



# Energy and Environment Field Laboratories

Subsurface Energy and Environment Laboratories

## MSEEL & USEEL

Led by a Partnership between:



The Ohio State University



West



A Collaboration of Universities, Private and Public Organizations, working together to improve production efficiency and environmental efficacy of shale energy development through field testing.

# Motivation: Opportunities and Challenges



## Opportunities:

- **Workforce**
  - Direct employment in oil and gas
  - New business development
- **Economic Drivers**
  - Difficult economic climate
  - Billions Invested in leases and infrastructure
  - Production numbers Impressive

## Challenges:

- **Public infrastructure**
- **Market development**
- **Environment**
  - Surfaces and subsurface water protection
  - Air
  - Wildlife

**A Field Lab in the Utica Shale to improve production efficiency  
find solutions to potential environmental problems**

**Total Funding: \$9,137,479**

**Primary Research Partners: WVU,  
EFD**

**Other Partnering Institutions & Companies**

- **WVU**
- **Miami (Ohio)**
- **Ohio University**
- **University of Calgary**
- **Environmentally Friendly Drilling (EFD)**
- **Texas A&M (through EFD)**
- **CSI Technologies**
- **General Synfuels Inc.**
- **TGS International**
- **Newpark**
- **Ohio Geological Survey**

# General Approach

## DRIVING GOAL

- Increase production efficiency
- Improve production longevity
- Reduce Injected Fluids
- Improve environmental efficacy

## NEEDED TO ADDRESS GOALS

- Better understand the geology (natural fractures, permeability, oil generation, rock diagenesis)
- Understand natural, injected, and returned Fluids
- Understand and map induced fractures
- Understand natural and introduced microbial activity
- Improved technologies for environmental measurements for pre, During, and Post drilling

## TASK TO ADDRESS THE GOAL

- Rock sampling (Core, chips)
- Collecting and analyzing natural, injected, and returned Fluids
- In situ borehole measurements (geophysical well logging, micro-seismic measurements, seismic imaging, hole-to-hole geophysics)
- Fiber optic measurements in the lateral
- Other in-situ measurements for fracture definition
- Documented and verified surface air and water, groundwater measurements (baseline to post production)

# Pre-Drilling Surface Research

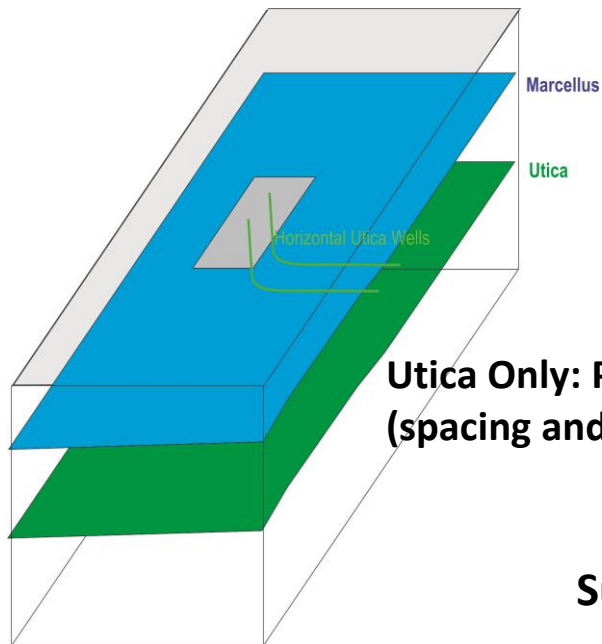
- **Subsurface characterization**
  - **Seismic reflection imaging**
  - **Induced seismicity measurements**
- **Baseline environmental monitoring**
  - **Ecosystem/biological**
  - **Surface water**
  - **Air**
  - **Groundwater**

# Surface and Subsurface Data Collection and Analysis during Drilling, Construction, and Stimulation of Horizontal Well

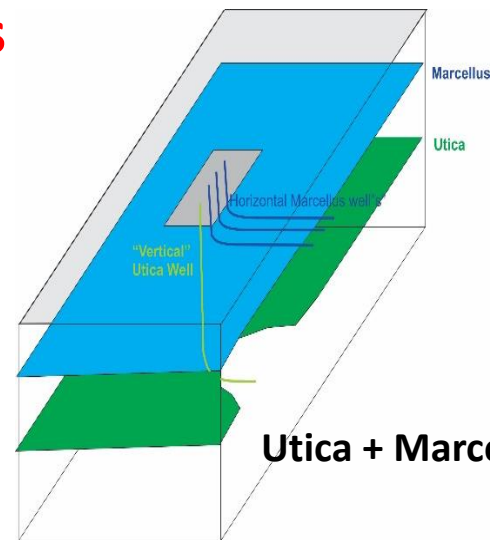
## Subsurface Objectives:

- **Frac induced fractures frequency/orientation – conventional geophysical logs, image logs, cores**
- **Fluids – sampling of fluids input and returned, interstitial analysis of core for connate water**
- **Microbiology (natural & introduced) – core/cuttings**
- **Natural fracture frequency, relative age, and orientation (cores, geophysical/imaging logs, cross hole**
- **Characterize geology in the Utica (pore space, mineral alteration, pore connectivity, nano-micro fracturing, chemistry, etc.) – core/cuttings analysis (SEM, imaging, neutron scattering, etc.), geophysical well logs & borehole imaging**
- **Rock strength (Utica) – borehole logs, cores**

# Subsurface Options



**Utica Only: Production Efficiency Testing  
(spacing and fracture effectiveness)**



**Utica + Marcellus: Fracture mapping**

## Subsurface and subsurface Methods:

- Geophysical well logging
- Coring (whole core, sidewall pressure cores)
- Crosshole (seismic/vibrational, DAS/IDAS detection, conventional seismic sensors and detectors in vertical hole and on the surface)
- Passive seismic – DAS and IDAS

# Operations: Research Lab Management Norms & Procedures

- **Data Security, storage, interpretation, review, and appropriate communication of results is critical to the integrity of the project**
- **Safety is the #1 Priority in the field** (Safe Land Training, minimize “Civilians” on Site & Pad)
- **Maintain Normal Operations** (minimize downtime, maintain production)

## Advisory

- **Primary Advisory & Oversight** ( OSU, WVU, NETL, E&P/Drillers, Community member, Science Advisory Chair)
- **Science Experiment Oversight Advisory Committee** (Operator, Ohio State, NETL, Primary Site Contractors)
- **External Advisory Committee** (Community, NGOs, Industry, Academia)



## **Next Steps:**

- 1. Establish site & industry partner**
- 2. Establish advisory boards**
- 3. Institute process, procedures, and QA/QC**

### **Research:**

- 6 months to 1 year of environmental baseline studies**
- Drilling Research (geology, well optimization, wellbore Integrity, seismicity, water)**
- Post Drilling environmental measurements**

# Tri-State Shale Summit: W.Va., Ohio, Pa. Form Agreement To Grow Shale Gas Industry, October 13, 2015



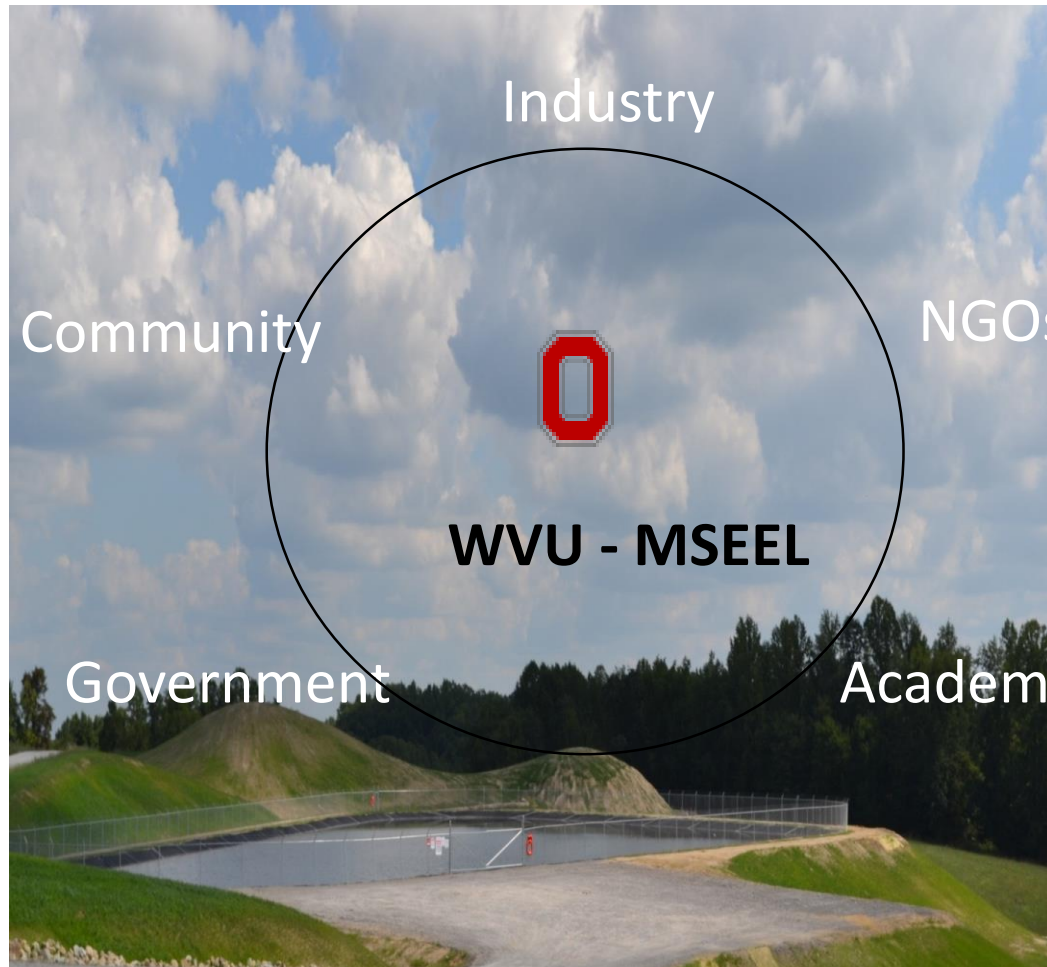
W.Va. Gov. Earl Ray Tomblin signs an agreement between West Virginia, Ohio and Pennsylvania, Tuesday, Oct. 13, 2015 at the Tri-State Shale Summit in Morgantown.

## 4 Areas of Cooperation:

- A. Marketing and Production
- B. Workforce Development
- C. Transportation and Infrastructure
- D. Research: The Tri-State Region is home to numerous world-class academic institutions of higher learning that are actively involved in advancing cutting-edge research to help capitalize on shale gas opportunities.**

# Building Partnerships for Research, Education, and Outreach

## “50,000 foot” Outcomes



- Advance Technologies
- Advance Education
- Ensure Integrity of Results
- Establish Trust & Partnerships