

Hydraulic Fracturing: The Issues and Where We are Heading

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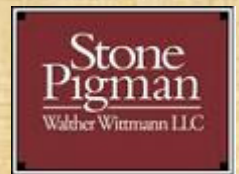
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Professional Landmen's Association
of New Orleans



What is fracturing?

Fracturing is the process of creating fractures or cracks in the rock, so that oil or gas can flow through the fractures.

Explosive Fracturing

Explosive fracturing was used in Pennsylvania starting in the 1860s.

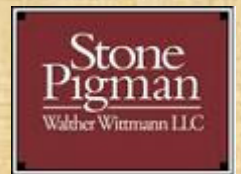
Nitroglycerin “torpedos” were lowered into wells and detonated.

Hydraulic Fracturing

Hydraulic fracturing was commercially developed in the late 1940s.

Water or some other fluid is pumped into a rock formation at sufficiently high pressure to fracture the rock.

Proppants (typically sand) and additives also used.



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THE TIMES-PICAYUNE

Benefits of Fracturing

- Jobs, revenue to mineral owners, and revenue to local and state government
- Less dependence on imported oil and gas
- Natural gas is clean burning, can displace coal for use in generating electricity

Concerns about Fracturing

- Fear of groundwater contamination

Distance Between Shale and Water

| Shale Play | Shale Depth | Water Depth | Difference |
|-------------|-------------|-------------|------------|
| Barnett | 7500 | 1200 | 6300 |
| Haynesville | 12,000 | 400 | 11,600 |
| Marcellus | 6250 | 850 | 5400 |

Fracturing Fluid Composition

- Louisiana enacted mandatory disclosure regulations effective October 20, 2011
- FracFocus

Concerns about Fracturing

- Fear of groundwater contamination
- Amount of water use

Amount of Water Used

- 3 to 5 million gallons per horizontal well
- not high compared to other industrial and agricultural uses
- 5 million gallons is about as much as is used to irrigate 8 to 10 acres of corn
- can be a problem when and where water already is in short supply

Concerns about Fracturing

- Fear of groundwater contamination
- Amount of water use
- Disposal of flowback

Disposal of Flowback

- In Texas and Louisiana, most disposal is by underground injection
- Not many underground injection wells exist in Pennsylvania

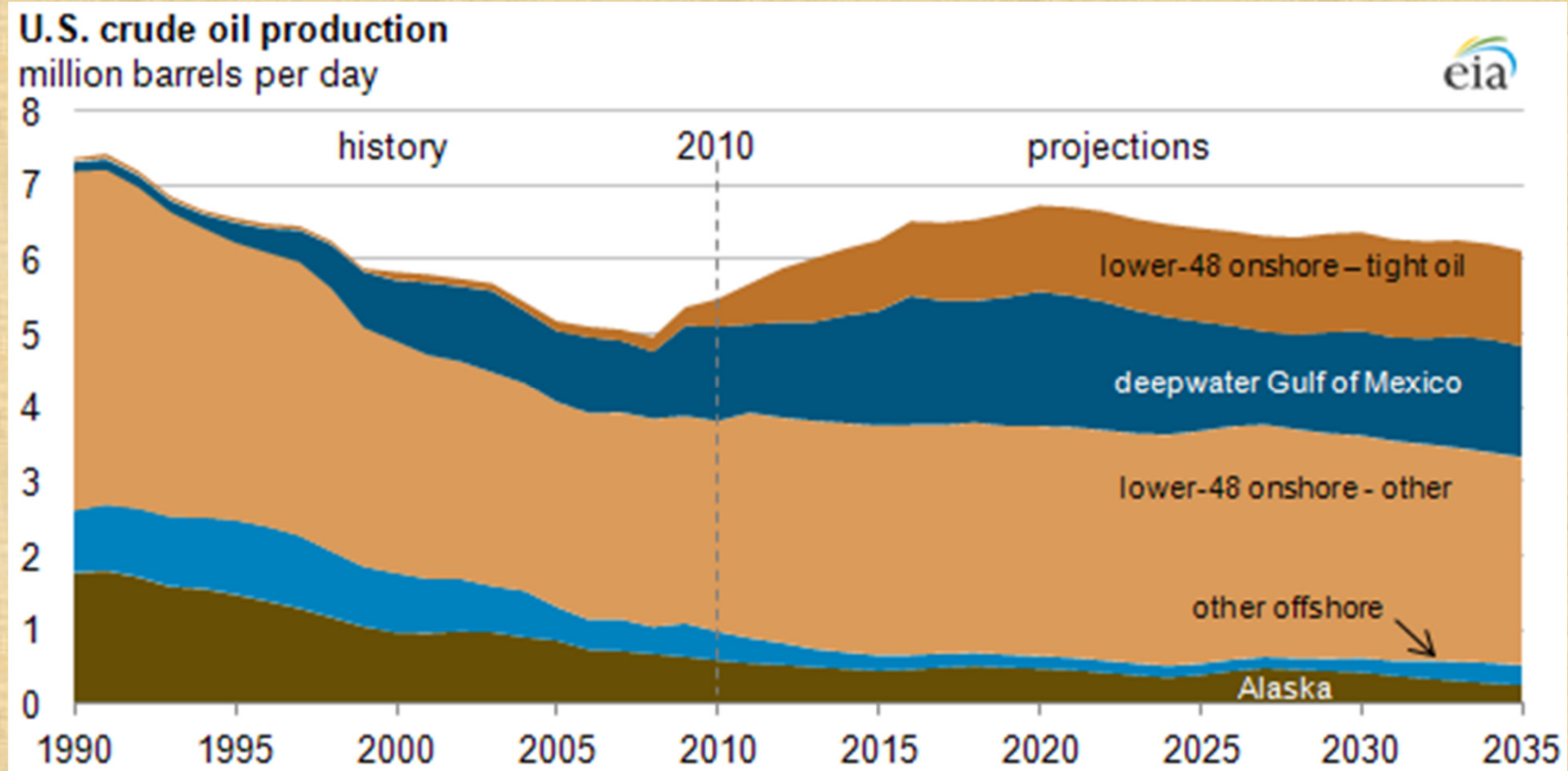
Disposal of Flowback

- EPA announces plans to develop Clean Water Act regulations to require pre-treatment of flowback prior to it being sent to treatment plants by 2014

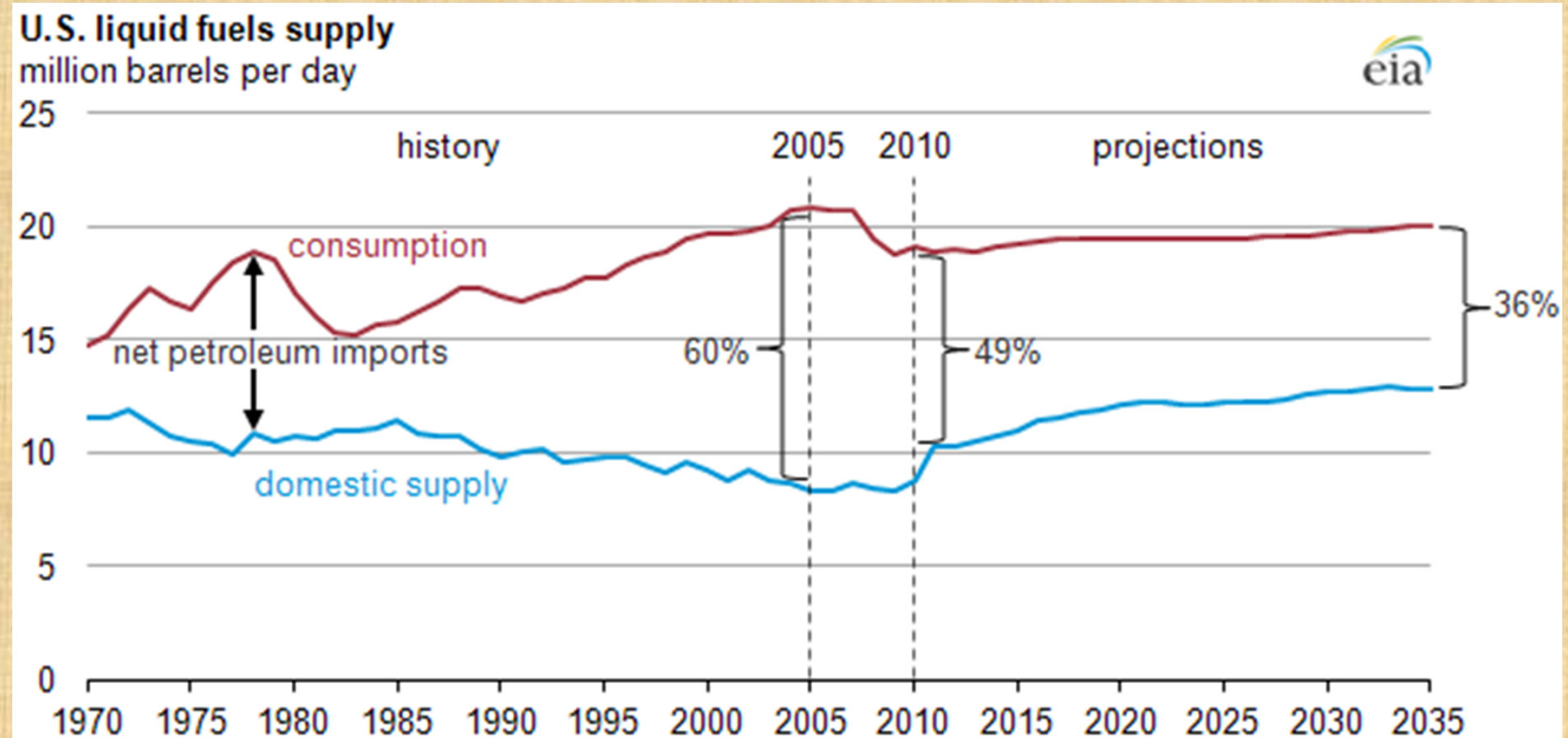
Effects on Industry

- Increased production of oil and gas
- Gas prices low
- Significant pipeline additions
- Decreased imports of gas, possible exports of gas, decreased imports of crude
- New regulations, studies, controversy

U.S. Crude Oil Production



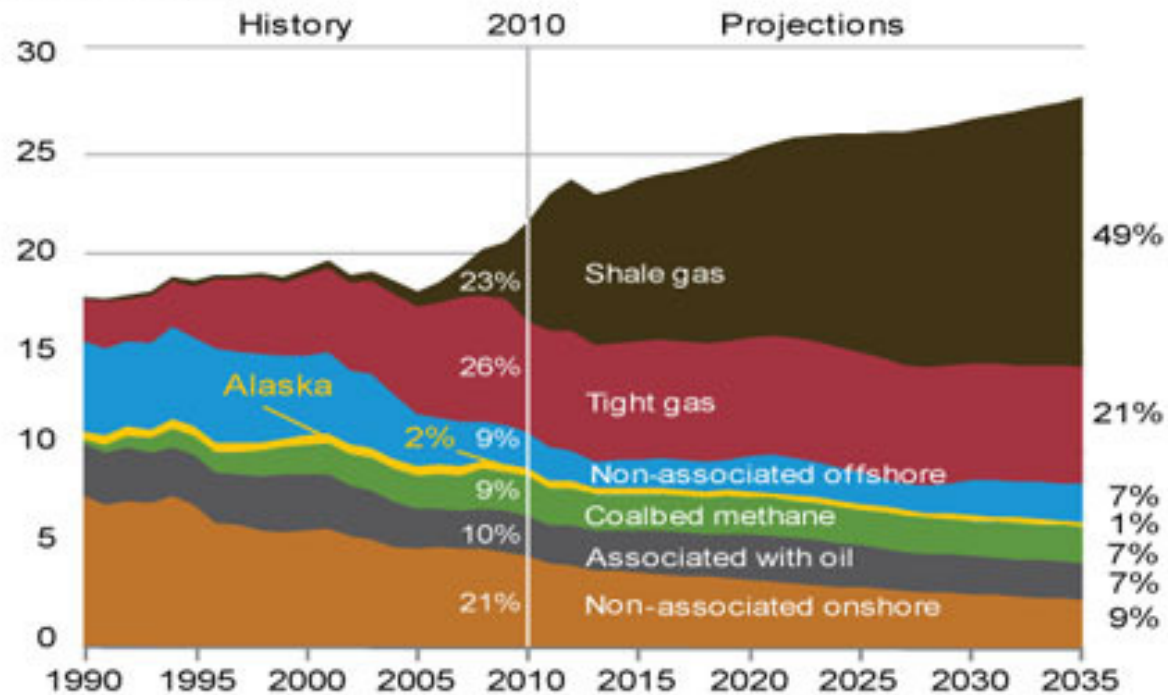
Petroleum Imports



U.S. Natural Gas Production

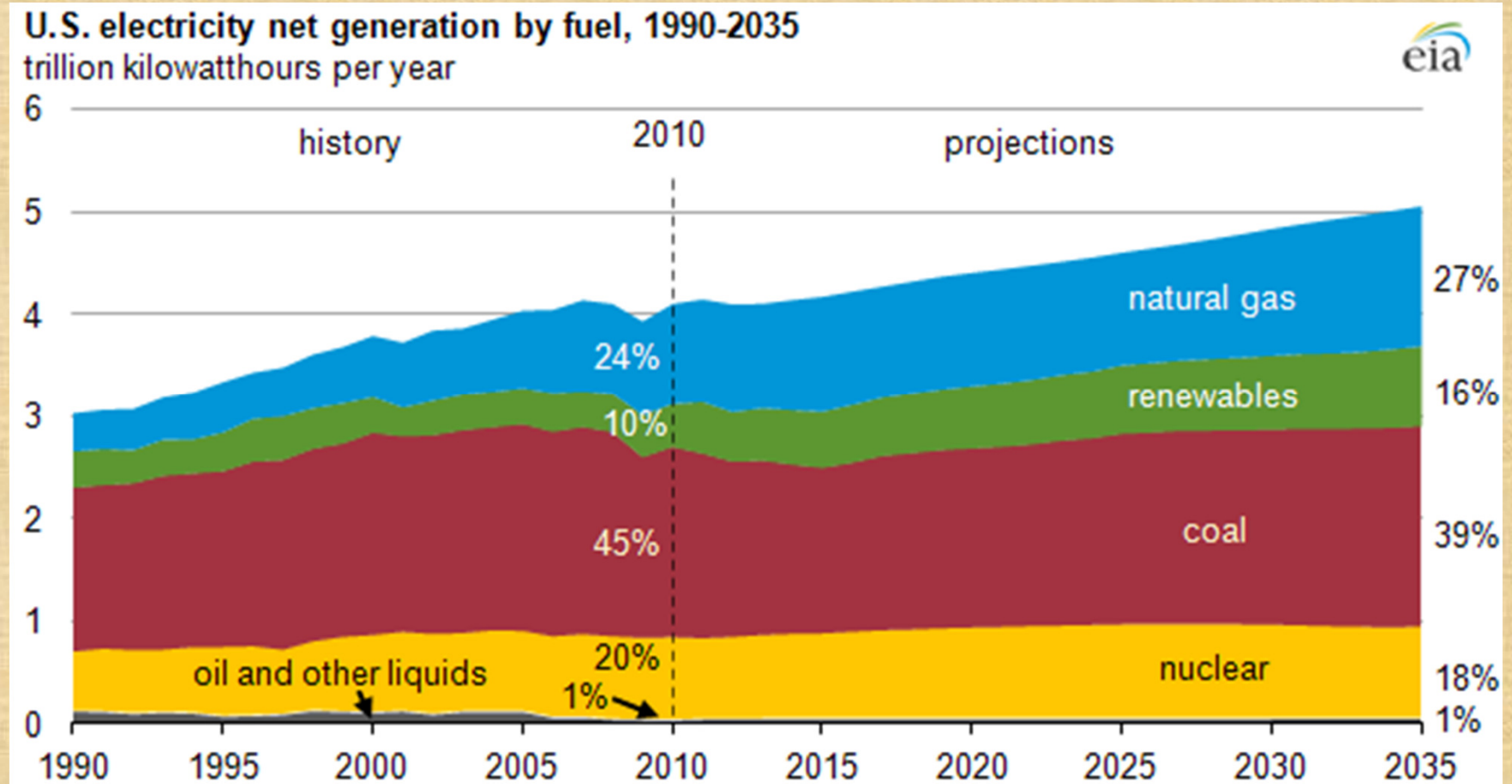
U.S. Natural Gas Production, 1990-2035

trillion cubic feet

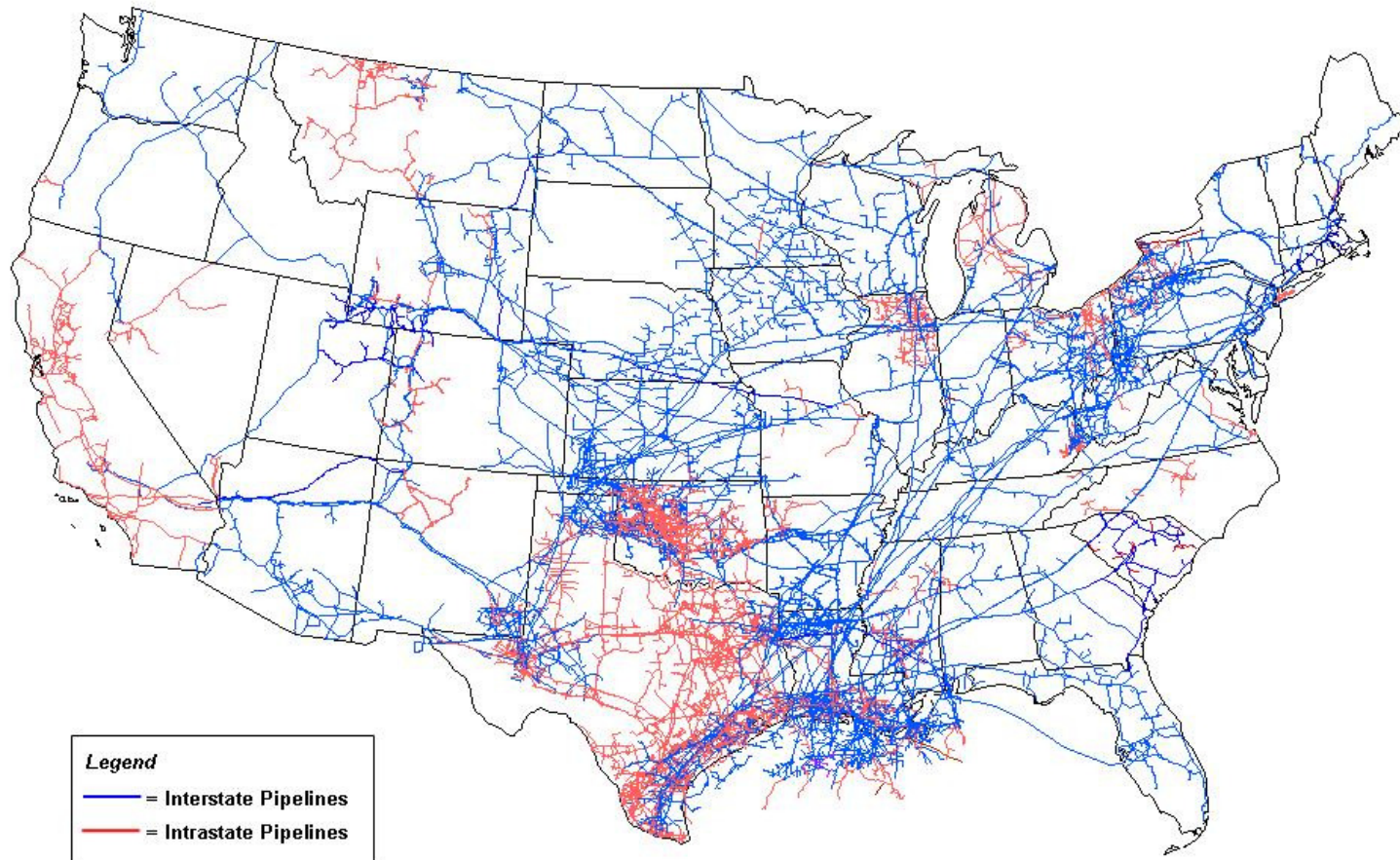


Source: U.S. Energy Information Administration, AEO2012
Early Release Overview, January 23, 2012.

Fuel Source for Electricity

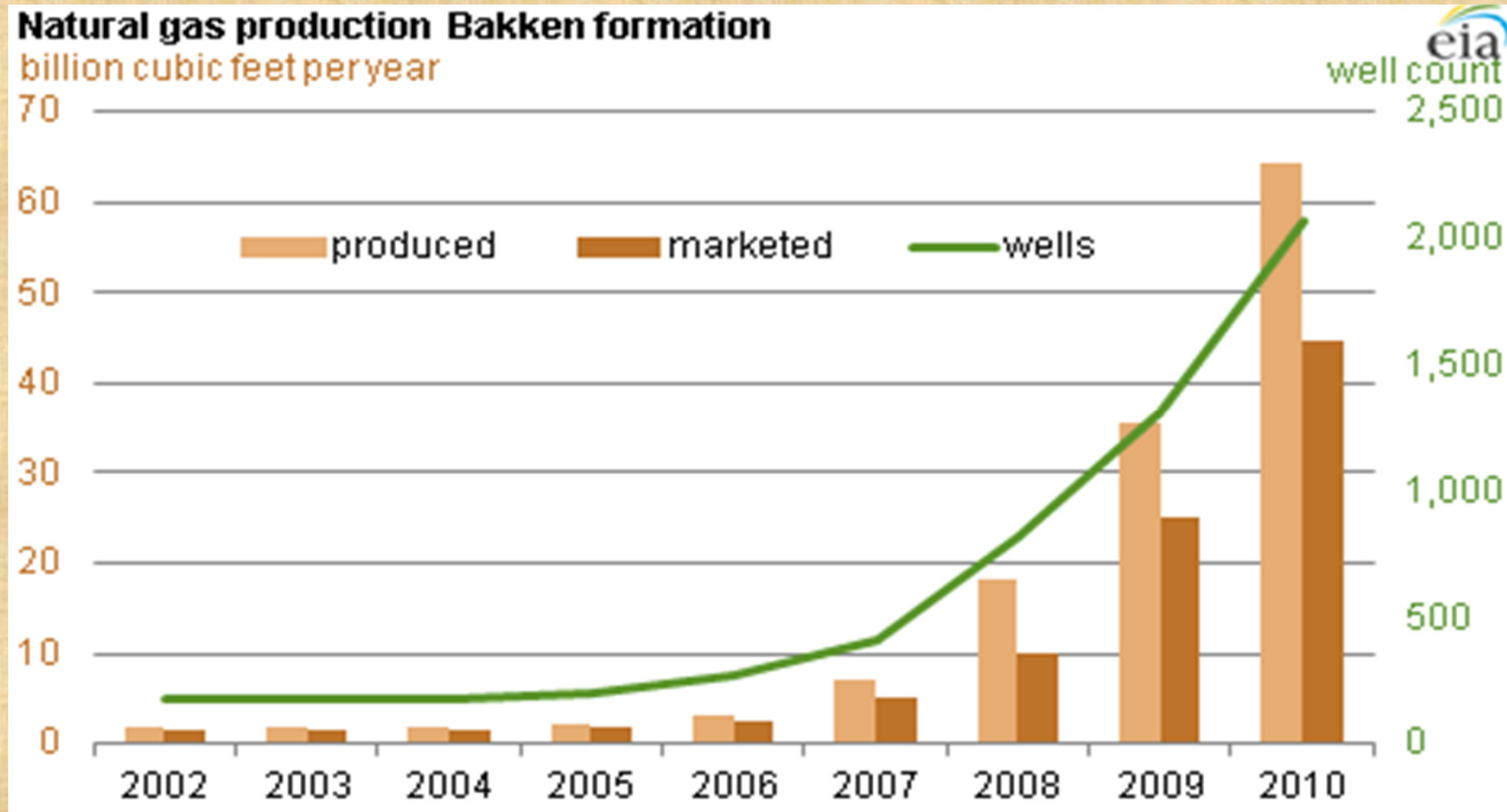


Natural Gas Pipeline Network



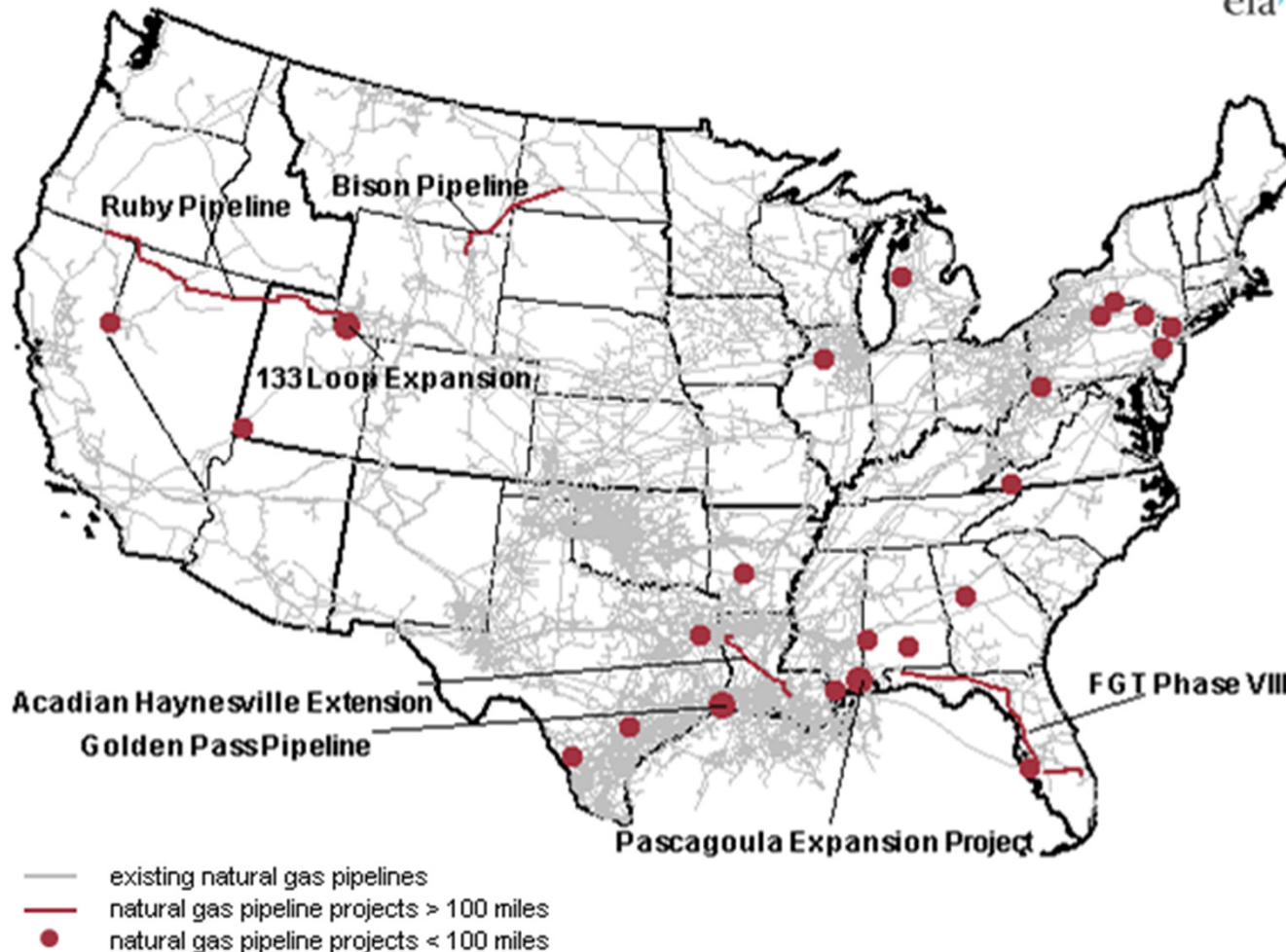
Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

Bakken Natural Gas Production

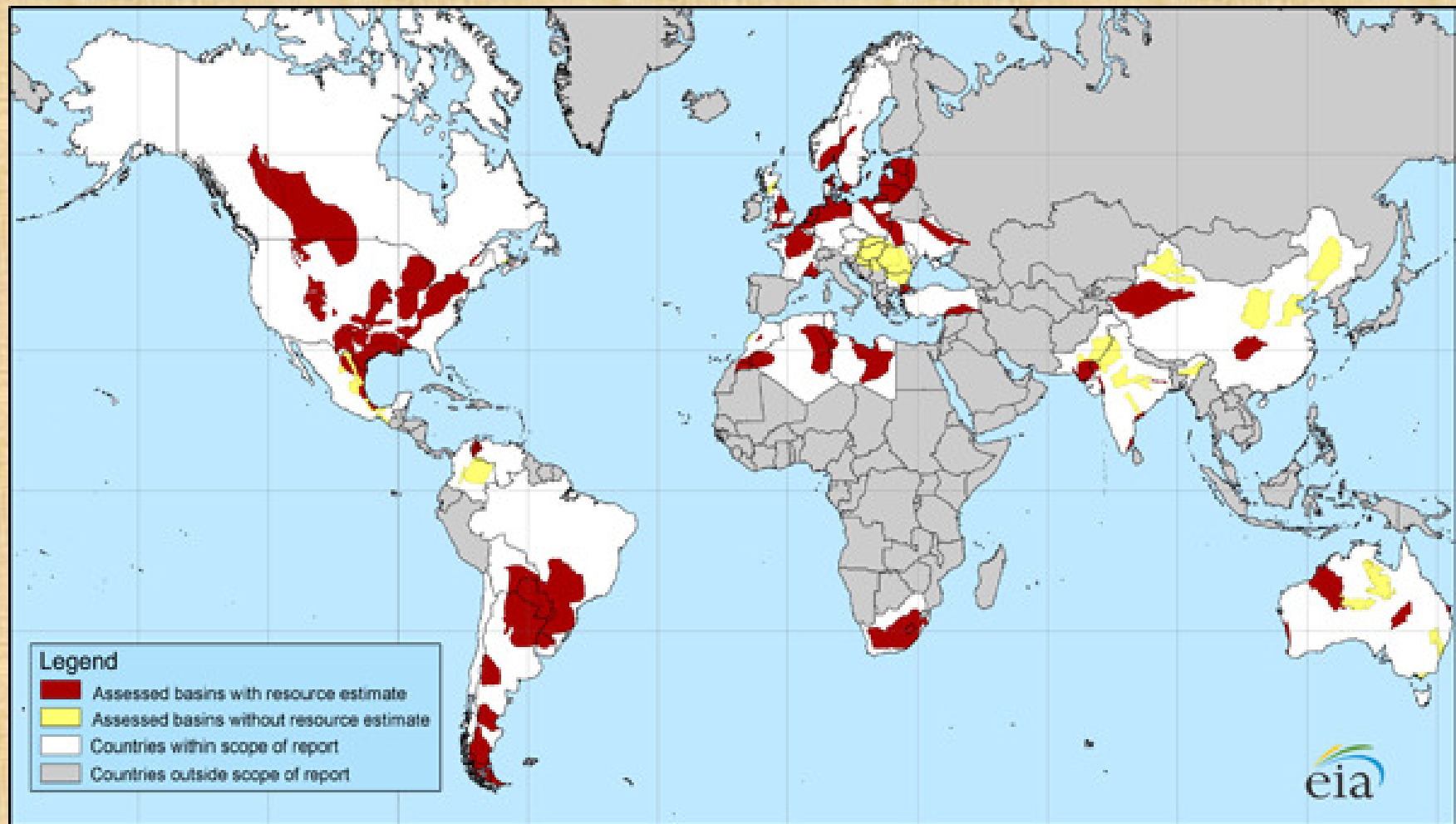


2011 Natural Gas Pipeline Additions

Natural gas pipeline capacity expansions, 2011



Global Shale Basins





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