

15. “Conventional” Natural Gas I. Basic concepts, reserves, and production

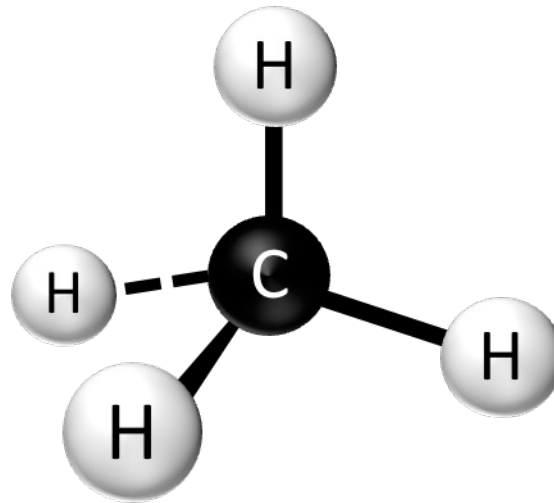
Kenneth M. Klemow, Ph.D.

EGY 105 at Wilkes University



What is natural gas (NG)?

- Composed mainly of methane and other molecules.



About methane:

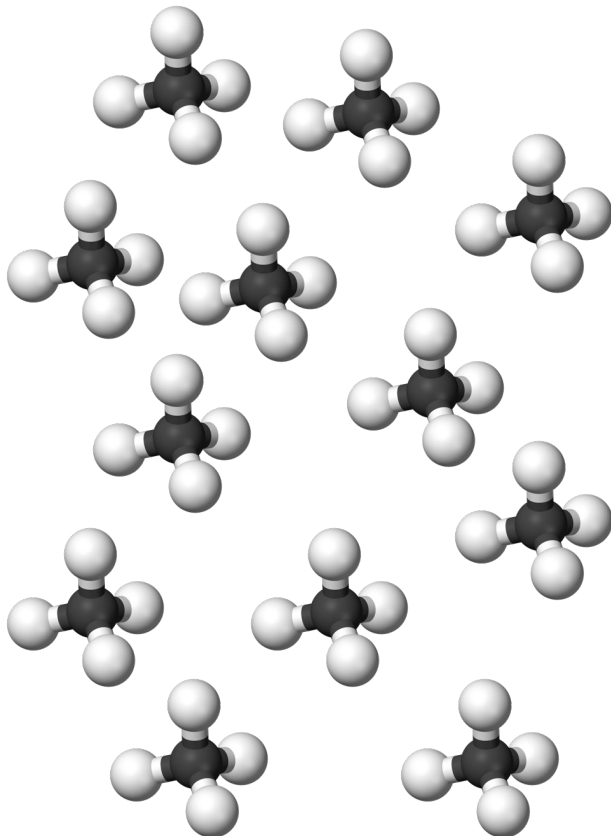
- Energy content: 55.7 kJ/g
- Vaporization point: -260°F 160°C

NG has two general forms

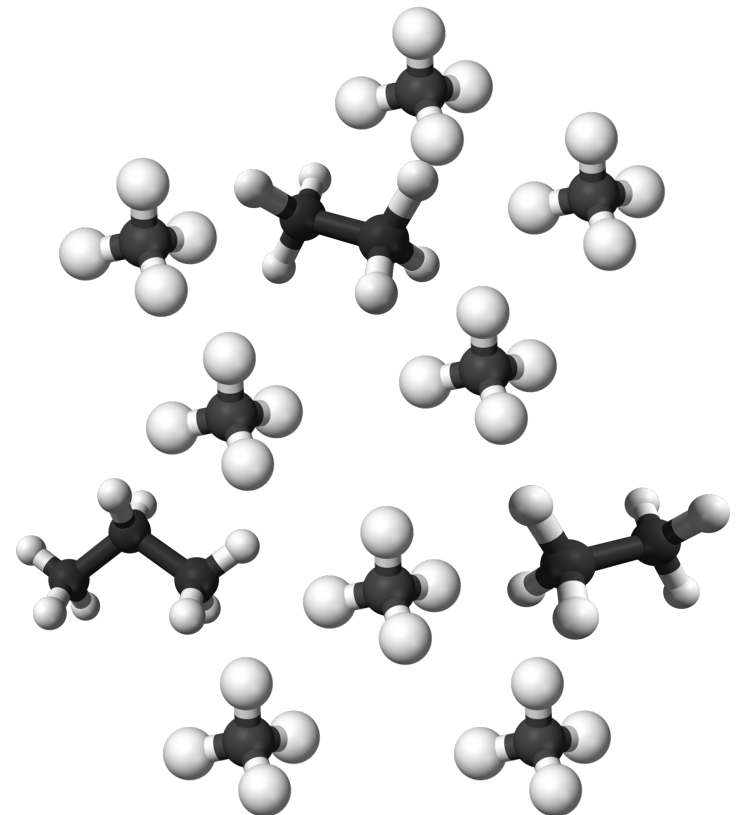
- Thermogenic – From breakdown of fossil organic matter below earth's surface
 - Hundreds of feet to miles below surface
 - Need heat and pressure
- Biogenic – From breakdown of organic matter at earth's surface.
 - Decomposition without oxygen
 - Wetlands, garbage dumps

Wet Gas Vs Dry Gas

Dry Gas
(Mainly methane)



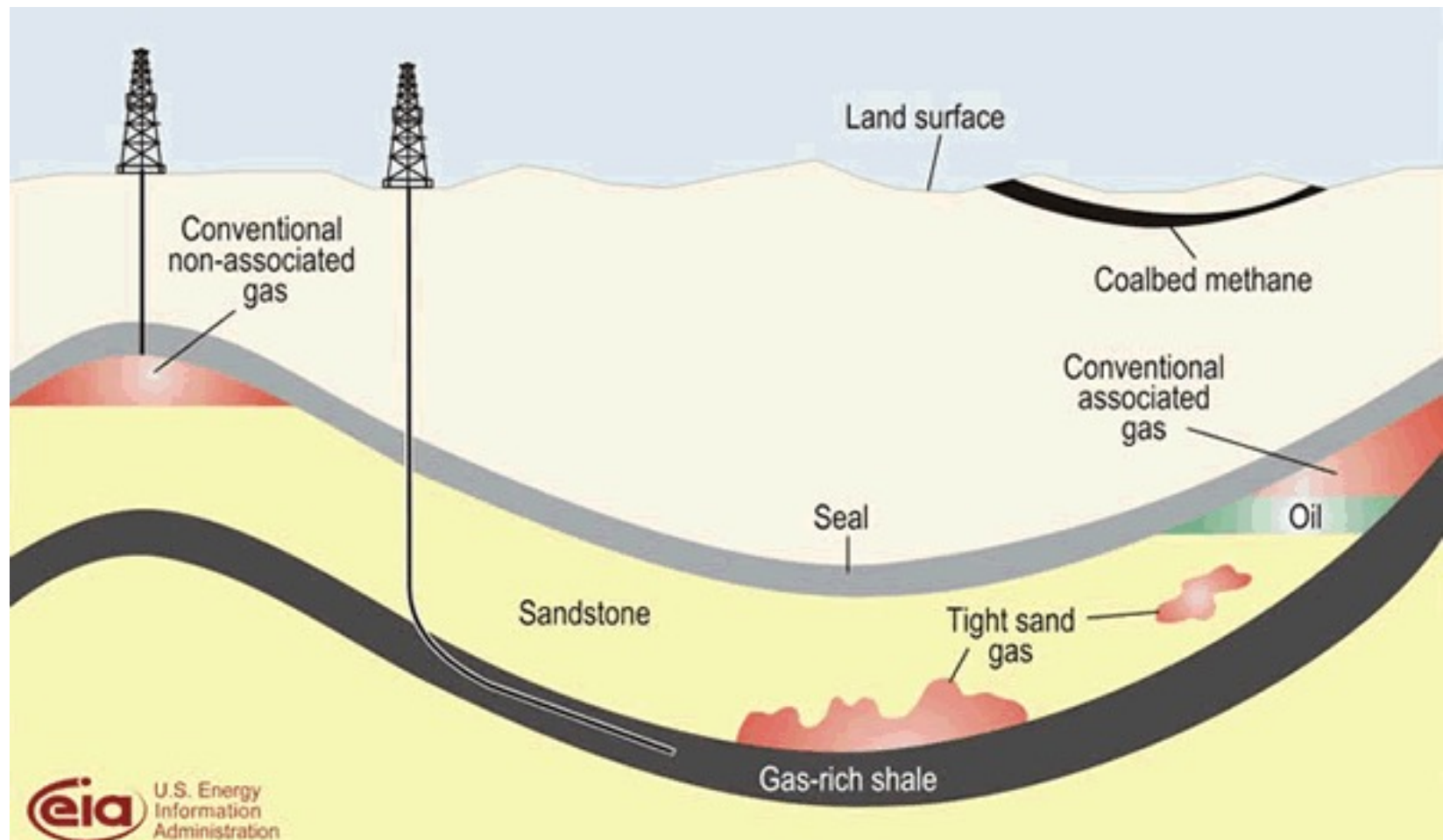
Wet Gas
(Contains some ethane and propane)



Conventional vs Unconventional Natural Gas

- Conventional gas
 - Relatively easy to extract
 - Forms include
 - Associated with oil
 - Not associated with oil
 - Can be onshore or offshore
- Unconventional gas
 - More difficult to extract
 - Derived from
 - Shale, coal-bed

Geology of gas



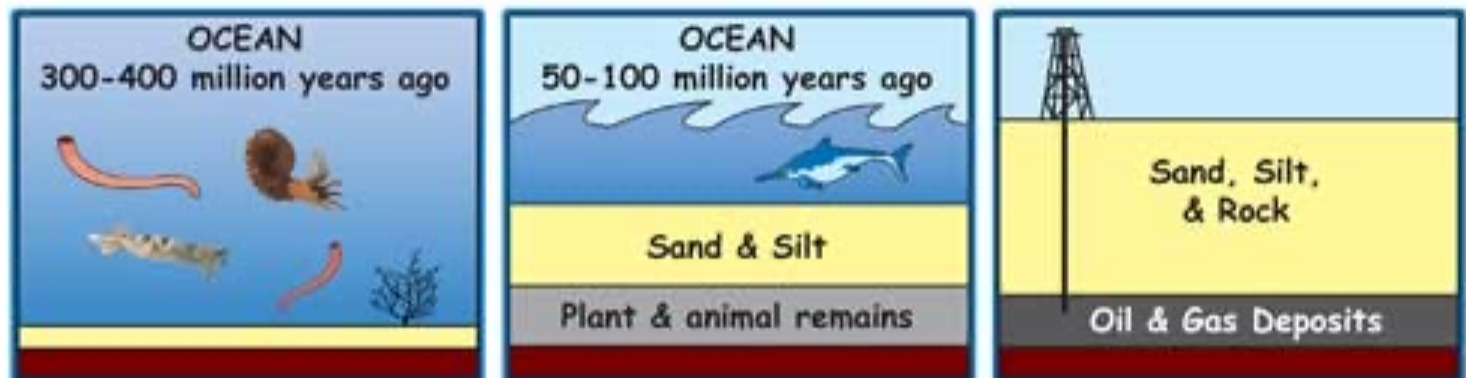
Focus on Conventional Gas



How does thermogenic NG form?

- Organic matter gets buried by other sediments
- Breaks down without oxygen under pressure, forming hydrocarbons
- Temperature dependent
 - Lower – petroleum
 - Higher – methane
- Often gas mixed with petroleum, released when pressure reduced.

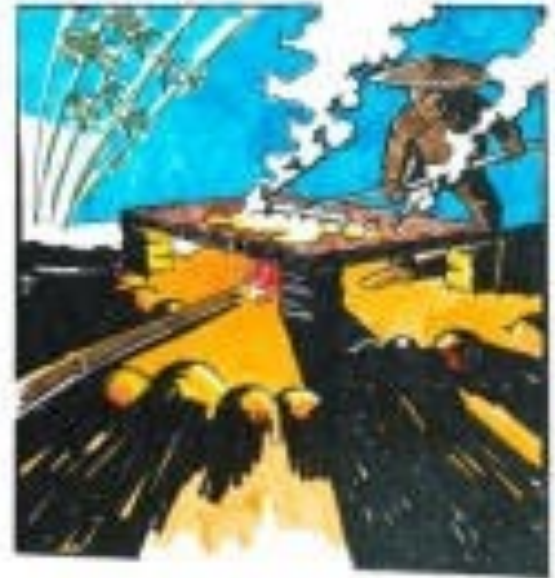
OIL AND NATURAL GAS FORMATION



History of natural gas development

See: <http://www.mesaaz.gov/energy/nghistory.aspx#1851>

- First isolated by Chinese about 500 BC.
 - Captured gas seeping from ground, piped it using crude pipelines.

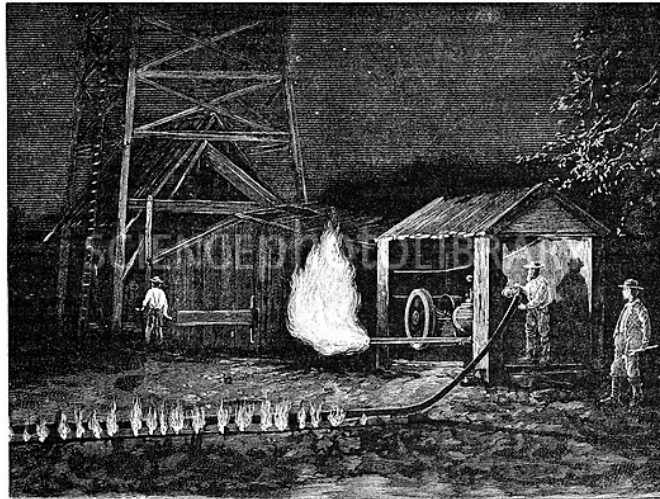


<http://www.mesaaz.gov/>

History of natural gas development

Mid-19th Century

Burned off during oil production (flaring)



<http://www.sciencephoto.com/media/436826/enlarge>

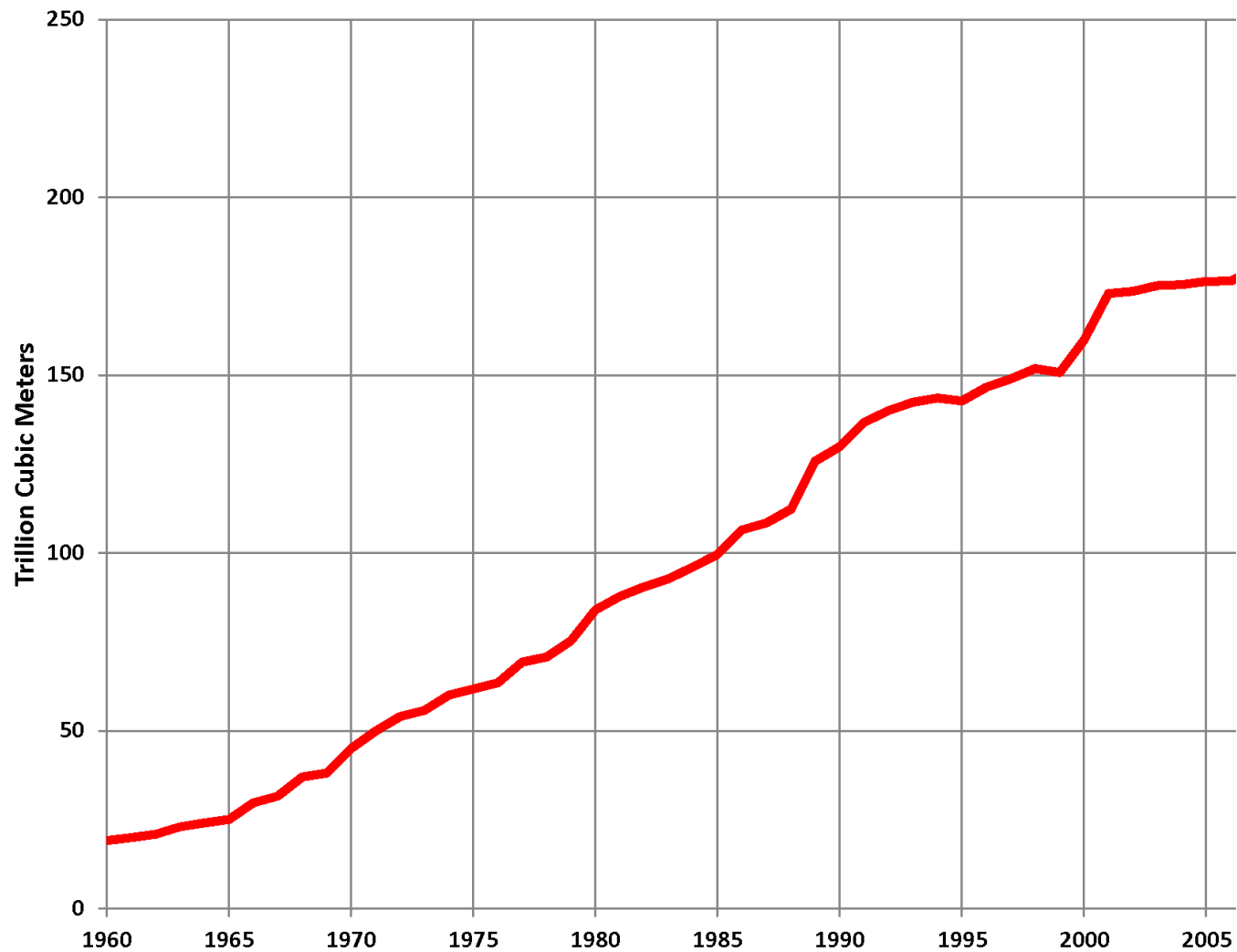
Early 20th Century

Pipelines constructed to capture and transport

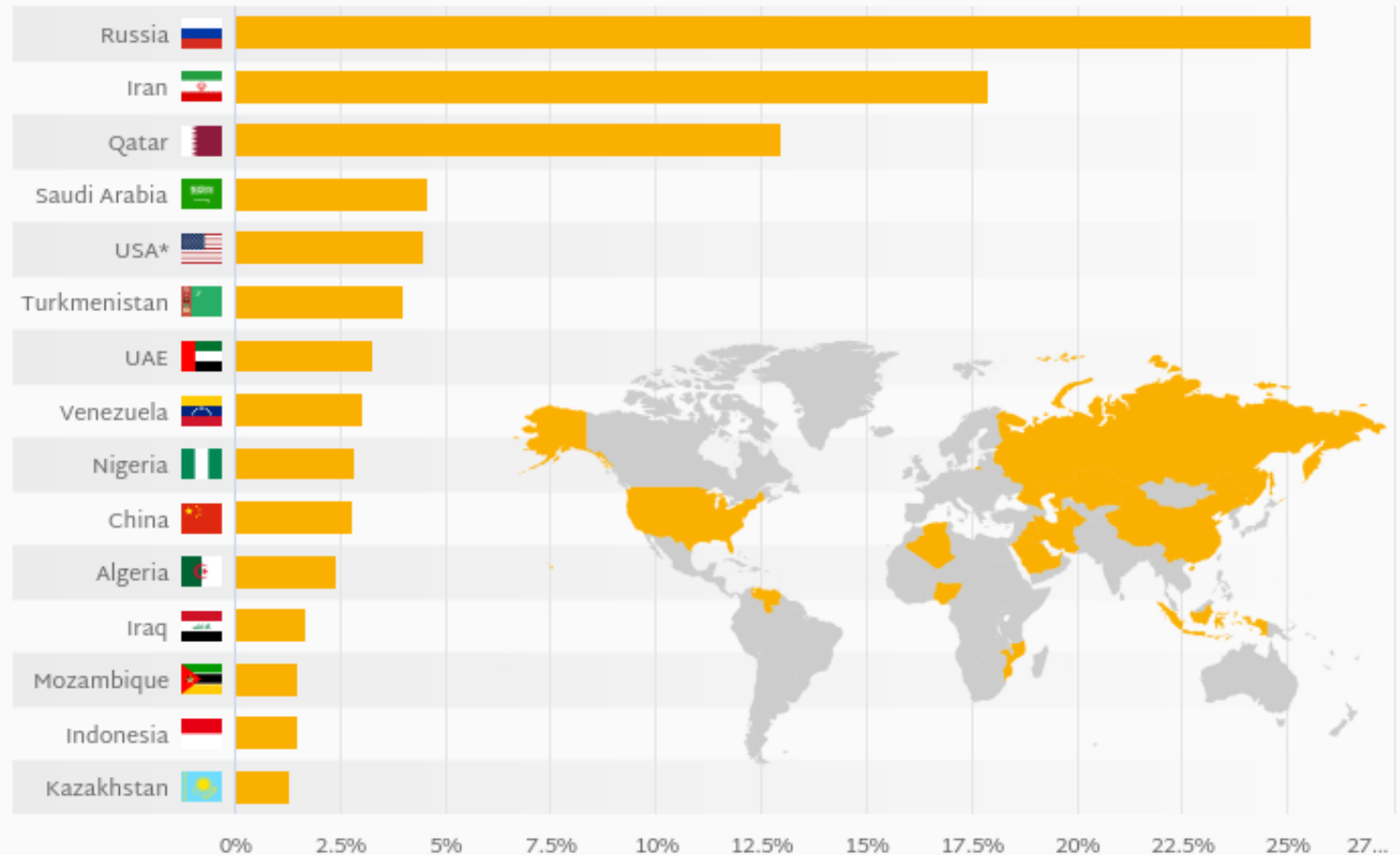


http://scottbeveridge.blogspot.com/2011_04_01_archive.html

World gas reserves 1960 - 2005



World natural gas reserves by country (2016)



Source: National Statistical Office, * Data from 2016

US Natural Gas Reserves 1965-2005

trillion cubic feet (Tcf)

700

600

500

400

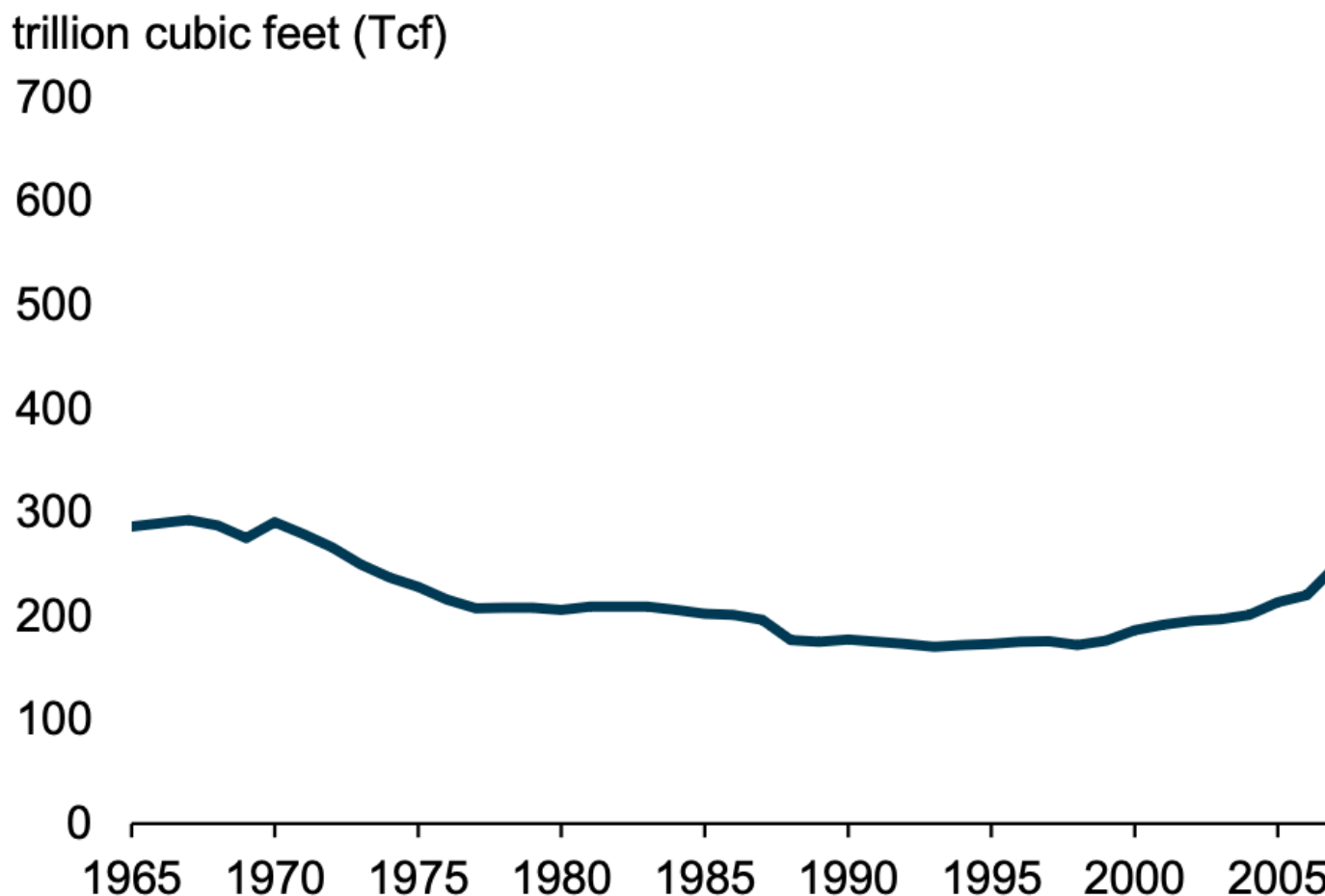
300

200

100

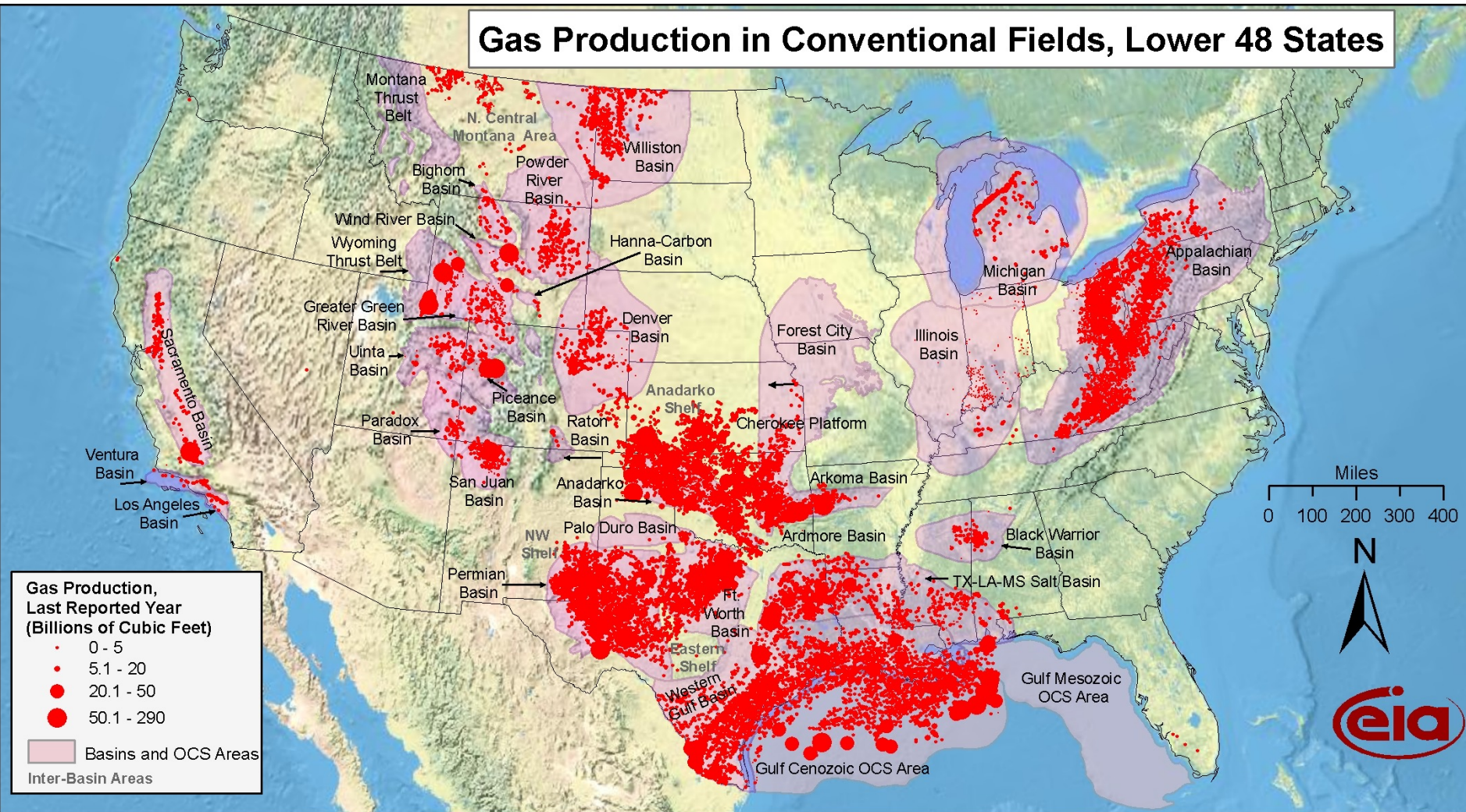
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1965 1970 1975 1980 1985 1990 1995 2000 2005



Location of conventional natural gas fields in the United States

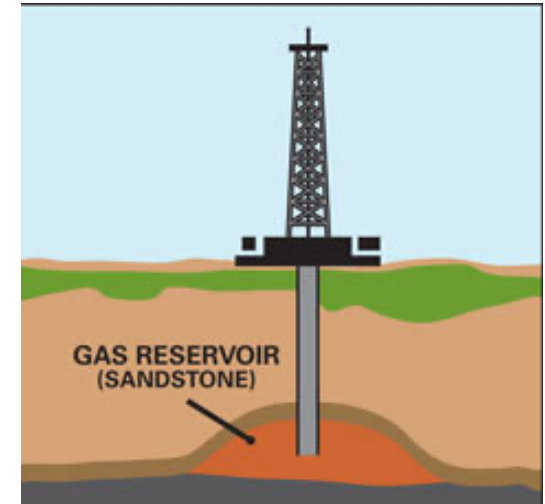
Gas Production in Conventional Fields, Lower 48 States



Source: Energy Information Administration based on data from HPDI, IN Geological Survey, USGS
Updated: April 8, 2009

Conventional well production

- Geologists find gas reservoir
- Drill borehole
- Case well in steel and concrete
- Gas flows upward
- Captured into pipeline



Wells sometimes need to be stimulated

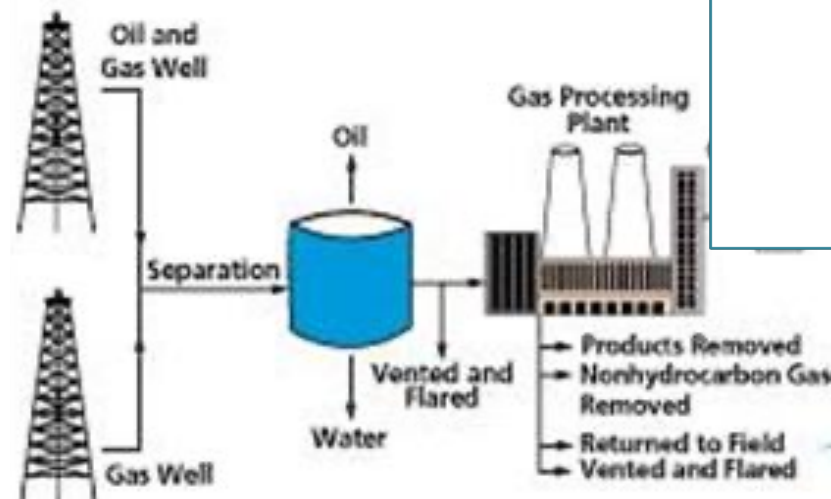
- Add acid, water, or gases to promote NG flow from the well



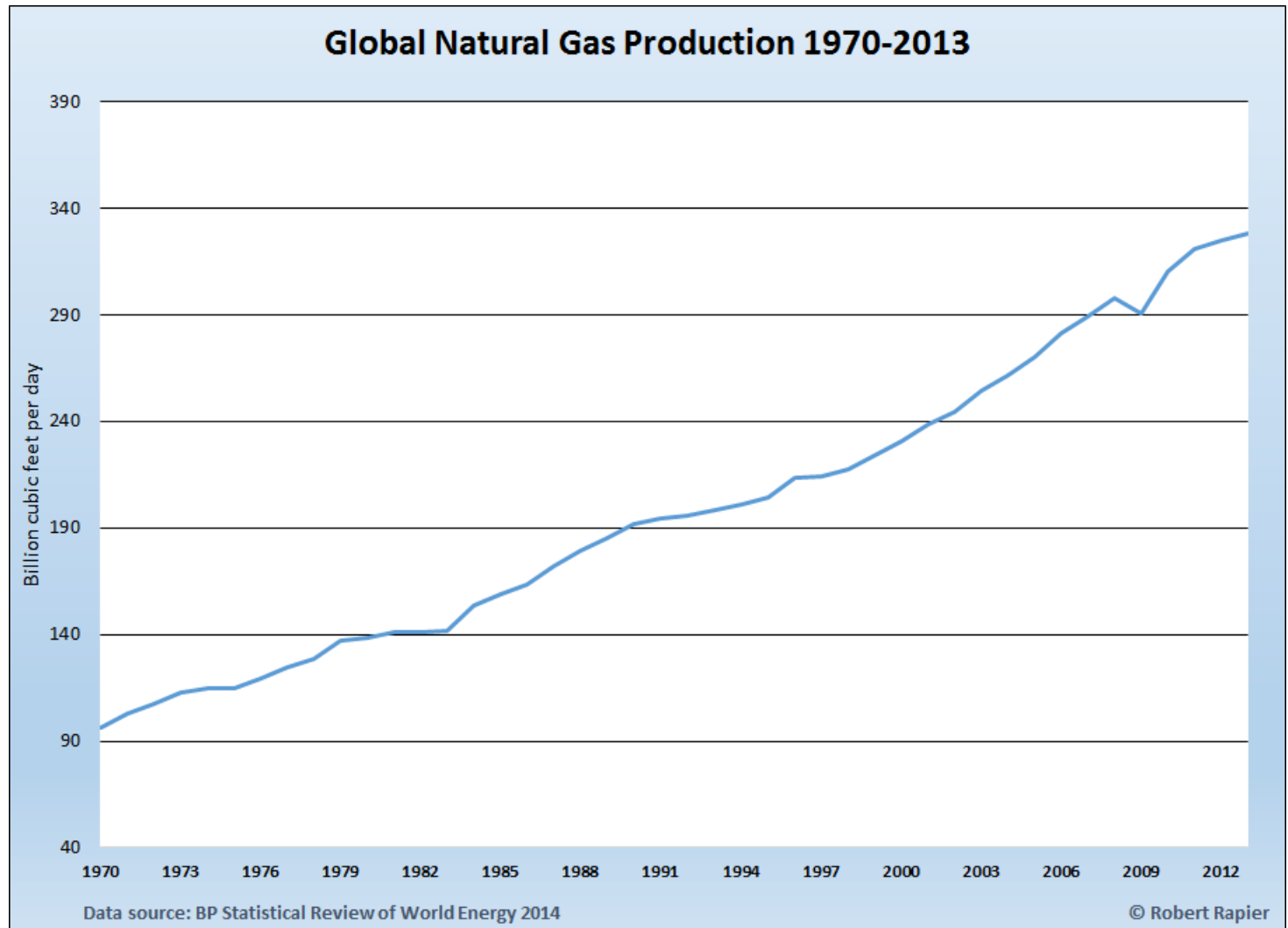
<http://www.businessweek.com>

Natural gas must be processed

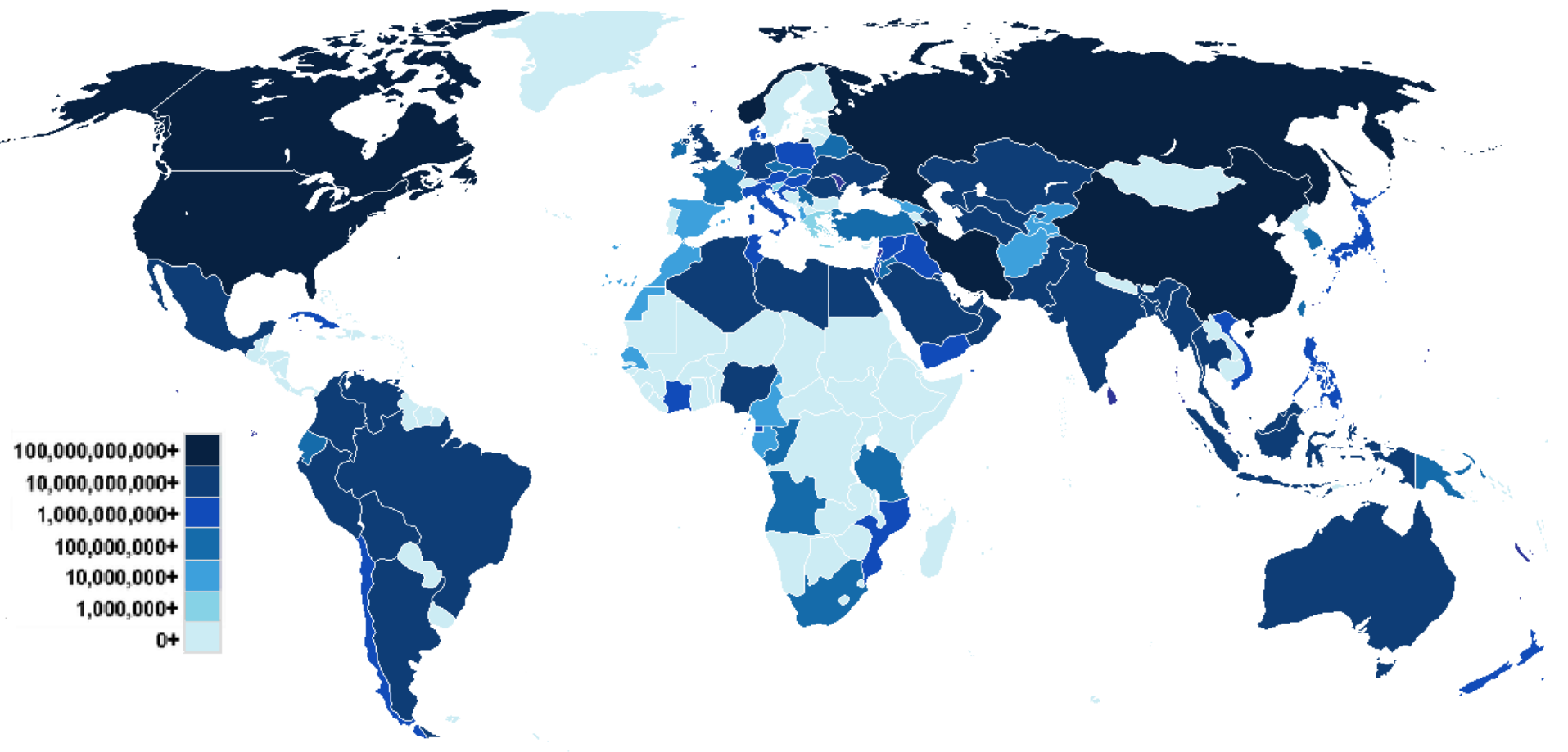
- Remove impurities
 - Hydrocarbons (ethane, propane, butane)
 - Hydrogen sulfide
 - Water vapor
 - Nitrogen compounds



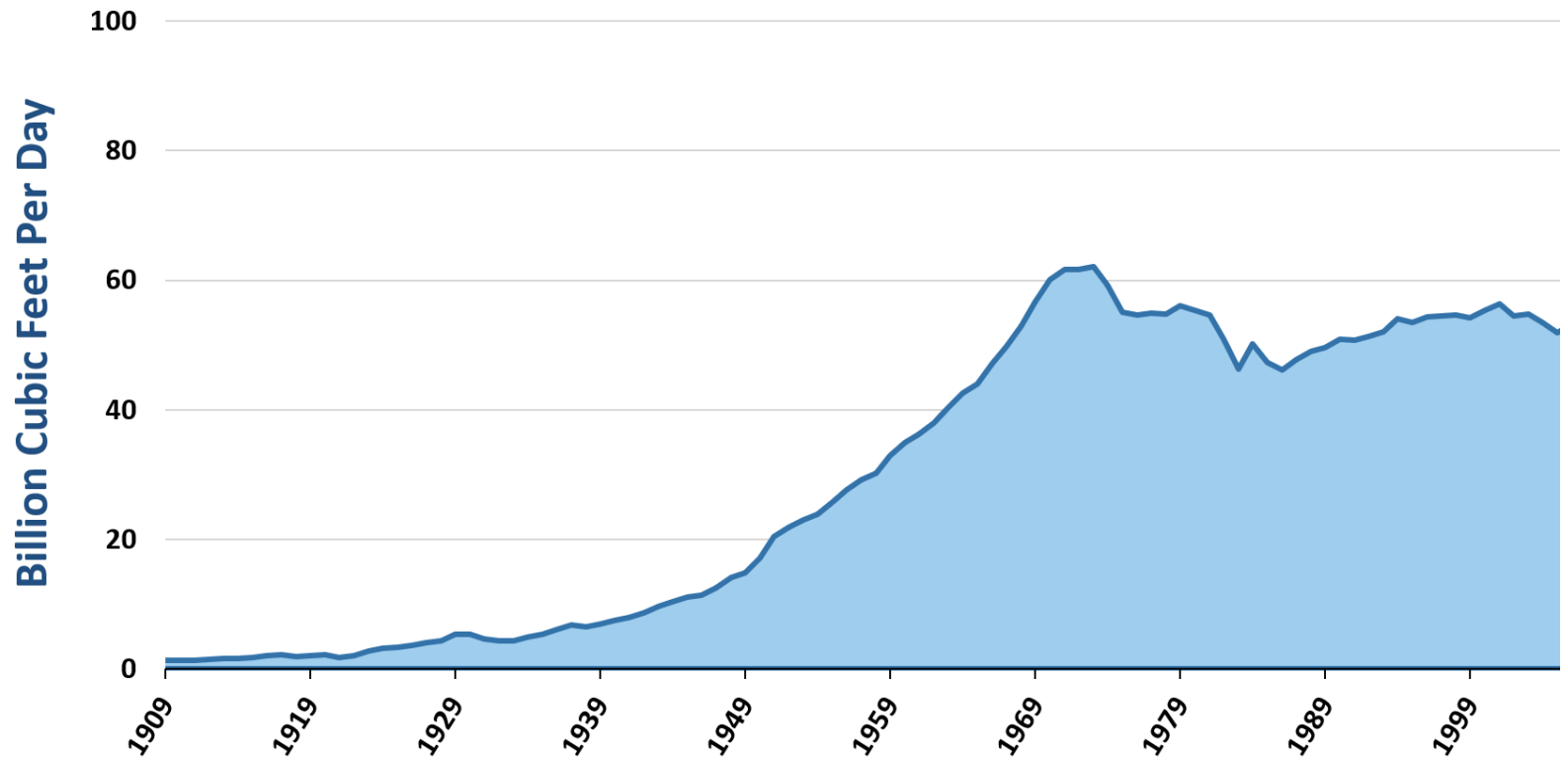
Global Gas Production



Conventional gas production – worldwide



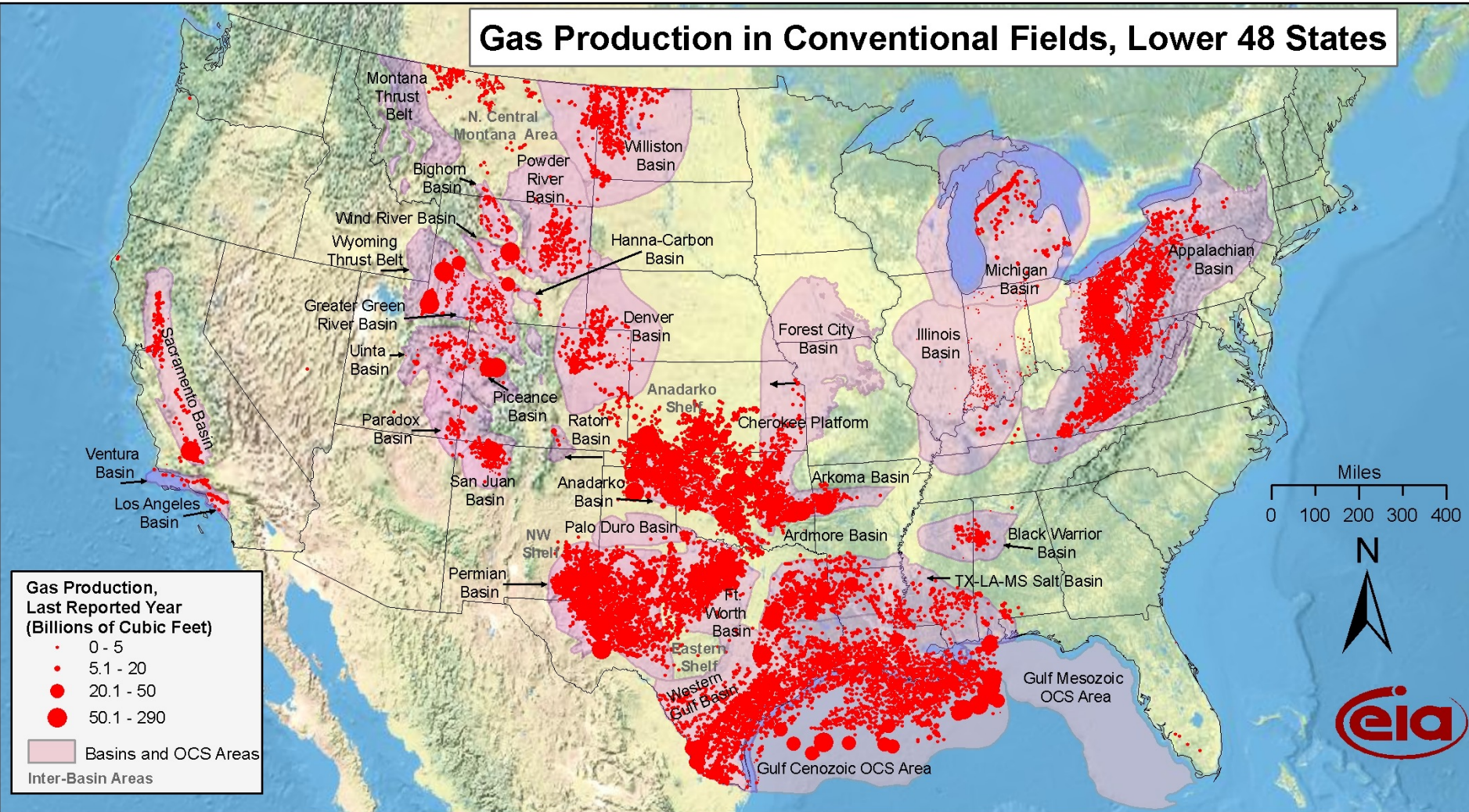
U.S. Natural Gas Production 1909-2005



Source: EIA.gov

Location of conventional natural gas

Gas Production in Conventional Fields, Lower 48 States



Source: Energy Information Administration based on data from HPDI, IN Geological Survey, USGS
Updated: April 8, 2009

Up next: Lecture 16 – CNG 2

- Gas distribution and utilization
- Gas consumption
- Compressed and liquified NG
- Pricing NG
- Benefits and drawbacks