U.S. DOE Upstream Unconventional Oil and Gas Research
Unconventional Oil and Gas
Utica Upstream Conference

Elena Melchert
Division Director, Upstream Oil and Gas Research
Acting Director, Office of Technology Transfer

April 5, 2017
DEPARTMENT OF ENERGY

Office of the Secretary
Rick Perry
Secretary

Associate Deputy Secretary

Federal Energy Regulatory Commission
Inspector General
Ombudsman

U.S. Energy Information Administration

Office of the Under Secretary for Nuclear Security and National Nuclear Security Administration
Frank G. Klotz
Under Secretary for Nuclear Security Administrator, NNSA
Vacant
Principal Deputy Administrator, NNSA

Office of the Under Secretary for Science & Energy
Patricia Hoffman
Acting, Under Secretary for Science and Energy

Office of the Under Secretary for Management & Performance
Gena Cadieux
Acting, Under Secretary for Management and Performance
OFFICE OF FOSSIL ENERGY

Chief of Staff
Margaret Schaus, Acting
Senior Advisor
Geoffrey H. Lyon

Assistant Secretary
Douglas Hollett, Acting
Principal Deputy
Assistant Secretary
Douglas Hollett

Director, National Energy Technology Laboratory
Grace M. Bochenek

Deputy Assistant Secretary
For Oil & Natural Gas
Robert J. Smith, Acting
Associate Deputy Assistant Secretary for Oil & Natural Gas
Vacant

Deputy Assistant Secretary
For Petroleum Reserves
Robert Corbin
Associate Deputy Assistant Secretary for Petroleum Reserves
Douglas MacIntyre

Office of Research

Office of Regulation & International Engagement
THE OFFICE OF OIL & NATURAL GAS

A research organization that is developing technologies to advance oil and natural gas production in a safe and sustainable manner.

Vision & Mission

Vision

A secure and environmentally sound energy future through responsible production and delivery of our nation’s diverse oil and natural gas resources.

Mission

Maximize the public benefits of oil and natural gas resources and ensure their responsible development and delivery through research, policy analysis, regulation, innovation, and outreach.

Major Research Areas

- Onshore Unconventional Oil and Gas
- Offshore Oil Spill Prevention
- Gas Hydrates
- Midstream Infrastructure
UPSTREAM OIL AND GAS RESEARCH PORTFOLIO

Strategy for Federal Multiagency Collaboration on Unconventional Oil and Gas Research: DOE/DOI/EPA

Unconventional Oil & Gas
Resource Characterization, Water Quality, Water Availability, Induced Seismicity

Offshore Spill Prevention
Geologic Hazards, Drilling & Completion, Surface Systems and Umbilicals, Subsea Automation

Footprint Reduction
Develop resources efficiently

Induced Seismicity
Understand and mitigate earthquake risks

Water Quality and Availability
Protect water resources and prevent water shortages

Subsurface Science
Inform resource assessments
Economic prosperity requires low cost fuels.
Energy security requires stable, abundant domestic resources.
Low carbon economy requires reduction of greenhouse gas emissions.

--2015 Quadrennial Technology Review
U.S. Department of Energy
U.S. DOMESTIC CONSUMPTION BY FUEL TYPE

Total Energy: Use

Case: Reference case quads

- Liquid Fuels
- Natural Gas
- Coal
- Nuclear
- Other Renewable Energy

Source: U.S. Energy Information Administration
2017 Annual Energy Outlook
✓ Economic prosperity requires low cost fuels.

Energy security requires stable, abundant domestic resources.

Low carbon economy requires reduction of greenhouse gas emissions.

--2015 Quadrennial Technology Review
U.S. Department of Energy
The United States has been the world’s top producer of petroleum hydrocarbons since 2013.

Before 2030, U.S. oil production is expected to exceed the previous historical high of 9.6 million barrels/day in 1970.

The first U.S. exports of LNG produced in the lower 48 states occurred in February 2016. U.S. is a net exporter on select days.

U.S. is a net exporter on selected days. The United States will be a net exporter on an annual basis by 2018, per EIA’s Annual Energy Outlook 2017.

Source: U.S. Energy Information Administration, Annual Energy Outlook 2017
✓ Economic prosperity requires low cost fuels.
✓ Energy security requires stable, abundant domestic resources.
Low carbon economy requires reduction of greenhouse gas emissions.

--2015 Quadrennial Technology Review
U.S. Department of Energy
FUTURE U.S. TIGHT OIL AND SHALE GAS PRODUCTION

U.S. Shale Gas Production (2010-50)
trillion cubic feet per day

- Other
- Utica
- Marcellus
- Haynesville/Bossier
- Barnett

EIA 2017 Annual Energy Outlook Reference
### Scale and Nature of UOG Resources
- Fundamental Science of UOG Reservoirs
- Resource Assessment/Characterization
- Recovery Efficiency
- Development Intensity

### Water Quality
- Wellbore Integrity
- Produced Water Treatment and Management

### Water Availability
- Alternative Water Sources
- Less Water-Intensive Stimulation
- Waterless Stimulation

### Air Quality
- Measurement and Attribution
- Emission Mitigation

### Induced Seismicity
- Analysis and Attribution
- Prediction and Avoidance

### Opportunities for Objective Science
- Dedicated Field Laboratories
SHALE DEVELOPMENT: FROM LAB TO FIELD: SPANNING MULTIPLE TRL

Regional Field Observatories

Current Sites

Potential Sites

Ohio State U.
Utica Pt. Pleasant Shale
eastern, deep dry gas

West Virginia U.
Marcellus Shale
eastern, dry-gas

Gas Technology Institute
Permian Basin
(western, liquid-rich play)

Fundamental Science at Nanopore scale

LANL
--thermodynamics at nanopore scale
--fracture generation and hydrocarbon flow in heterolithic formations

LBNL
--fundamental petrophysics of oil-rich shale
--petrophysics of water injection on shale gas mobilization into fractures
--geomechanics of fracture initiation and propagation and permeability evolution

SLAC
--effects of chemical additives especially mineral precipitation

SNL
--equations of state for CH₄, CO₂, and H₂O
Objectives:
Long-term field research platform for environmental and geotechnical studies before, during and after unconventional oil and gas development.

Site Owner: Energy Corporation of America (ECA)

Principal Investigator: The Ohio State

Project Team Members:
West Virginia University, Texas A&M University, Houston Advanced research Center

Cost: $10.7 million Total Cost; $8.4 million DOE; Term: TBD

Site Characteristics: deep dry gas


Project Location: Utica – Meadows Pad Greene County, PA
USEEL ENVIRONMENTAL AND SUBSURFACE SCIENCE

– Subsurface Geochemistry

– Subsurface Microbiology

– Petrophysics/Geomechanics

– Baseline Geophysics and Geophysical Monitoring

– Baseline Environmental
ECONOMIC PROSPERITY AND ENERGY SECURITY REQUIRE STABLE ABUNDANT DOMESTIC SUPPLIES OF OIL AND NATURAL GAS

Oil and gas play an essential role in our nation’s economic prosperity, energy security, and national security.

There are operational and efficiency challenges to the development of stable, abundant domestic supplies of oil & gas.

DOE’s investment in innovative technology R&D in concert with our partners focuses on the efficient development of oil & gas resources.

Note: Sum of components may not equal 100% due to independent rounding