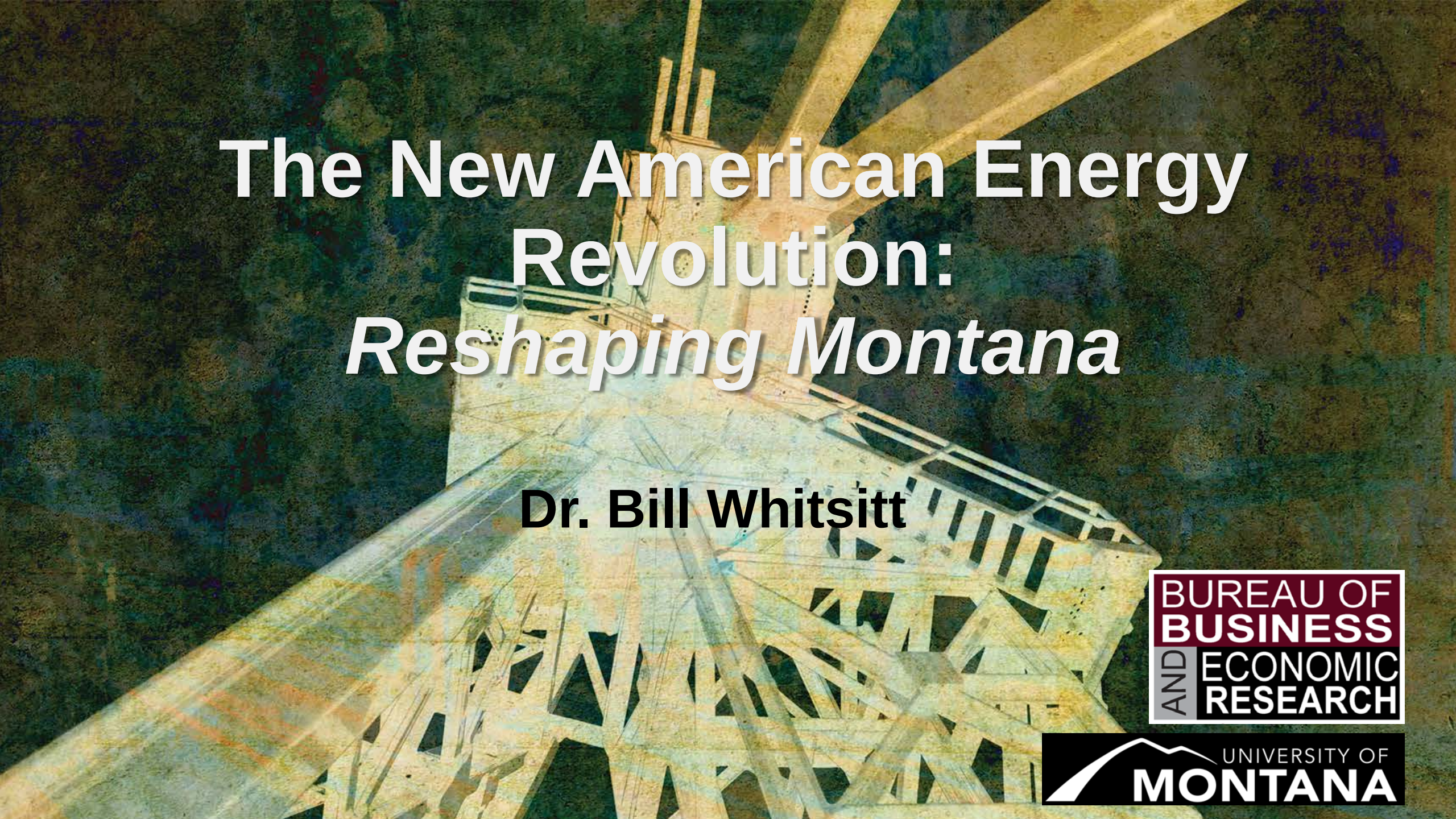


The New American Energy Revolution: *Reshaping Montana*

Dr. Bill Whitsitt

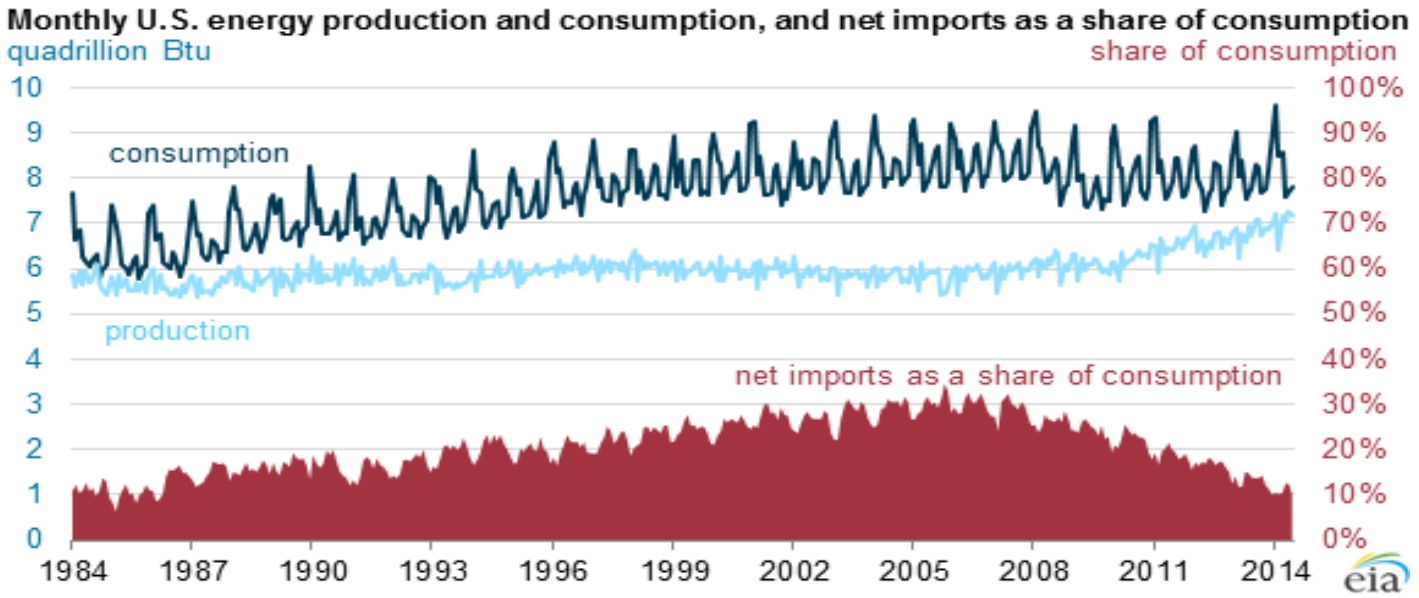
BUREAU OF BUSINESS AND ECONOMIC RESEARCH

UNIVERSITY OF MONTANA

The New American Energy Revolution
What's it all about?

The US:

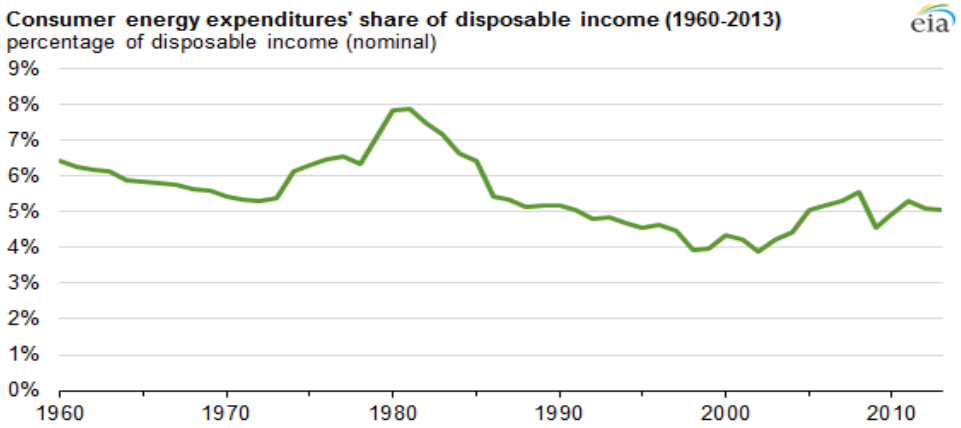
- having the lowest percentage of its energy consumption provided by imports in 29 years
- supplying 84% of its own domestic energy
- being the world's largest oil & gas producer

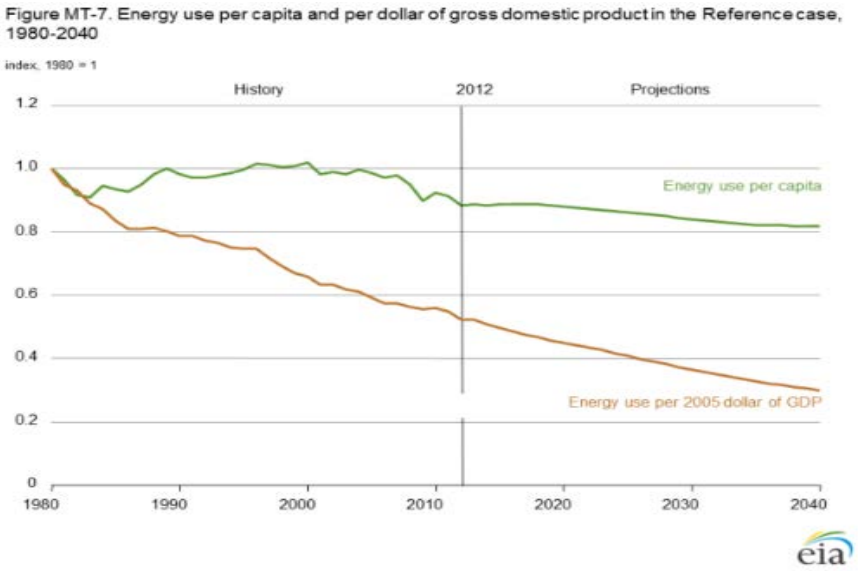


The New American Energy Revolution
What's it all about?

Consumers:

- spending less on energy
  - per capita
  - per $ of GDP
  - as share of disposable income



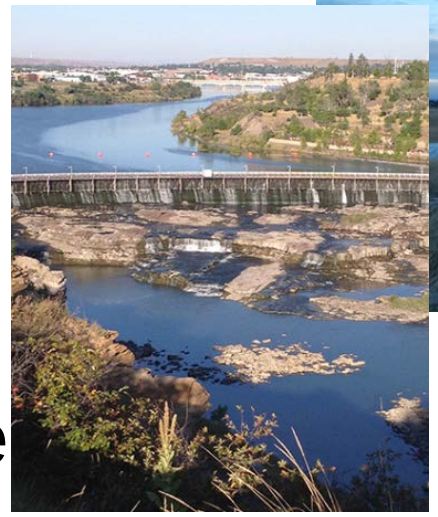


The New American Energy Revolution
What's it all about?

Workers:

- with good-paying energy jobs, some 12,500 oil & gas and supporting ones alone
- starting their own energy-related businesses
- seeing population growth in their towns and counties, with new infrastructure needs

The New American Energy Revolution *is about that …*



and…

- “new” energy resources
- technology
- Innovation
- better operations
- environmental progress
- price responsiveness
- questions, concerns and debate
- new thinking for the long term

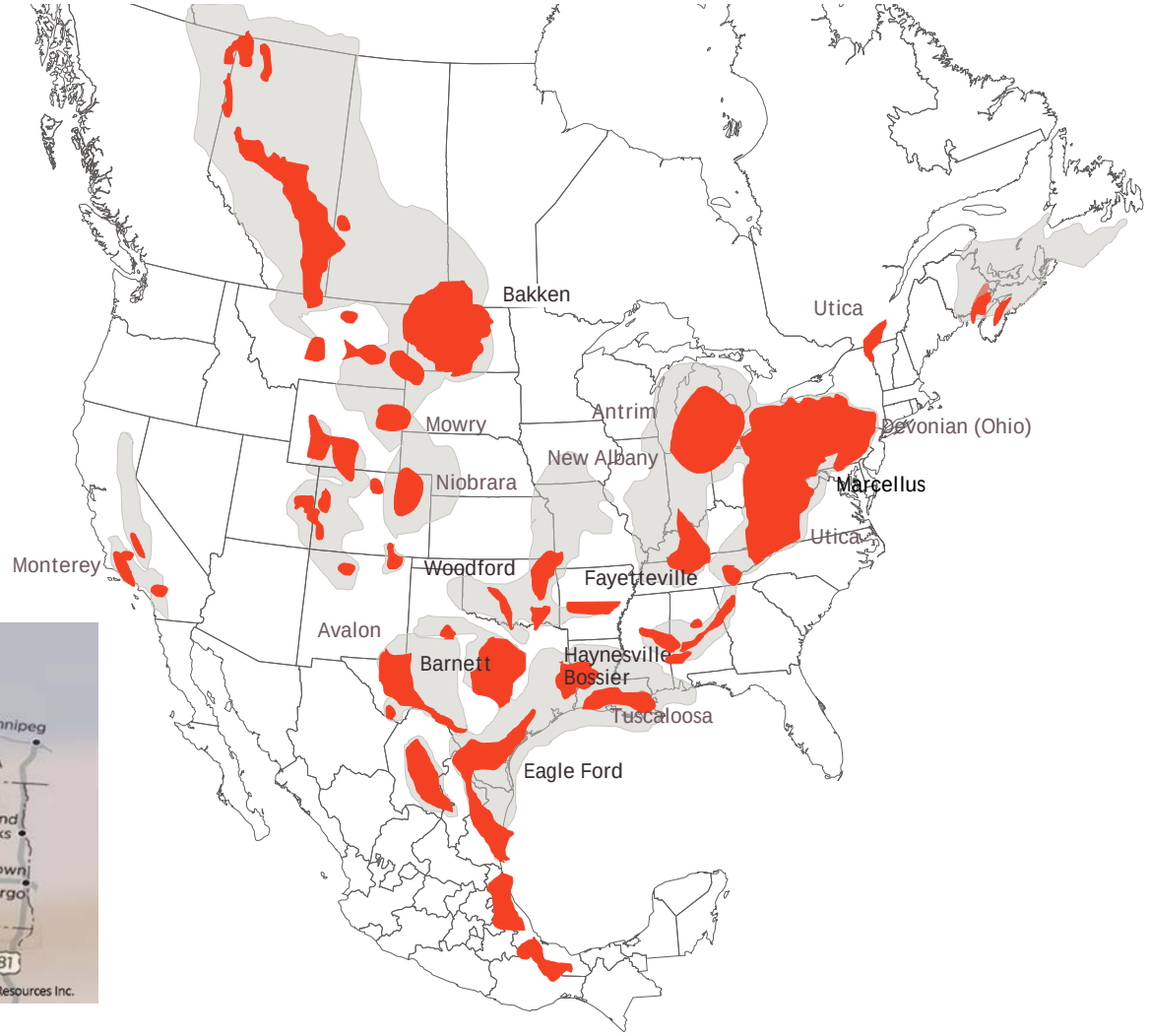
“New” energy resources

A wide range – “new” because of

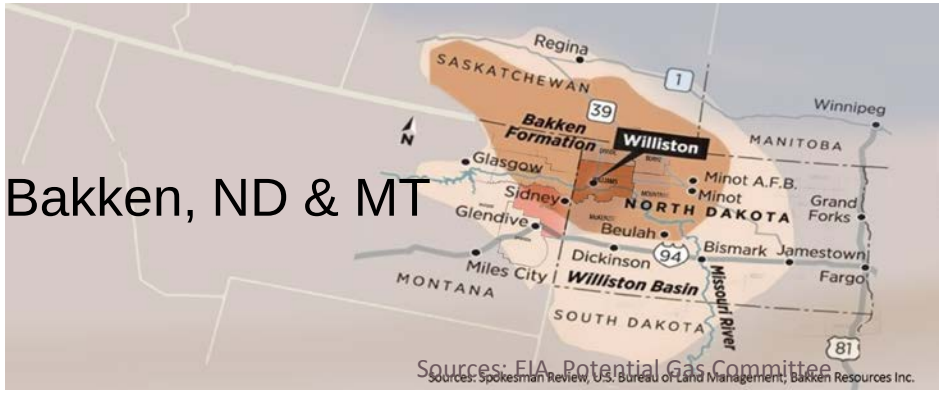
- technology
- innovation
- price

“New” energy resources
Example: oil & gas from source rocks

North American
shale basins and plays

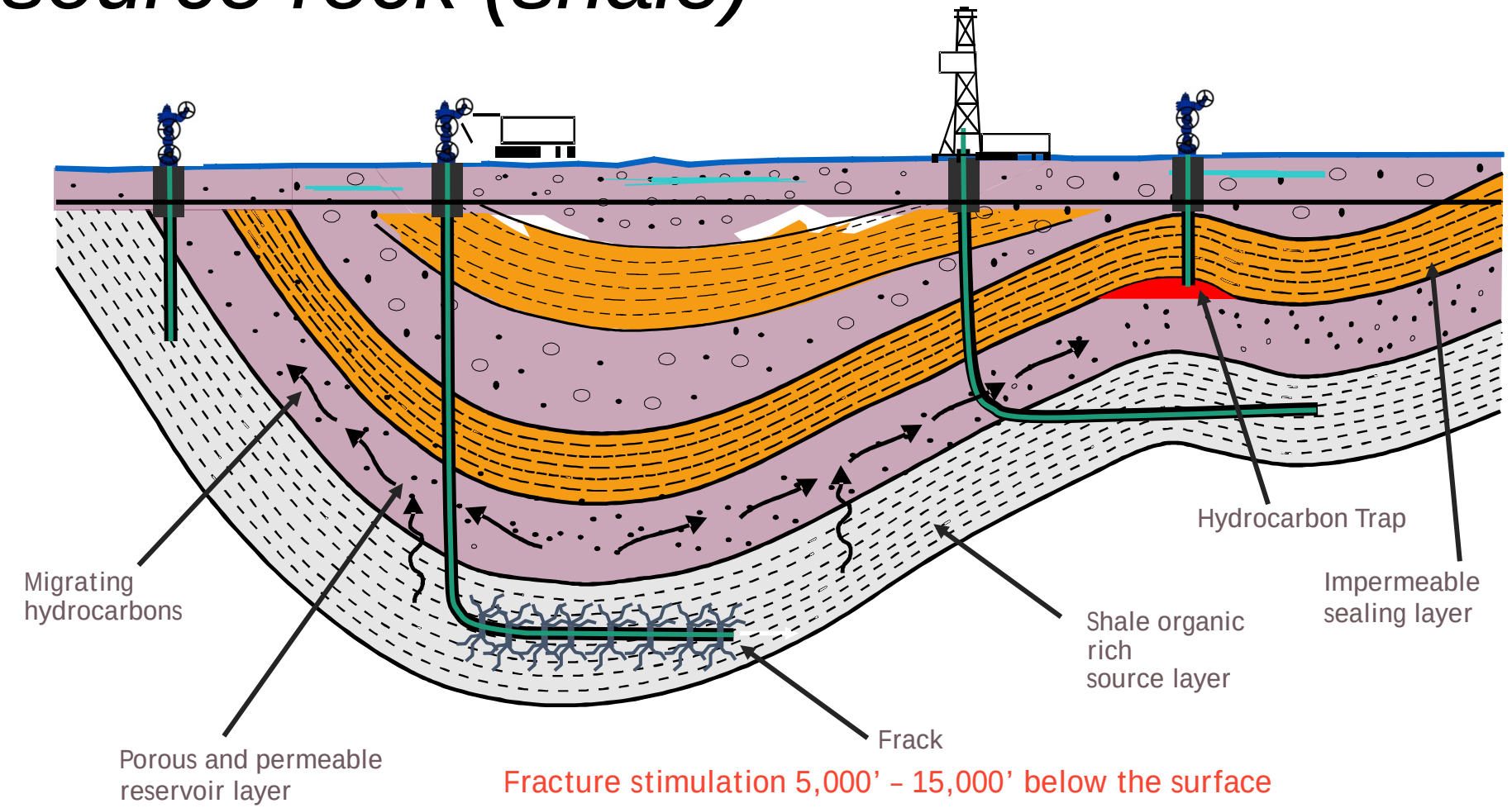


Bakken, ND & MT



Sources: EIA, Potential Gas Committee

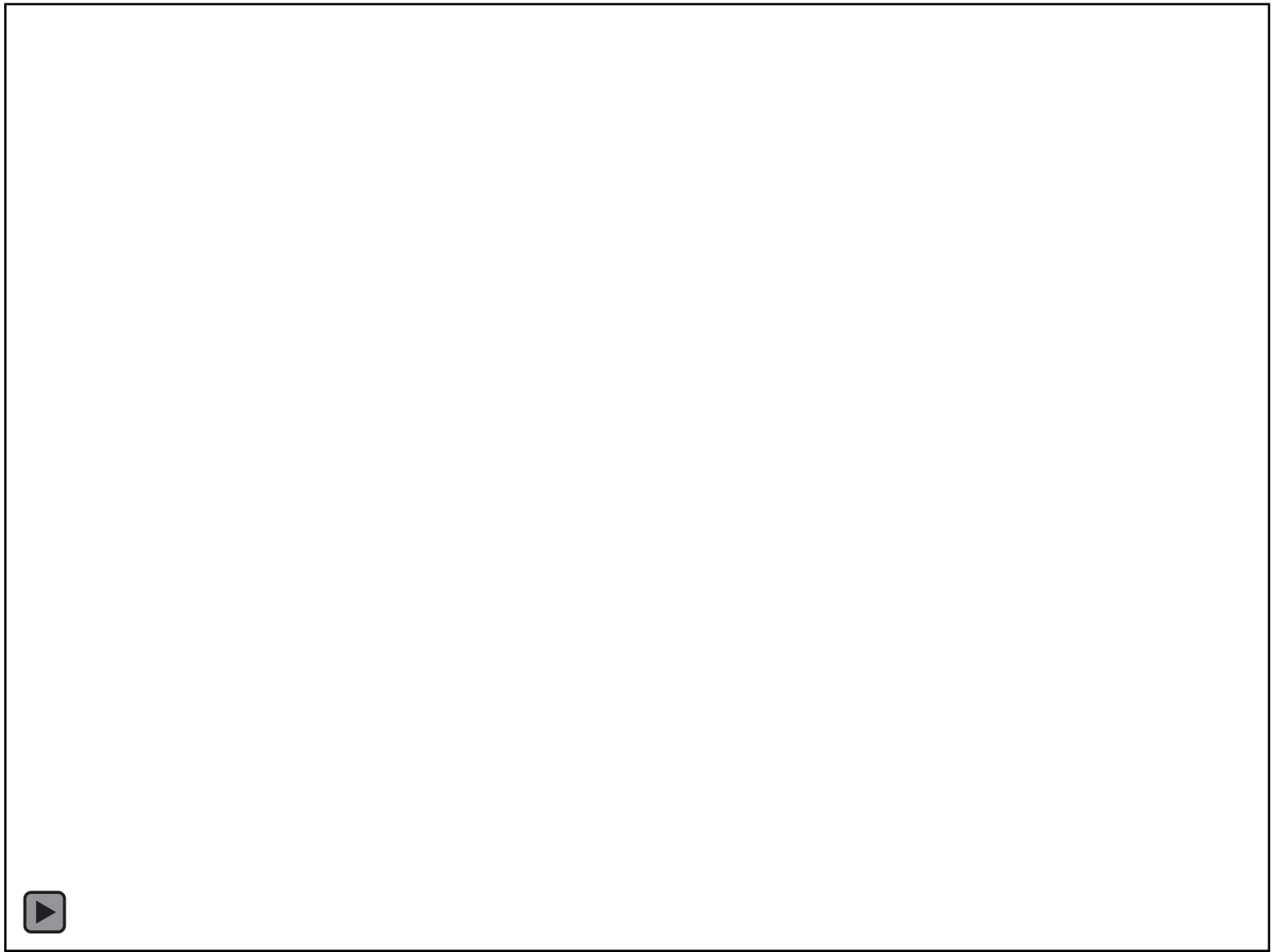
“New” energy resources
In source rock (shale)



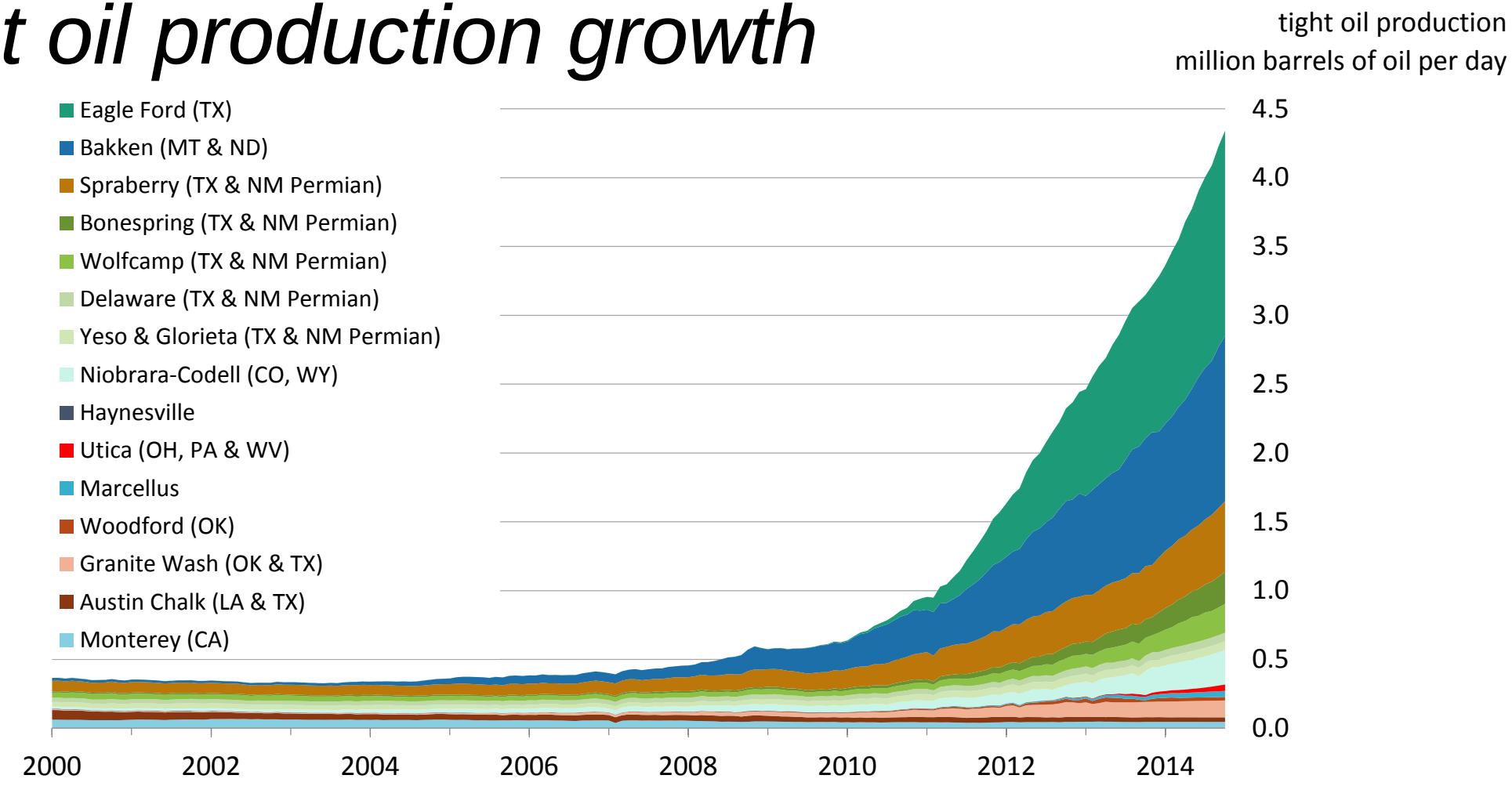
Fracture stimulation 5,000’ – 15,000’ below the surface

“New” energy resources

By horizontal drilling and hydraulic fracturing

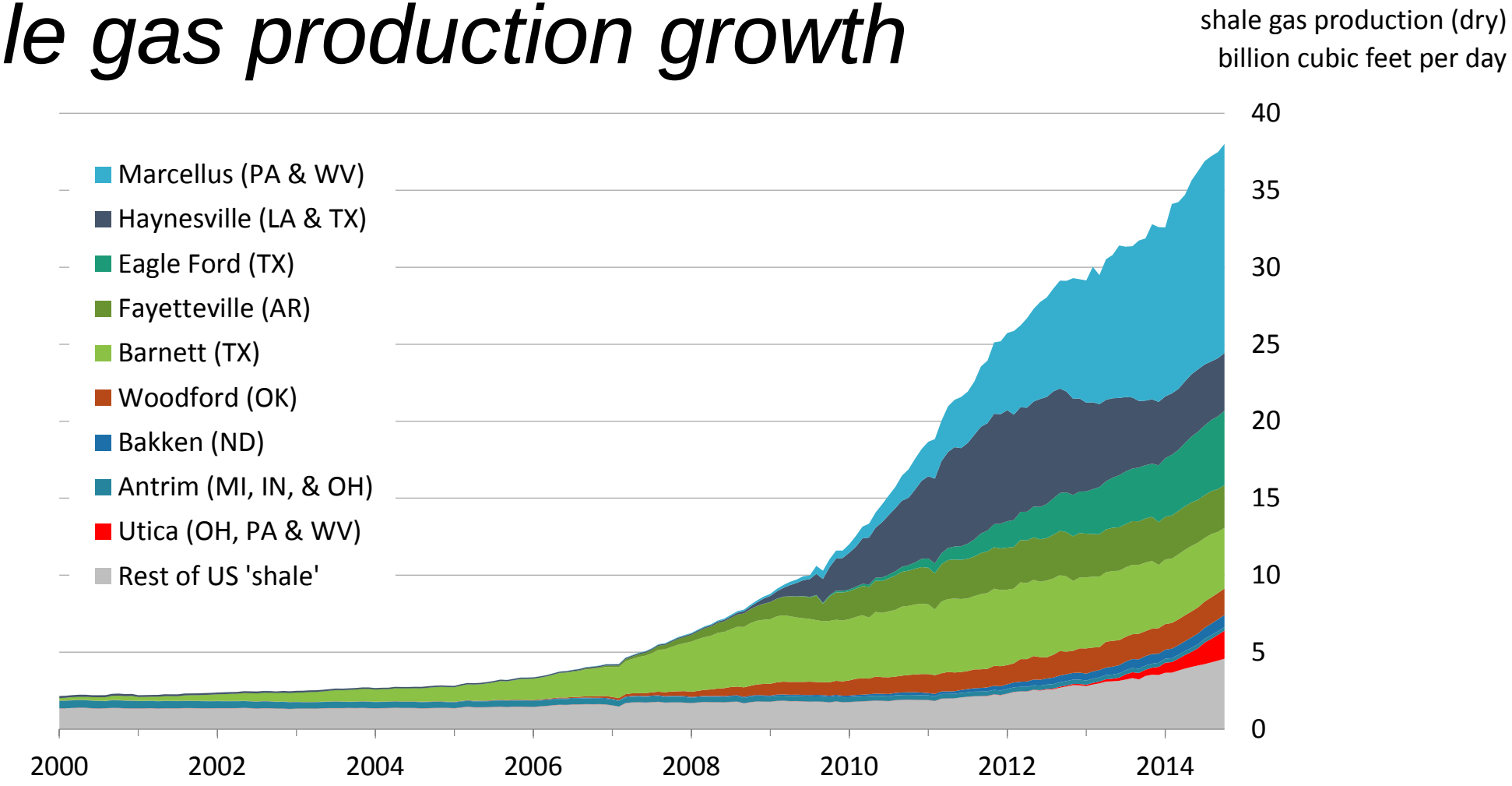


“New” energy resources
Tight oil production growth



Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through October 2014 and represent EIA’s official tight oil estimates, but are not survey data. State abbreviations indicate primary state(s).

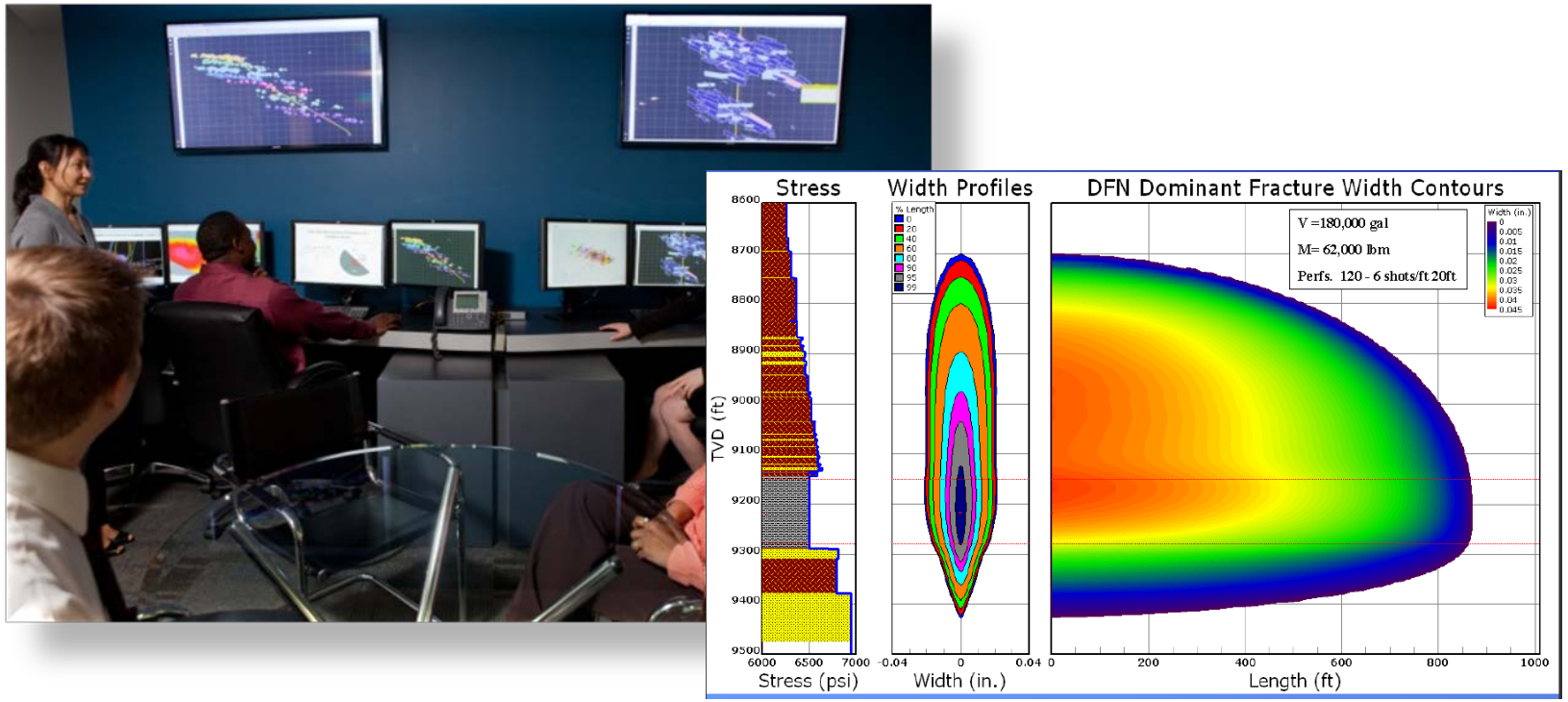
“New” energy resources
Shale gas production growth



Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through October 2014 and represent EIA’s official shale gas estimates, but are not survey data. State abbreviations indicate primary state(s).

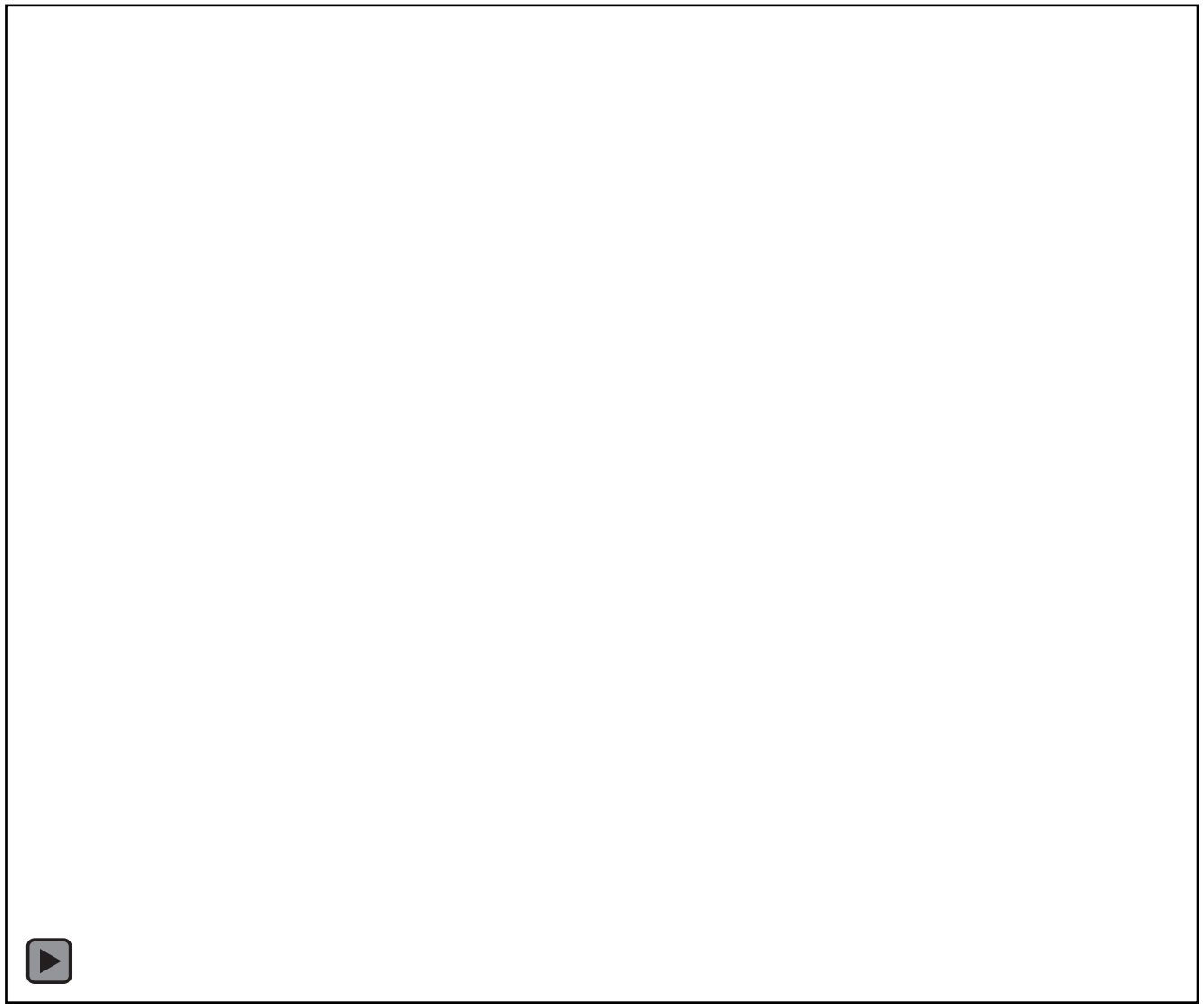
“New” energy resources
Technology progress continues…

The ability to “see” beneath the ground…



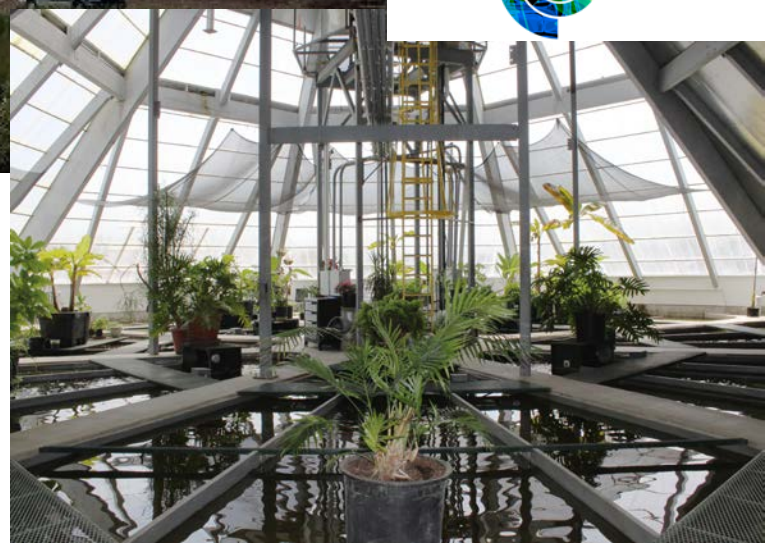
…has become the ability to hear with micro seismic technology

Technology progress continues…
Micro seismic listening



MicroSeismic
Passive Monitoring, Active Listening

Technology progress continues…
…*for renewables that are growing*



F. H. STOLTZE LAND & LUMBER CO

Technology progress continues…
for all energy resources

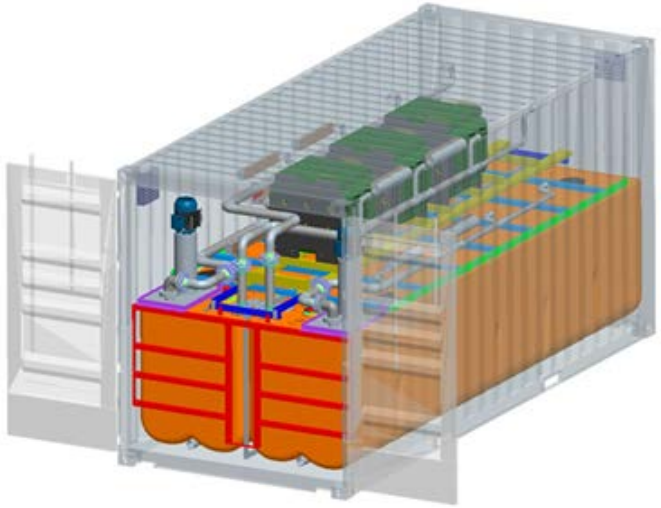
…for efficiency, safety and environmental protection

Technology and other work continue…
for managing the future electric power system

- smart grid
- renewables integration
- distributed generation and net metering
- microgrids
- storage

Scalable storage battery

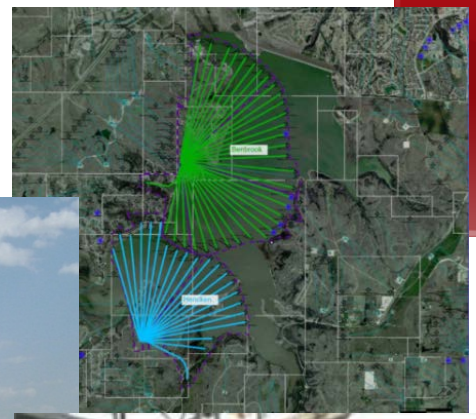
Apartment complex w microgrid



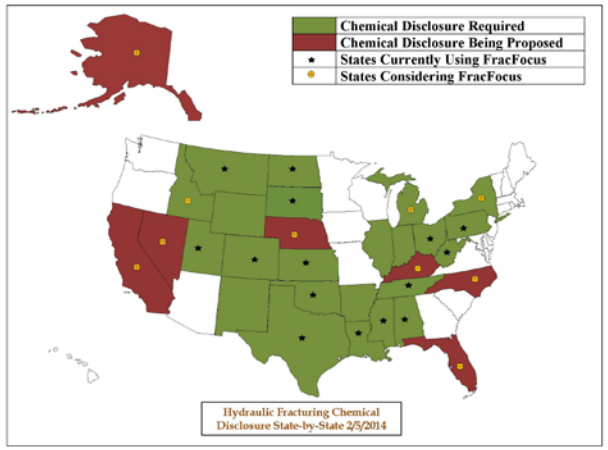
The New American Energy Revolution
What about operations and the environment?

Continuous improvement is key

- operator standards and practices
- good regulation
- solid enforcement
- transparency



FracFocus
Chemical Disclosure Registry

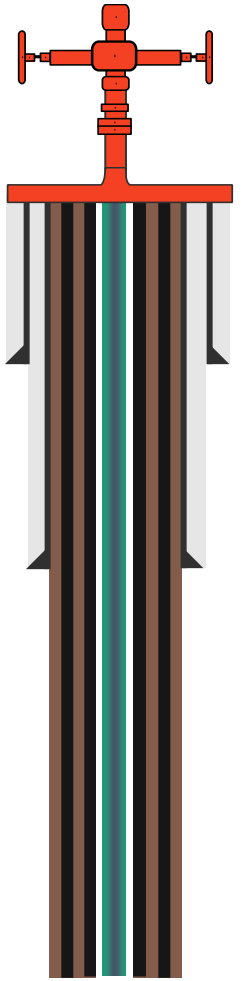


Continuous regulatory improvement

States are crucial

- enforcing federal and state laws and rules

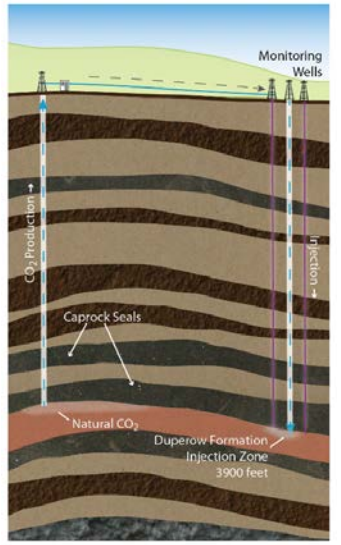
STATES FIRST INITIATIVE
A Partnership of IOGCC & GWPC



The New American Energy Revolution
What about its challenges?

There clearly are some

- infrastructure needs in Eastern Montana
- oil price effects
- planning to be done
- ongoing and future research
- workforce preparation
- policy choices to be made

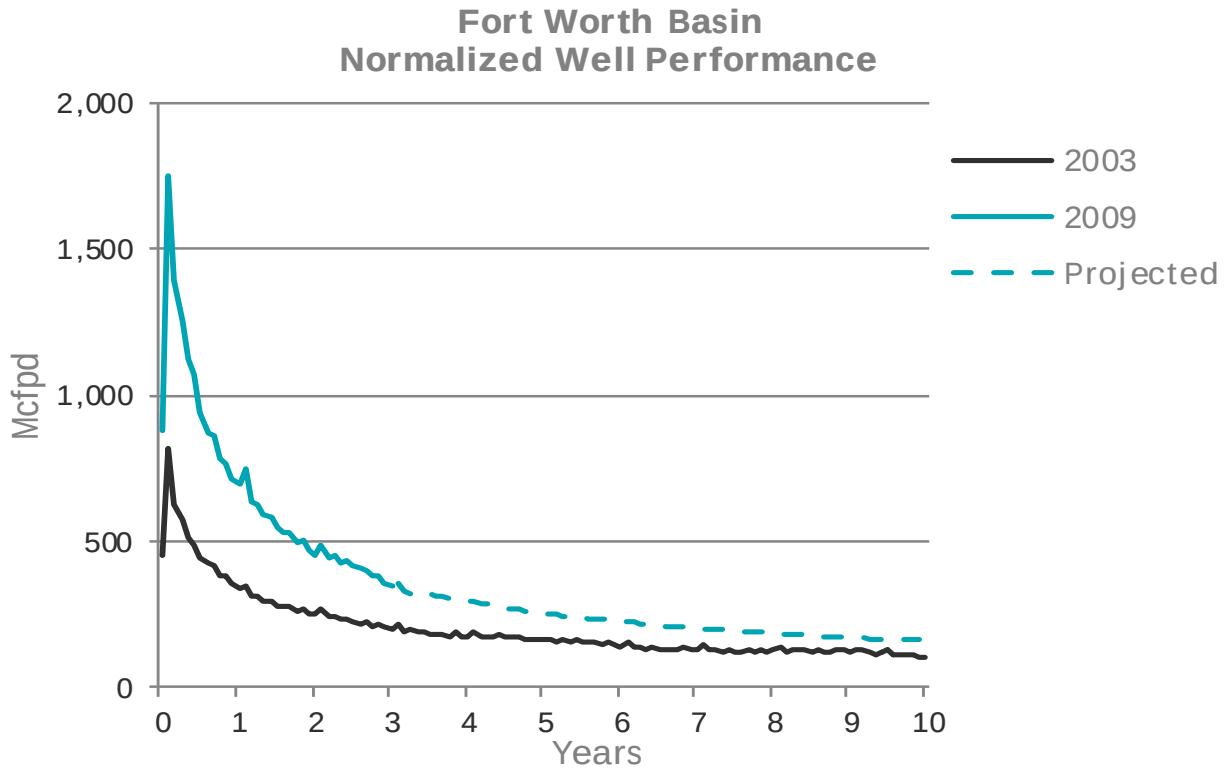


Montanans are already working to meet those challenges – in a spirit of cooperation and entrepreneurship

Thank you

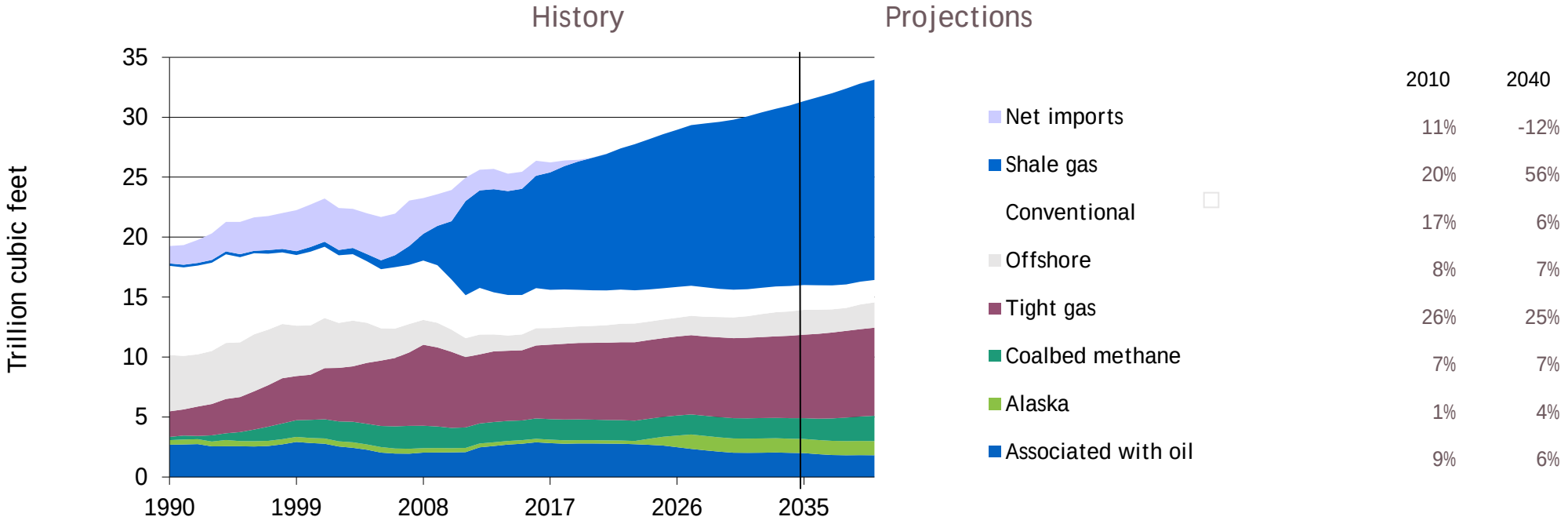
Shale well performance

- 2003-88% of wells drilled in Barnett Play were vertical
- 2009-91% of wells drilled in Barnett Play were horizontal



Projecting natural gas sources
Shale to provide growing share of U.S. supply

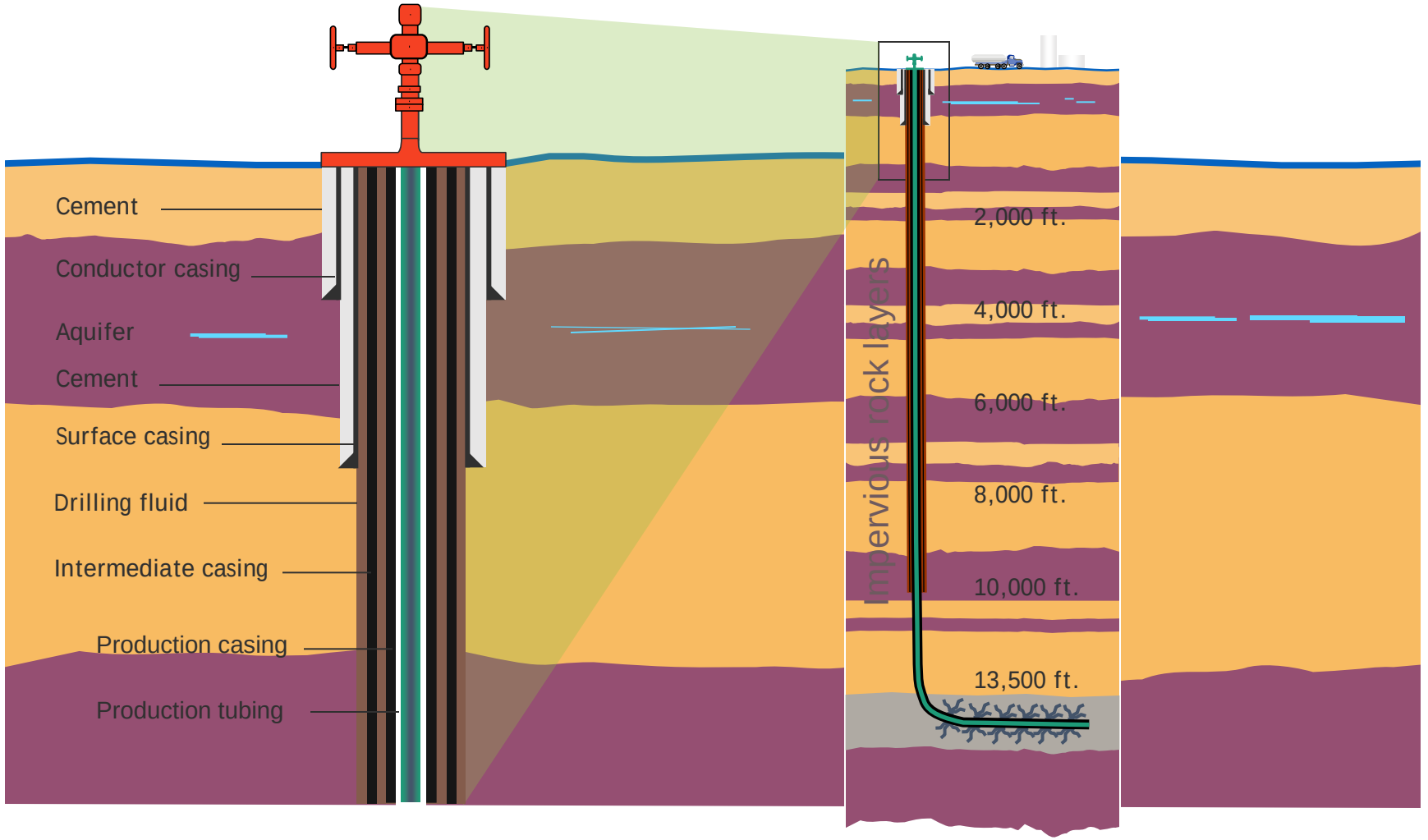
- Shale gas offsets declines in other U.S. supplies to meet consumption growth and lower import need



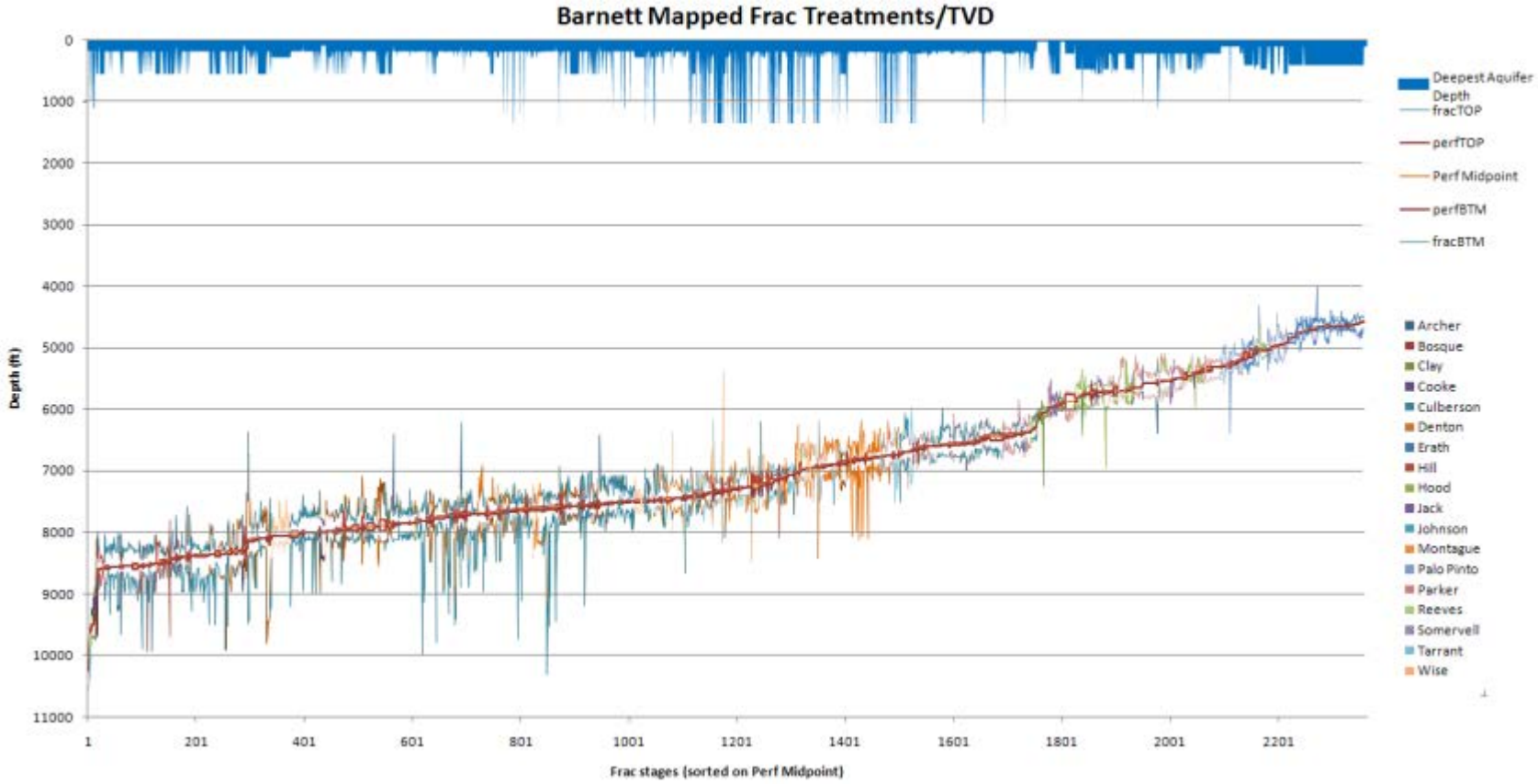
Source: EIA, Annual Energy Outlook 2013

Well Construction

To prevent harm to water



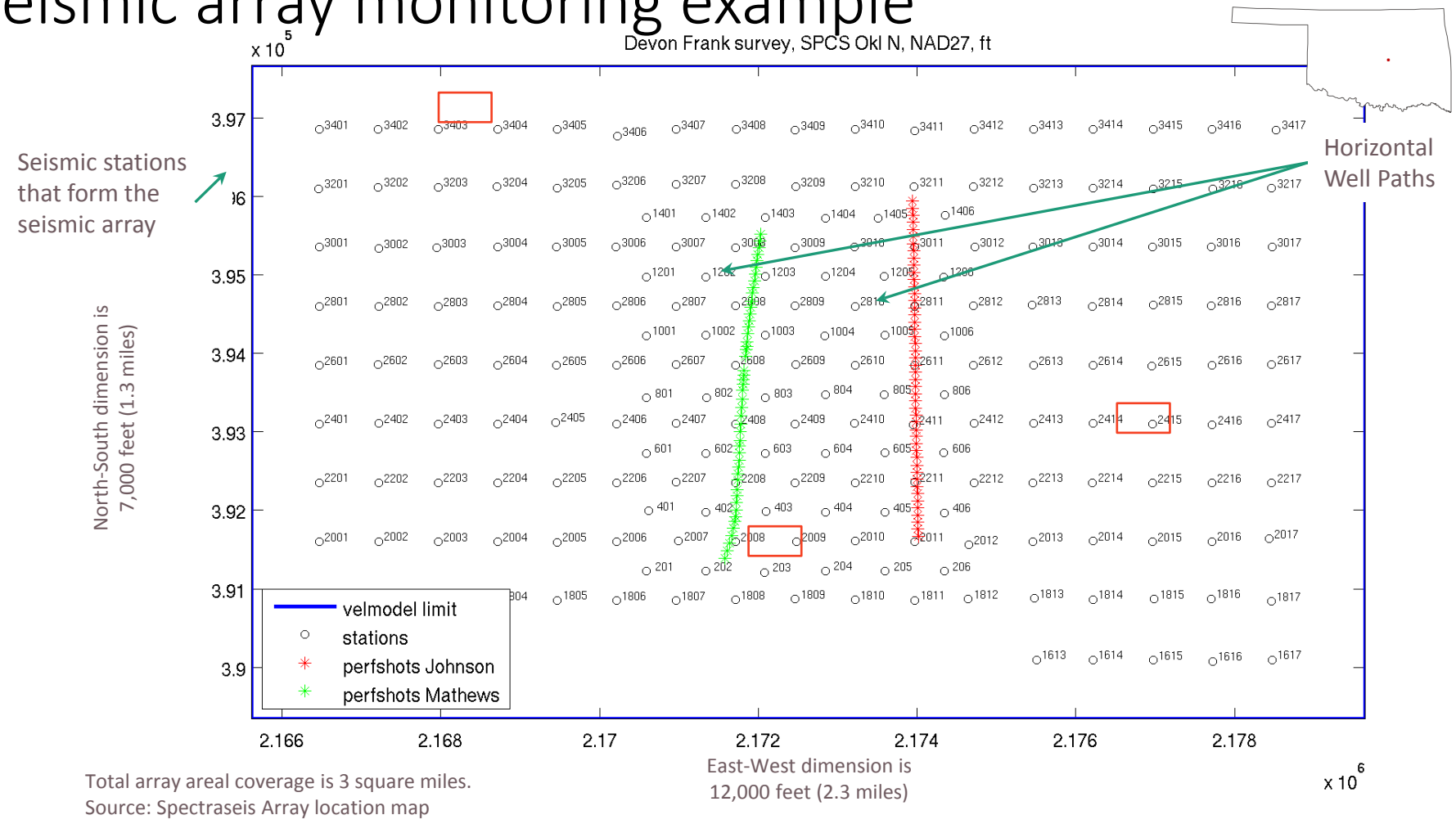
Mapped fracture treatments
Barnett Shale



Kevin Fisher, "Data Confirm Safety of Well Fracturing" — *American Oil & Gas Reporter, July 2010*

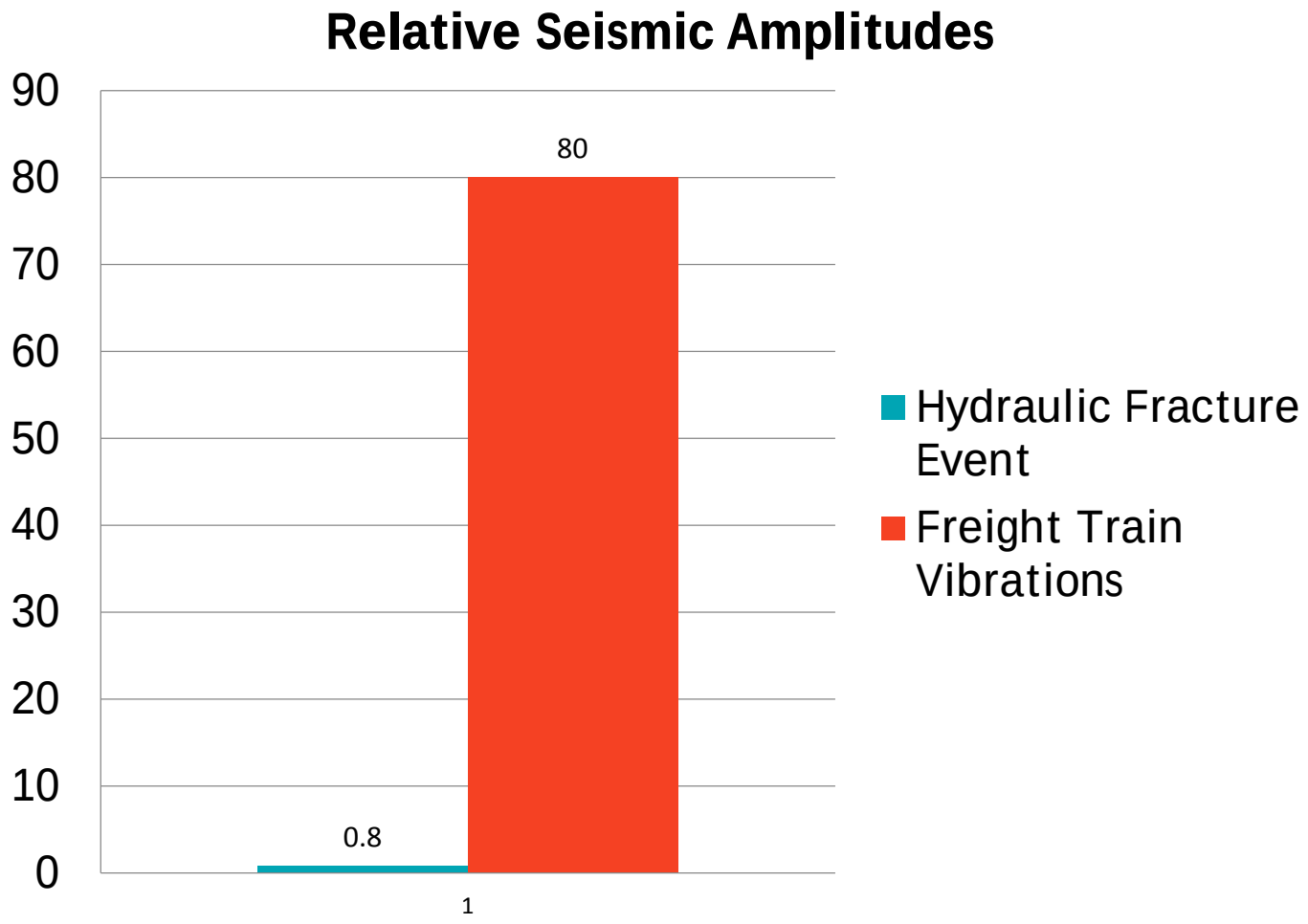
Seismic risk in context

Seismic array monitoring example



Total array areal coverage is 3 square miles.
Source: Spectraseis Array location map

Seismic risk in context



Hydraulic fracturing and earthquakes

- Experts' consensus: Low risk managed through good practices
- "We don't see any connection between fracking and earthquakes of any concern to society." — Bill Ellsworth, senior U.S. Geological Survey geophysicist, to *E&E News*, April 23, 2012.
- Fewer than 30 out of 150,000 U.S. disposal wells have had any alleged connection to seismic activity
- Generally no damage from those events
- Advanced seismic imaging technology and interpretation methods can identify and avoid faults
- Industry expanding water recycling/reuse programs to reduce need for disposal wells

API standards

For hydraulic fracturing

- Well construction and integrity guidelines (2009)
- Water management associated with HF (2010)
- Practices for mitigating surface impacts (2011)
- Environmental protection for onshore production (2009)
- Isolating potential flow zones during construction (2010)
- Effectively engaging the community (2013)

Continuous improvement

- Reviewed and revised on a regular basis
  - Current Technology
  - Current Engineering Practices

- 2013 API Standards Work Program
  - 10+ regional outreach workshops
  - Continued technical work
  - Regular interaction with state and federal government

Good regulation
States' roles

- States manage the oversight and enforce federal law and state rules
  - Have the on-the-ground personnel and expertise

- State-led enforcement allows fit-to-purpose solutions for localized issues

- Regulated activities:
  - well design
  - well location
  - well spacing
  - well operation
  - water management and disposal
  - air emissions
  - wildlife impacts
  - surface disturbance
  - worker health and safety

State regulation
Continuous improvement

- Regulator exchange based on
  - Open communication
  - Sharing best practices
  - Focus on field operations
  - Continuous improvement

- Phase I
  - Hydraulic fracturing
    - FracFocus 2.0
  - Inspector certification
  - Field practices improvement
  - Saltwater disposal well guidelines & peer review

GROUNDWATER PROTECTION COUNCIL

INTERSTATE Oil & Gas COMPACT COMMISSION

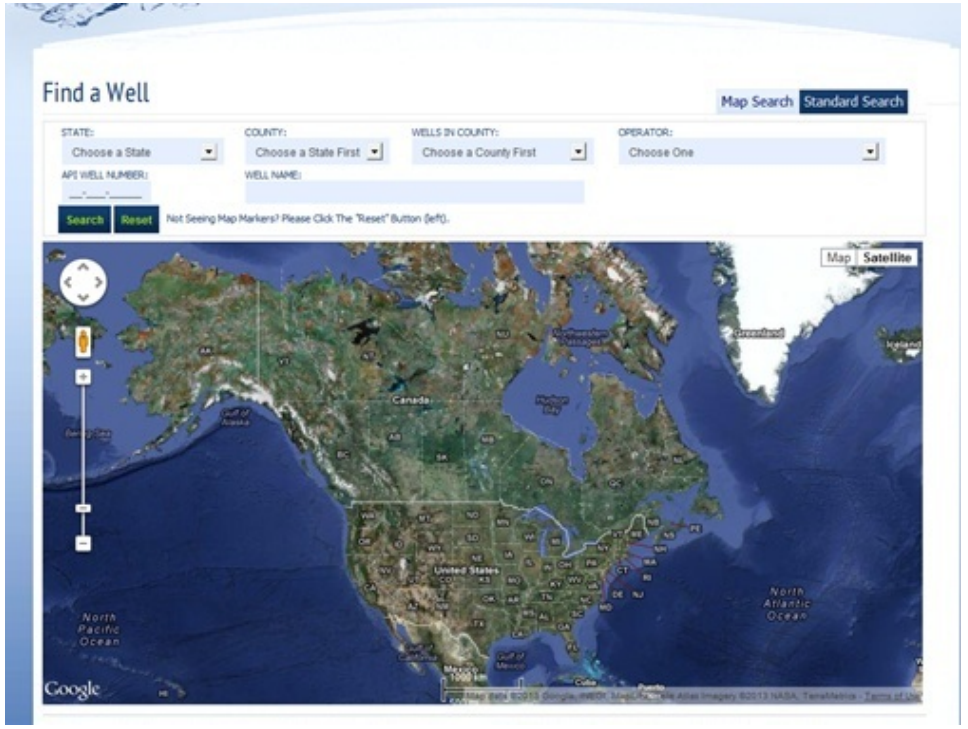
GWPC/IOGCC chemical registry

FracFocus

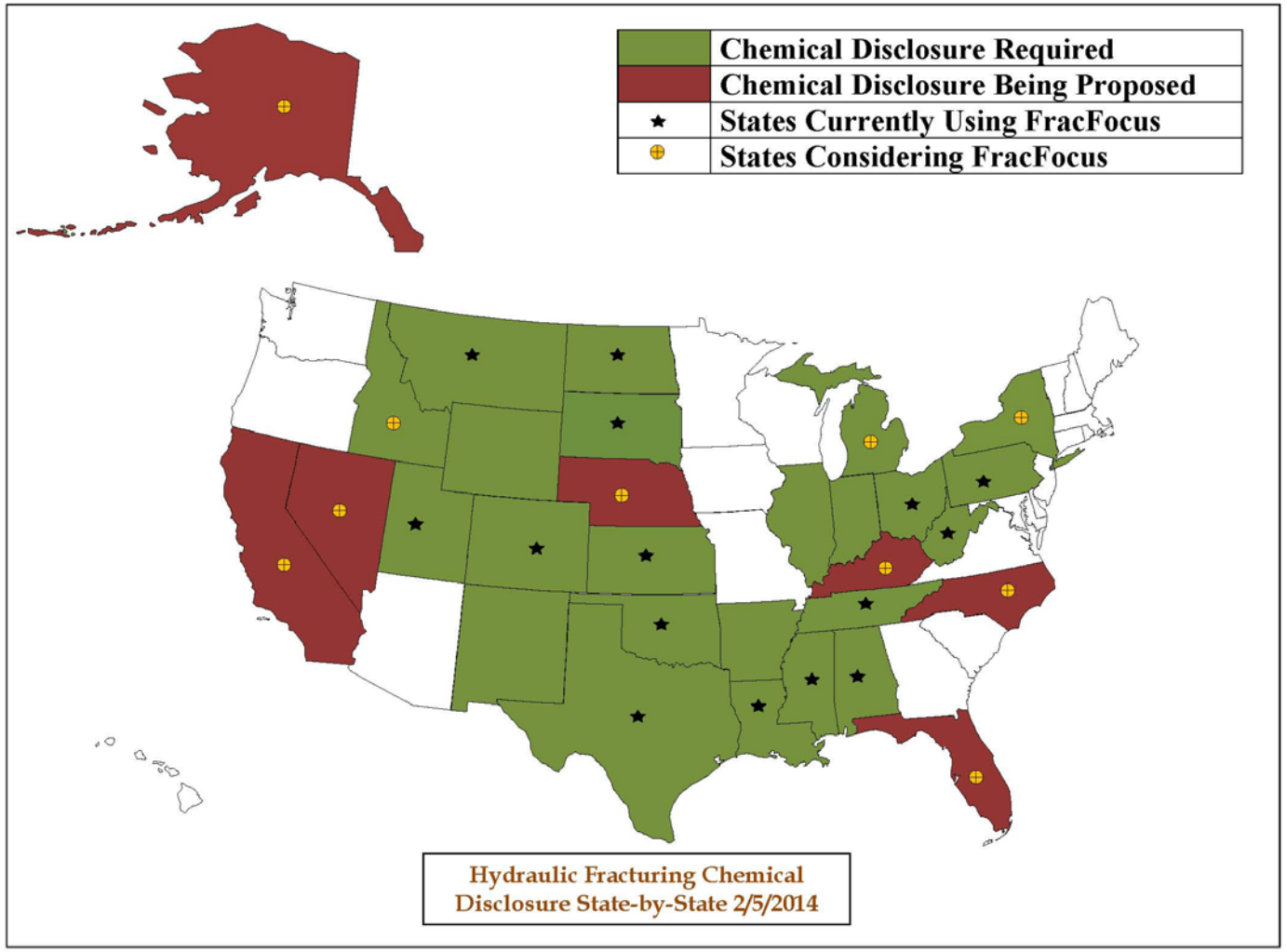
Fracfocus.org

What goes into the well

- Created by state regulators and the Interstate Oil and Gas Compact Commission
- Site went live in April 2011
- Industry is responding to this voluntary disclosure effort
  - 600+ companies have reported well information
  - 71,000+ disclosures
  - 751,000+ Website visits from 135+ countries

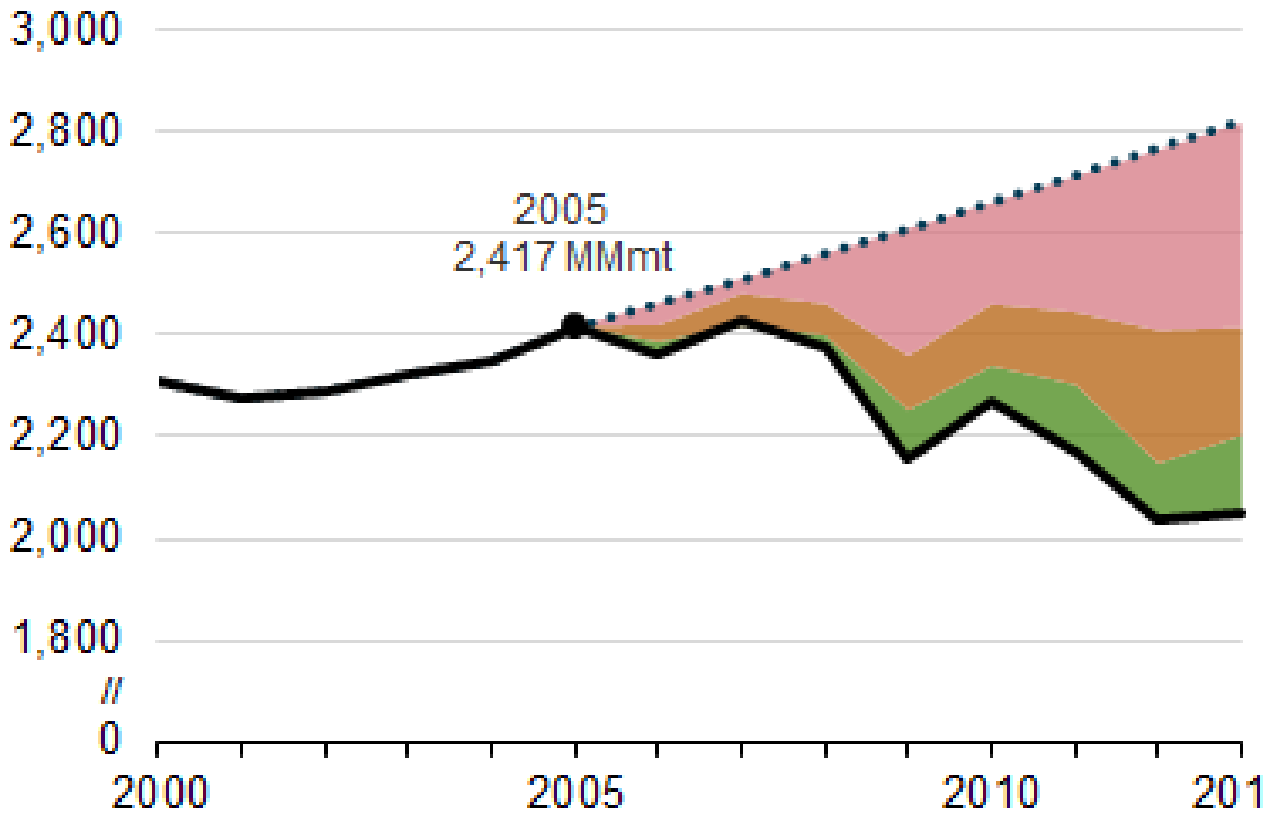


State disclosure rules



U.S. electric power carbon dioxide emissions (2000-2013)

million metric tons (MMmt) of carbon dioxide



If demand growth had remained near 2% and carbon intensity fixed at 2005 levels, emissions would have been **2,817 MMmt**

Lower demand growth alone reduced emissions by **402 MMmt**

Switching among fossil fuels further reduced emissions by **212 MMmt**

Adding noncarbon sources reduced emissions by **150 MMmt**

After these reductions, actual carbon dioxide emissions in the power sector were **2,053 MMmt** in 2013.

eia