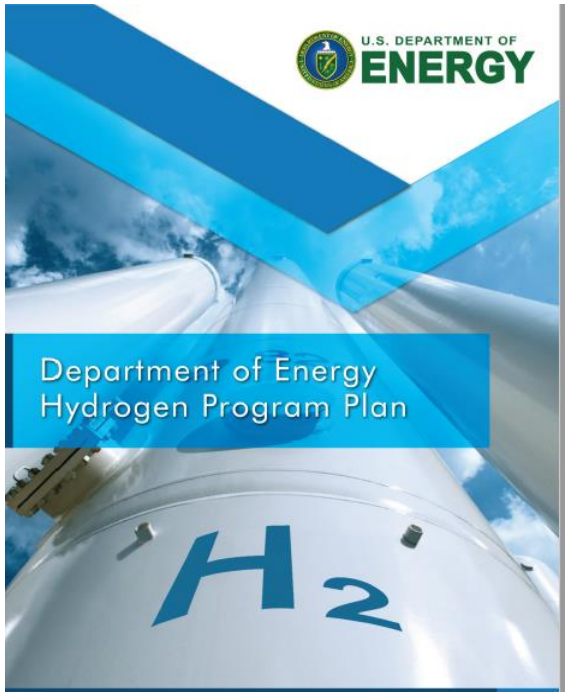
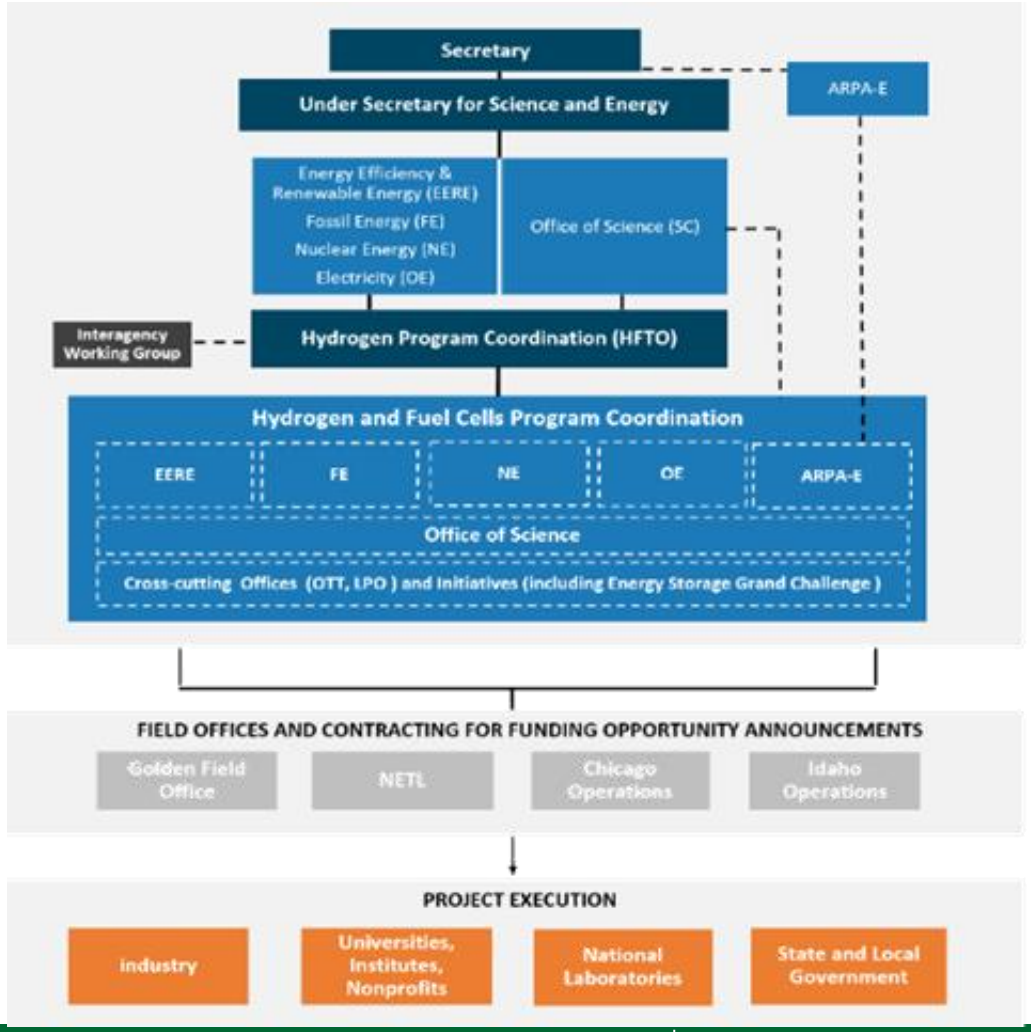
The U.S. DOE Hydrogen Program

The Energy Policy Act (2005) Title VIII and Energy Policy Act of 2020 provide key authorization, coordinated across DOE Offices

Hydrogen is one part of a broad portfolio of activities



www.hydrogen.energy.gov

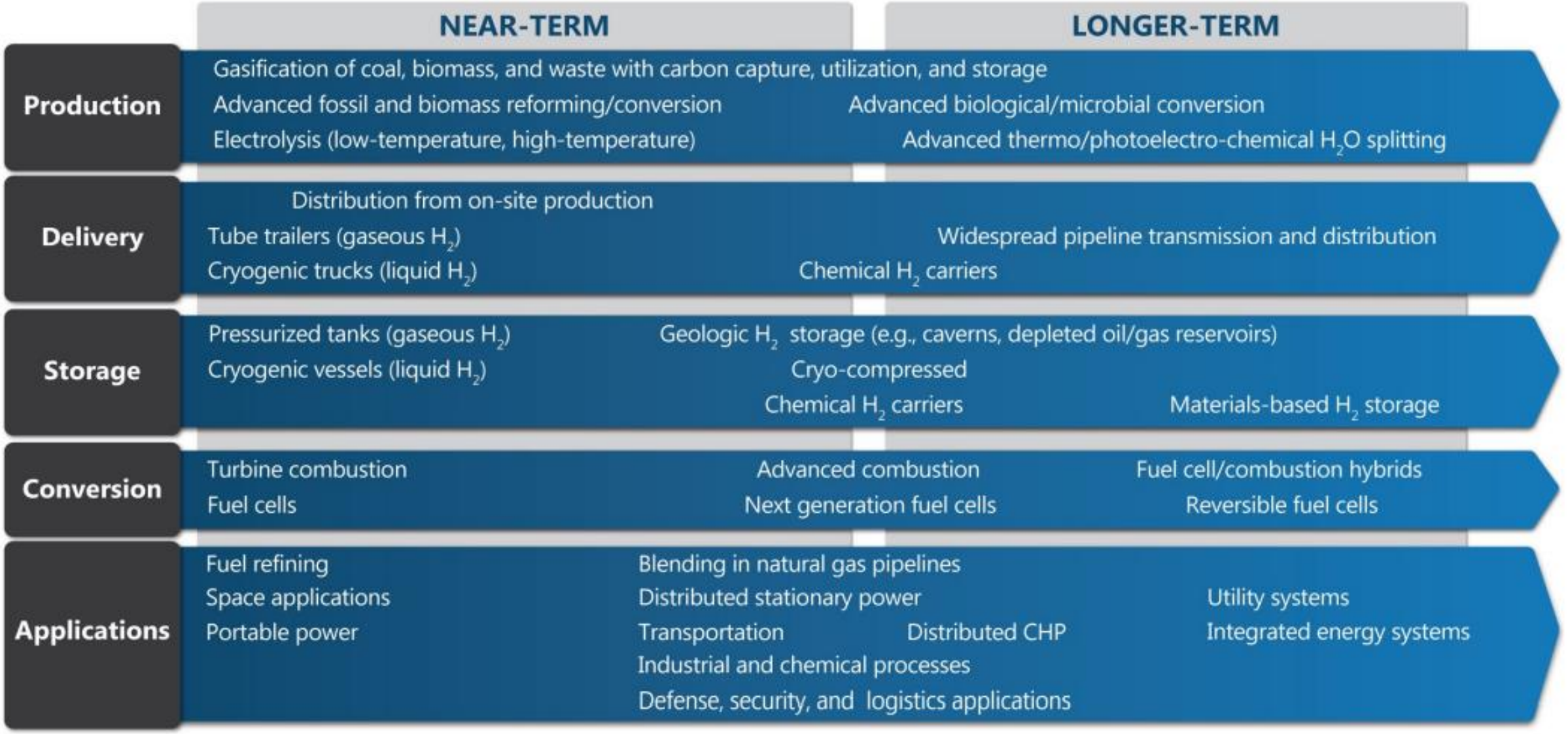


Priorities

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

Comprehensive Strategy Across the Hydrogen Value Chain



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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

DOE Hydrogen Shot Summit

Convened thousands of stakeholders

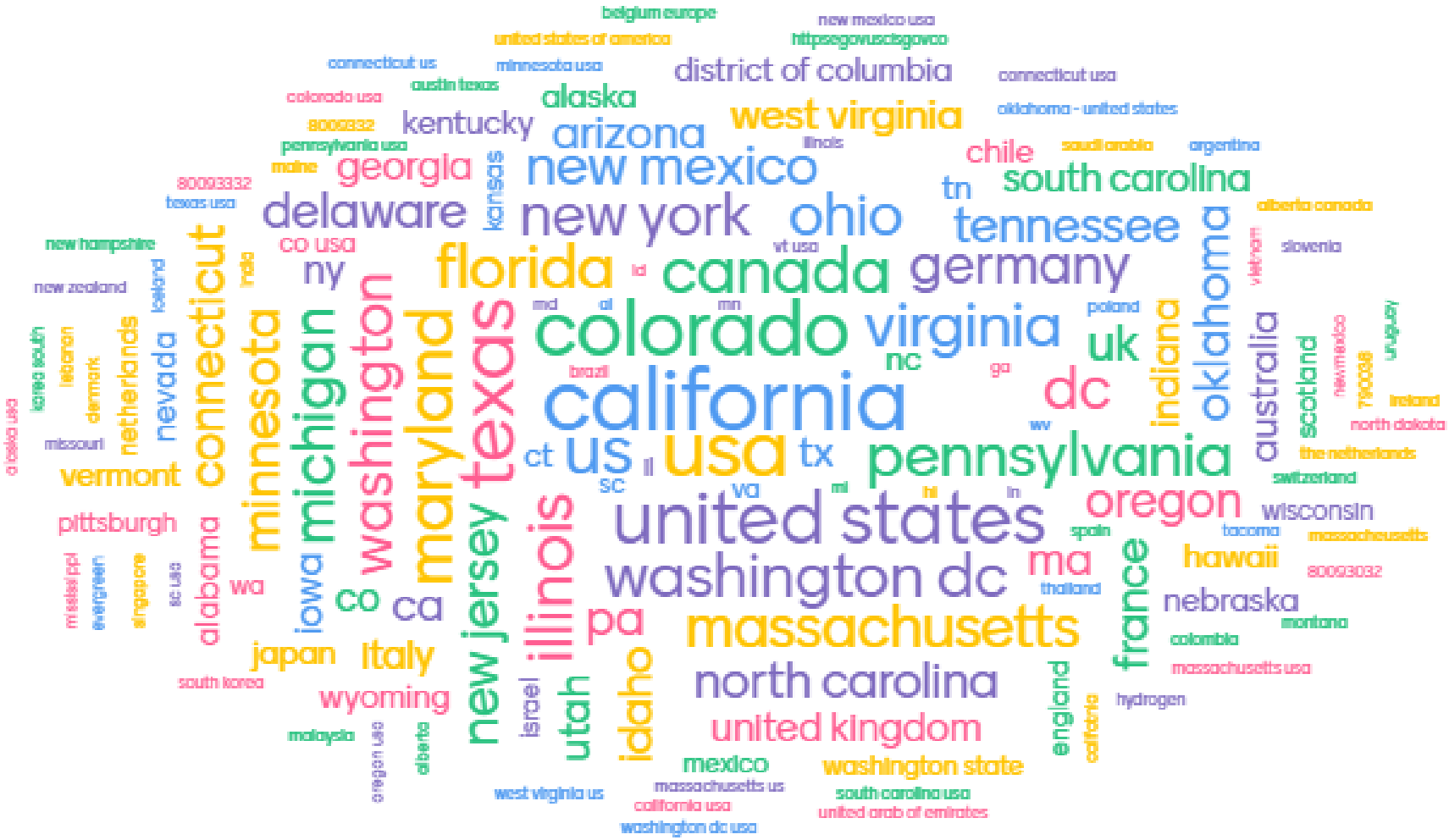
4,900+ total registrants

3,200+ participants in Plenary

Participants from across the US and around the world

48 states + DC

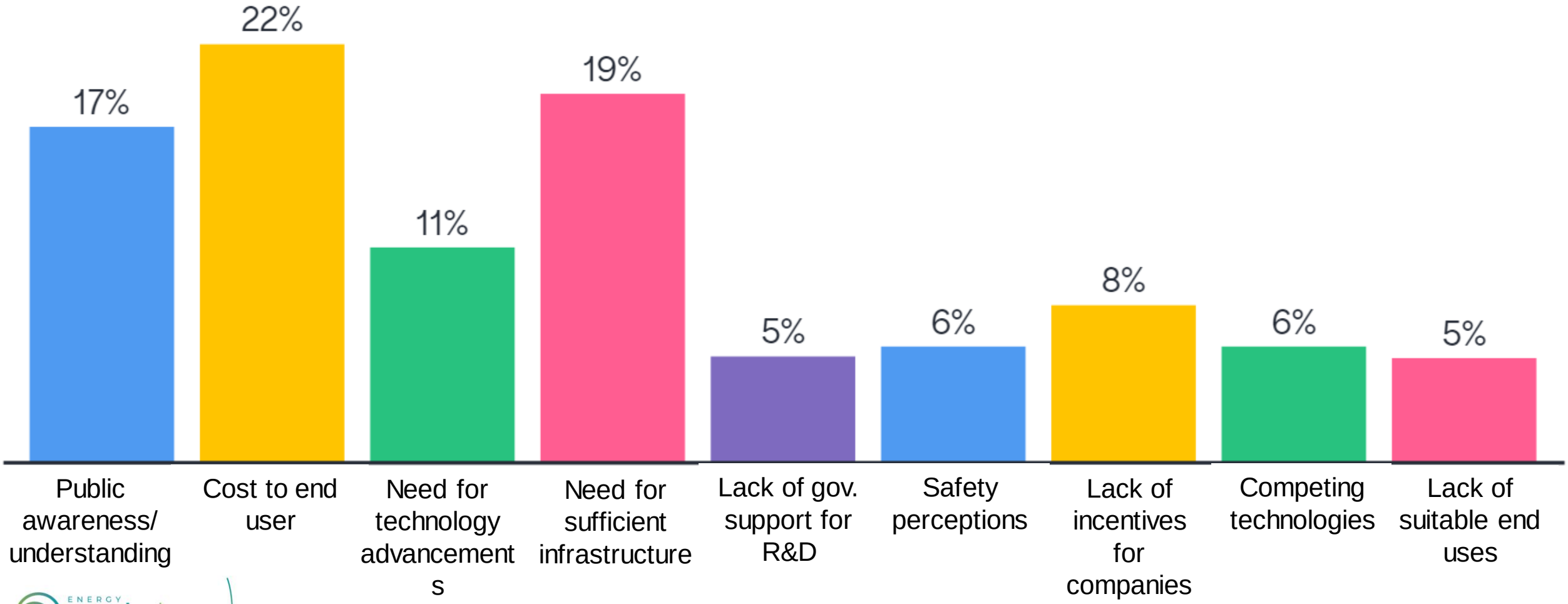
33 countries + USA



Source: Wieliczko, et al, DOE HFTO

Hydrogen Shot Summit Stakeholder Feedback

Responses to: Which are the greatest barriers currently preventing public acceptance of wide-spread hydrogen in the US?



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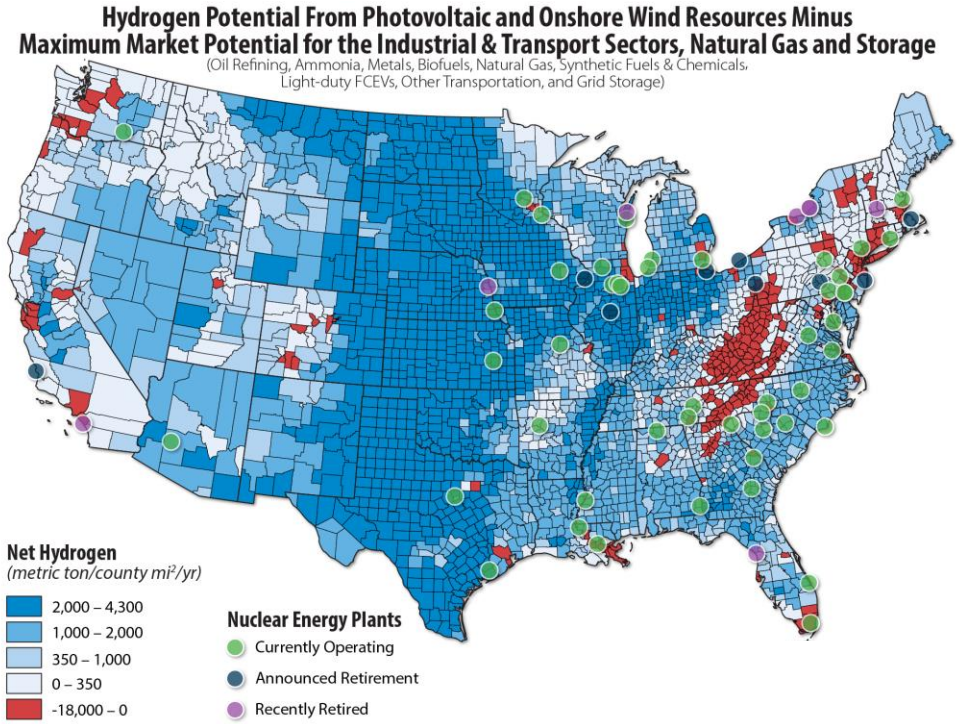
Source: Wieliczko, et al, DOE HFTO

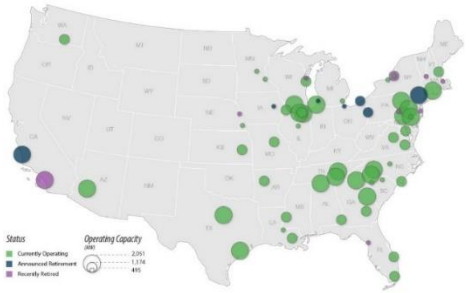
Stakeholder Engagement, Production and End-Use Collocation and Environmental Justice to Drive Activities

Renewables



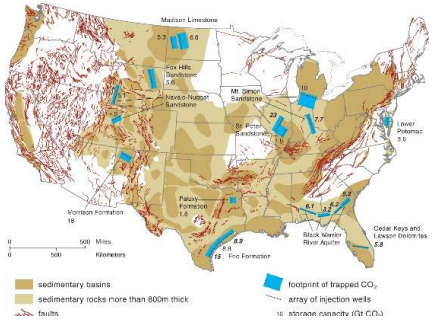
Red: Regions where projected industrial & transportation demand exceeds local supply.

Regional and national analyses planned – stay tuned to Hydrogen Shot and www.hydrogen.energy.gov



Natural Gas (SMR)

CCS



DOE Request of Information covered key themes:

- Production, Resources, Infrastructure
- End Users, Cost, Value Proposition
- Co-location potential
- Emissions Reduction Potential
- DEI, Jobs, EJ
- Science & Innovation Needs and Challenges

DEI: Diversity, Equity and Inclusion
EJ: Environmental Justice

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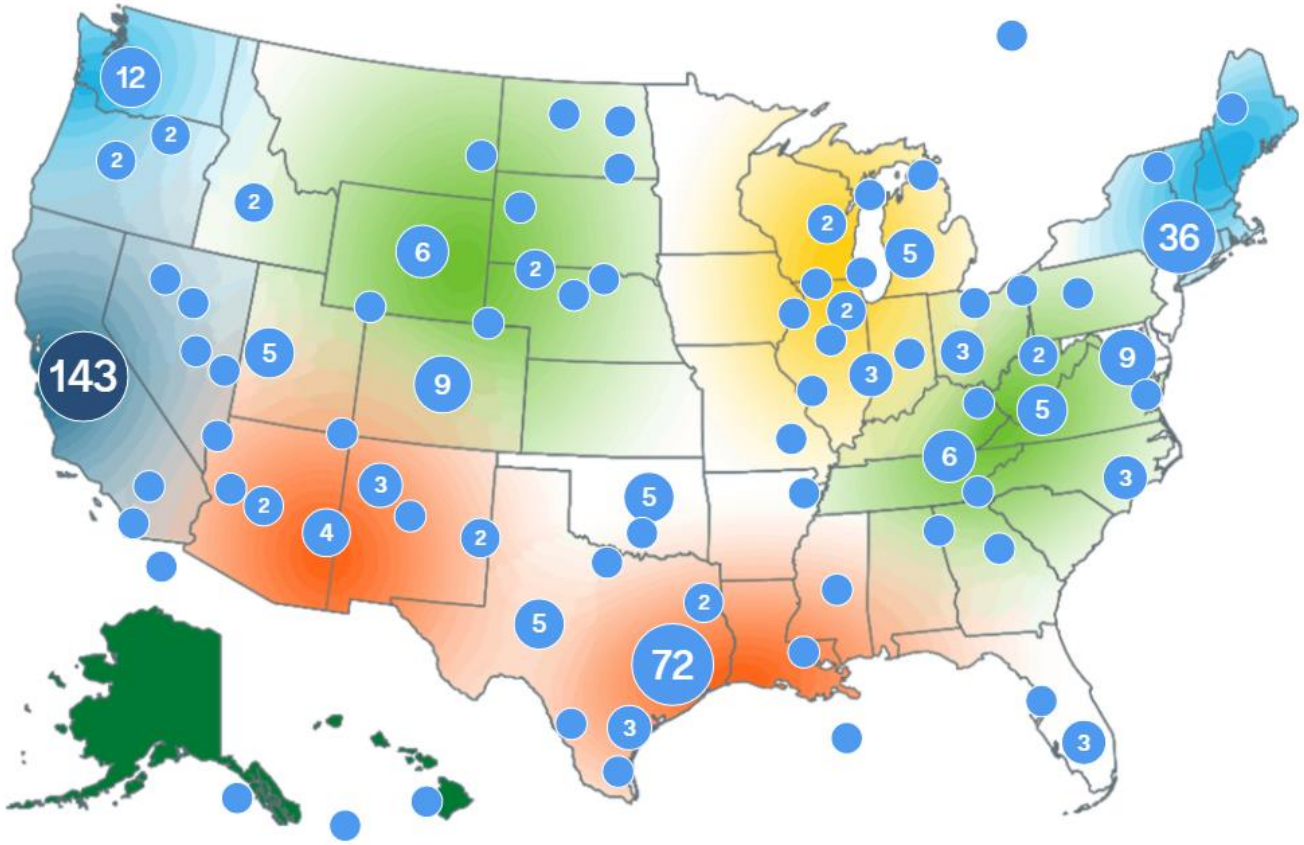
Source:: Arjona, et al, DOE HFTO

Potential Locations for Hydrogen Demonstrations

Please select the region that you believe is most ready for a large-scale hydrogen demonstration.



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Source: Wieliczko, Harting, et al, DOE HFTO

How Can We Succeed?

What are your top 3 priorities for Hydrogen Shot to be successful?

Increase R&D to reduce cost
20%

Focus on scale and deployments
20%

Develop partnerships
14%

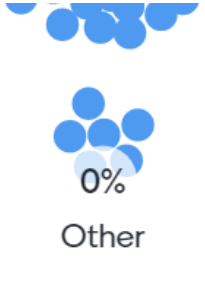
Policies to increase scale and cost parity
18%

Increasing supply chain
6%

Delivery and storage infrastructure
11%

Reducing siting/permitting barriers
5%

Address hydrogen safety
5%

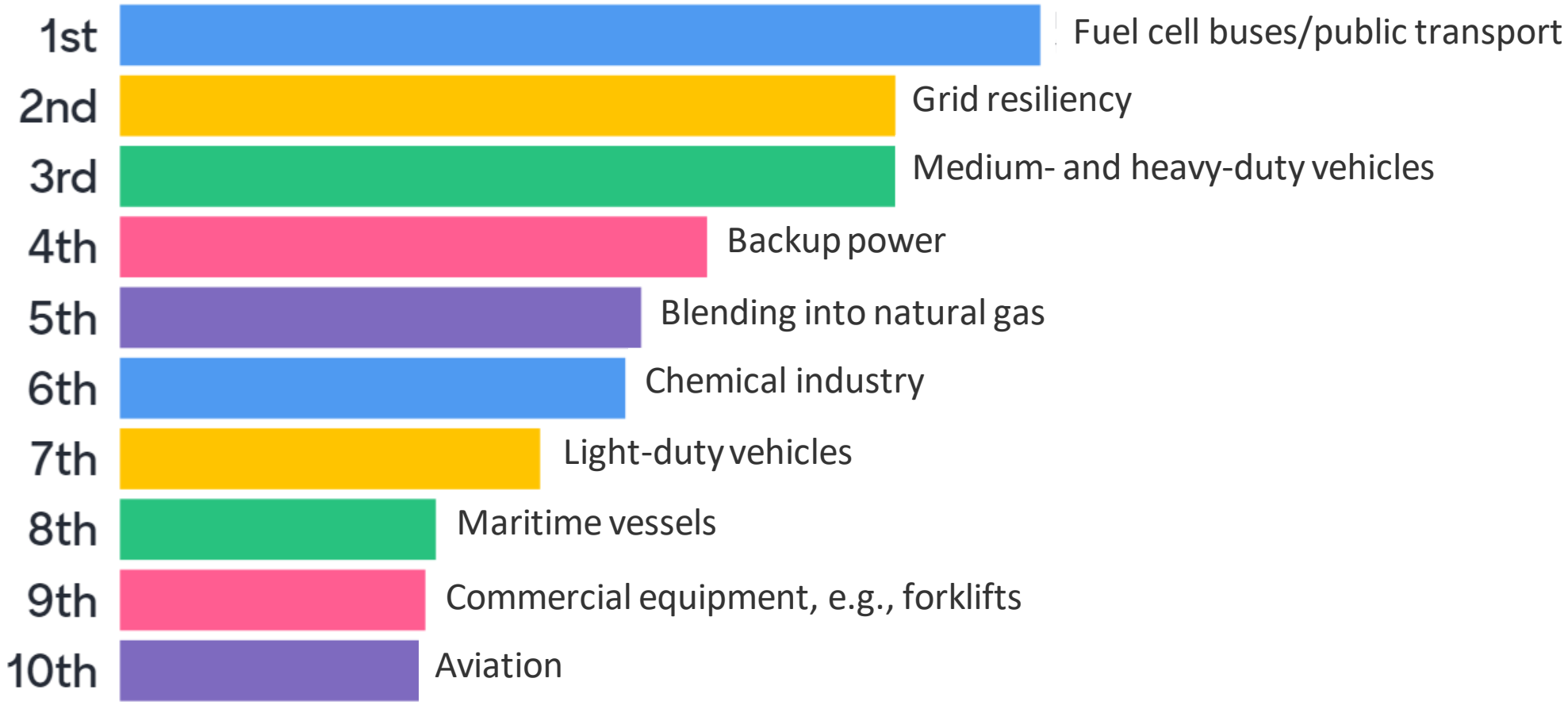


0%
Other

Source: Wieliczko, et al, DOE HFTO

Identifying DEI Opportunities

Please rank these end use applications by the potential impact to underserved communities.



Source: Wieliczko, et al, DOE HFTO

RFI findings: Regional clusters and geographic factors

Pacific Northwest

- *Port communities*
- *Tribal communities*
- *Extensive renewables*
- *8 jobs per $1M invested in H_2*

California

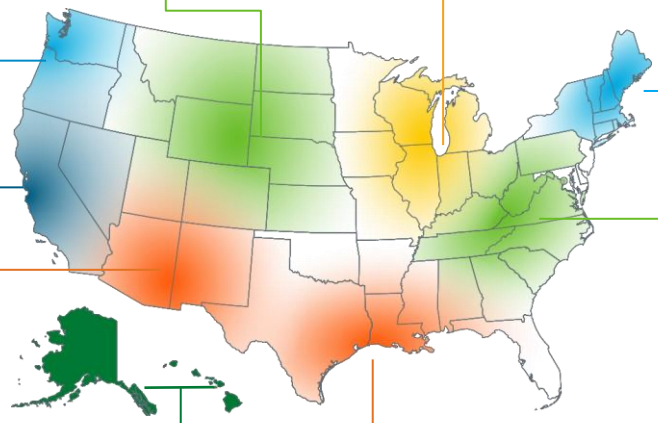
- *Diverse populations*
- *Extensive infrastructure*
- *Emissions regulations*
- *40,000+ jobs*

Southwest

- *Tribal and Hispanic communities*
- *Underutilized solar*
- *Nuclear power*
- *Up to 2B tonnes/yr emission reduction potential*

Central U.S.

- *Ample wind*
- *Geological storage*
- *Railway transport*
- *Nuclear resources*
- *>630,000 tonnes/yr CO_2 reduction*



Alaska and Hawaii

- *Extensive renewables – geothermal, solar, ocean*
- *Backup power*
- *Isolated communities*
- *86,000 tonnes/yr emission reduction*

Great Lakes

- *Major national corridors* • *Nuclear power* • *60,000+ jobs*

New England

- *Offshore wind*
- *Fishing communities*
- *Backup power and winter heating*
- *~120K tons CO_2/year reduction*

Appalachia

- *Retiring fossil plants*
- *Mining, refining transferable skills*
- *Carbon capture and sequestration*
- *70,000 tons/yr H_2 production*

Gulf Coast

- *Existing infrastructure*
- *Multiple opportunity zones*
- *Renewable resources*
- *1,000s of jobs*
- *Chemical industry*

Source: Wieliczko, Harting, et al, DOE HFTO

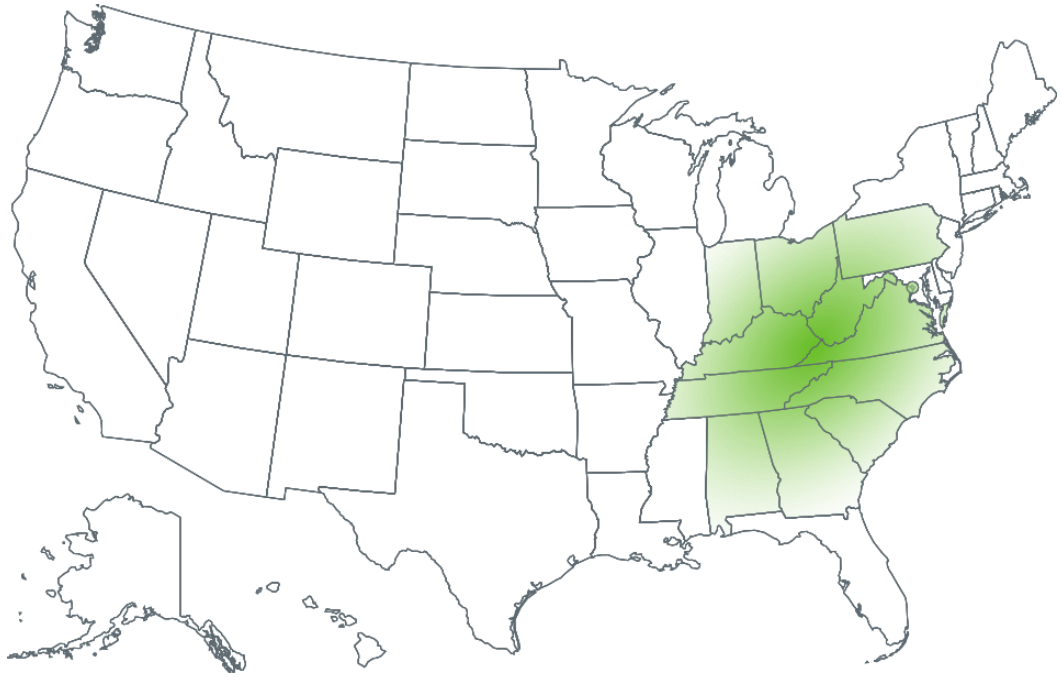
Appalachia Regional Cluster Responses

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_2 storage throughout

End Users, Cost, Value Proposition

- H_2 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



Emissions Reduction Potential

- 0.9 MT CO_2/year with NG reforming + 1-4 MT with additional CCS in a single project
- Decarbonization of current processes and possible negative emissions

DEI, Jobs, EJ

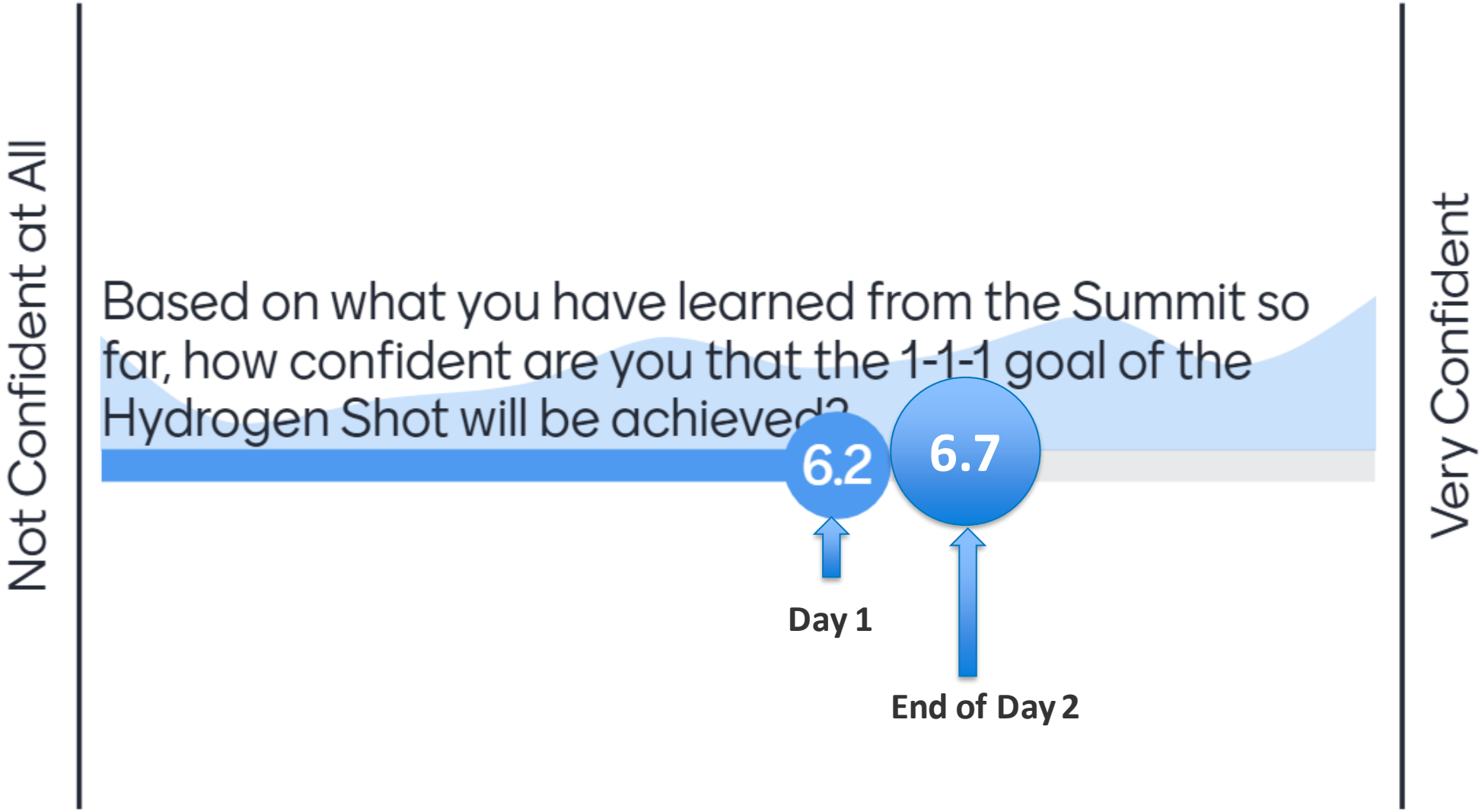
- Many distressed communities based on unemployment rates, per capita market income, and poverty rates.
- Coal industry employment in that period has declined 54% in 15 years
- High dependence on mining as a portion of overall economic activity, e.g., one mine closure lost 2000 jobs

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

Source: Wieliczko, Harting, et al, DOE HFTO

Will We Succeed?



Source: Wieliczko, Harting, et al, DOE HFTO

We gratefully acknowledge the RFI Team

Karen Harting

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Vanessa Arjona

Kim Cierpik-Gold

John Huston and Warren Williams

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Additional Information

Example: Deep Dive on Fossil + CCS Responses

A. How many responses involved fossil resources (coal, NG) – 92 of 195

B. How many involve any type of gasification or high temperature thermal conversion (any fuel) – 59 of 195

C. Provide a breakdown of interest by region – See Summary in Slide

D. Identify any trends in what is suggested for R&D needs; any specific technology areas?

- Improving the Reforming Process
- More research on possible Hydrogen storage (both Geologic & On-Site)
- More research on CCS. CCUS, and Cryogenic Carbon Capture (CCC) to make more economic

E. How many showed interest in Geologic Hydrogen Storage or CCUS? – 53 of 195

Source Huston, Williams, et al, DOE FECM

Deep Dive: Responses on Specific Qs

A total of 92 out of 195 were found to have interest in categories below:

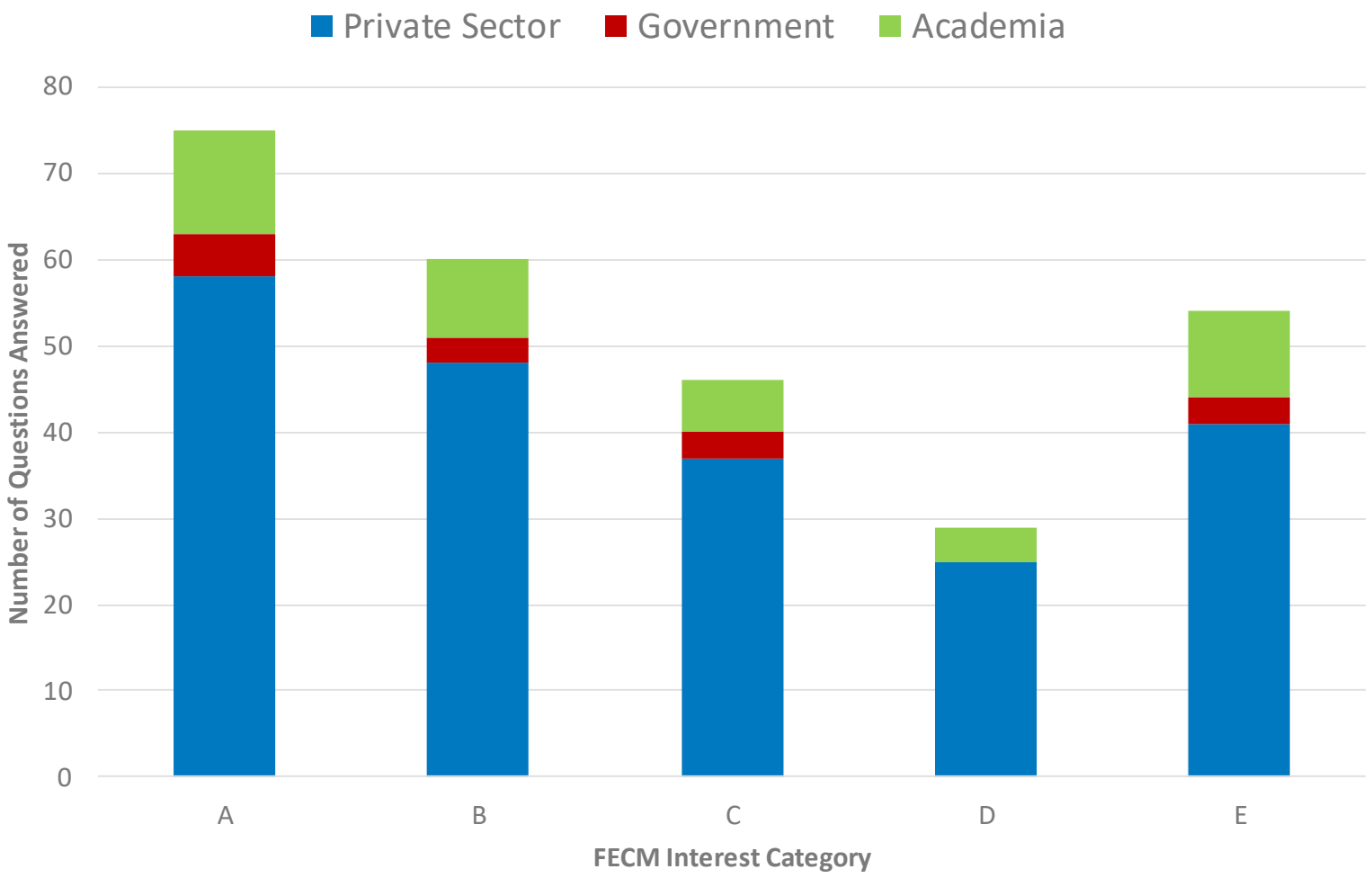
A. How many responses involved fossil fuel (coal, NG)

B. How many involve any type of gasification or high temperature thermal conversion (any fuel)

C. Provide a breakdown of interest by region (related to fossil, large storage, infrastructure)

D. Identify any trends in what is suggested for R&D needs; any specific technology areas?

E. Any discussion of Geologic Hydrogen Storage or CCUS?



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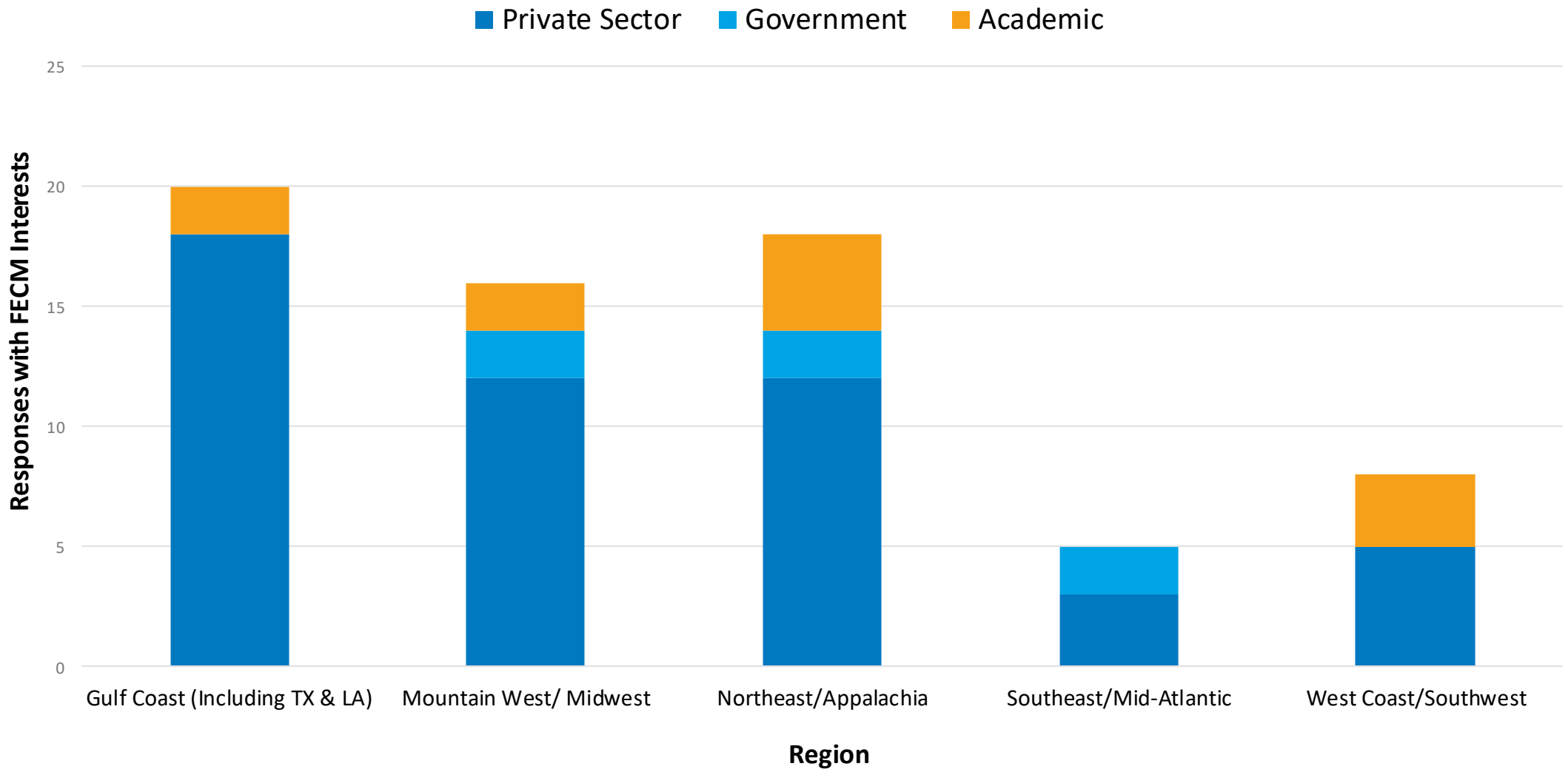
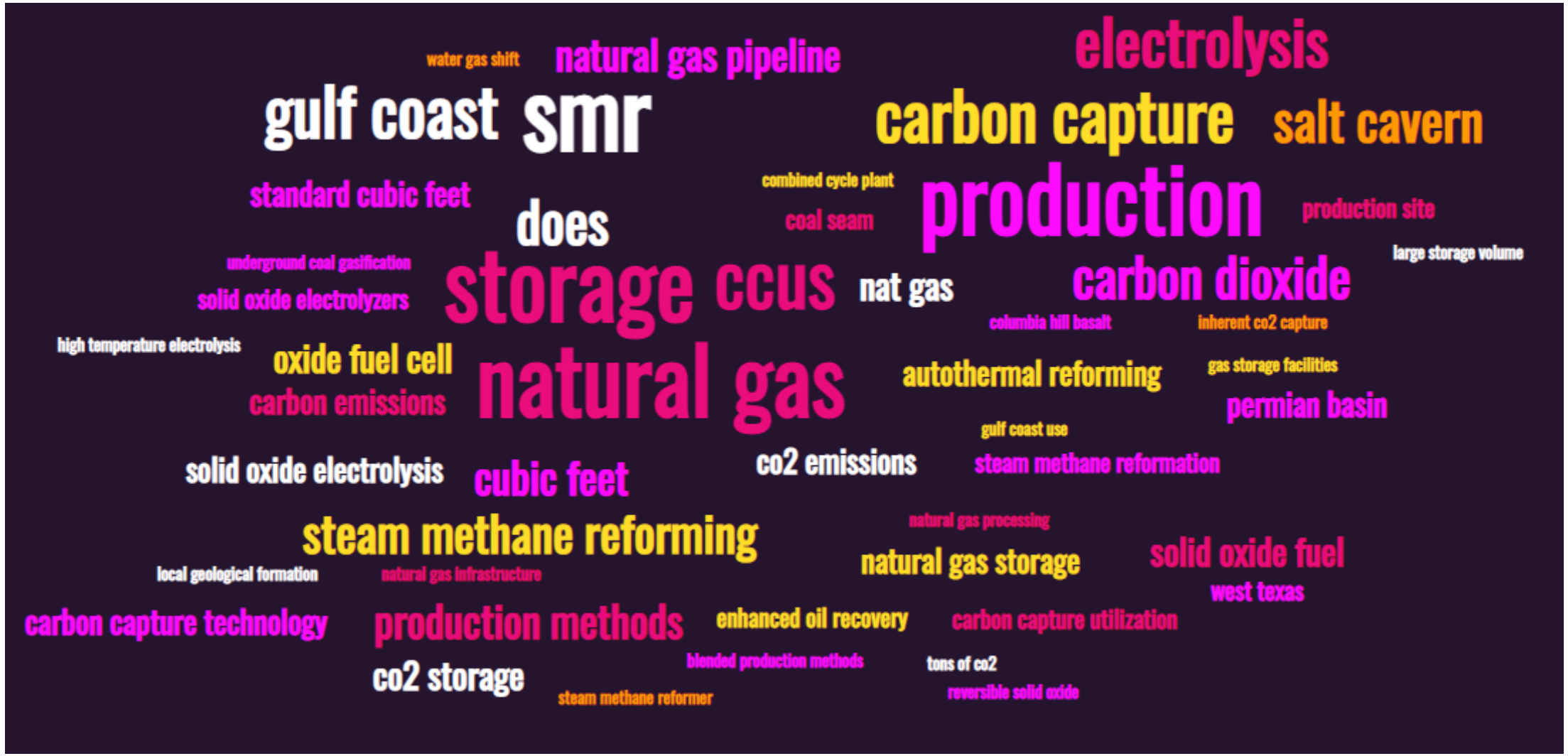
Source Huston, Williams, et al, DOE FECM

Responses related to storage, infrastructure, fossil resources by region



Source Huston, Williams, et al, DOE FECM

Examples of Popular Terms used by Respondents



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Source Huston, Williams, et al, DOE FECM

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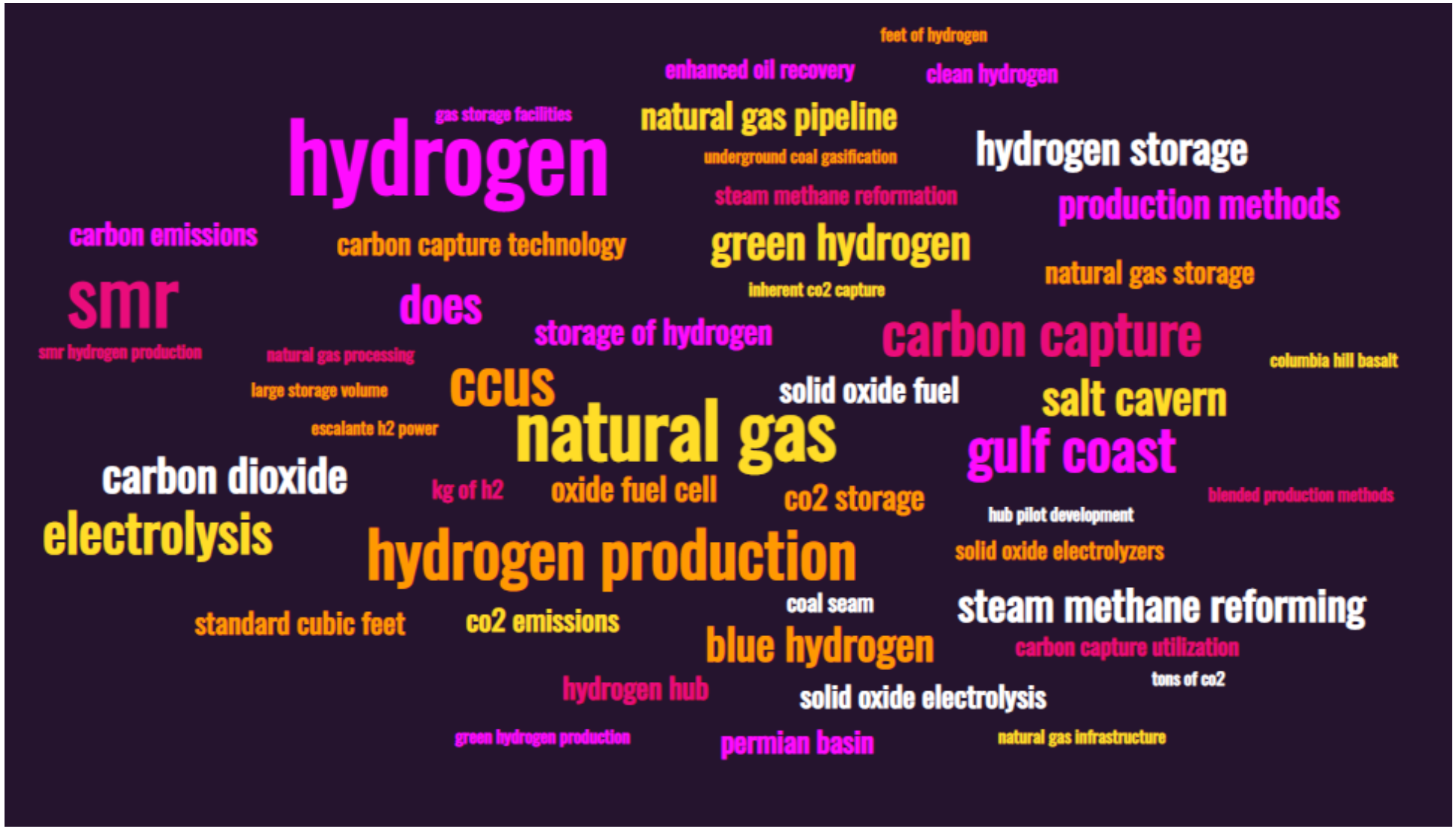
Examples of Popular Terms using “Hydrogen” in Response



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Source Huston, Williams, et al, DOE FECM

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Thank you

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