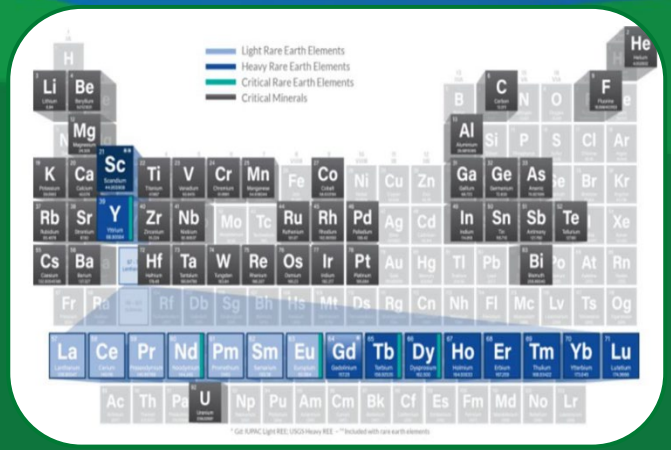
U.S. DEPARTMENT OF ENERGY
Fossil Energy and Carbon Management

Division of Advanced Remediation Technologies

Project Review Meeting
April 3, 2024



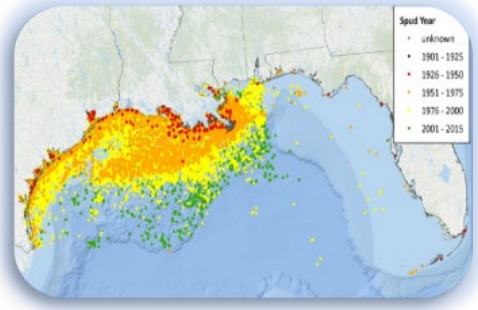
Advanced Remediation Technologies

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

Environmentally Prudent Stewardship

Field Laboratory Network

Basin-specific strategy
Fundamental shale
Emerging Plays



Onshore & Offshore

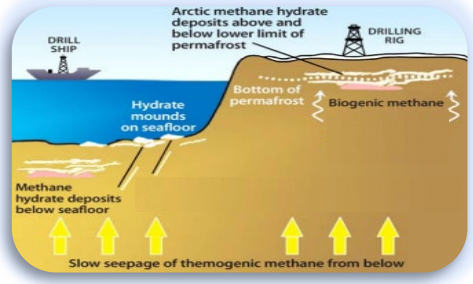
Spill prevention
Borehole integrity
Aging infrastructure

Water Management Technologies

Beneficial Reuse

Waste to resource
Environmental sustainability
Industry collaboration

Methane Hydrates



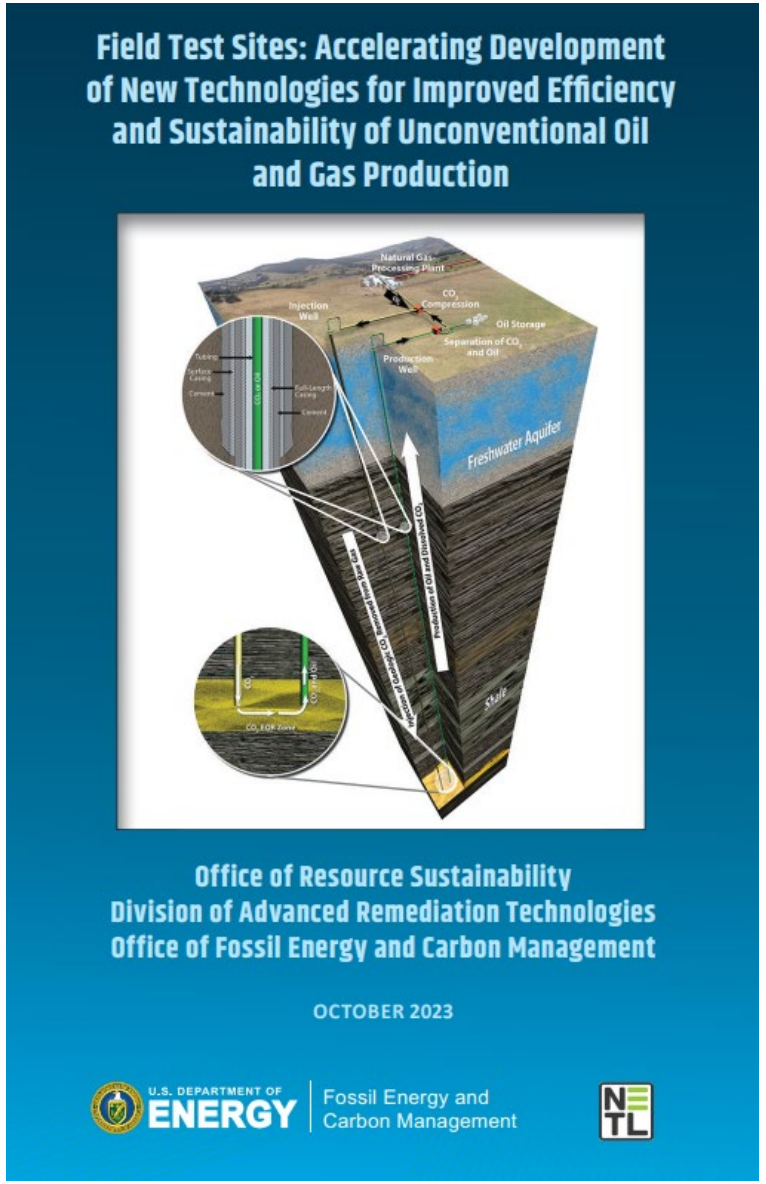
GoM & Alaska

Climate change stability
Resource characterization
International collaboration

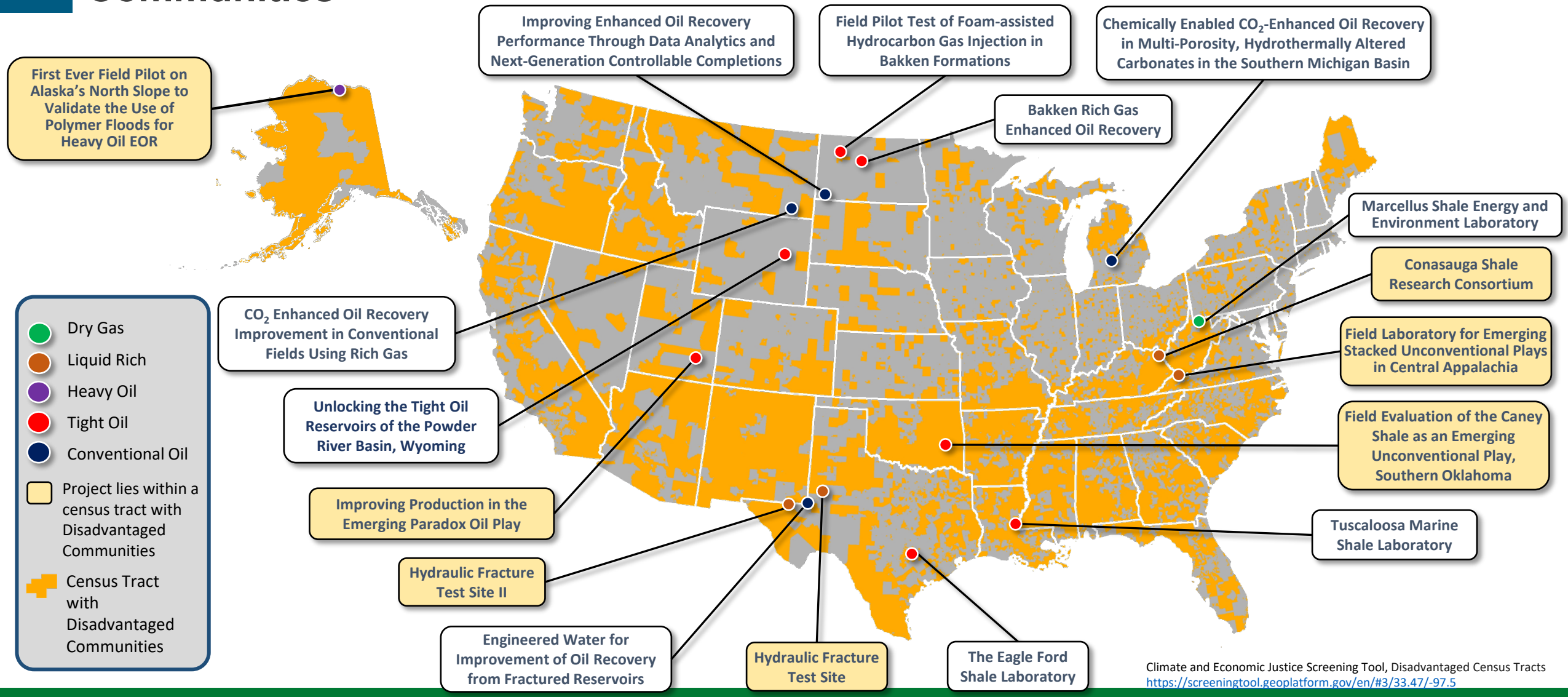
Artificial Intelligence/Machine Learning

DOE Field Laboratories (Test Sites)

- A portfolio of 17 Field Labs with the overarching premise of accelerating the development and application of new technologies, tools, and processes for optimizing the operational efficiency and environmental sustainability in a diverse array of field-based settings.
  - Basin-specific strategy for environmentally prudent stewardship of unconventional resources.
  - Improved characterization of unconventional oil and natural gas reservoirs for future energy storage opportunities.
  - Make results and data available to the public, and
  - Foster collaborative research within industry, academia, and the National Labs.



Field Laboratory Locations and Census Tracts with Disadvantaged Communities



Climate and Economic Justice Screening Tool, Disadvantaged Census Tracts
https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

DOE Field Laboratories (Test Sites)

- Future Field Labs are planned for additional test sites, focusing on combining enhanced oil recovery (EOR) with CO_2 storage in unconventional oil reservoirs.

  - ✓ Assess the overall effectiveness of Carbon Dioxide Enhanced Oil Recovery (CO2-EOR) in unconventional oil reservoirs and understand the potential to store CO2 in these complex reservoirs.
  - ✓ Co-optimize CO2-EOR and carbon storage with the goal of reducing the carbon footprint associated with the incremental oil produced.

FOA-3015: Enabling a Reduced Carbon Footprint for Carbon Dioxide Enhanced Oil Recovery (CO2-EOR)/Storage Field Test Sites in Unconventional Reservoirs
Funding Amount: $23.2 million

ART Water Management Technologies

All water related R&D within the FECM portfolio is managed by ART

WATER MANAGEMENT FOR POWER SYSTEMS

Remediation of coal power waste

Active Projects

10 Projects

9 Partnering Organizations

PRODUCED WATER

Characterization, treatment, and management of water produced during oil and gas operations

Active Projects

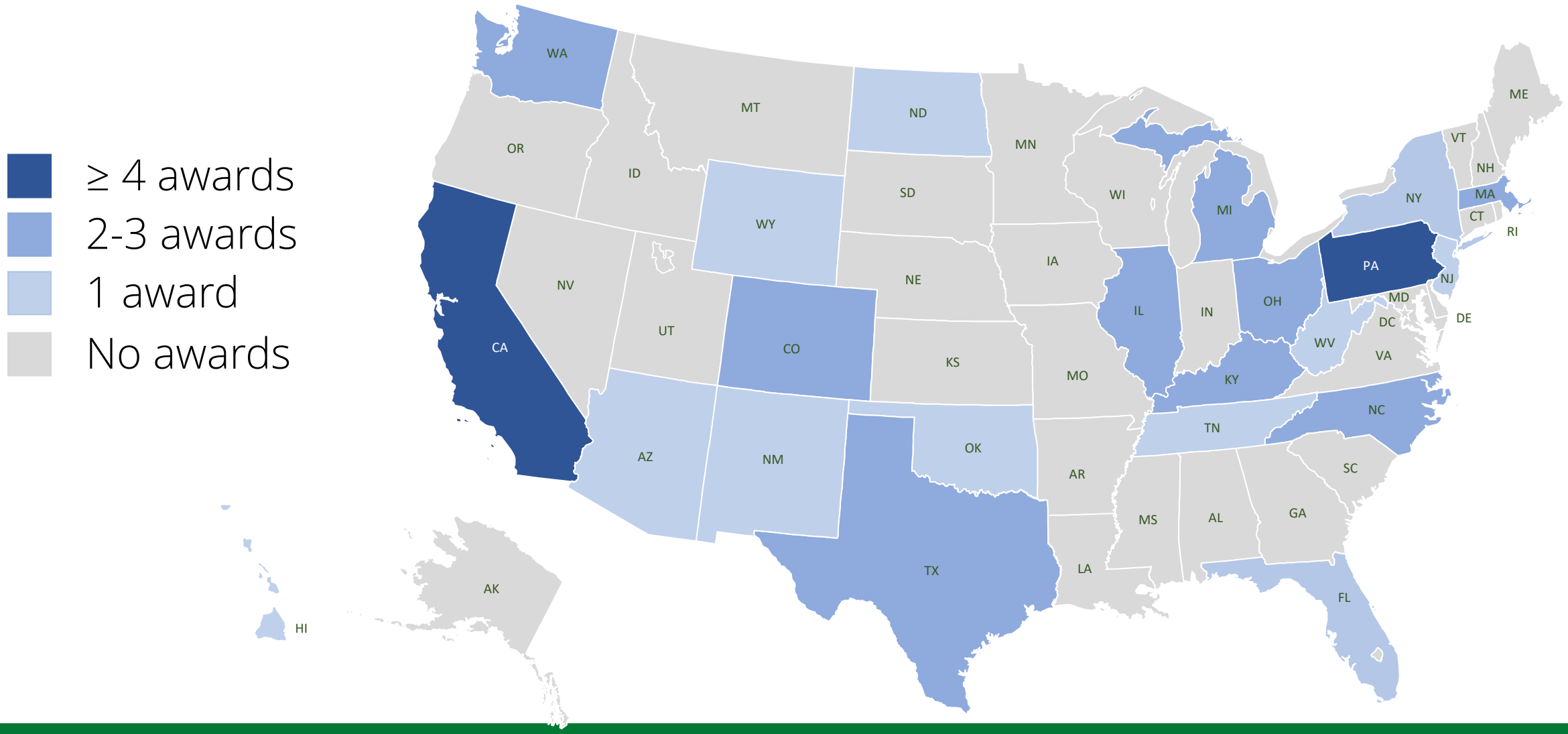
13 Projects

10 Partnering Organizations

Additional Objectives:

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

Since 2018, ART-WM Funded Projects Across 23 States



New Water Management Projects Under FOA 2796

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Water Research and Development for Oil and Gas Produced Water and Coal Combustion Residuals Wastewater Associated With Coal Power Plants. **Funding amount: $18,050,000**

- Desalinated Produced Water as Irrigation Source for Non-Consumptive Agriculture and Adjacencies for Ammonia Mining and Carbon Sequestration Field Trials — **Aris Water Solutions** (Houston, Texas) plans to advance the beneficial reuse of produced water for non-consumptive agriculture and industrial application.

- Produced Water Consortium for Ultralightweight Composite Manufacturing by Accelerated Carbon Mineralization — **PVT Clean Energy** (Poughkeepsie, New York) plans to form the Produced Water Consortium for Ultralightweight Composite Manufacturing to manage, treat, and/or beneficially reuse produced water from onshore oil & gas operations.

- Advanced Characterization of Wastewaters with a Focus on the Environment & Economics — **University of Illinois at Urbana-Champaign** (Urbana, Illinois) plans to advance the characterization of CCR effluents and illustrate the use of such characterization to determine environmental impact and resource recovery.

- Treatment of Produced Water for Beneficial Use with Concurrent Resource Recovery Utilizing Coal- and Waste Coal-derived Material. — **Ohio University** (Athens, Ohio) intends to develop an economically feasible process to render treatment of oil- and gas-produced water for beneficial use outside of the oil and gas industries.

Water Management Research – Research and Innovation Center

Systems Analysis	Advanced Computing Systems and Big Data	Biological and Chemical Characterization	Advanced Treatment Processes
			

PARETO

The Produced Water Optimization Initiative

NEWTS DATABASE

PW Research Partnership

University of Pittsburgh

Carnegie Mellon University

Colorado School of Mines 1874

The University of Texas at Austin

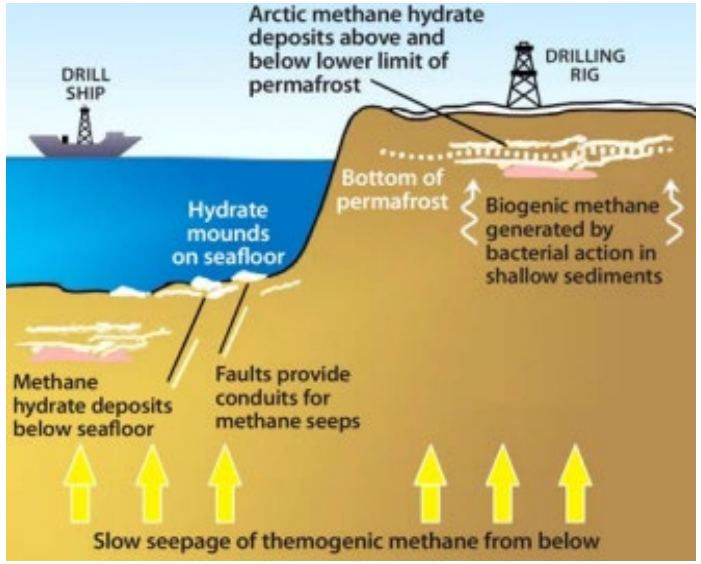
UTEP

EERC University of North Dakota

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

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

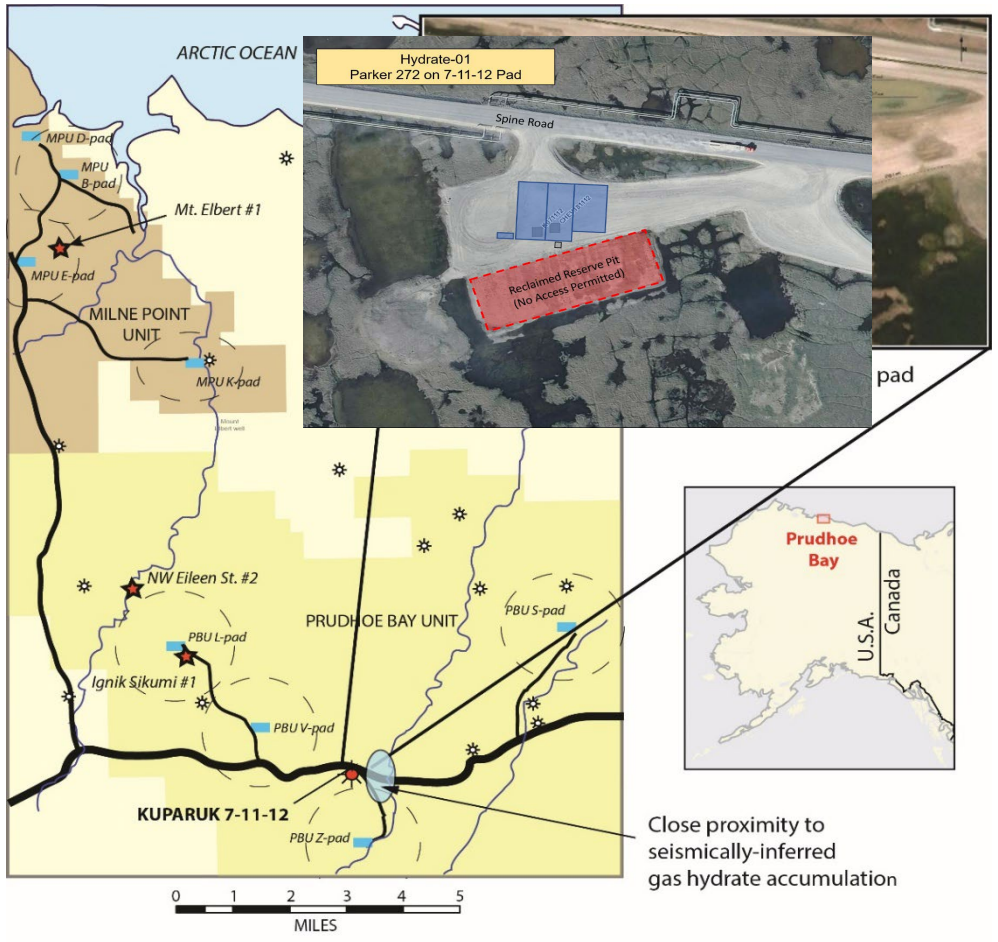
- Fiber-optic Strain, Acoustic, and Temperature Monitoring
- Pressure monitoring
- Monitoring inside (PTW) and outside (PTW, STW, GDW) casing
- Time Series VSP via DAS → Reservoir System Response

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.

High level Operation Summary (Ops Plan)

Advanced Remediation Technologies – HQ Team

- **Vanessa Nunez-Lopez**
  Director
- **Steven Wong**
  Program Manager - Environmentally Prudent Stewardship
- **Sailendra Mahapatra**
  Program Manager - Environmentally Prudent Stewardship, Methane Hydrates
- **Hichem Hadjeres**
  Program Manager - Water Management
- **Gabby Ubay, Senior Program Manager**
  Senior Program Manager - Methane Hydrates