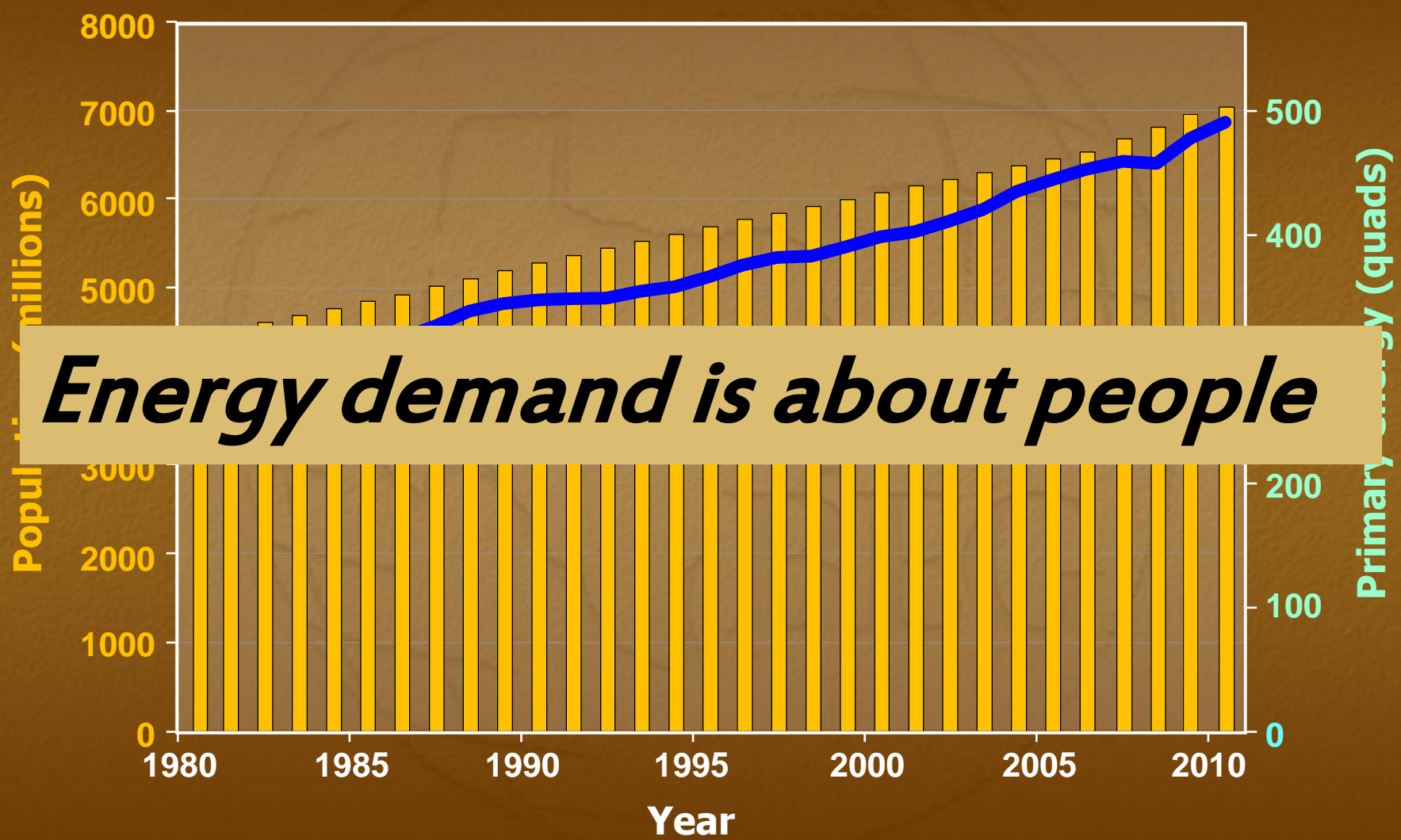




# Global Population and Energy

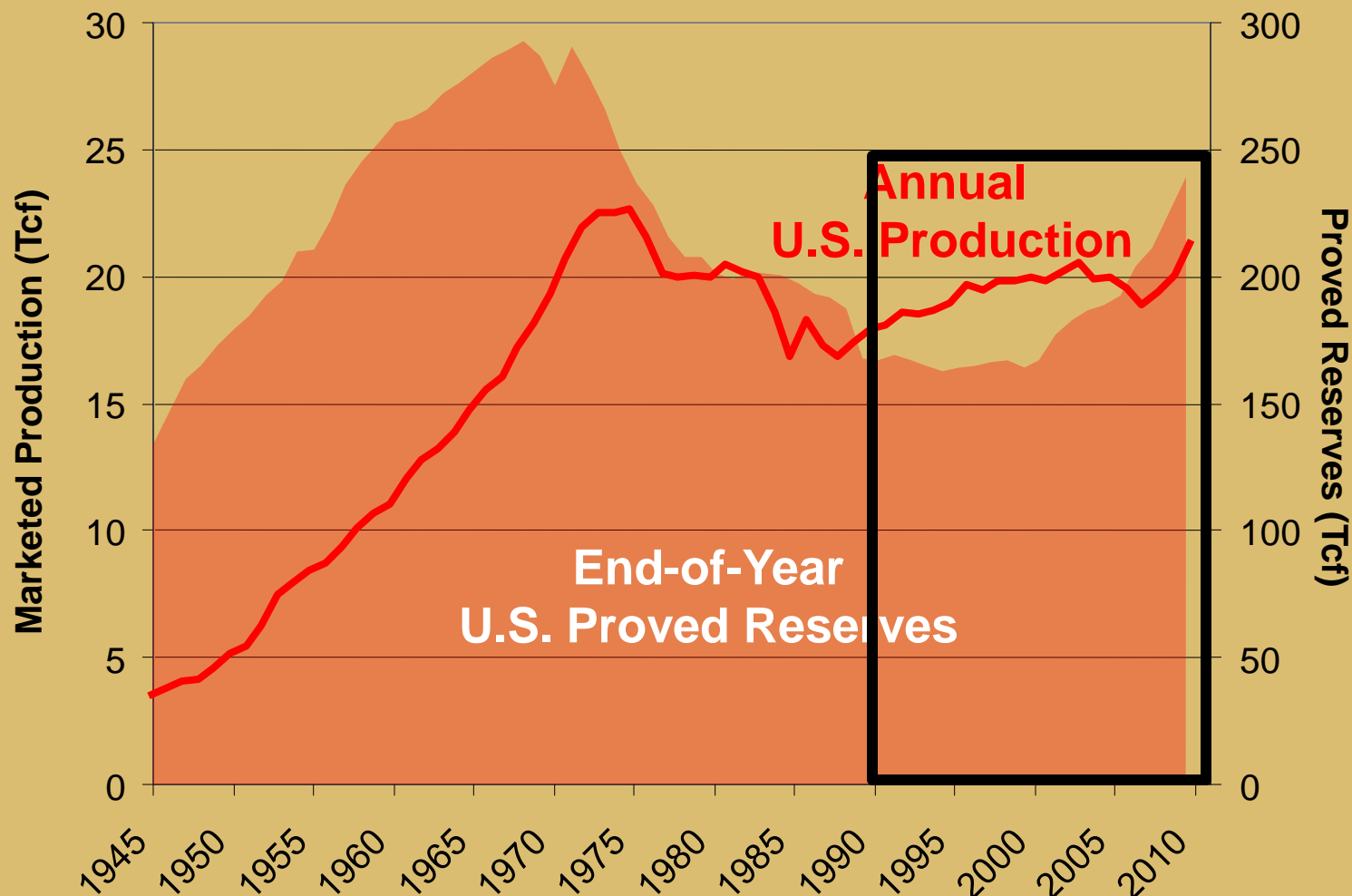


***Energy demand is about people***

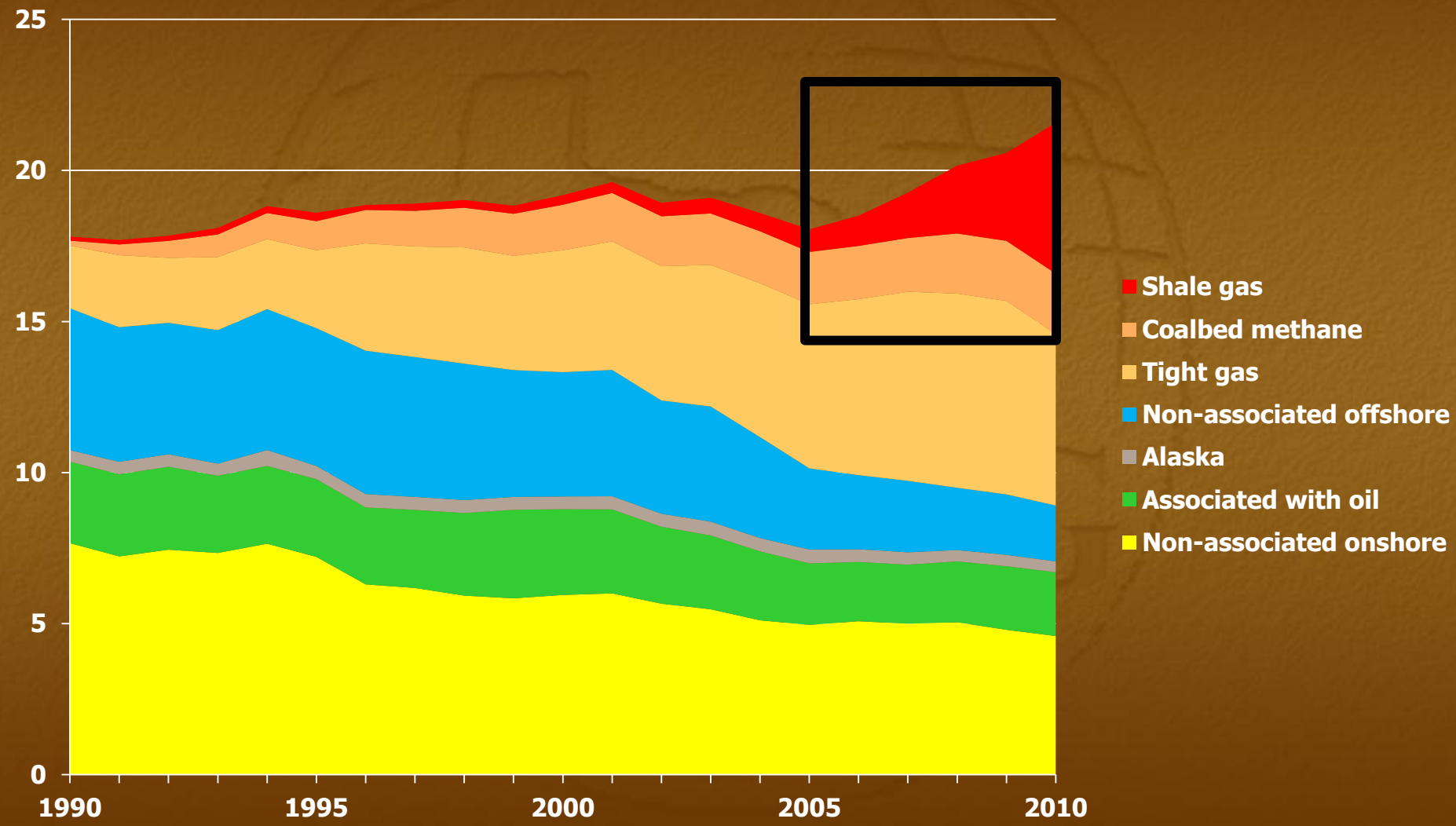
# Outline

- **Unconventional Gas Reservoirs**
  - ❖ **To “Frack” or not to “Frack”**
- **Unconventional Oil Reservoirs**
  - ❖ **Mountain or Molehill**
- **Options to Oil**
  - ❖ **Nothing is Perfect**

# U.S. Natural Gas *Production and Reserves*



# U.S. Natural Gas Production (TcF)





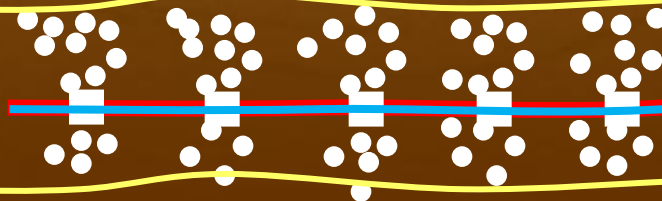
Tinker, 2012

# Hydraulic Fracturing “Fracking”

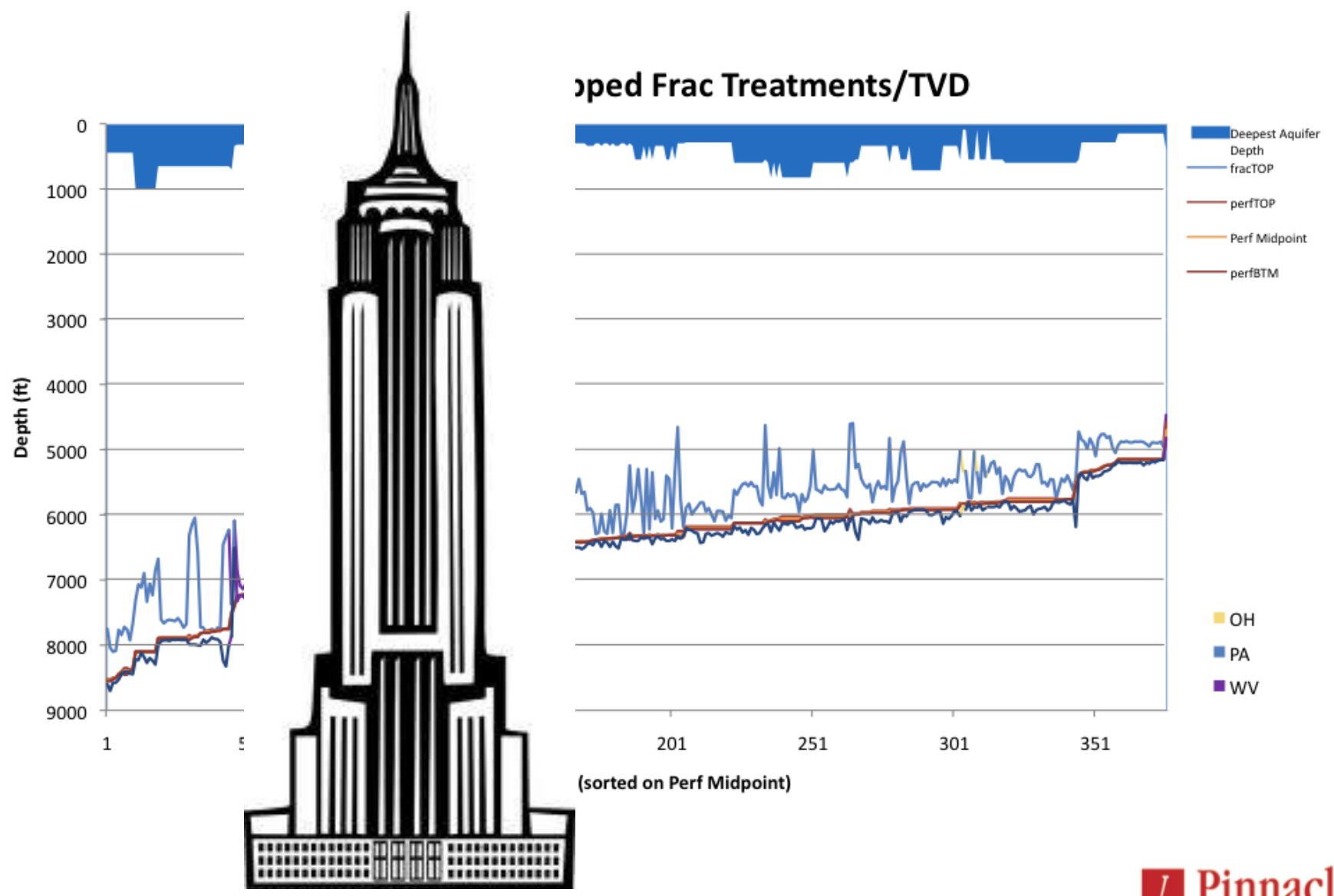
3,000 to  
10,000+ feet

3,000 – 10,000 feet

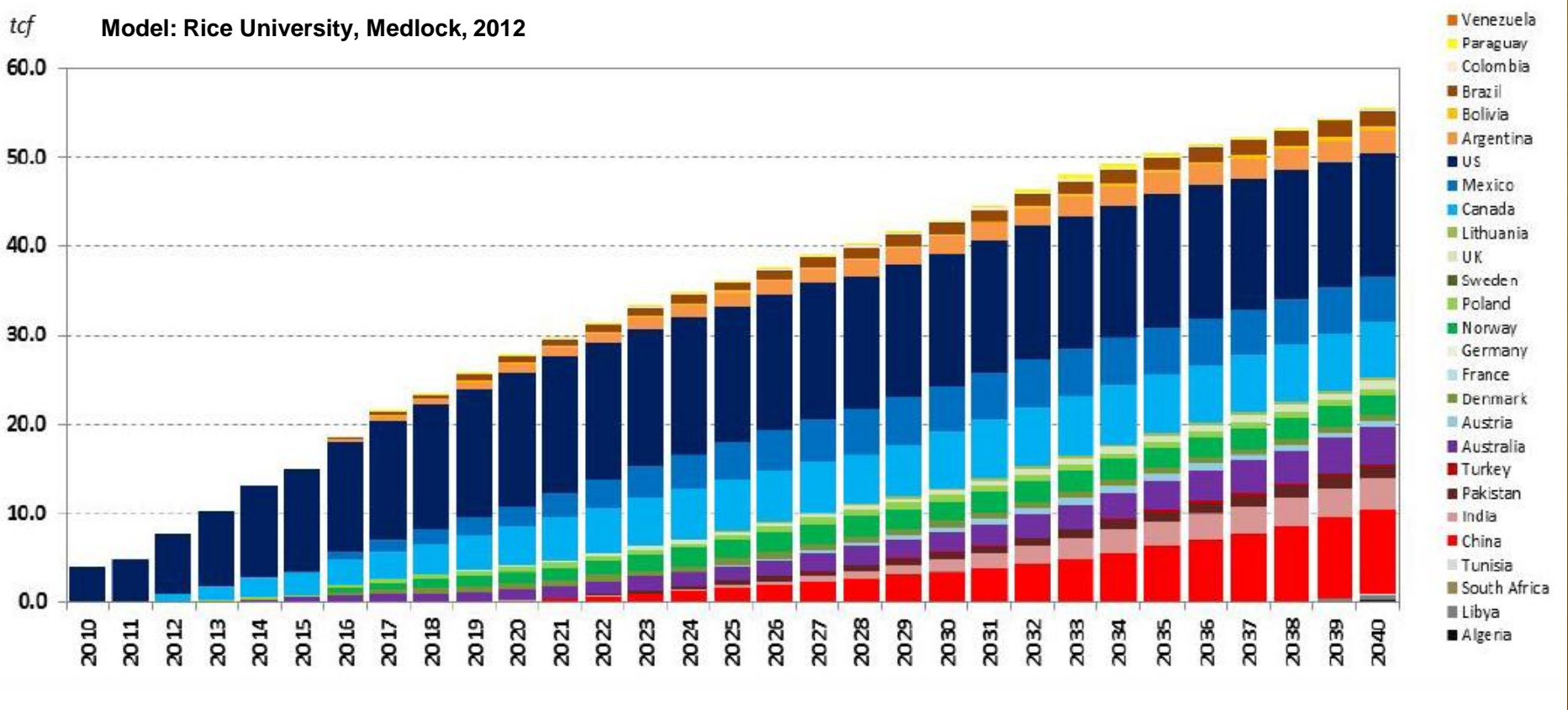
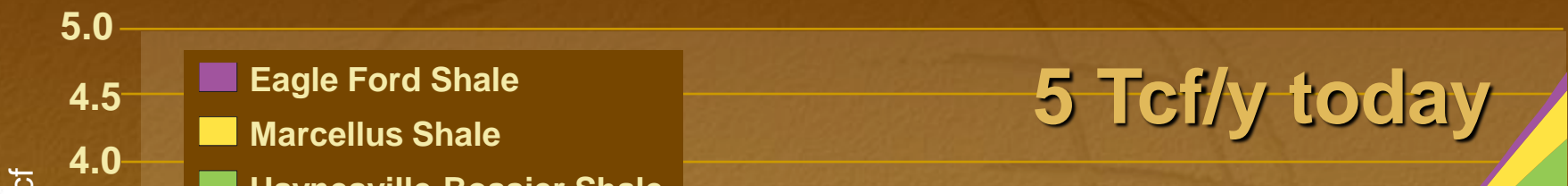
Shale



# Woodford Shale Frac Depth



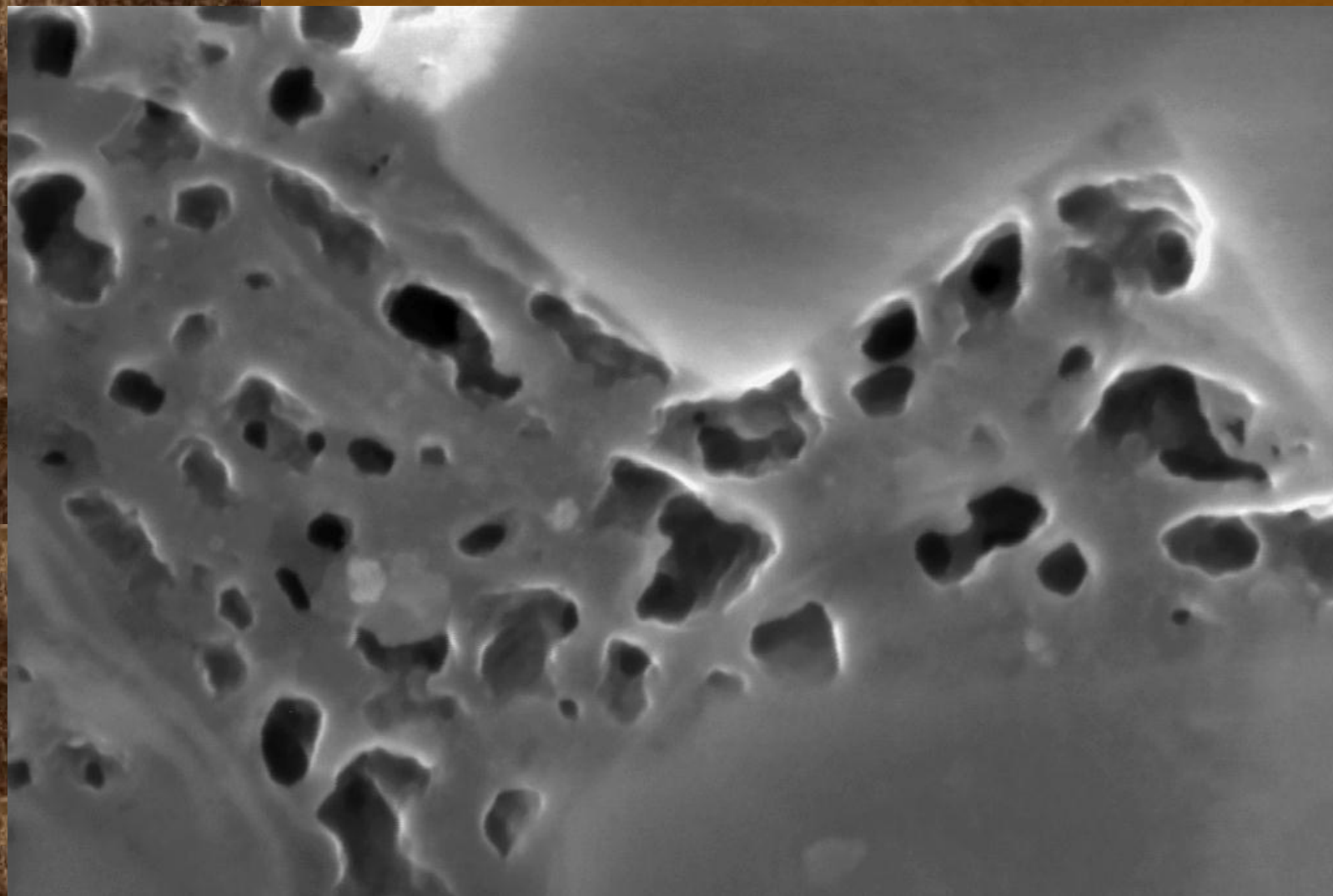
# U.S. Gas Shale Production





# Barnett Shale

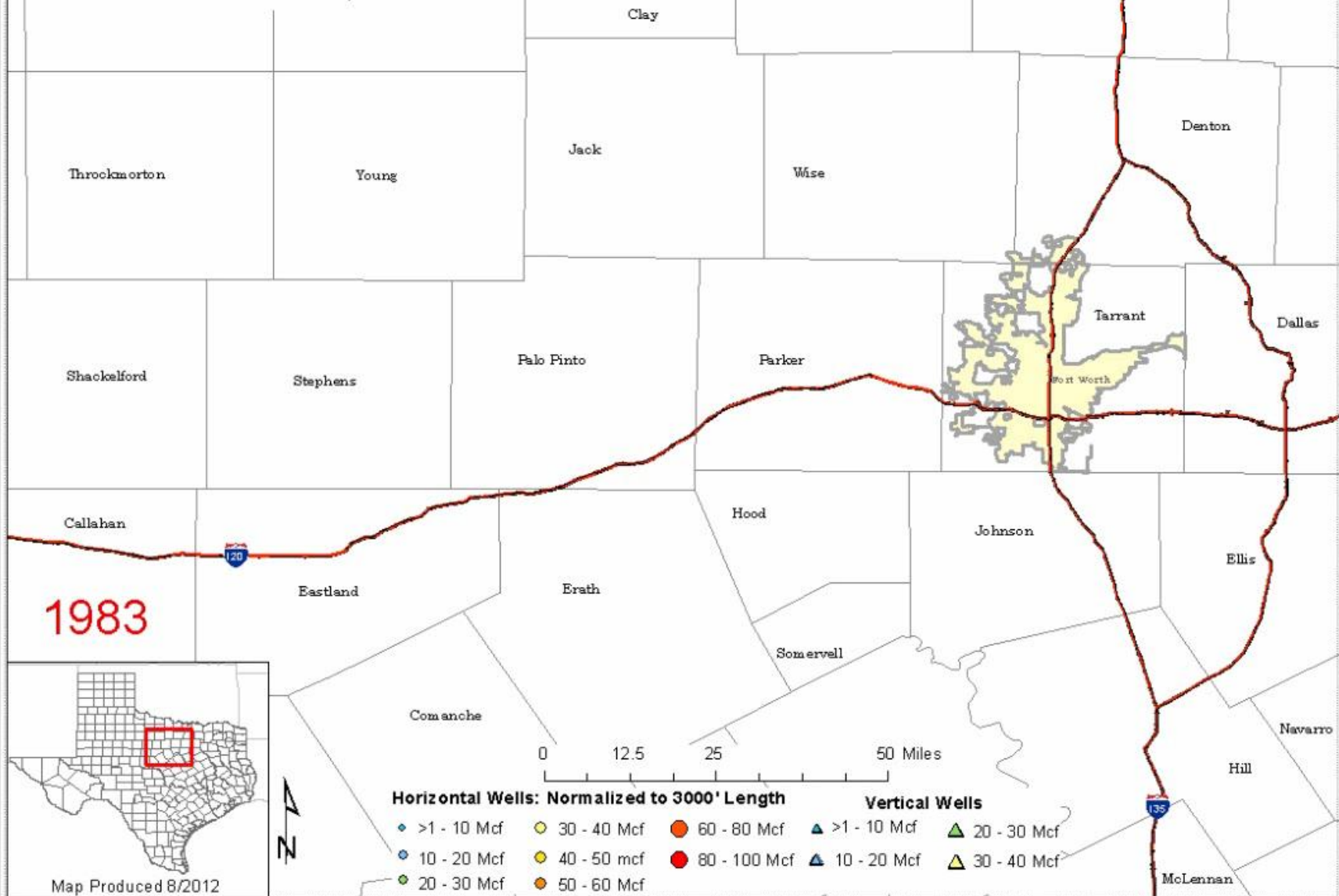
## *Nanopores in Organics*



# Cumulative Production: First 24 Months Natural Gas Wells, 1983-2011 Barnett Shale, TX



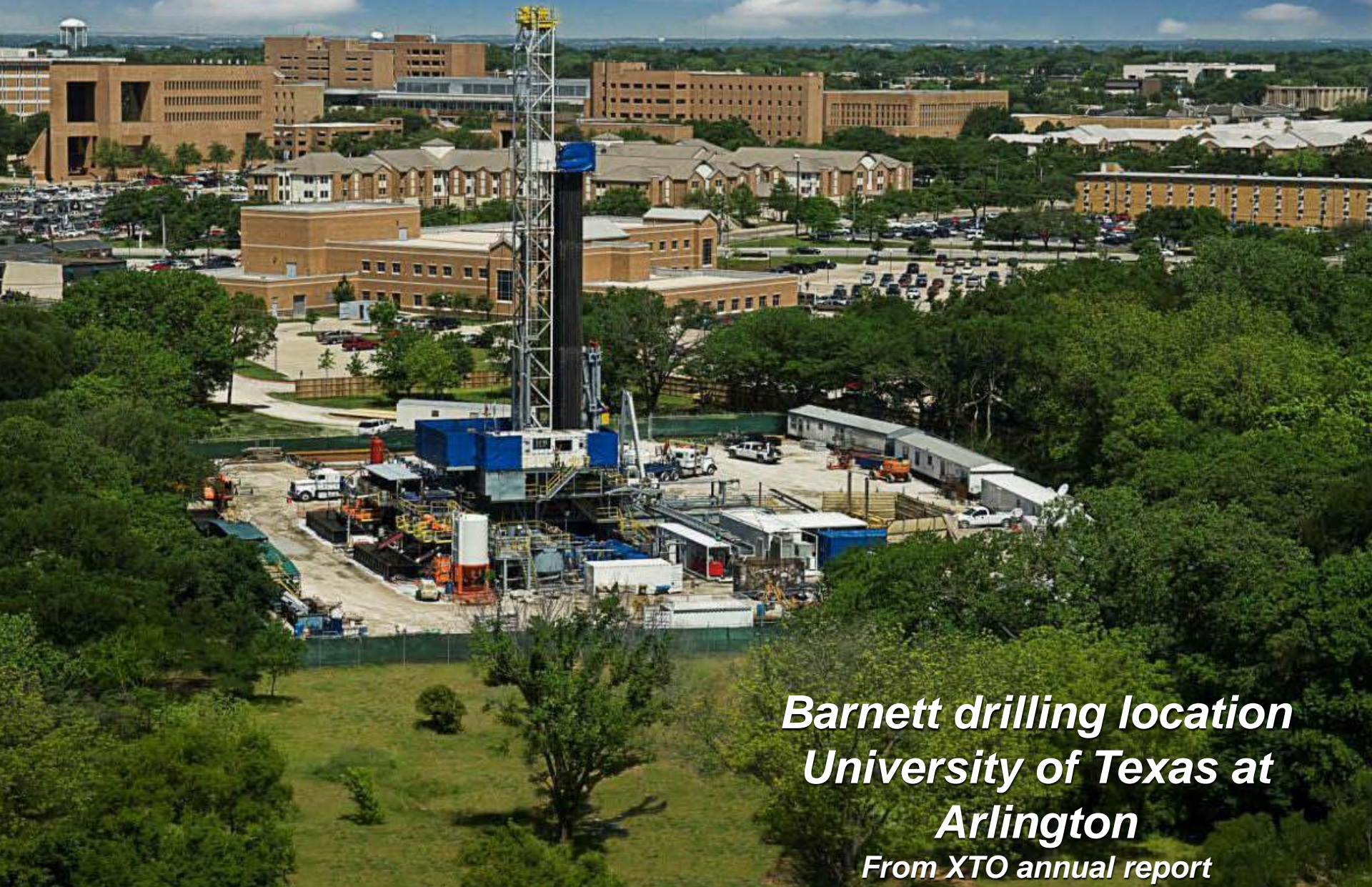
BUREAU OF  
ECONOMIC  
GEOLOGY







# Innovation driven by necessity



***Barnett drilling location  
University of Texas at  
Arlington  
From XTO annual report***



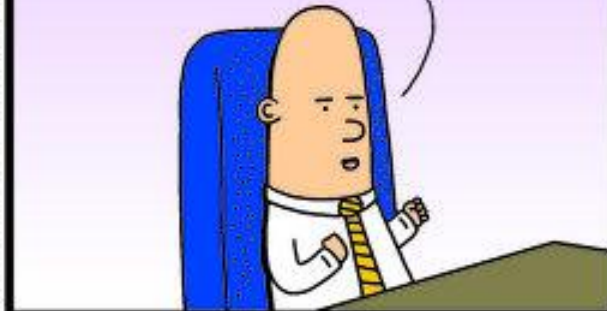


WE'RE GOING TO START FRACKING UNDER OUR BIGGEST COMPETITOR'S HEADQUARTERS.



Dilbert.com DilbertCartoonist@gmail.com

MY PLAN IS TO POLLUTE THEIR WATER AND GENERATE EARTHQUAKES TO DESTROY THEIR CAMPUS.



3-2-12 ©2012 Scott Adams, Inc./Dist. by Universal Uclick

THE PROJECT CODE NAME IS "FRACKING AWESOME."



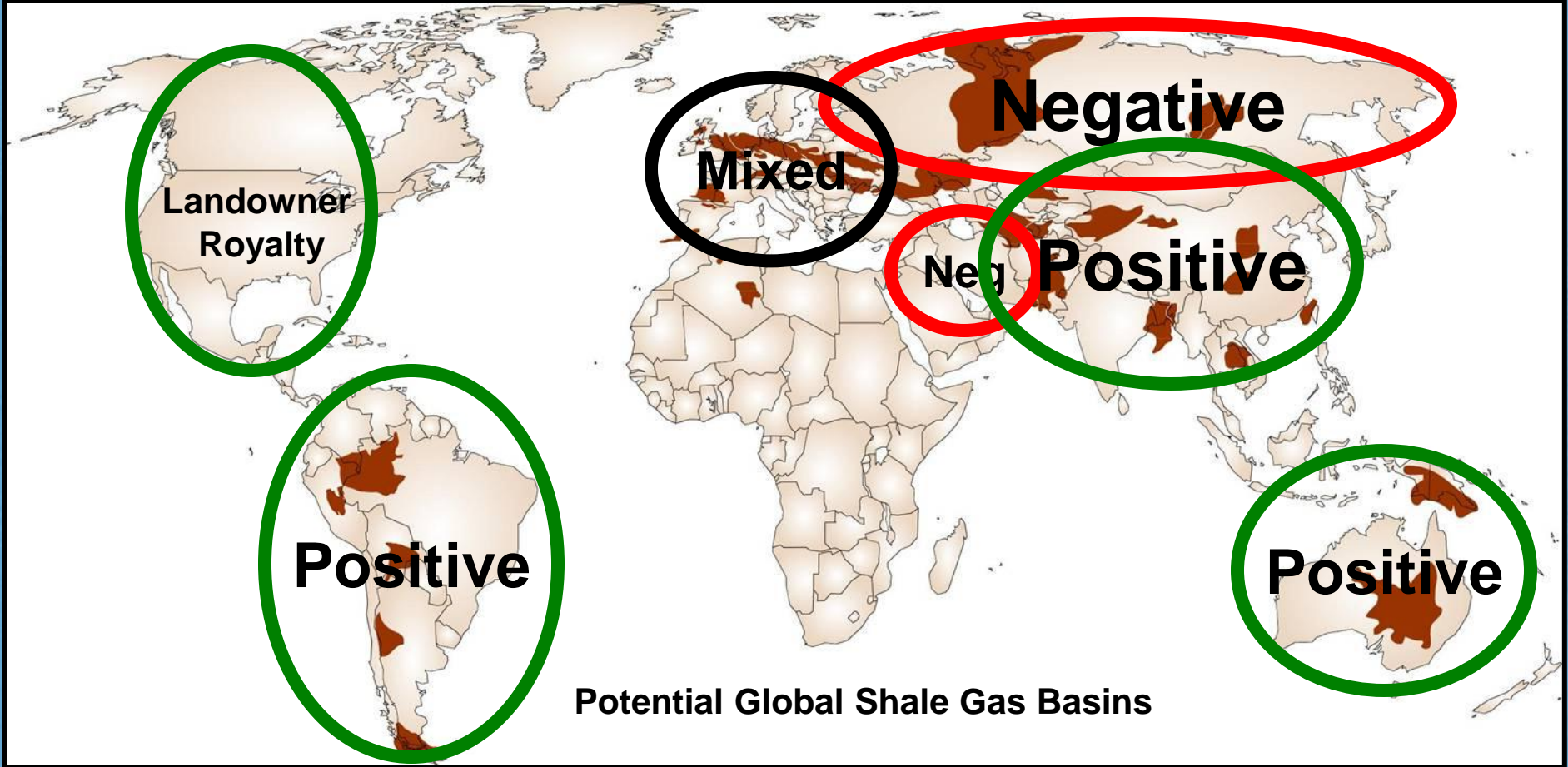
CATCHY

1 mile



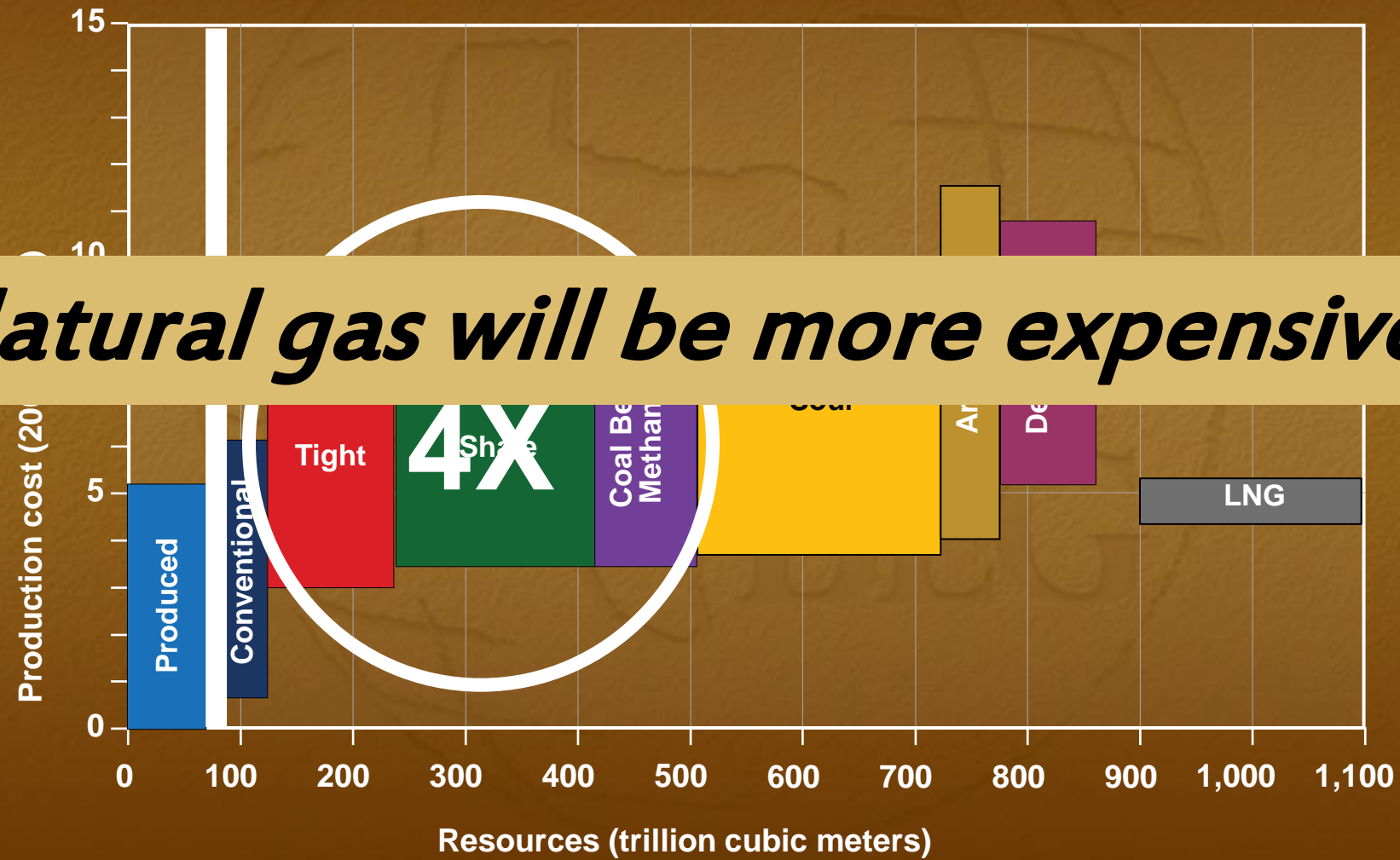


# North American shale plays (as of May 2011)



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

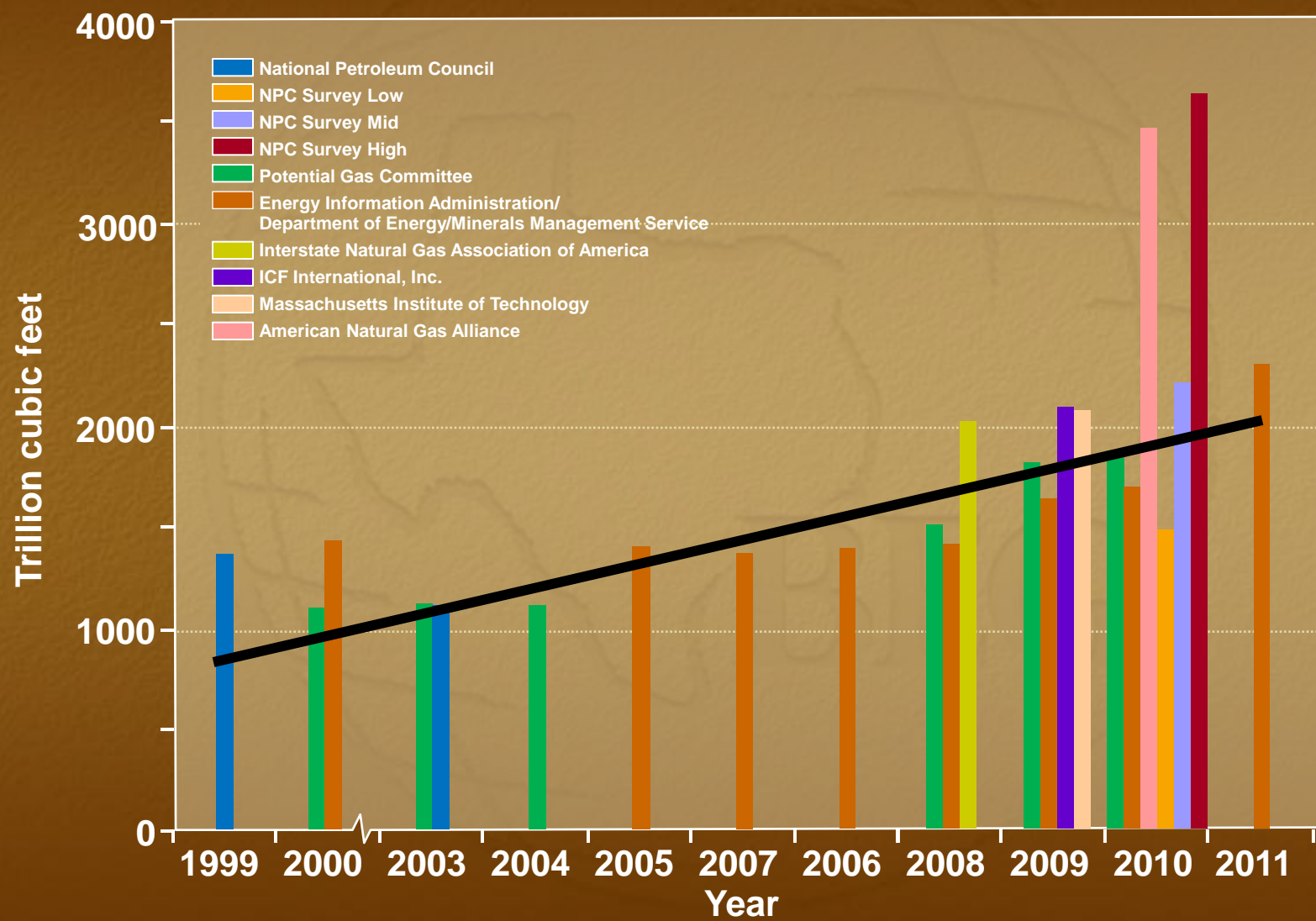
# Natural Gas Supply - Resources and Production



***Natural gas will be more expensive***

Source: IEA World Energy Outlook (2009)

# U.S. Unconventional Gas Reserves



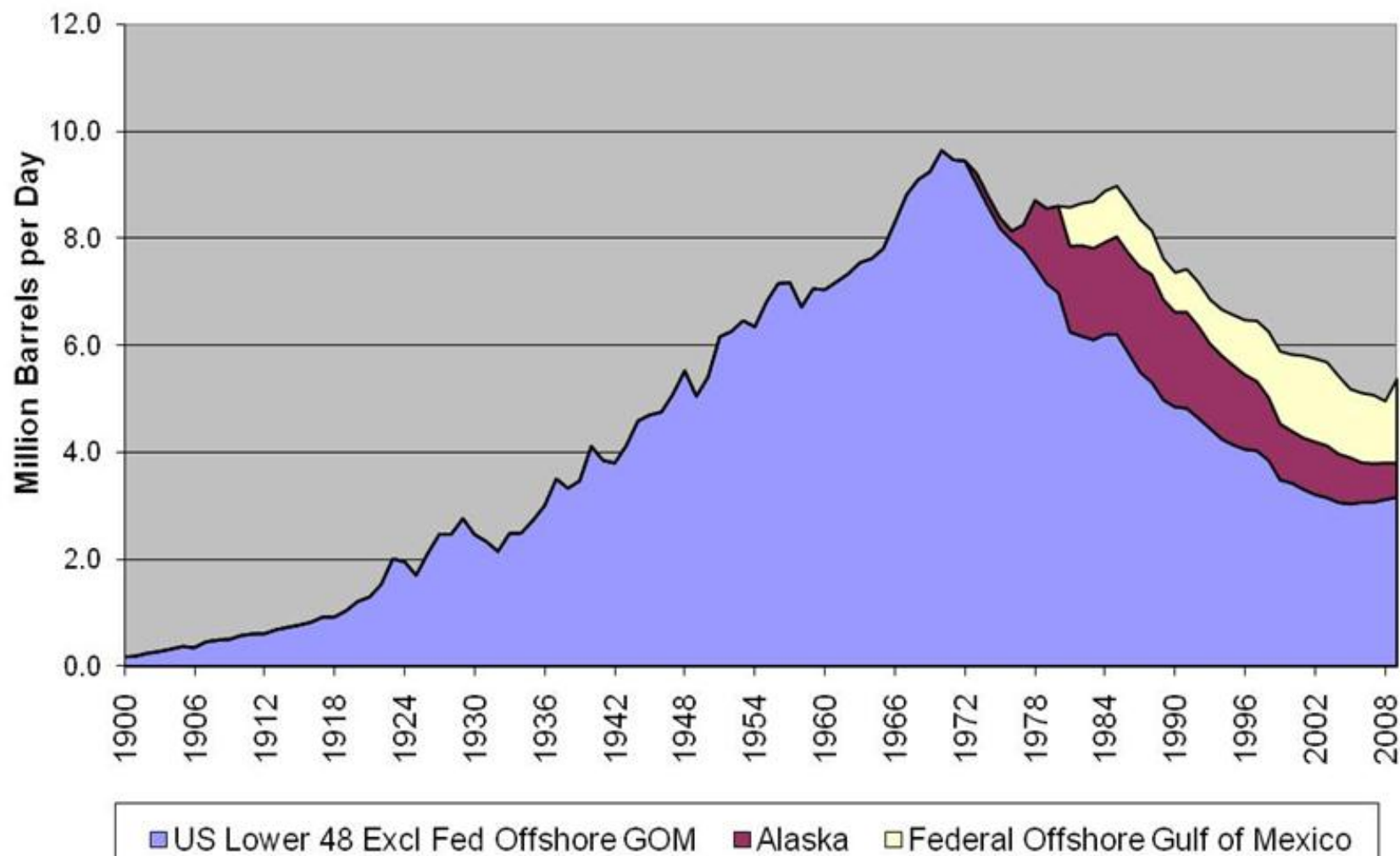
Note: Materials Management Service (MMS) no longer exists, its functions are now administered by the Bureau of Ocean Energy Management, Regulation and Enforcement.



# Outline

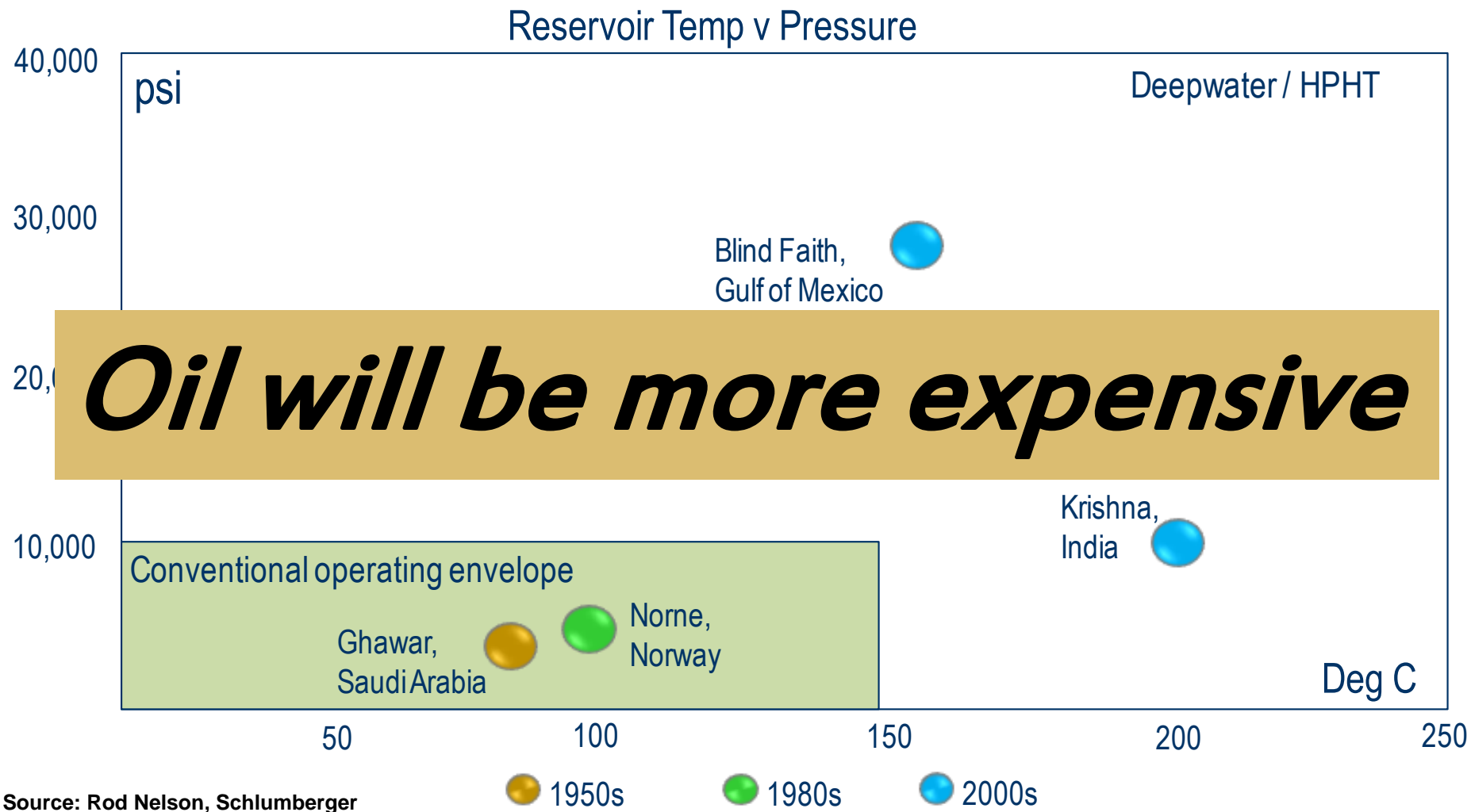
- **Unconventional Gas Reservoirs**
  - ❖ To “Frack” or not to “Frack”
- **Unconventional Oil Reservoirs**
  - ❖ **Mountain or Molehill**
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  - ❖ **Nothing is Perfect**

# U.S. Oil Production





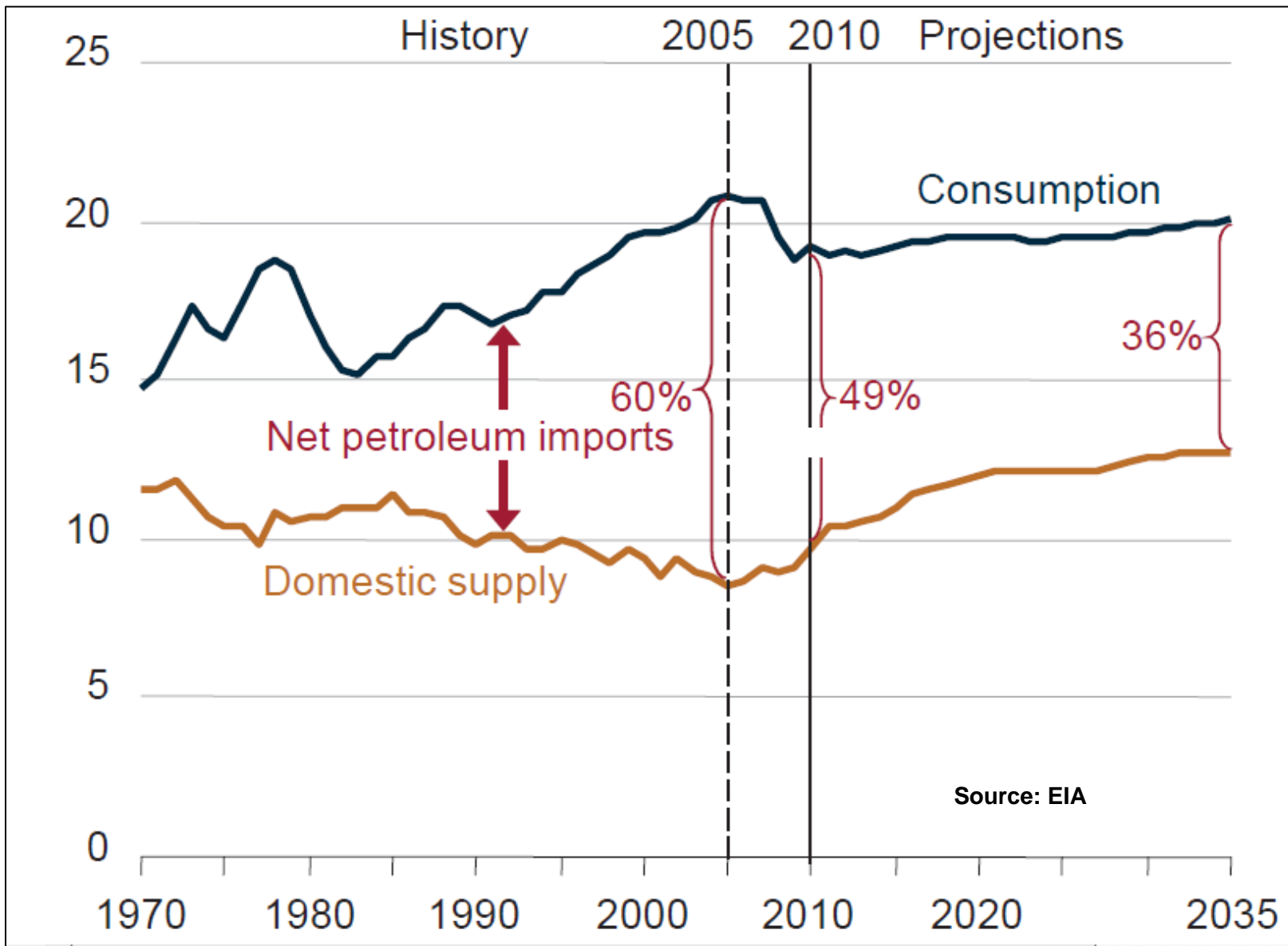
# Oil Supply *Resources and Cost*



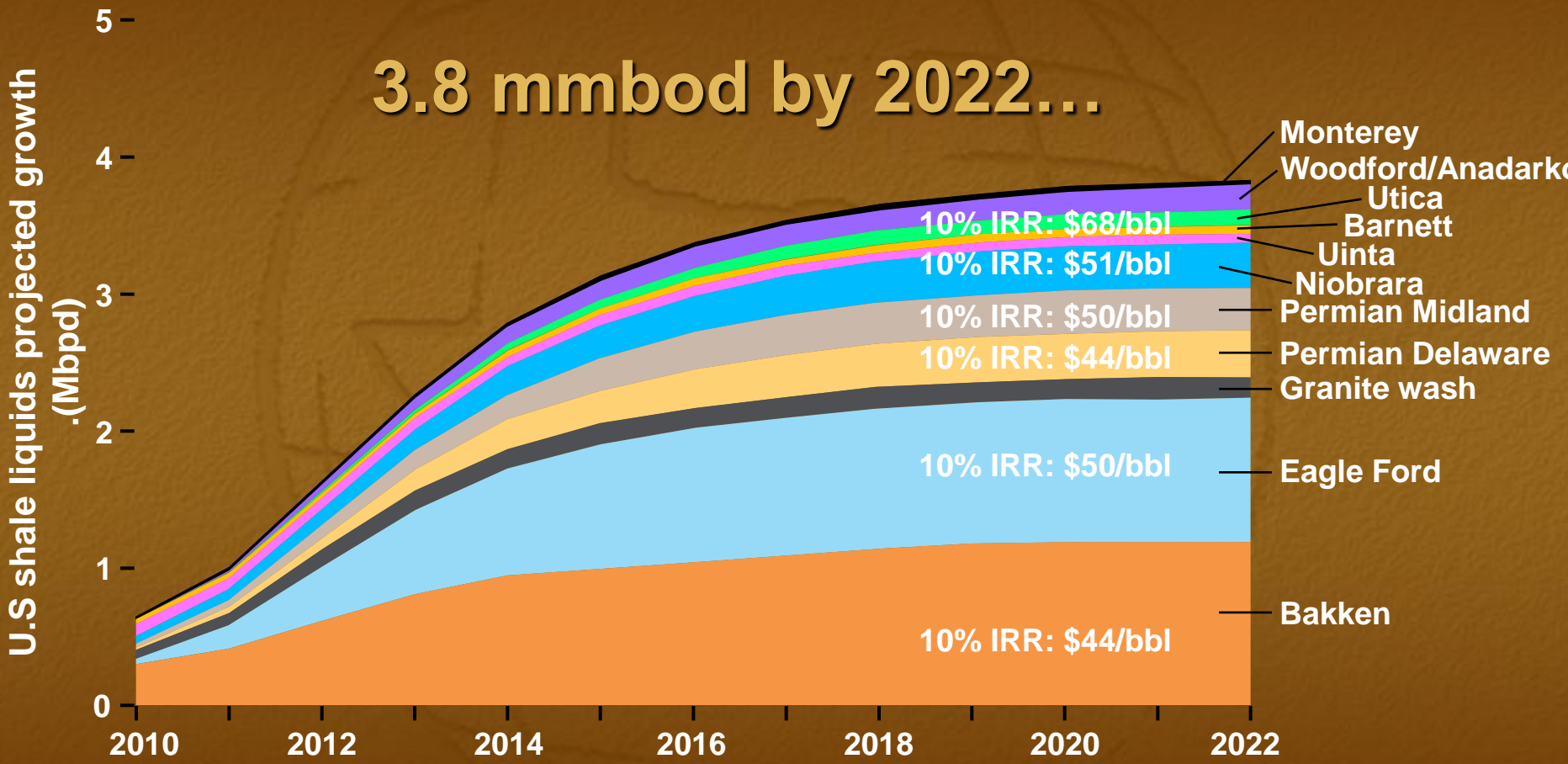
Source: Rod Nelson, Schlumberger

Source: IEA World Energy Outlook (2009)

# US Oil Production



# U.S. SHALE LIQUIDS PROJECTIONS

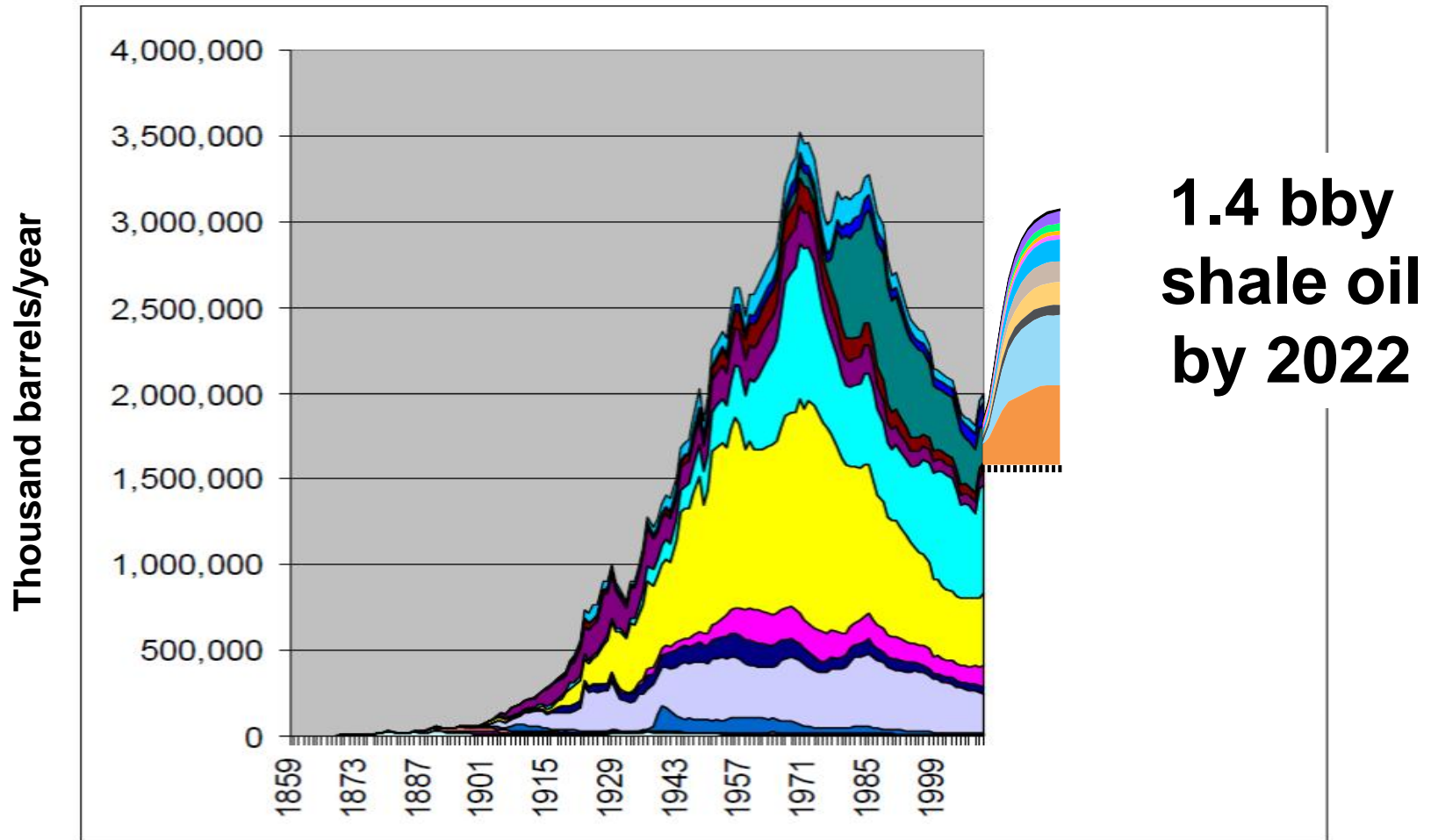


After Morse et. al., 2012, Energy 2020: North America, the new Middle East: Citi GPS: Global Perspectives & Solutions, figure 14, p. 17.

IRR Source: Rystad Energy

# US Oil Production (BBY)

Tinker, 2012



From: James D. Hamilton, Working Paper 17759, NATIONAL BUREAU OF ECONOMIC RESEARCH, 2012





# Outline

- **Unconventional Gas Reservoirs**
  - ❖ To “Frack” or not to “Frack”
- **Unconventional Oil Reservoirs**
  - ❖ Mountain or Molehill
- **Options to Oil**
  - ❖ **Nothing is Perfect**



*No form of energy is perfect*



