

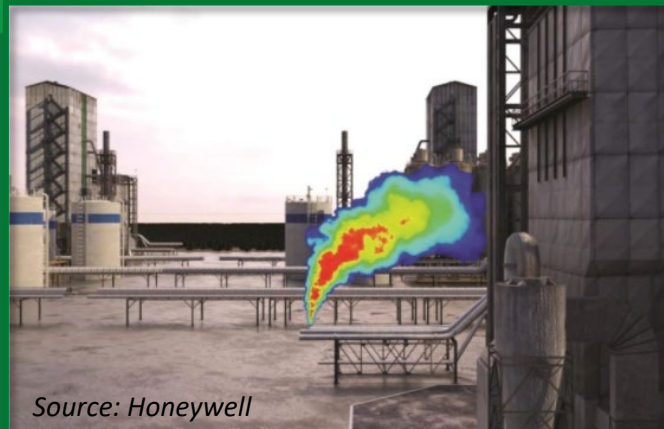


U.S. DEPARTMENT OF
ENERGY

Fossil Energy and
Carbon Management

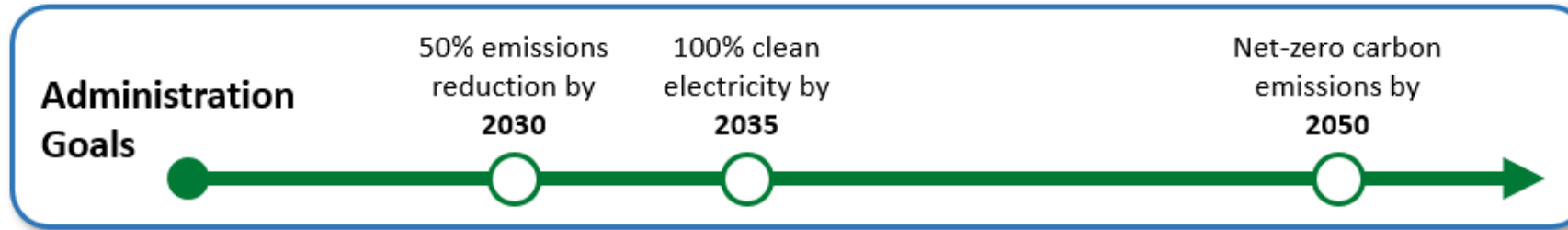
Division of Methane Mitigation Technologies Overview

Annual Review Meeting
Timothy Reinhardt
October 25-27, 2022



Program Mission

Administration's Goals



Accelerate the development and deployment of ***technology solutions*** to increase the efficiency, reliability, resiliency, and ***elimination of methane emissions*** across the oil and natural gas infrastructure—from oil and natural gas production, through processing, transportation, and storage, to end-use utilization.



Dynamic Factors Shape R&D Portfolio

Administration's Goals



Administration
Goals

50% emissions
reduction by
2030

100% clean
electricity by
2035

Net-zero carbon
emissions by
2050

Shifting Priorities of Industry Research Partners



International Considerations



Rapidly Changing Technology



National Laboratory and Academic Research Partners Capabilities



U.S. DEPARTMENT OF
ENERGY

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Prioritizing R&D Efforts Across The Natural Gas Value Chain

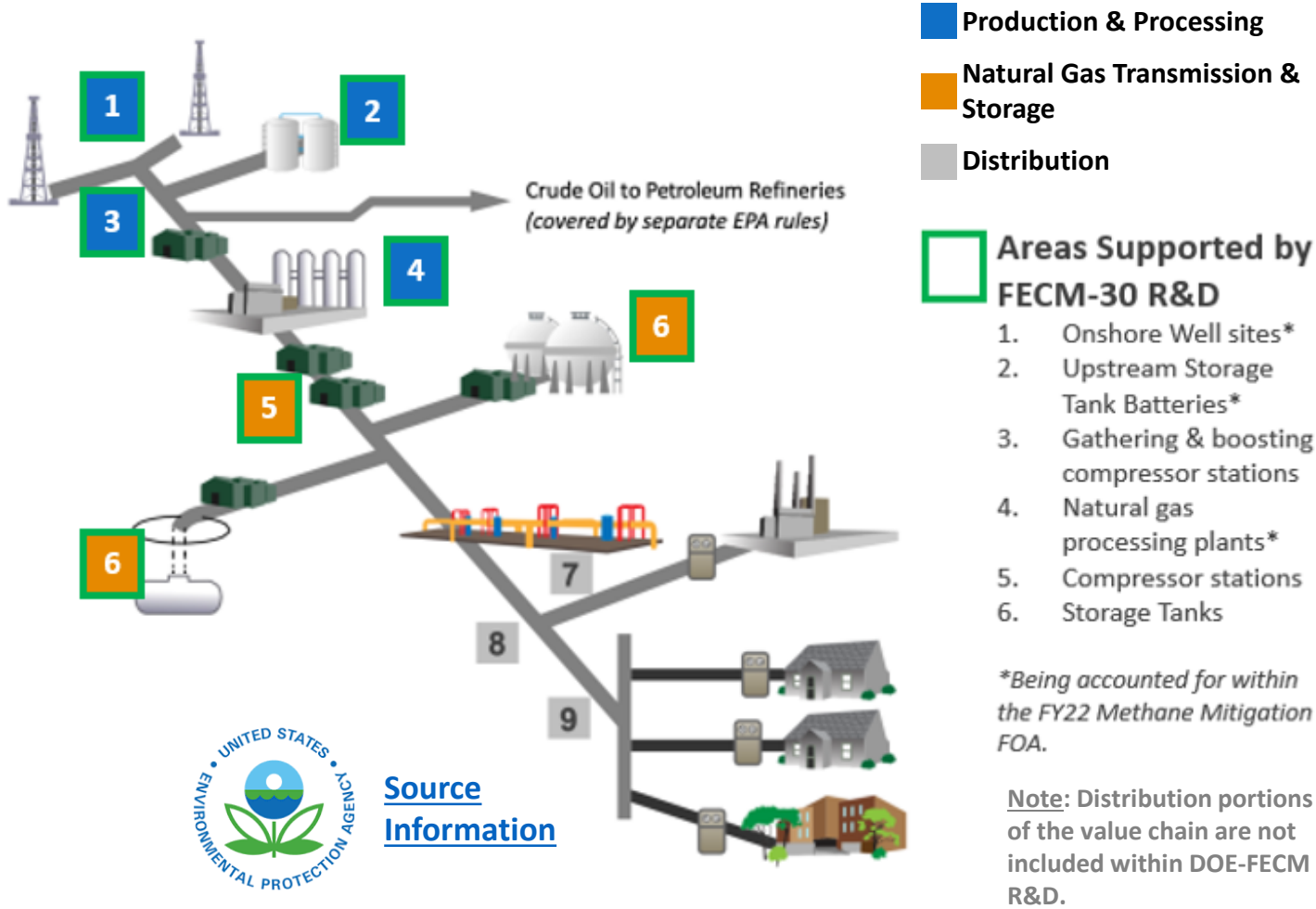
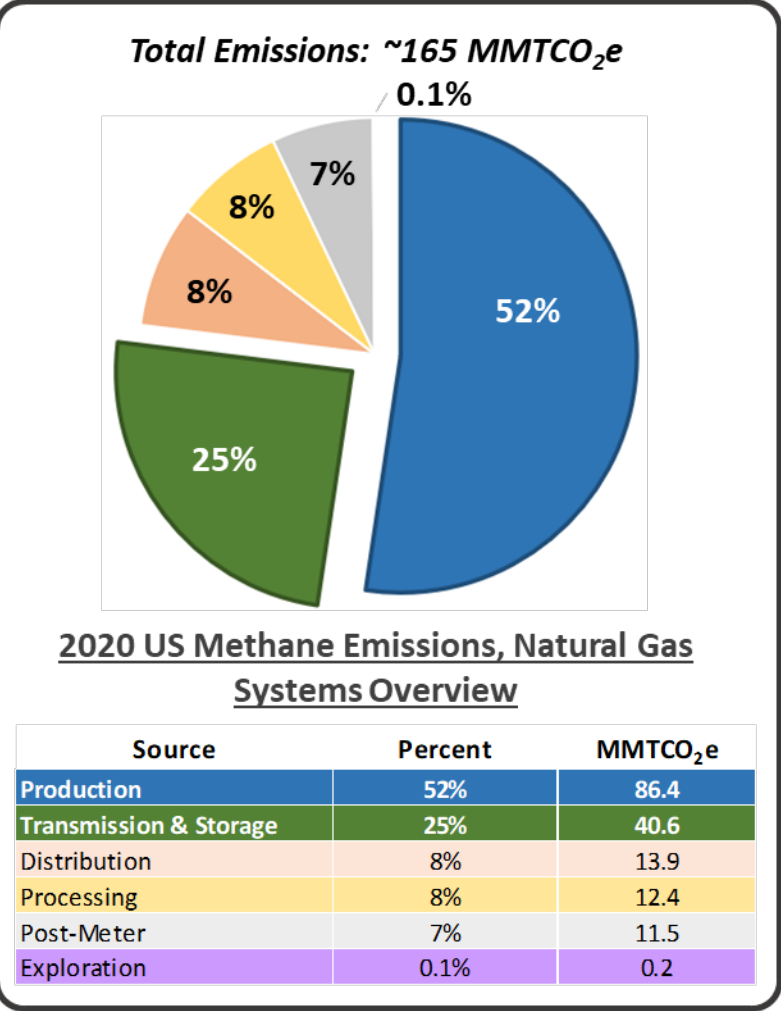


Figure: Adapted from American Gas Association and EPA Natural Gas STAR Program

Methane Mitigation Technologies Overview

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



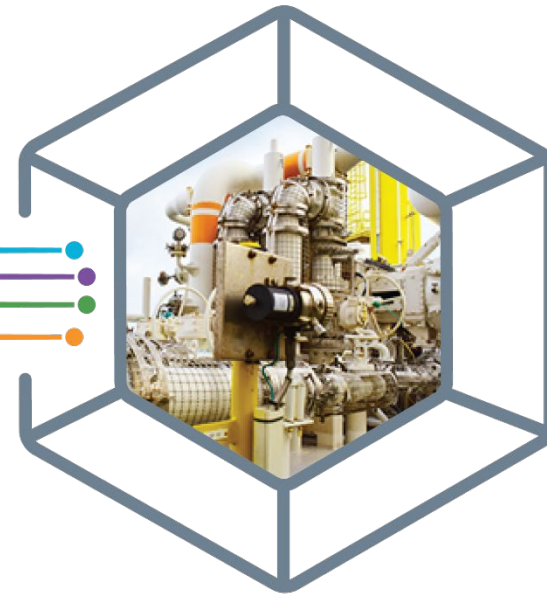
Decarbonization of Natural Gas Resources

Technologies for carbon-neutral hydrogen production, safe and efficient transportation, and geologic storage technologies supported by analytical tools and models



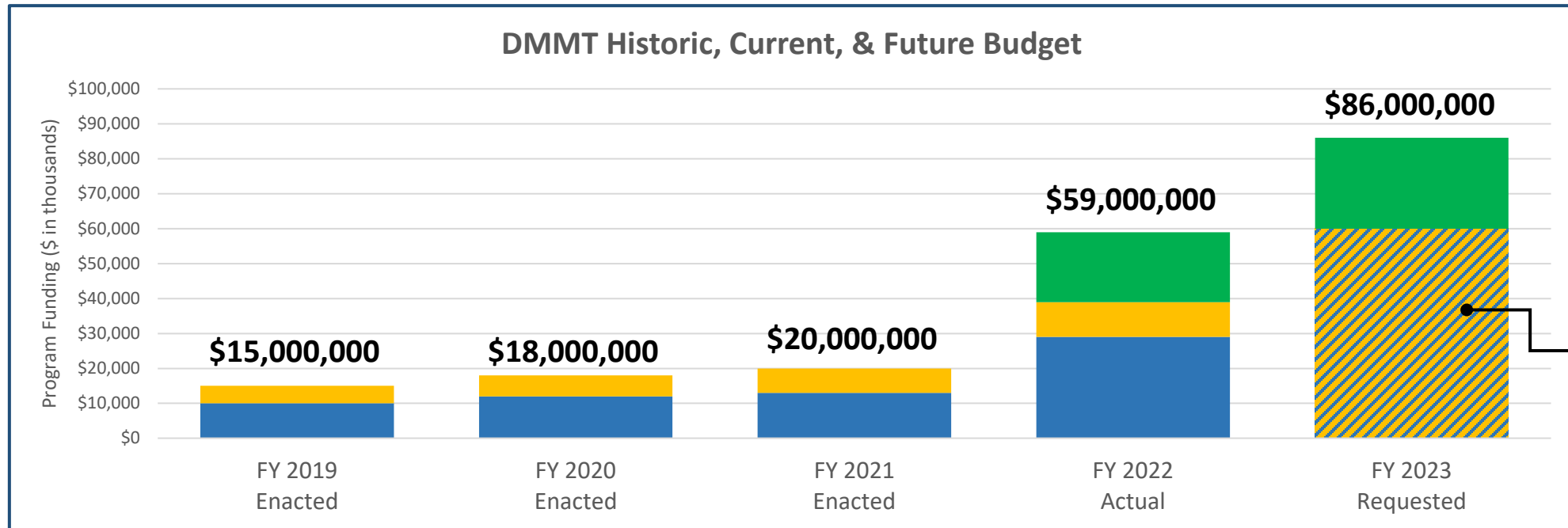
Undocumented Orphaned Wells Research

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



Historic & Working Budget

Program (\$ in thousands)	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Actual	FY 2023 Requested
Emissions Mitigation	\$10,000	\$12,000	\$13,000	\$29,000	\$60,000
Emissions Quantification	\$5,000	\$6,000	\$7,000	\$10,000	
Natural Gas Decarbonization and Hydrogen Technologies	\$0	\$0	\$0	\$20,000	\$26,000
DMMT Total*	\$15,000	\$18,000	\$20,000	\$59,000	\$86,000



Note: The FY 2023 Budget Request does not distinguish between Mitigation and Quantification funding.

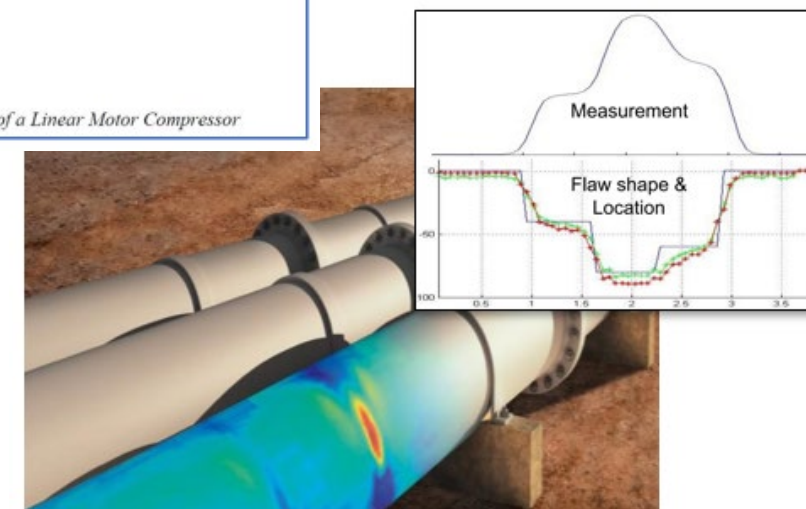
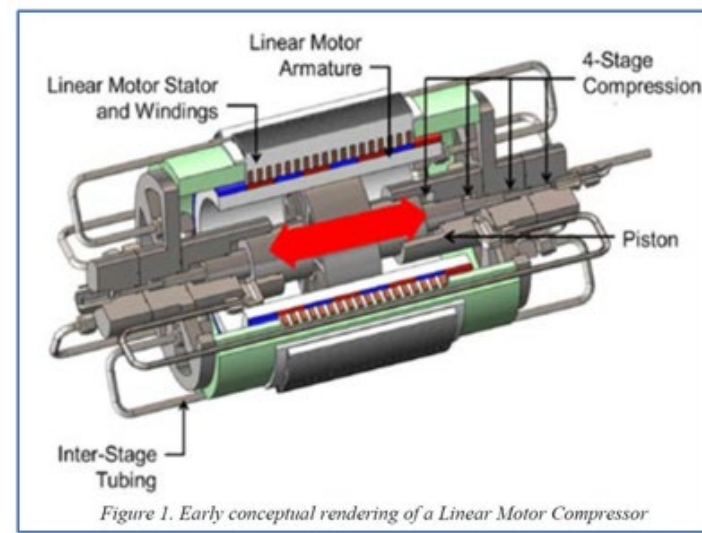
Methane Mitigation Research

Develop and validate cost-effective and state-of-the-art tools, technologies and materials to mitigate methane emissions and improve the resiliency and efficiency of natural gas transportation and storage infrastructure.

Emissions Mitigation Research Priorities

Emissions mitigation research supports industry by improving the resiliency and efficiency of natural gas infrastructure components.

- Advancing pipeline inspection and repair technologies.
- Improving compressor system operational performance, including zero emission compressors.
- Developing the capability to integrate smart sensor systems with monitoring and risk assessment tools.
- Developing advanced materials for improved pipeline resiliency.
- Developing modular solutions to convert associated gas into sustainable chemicals and fuels at the wellhead to eliminate the need for flaring.



Diagnostic component: Predict flaw characteristics from signal data.

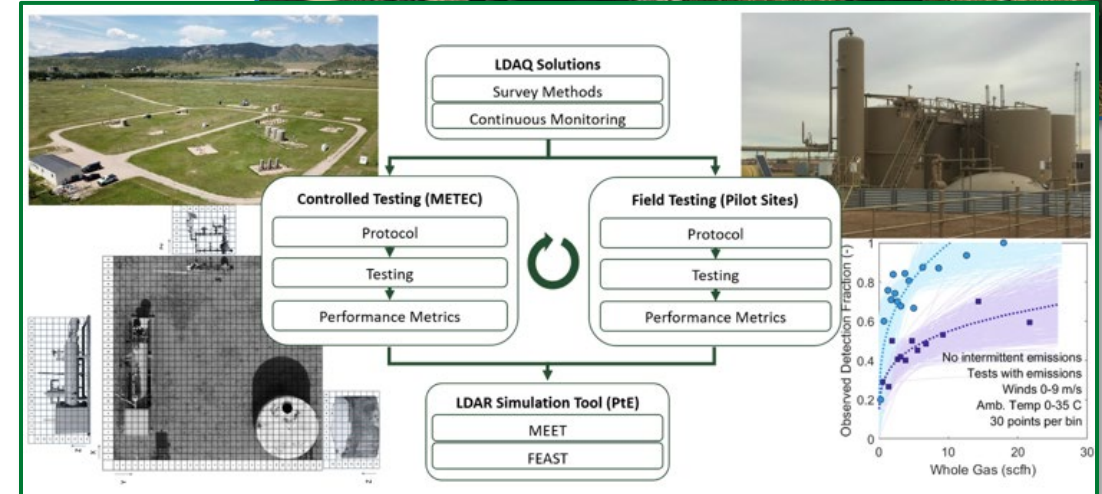
Quantification Research

Developing and validating the performance of new technologies that are intended to more accurately and precisely measure emissions occurring across the natural gas supply chain.

Emissions Quantification Research Priorities

Emissions quantification research can assist in identifying the volume of methane that is emitted by industry across the supply chain and potentially lead to operational, technological, and process enhancements through:

- Advancing external leak detection and rate quantification technologies and methodologies.
- Developing direct and remote measurement sensor technologies for the collection, dissemination, and analysis of emissions data.
- Engaging in field efforts to characterize emissions from a variety of sources related to natural gas production, transport, and storage to better inform industry and regulators.



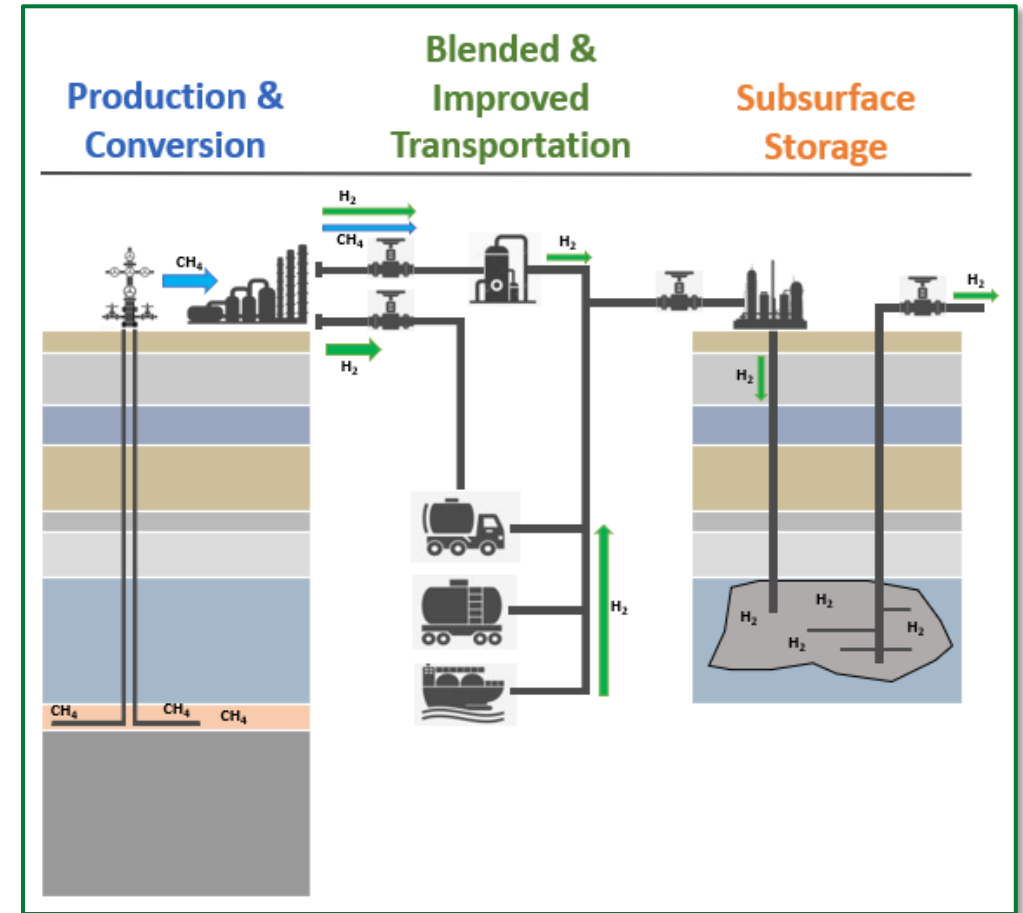
Hydrogen & Natural Gas Decarbonization

Developing and advancing sensors, coatings, and real-time monitoring systems for the safe, reliable, and optimized hydrogen or blended gas transportation of domestically produced hydrogen.

The Need for Hydrogen Research

Supporting research and development to effectively utilize natural gas for decarbonization solutions, including activities focused on natural gas conversion to low-carbon chemicals and derivatives, such as ammonia and hydrogen, and comprehensive planning of the infrastructure required to store and transport them.

- Development and rapid validation of carbon-free hydrogen production technologies.
- Development of infrastructure coatings, materials, hydrogen sensors.
- Development of separation technologies enabling for high-yield utilization of existing infrastructure.
- Characterize subsurface storage options for optimized long-term hydrogen storage.
- Conduct field demonstrations of production, transportation, and subsurface hydrogen storage technologies.



Undocumented Orphaned Well Research

UOW Identification

Gather data on undocumented well locations, wellbore characteristics, and environmental impact to support development of new tools, technologies and processes (such as magnetics, gravimetrics, LiDAR, UAV tools, satellite based remote sensing) for robust, efficient identification of undocumented orphaned wells.

UOW Characterization

Improve advanced data analytics to combine and analyze disparate datasets to better assess environmental impacts from undocumented orphaned wells, develop cost-effective and advanced technologies for wellbore characterization that includes in-situ, real-time, and long-term sensor technologies to monitor wellbore integrity, methane emissions, and subsurface conditions.

The Need for UOW Research

- The total estimated number of undocumented orphaned wells reported by the states is between 310,000 and 800,000.
- Unplugged, abandoned wells in the U.S. leaked 5,000 times more methane than plugged wells did, according to a 2015 study cited by the EPA.



Natural Gas Demand Response

Objective: Establish multiple regional, 3 to 5-year Natural Gas Demand Response (NGDR) pilot programs in collaboration with utilities, local distribution companies (LDCs), and public utility commissions (PUCs).

Awards

GTI Energy: *NGDR Program for Residential, Commercial and Industrial Customers of SoCalGas*

- Provide the information needed to make good decisions regarding investments in demand response
 - Proposed two new innovative DR pilot programs to be implemented
 - A Residential Thermostat and Water Heating Controls program
 - A Commercial and Industrial (C&I) program with three components:
 - Custom load reduction program or LRP
 - Space heating program
 - Water heating program

National Grid: *Future of Heating, Residential Gas Demand Response Pilot in Single-Family and Multifamily Use Cases*

- Determine how well the use of hybrid heating (gas and electric) technologies in multifamily and single-family households enables reduced gas system peak-hour and peak-day usage to alleviate gas system constraints
 - Proposed pilot expands upon the existing successful gas demand response programs using electric heating technology to expand the market potential of gas demand response
 - Focuses on two distinct customer groups: multifamily and single-family households in National Grid's downstate New York service territories

Mitigation and Quantification (FOA 2616)

Innovative Methane Measurement, Monitoring and Mitigation Technologies (iM⁴ Technologies)


- Advanced Methane Mitigation Technology Solutions
- Surface-based Methane Monitoring and Measurement Network Pilot Demonstration
- Basin Specific Methane Emissions Inventory via Field Assessments
- Integrate Methane Monitoring Platform Design
- Storage Tank Emissions (Field)

Scale: \$46 Million

FOA Closing: October 18, 2022

Project Awards: February 2023

FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT



Department of Energy (DOE)
Office of Fossil Energy and Carbon Management (FECM)

Innovative Methane Measurement, Monitoring, and
Mitigation Technologies (iM⁴ Technologies)

Funding Opportunity Announcement (FOA) Number: DE-FOA-0002616
FOA Type: Initial
Assistance Listing Number: 81.089, Fossil Energy Research and
Development

FOA Issue Date:	08/05/2022
Submission Deadline for Full Applications:	10/04/2022 11:59:59PM ET
Expected Date for Selection Notifications:	January 2023
Expected Date for Award:	May 2023

DE-FOA 0002616

H2 and NG Decarbonization (FOA 2400)

This FOA will develop technologies enabling **clean hydrogen production**, **transport**, **storage**, and use in the energy sector, including electricity, heat, transportation, and industrial use. The development of these technologies supports the ambitious goals for a carbon-neutral economy by 2050, a carbon-neutral power sector by 2035, and a 50% reduction from 2005 levels in economy-wide net GHG pollution by 2030.

AOI 14 (with two applicable subtopics)

1. Methane Pyrolysis/Decomposition, In Situ Conversion, or Cyclical Chemical Looping Reforming
2. Hydrogen from Produced Water

AOI 15

Technologies for Enabling the Safe and Efficient Transportation of Hydrogen Within the U.S. Natural Gas Pipeline System

AOI 16

Fundamental Research to Enable High Volume, Long-term Subsurface Hydrogen Storage

Applications Due

October 25, 2022
11:59pm EST

Estimated Federal
Funding

\$27MM

Anticipated Number of
Awards

AOI 14a - 4
AOI 14b - 3
AOI 15 - 2
AOI 16 - 2

Award Size
(DOE/Cost Share)

AOI 14a - \$1.5 MM/\$375 K
AOI 14b - \$5 MM/\$5 MM
AOI 15 - \$1.5 MM/\$375 K
AOI 16 - \$1.5 MM/\$375 K

Period of Performance

AOI 14 - 24 months
AOI 15 - 24 months
AOI 16 - 24 months

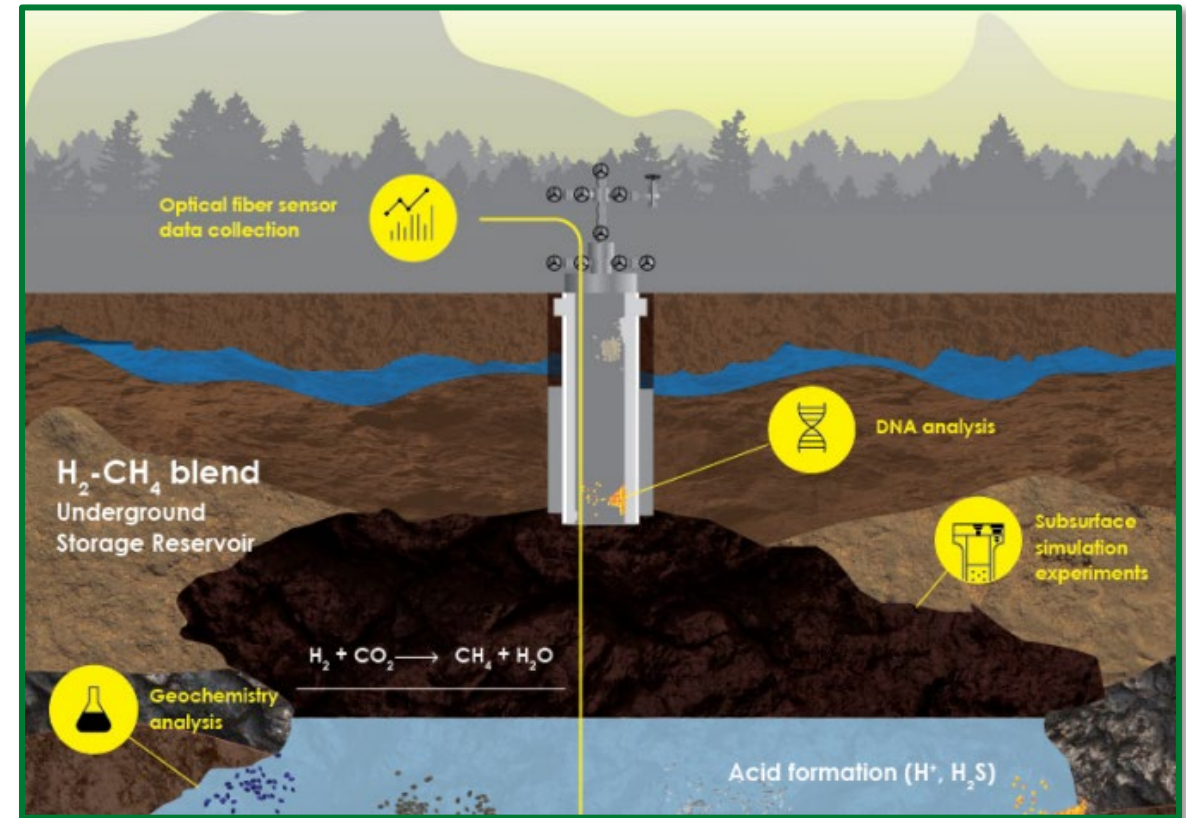
Subsurface H₂/NG Storage

Recent Accomplishments

- Completed the “[Subsurface Hydrogen and Natural Gas Storage: State of Knowledge and Research Recommendations Report](#)”
 - Discusses the current understanding and knowledge gaps of hydrogen storage.
 - Found that underground hydrogen storage is less costly than storage in above-ground vessels. Depleted NG reservoirs are generally the most cost-effective locations for UHS, largely because equipment for injection, withdrawal, and transportation is already in place.

Recommendations

- Characterize well integrity for compatibility with H₂.
- Assess biogeochemical impacts of H₂ in the subsurface.
- Collaborate with stakeholders
- Develop understanding of the multiphase/multicomponent flow behavior of H₂.
- Develop relevant modeling tools.
- Develop advanced sensors.
- Develop one or more pilot demonstration tests in the next 3-5 years.



DOE-FECM Would Like to Thank All Current and Past R&D Participants!



DOE-FECM Team

FECM-30

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Site Support

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