



# Developments in U.S. Energy Markets and the Implications for Future Growth

Leadership Maryland Breakfast Program  
February 19, 2014



R. Andrew Bauer  
Senior Regional Economist

# Dramatic changes in the energy sector

ft.com/frontpage US  All times are London time

## FINANCIAL TIMES

January 7, 2014 11:17 pm

### US oil boom drives trade deficit to four-year low

By James Politi in Washington and Ed Crooks in New York

**TIME**  
**U.S.**

ENERGY REVOLUTION

### How the U.S. Energy Boom is Changing America's Place in the World

New report sees America's energy riches upending the geopolitical order

By Denver Nicks @DenverNicks | Feb. 07, 2014 | 0

# Dramatic changes in the energy sector

## THE WALL STREET JOURNAL.

BUSINESS

### U.S. Is Overtaking Russia as Largest Oil-and-Gas Producer

By RUSSELL GOLD and DANIEL GILBERT

Updated Oct. 2, 2013 8:10 p.m. ET

## The New York Times

BUSINESS DAY

### *U.S. Oil Production Keeps Rising Beyond the Forecasts*

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JAN. 24, 2014

## Dramatic changes in the energy sector

**MIT  
Technology  
Review**

# Shale Gas Will Fuel a U.S. Manufacturing Boom

Chemical producers abandoned the U.S. in droves. Cheap natural gas is luring them back.

By Kevin Bullis on January 9, 2013

# Key results from the EIA 2014 Annual Energy Outlook

- Growing domestic production of natural gas and oil continues to reshape the U.S. energy sector
  - Crude oil approaching 1970 high of 9.6 million barrels per day

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- With strong growth in domestic oil and gas production, U.S. dependence on imported fuels falls sharply

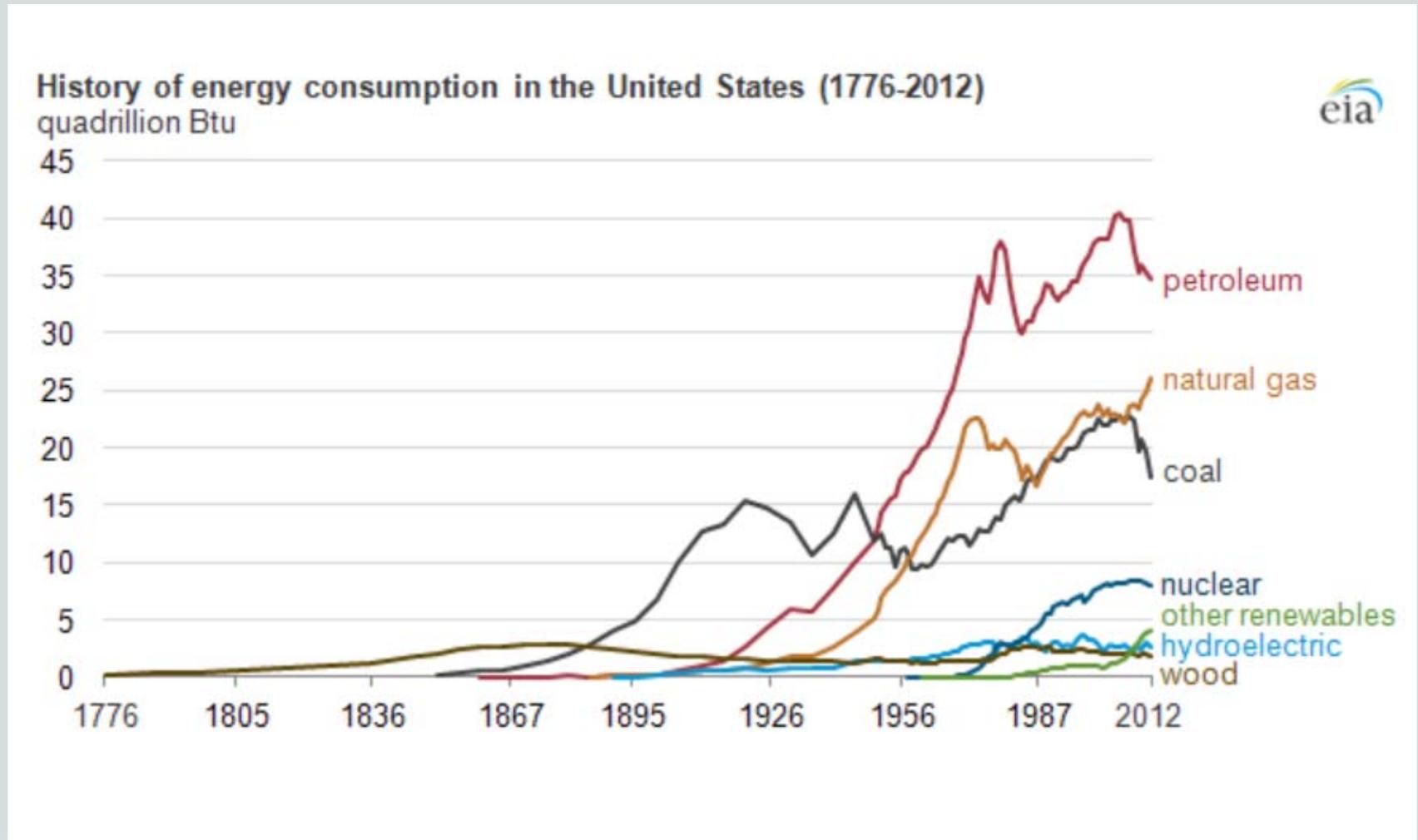
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- With strong growth in domestic oil and gas production, U.S. dependence on imported fuels falls sharply
- Improved efficiency of energy use and a shift away from carbon-intensive fuels keep U.S. energy-related carbon dioxide emissions below their 2005 level through 2040

# Outline for today's presentation

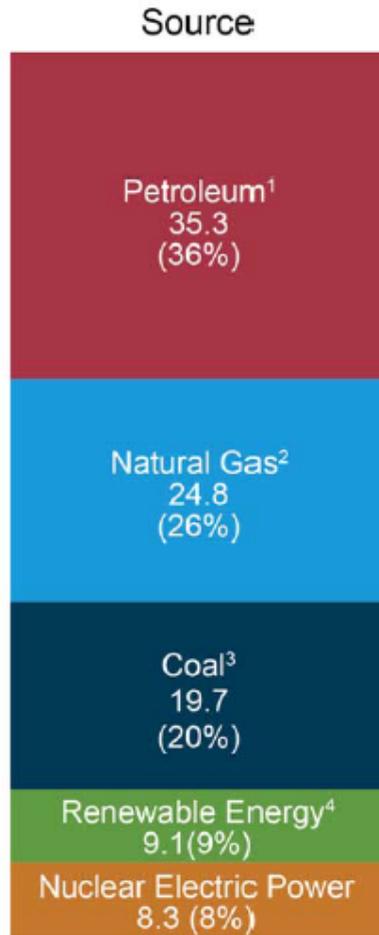
- Quick background on U.S. energy sector
- Unconventional oil and natural gas
  - What is unconventional oil and natural gas?
  - What is fracking?
  - Environmental issues
  - Changes in U.S. energy production and reserves in recent years and the long-term outlook
- Impact on the economy
  - Manufacturing sector
  - Labor markets
- Maryland: To frack or not to frack ...

# Shift among fossil fuel consumption in recent years



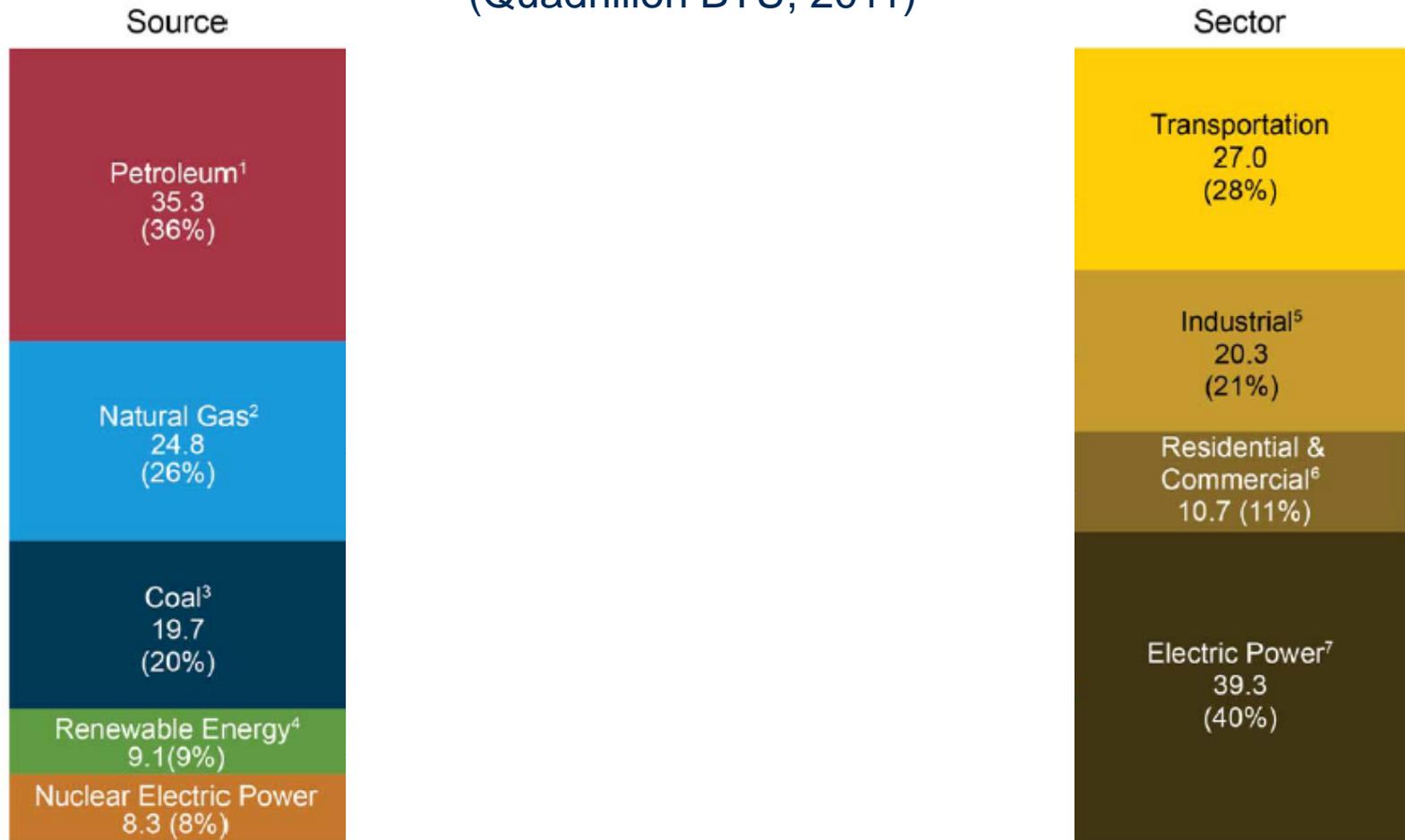
# Primary energy consumption by source and sector

(Quadrillion BTU, 2011)

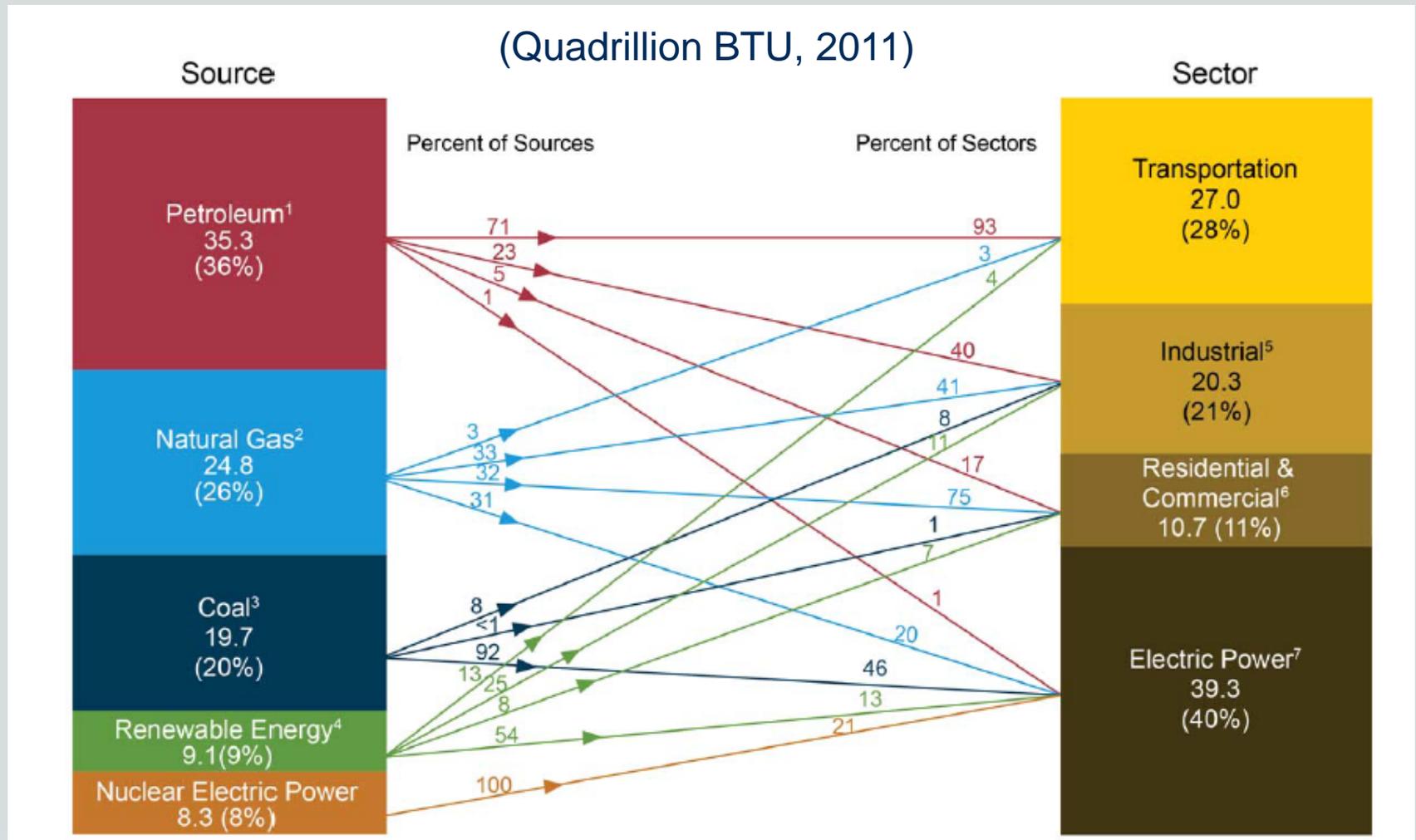


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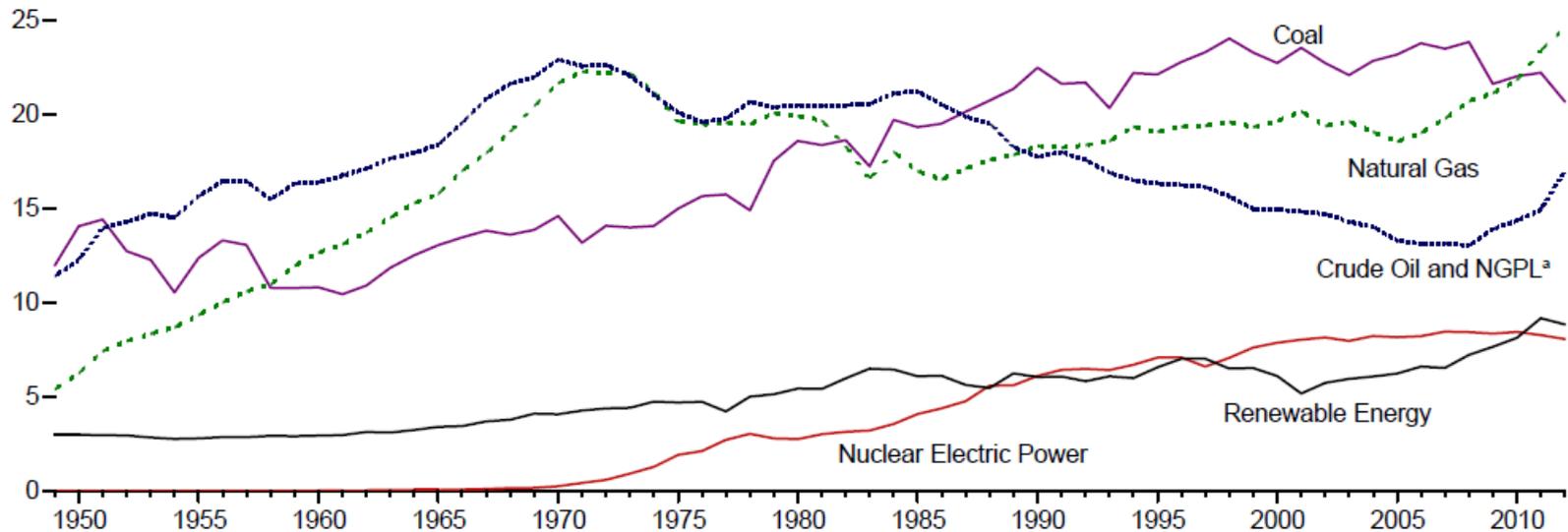
# Primary energy consumption by source and sector



# U.S. energy production by source

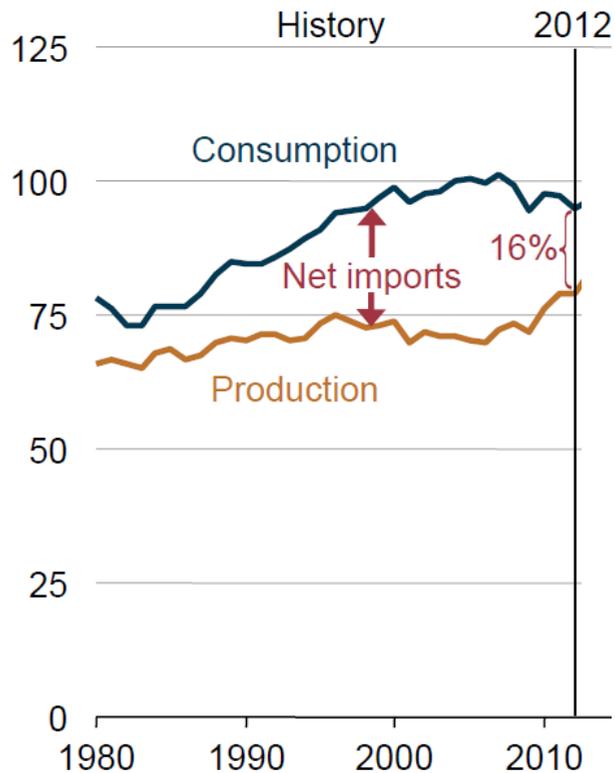
**Figure 1.2 Primary Energy Production**  
(Quadrillion Btu)

By Source, 1949–2012

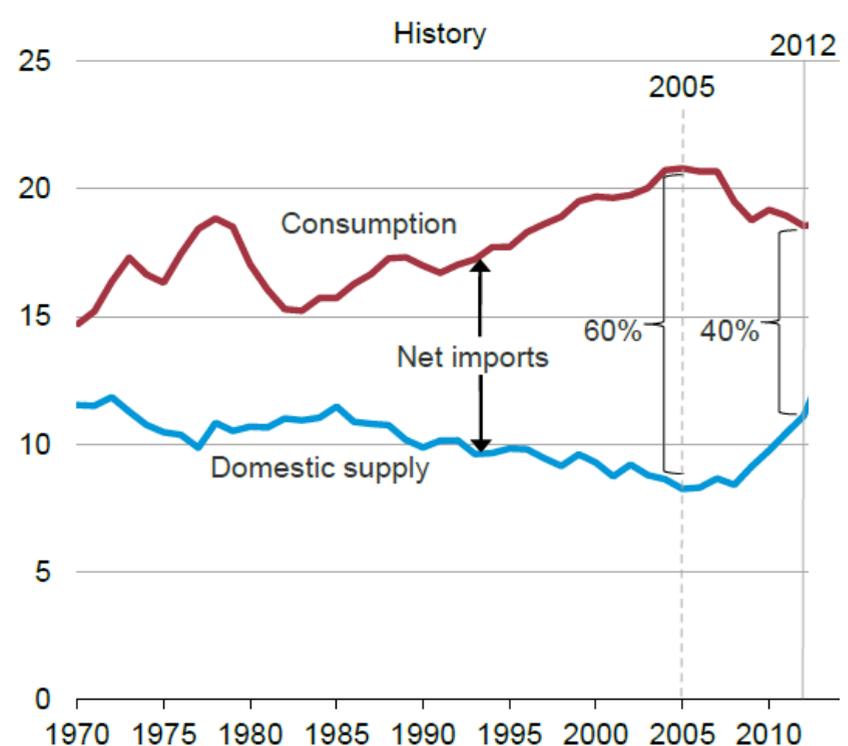


# U.S. energy consumption greater than production

Total U.S. Energy  
(quadrillion Btu)



U.S. Liquid Fuel Supply  
(million barrels per day)



# The unconventional oil and natural gas boom

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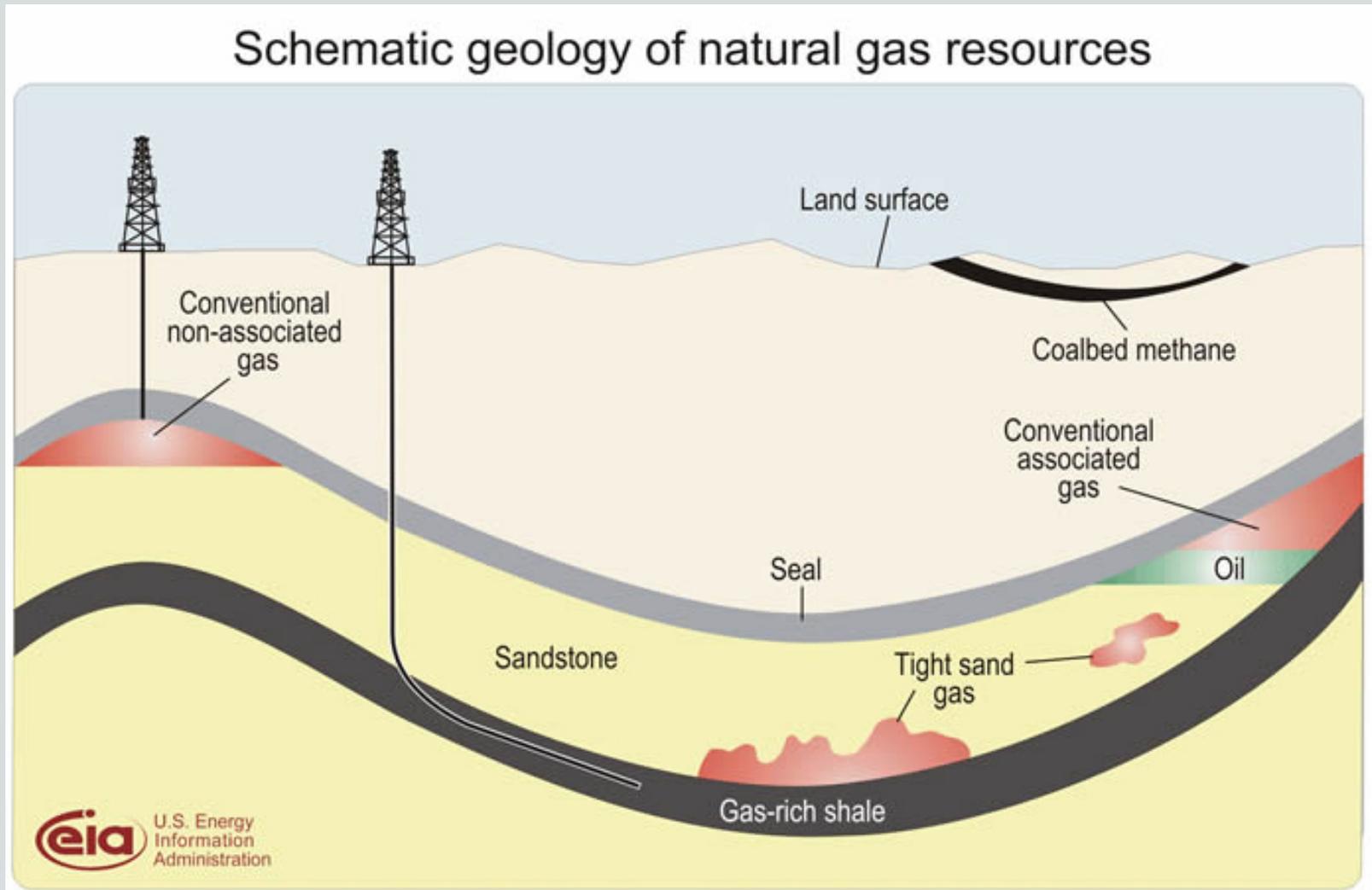
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# The unconventional oil and natural gas boom

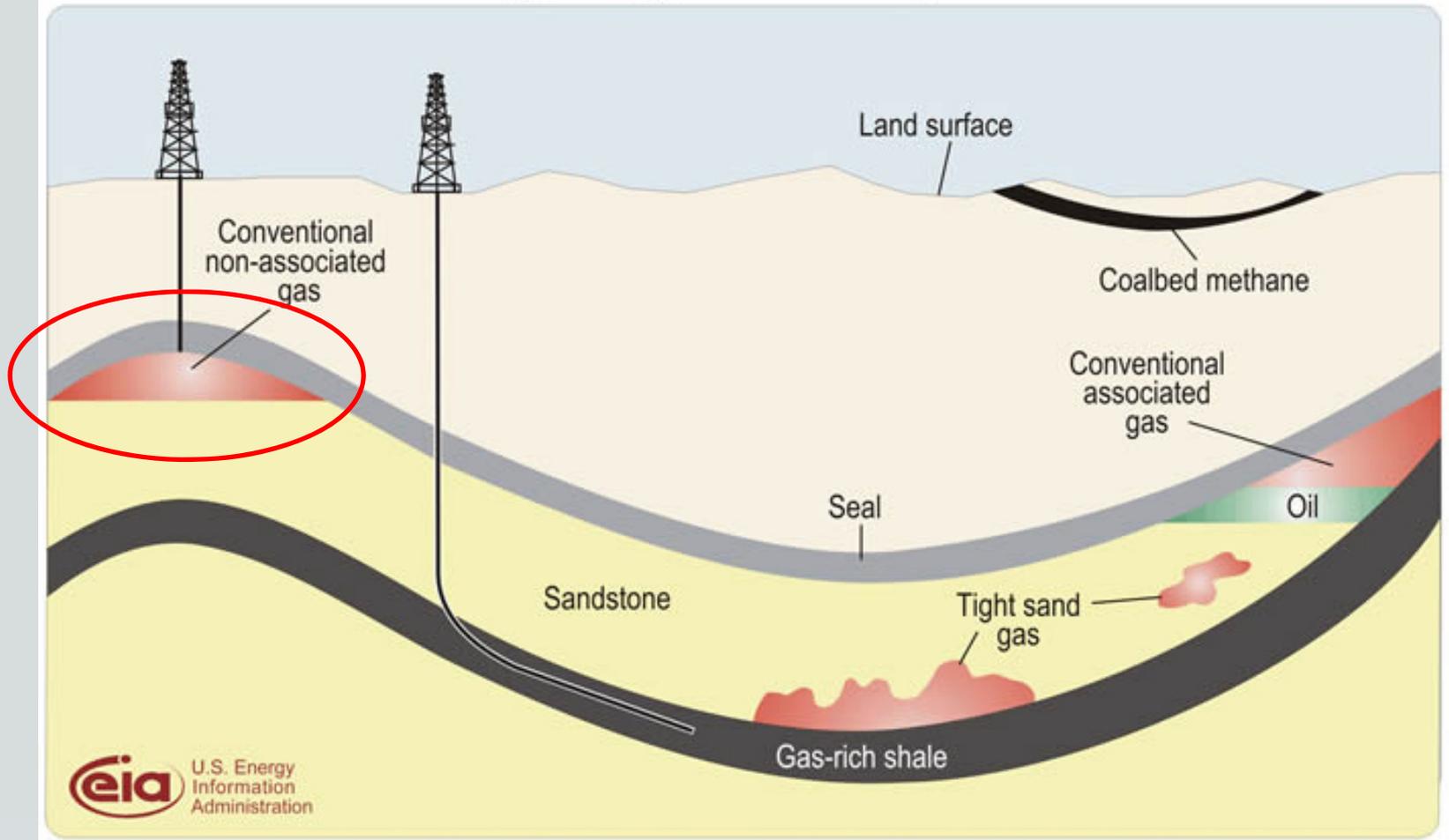
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  - Tight oil, tight gas, shale gas, coalbed methane
- Three factors have come together to make production of these resources economically viable:
  - advances in horizontal drilling
  - advances in hydraulic fracturing (first developed in ‘50s)
  - increases in natural gas prices

# What is unconventional oil and natural gas?

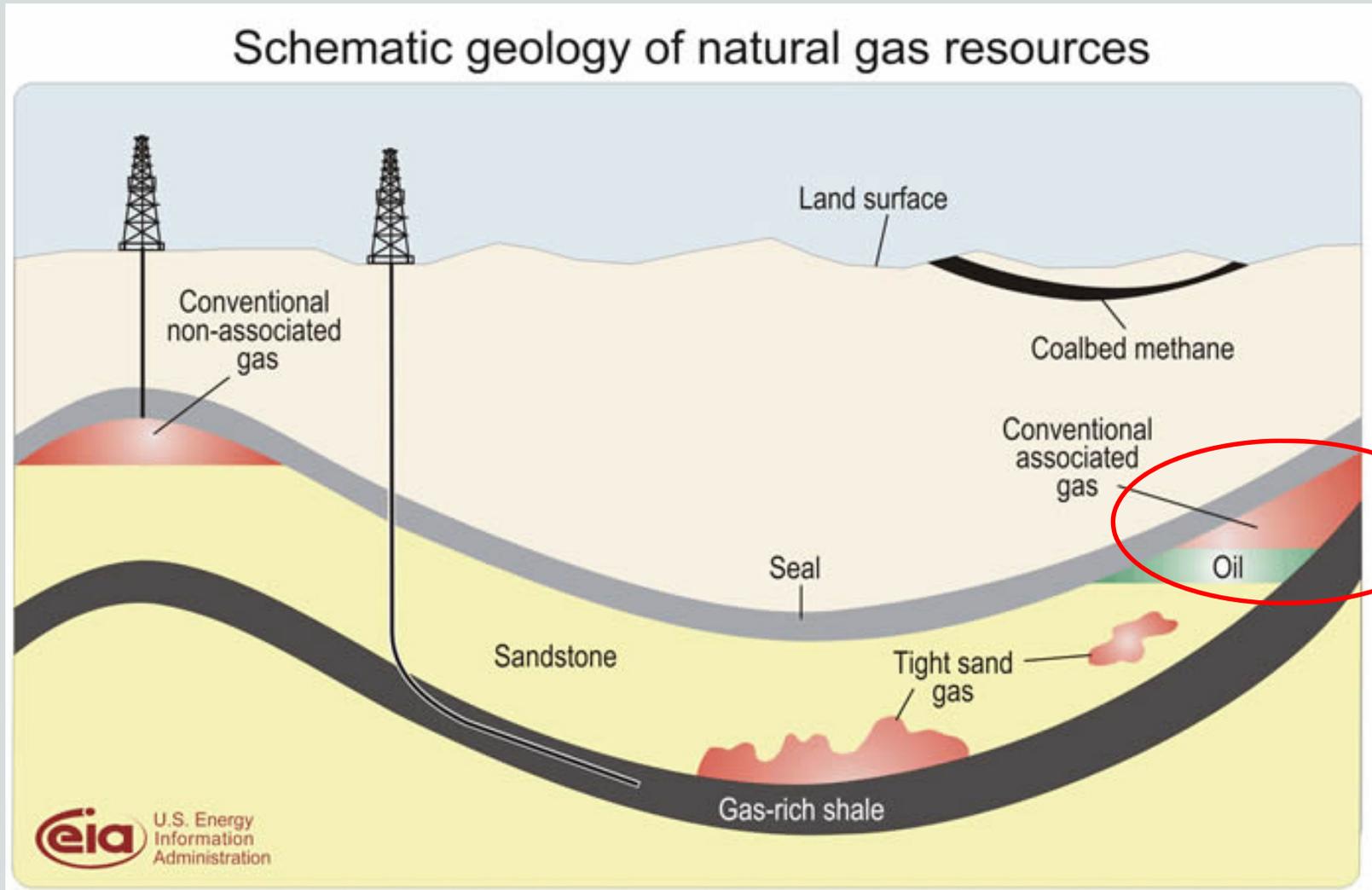


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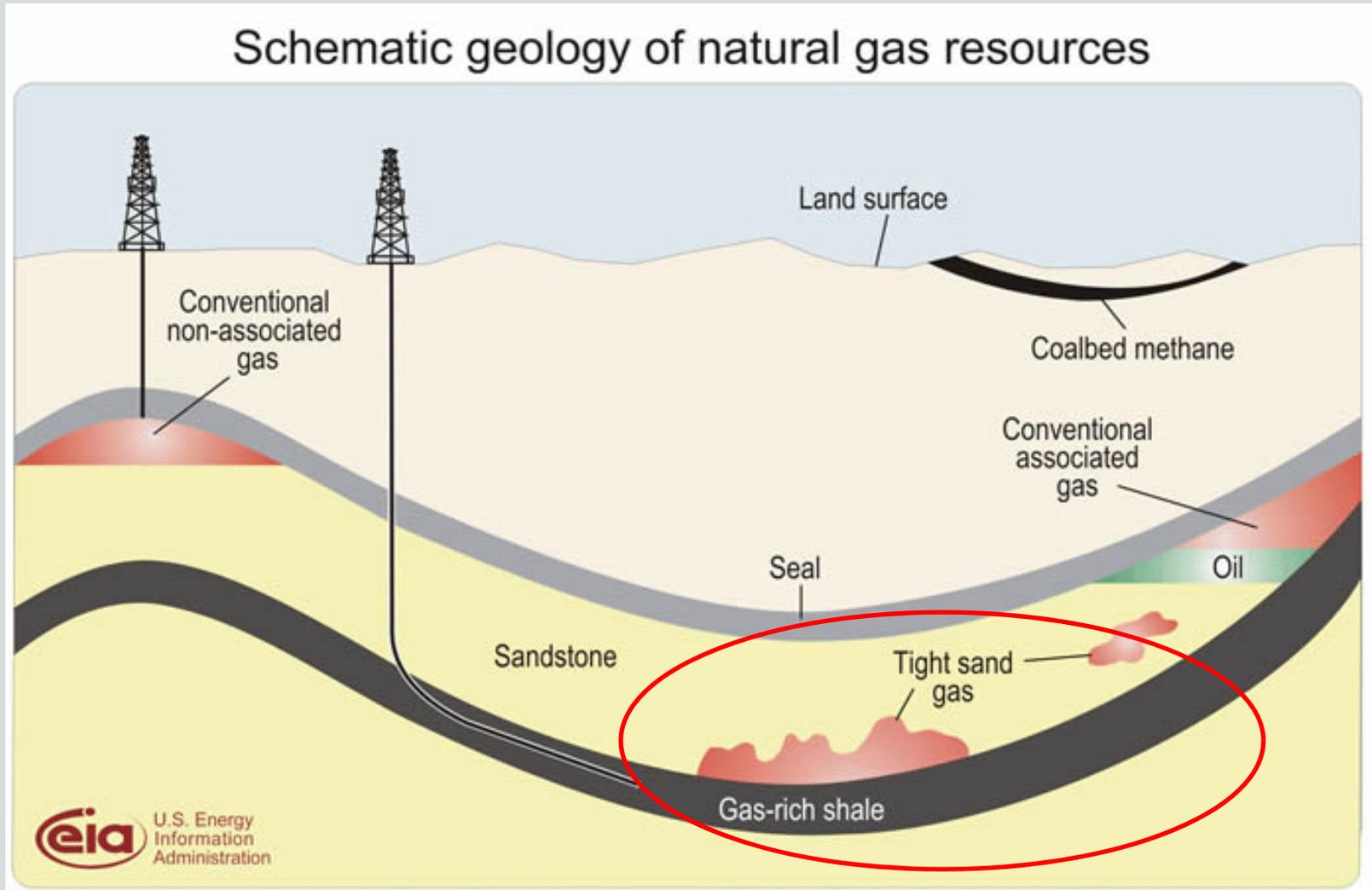
Schematic geology of natural gas resources



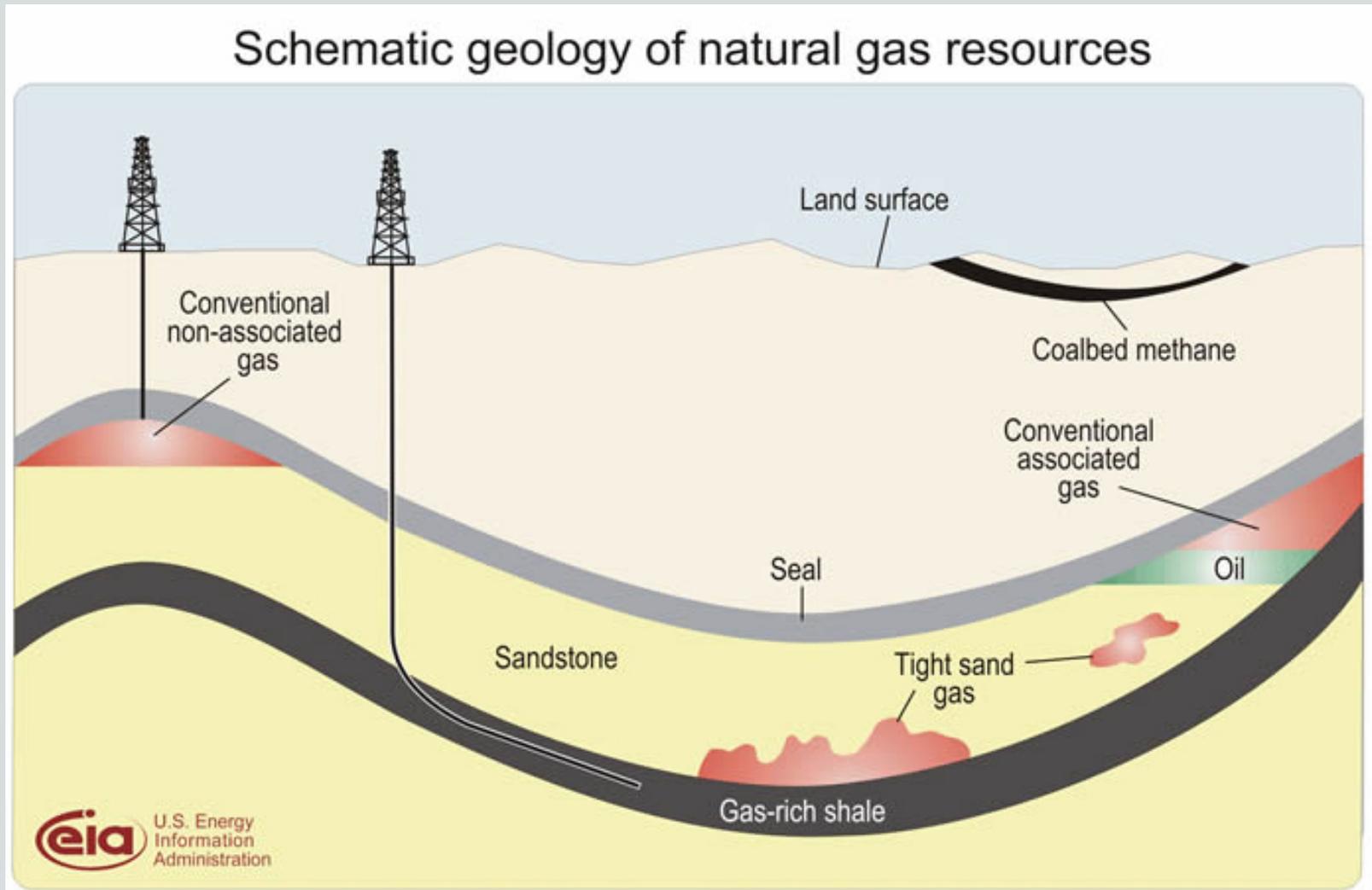
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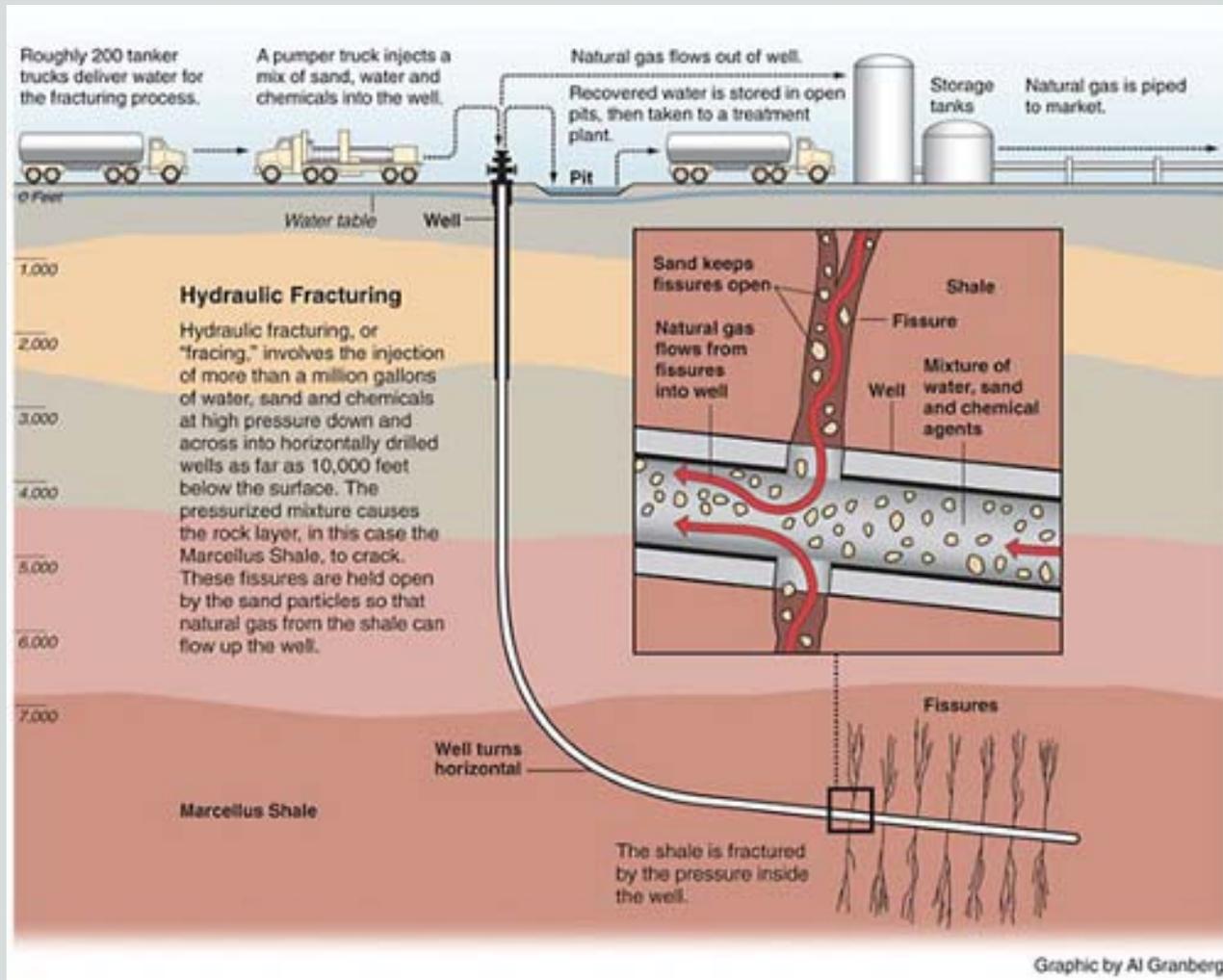
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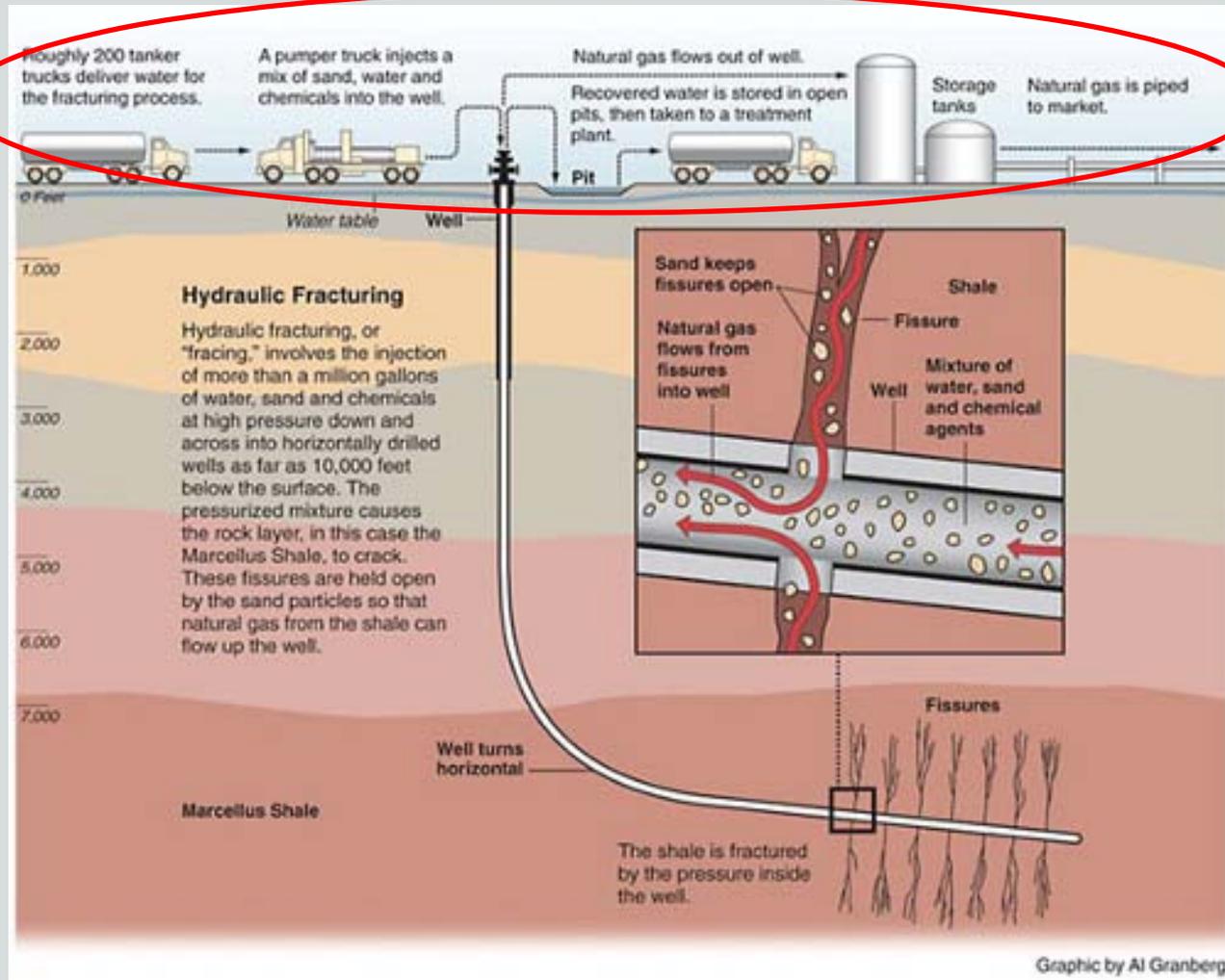
# What is unconventional oil and natural gas?



# What is fracking?



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# Environmental concerns with fracking

## Marcellus Shale Water Pollution Risk

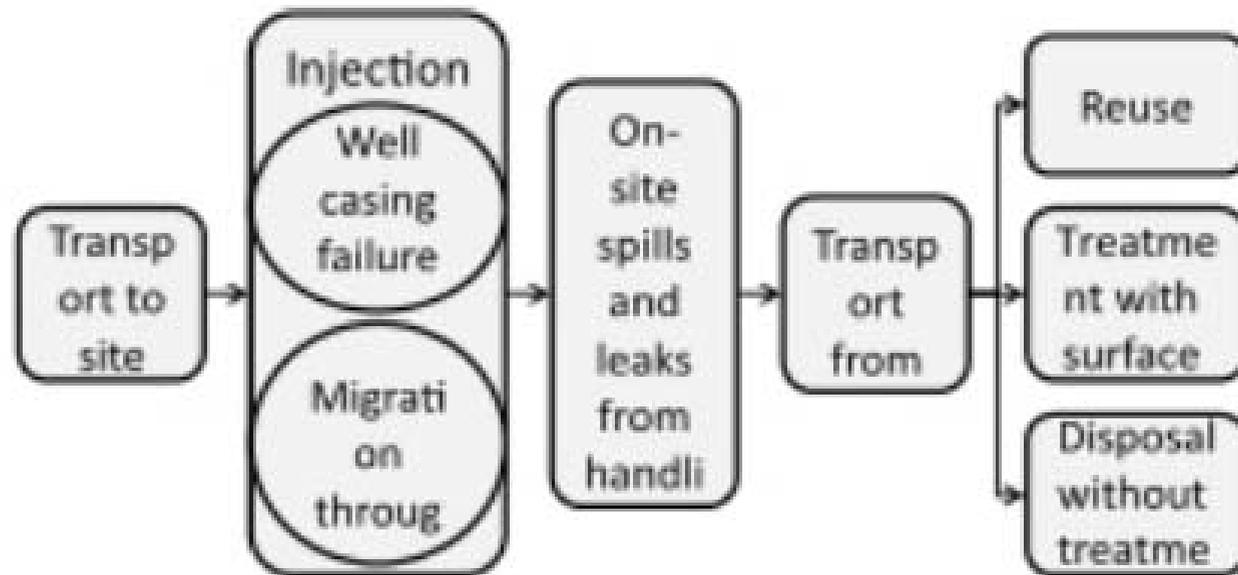


Fig. 2. Model of water contamination pathways.

Source: Rozell & Reaven, "Water Pollution Risk Associated with Natural Gas Extraction from the Marcellus Shale," 2012.

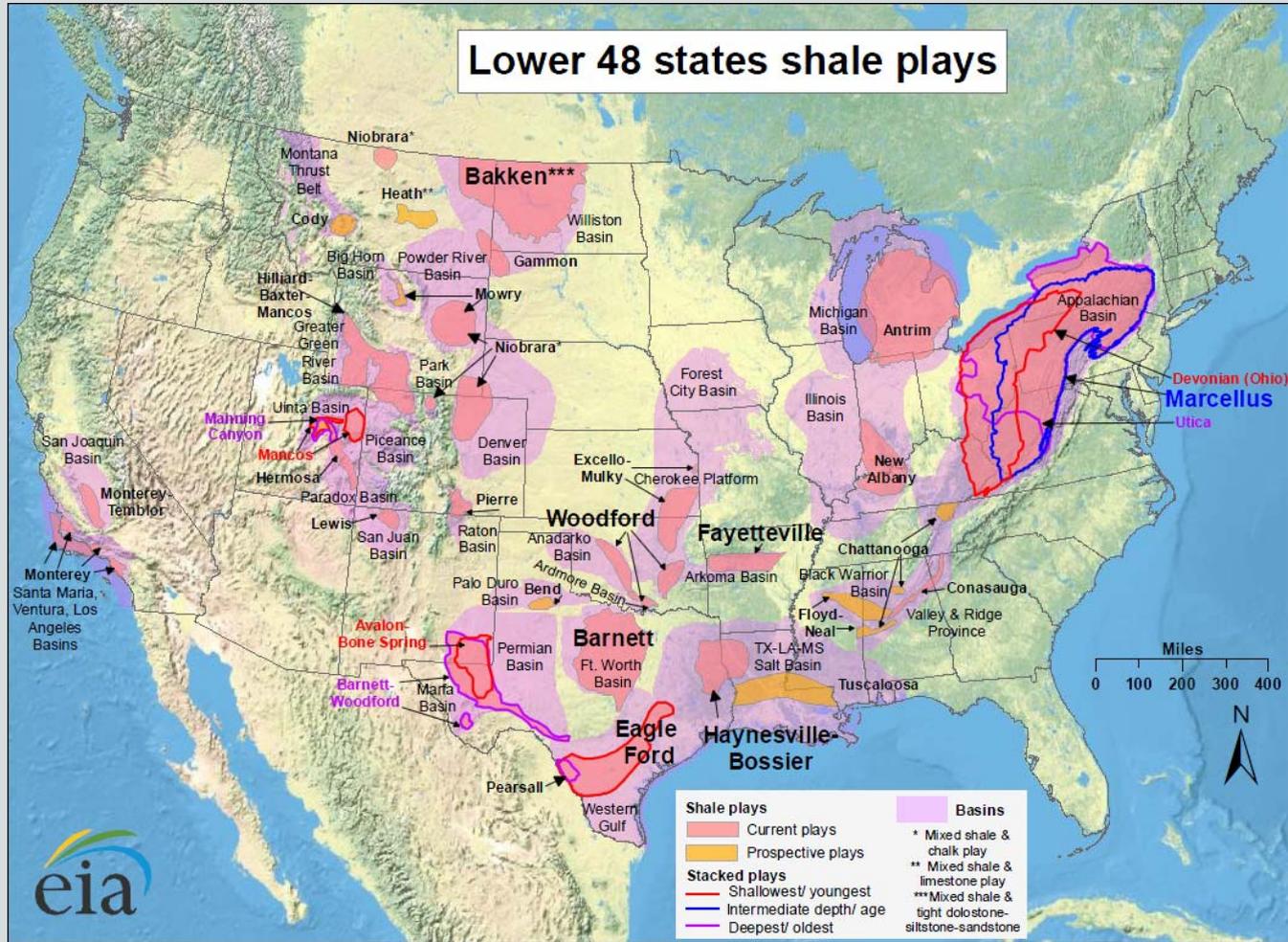
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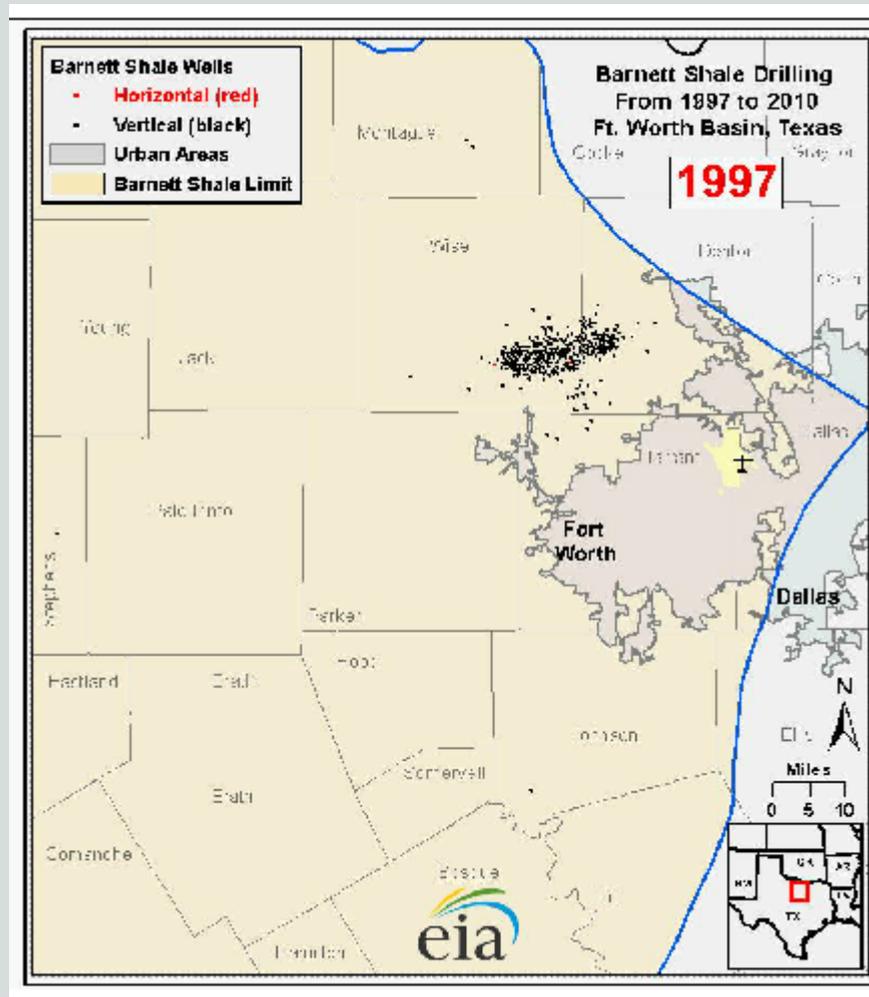
# Environmental concerns with fracking

- Potential for water pollution
- Heavy impact on local communities
  - Congestion, noise & air pollution

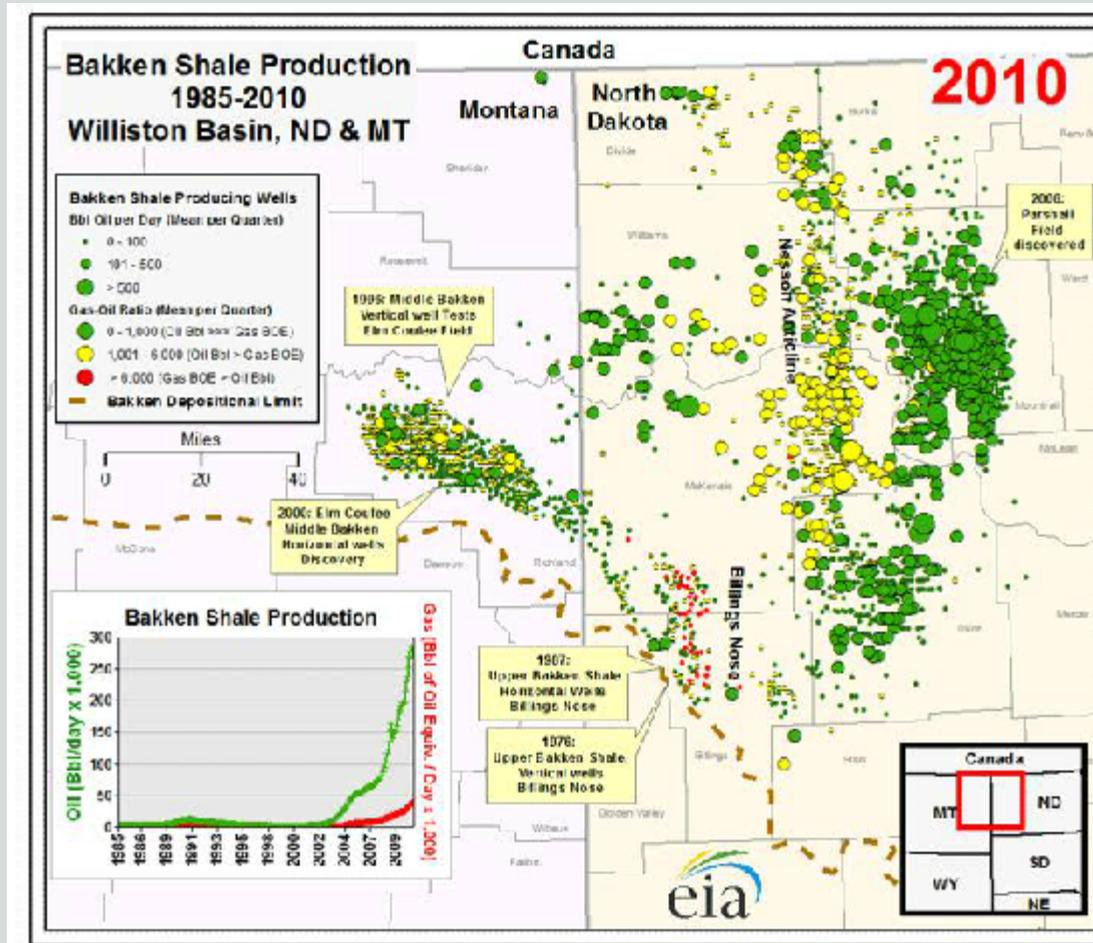
# Where are the shale plays?



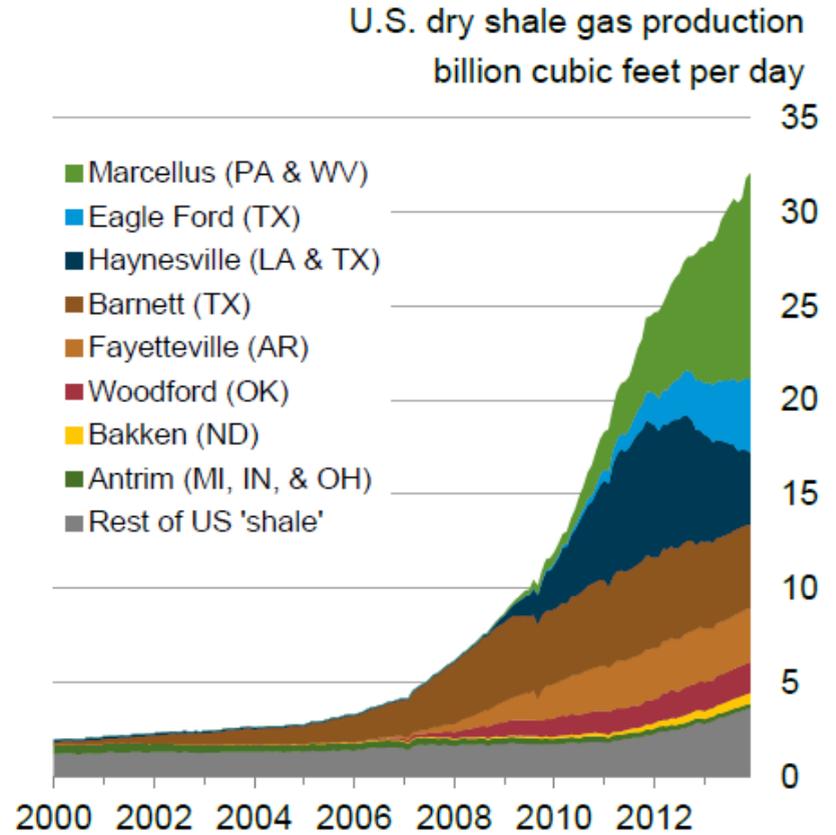
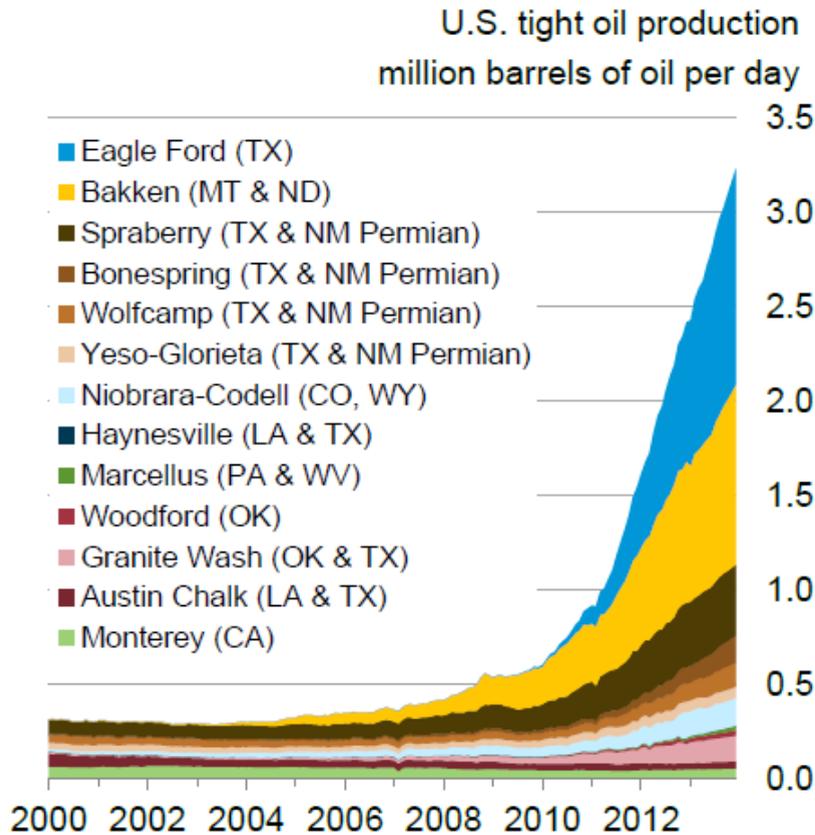
# Barnett Shale paves the way for future development



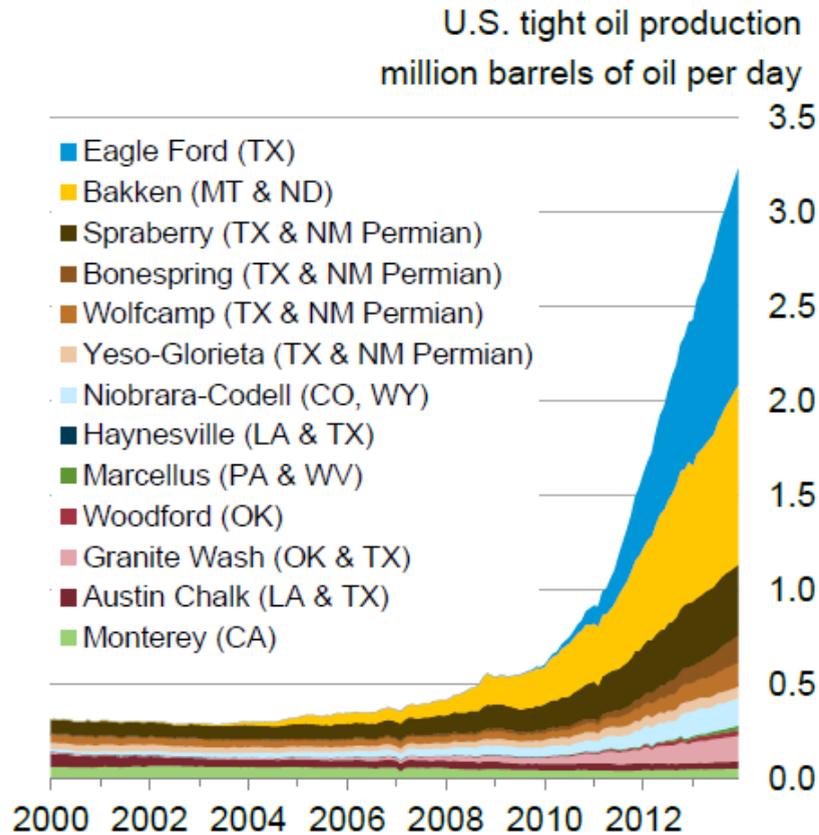
# Bakken Shale also advanced hydraulic fracturing



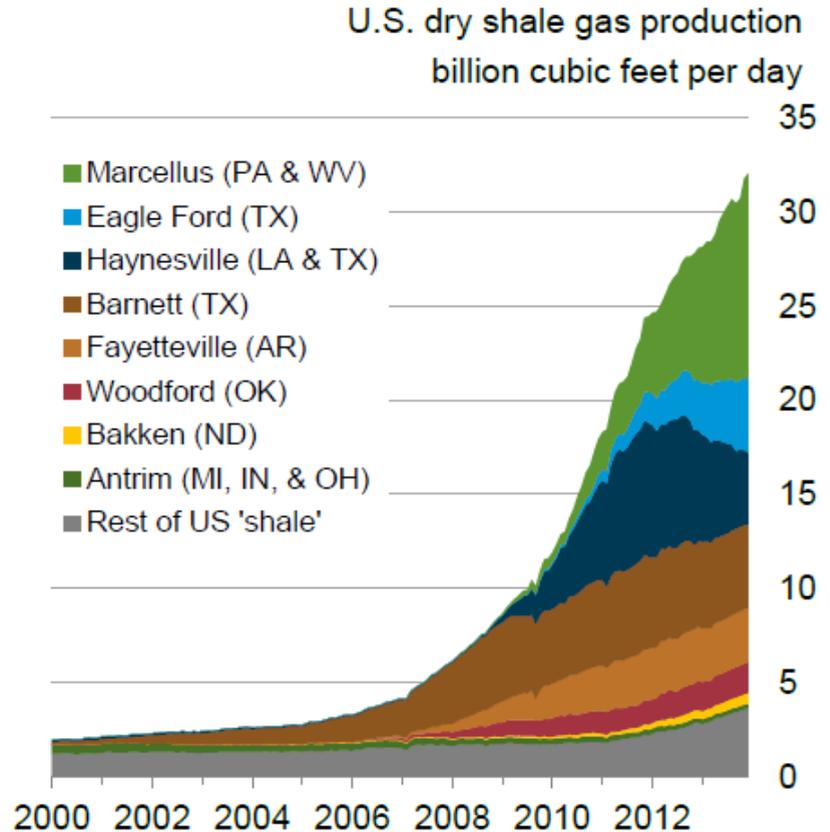
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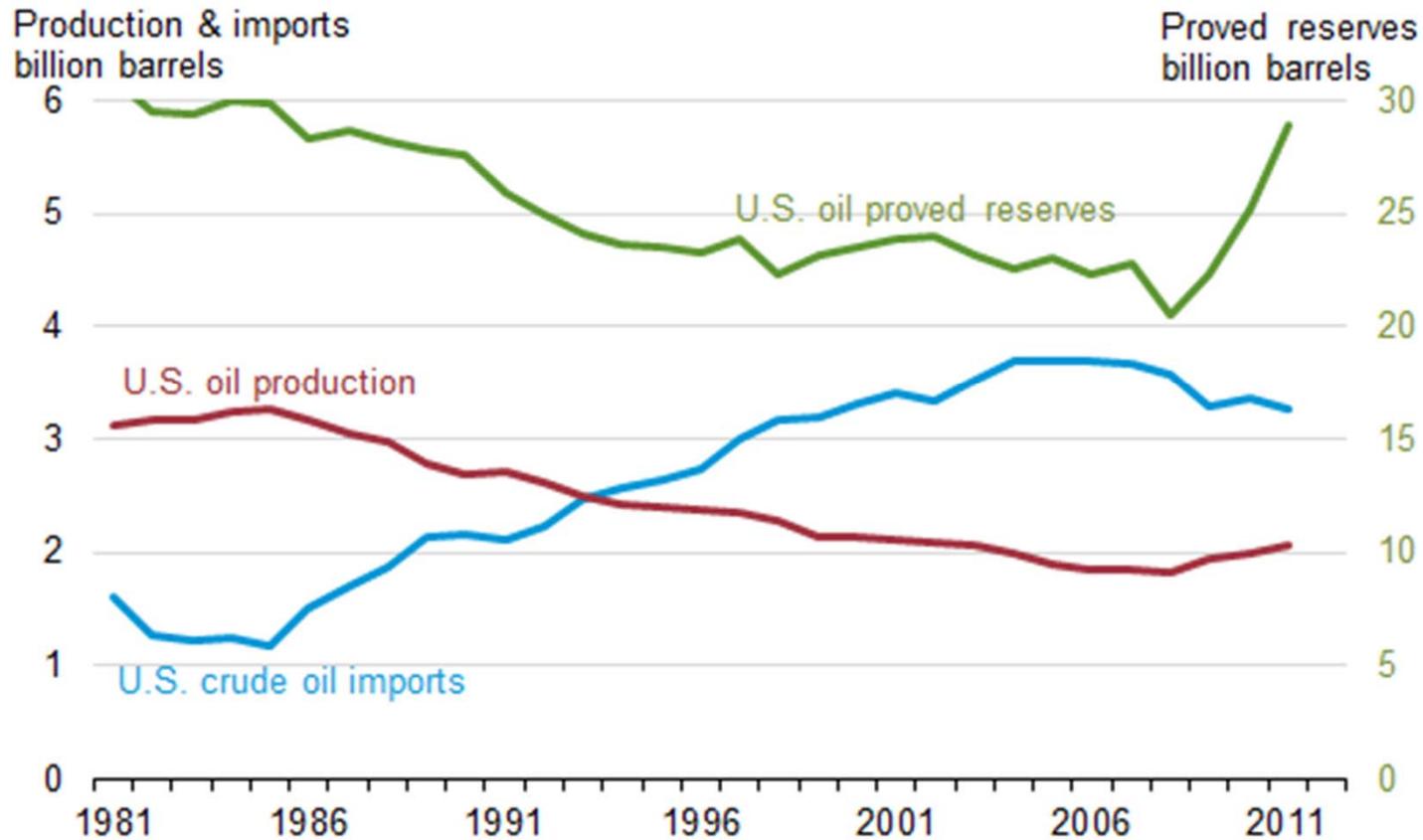


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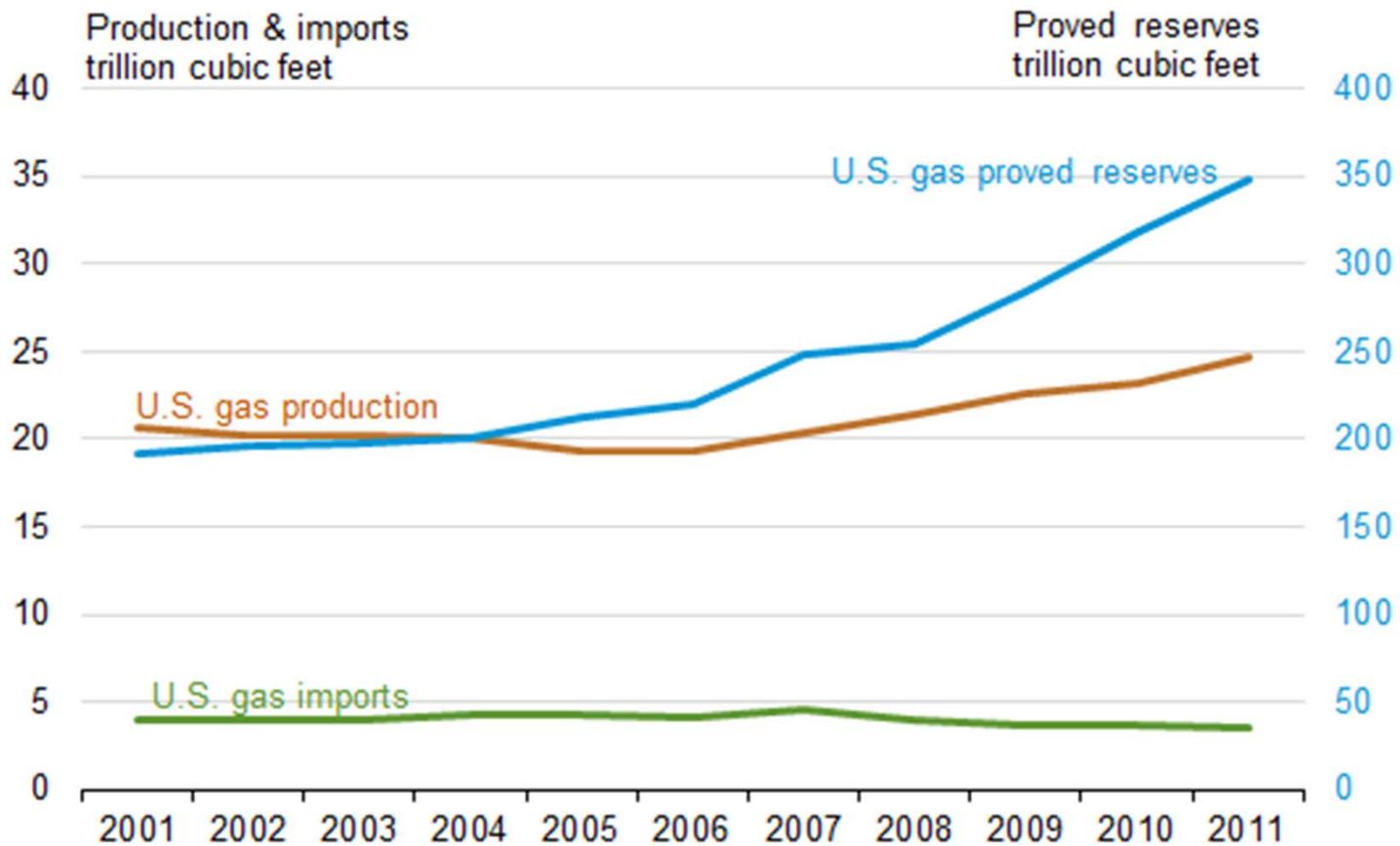
# U.S. proved crude oil reserves continue to increase

Figure 4. U.S. crude oil and lease condensate reserves, production, and imports, 1981-2011

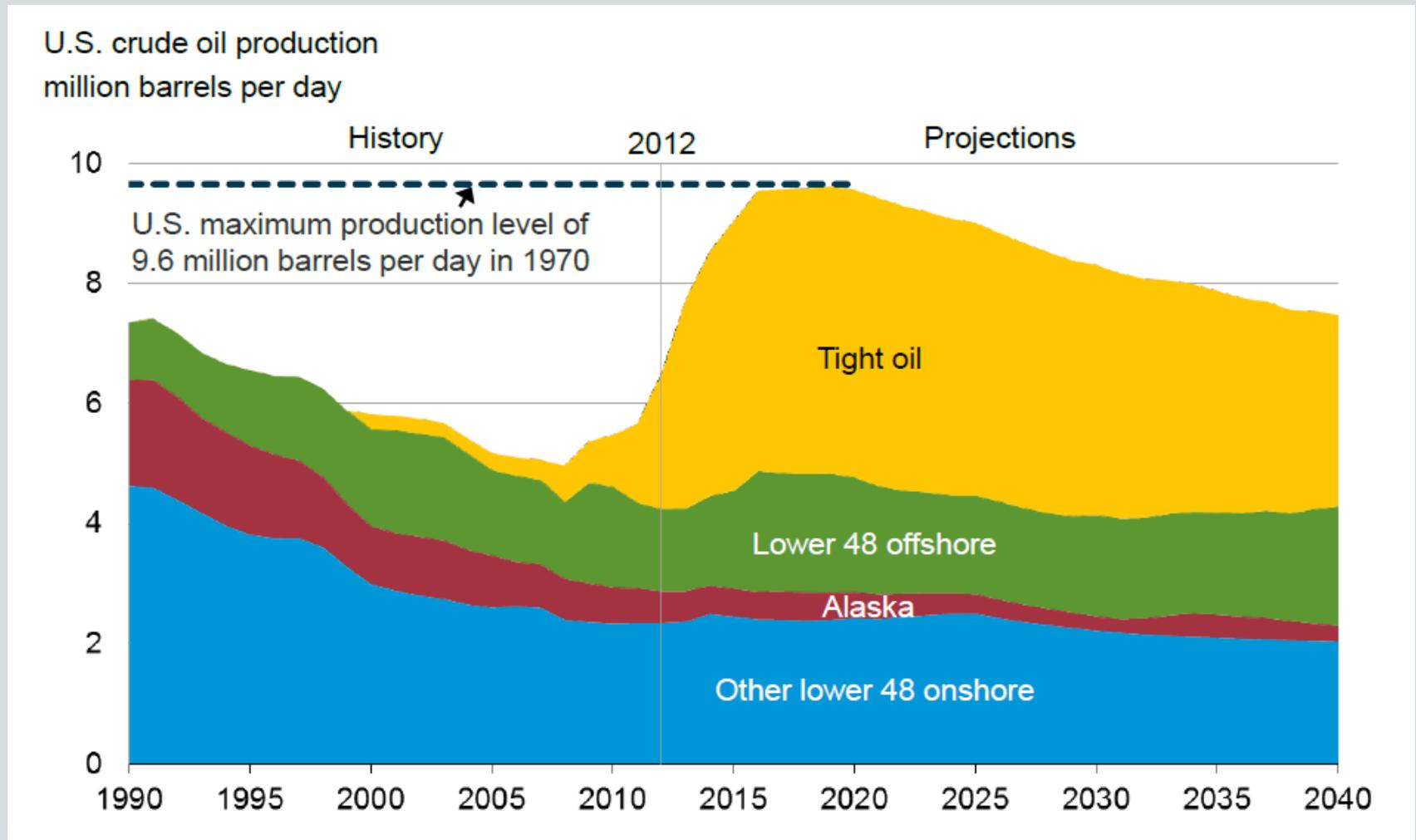


# U.S. proved natural gas reserves continue to increase

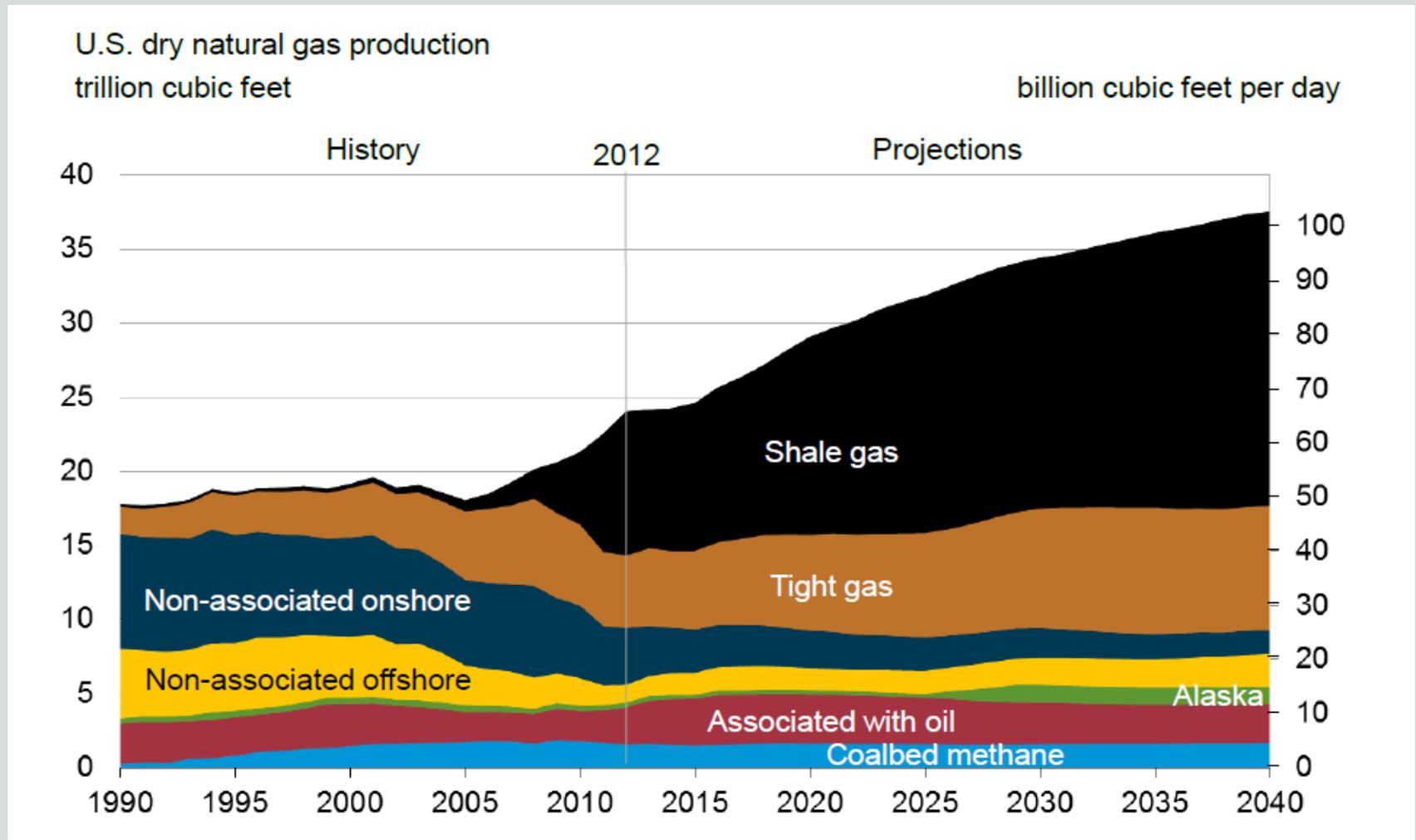
Figure 5. U.S. wet natural gas reserves, production, and imports, 2001-2011



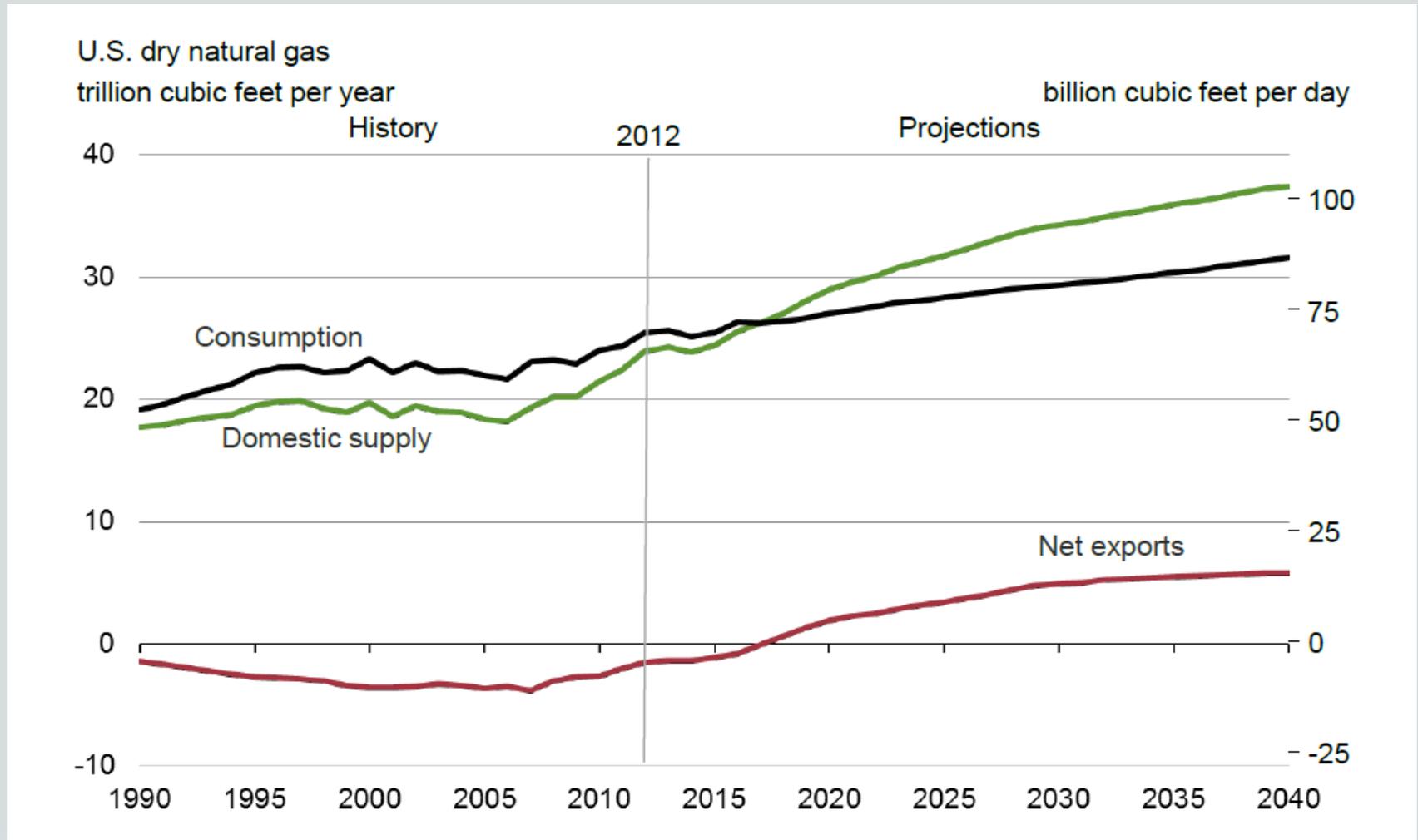
# U.S. oil production expected to increase in near-term



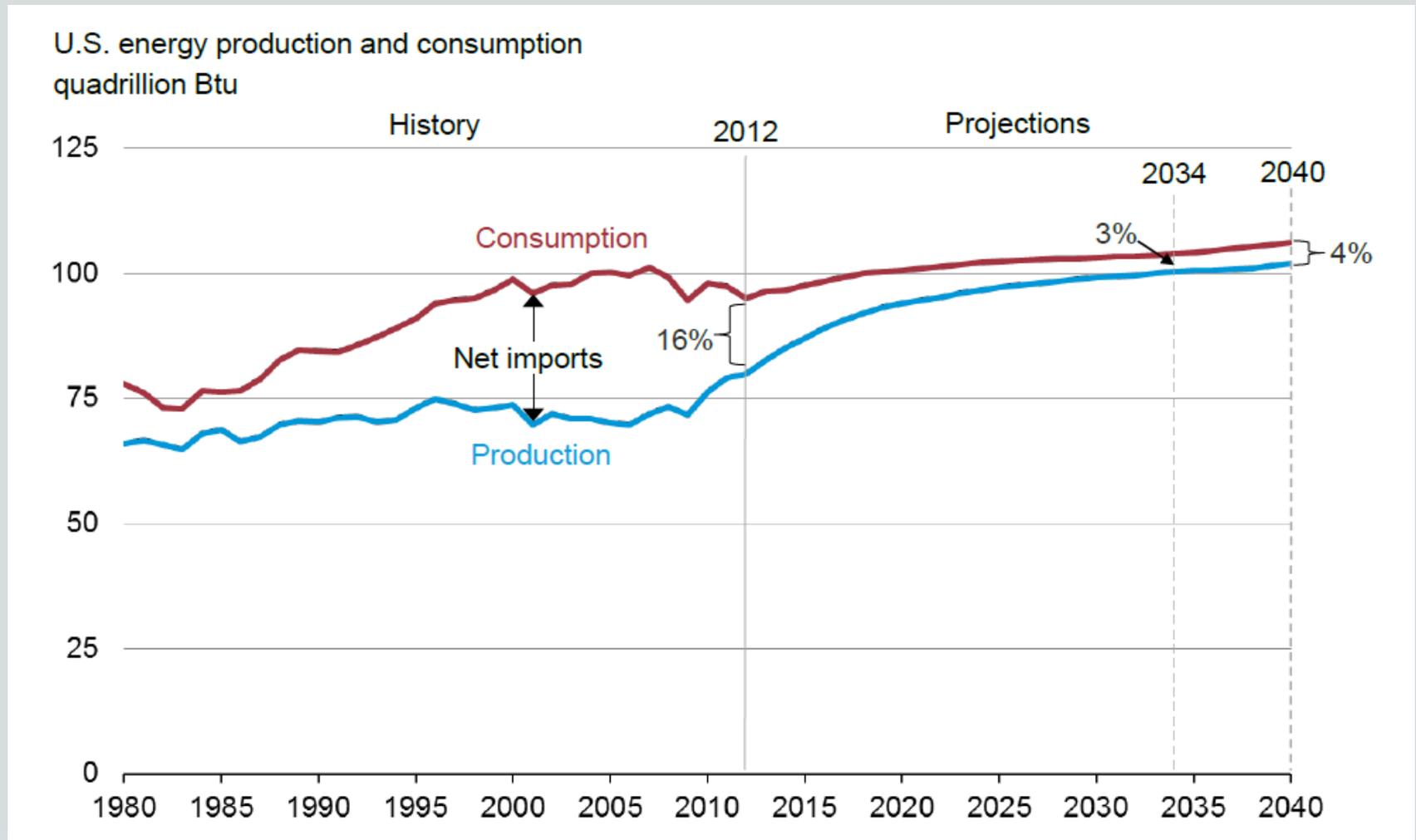
# U.S. natural gas production expected to increase



# U.S. to become net exporter of natural gas



# U.S. imports of energy goods to fall considerably



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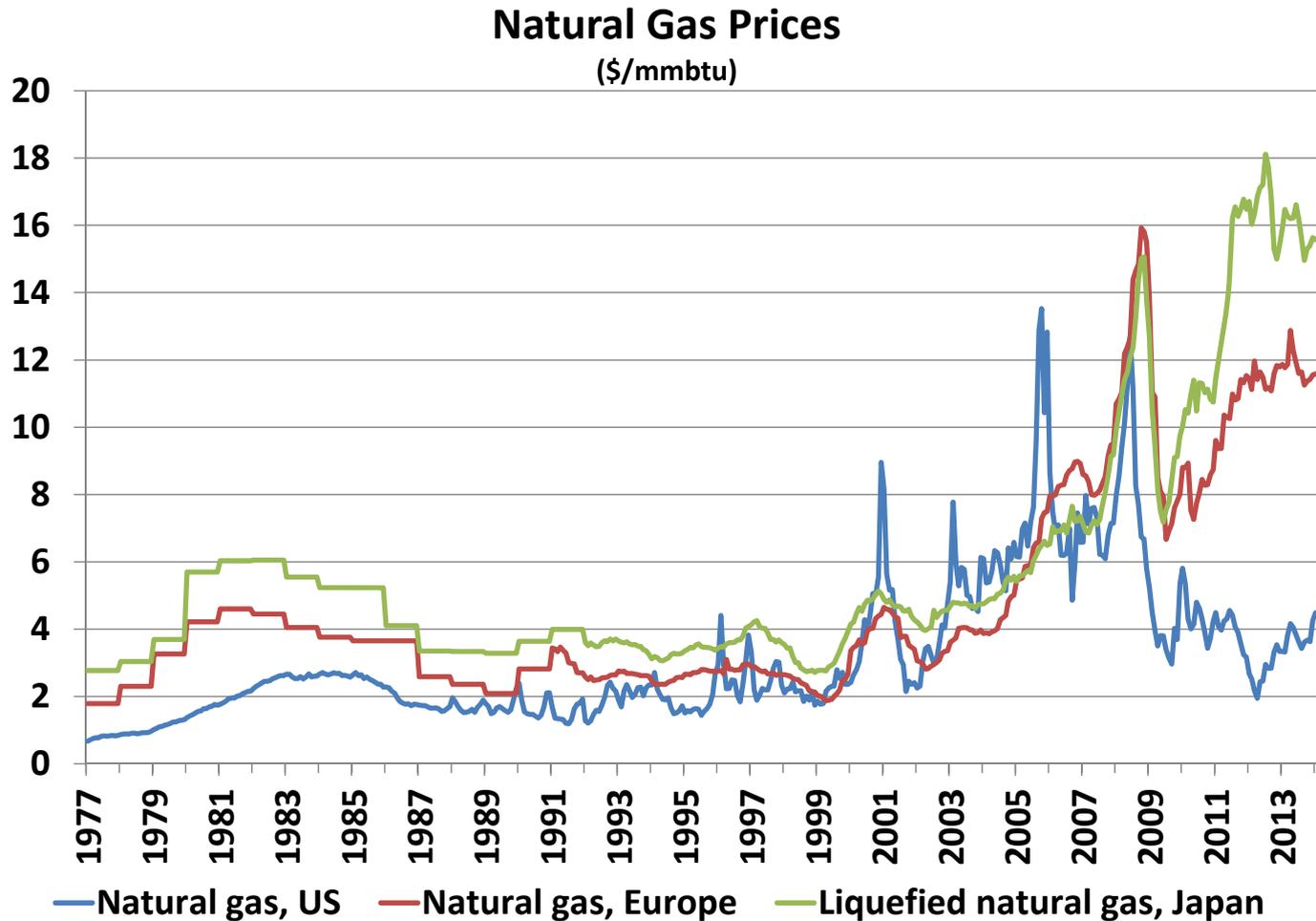
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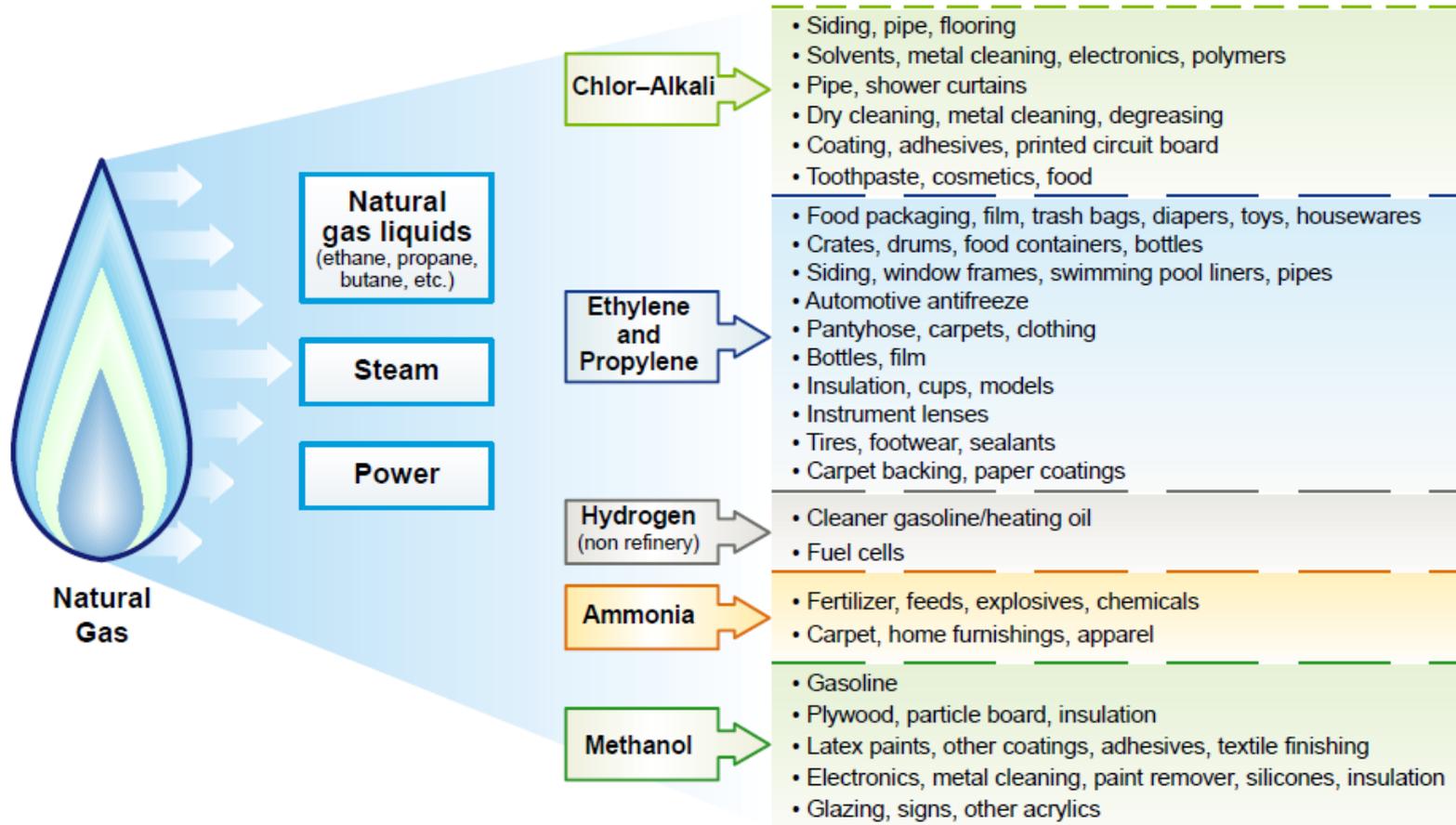
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- Makes U.S. a more attractive place to invest and increases capital inflows

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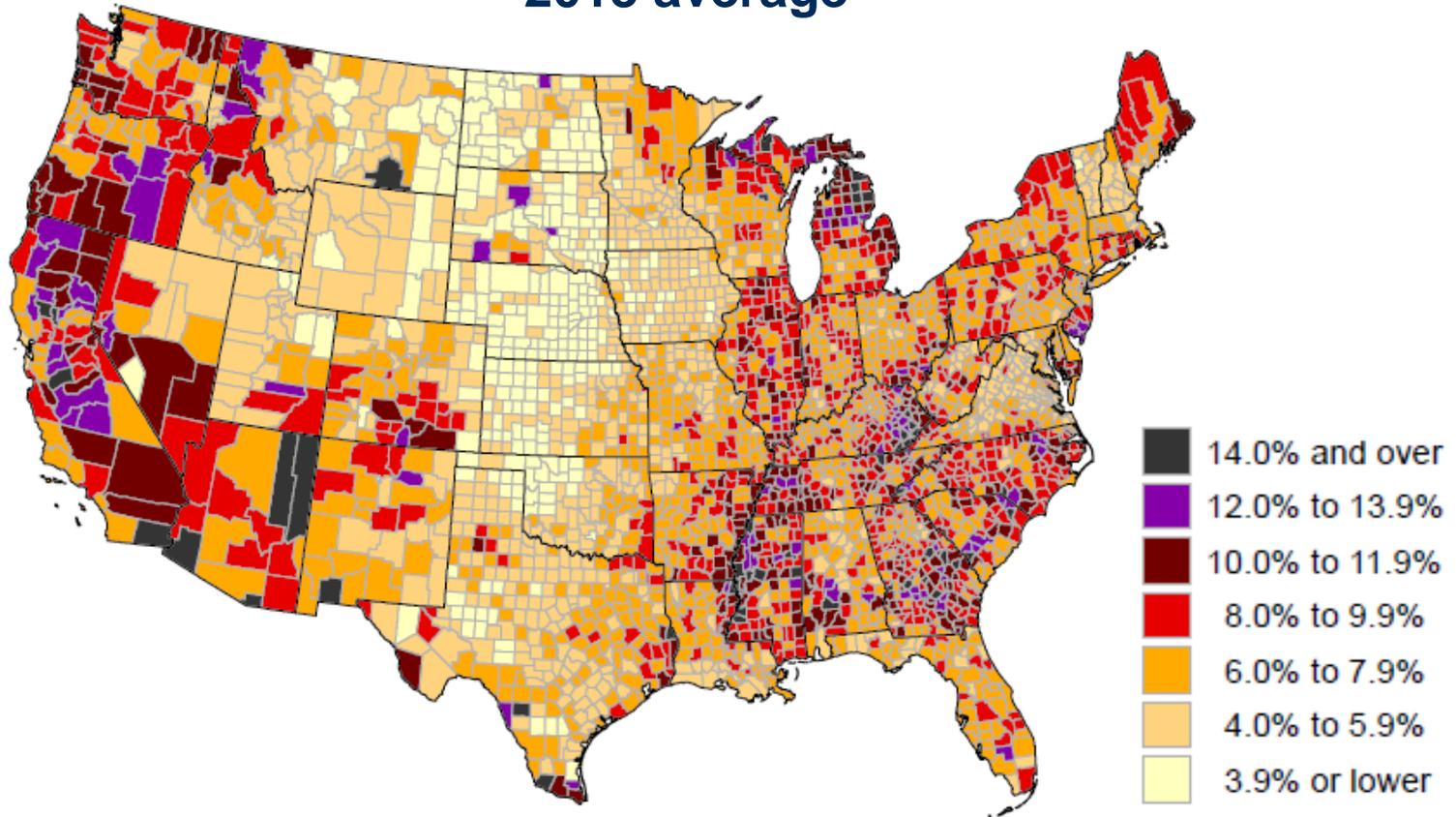
# Benefits from increased energy production are broad

## Everyday Connection to Natural Gas



# Strong job growth in energy-producing regions

## Unemployment rates by county 2013 average



# Influx of labor becomes a problem in some areas

According to [Apartment Guide](#), a 700 square-foot, one [bedroom](#) apartment in Williston cost upwards of \$2,000 a month — more than many apartments in New York or San Francisco.

These 10 cities topped the list, with average monthly rents for entry-level apartments:

1. Williston, ND (**\$2,394**)
2. San Jose-Sunnyvale-Santa Clara, CA (**\$1,881**)
3. San Francisco-Oakland-Fremont, CA (**\$1,776**)
4. Dickinson, ND (**\$1,733**)
5. Key West, FL (**\$1,640**)
6. [Boston](#)-Cambridge-Quincy, MA-NH (**\$1,537**)
7. New York-Northern New Jersey-Long Island, NY-NJ-PA (**\$1,504**)
8. Los Angeles-Long [Beach](#)-Santa Ana, CA (**\$1,411**)
9. Oxnard-Thousand Oaks-Ventura, CA (**\$1,387**)
10. Santa Barbara-Santa Maria-Goleta, CA (**\$1,346**)

# What about Maryland?



## Candidates differ over 'fracking'

Mizeur stresses "dangers" of shale gas drilling, while Brown-Ulman cite study of safety questions

January 10, 2014 | Tim Wheeler

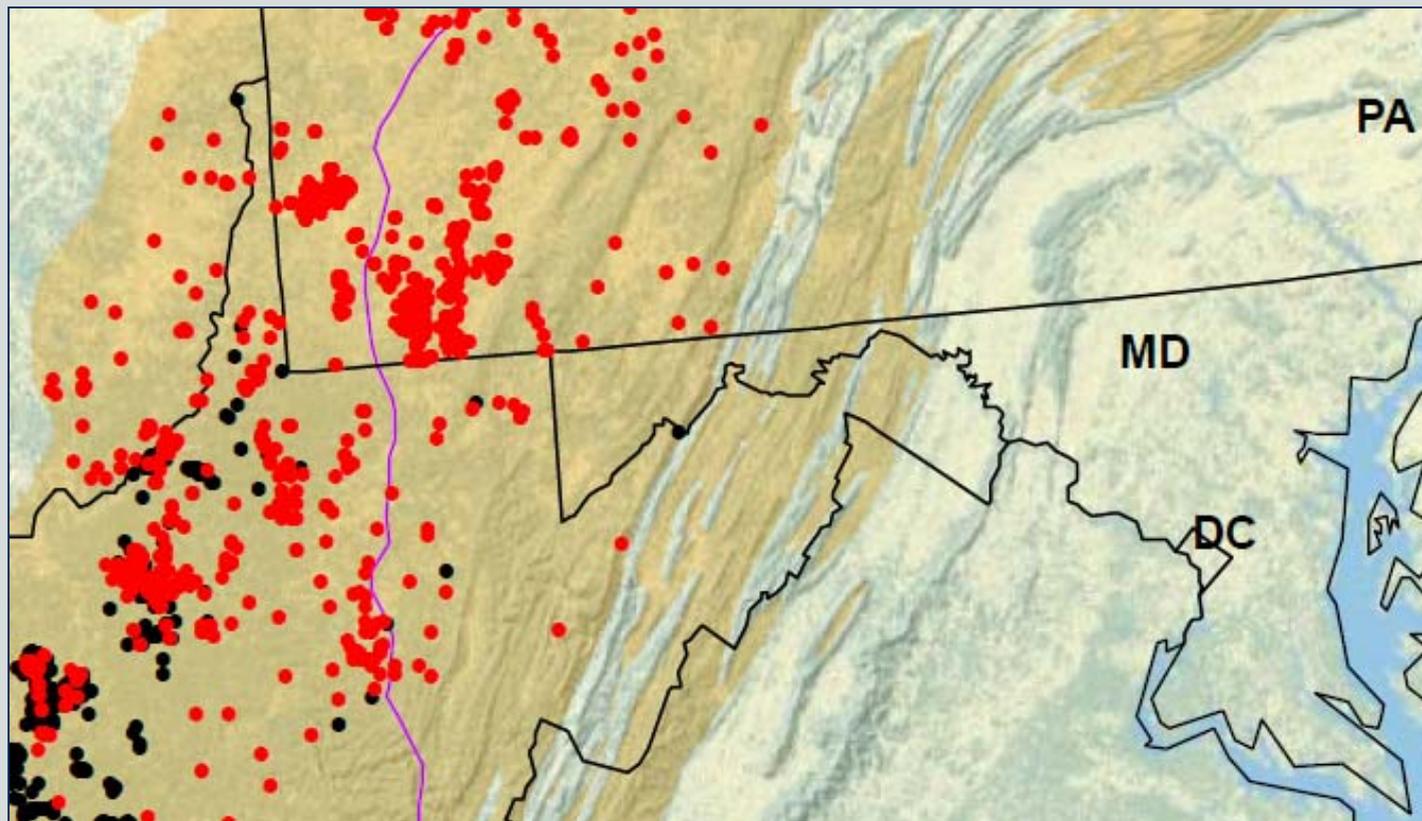
**CAPITALGAZETTE.COM**

## Bill to ban fracking in Maryland lacking support

Posted: Thursday, February 6, 2014 7:06 pm

By E.B. FURGURSON III [pfurgurson@capgaznews.com](mailto:pfurgurson@capgaznews.com)

# What about Maryland?



## Wells Producing from Marcellus Shale

- Marcellus Shale Only
- Marcellus + Other Formation Commingled
- Marcellus Shale gross thickness, Ft (Wrightstone)
- Extent of Marcellus Shale (USGS, Wrightstone)

## In summary

- U.S. energy boom due to technological advances in extraction methods and higher energy prices
- Proved recoverable reserves of oil and natural gas continue to increase
- Production of shale gas expected to continue to grow to the point where supply will exceed consumption
  - U.S. anticipated to be net exporter of natural gas and petroleum products
- Broad implications for economic growth, particularly in the manufacturing sector
- Considerable environmental concerns



The views expressed here are those of the author, and do not necessarily represent those of the Federal Reserve Bank of Richmond or the Federal Reserve System.

