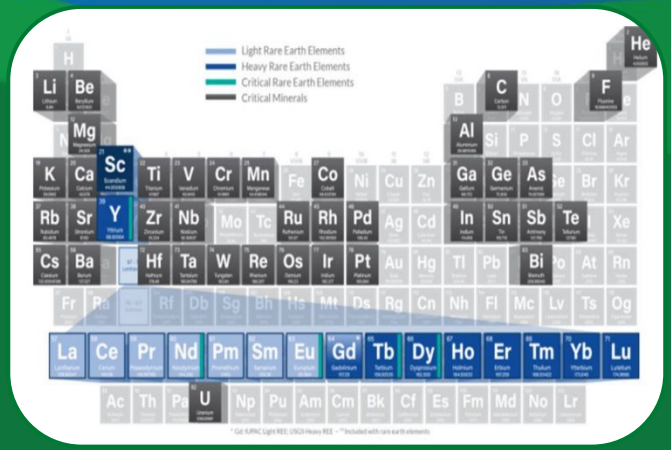
U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

Division of Advanced Remediation Technologies

Annual Project Review Meeting
October 25, 2022



Advanced Remediation Technologies

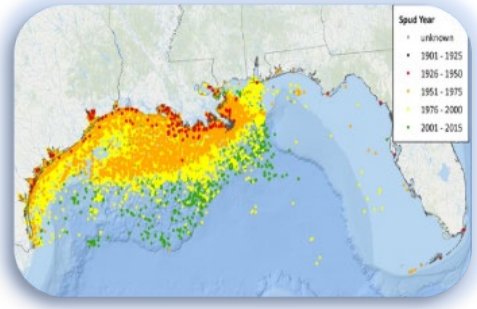
Focused on developing technologies that can be applied to the remediation and prevention of environmental impacts from the recovery of fossil energy resources.

Water Research

Waste to resource
Environmental sustainability
Industry collaboration

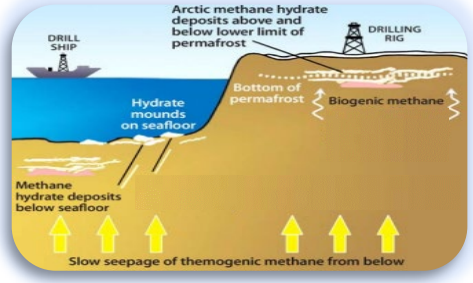
Field Laboratory Network

Basin-specific strategy
Fundamental shale
Emerging Plays



Offshore

Spill prevention
Borehole integrity
Aging infrastructure



Methane Hydrates

Climate change stability
Resource characterization
International collaboration

AI/ML

SMART initiative
Reservoir characterization
Interagency collaboration

ART Water Research: Integration of Water Programs

All water related R&D within the FECM portfolio will be executed by ART

WATER MANAGEMENT FOR POWER SYSTEMS

Shift from power plant water research to remediating coal power waste

Active Projects

10 Projects

9 Partnering Organizations

PRODUCED WATER

Treatment and management of water produced during oil and gas operations

Active Projects

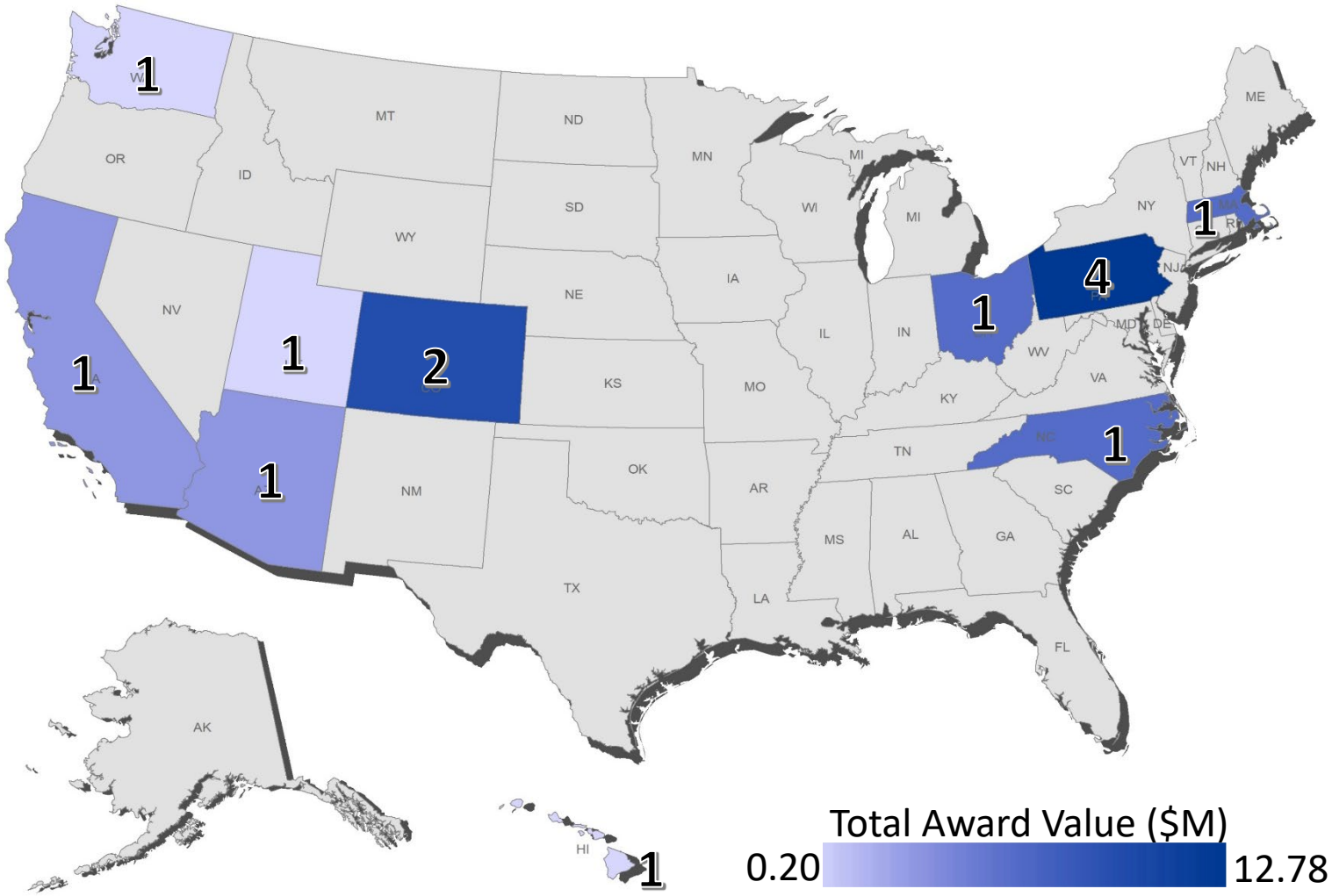
7 Projects

5 Partnering Organizations

Additional Objectives:

- Recovery of critical minerals, rare earths, and other beneficial resources from associated waste streams.
- Water recycling and beneficial reuse.

ART-WM Currently Funds Projects in 10 States*

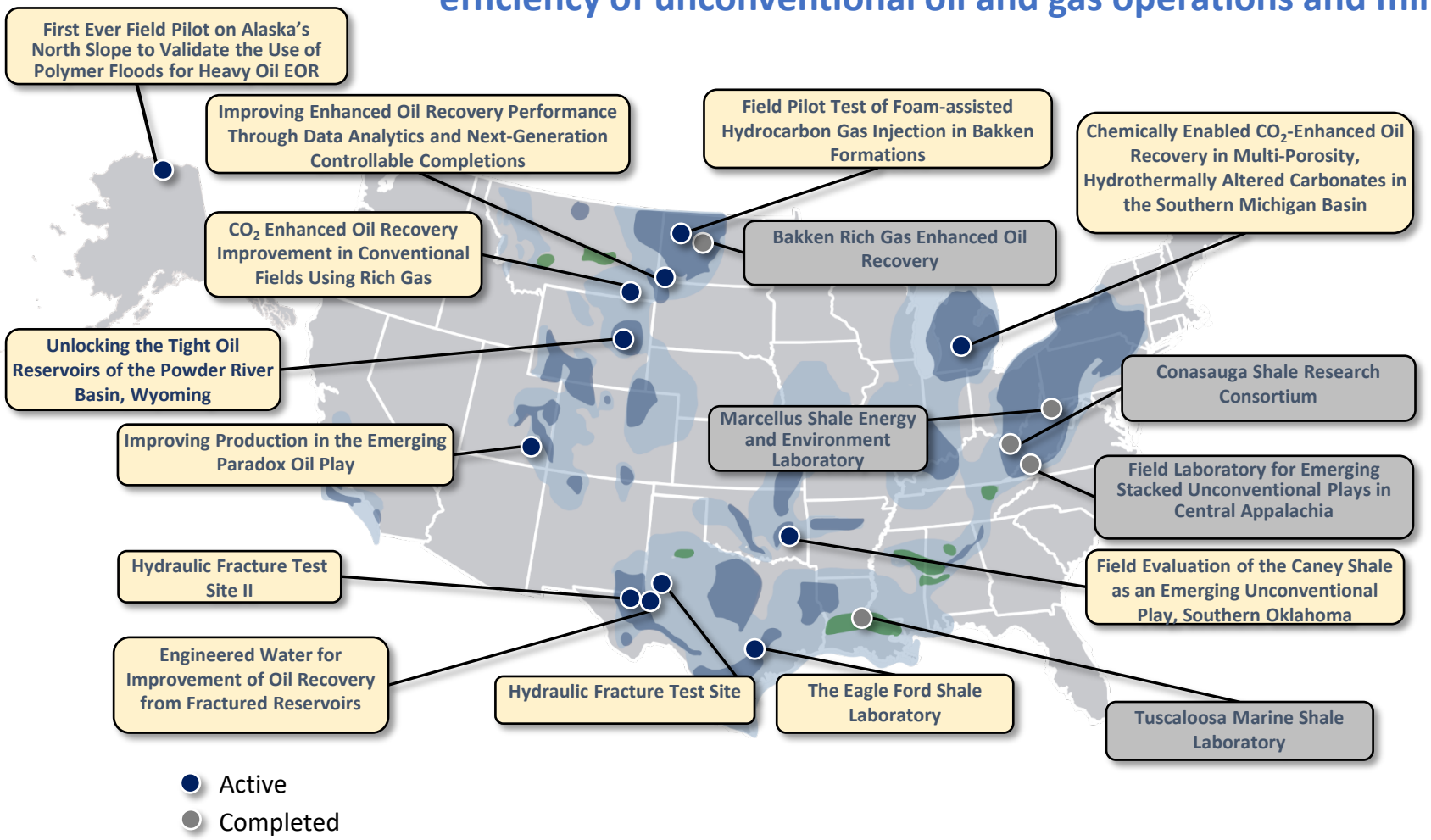


State	Total Projects	Total Award Value (M)
AZ	1	$ 1.17
CA	1	$ 0.94
CO	2	$ 2.59
HI	1	$ 0.20
MA	1	$ 1.59
NC	1	$ 1.82
OH	1	$ 1.87
PA**	4	$ 12.78
UT	1	$ 0.21
WA	1	$ 0.49

**All projects listed in PA are work completed by NETL-RIC. This work is reported in the VUE in PA but could be carried out via researchers at any NETL site.

Field Laboratory Network

Research for the development, testing, and validation of advanced technologies to increase the efficiency of unconventional oil and gas operations and minimize associated environmental impacts.



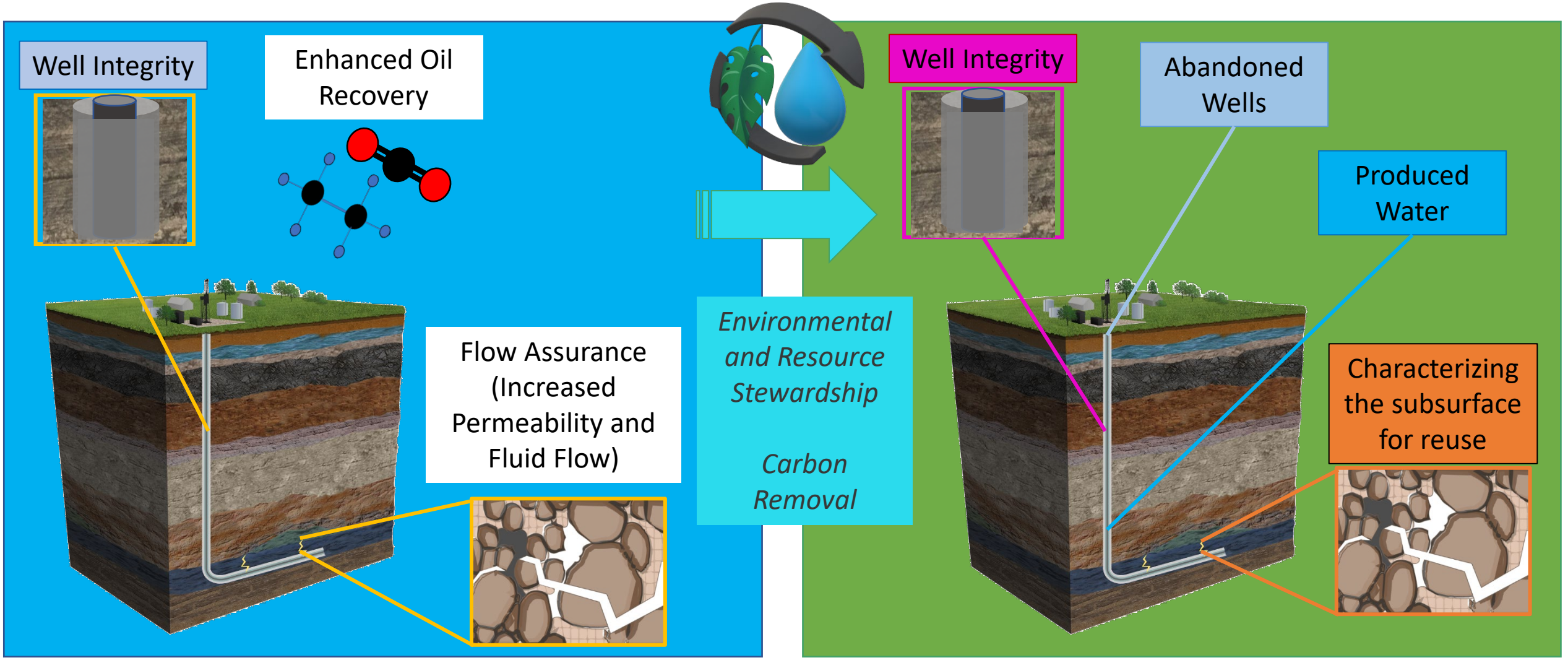
17 field test sites in different basins

- Extracted core samples
- Tested new field technologies

Results and data are made public

- Drilling and completion
- Production
- Environmental
- Stakeholders

Onshore Research – NETL RIC



Offshore Research

Purpose

- Reduce and quantify risks associated with hydrocarbon exploration and production in offshore environments.

Primary Enabler

- Macondo incident (20 April 2010)

Areas of Research and Cooperation

- NETL Offshore Research Innovation Center (RIC)
- Ocean Energy Safety Institute (OESI)
- Subsea Systems Institute (University of Houston) funded by Gulf Coast Restoration Trust Fund
- Rice University and the Johnson Space Center (NASA)
- Interagency Coordinating Committee on Oil Pollution Research (ICCOPR)
    - 15-member Interagency Committee established by Title VII of the Oil Pollution Act of 1990 (Section 7001)

Ocean Energy Safety Institute

Goal: Improve the safety and environmentally sustainable development and operation of offshore energy production through cooperative applied research and development

Benefit: Coordination of multi-university and industry offshore energy R&D activities

Duration: 2022-2027

DOE Cost: $20M over 5 years ($10M FECM / $10 M EERE)

Key Accomplishments:

- Roadmaps complete
- Oil & Gas, Wind and Marine Energy workshop completed

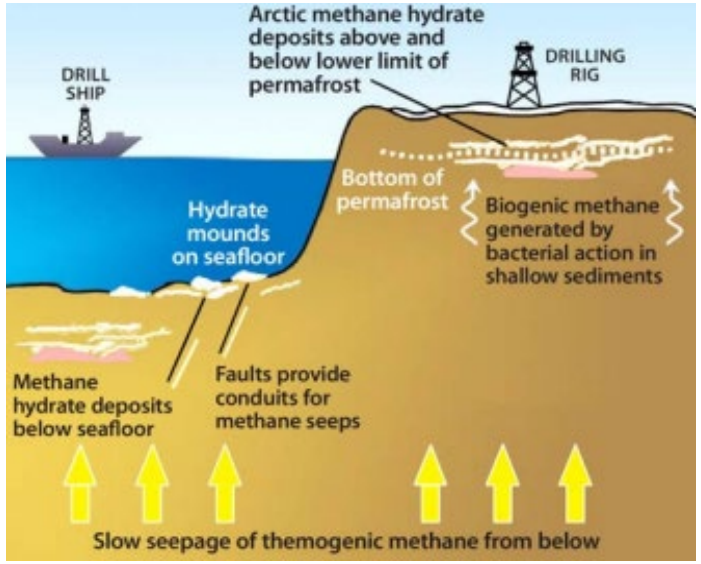
NEXT Key Milestones:

- Roadmaps for Oil & Gas, Wind and Marine Energy
- Initial research RFPs

Methane Hydrates Research

Advance the scientific understanding of very large hydrate resources and assess the environmental impacts from global climate change through:

- Fundamental understanding gas hydrate deposits and climate change impacts (degas) on system stability
- Characterization of marine hydrate bearing sediments in the Gulf of Mexico
- Assessment of long-term reservoir response: Alaska North Slope, production flow test at Prudhoe Bay
- International collaboration



- U.S. resource is thought to be roughly 10,000 trillion cubic feet (TCF) in offshore marine deposits and several hundred TCF in onshore, permafrost-associated deposits
- Global resource estimates range from 250,000 to 700,000 trillion cubic feet
- DOE research has the potential to impact hydrates as it did for shale and unconventional resource development over the past 30 years

Alaska Hydrates Production Testing Program Objectives

Robust, Proven, State-of-art Equipment for Well Sampling, Completion, and Monitoring

Science

Full characterization of GH systems → Physical Properties, Geomechanics, Petrophysics

- Sidewall pressure coring (STW)
- Whole core pressure coring (GDW)

Observation of controlled perturbation → Dynamic Geomechanics, Petrophysics, Heat Flow

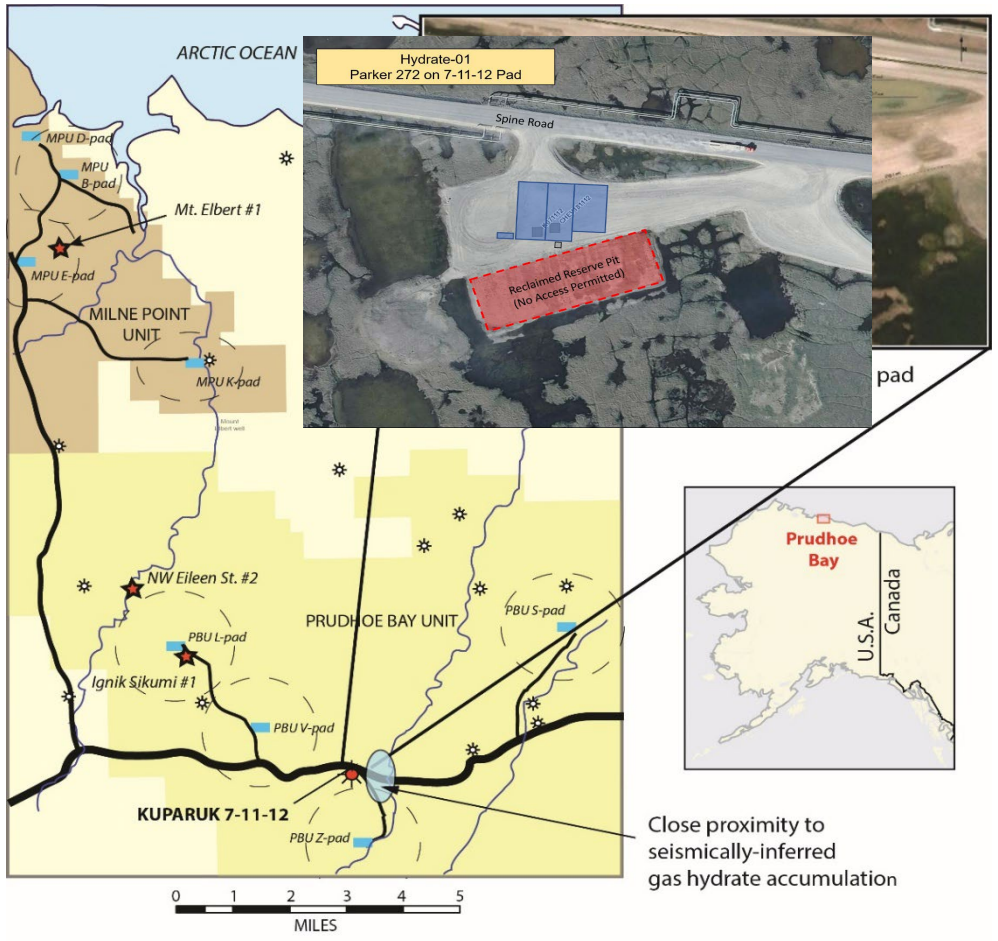
- Fiber-optic Strain, Acoustic, and Temperature Monitoring
- Pressure monitoring
- Monitoring inside (PTW) and outside (PTW, STW, GDW) casing
- Time Series VSP via DAS → Reservoir System Response

Technology

Assessment of Mitigations to production challenges (heat flow, permeability, geomechanics)

- Sand control/completion/stimulation/shut-in
- Artificial Lift; Hydraulic isolation

Improved evaluation/prediction of productivity and potential

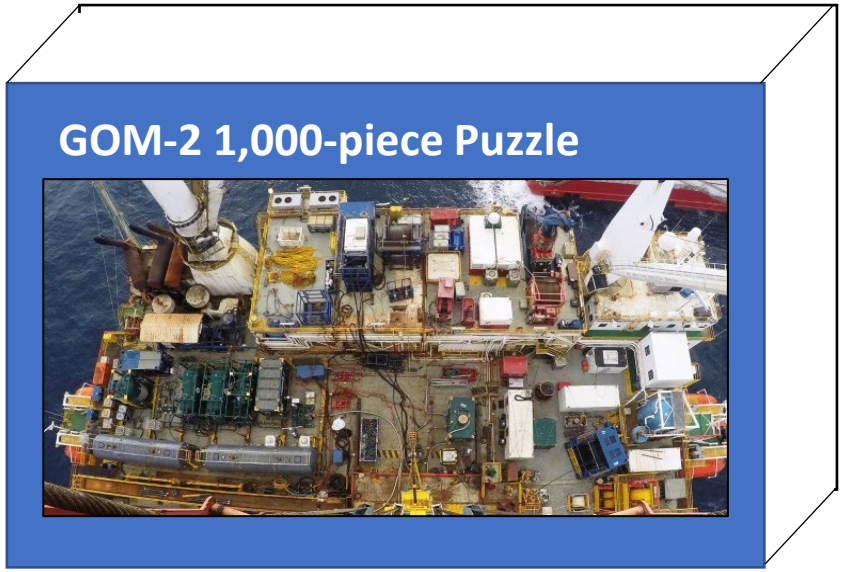


Gulf of Mexico Expedition (GOM2)

Deepwater Methane Hydrate Characterization and Scientific Assessment

- To locate, drill, and sample methane hydrate deposits through multiple expeditions.
- To store, manipulate, and analyze pressurized hydrates samples.
- To maximize science possible through sample distribution and collaboration.

All the planning pieces..



High level Operation Summary (Ops Plan)

Data Analytics

Accurate and robust machine-learning for subsurface reservoirs requires both data and physics

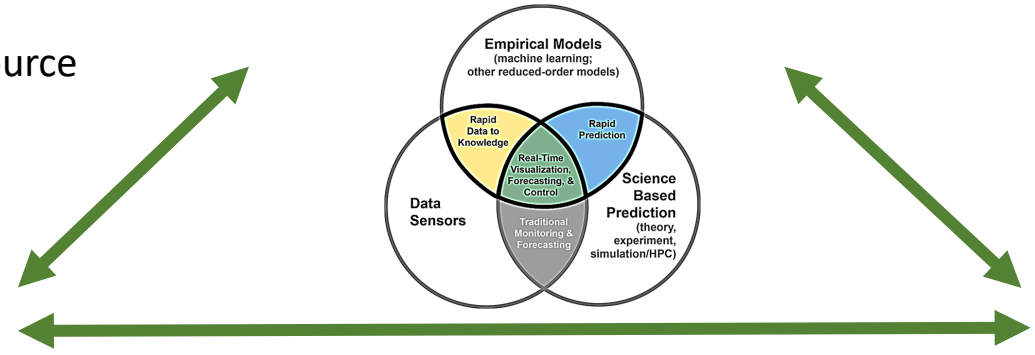
CO_2 storage and Leakage Detection

- Critical material recovery: Lithium recovery from brines along with CO_2 sequestration.
- CO_2 and methane leakage: Effectively monitor leaks and mitigate leaks underground. Identify leakage source to explore subsurface mitigation strategies.

SMART-OG Initiative
Science-informed Machine Learning for Accelerating Real-Time Decisions in Oil & Gas Applications

Artificial Intelligence – Machine Learning

- Real-time Visualization
- Real-time Forecasting of Production
- Real-time Data to Knowledge



Subsurface Reservoir Characterization

- Better inform subsurface conditions and on how reservoir will perform in the future can lead to operations that are more efficient and less impactful.

Increase CO_2 based Recovery

- To aid in carbon sequestration.

Data

- Data availability-access; identification of critical data; ML ready.
- Field-scale testing of technology and operational strategies.

Physics

- Identify critical mechanisms to constrain ML.
- Develop realistic synthetic data to enable ML.

Advanced Remediation Technologies – HQ Team

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  Director
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  Program Manager, Onshore & Offshore
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