Evan Frye
Natural Gas Decarbonization and Hydrogen Technologies Program Manager
Division of Methane Mitigation Technologies
Office of Fossil Energy and Carbon Management
U.S. Department of Energy

He joined DOE in 2014 after working in upstream oil and natural gas production and analysis. He has previously served as an Economist at the U.S. Department of Agriculture and as Geologist at the U.S. Energy Information Administration. His current portfolio includes natural gas decarbonization and hydrogen technologies across production, transportation, and storage R&D efforts.

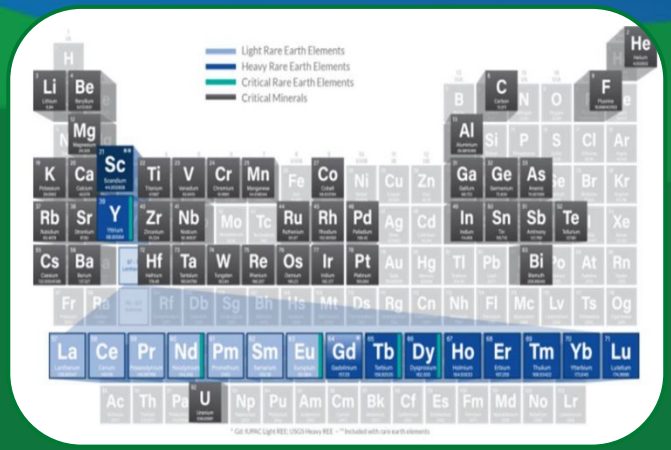
He holds a BA in Environmental Science/Geosciences from Franklin & Marshall College, an MSc in Energy and Mineral Engineering from The Pennsylvania State University, and a MBA from The Johns Hopkins University.

U.S. DEPARTMENT OF ENERGY

Fossil Energy and Carbon Management

Natural Gas Decarbonization and Hydrogen Technologies (NGDHT): Programmatic Overview

November 08, 2023



FECM RDD&D Priorities

Advance Carbon Dioxide Removal & Low Carbon Supply Chains for Industry

Demonstrate and Deploy Point Source Carbon Capture

Accelerate Carbon-Neutral Hydrogen (H_2)

Reduce Methane Emissions

Low-Carbon Industrial Supply Chains

Advance Critical Minerals, Rare Earth Elements (REE), and Mine Remediation

Increase Efficient Use of Big Data and Artificial Intelligence

Address the Energy Water Nexus

Invest in Thoughtful Transition Strategies

Methane Mitigation Technologies Division

Methane Emissions Mitigation

Advanced materials, data management tools, inspection and repair technologies, and dynamic compressor R&D for eliminating fugitive methane emissions across the natural gas value chain

Methane Emissions Quantification

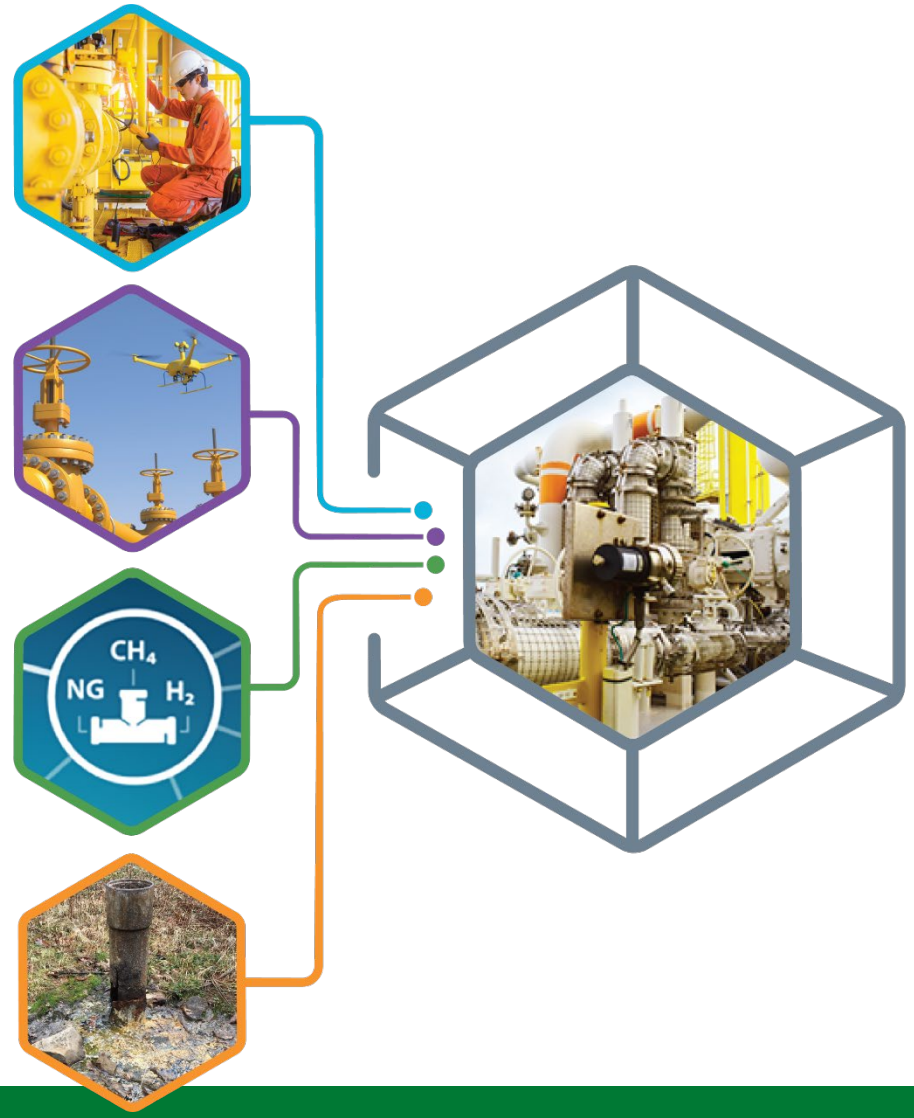
Direct and remote measurement sensor technologies and collection of data, research, and analytics that quantify methane emissions from point sources along the upstream and midstream portion of the natural gas value chain

Natural Gas Decarbonization and Hydrogen Technologies

Technologies for clean hydrogen production, safe and efficient distribution, and geologic storage technologies supported by analytical tools and models

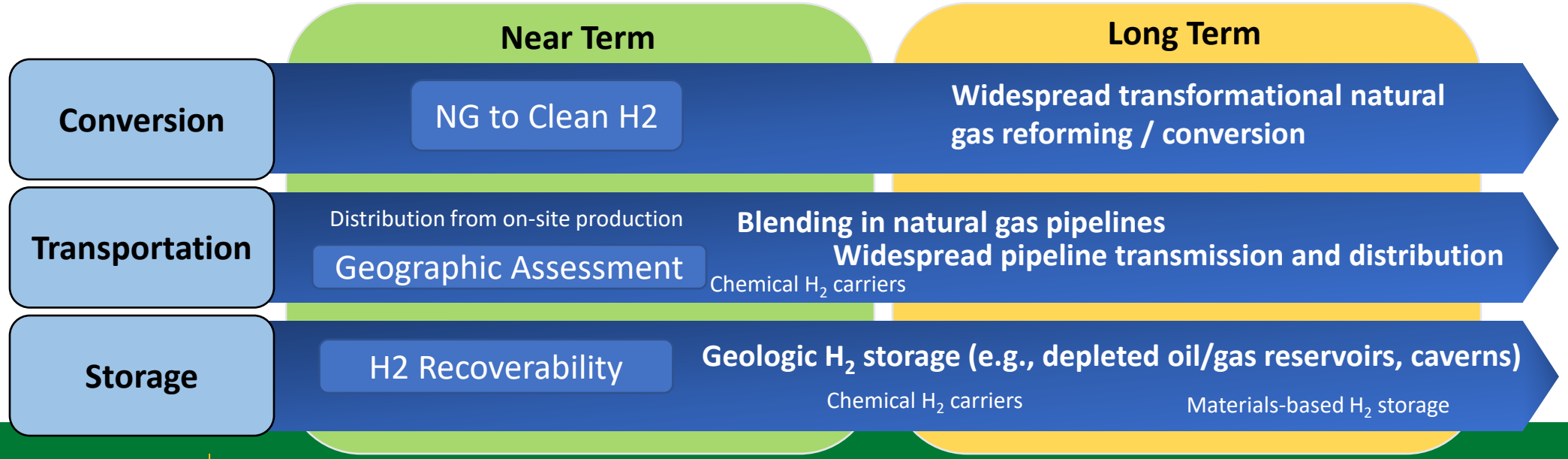
Undocumented Orphaned Wells Research

Developing tools, technologies, and processes to efficiently identify and characterize undocumented orphaned wells in order to prioritize them for plugging and abandonment.

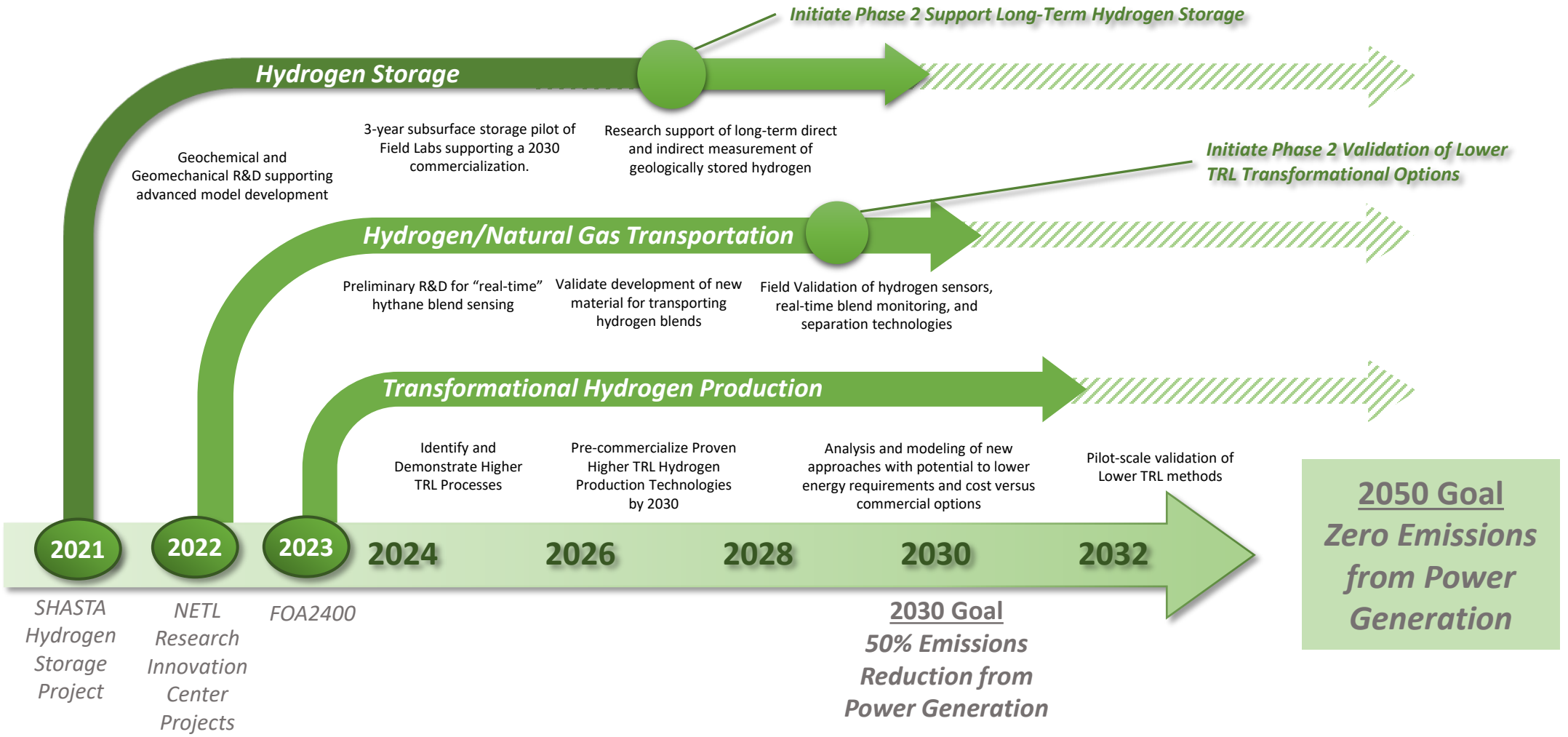


Natural Gas Decarbonization and Hydrogen Technologies

- The **Natural Gas Decarbonization and Hydrogen Technologies** (**NG-DHT**) Program was formally initiated in 2022 Omnibus.
- The NG-DHT Program coordinates with other DOE offices to support the transition towards a clean hydrogen-enabled economy through the decarbonization of natural gas conversion, transportation, and storage.
  - Supports transformational concepts for clean hydrogen production from domestic natural gas resources, with emphasis on decarbonization opportunities and value tradeoffs within energy markets.
  - Works to ensure the suitability of existing natural gas pipelines and infrastructure for hydrogen distribution, while emphasizing technology opportunities to detect and mitigate emissions.
  - Identifies underground storage infrastructure to handle high-volume fractions of hydrogen, while seeking demonstration opportunities for novel bulk storage mechanisms.

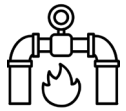


Technology Development Timeline



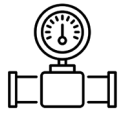
NETL RIC Natural Gas Decarbonization and Hydrogen Technologies

- Production of Hydrogen and Carbon from Associated Gas Catalytic Pyrolysis



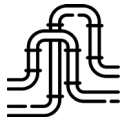
- Assessment of State-of-the-art H2 Production via Pyrolysis

- H2 Sensing Materials Development for Safe Hydrogen Transportation



- Advanced Multi-functional Electrochemical H2 Sensor

- Real-time in-Pipe Gas Blend Monitoring with Raman Gas Analyzer



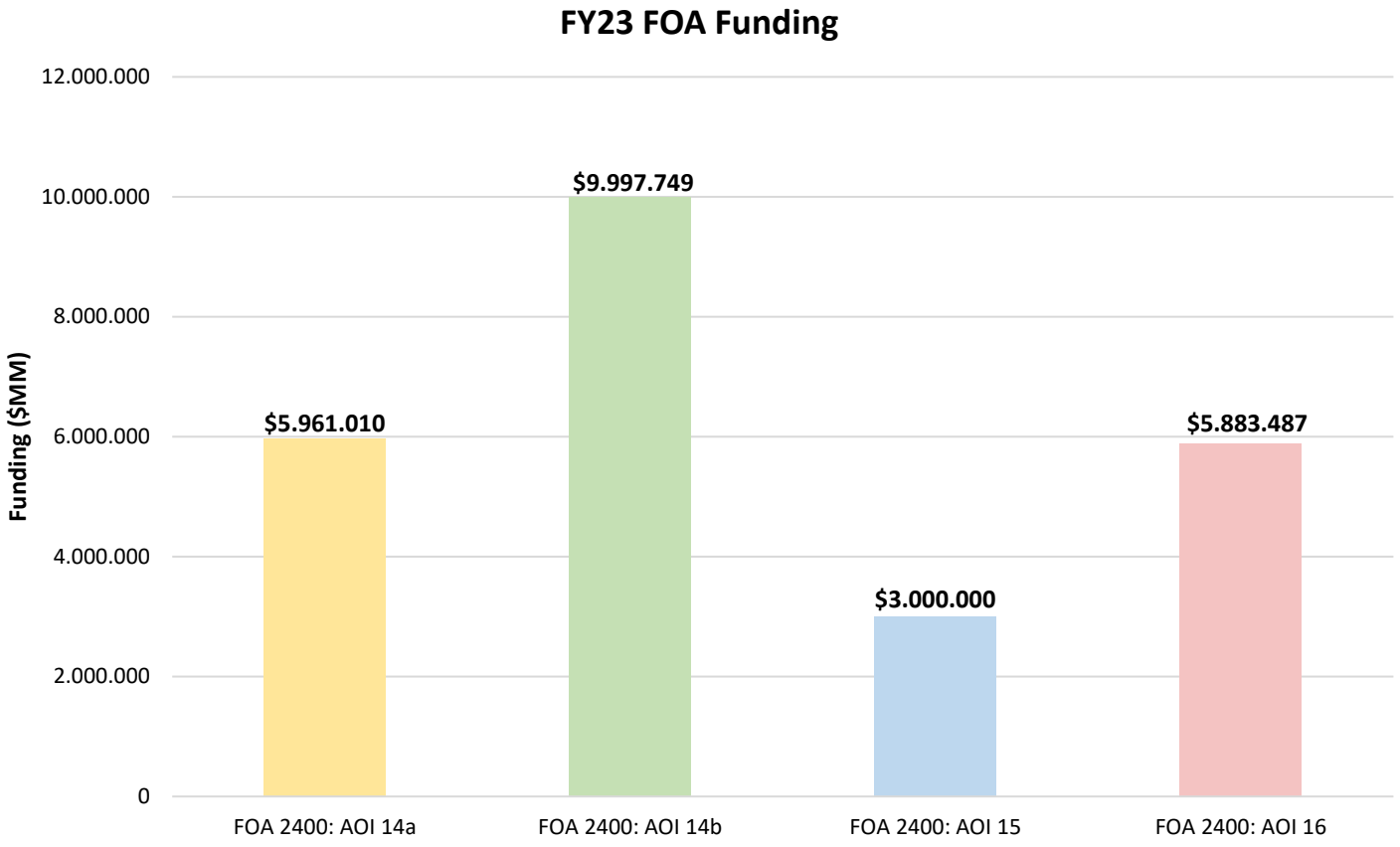
- Techno-economic Pipeline Model for Transporting Blends of Natural Gas and Hydrogen

- Comparison of Commercial, State-of-the-Art, Fossil-Based Ammonia Production Technologies

NATIONAL ENERGY TECHNOLOGY LABORATORY

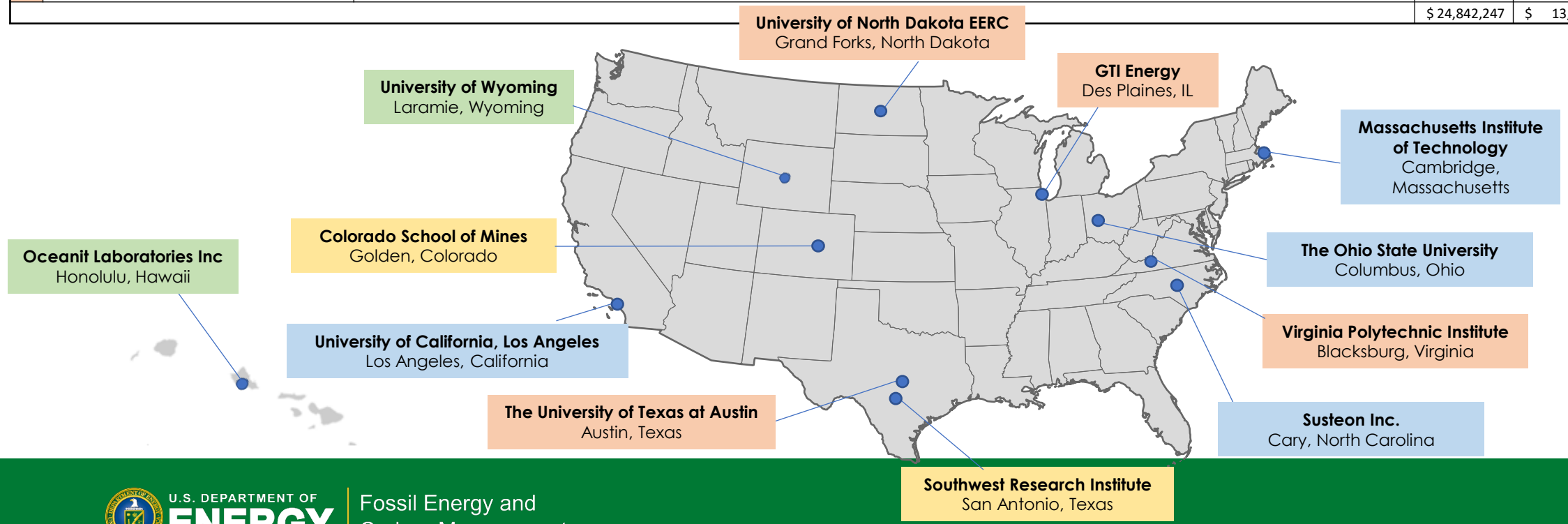
FOA2400 - Fossil Energy Based Production, Storage, Transport and Utilization of Hydrogen Approaching Net-Zero or Net-Negative Carbon Emissions

FOA 2400 Clean Hydrogen Production, Storage, Transport and Utilization to Enable a Net-Zero Carbon Economy	Area of Interest 14a: Methane Pyrolysis/Decomposition, In situ Conversion, or Cyclical Chemical Looping Reforming
	Area of Interest 14b: Hydrogen Production from Produced Water
	Area of Interest 15: Technologies for Enabling the Safe and Efficient Transportation of Hydrogen Within the U.S. Natural Gas Pipeline System
	Area of Interest 16: Fundamental Research to Enable High Volume, Long-term Subsurface Hydrogen Storage



FOA2400 - Fossil Energy Based Production, Storage, Transport and Utilization of Hydrogen Approaching Net-Zero or Net-Negative Carbon Emissions

AOI	Performer	Project Title	DOE Share	Non-DOE Share	Total Cost
14A	The Ohio State University	Bench Scale Testing and Development of Fixed Bed Chemical Looping Reactor for Hydrogen Generation from Natural Gas with CO2 Capture	$ 1,499,238	$ 375,000	$ 1,874,238
14A	Massachusetts Institute of Technology	Lower Cost, CO2 Free, H2 Production via CH4 Pyrolysis in Molten Tin	$ 1,500,000	$ 375,048	$ 1,875,048
14A	Susteon Inc.	Thermo-Catalytic Co-Production of Hydrogen and High-Value Carbon Products from Natural Gas using Structured Materials	$ 1,500,000	$ 375,000	$ 1,875,000
14A	University of California, Los Angeles	Direct Solar Self-Catalyzing Pyrolysis of Natural Gas to Hydrogen and High-Quality Graphite	$ 1,461,772	$ 377,848	$ 1,839,620
14B	University of Wyoming	Integration of Produced Water Thermal Desalination and Steam Methane Reforming for Efficient Hydrogen Production	$ 4,997,749	$ 4,999,387	$ 9,997,136
14B	Oceanit Laboratories Inc	HALO: Hydrogen-Recovery Using an AI-Arc-Plasma Learning Operational System for Produced Water	$ 5,000,000	$ 5,000,000	$ 10,000,000
15	Colorado School of Mines	Assessment of Toughness in H-Containing Blended Gas Environments in High Strength Pipeline Steels	$ 1,500,000	$ 375,000	$ 1,875,000
15	Southwest Research Institute	Technologies for Enabling The Safe and Efficient Transportation of Hydrogen within the U.S. Natural Gas Pipeline System	$ 1,500,000	$ 375,000	$ 1,875,000
16	GTI Energy	Developing & Investigating Subsurface Storage Potential And Technical Challenges for Hydrogen (DISSPATCH H2)	$ 1,400,000	$ 350,000	$ 1,750,000
16	University of North Dakota EERC	Williston Basin Resource Study for Commercial-Scale Subsurface Hydrogen Storage	$ 1,500,000	$ 375,000	$ 1,875,000
16	The University of Texas at Austin	Hydrogen Storage in Salt Caverns in the Permian Basin: Seal Integrity Evaluation and Field Test	$ 1,483,488	$ 370,873	$ 1,854,361
16	Virginia Polytechnic Institute	Assessment of Subsurface Hydrogen Storage in Depleted Gas Fields of Appalachia	$ 1,500,000	$ 375,000	$ 2,250,000
			$ 24,842,247	$ 13,723,156	$ 38,940,403

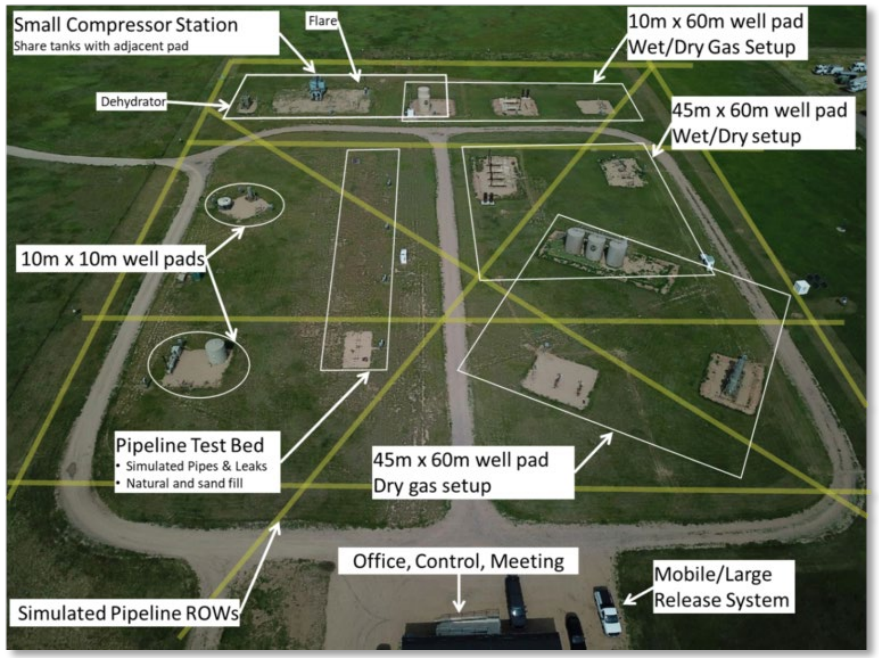


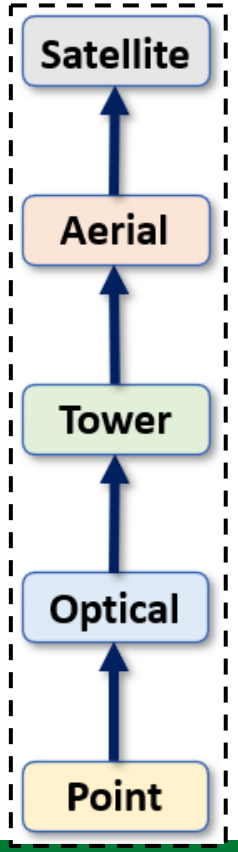
METEC - Advancing Development of Emissions Detection

Comprehensive process of protocol development and testing to accelerate the adoption of natural gas leak detection and quantification (LDAQ) solutions by natural gas operators, and their approval by cognizant regulatory authorities.

- Develop test protocols for LDAQ methods through controlled testing performed at CSU's Methane Emissions Technology Evaluation Center
- Comprehensive field testing of LDAQ solutions on a variety of oil and natural gas emulated facilities (e.g. equipment); and
- Demonstrate methods to evaluate the control efficacy of LDAQ solutions using simulation software developed in parallel projects.

Colorado State University Methane Emissions Technology Evaluation Center





Subsurface Hydrogen Assessment Storage & Technology Acceleration (SHASTA)

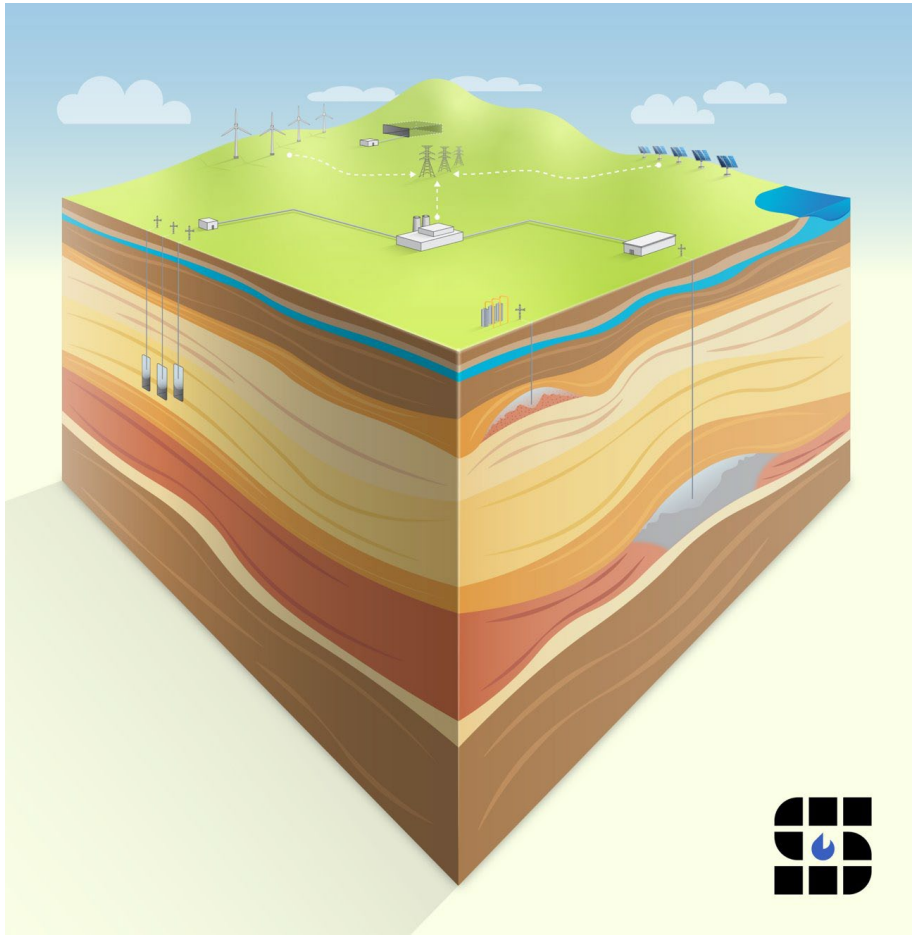
Identify and address key technological hurdles and develop tools and technologies to enable broad public acceptance for subsurface storage of pure hydrogen and hydrogen/natural gas mixtures

Specific Goals:

- Quantify operational risks
- Quantify potential for resource losses
- Develop enabling tools, technologies, and recommended practices
- Develop a collaborative field-scale test plan in partnership with relevant stakeholders

Focus on reservoir performance and well component compatibility in the storage system

- Pipelines and surface components upstream from the wellhead are covered by separate DOE research activities



Selected Regional Clean Hydrogen Hubs

Unprecedented Investment in America's Hydrogen Infrastructure

- Federal investment of $7 billion

To accelerate adoption of hydrogen technologies

- To accelerate adoption of hydrogen technologies

Providing tangible benefits for Americans

- Dedicated Dollars for Community Benefits
- Tens of Thousands of Jobs
- Greenhouse Gas Reduction of 25 million Metric Tons Per Year

Technology Transfer

- Assessing Compatibility of Natural Gas Pipeline Materials with Hydrogen, CO2, and Ammonia – ORNL
- Hydrogen Storage Potential in U.S. Underground Gas Storage Facilities – SHASTA
- Underground Storage of Hydrogen and Hydrogen/Methane Mixtures: Influence of Reservoir Factors and Engineering Choices on Feasibility, Storage Operations, and Risks – SHASTA
- Local-Scale Framework for Techno-Economic Analysis of Subsurface Hydrogen Storage – SHASTA
- Managing Reservoir Dynamics When Converting Natural Gas Fields to Underground Hydrogen Storage – SHASTA
- SHASTA Homepage
- 2024 Resource Sustainability Project Review Meeting – Pittsburgh, PA (April 2024)

U.S. DEPARTMENT OF ENERGY

Fossil Energy and Carbon Management

Questions?