Louisiana's Unconventional Plays: Economic Opportunities, Policy Challenges

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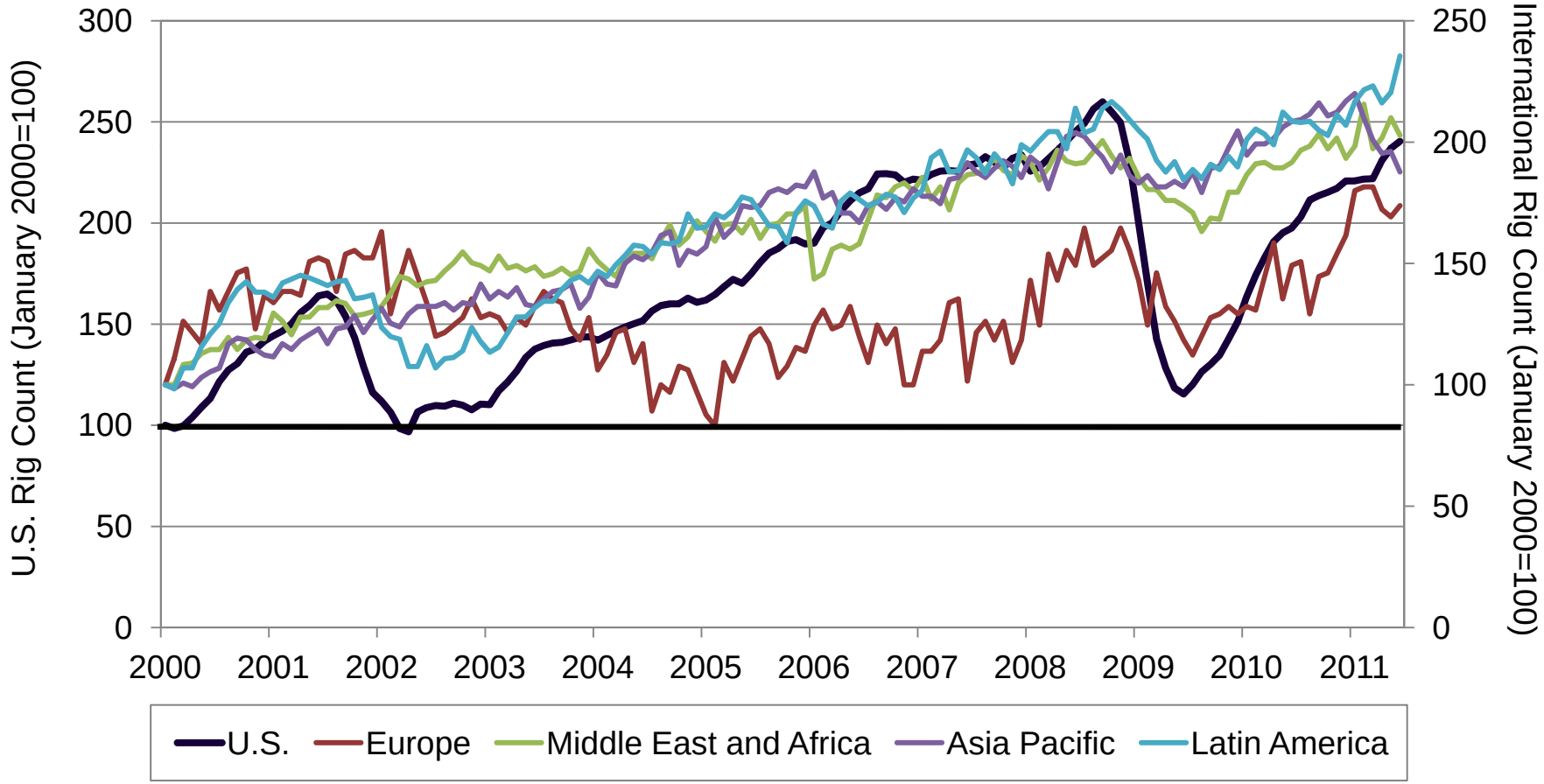
Rig Movements

Domestic and International Rig Counts

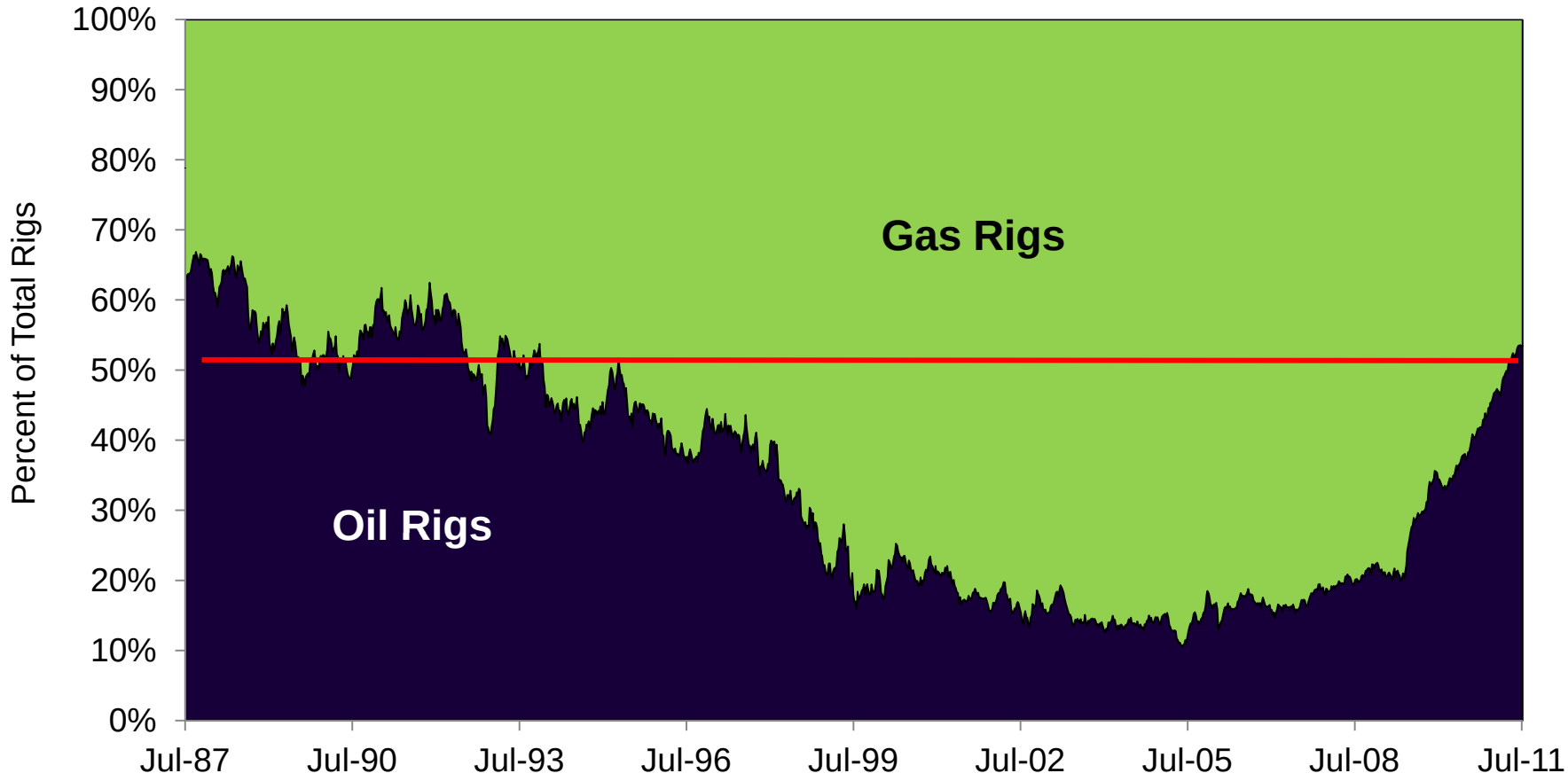
Recent changes in crude oil prices are leading to a rebound in overall U.S. rig count from 2008-2009 recession.



Source: Baker Hughes.

Domestic Rig Count – Crude Oil vs. Natural Gas

However, for the first time in 16 years, the number of oil rigs is equivalent to gas rigs.

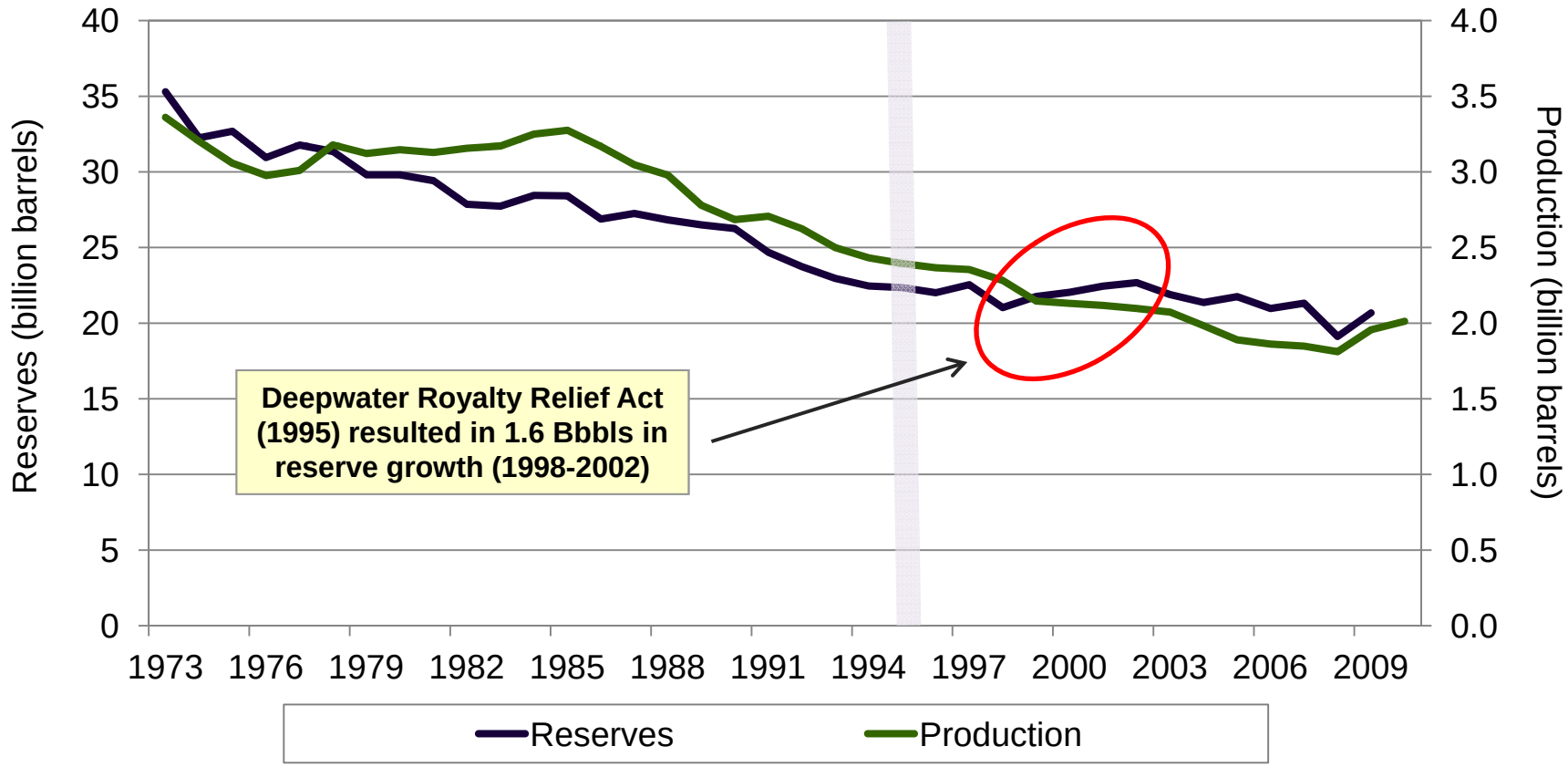


Source: Baker Hughes.

Supply Implications

U.S. Crude Oil Proved Reserves and Production

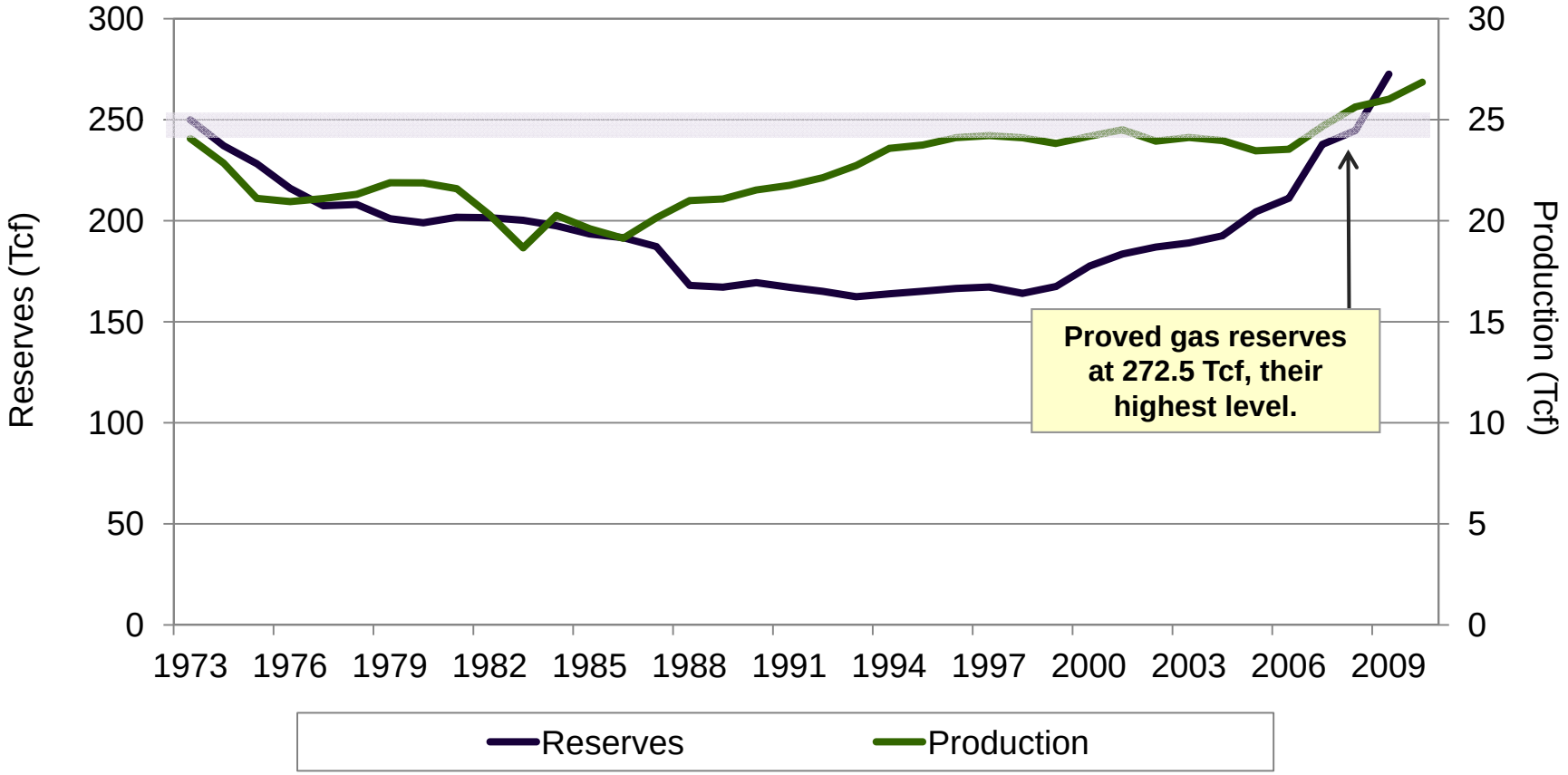
Crude oil reserves holding steady between 22 to 20 BBbls since 1995.
DWRRA (1995) helped reverse a deteriorating trend in GOM reserve declines.



Source: Energy Information Administration, U.S. Department of Energy

U.S. Natural Gas Production and Proved Reserves, January 2007 to Present

2006-2007 reserves growth is the largest in over 30 years. On average, natural gas reserves have been increasing by 5 percent per year since 2000 (except 2004-2005 tropical season, 2 percent).

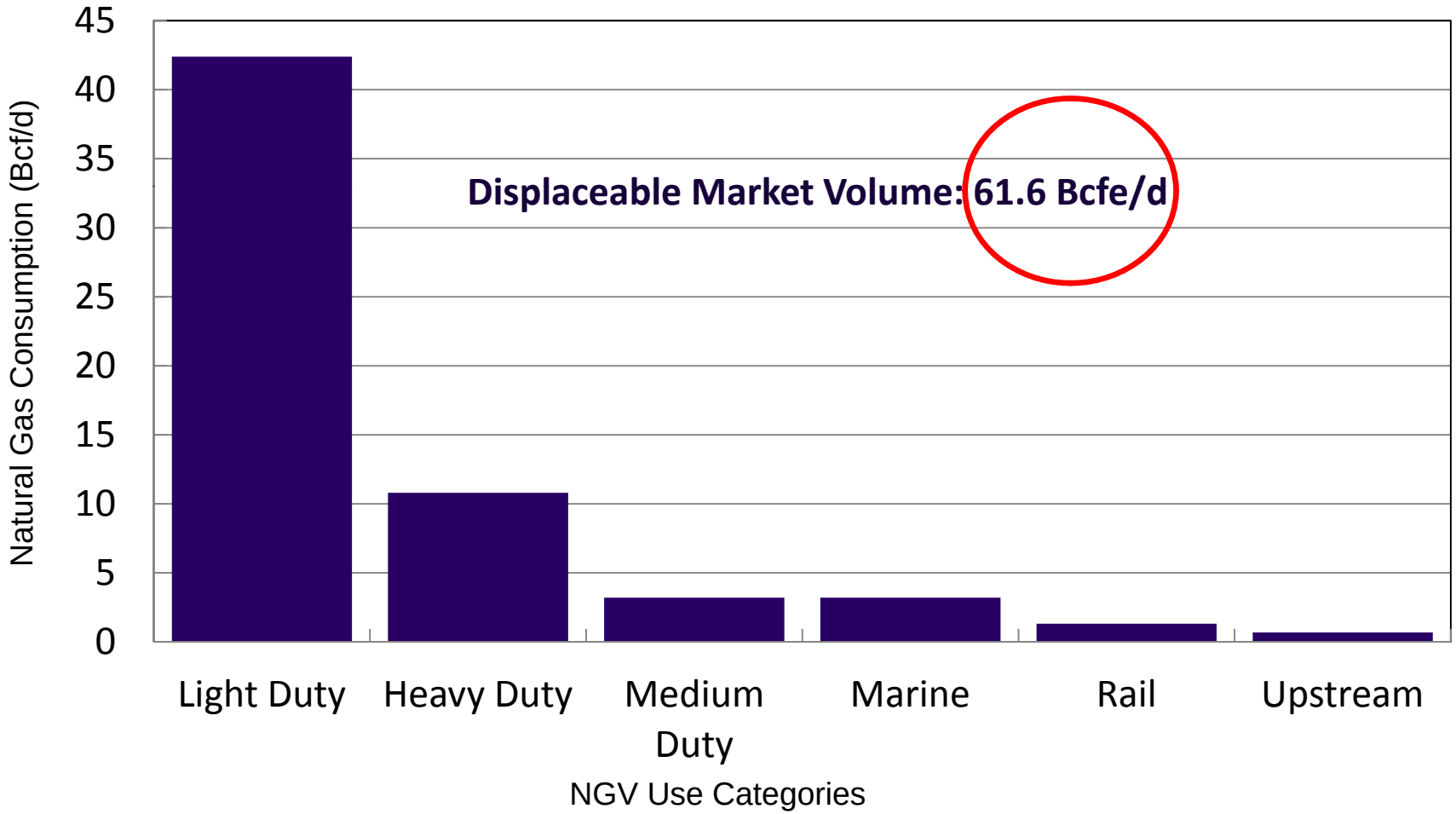


Source: Energy Information Administration, U.S. Department of Energy.

Policy Issue 1: Natural Gas Uses

Potential NGV Usage

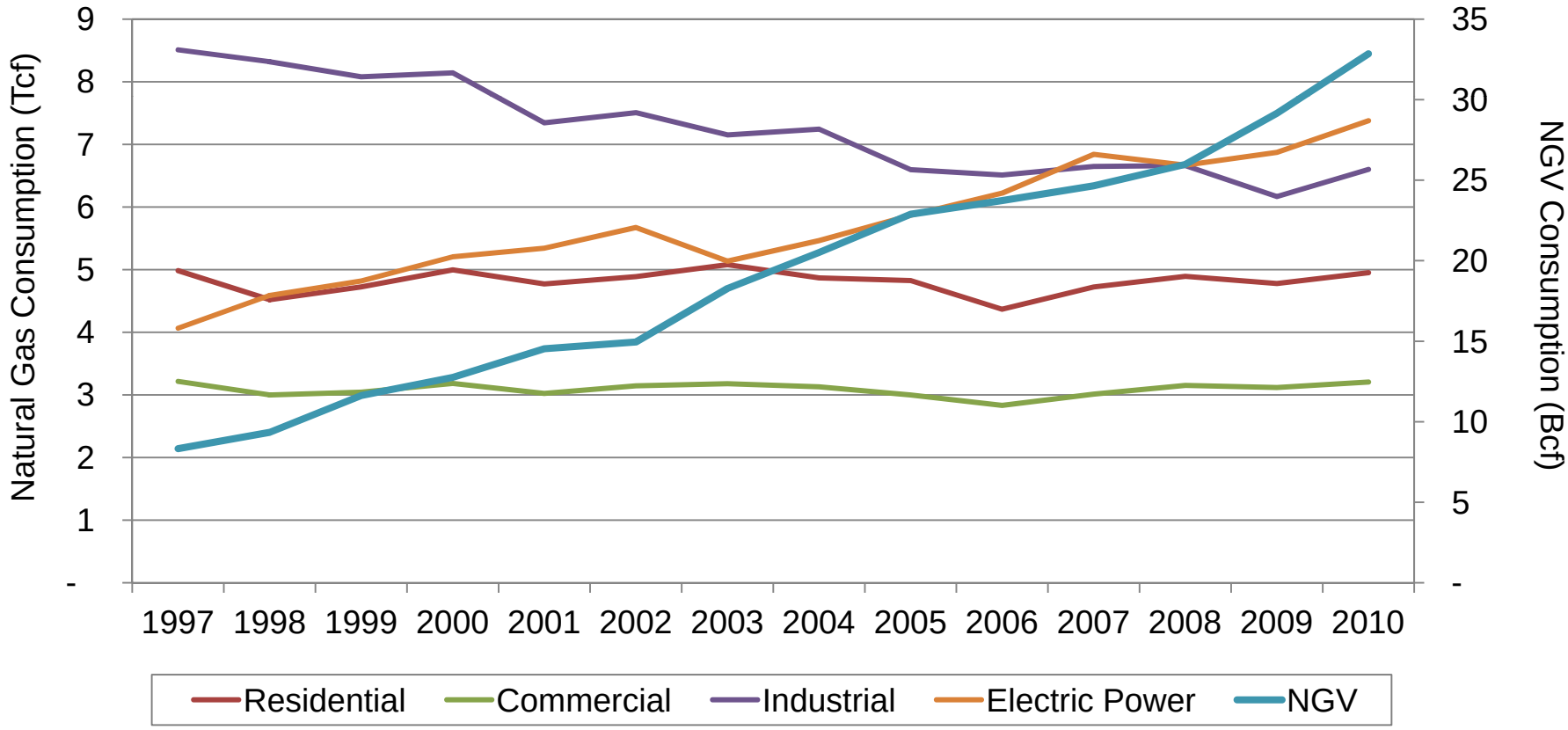
The large potential size of NGV market has a number of competing end-use categories (i.e., chemicals, manufacturing) concerned.



Source: Data and forecast from EIA, Encana, 2010
Displacement opportunities exclude Air, International Shipping, Military, Pipeline Fuel

Natural Gas Consumption by Sector

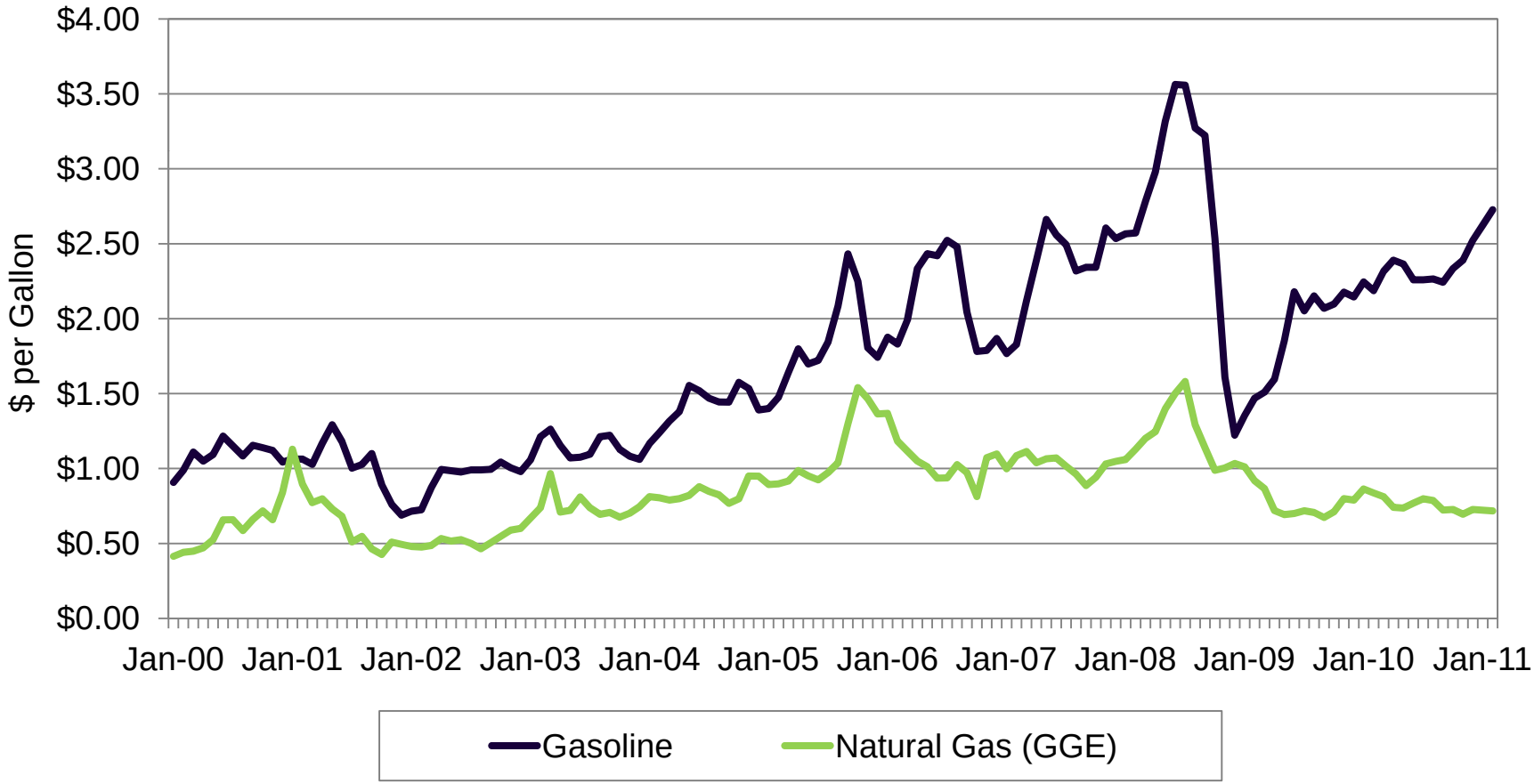
Currently, NGVs account for less than 0.18 percent of U.S. natural gas consumption, but the rate of growth in consumption (158 percent) over the past decade has surpassed all other end-uses.



Source: Energy Information Administration, U.S. Department of Energy

Retail Gasoline Prices and Natural Gas GGE

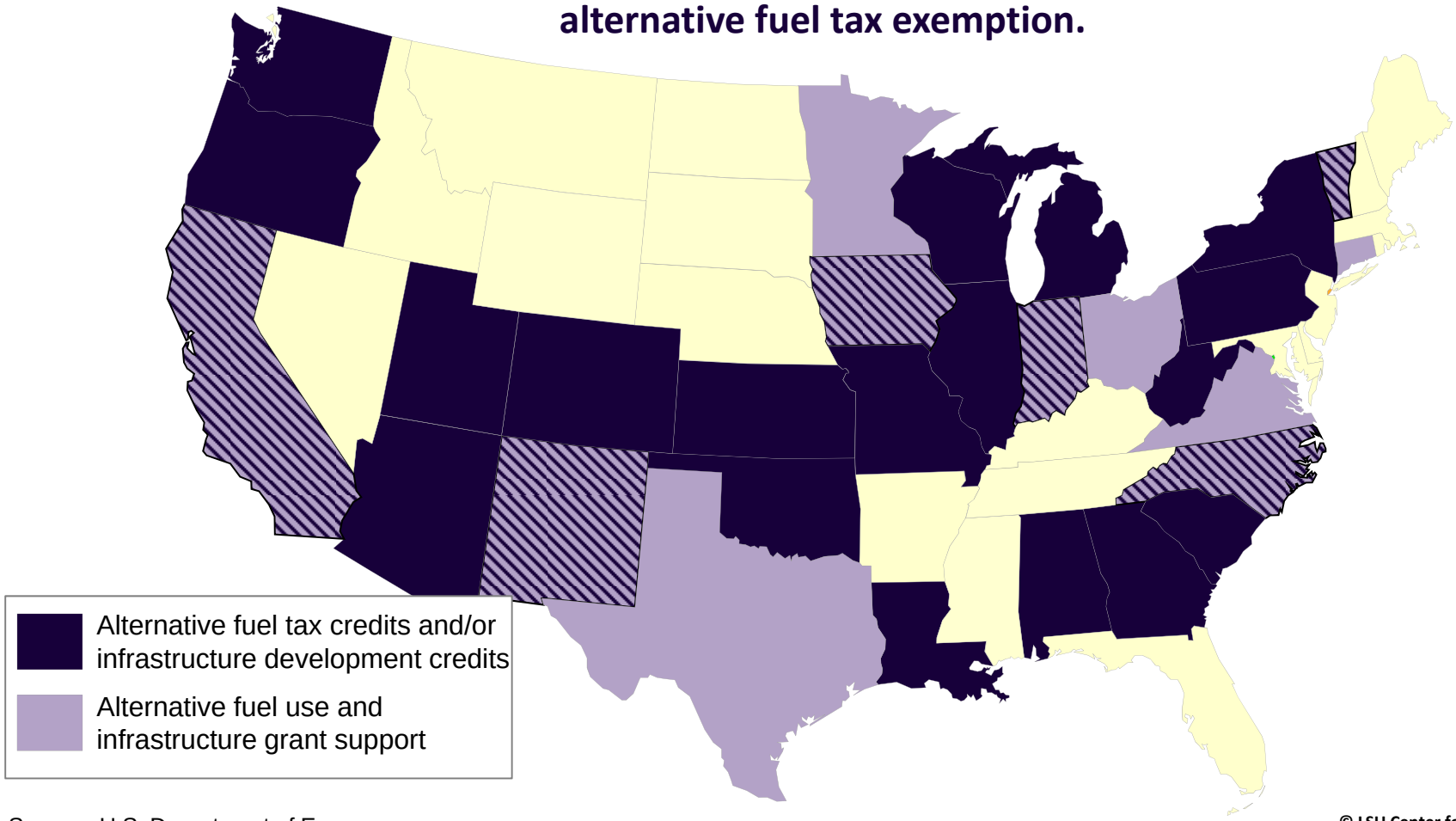
Basic economics, primarily lower relative prices, have played an important role in driving recent increases in natural gas vehicle use.



Source: Energy Information Administration, U.S. Department of Energy

Leading States in NGV Preferences

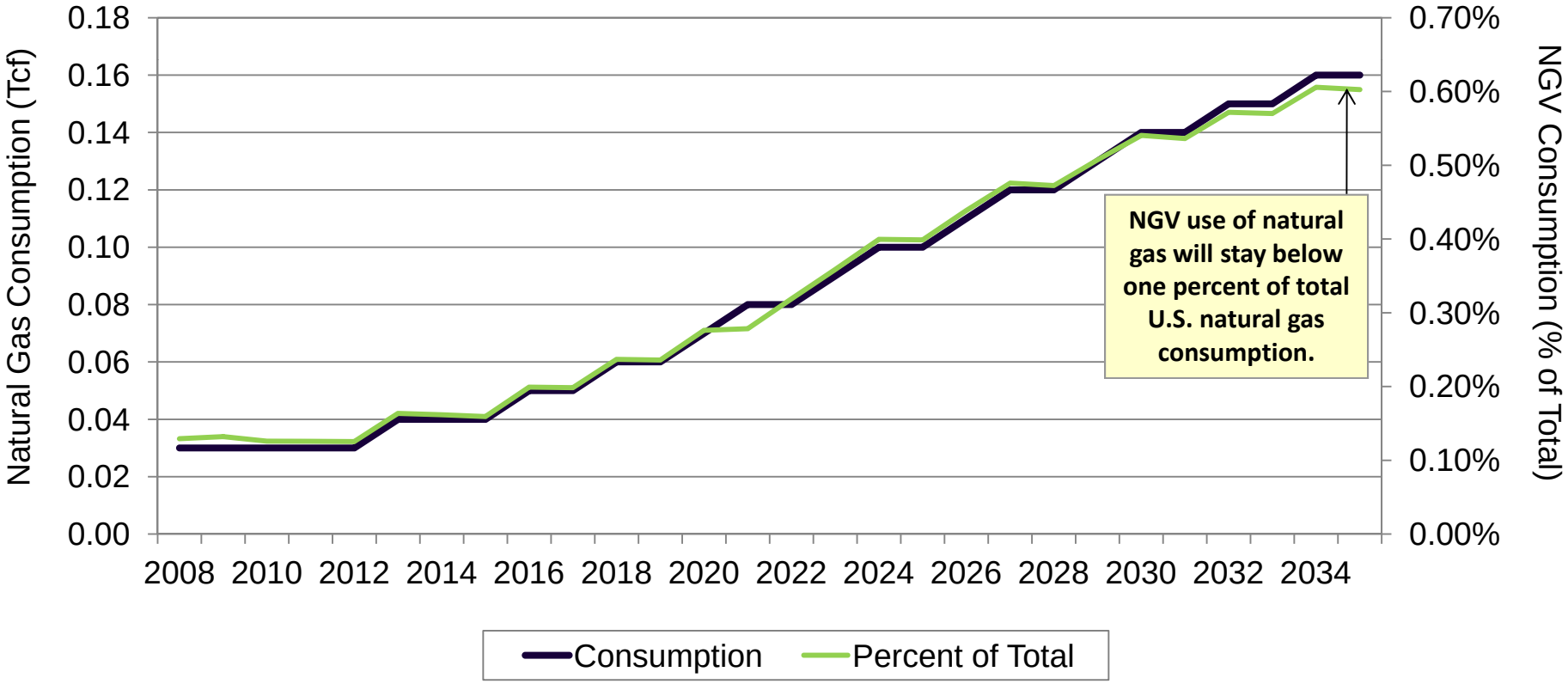
Many of these same states also have generous incentive programs that range from additional tax incentives, to infrastructure grant support. Federal benefits include alternative fuel infrastructure tax credit, an excise alternative fuel tax credit and an alternative fuel tax exemption.



Source: U.S. Department of Energy

Potential Natural Gas Consumption – NGV

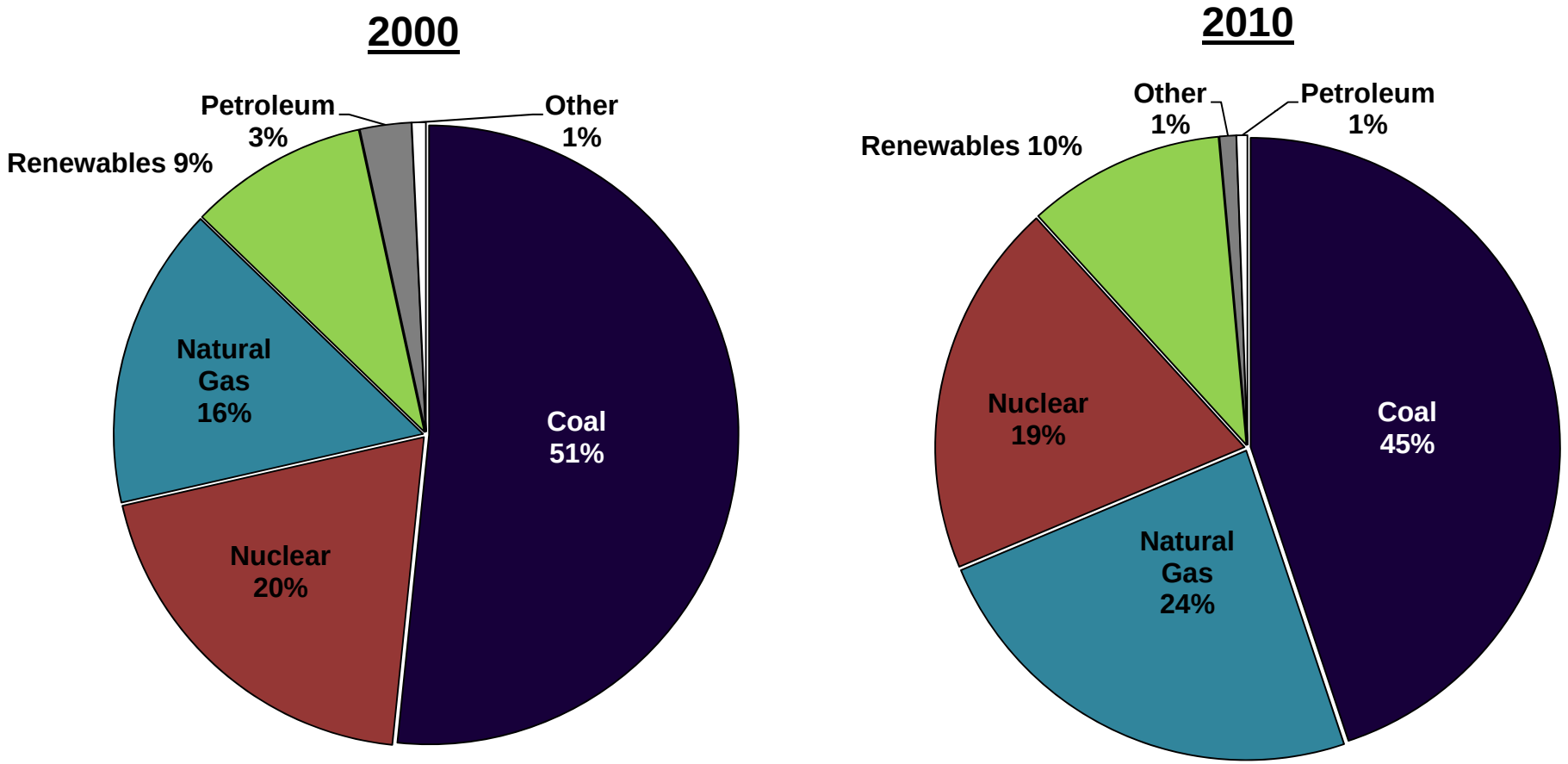
NGV consumption of natural gas is estimated to increase at an average annual rate of 7 percent through 2035. At best, this usage will be considerably less than 1 Tcf and slightly over one-half of one percent of total natural gas market.



Source: Energy Information Administration, U.S. Department of Energy

U.S. Power Generation – Fuel Mix

Over 250,000 MWs of natural gas power generation capacity has been added over the past decade at the expense of coal and nuclear.



Source: Energy Information Administration, U.S. Department of Energy

Electric Industry Environmental Regulations Create Uncertainty for Coal

National Ambient Air Quality Standards (NAAQS)

- Sets acceptable levels for six criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, sulfur dioxide).
- A network of 4,000 State and Local Air Monitoring Stations is used to determine if geographic areas are meeting or exceeding the NAAQS.

Transport Rule (now CSAPR) [proposed]

- Issued to replace the Clean Air Interstate Rule (CAIR) and its predecessor the Clean Air Transport Rule ("CATR"). Requires 31 states (and D.C.) to improve air quality by reducing power plant emissions (SO2 and NOX) that contribute to ozone and fine particulate pollution in other states (some annual, some on ozone season only).
- By 2014, the rule and other state and EPA actions would reduce power plant SO2 emissions by 80% over 2005 levels. Power plant NOx emissions would drop by 58%.

Utility Maximum Achievable Control Technology (MACT) [to be proposed]

- EPA must set emission limits for hazardous air pollutants. The rule is expected to replace the Clean Air Mercury Rule (CAMR) and add standards for lead, arsenic, acid gases, dioxins and furans.

Coal Combustion Residuals (CCR) [proposed]

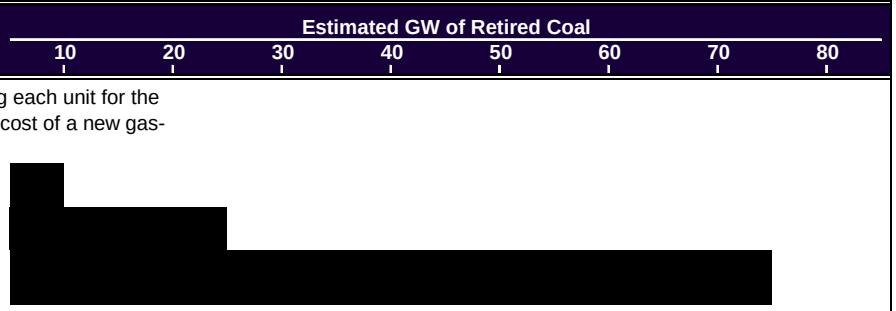
- Would establish, for the first time under the Resource Conservation and Recovery Act (RCRA) requirements for the proper disposal of coal ash generated by coal combustion at electric power plants.

Power Plant Cooling Water Intake Structures Rule

- Section 316(b) of the Clean Water Act is intended to address environmental impacts from cooling water intake to and discharge from power plant cooling systems. Requires that the location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

Summary of Retirement Studies Related to EPA Rules

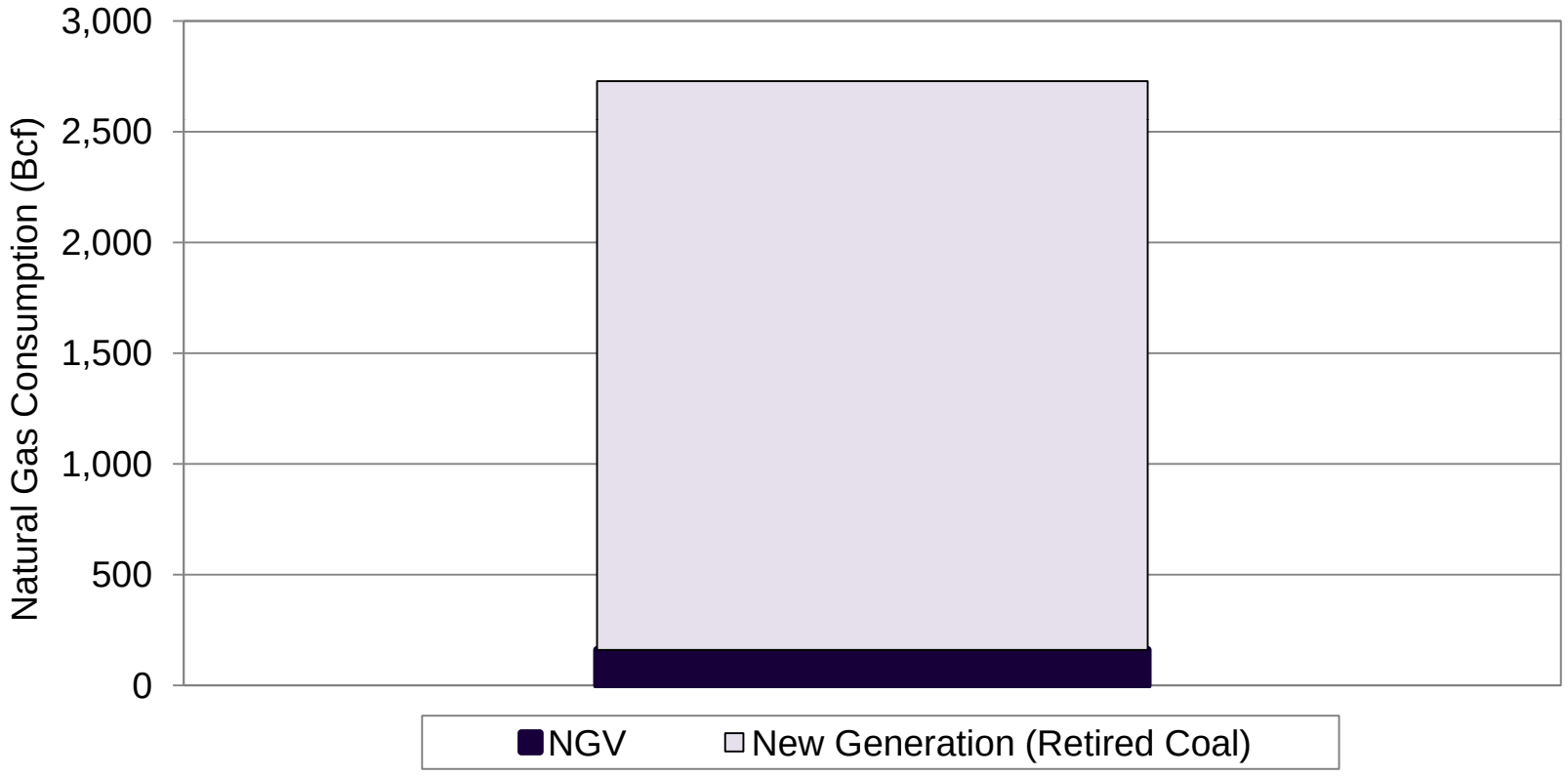
Study	Retired Capacity	Regulation Requirements
NERC (October 2010)	47 to 76 GW by 2018 (total fossil fuel capacity, including oil and gas)	Levelized costs (@2008 CF) after retrofitting each unit for the environmental regulations compared to the cost of a new gas-fired unit. Scenario 1 - Transport Rule Scenario 2 - Transport Rule, MACT Scenario 3 - Transport Rule, MACT, 316(b) Cooling Water, Coal Ash
ICF/IEE (May 2010)	25 to 60 GW by 2015	Cost of retrofitting coal plant compared to cost of new gas CC Scenario 1 - Transport Rule, MACT Scenario 2 - Transport Rule, MACT, CWA 316(b)
Brattle Group (December 2010)	50 to 65 GW by 2020	Regulated Units - 15-year present value of costs > replacement power from a CC or CT. Merchant unit - 15-year present value of cost > revenues from energy and capacity markets. Transport Rule, MACT, 316(b) Cooling Water, Coal Ash
Credit Suisse (September 2010)	60 GW	Size and existing controls Transport Rule, MACT
Charles River Associates (December 2010)	39 GW by 2015	In-house model (NEEMS) optimizing costs of existing capacity and costs of potential new capacity. Transport Rule, MACT
MJ Bradley (August 2010)	30 to 40 GW	Switch to lower sulfur coal, install emission controls, or retire Transport Rule, MACT
Bernstein Research (October 2010)	51 GW	FGS + emissions on all coal fired units by 2015 Transport Rule, MACT



Source: Synapse Energy Economics, Inc., "Public Policy Impacts on Transmission Planning, Prepared for Earthjustice", December 10, 2010; and "Miller, P. A Primer on Pending Environmental Regulations and their Potential Impacts on Electric System Reliability. Working Draft, JD Northeast States for Coordinated Air Use Management. January 24, 2011.

Potential Natural Gas Consumption – New Generation Use (Retired Coal)

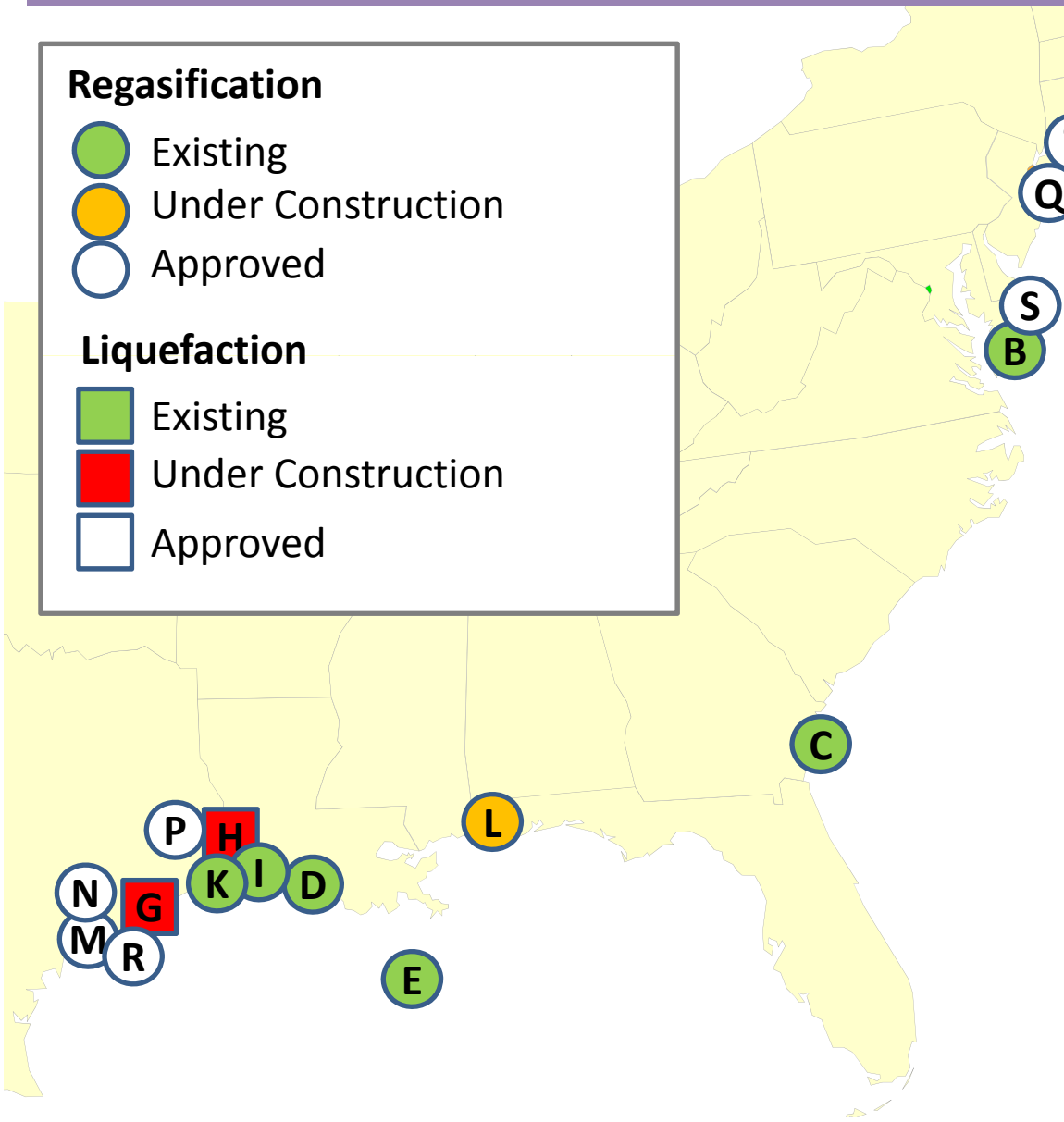
The retirement of 45 gigawatts of capacity would likely still have only a limited impact on overall natural gas usage.



Note: Assumes 160 Bcf of NGV natural gas use. Also assumes retirement of 45 GW of coal-fired capacity, replaced with new natural gas generation with an 85 percent capacity factor and a 7,600 Btu/kWh heat rate.

Policy Issue 2:
LNG and US Natural Gas Exports

Considerable Underutilized LNG Regasification Capacity along GOM



Existing

A. Everett, MA: 1.035 Bcfd
B. Cove Point, MD: 1.8 Bcfd
C. Elba Island, GA: 1.6 Bcfd (+0.5 Expansion)
D. Lake Charles, LA: 2.1 Bcfd
E. Energy Bridge, GOM: 0.5 Bcfd
F. Northeast Gateway, Offshore MA: 0.8 Bcfd
G. Freeport, TX: 1.5 Bcfd (+2.5 Expansion)
H. Sabine, LA: 4.0 Bcfd
I. Hackberry, LA: 1.8 Bcfd (+0.85 Expansion)
J. Neptune, Offshore MA: 0.4 Bcfd
K. Sabine Pass, TX: 1.0 Bcfd (+ 1.0 Expansion)

Under Construction

L. Pascagoula, MS: 1.0 Bcfd

Approved

M. Corpus Christi, TX: 1.0 Bcfd
N. Corpus Christi, TX: 2.6 Bcfd
O. Fall River, MA: 0.8 Bcfd
P. Port Arthur, TX: 3.0 Bcfd
Q. Logan, NJ: 1.2 Bcfd
R. Port Lavaca, TX: 1.0 Bcfd
S. Baltimore, MD: 1.5 Bcfd
T. LI Sound, NY: 1.0 Bcfd

LNG Value Chain

Feedstock (production) costs will be critical in determining the location of basin-specific production along the global LNG supply curve.



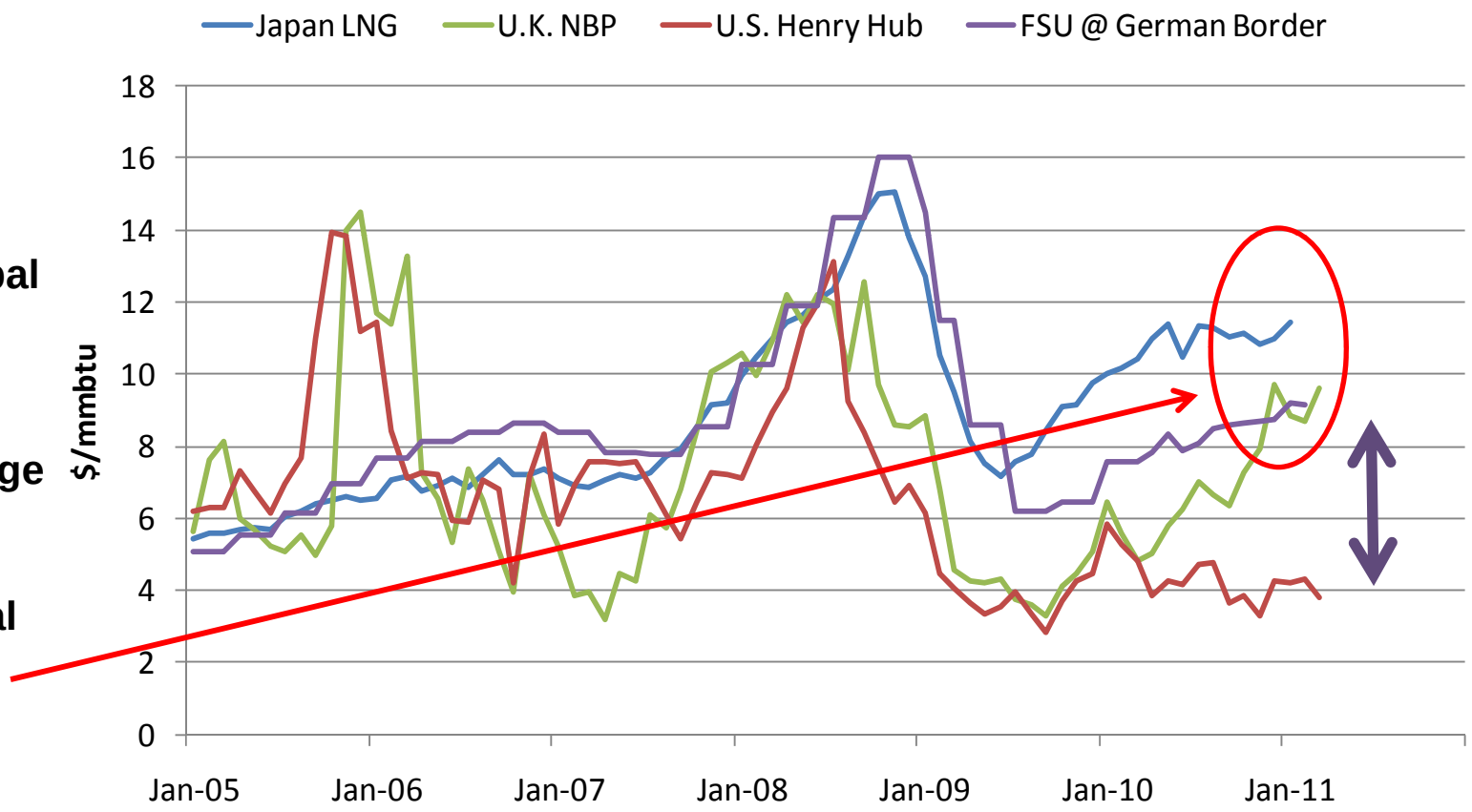

Europe:	Feedgas 56% ($/MMBtu)	Liquefaction 11%-17% ($/MMBtu)	Shipping & Fuel 20%-29% ($/MMBtu)	Regas 4%-7% ($/MMBtu)	Delivered Cost ($/MMBtu)	Equivalent Oil Price* ($/BOE)
Low	$4.00	$1.25	$1.40	$0.50	$7.15	$41.47
High	$6.50	$1.25	$1.65	$0.50	$9.90	$57.42
Asia:						
Low	$4.00	$1.25	$2.90	$0.50	$8.95	$51.91
High	$6.50	$1.25	$3.45	$0.50	$11.70	$67.86

Henry Hub:	WTI:
$4.50	$97.00
$5.00	$100.00

Note: *uses a BOE conversion of 5.8 Mcf/BOE.
Source: Cheniere.

Motivations for Moving Shale Gas to Global Consuming Areas

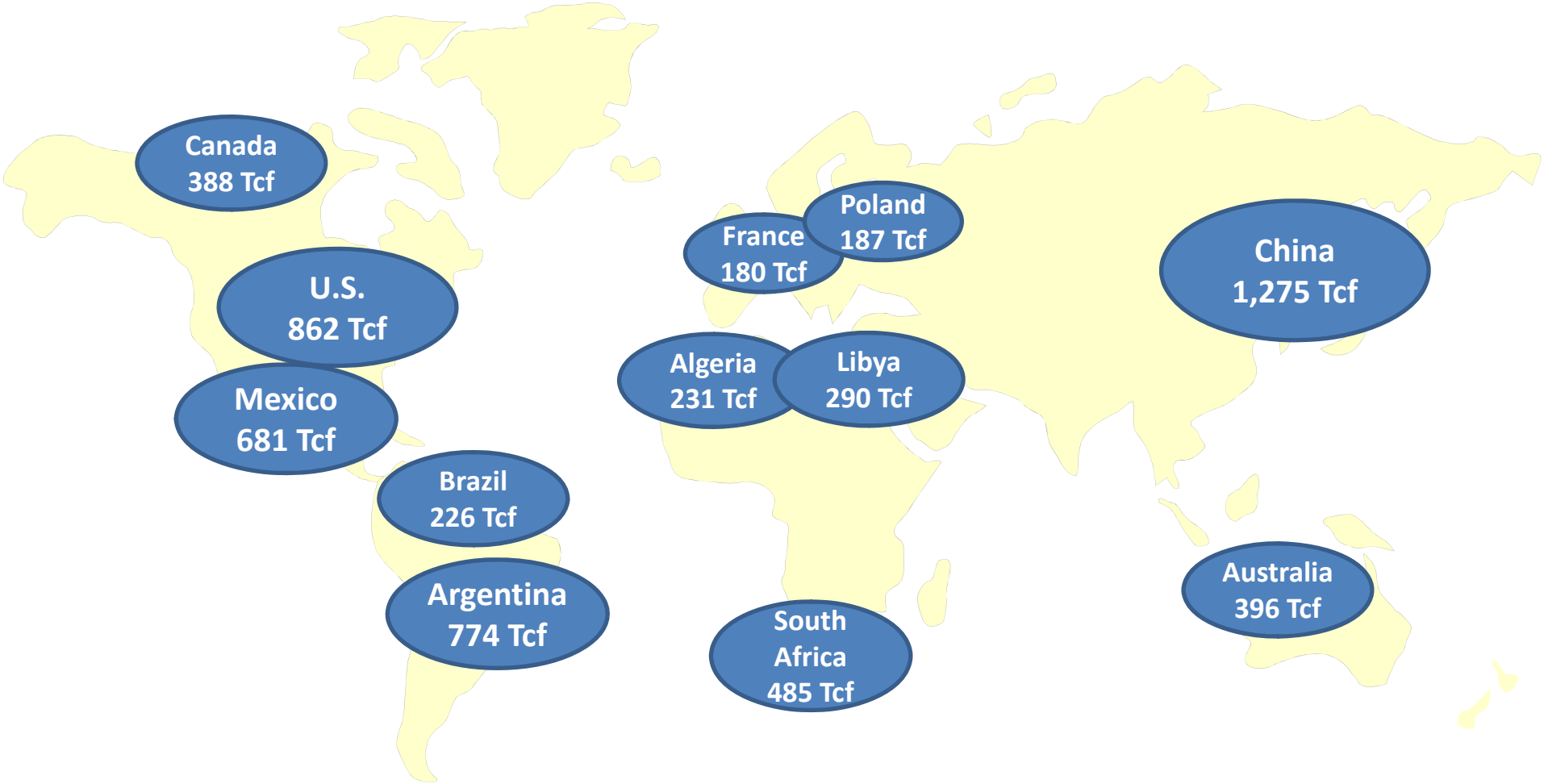
- **Excess U.S. shale production.**
- **Growing global energy demand.**
- **Climate change issues.**
- **Global natural gas price differentials.**



Source: Marathon

Basin Competition

Close to 6,000 TCF of shale gas opportunities around the world. Coupled with 9,000 Tcf in conventional suggest a potentially solid resource base for many decades.

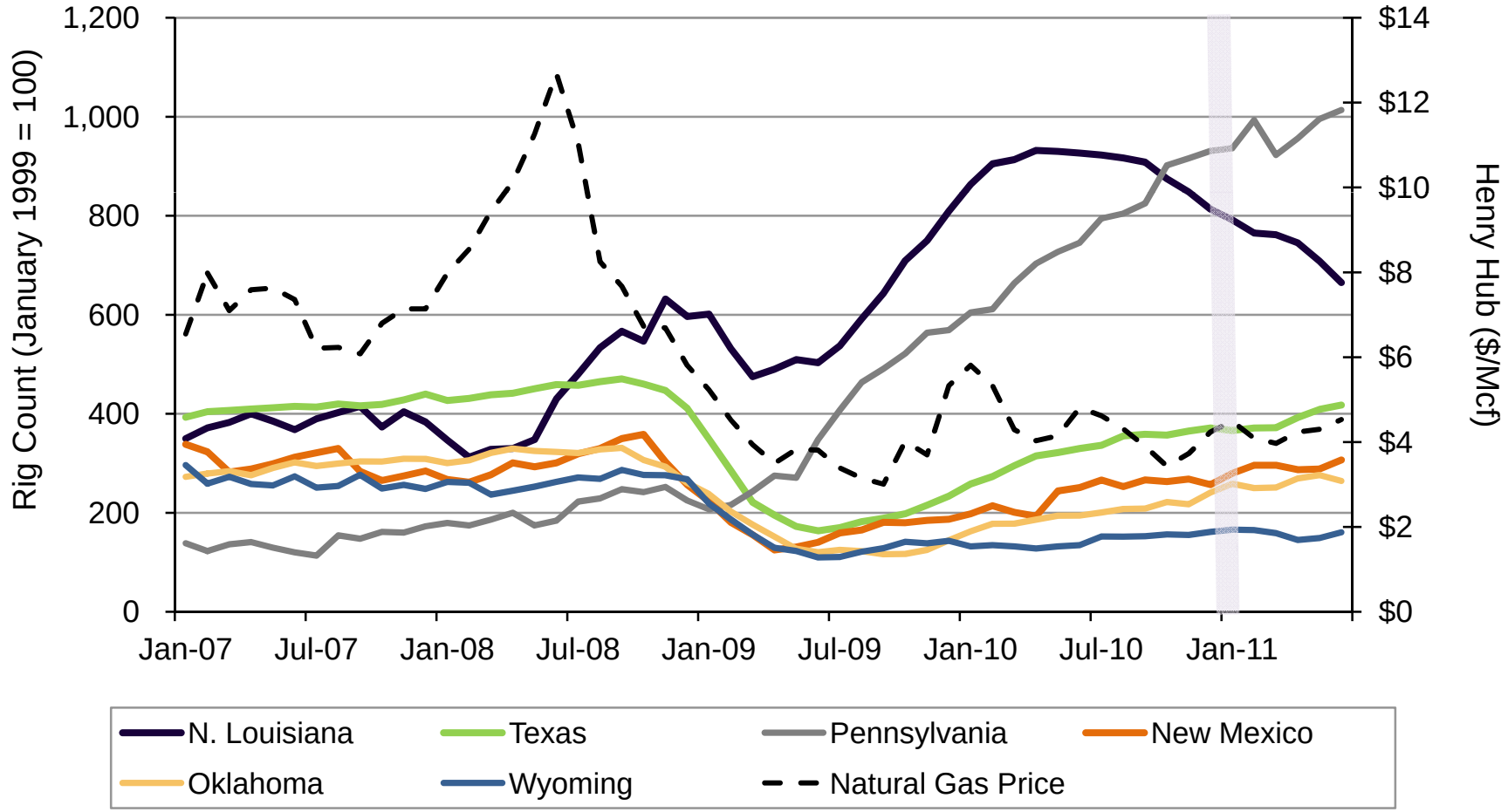


Source: MIT Energy Initiative.

Policy Issue 3: Drilling-Production Challenges & Opportunities

Rig Count and Crude Oil Price, (Each State Measured Relative to 1999 Activity)

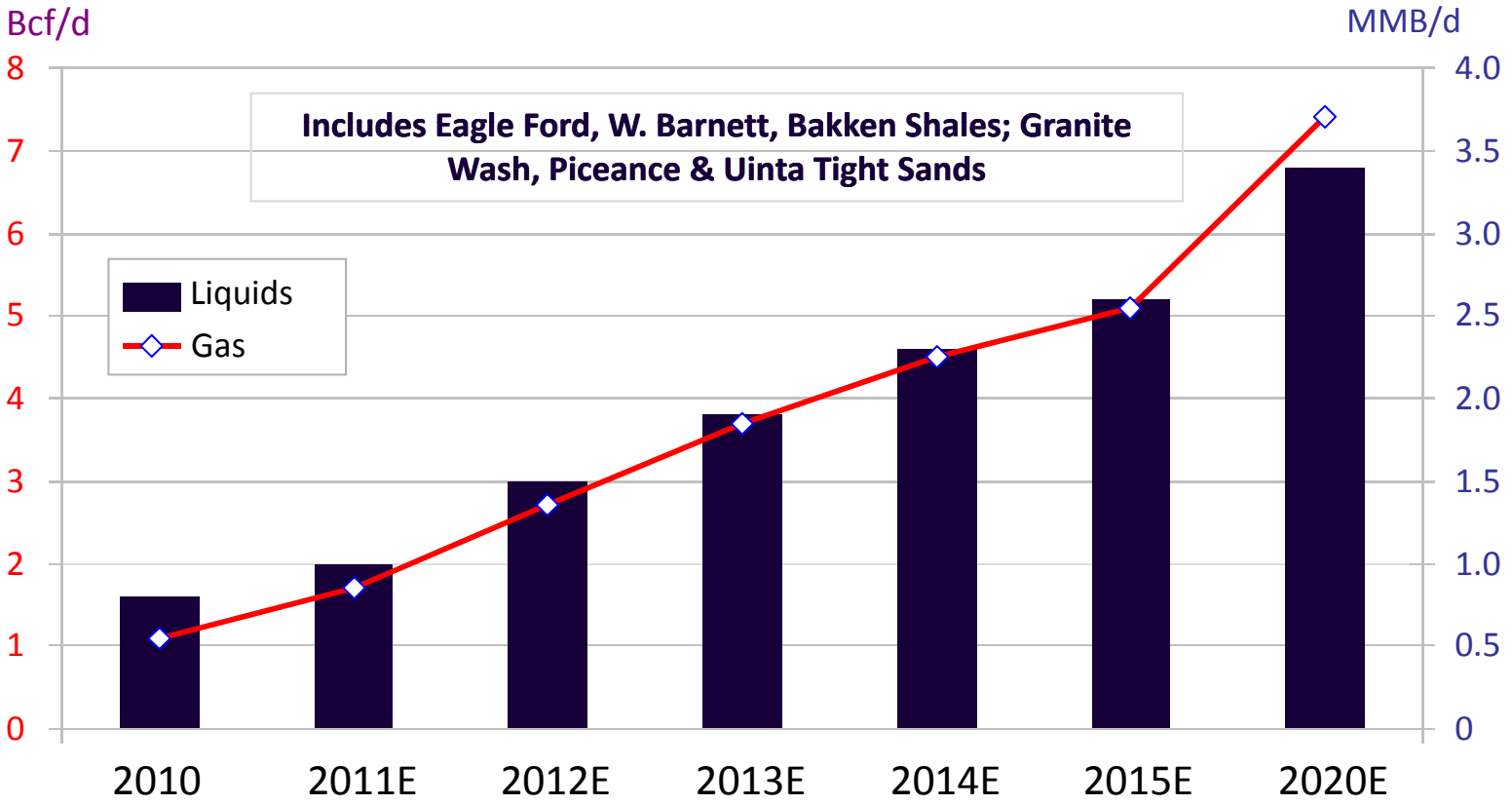
North Louisiana has been the shining opportunity in the industry during the recent price downturn/correction. However, that competitive advantage is starting to deteriorate.



Source: Baker Hughes; and Federal Reserve Bank of St. Louis.

Annual Production, Unconventional Resources (Cheniere)

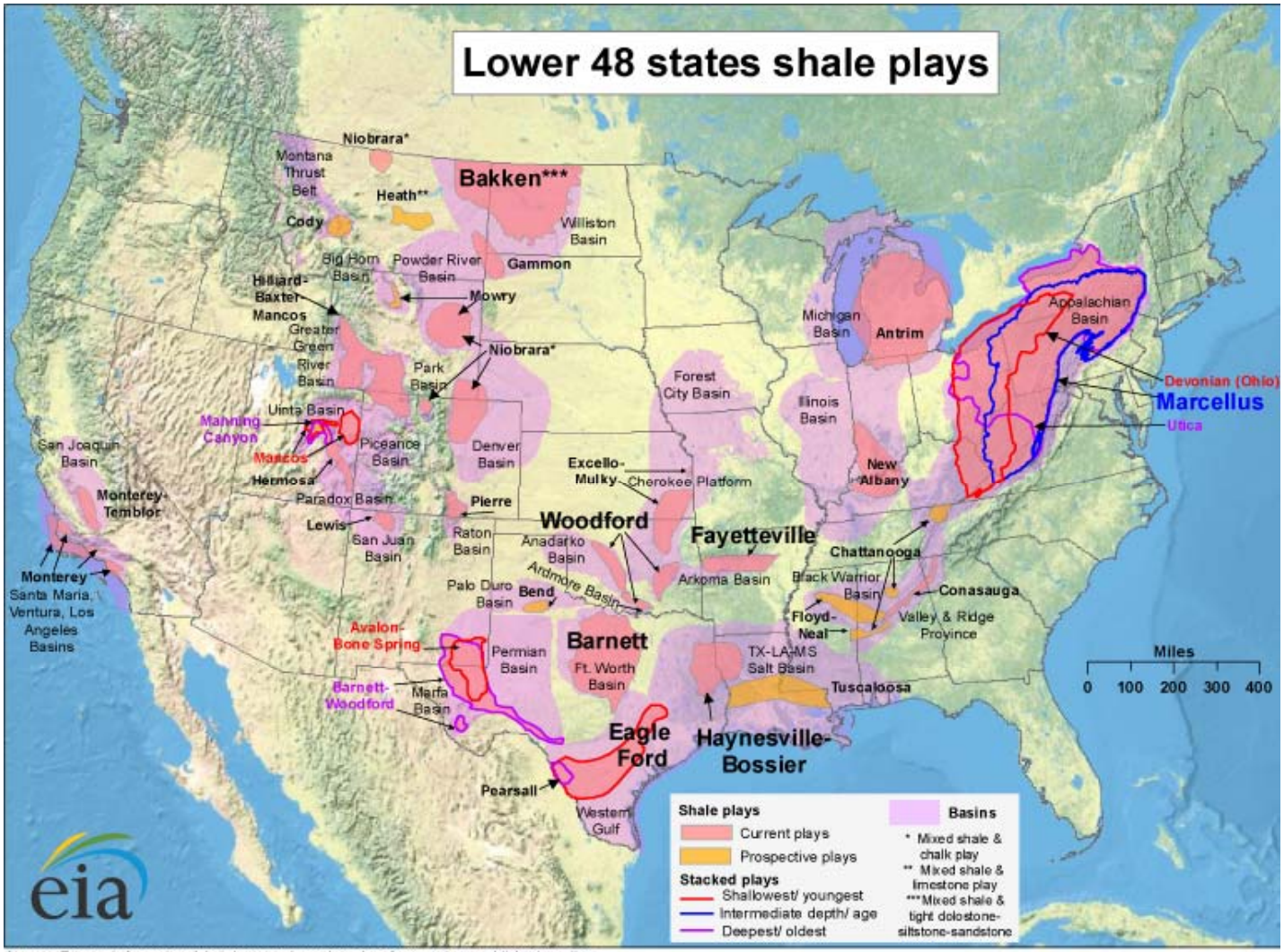
Liquids production from shale plays > 3 million barrels per day by 2020
Associated natural gas > 7 Bcf/d of "costless" supply



Source: Advanced Resource Intl; presentation to Cheniere Board, March 2011; Cheniere Research

The Next Frontier: Crude Oil Shales

- **Number of emerging crude oil shale plays that could have dynamic impact on industry.**
- **As much as 24 billion barrels in plays such as Monterey (CA), Bakken (ND), Eagle Ford (TX), and Niabrara (CO/NE).**

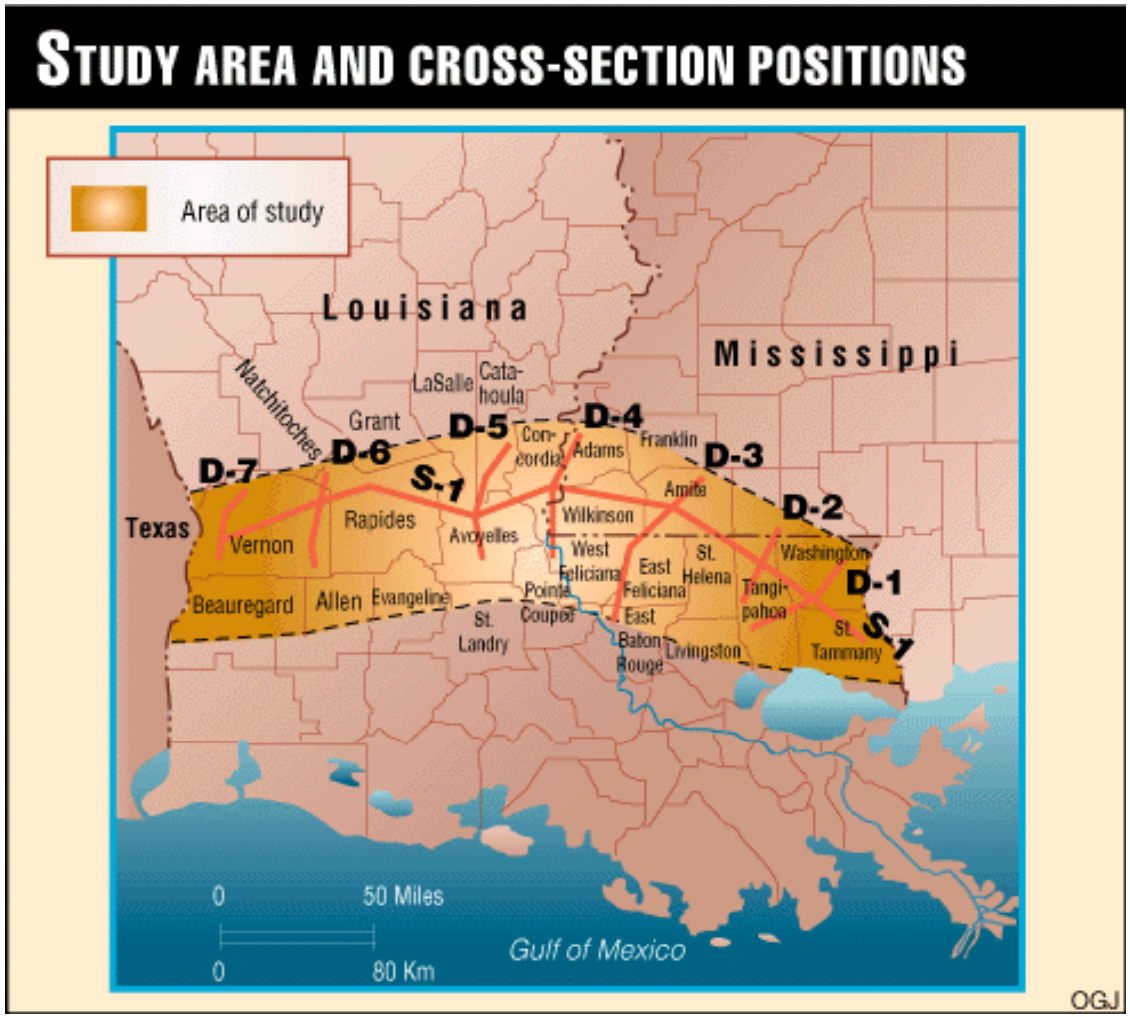


Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011

Source: Energy Information Administration.

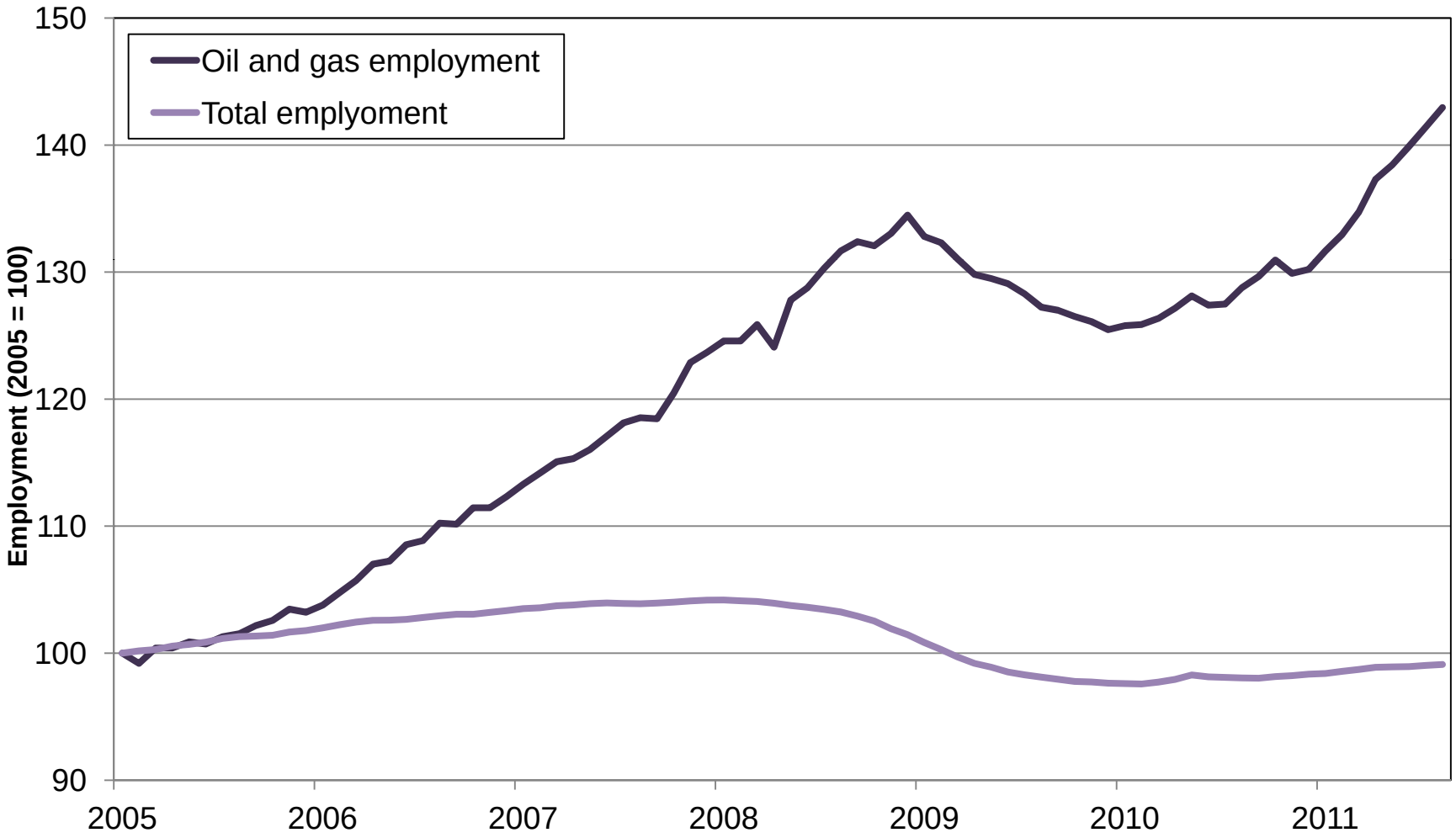
Crude Oil Shale Opportunities -- Louisiana

- 1998 LGS Study primary publicly-available source of information on the formation.
- Lies between sands of the upper and lower Tuscaloosa.
- Varies in thickness from 500 feet (MS) to around 800 feet (LA).
- Shallowest opportunity around 10,000 feet – mostly between 11,000 to 12,000 – some areas as deep as 16,000 (EBR).
- Estimated potential resource of 7 BBbls.



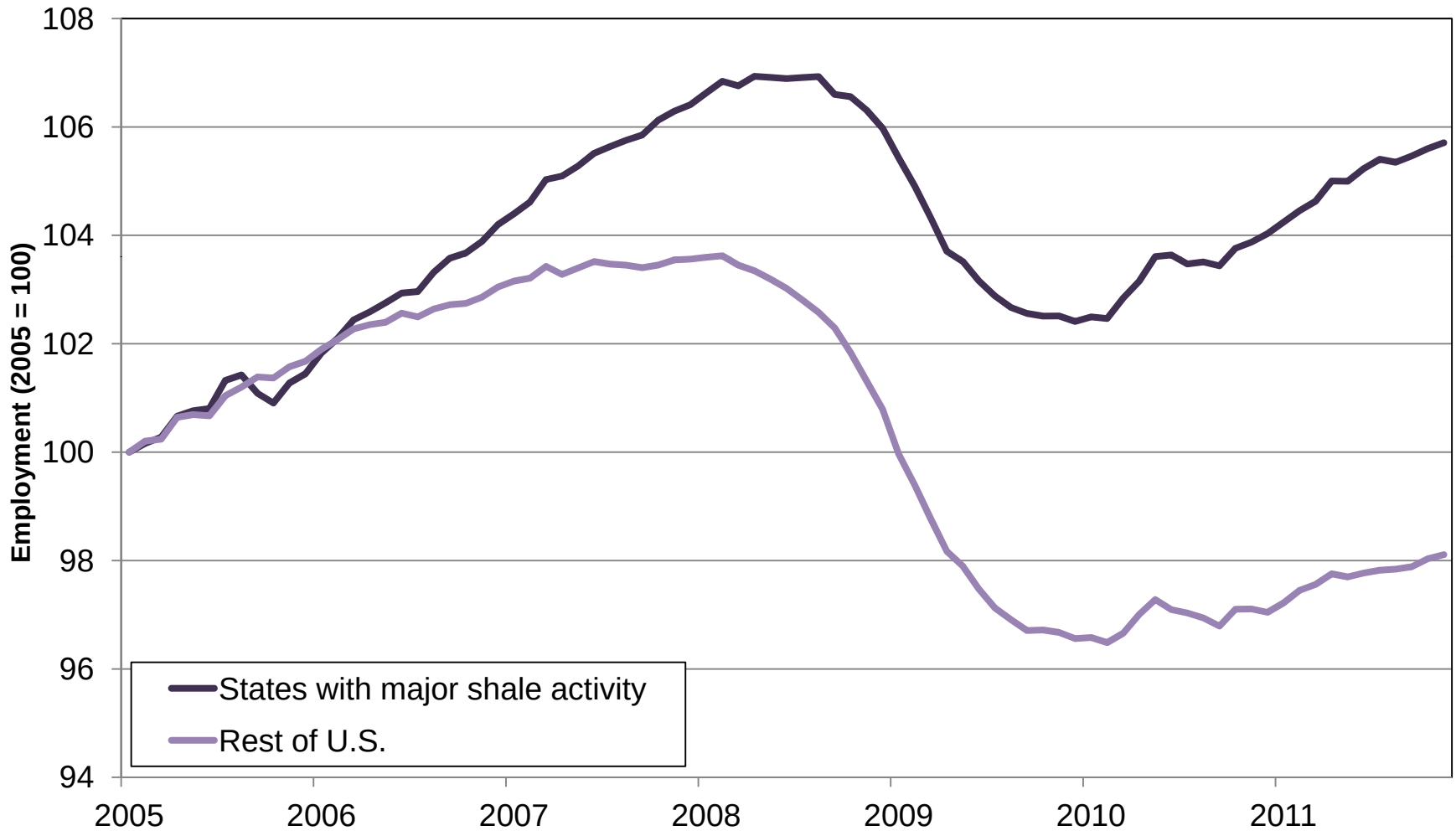
Source: Oil and Gas Journal and Louisiana Geological Survey.

United States Employment (2005 = 100)



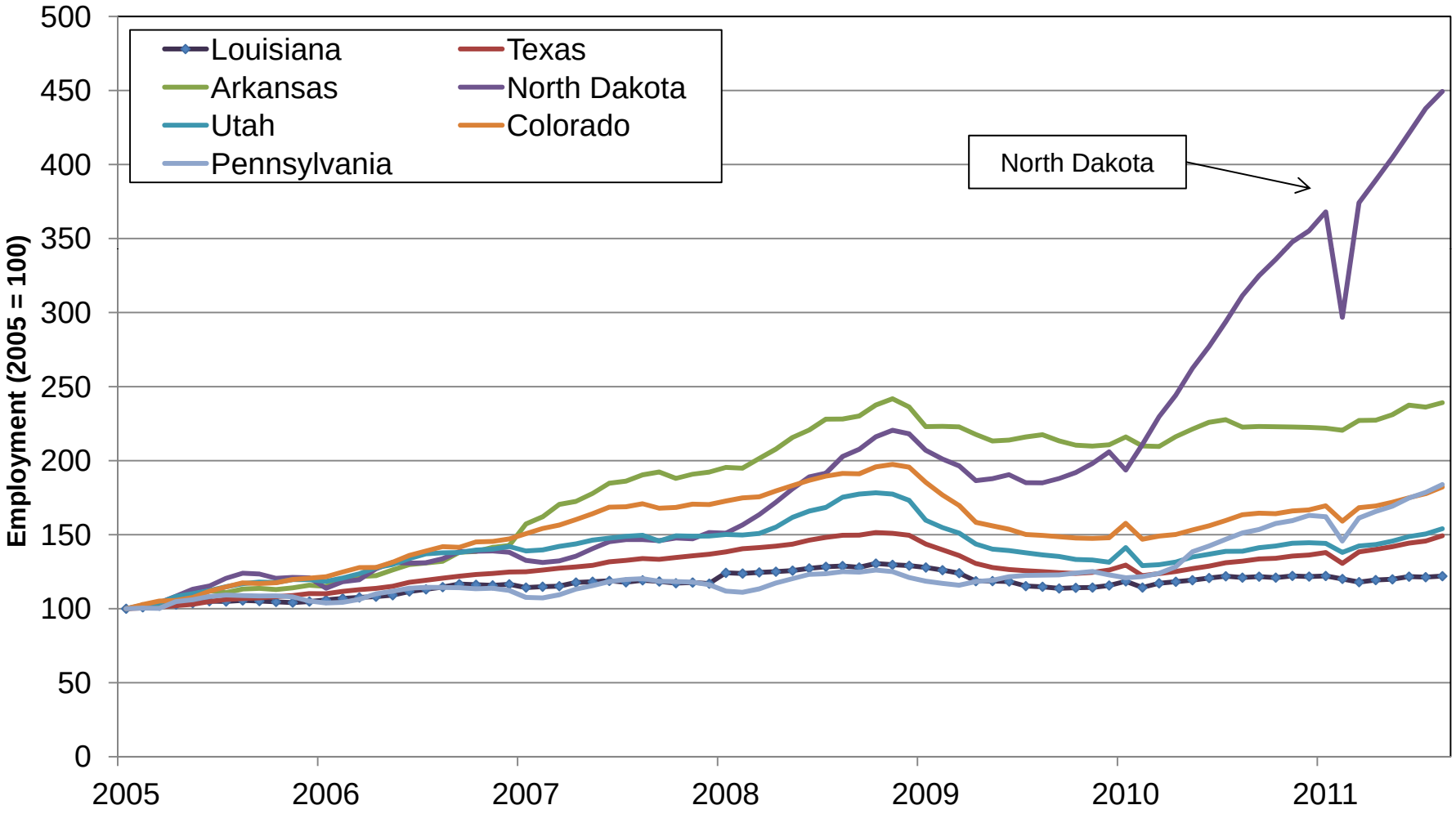
Source: Bureau of Labor Statistics

U.S./Shale Producing State Employment (2005 = 100)



Shale states: LA, TX, AR, ND, UT, CO, & PA
Source: Bureau of Labor Statistics

Oil and Gas Industry Employment (2005 = 100)



Shale states: LA, TX, AR, ND, UT, CO, & PA

Source: Bureau of Labor Statistics

Continued Shale Development Challenges

Still a number of lingering issues that create challenges for all shale development:

- **Public challenges on true resource size.**
- **Water/aquifer contamination issues.**
- **Water usage issues.**
- **Other environmental issues (geological, emissions)**
- **Regulatory/tax changes**
- **Supporting infrastructure development.**
- **Market demand and price support.**

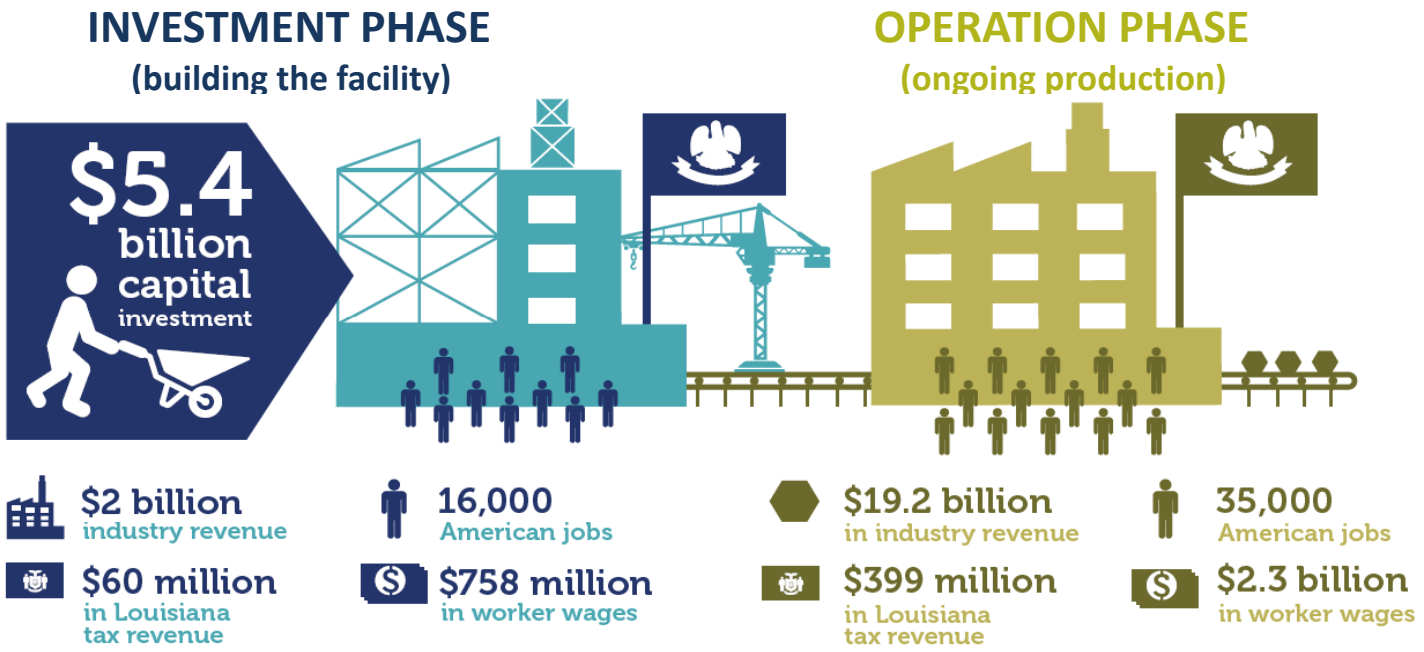
Policy Issue 4: Other New End-Uses and Industrial Renaissance

Louisiana Shale-Facilitated Employment

A **$5.4 BILLION** investment in expanded ethylene production capacity in Louisiana will generate a total of **$10.9 BILLION** in additional chemical industry output, bringing the state's industry revenues to **$56.9 BILLION** and maintaining it as the country's 2nd largest chemical producing state.

In Louisiana, more than **35,000 permanent jobs** will be created in the chemical industry and throughout the supply chain in everything from trade and craft jobs to highly-skilled knowledge workers.

More than **$2.3 BILLION** in wages will go into the pockets of Louisiana workers, generating **$399 MILLION** in state tax revenue and nearly **$440 MILLION** in federal revenue.



Source: American Chemistry Council

Economic Impact of Additional Ethane Utilization

Impact Type	Economic Impact from Expanded Production of Petrochemical and Derivatives from a 25 Percent Increase in Ethane Production			Economic Impact from New Investment in Plant and Equipment		
	Employment	Payroll --- (Billion $) ---	Output --- (Billion $) ---	Employment	Payroll --- (Billion $) ---	Output --- (Billion $) ---
Direct Effect	17,017	$ 2.4	$ 32.8	54,094	$ 4.3	$ 16.2
Indirect Effect	79,870	$ 6.6	$ 36.9	74,479	$ 5.1	$ 16.8
Induced Effect	85,563	$ 4.1	$ 13.7	100,549	$ 4.8	$ 16.1
Total Effect	**182,450**	**$ 13.1**	**$ 83.4**	**229,122**	**$ 14.2**	**$ 49.1**

Recent Expansion Announcements

Sep-2011: **Williams** announced an expansion at its **Geismar** olefins production facility (Baton Rouge, LA). The expansion will **increase the facility's ethylene production** by 600 million pounds per year to a new annual capacity of 1.95 billion pounds and is expected to be in service by the third quarter of **2013**.

Apr-2011: **Dow announced plans to increase its ethylene and propylene production**, and to integrate its US operations into feedstock opportunities available from increasing supplies of US shale gas. Specifically, the Company plans to increase its ethylene supply and cracking capabilities at existing Gulf Coast facilities by:

- Re-starting an ethylene cracker at its St. Charles operations site near Hahnville, LA by the end of **2012**;
- Improving ethane feedstock flexibility for an ethylene cracker at its Plaquemine, LA site in **2014**;
- Increasing ethane feedstock flexibility for an ethylene cracker at the Freeport, TX site in **2016**;
- Constructing a new, world-scale ethylene production plant in the US Gulf Coast, for startup in **2017**.

Apr-2011: **Westlake Chemical Corporation announced an expansion program** to increase the ethane-based ethylene capacity at Lake Charles, LA, and the evaluation of expansion options and the upgrade of ethylene production facilities at Calvert City, KY in order to capitalize on new low cost ethane and other "light" feedstocks being developed.

Mar-2011: **Chevron Phillips Chemical announced it is advancing a feasibility study to construct a "world-scale" ethane cracker and ethylene derivatives at one of its existing facilities in the Gulf Coast region**. The new facility would utilize the advantaged feed sources expected from development of shale gas reserves.

Dec-2010: **Sasol announced plans to construct the world's first commercial tetramerization unit, capable of producing over 100,000 metric tons per year of combined 1-octene and 1-hexene**, at its existing Lake Charles, LA Chemical Complex.

Conclusions

Conclusions

- **Exceptional industry performance: employment up; reserves up; production up; investment/capacity up; and exports up.**
- **Traditional sectors of energy industry have proven they are high technology, high capital, and high growth – you'd have a hard time figuring that out watching the nightly news.**
- **Policy and perception continue to be things that plague continued industry development. It is hard to imagine the development and innovation that could arise if the current policy uncertainty were removed.**
- **There are a large number of new domestic end-uses: many are likely to arise over the next several years and many have simply been take away by policy (not economics).**
- **Policy uncertainty is the biggest impediment to continued development. Significant short-term policy retrenchment on unconventional resources could lead to economic impacts that would pale in comparison to past financial and housing crisis.**

Questions, Comments and Discussion

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