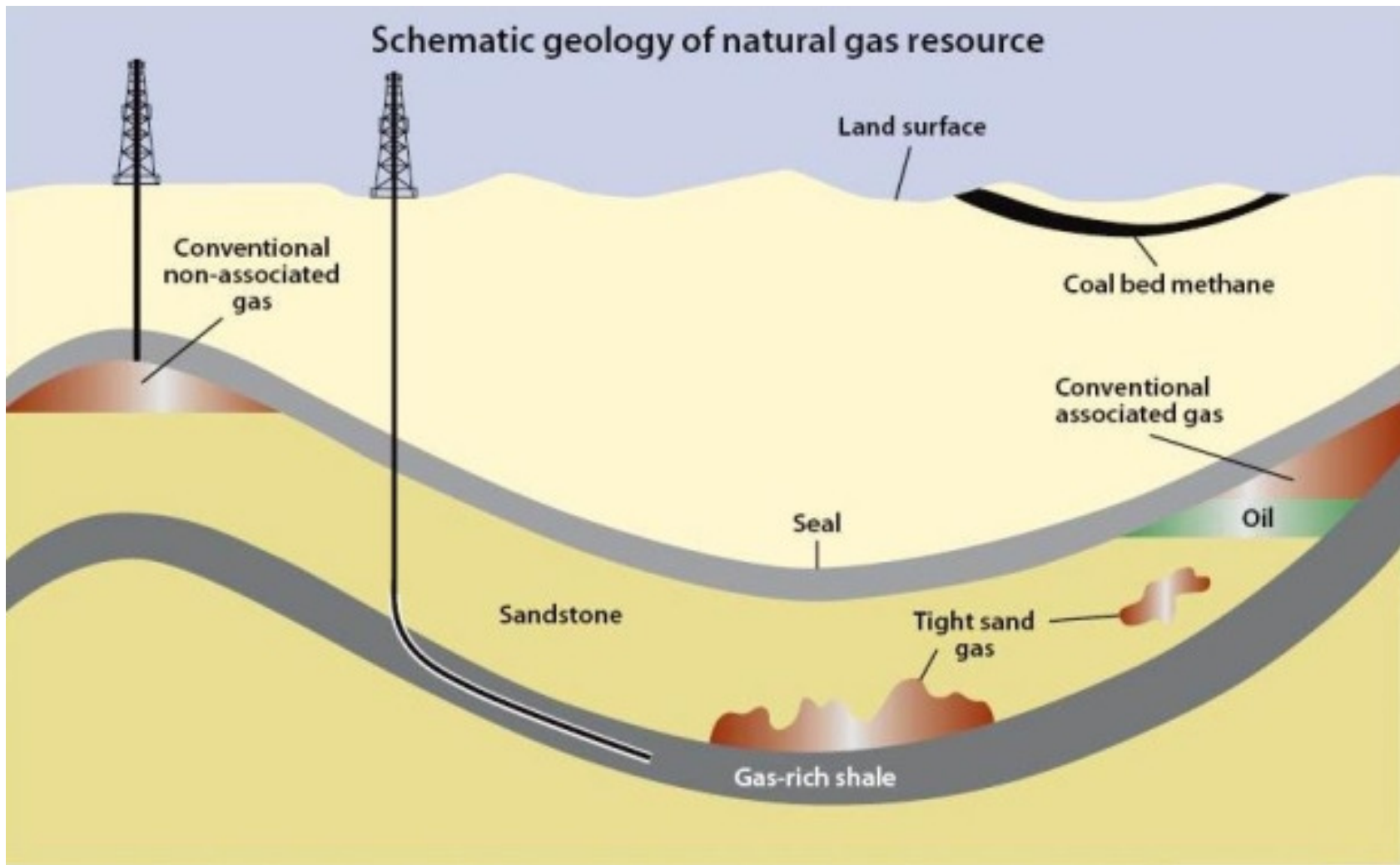


“FRACKING” Savior or Disaster?

**Oakwood Rotary Club Meeting
January 30, 2015**

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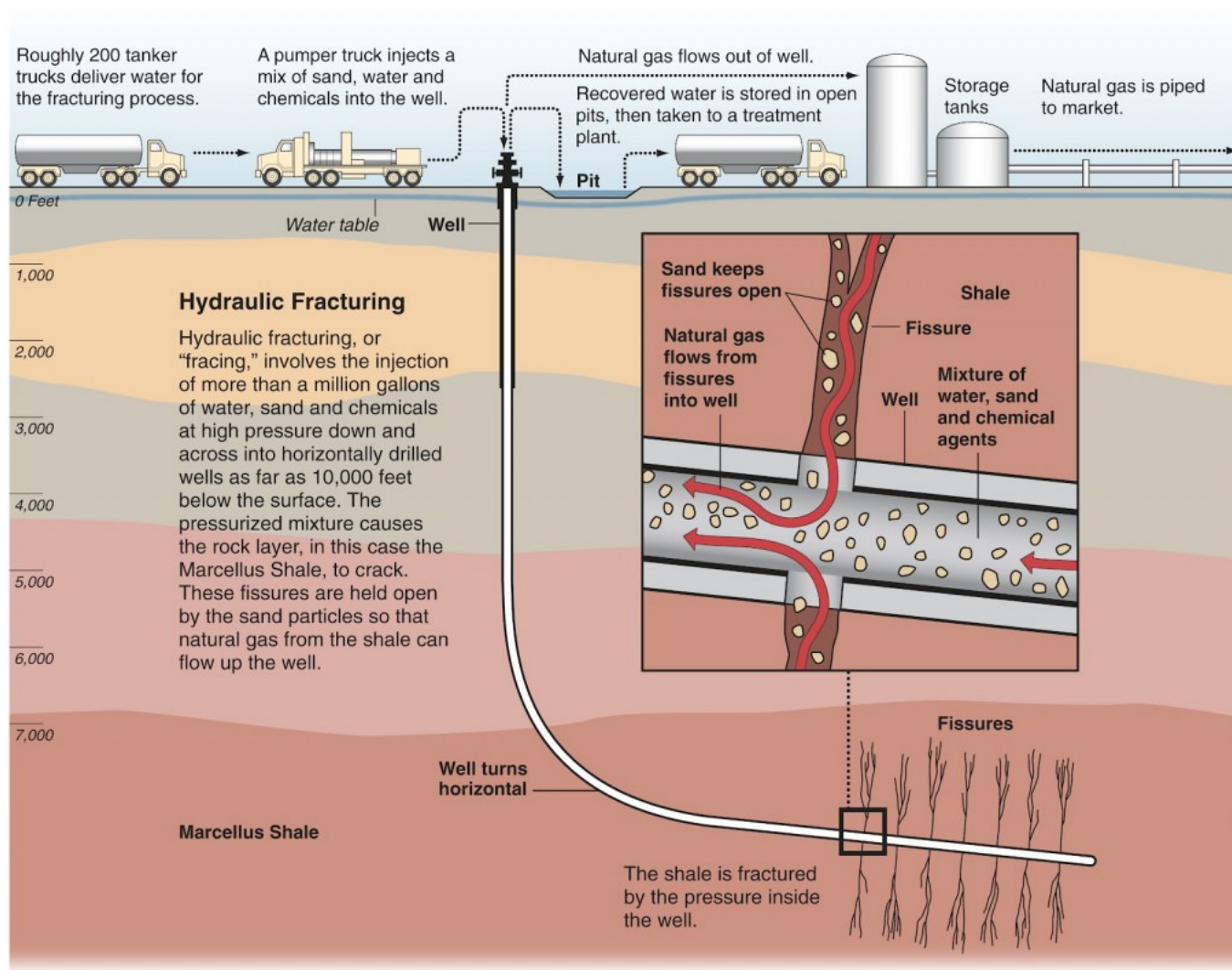


Fracking = Hydraulic Fracturing

- The injection of water, sand and lubricant mixture at high pressure to “fracture” rock formations allowing the release of oil and natural gas.

Fracking = Hydraulic Fracturing

- Fracturing fluid injected at a rate of 4,200 gallons per minute; 5 million or more gallons, creating small fractures in the rock.
- The released gas/oil flows into the casing and up to the surface.
- Some of the frack fluid flows with the gas to the surface, where it is pumped away for disposal or recycled. The rest remains underground.

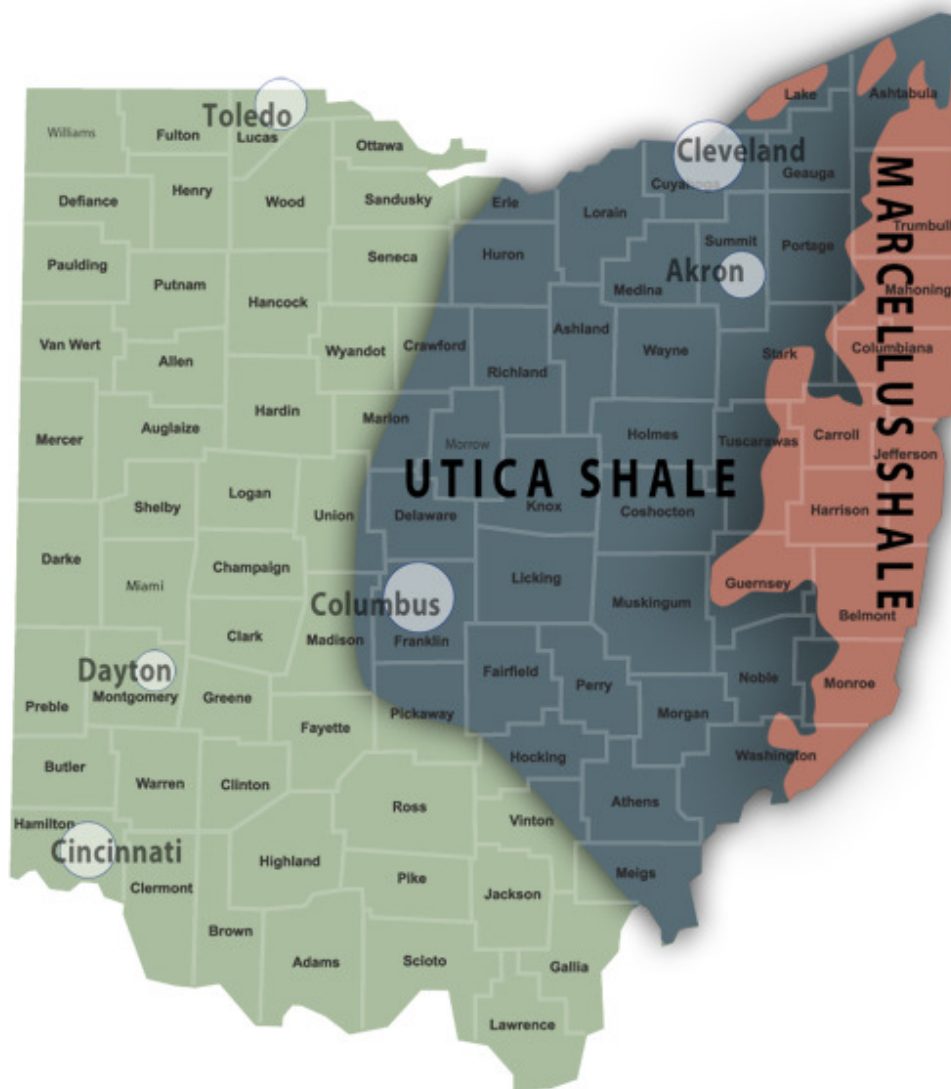


Graphic by Al Granberg



Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
 Updated: May 9, 2011

Hot Locations in Ohio

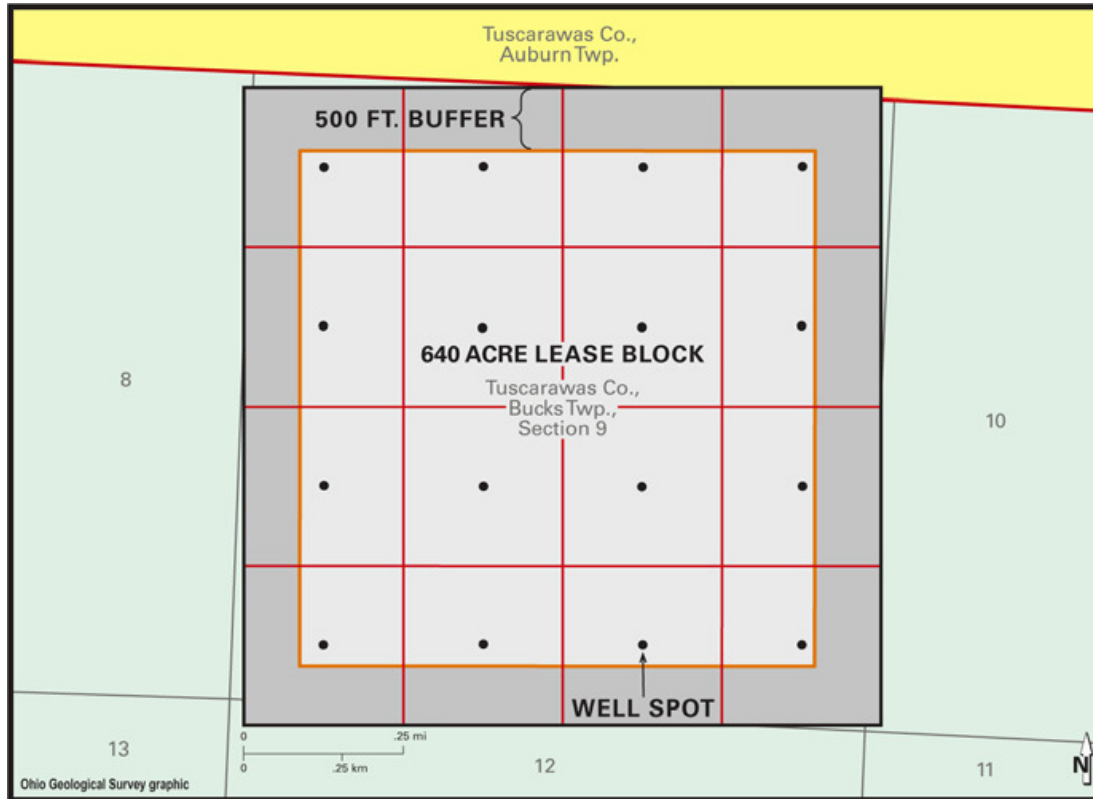


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Compensation to Lessor

- Lease bonus payments \$3,000 - \$7,000 per acre.
- Royalty interest payments are 20% of the value of oil and gas actually produced.

The Old Way



Development of a one square mile lease block (640 acres) requires 16 vertical wells

Each well involves a 2 acre drill site plus roads and pipelines.

The Old Way



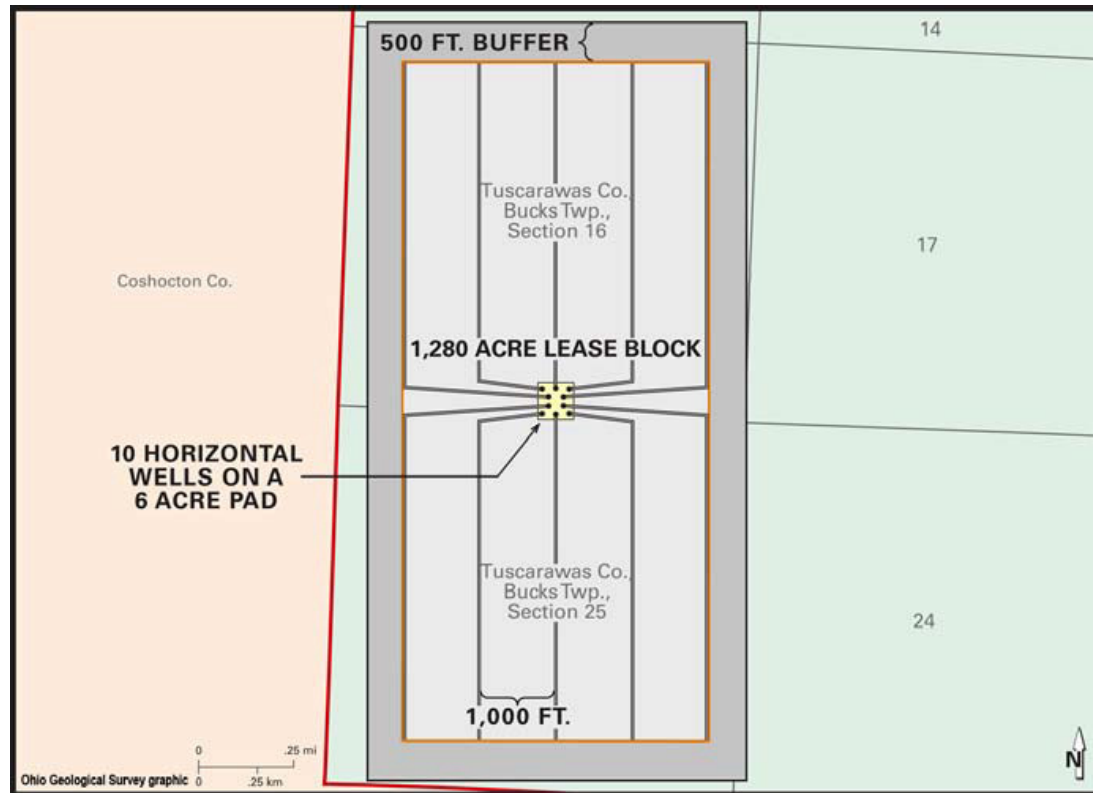
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The Old Way



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The New Way



Operators would like to have lease blocks of about 2 square miles contiguous to allow drilling in two directions from one central drill pad.

The New Way



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1. *Journal of the American Medical Association*, 2000; 283: 2689-2693.

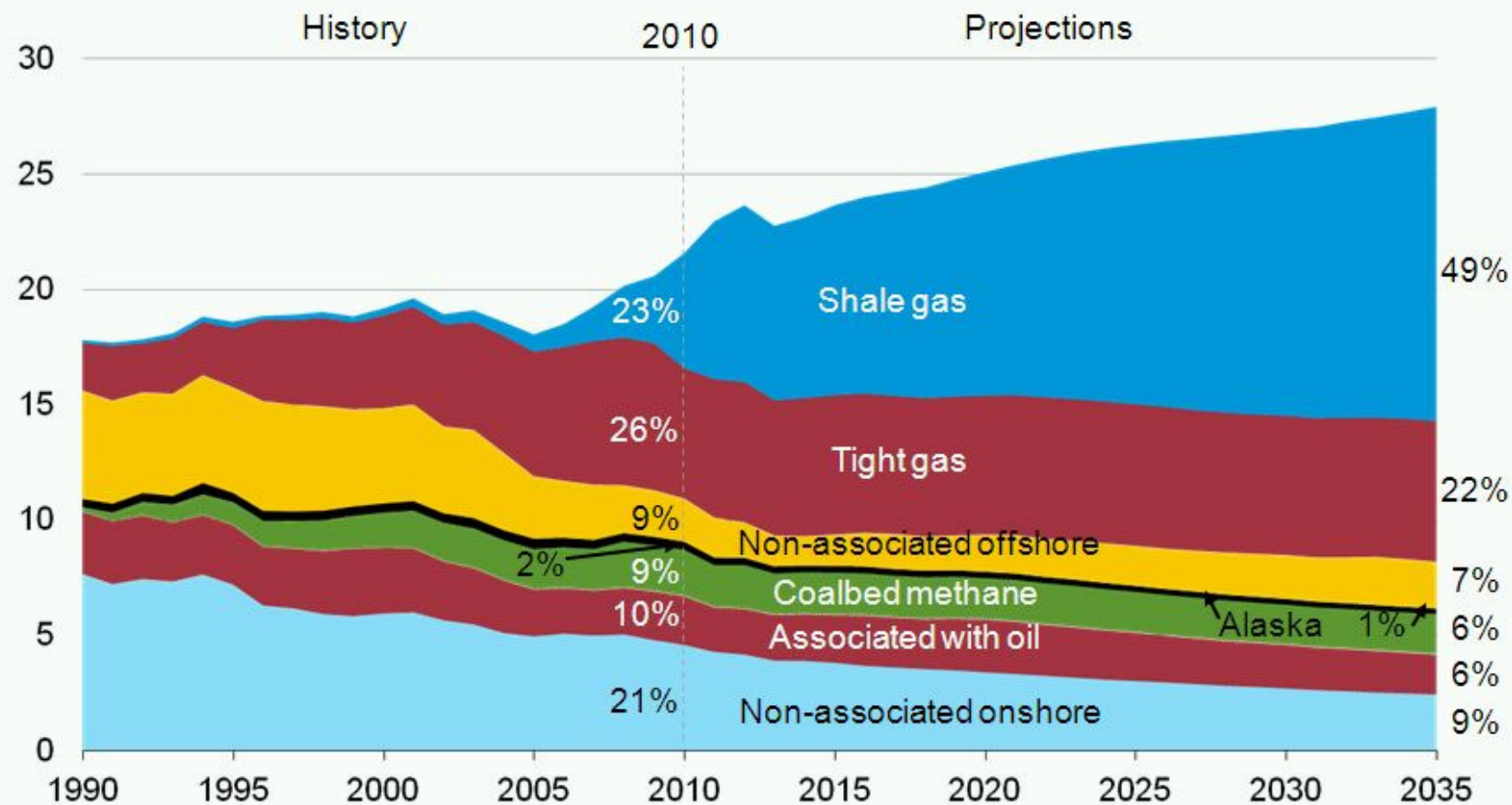


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New Resource Estimates

- USGS estimates for Utica shale formation:
 - 38 trillion ft.³ of undiscovered natural gas;
 - 940 million barrels of oil;
 - 9 million barrels of natural gas liquids (“NGLs”) like ethane and propane.
- Current market value = \$138 billion for the natural gas and NGLs; \$86 billion for the oil
- Ohio Oil and Gas Association believes the Utica value may exceed \$500 billion.

U.S. dry gas production
trillion cubic feet per year



Source: EIA, Annual Energy Outlook 2012

Traditional Energy Uses

- **Natural gas** is versatile
 - 34% Industrial
 - 34% Residential/Commercial
 - 29% Electrical Generation
 - 3% Transportation
- 71% of **petroleum** is used for transportation
- 91% of **coal** is used to generate electricity
- 100% of **nuclear** is used to generate electricity
- 51% of **renewables** are used to generate electricity

Environmental Impact

- **Natural gas** is more environmentally friendly than coal.
 - Less air pollution than coal
 - Produces more kilowatts of power than the equivalent amount of coal
 - Climate change bonus...Coal-fired electric power generation produces twice the amount of carbon dioxide emissions

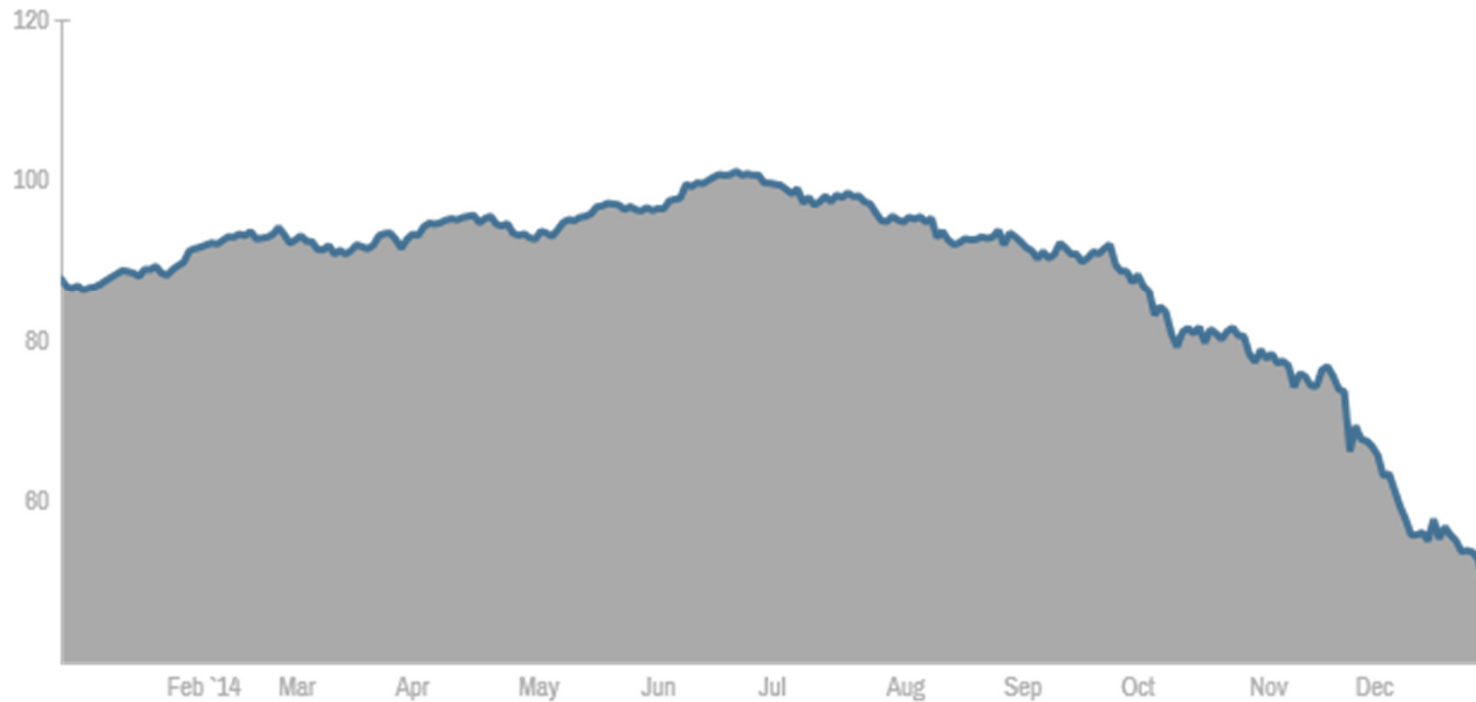
Current Economic Picture

- Increased domestic production of shale plays is one factor leading to the fall in natural gas and oil prices.
- Low market prices make it difficult to recover the cost to drill a deep, horizontal well (\$5 - \$6 million dollars per well).
- Current price of oil (\$50 per barrel) is expected to significantly slow shale field production.

Market Price of Oil

Oil falls off a cliff

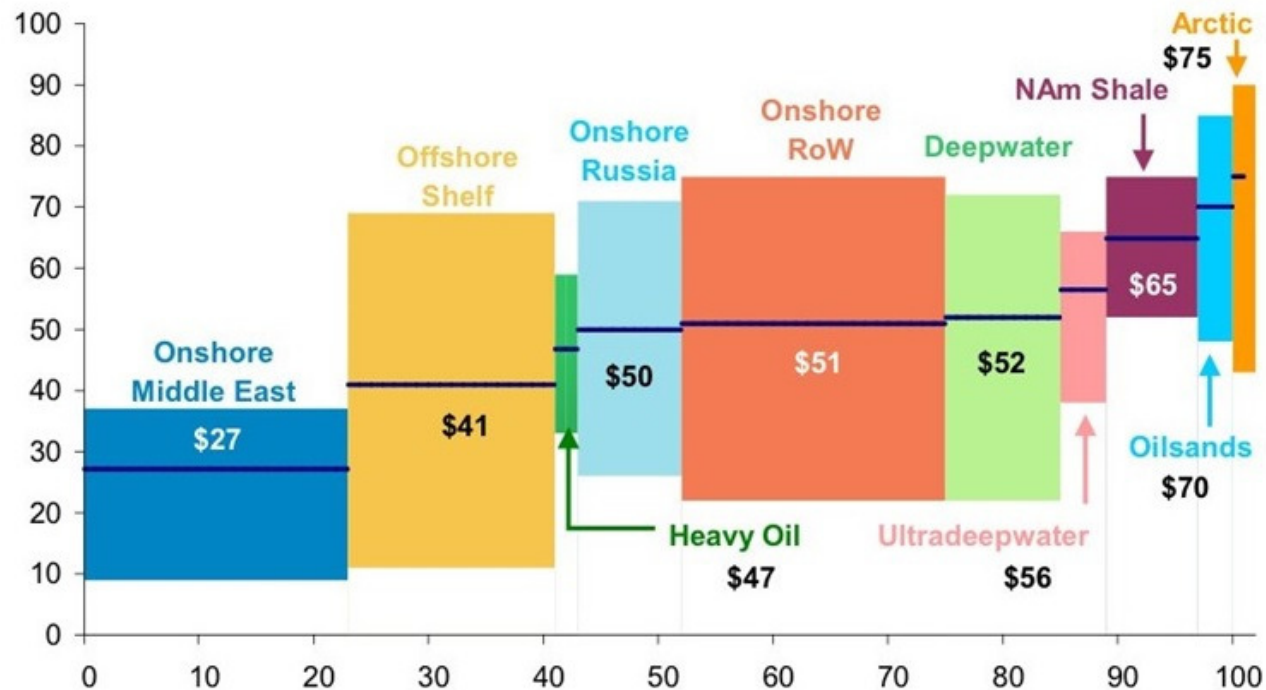
Below \$50 for first time since '09



\$50 Oil – Why?

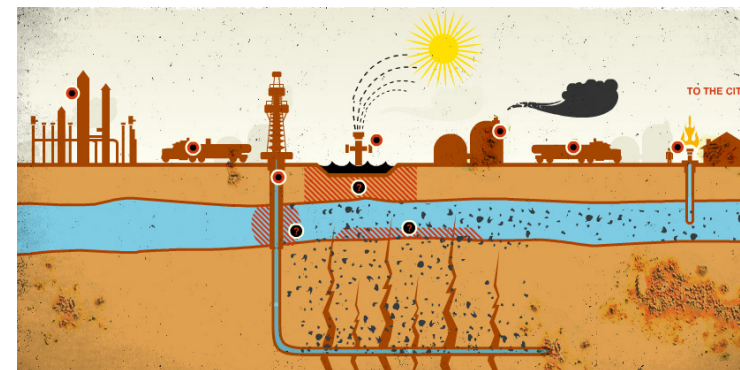
- US oil production up 90% since 2008.
- OPEC production has remained level.
- Europe and China demand is lower.
- January 2015 price of \$48 per barrel was lowest since April 2009.
- June 2014 peak price was \$107 per barrel.

Costs of Producing Oil



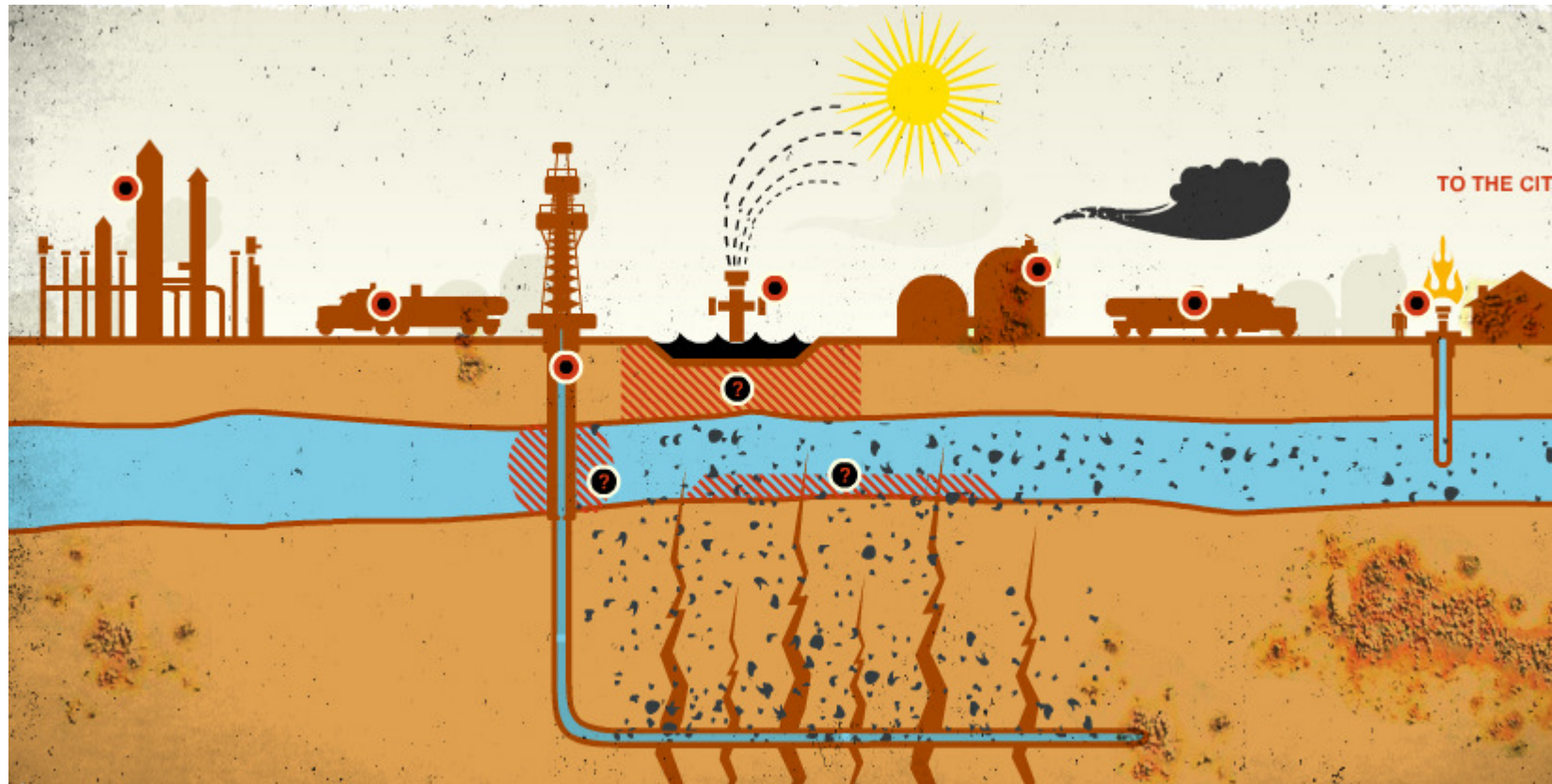
Source: Rystad Energy, Morgan Stanley Commodity Research estimates

Disaster Looming?



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Does Fracking Cause Groundwater Pollution?



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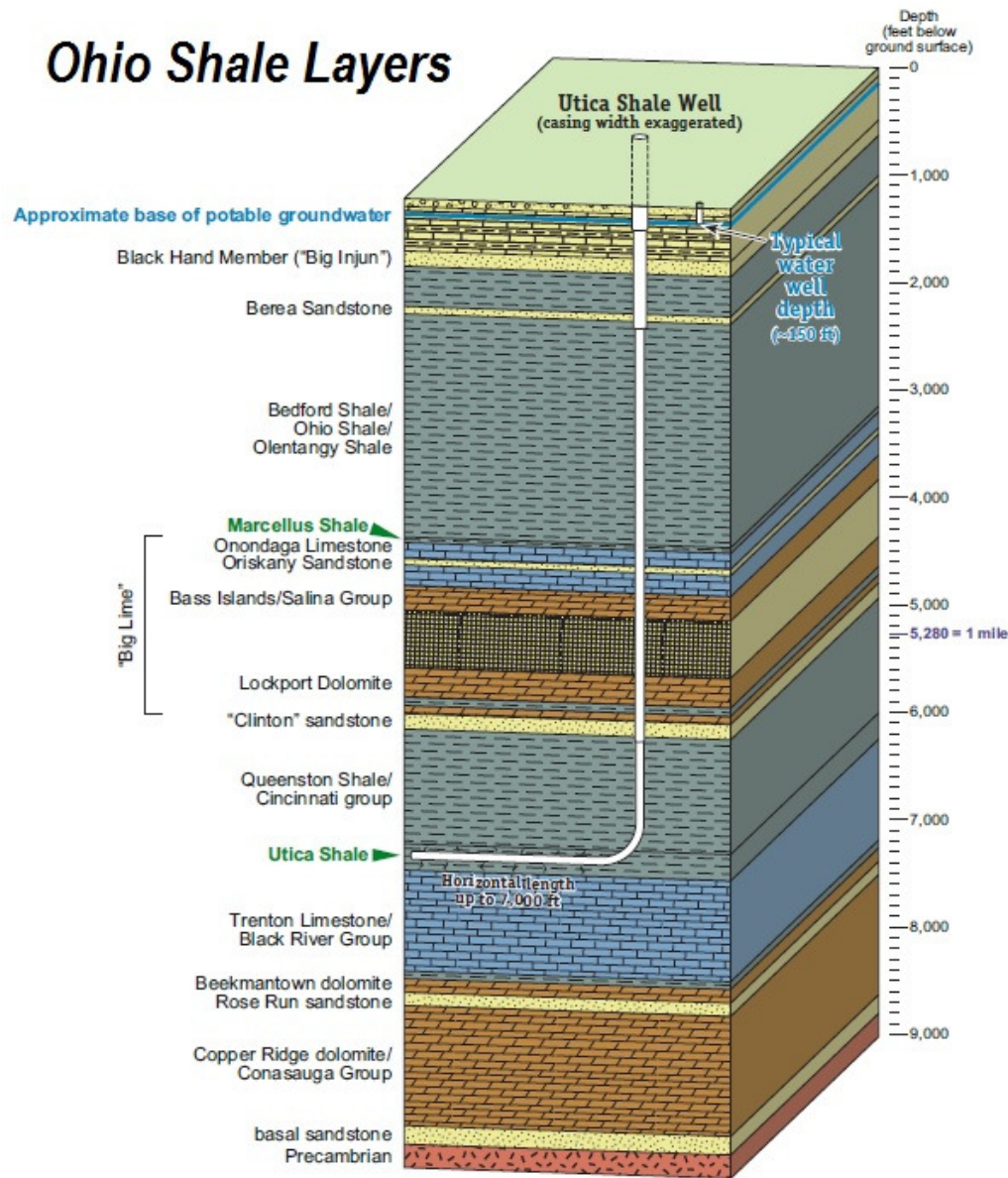


Granville Township, Pennsylvania

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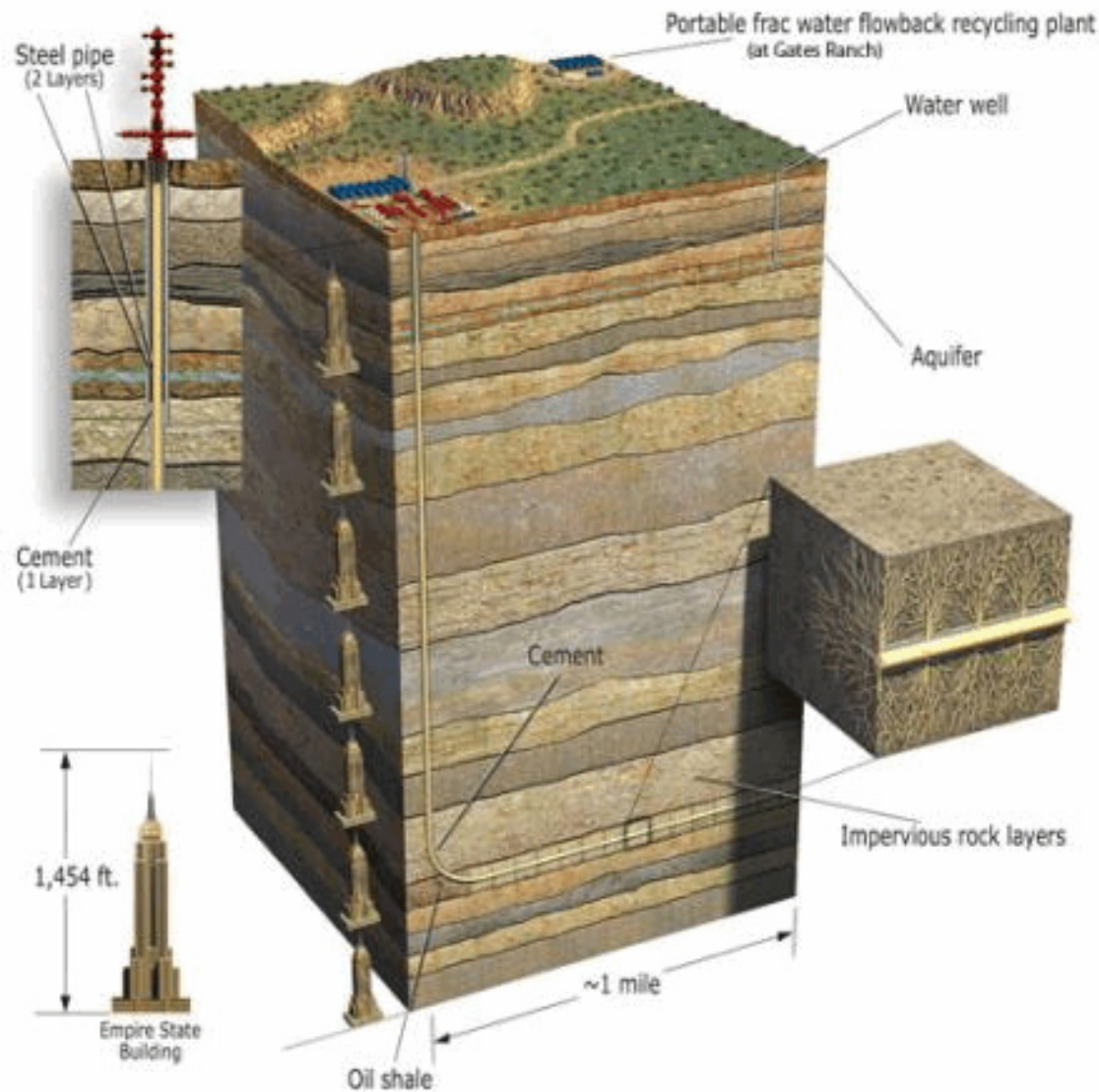
Ohio Shale Layers



Groundwater
<500 ft. bgs

Marcellus Shale
>3,000 ft. bgs

Utica Shale
>6,000 ft. bgs



The wells can be a mile deep and a mile long.

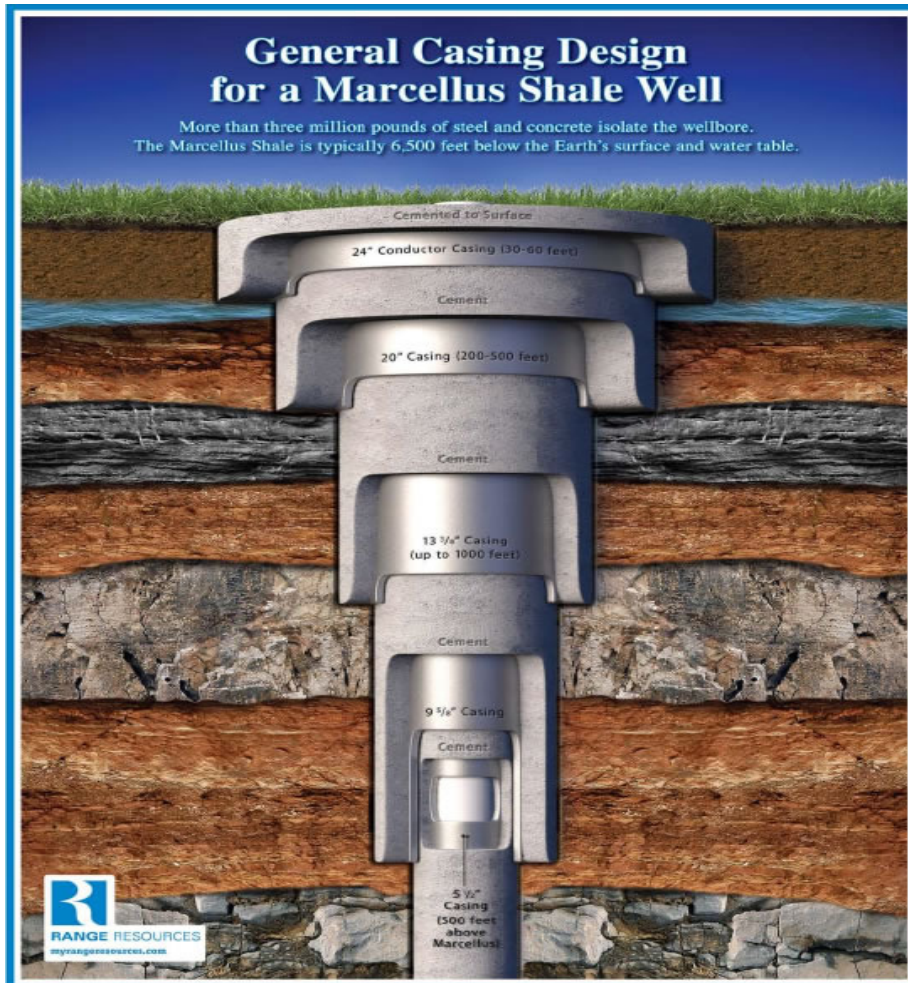
Rock layers and well casings protect groundwater aquifers.

Groundwater Protections

Modern horizontal drilling technologies isolate the well shaft from surrounding strata to protect groundwater supplies.

- Casing set in place below groundwater aquifer zone
- Depth of average well is 6,000 feet.
- Most drinking water aquifers are much more shallow.

Groundwater Protections



Multiple layers of steel casing and cement are installed, with the casing diameter getting smaller as the well gets deeper.

Legitimate Concerns

- Potential contamination of groundwater from the use of fracking fluids and methane infiltration.
- Extremely large volumes of water used to complete a deep well (5 million or more gallons)
- Disposal of “produced water” and “flow back water”
 - POTWs (can’t process it)
 - Recycling (expensive)
 - Underground Injection (earthquakes?)

Legitimate Concerns



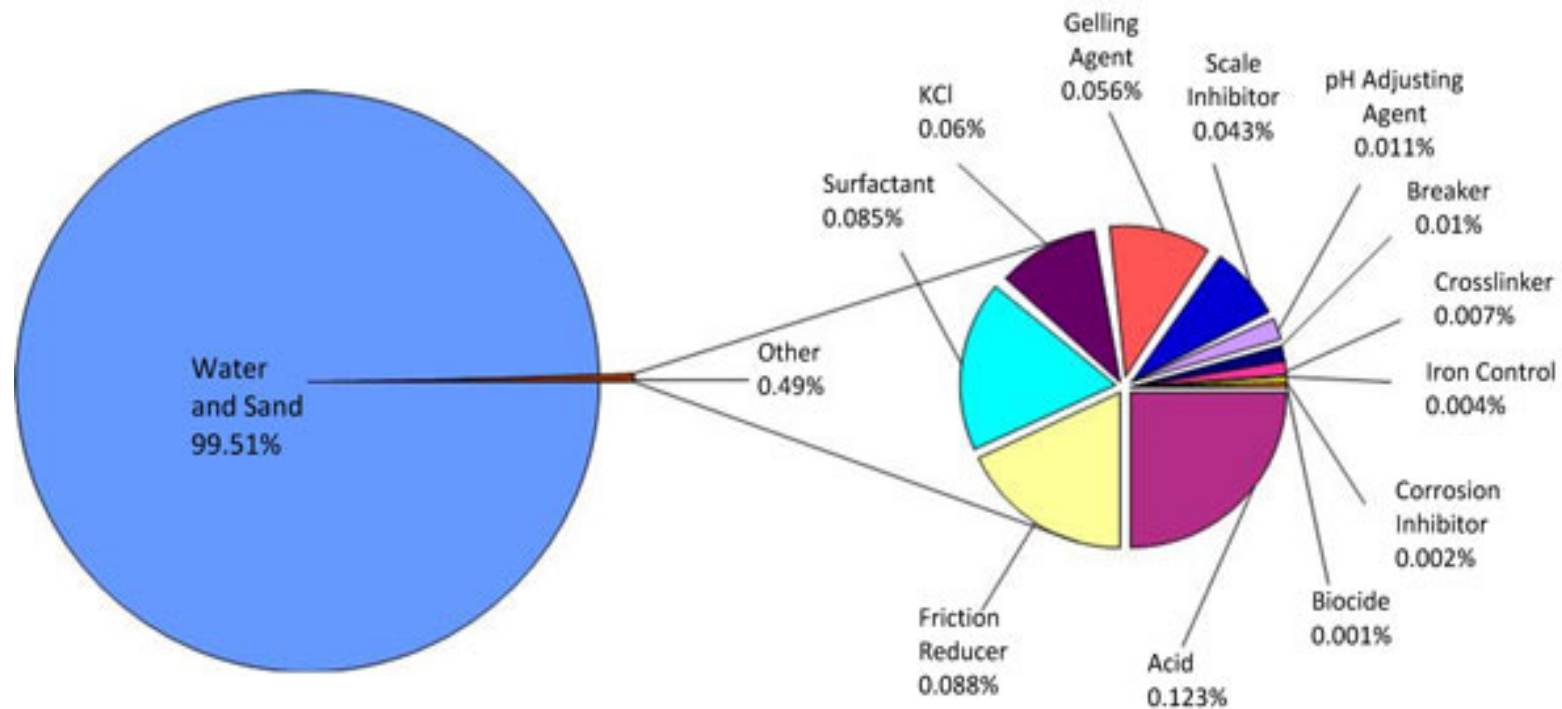
Youngstown, Ohio – January, 3, 2012

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Legitimate Concerns

- Naturally occurring radioactive materials (“NORM”) produced.
- Truck traffic/road damage.
- 24/7 operations (nuisance).
- Air emissions.
- *Trade secret protection on fracking chemicals exempts them from disclosure requirements.*

Legitimate Concerns



Fracking additives: .05% to 2 %

**Exempted from Hazardous Chemical
Reporting Requirements**

State by State Regulation

- Very little Federal regulation.
- States taking different approaches to regulation.
 - **New York** recently passed a permanent ban on fracking.
 - **California** regulations essentially ban fracking.
 - **Ohio, Pennsylvania, and West Virginia** taking balanced approach.
- Local ordinances

Impact for Consumers



2012



2015

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Impact on Alternative Energy

