

# The Domino Effect



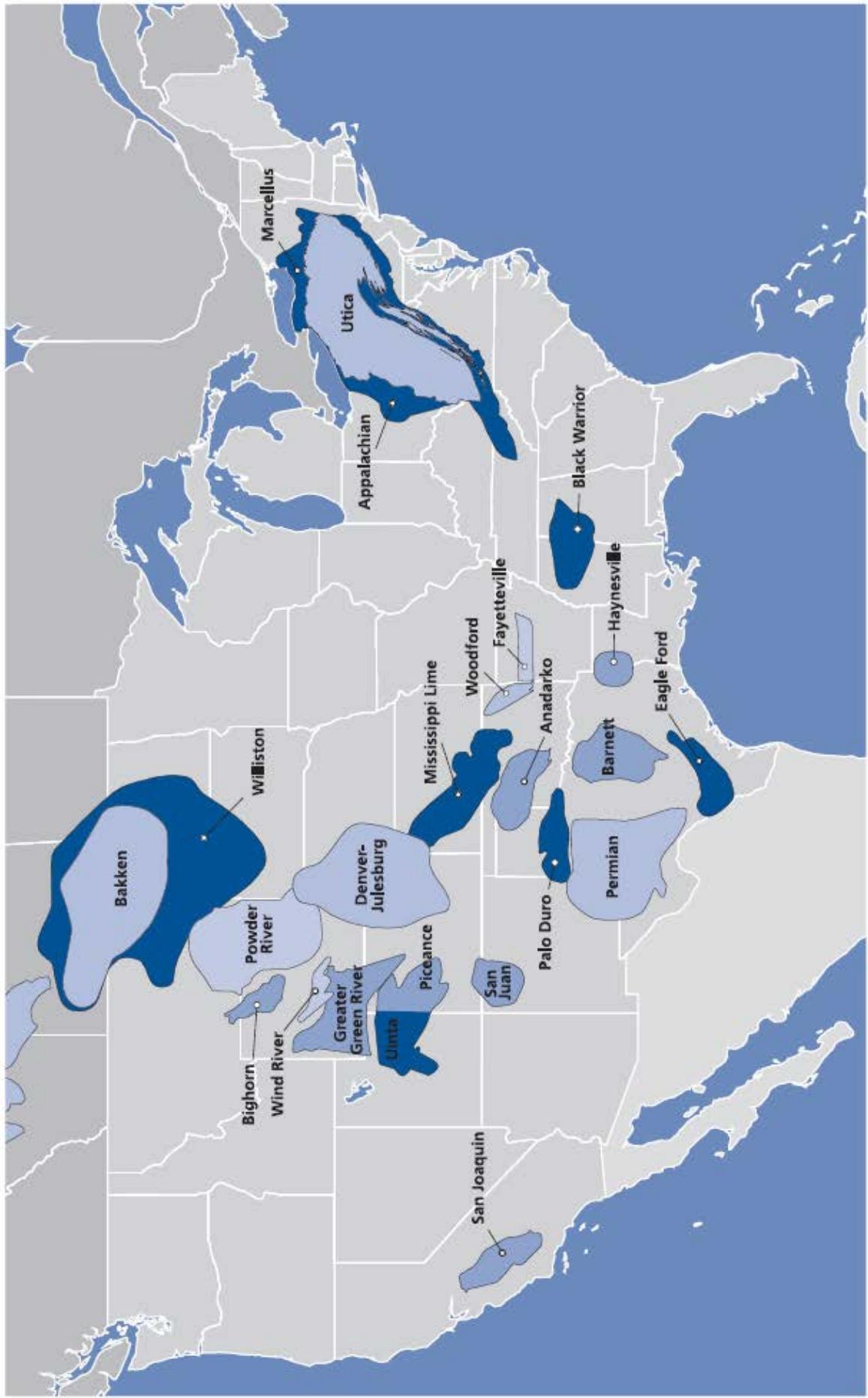
**How the Shale Revolution Is  
Transforming Energy Markets,  
Industries, and Economies**

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**E. Russell Braziel**

Figures and Tables to Support  
the Audio Version of the Book



U.S. Drill-Bit-Hydrocarbon-Producing Basins

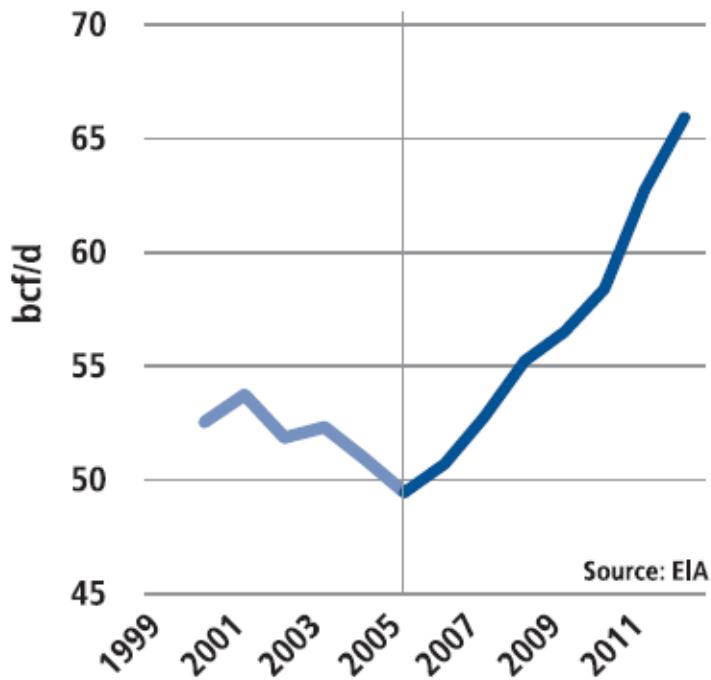


Figure 2.1. Natural gas production

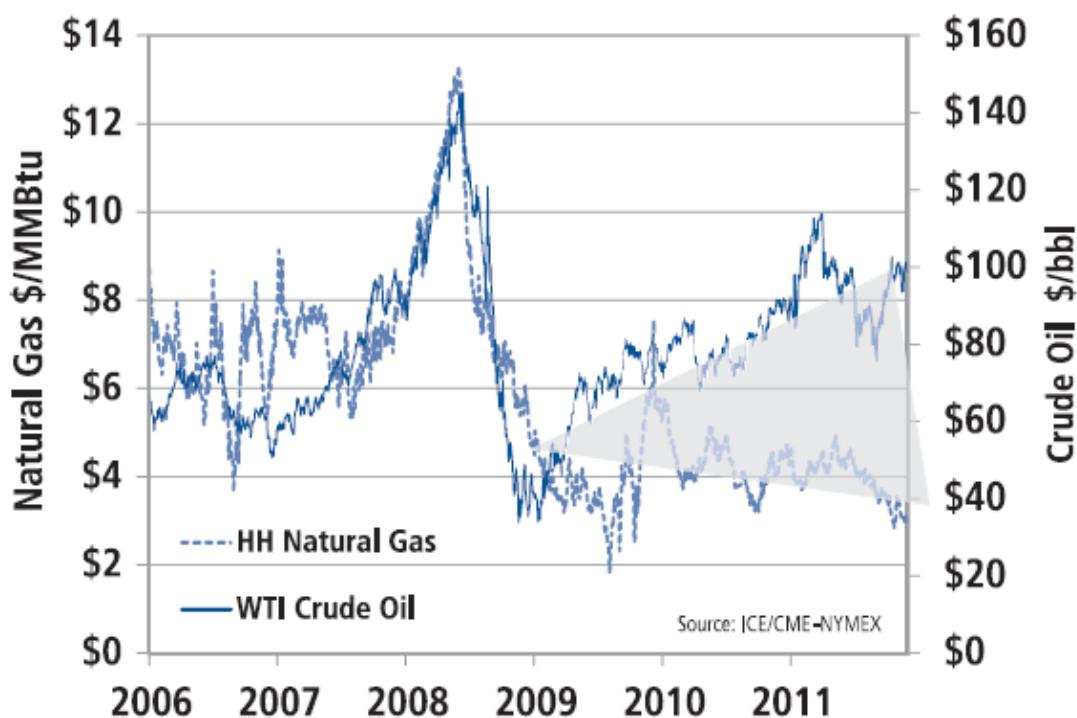


Figure 2.2. The Great Divide

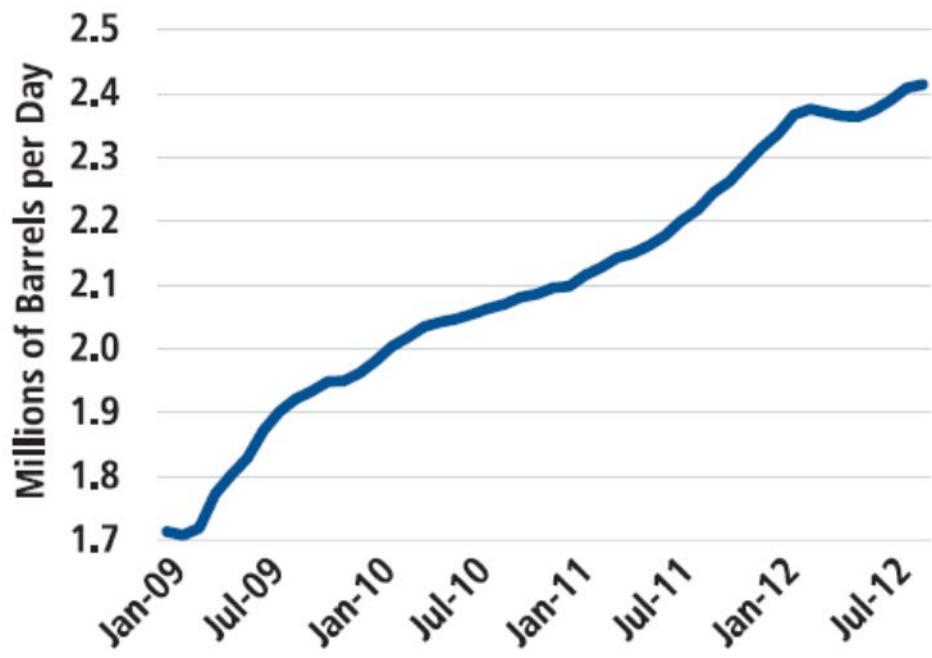


Figure 3.1. U.S. NGL production 2009–2012



Figure 3.2. The frac spread

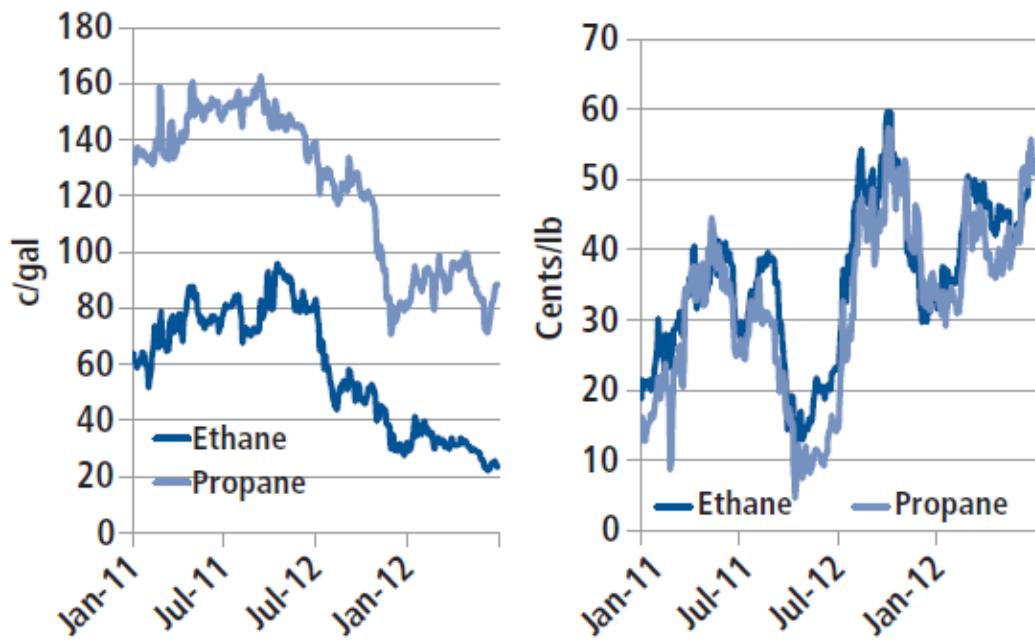


Figure 3.3. Light NGL prices (left), ethylene margins (right)



Figure 3.4. U.S. crude oil production

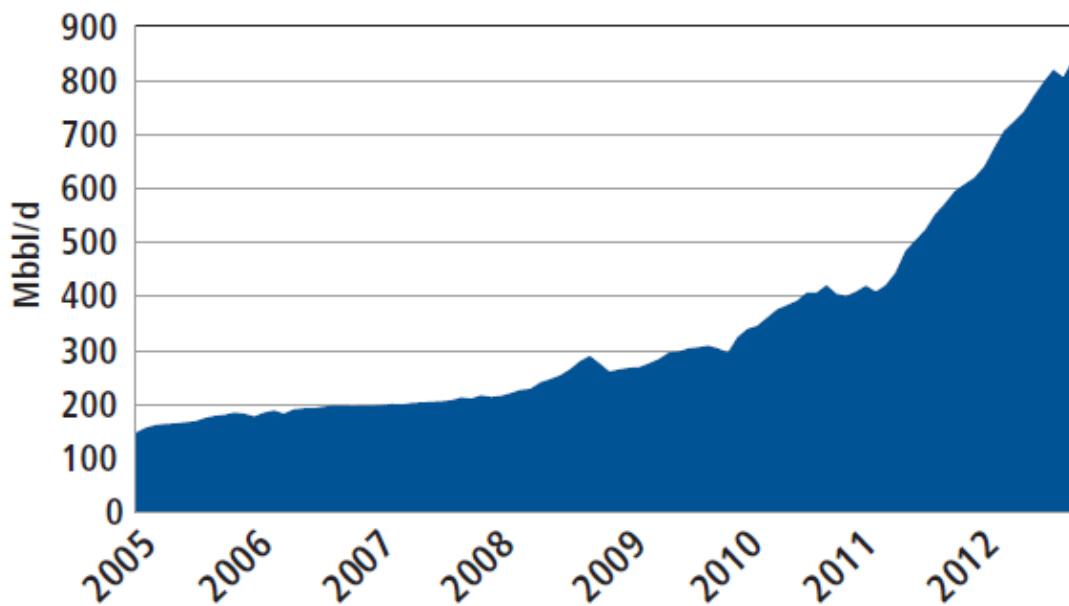


Figure 3.5. Bakken (Williston) production

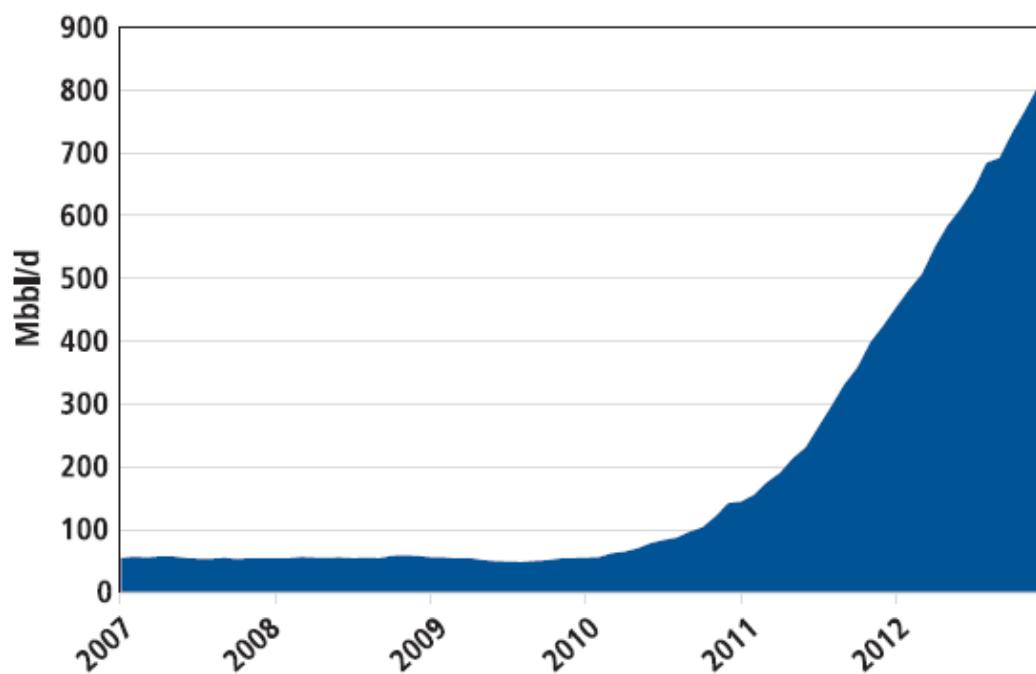


Figure 3.6. Eagle Ford production

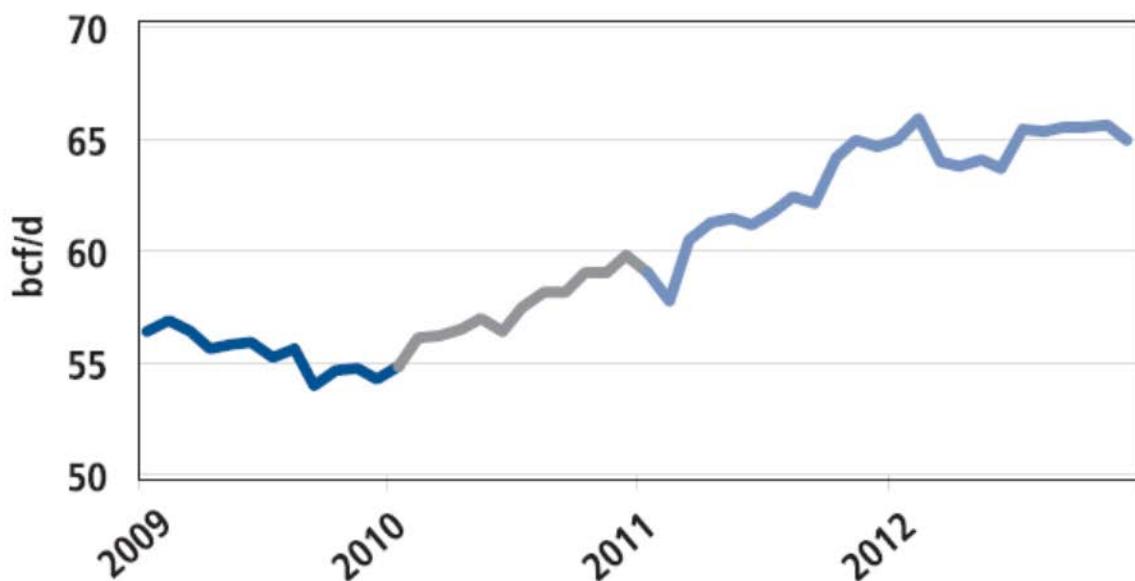


Figure 3.7. Lower 48 dry (residue) gas production

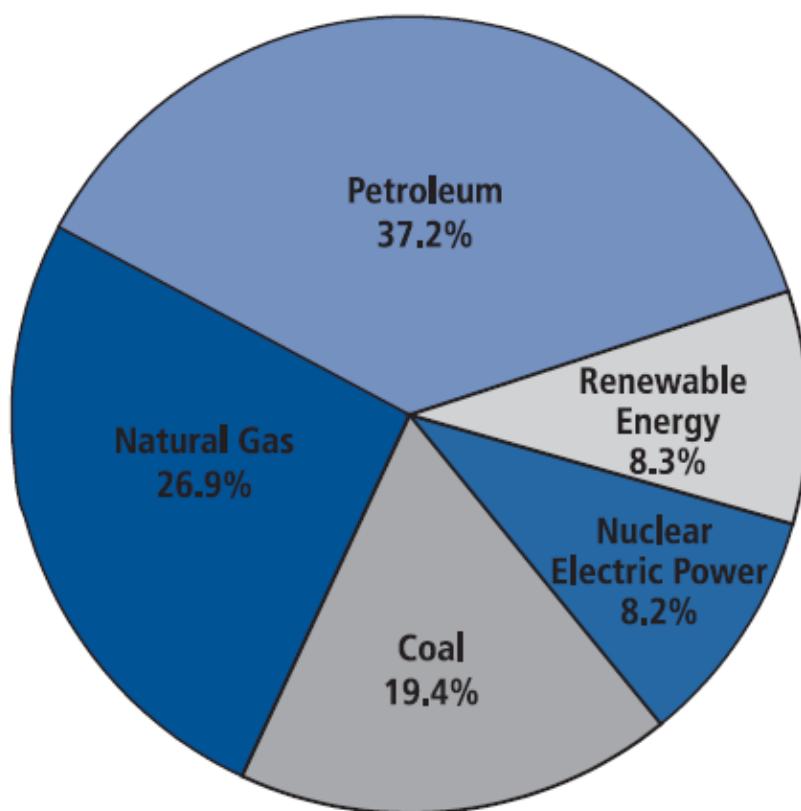


Figure 4.1. 2014 U.S. Energy Consumption by Source, 97 Quadrillion Btu. Source: EIA Annual Energy Outlook 2014



**Figure 4.2.** Photo credit: Fishtail Bits and Roughnecks ©Story Sloane, [www.sloanegallery.com](http://www.sloanegallery.com)



**Figure 4.3.** Photo credit: Sharp-Hughes Rock Bit (<http://aoghs.org/this-week-in-petroleum-history/oil-history-august-5>).

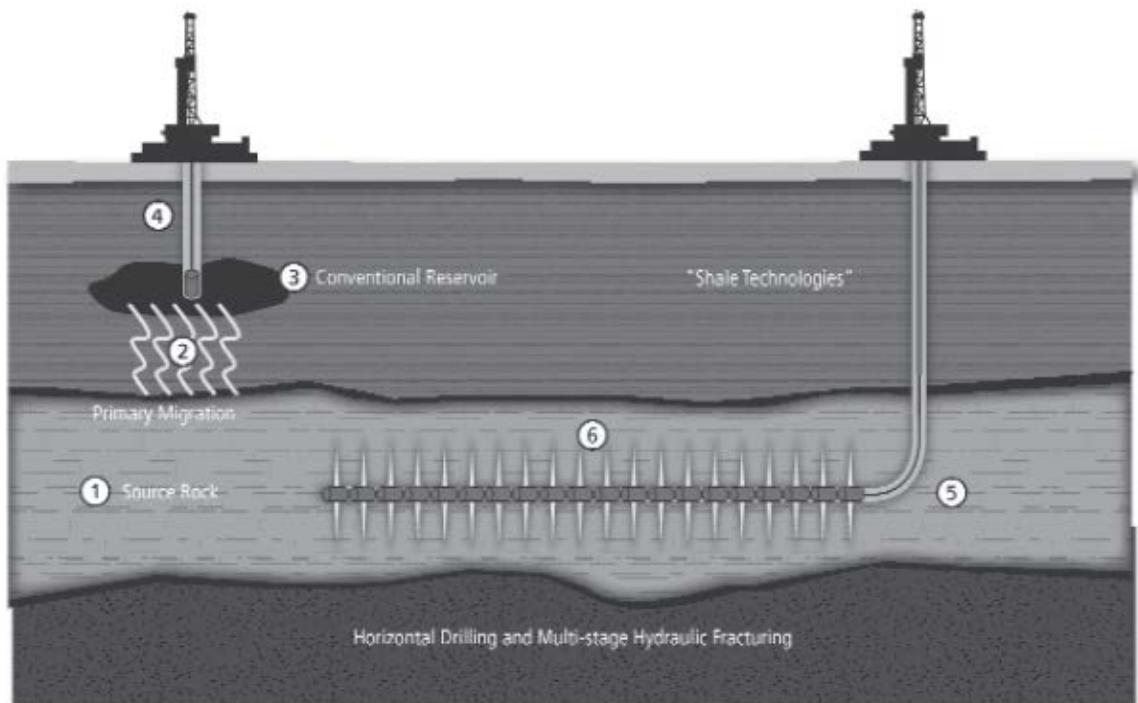


Figure 4.4. Horizontal drilling and multi-stage hydraulic fracturing

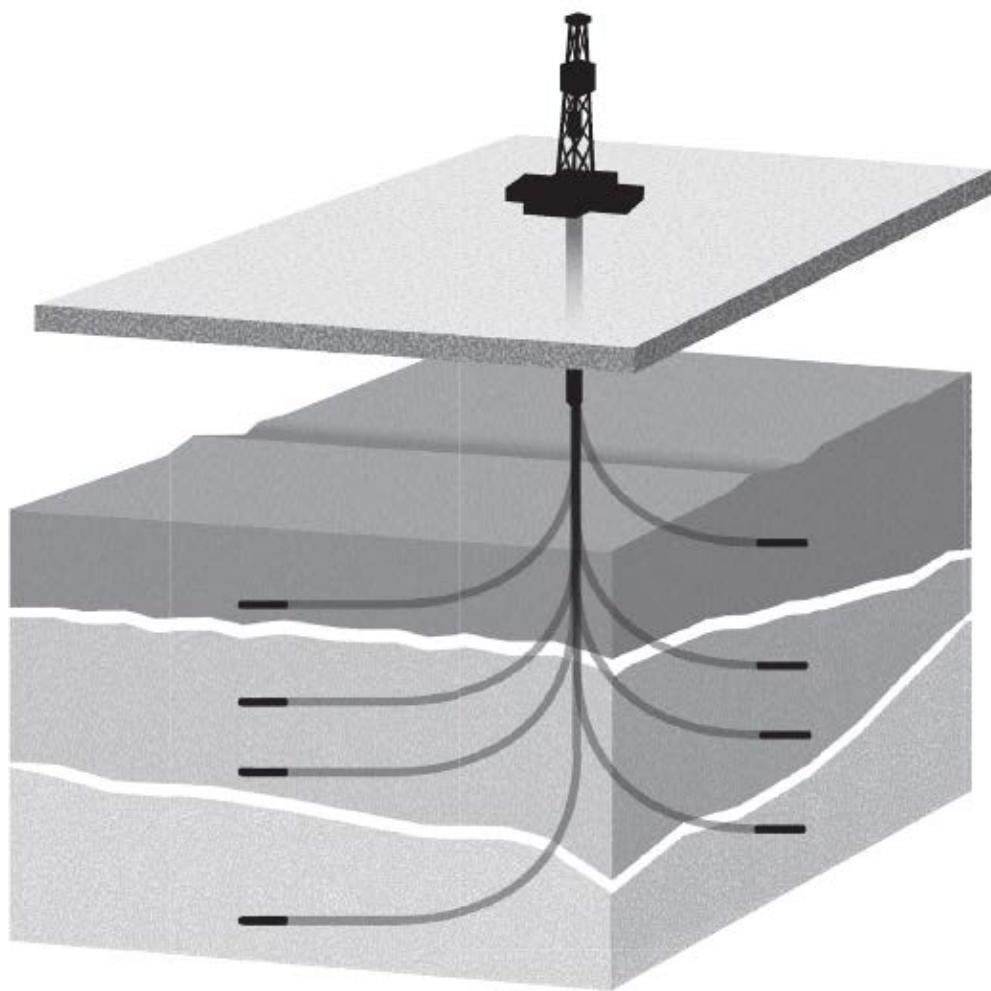


Figure 4.5. Pad drilling

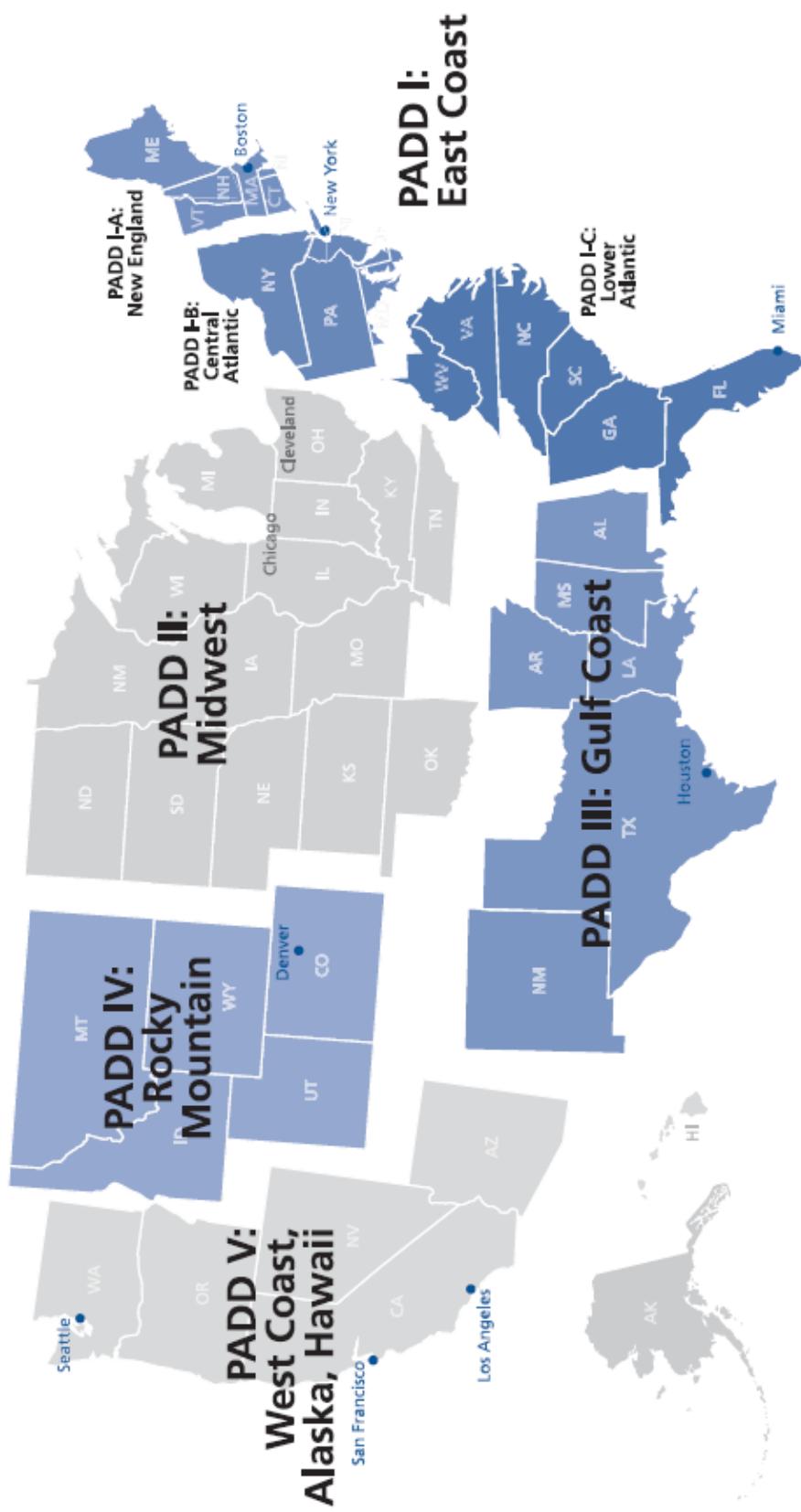


Figure II.1. Petroleum Administration for Defense Districts

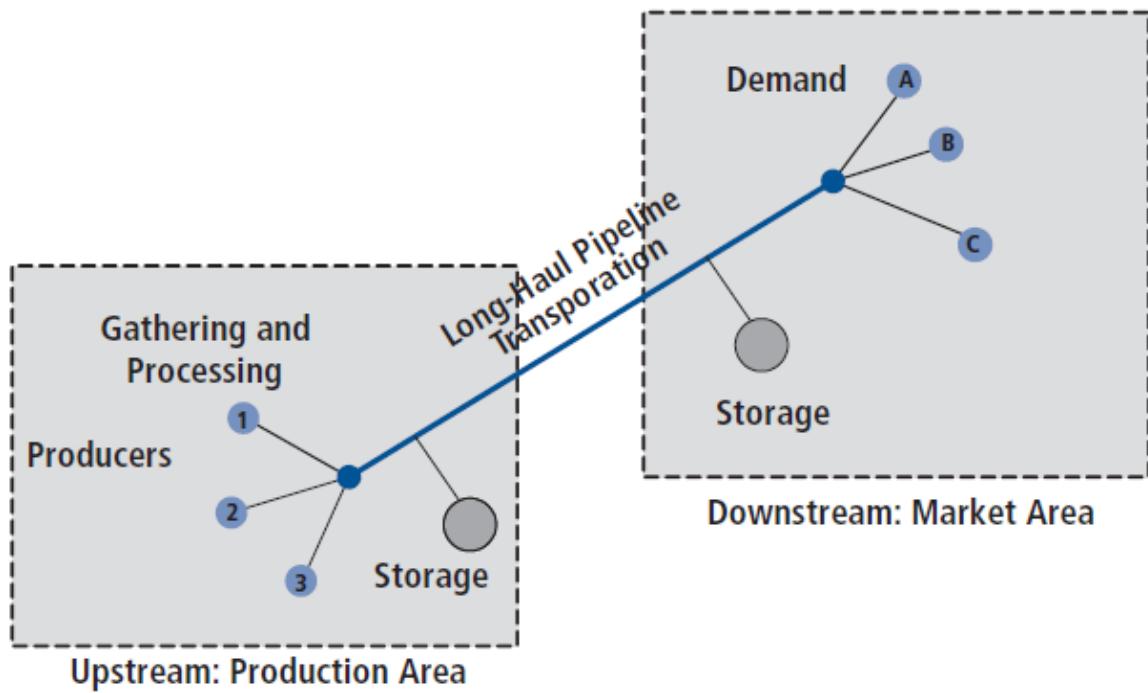


Figure 5.1. Natural gas pipeline network

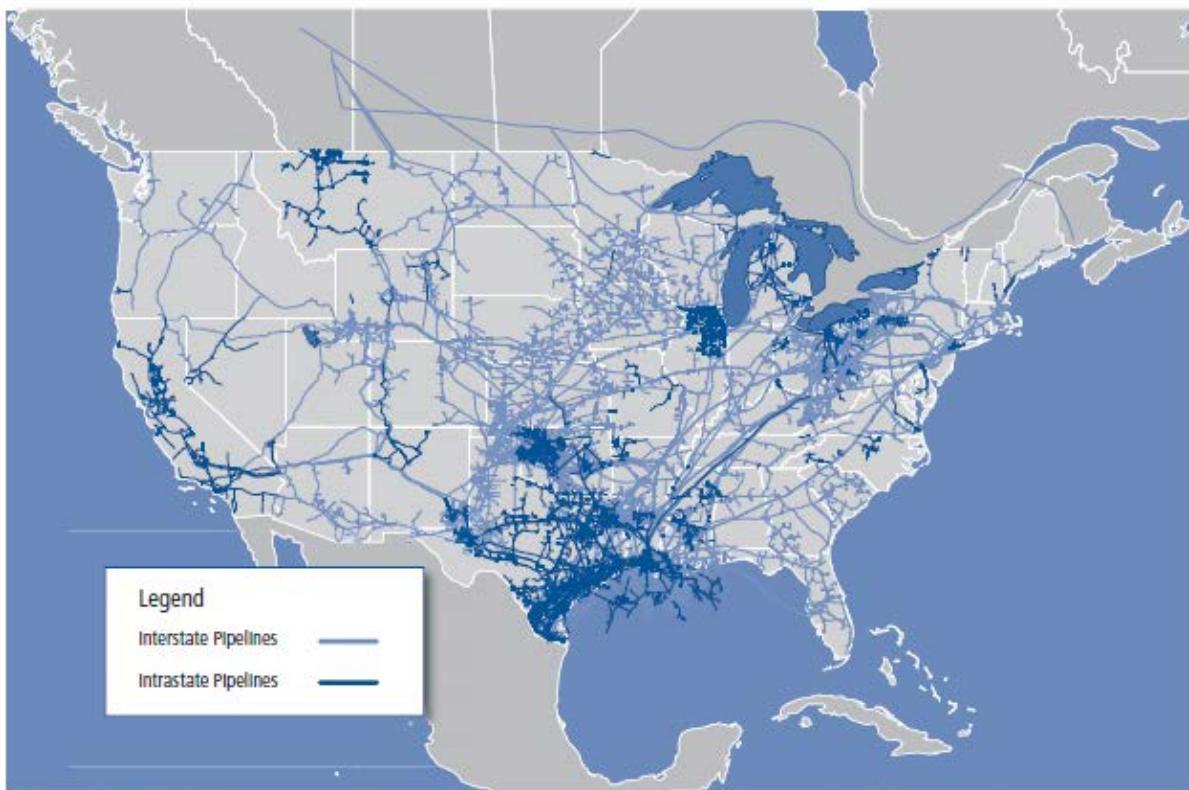
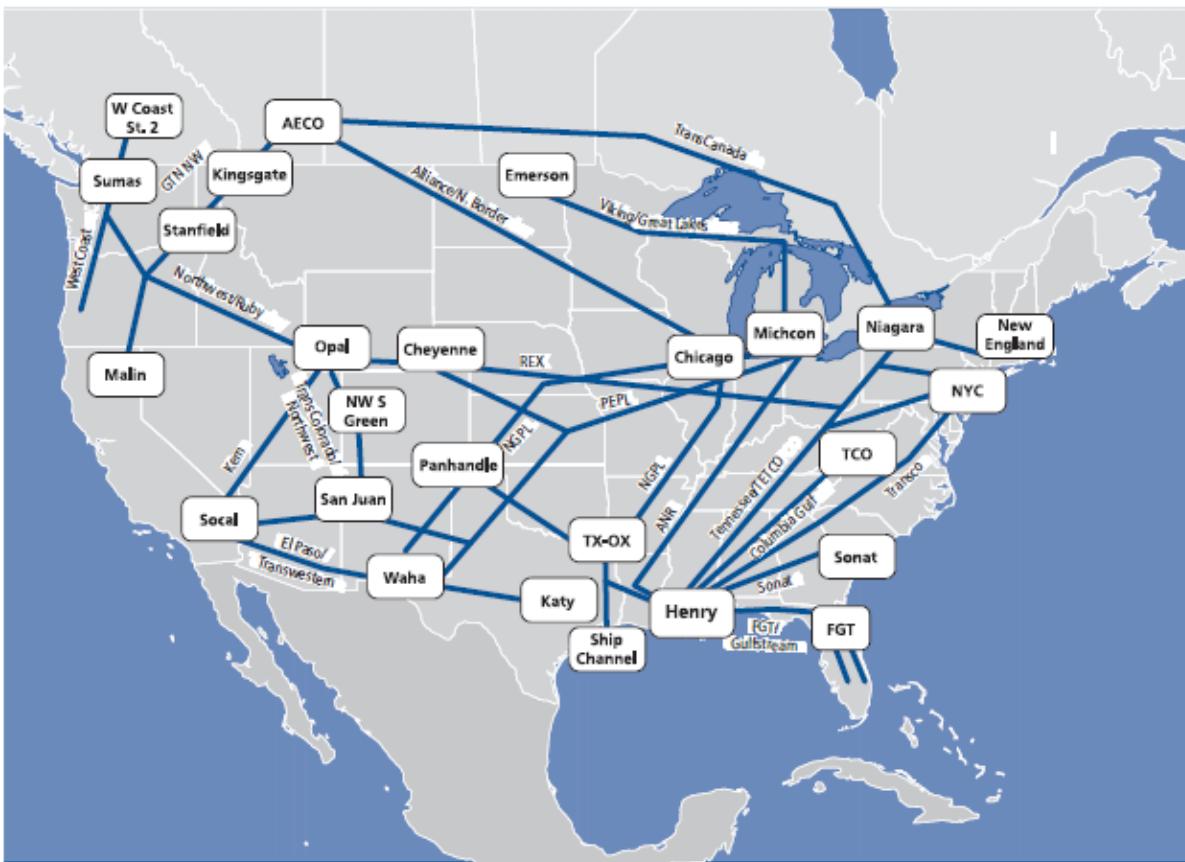
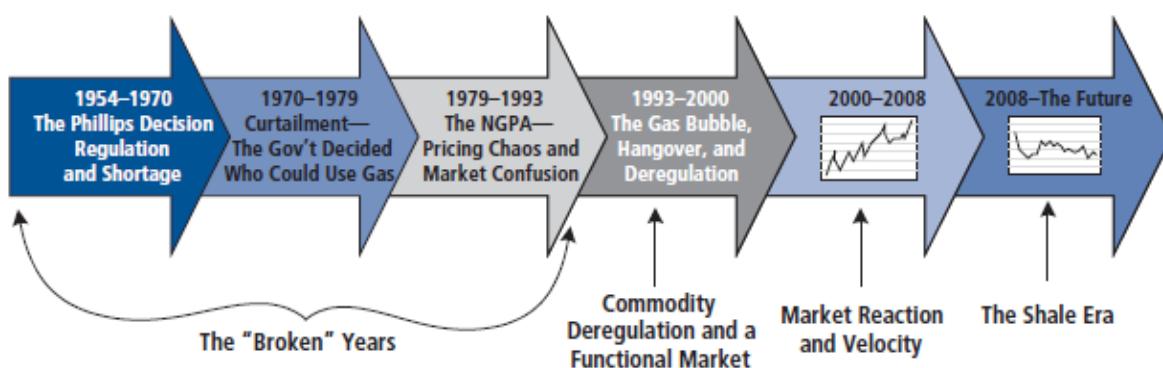


Figure 5.2. U.S. natural gas transmission pipelines



**Figure 5.3.** Natural gas hubs



**Figure 5.4.** Six periods of regulatory and market evolution

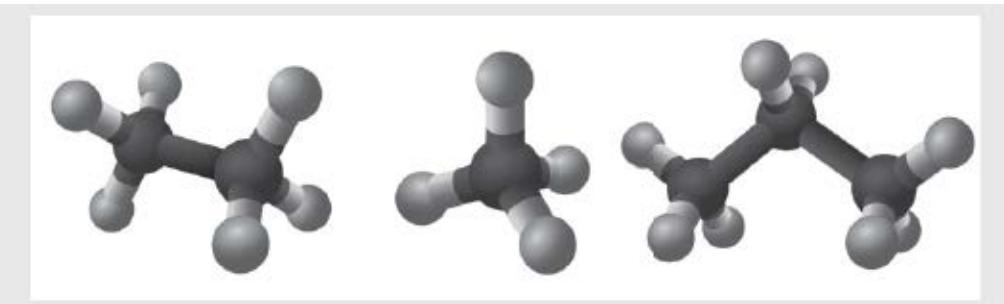


Figure 6.1. Ethane, Methane, and Propane

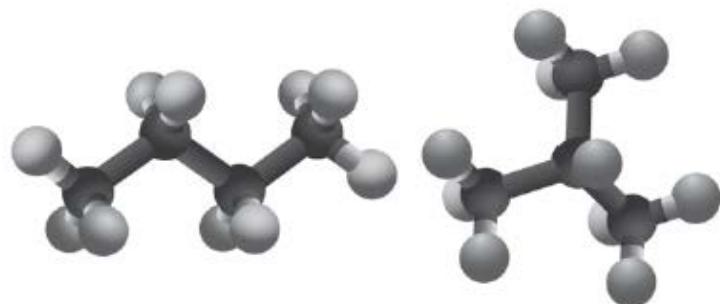


Figure 6.2. Normal Butane and Isobutane

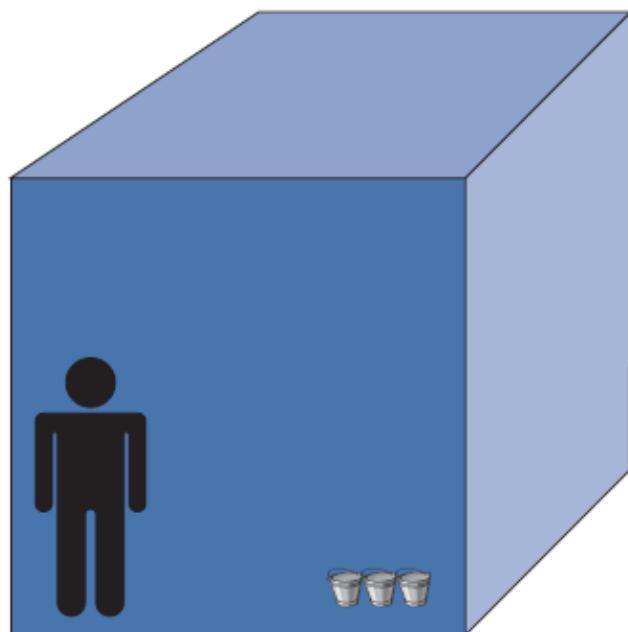


Figure 6.3. Visualizing gallons per Mcf

	Lean (Dry)	Rich (Wet)	Very Rich (Very Wet)
Btu	<1,050	1,050–1,400	>1,400
GPM	1–2	3–4	>4
Processing	Unlikely	Likely	Required

Table 6.1. Btu and GPM

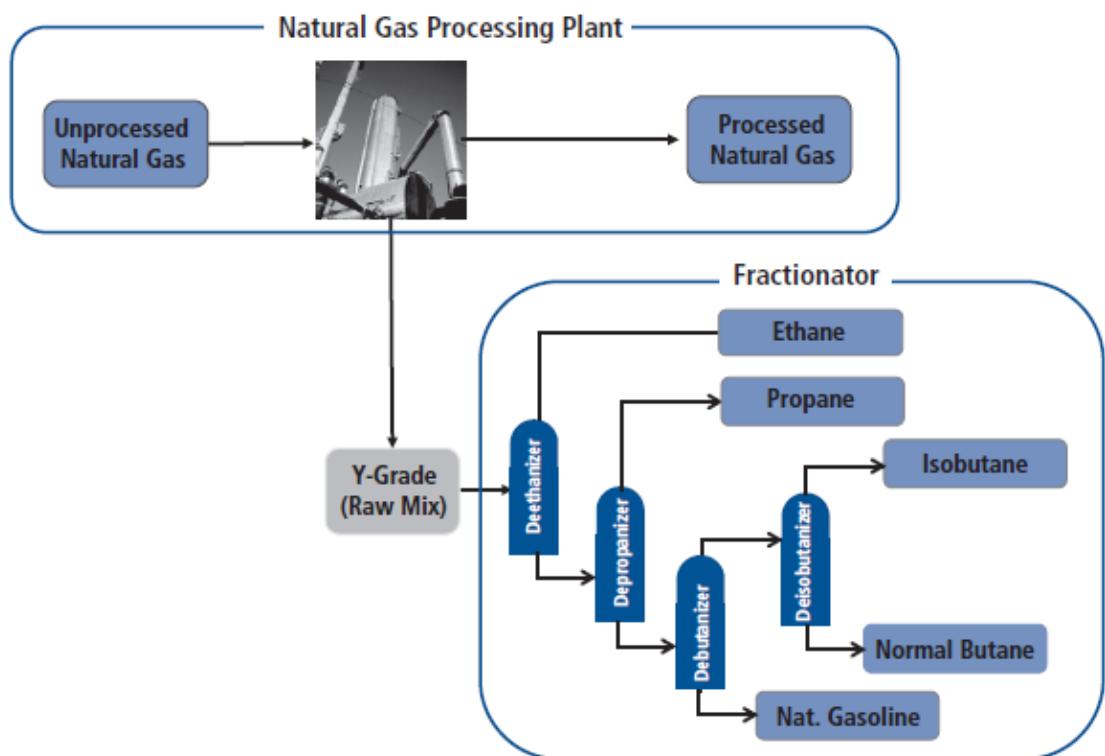


Figure 6.4. The processing of natural gas

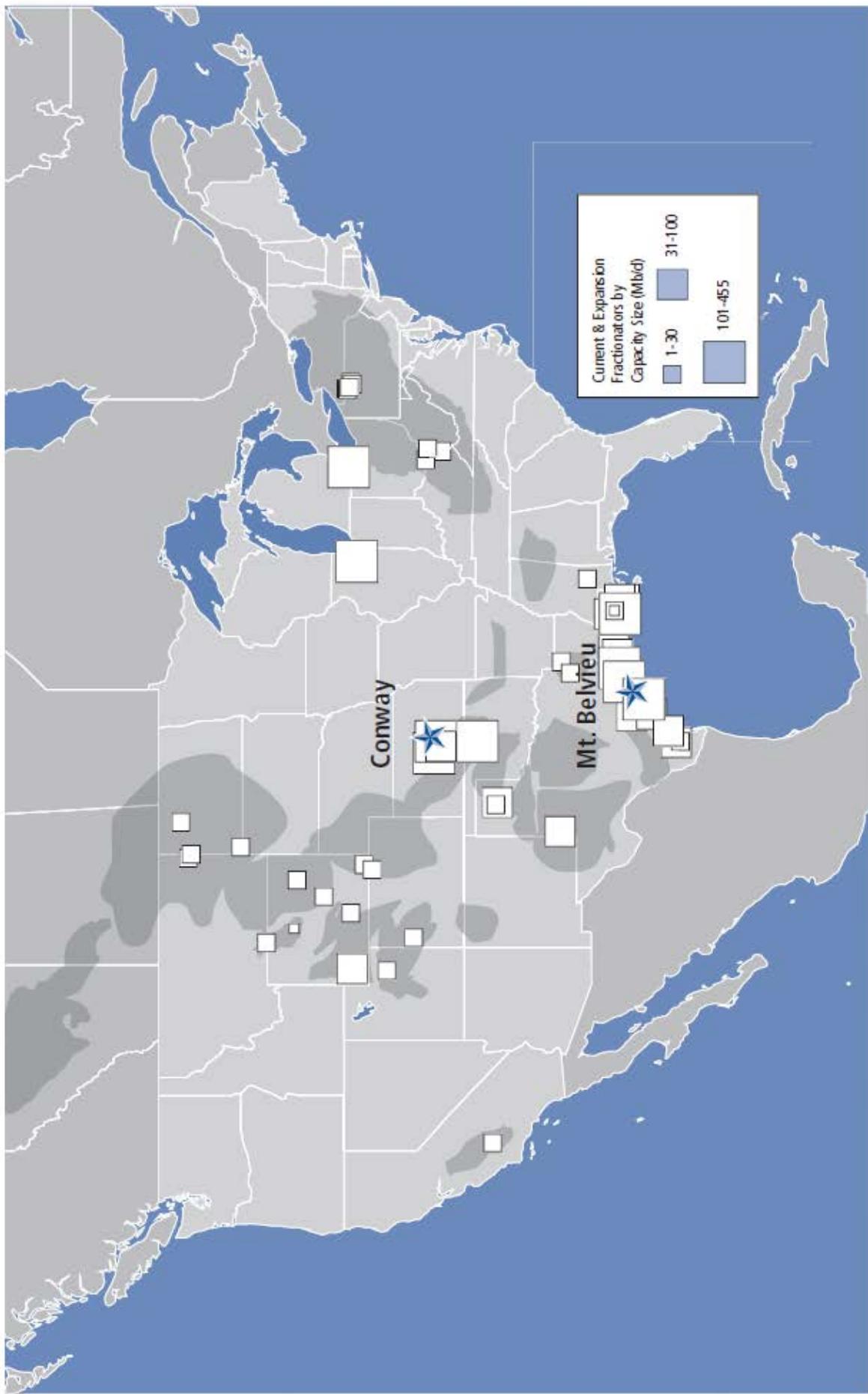


Figure 6.5. Location of fractionators



Figure 6.6. Major pipeline systems in North America

Regional Company	Becomes	Which Is Now...
New Jersey	Humble, later Exxon	Exxon Mobil
New York	Mobil	Exxon Mobil
Atlantic	ARCO	BP
Ohio	Sohio	BP
Indiana	Amoco	BP
Continental	Conoco	ConocoPhillips
California	Chevron	Chevron

Table 7.1. Pieces of Standard Oil today

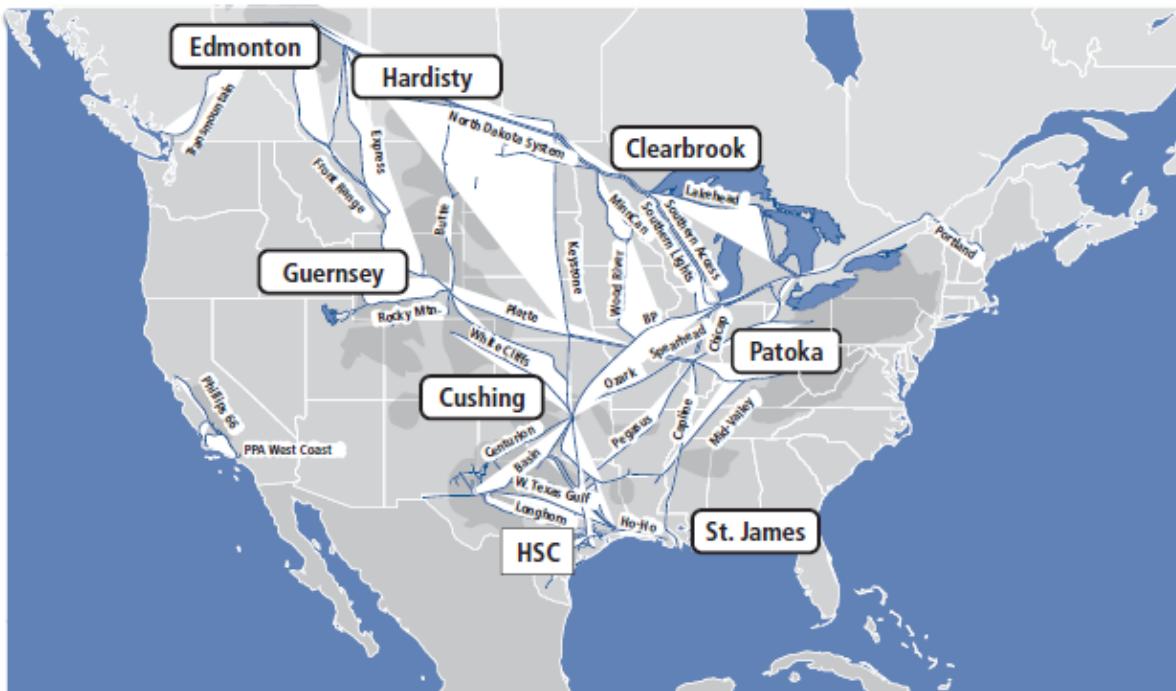


Figure 7.1. Crude oil shipping hubs

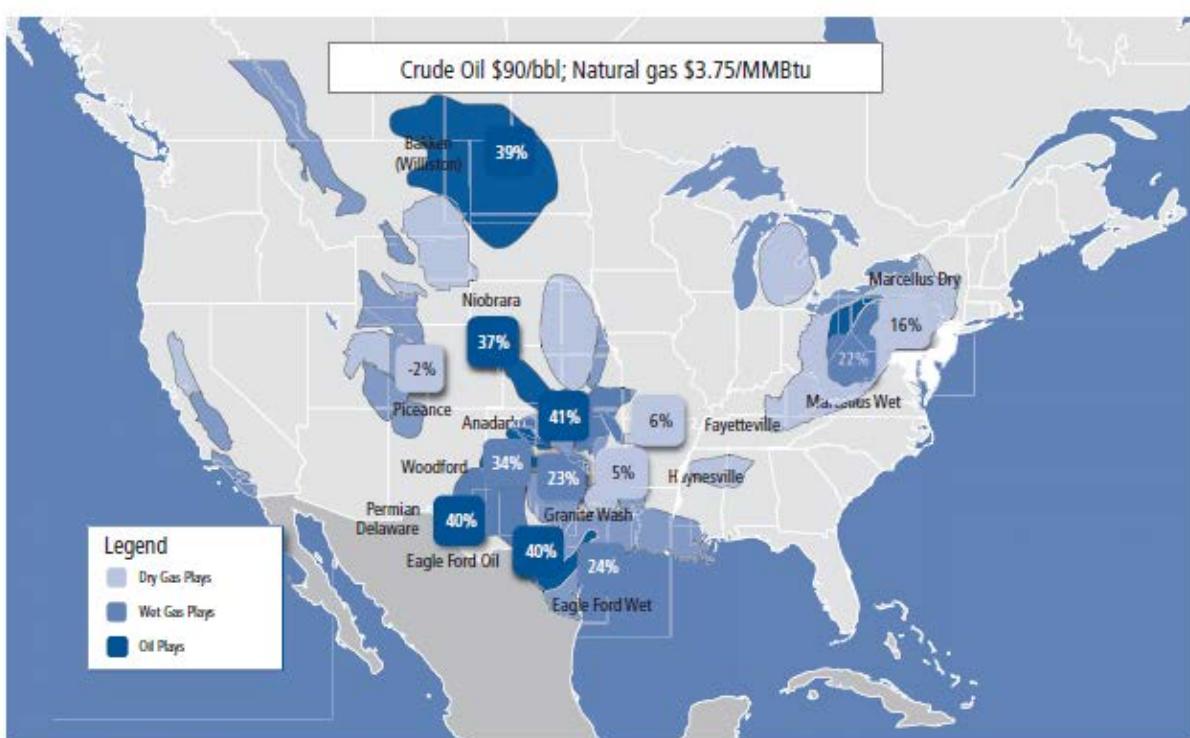


Figure 8.1. Rates of return for shale oil plays

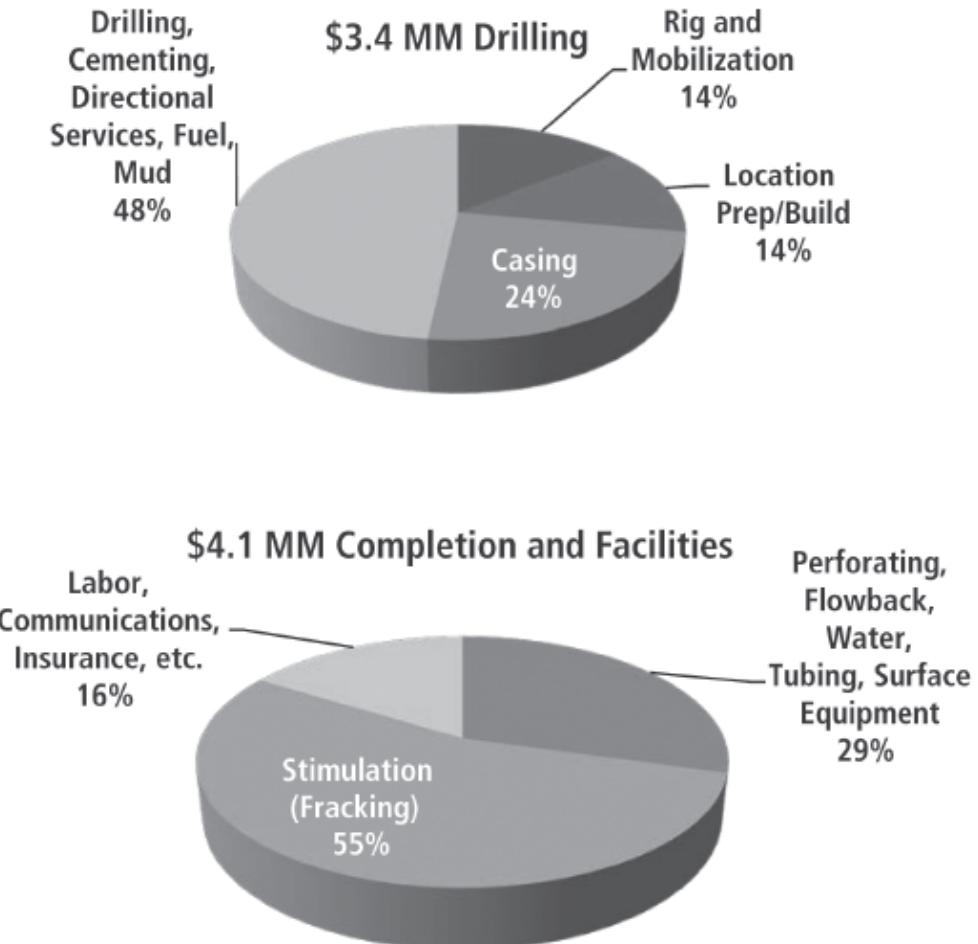


Figure 9.1. Breakdown of horizontal Wolfcamp representative well costs

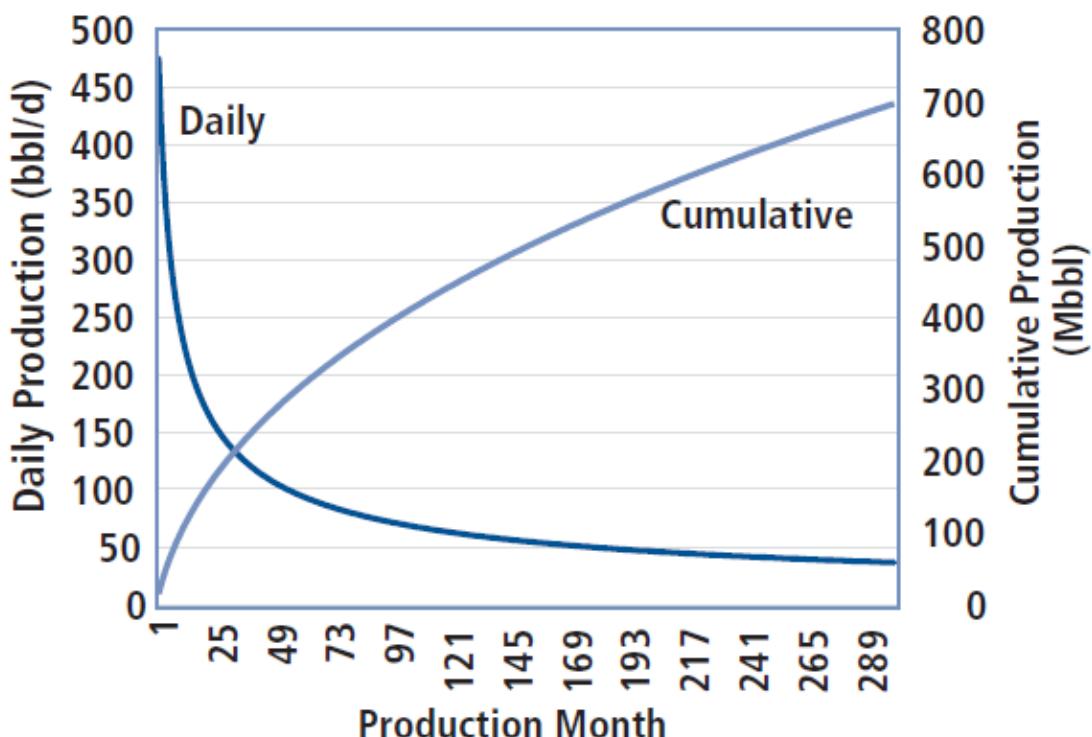


Figure 9.2. Daily oil production curve and cumulative production curve

Month	0	12	24	36	48	60
Annual Decline	55%	30%	20%	15%	10%	9%
Annual Production bbl/d	475	212	152	123	105	93
Cumulative Production MMbbl	14	120	183	232	273	309

Table 9.1. Declining Production

	Well Cost in the Millions	IP Rate in BOE per day	Price in BOE
High	>\$8	>900	>\$70
Medium	\$3–8	200–900	\$50–\$70
Low	<\$3	<200	<\$50

Table 10.1. Arbitrary grading scale

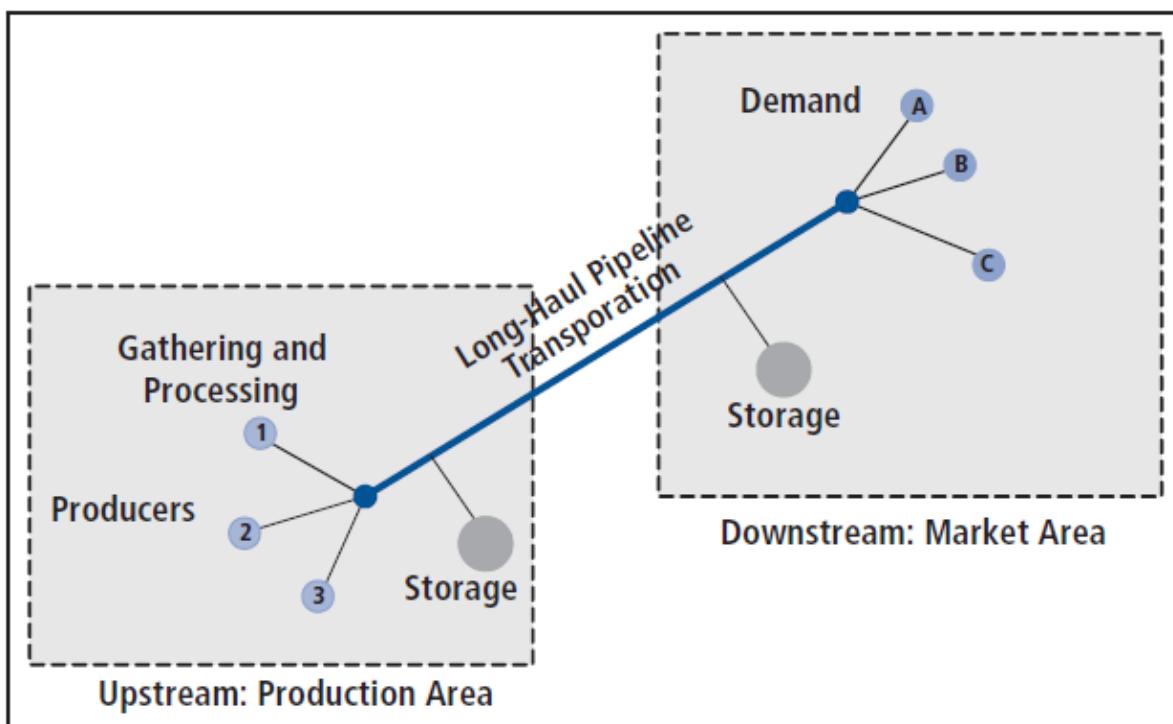
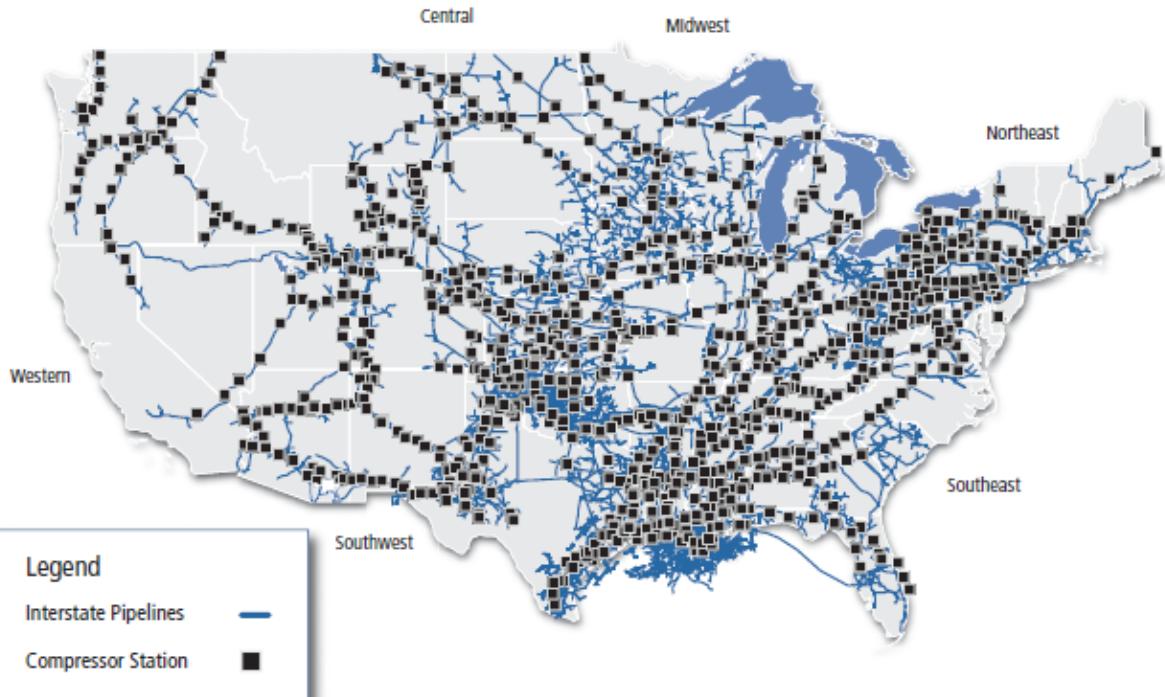


Figure 12.1. Natural gas network



**Figure 12.2.** Natural gas pipeline compressor stations on interstate pipelines.  
Source: EIA



**Figure 12.3.** © Abdelmajidfahim | Dreamstime.com, Pipeline Pig Cleaner Photo

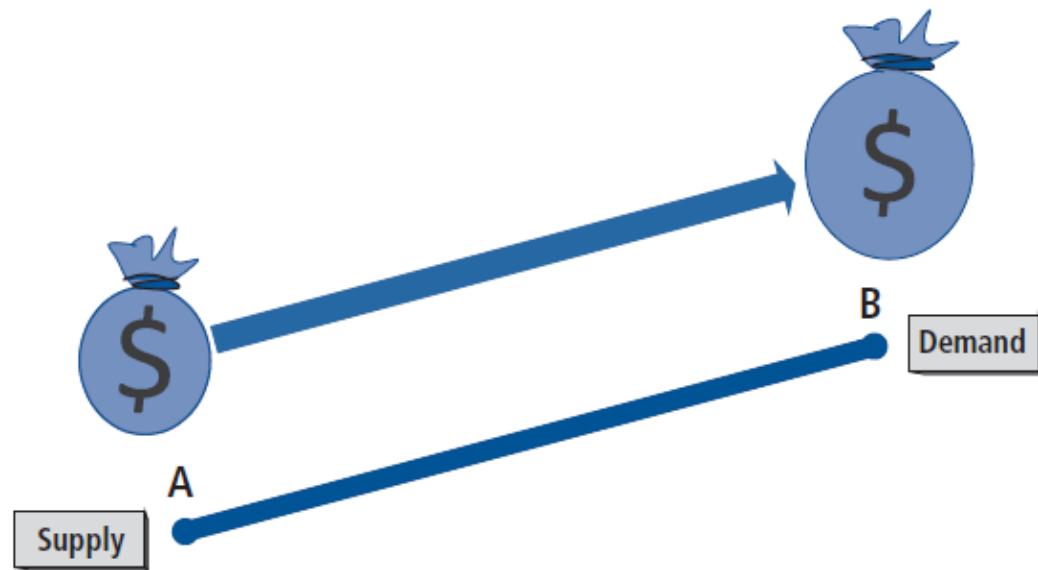


Figure 13.1. Understanding gas price differential

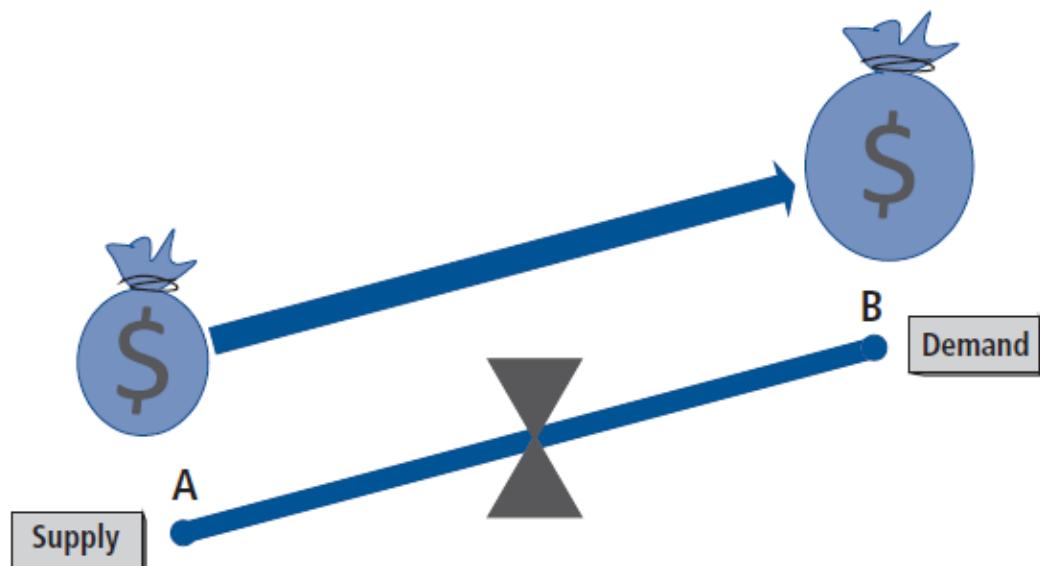


Figure 13.2. Impact of a capacity constraint

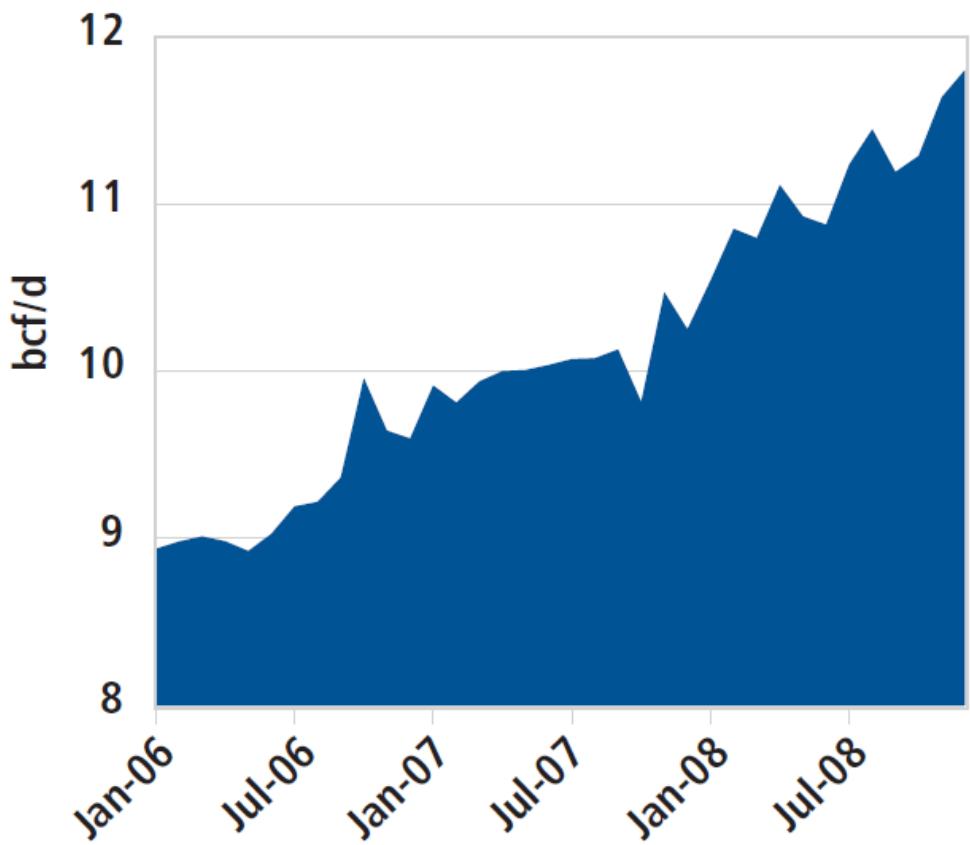


Figure 14.1. Rockies natural gas production

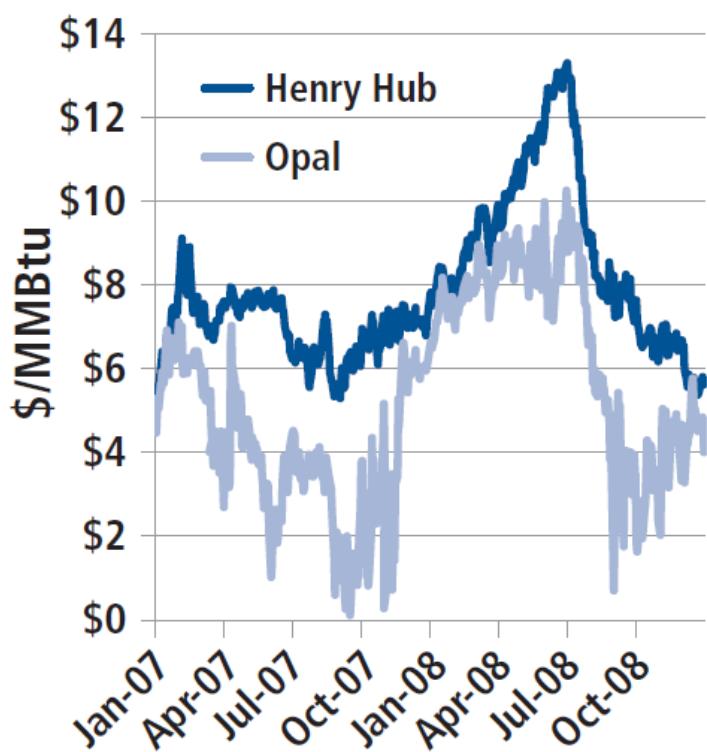
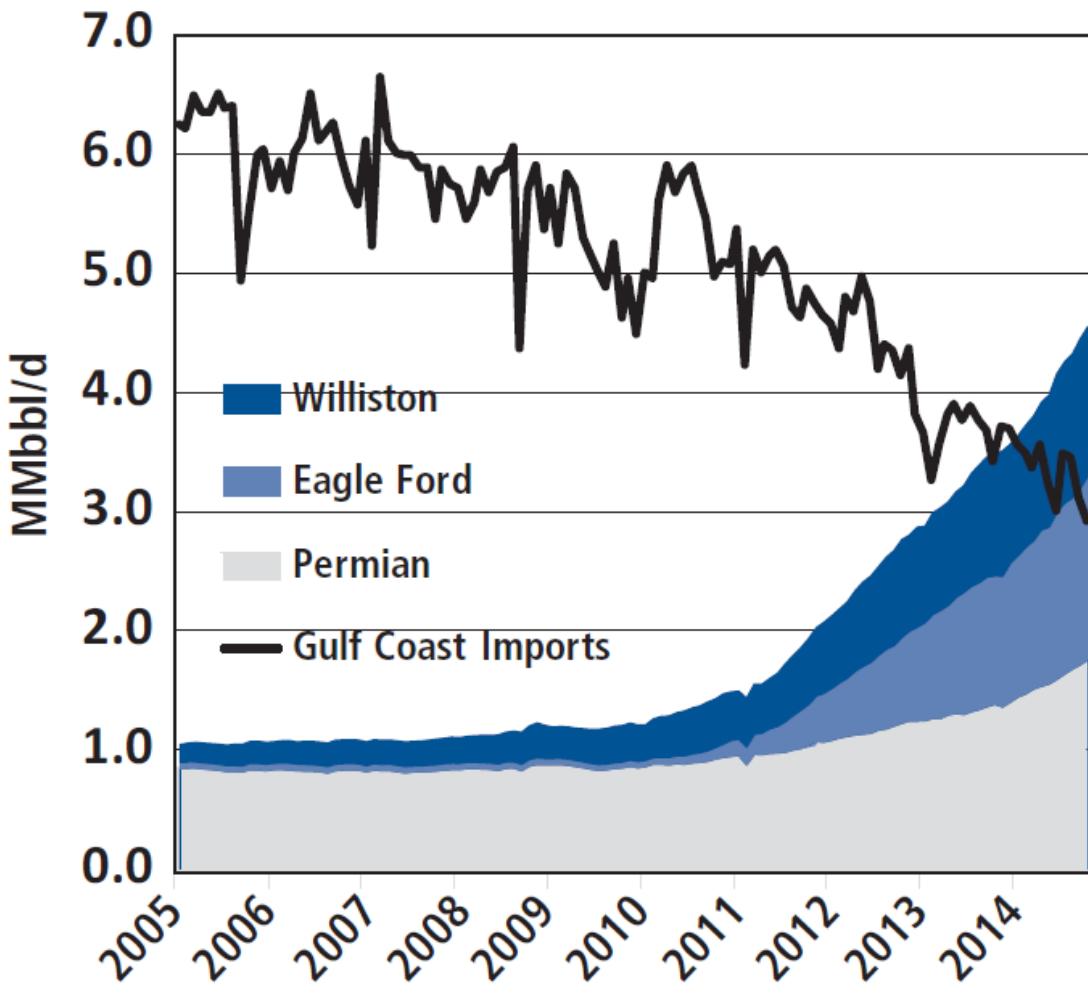
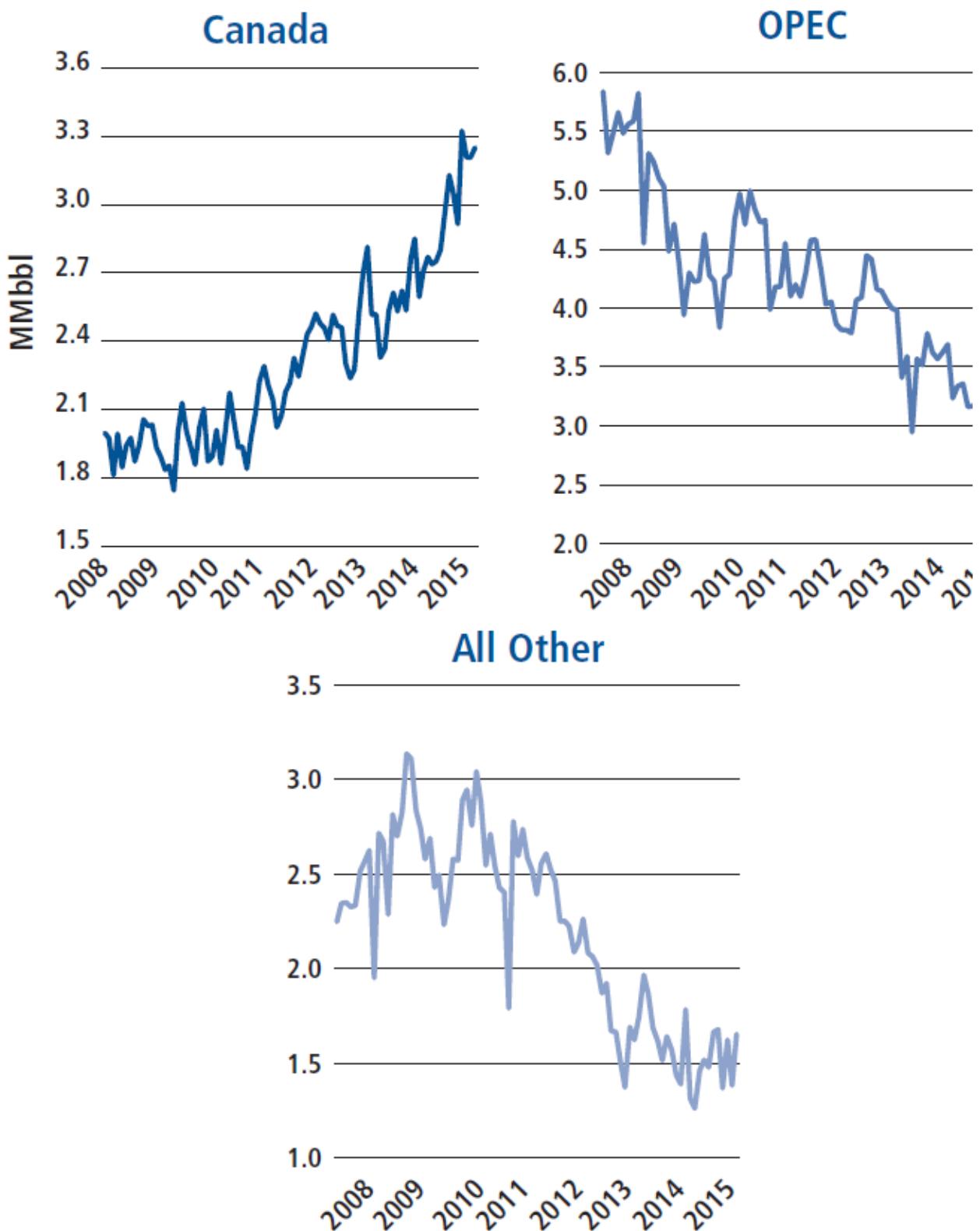


Figure 14.2. Rockies pricing



**Figure 15.1.** Big Three Basins vs. Gulf Coast (PADD III) imports



**Figure 15.2.** Declining crude imports in the U.S.

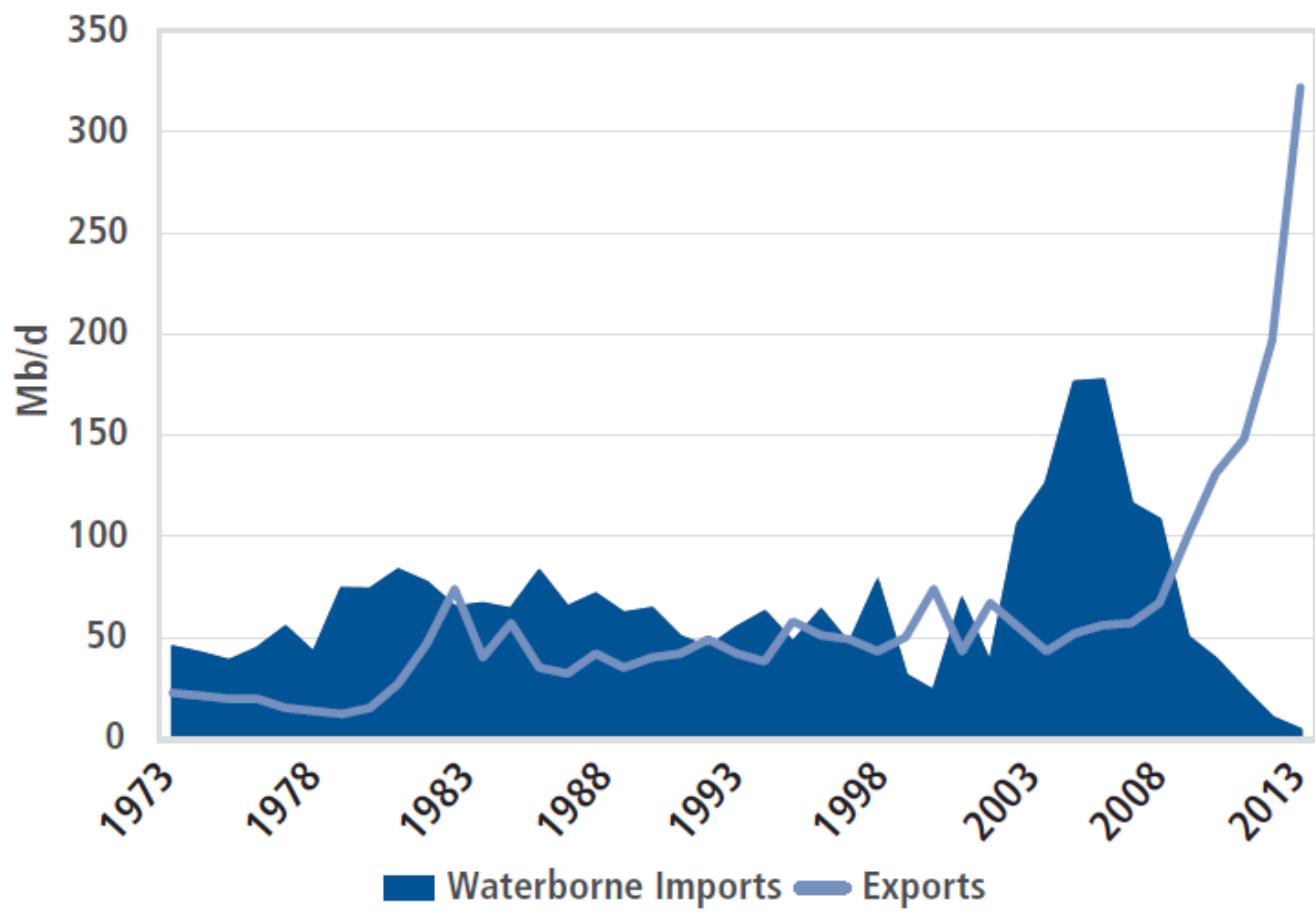


Figure 16.1. Imports and exports

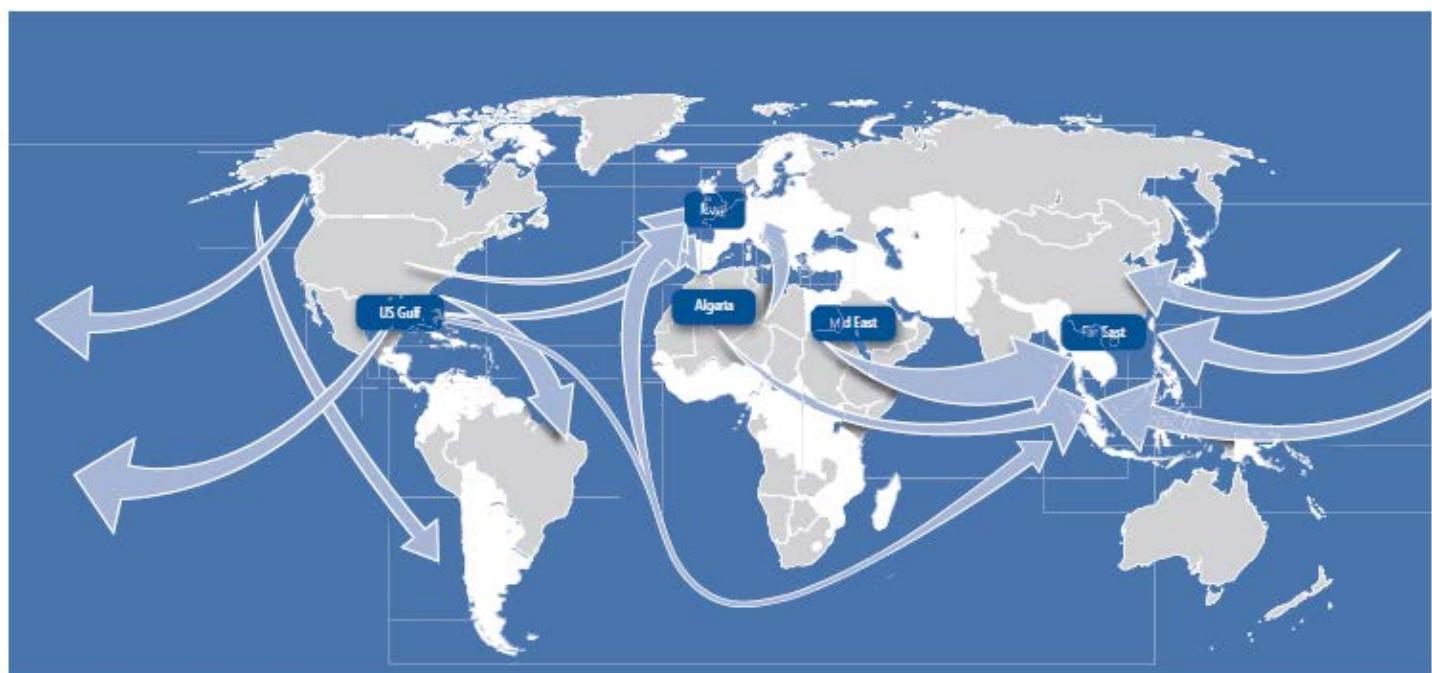
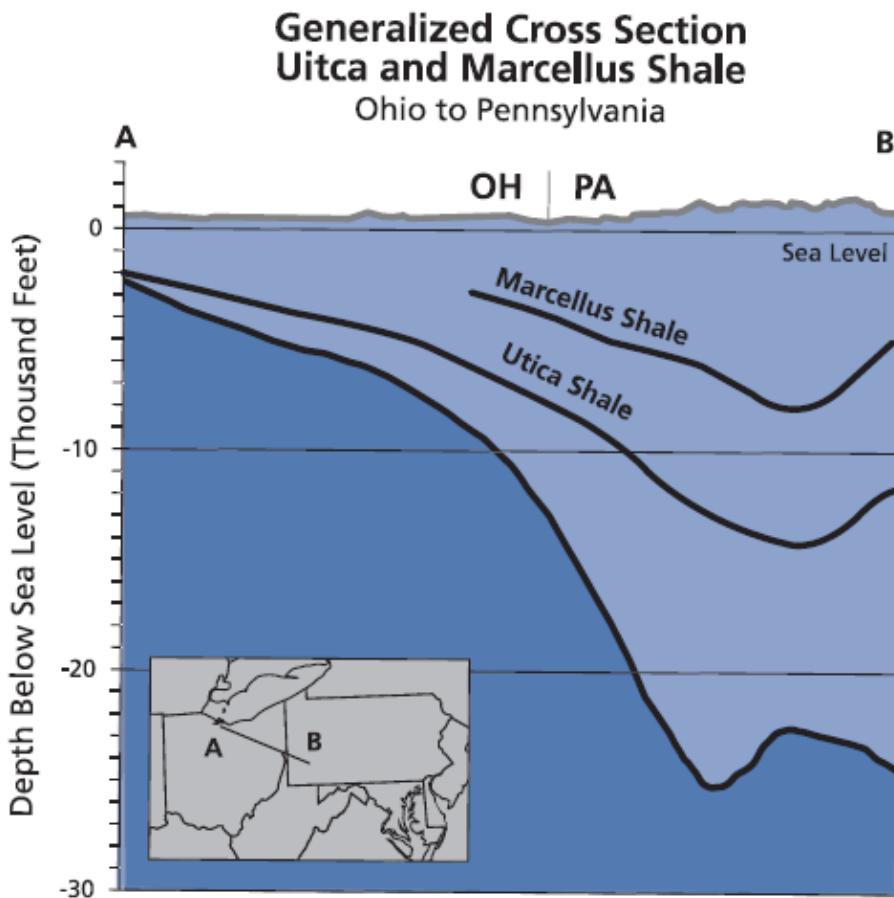
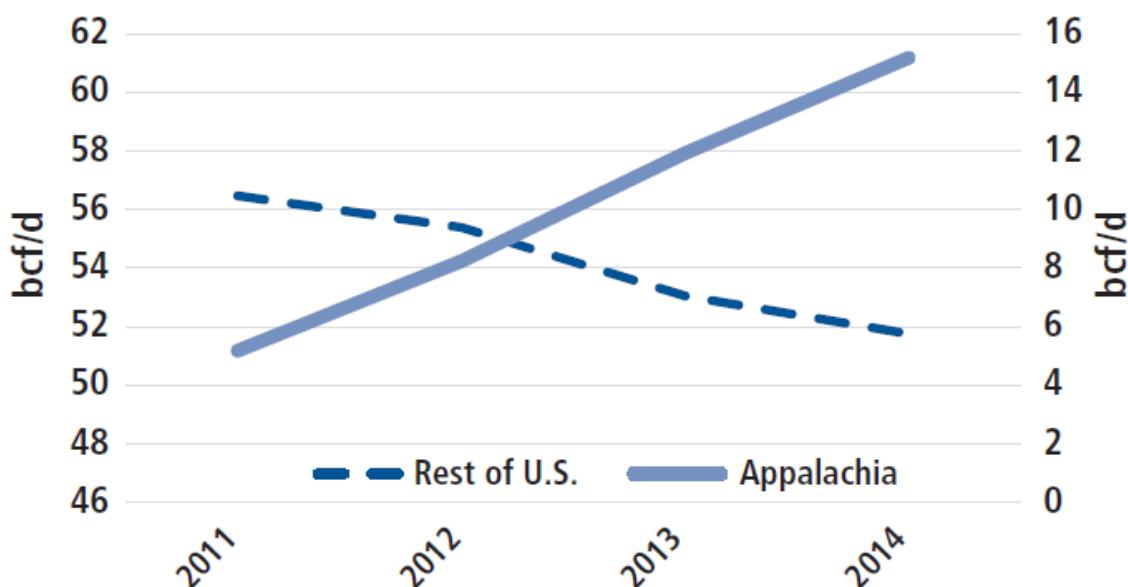


Figure 16.2. Major shipping routes for LPGs



**Figure 17.1.** This cross section was compiled by Geology.com using data provided by the Energy Information Administration, the United States Geological Survey, the Pennsylvania Geological Survey, and the U.S. Department of Energy.



**Figure 17.2.** Appalachia natural gas production vs. rest of U.S.

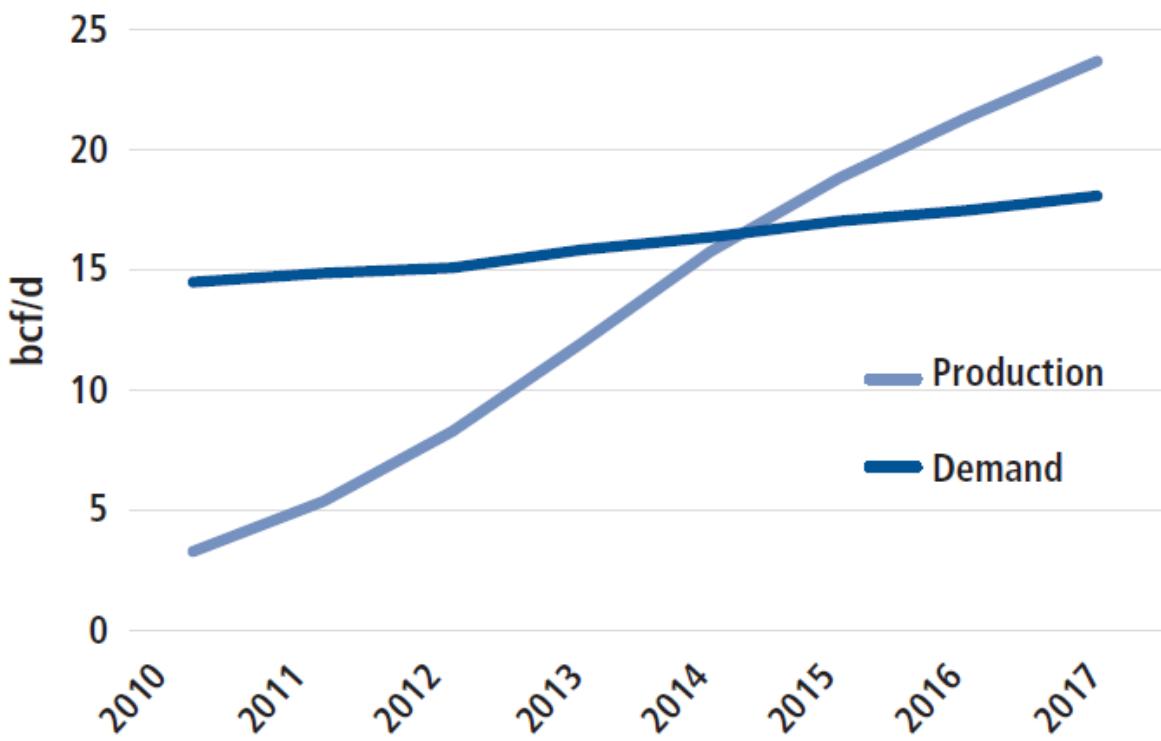


Figure 17.3. Northeast becomes net production region in 2015

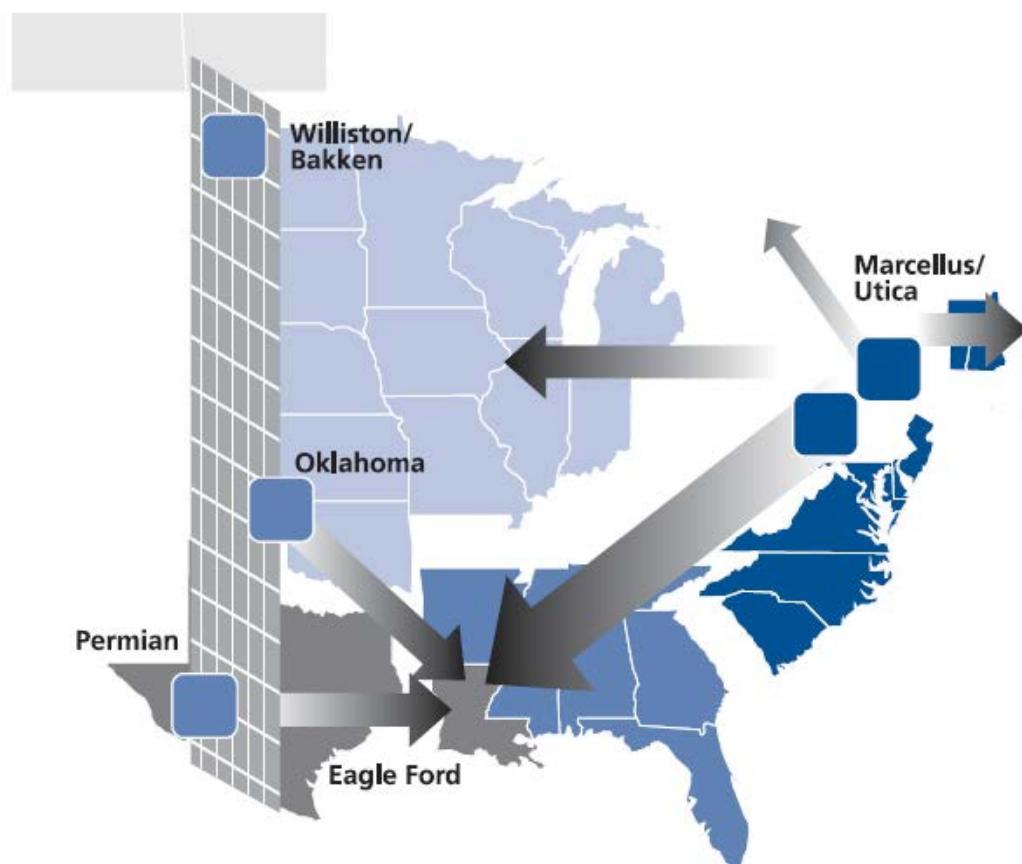


Figure 20.1. Possible natural gas flows