

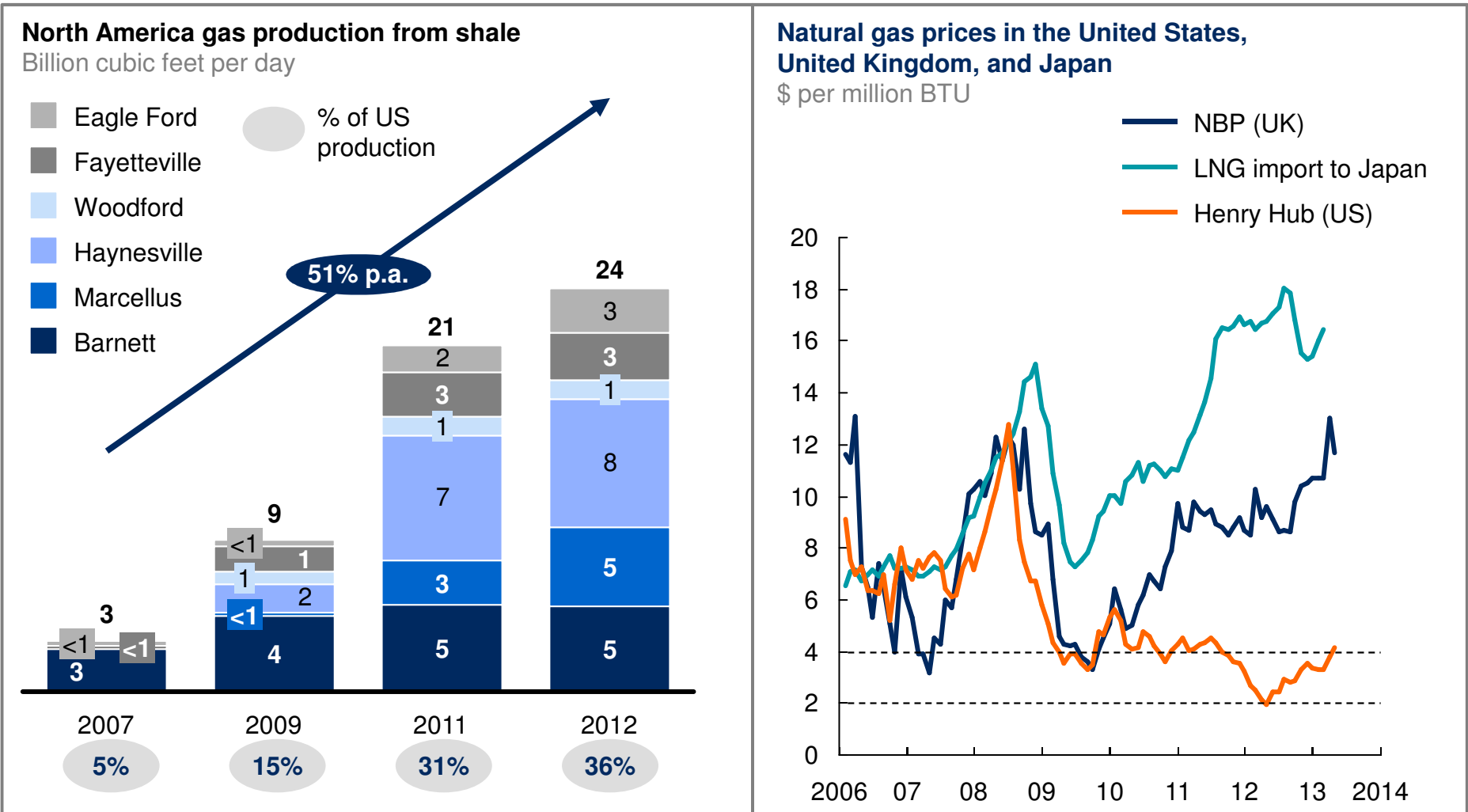


# NASEO 2013 Annual Meeting

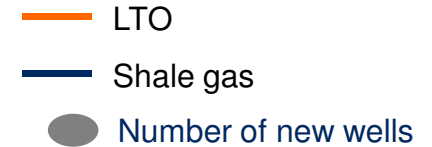
Presentation: "40 Years After the Oil Embargo: On a Path to North American Energy Independence"

September 16, 2013

# Shale gas production in North America has grown by 51 percent annually since 2007, lowering the price by two-thirds



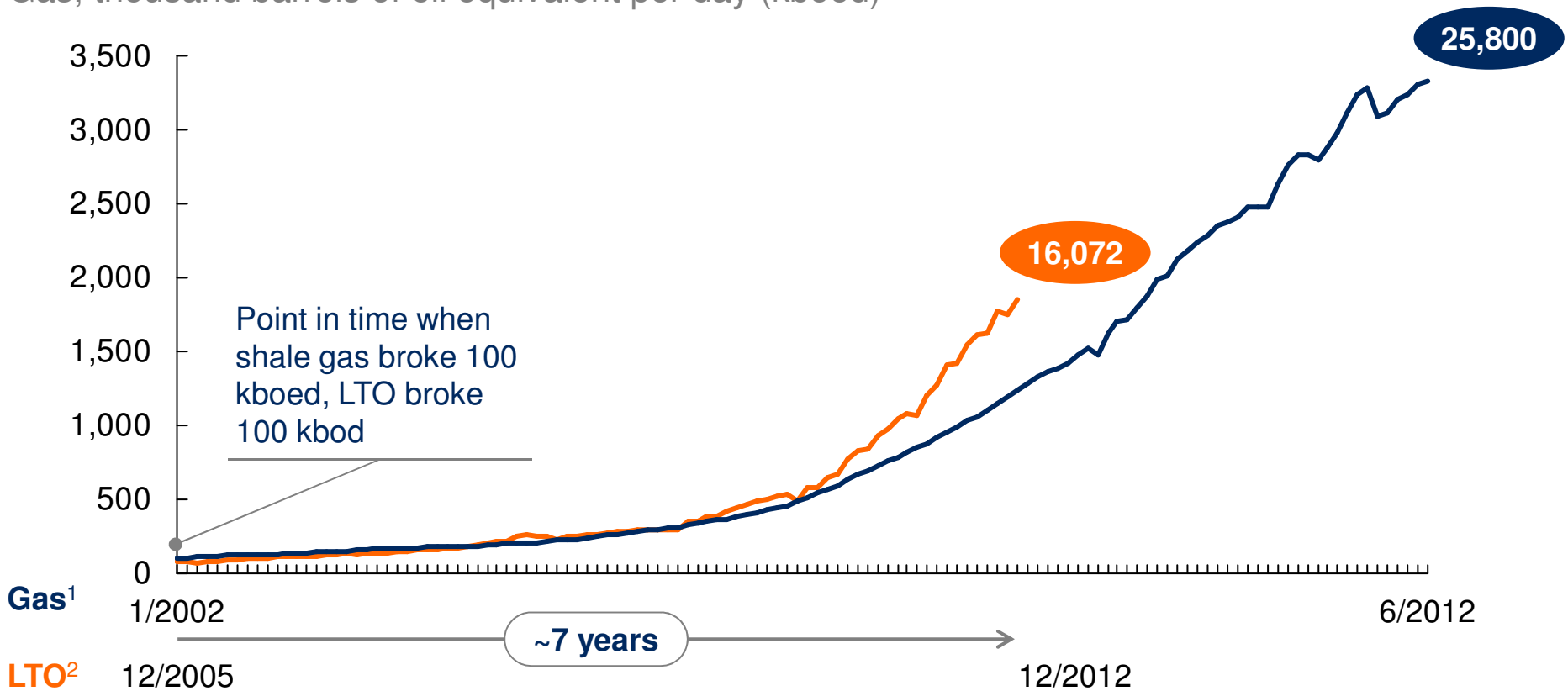
# US output of light tight oil (LTO) is growing even faster than shale gas output did in its early stages



## Production of LTO and shale gas

LTO, thousand barrels per day (kbod)

Gas, thousand barrels of oil equivalent per day (kboed)



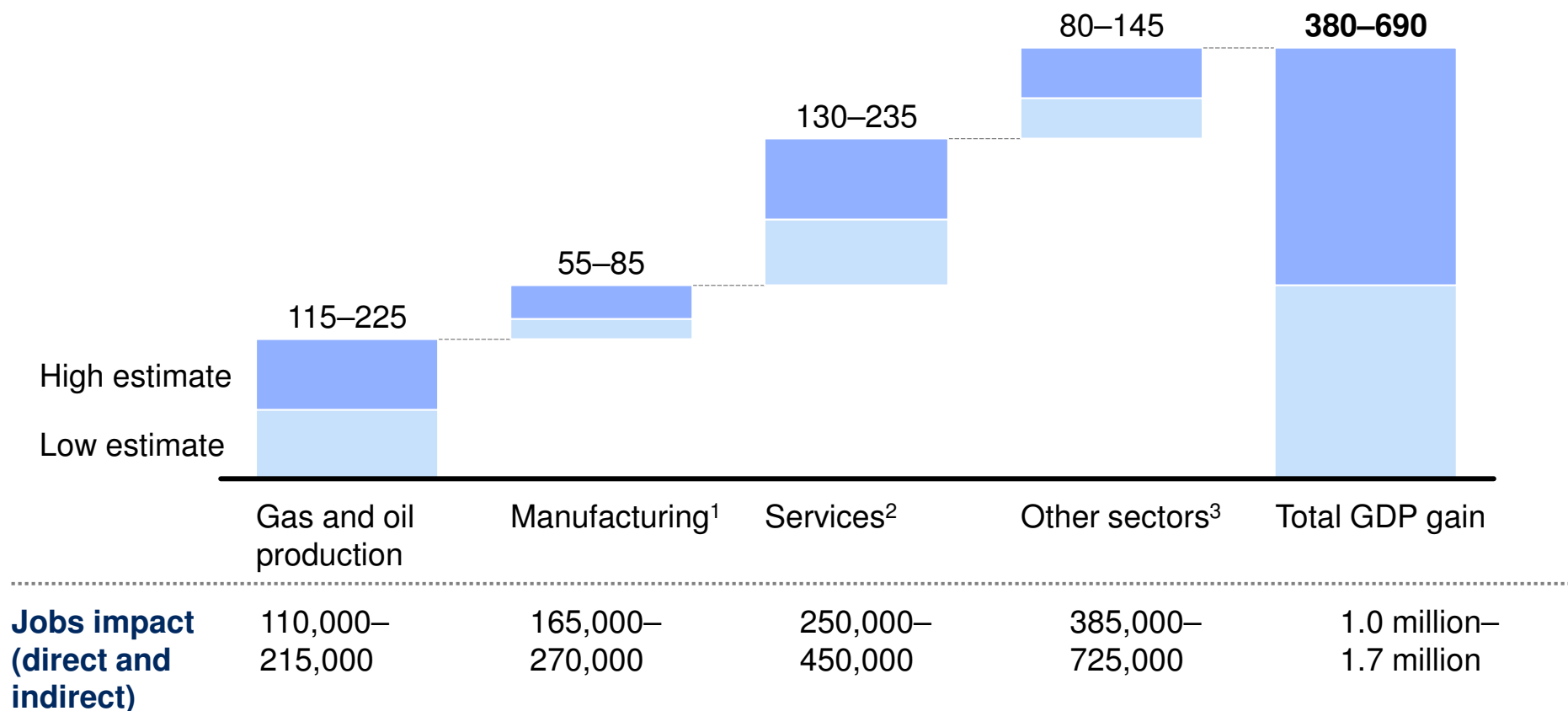
1 Barnett, Eagle Ford, Fayetteville, Haynesville, Marcellus, and Woodford—only gas included.

2 Bakken, Eagle Ford, Granite Wash, Avalon, Mississippi Lime, Spraberry, Austin Chalk, Bone Spring, Niobrara, Woodford, Monterey—only liquids included; wells with production after January 2000.

# By 2020, shale gas and oil could boost US GDP by roughly \$400 billion to \$700 billion annually and create up to 1.7 million jobs

## Annual incremental GDP impact by 2020

\$ billion



1 Includes chemicals, metals, paper and pulp, and rubber and plastics manufacturing.

2 Includes professional services, management, real estate, health care, education, leisure, and hospitality.

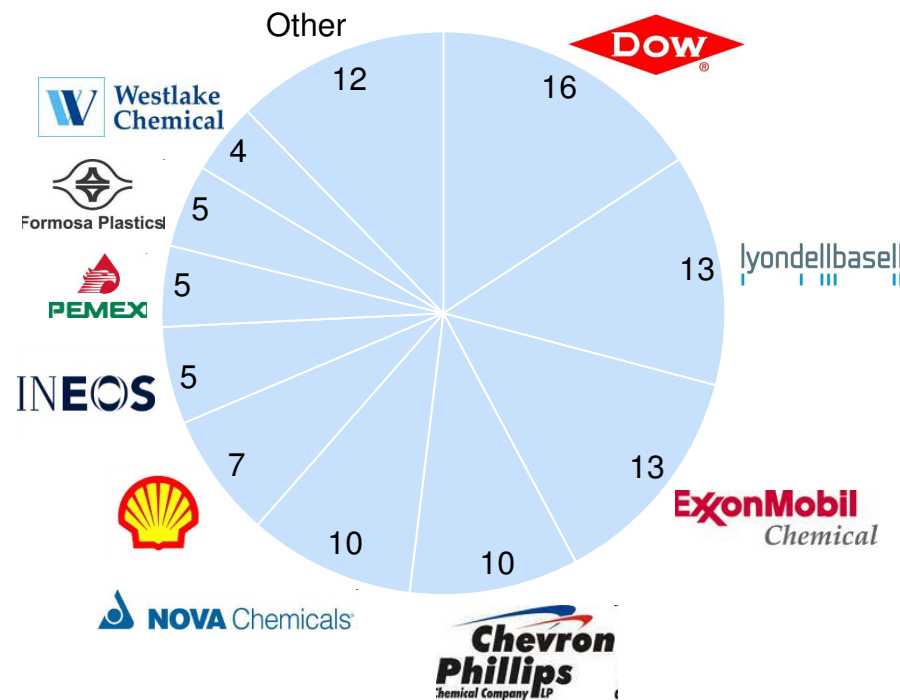
3 Includes wholesale and retail trade, construction, transport and warehousing, agriculture, mining, and government.

# Example: Many firms have announced ethylene plant expansions and construction of new facilities

5-6 players control the majority of the market, but low entry barriers allow for many smaller players

US ethane cracking expansions and new builds announced or being evaluated<sup>1</sup>

North American ethylene market share  
Percent, 100% = 32.5 million tons



- Plans ~30% expansion of US capacity; intention to build cracker by 2017



- Announced study to develop World Scale cracker on US Gulf Coast



- Announced plans to build world-scale ethylene cracker/PE plant in Marcellus



- Plans add ~250KT ethylene capacity, considering new cracker with partner



- Plans expansion of 230MM lbs/year at Lake Charles, LA for 2012



- Conduction feasibility study for 1-1.4 MMT cracker in Lake Charles LA



- Early-stage opportunity evaluation underway



- Considering US-based greenfield plant coupled with PE asset

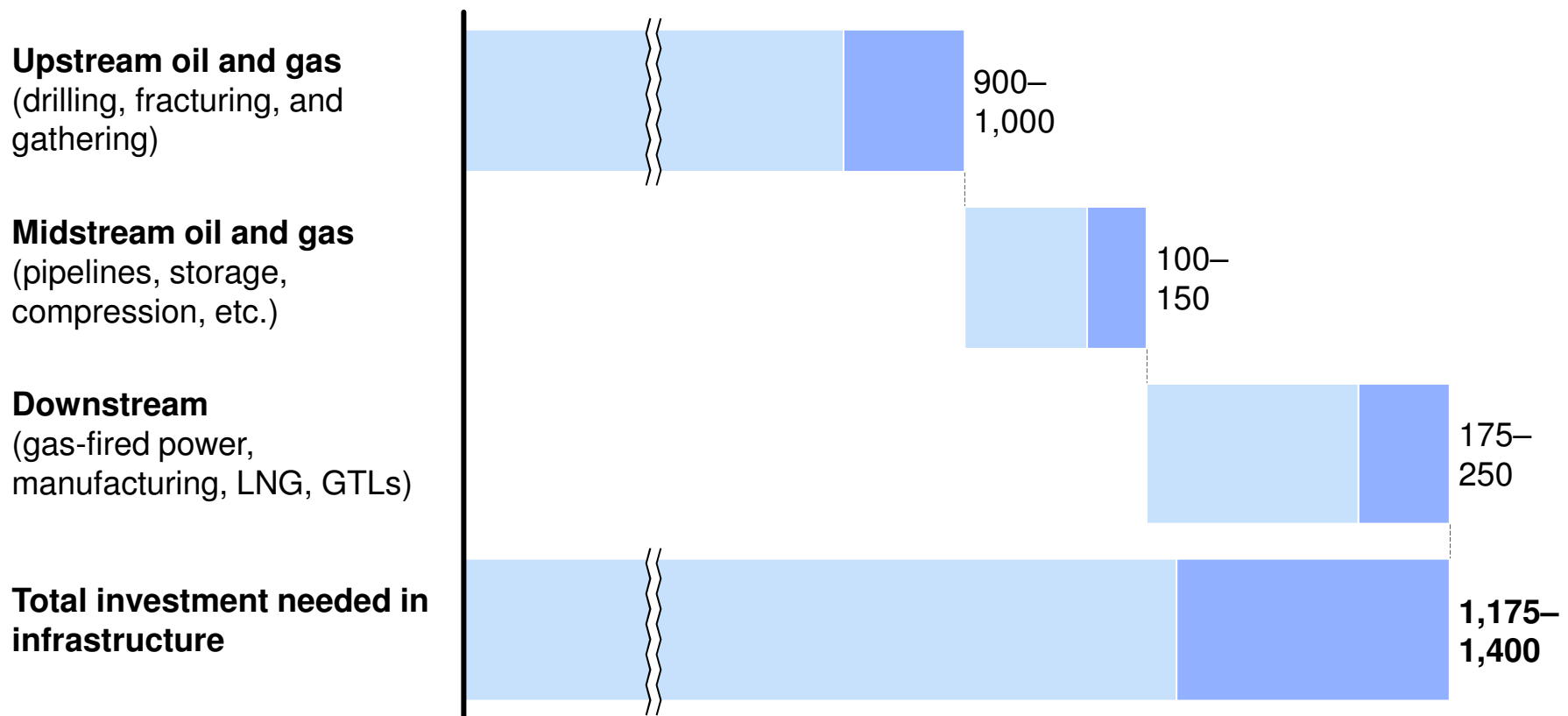
**More than 5 million tons of new capacity has been announced for the next 5-7 years**

<sup>1</sup> Additional expansions, conversions and debottlenecks can increase cracker capacity by an additional 200-300 tons/years in the next five years

# An investment of \$1.2 trillion to \$1.4 trillion is needed to unlock the potential of shale gas and tight oil—and drive significant short-term benefits

Low estimate  
High estimate

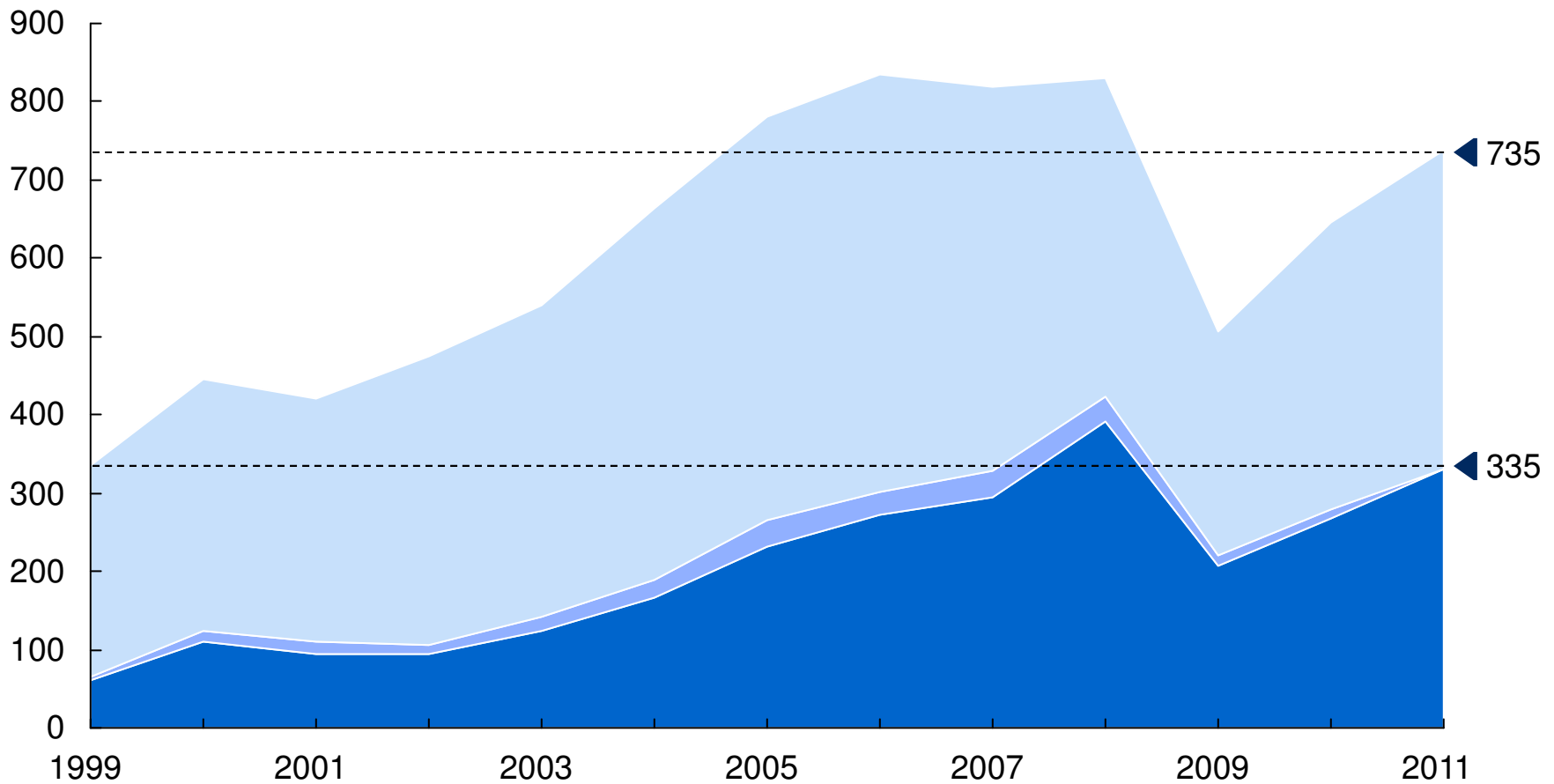
Total investment required, 2012–20  
\$ billion



# Energy imports are nearly half of the US goods trade deficit, but additional shale production could drive net energy imports to zero

US net imports of goods, energy, and petroleum, 1999–2011  
\$ billion

- Net imports of
- Goods
- Energy products
- Petroleum and products



# The shale boom is associated with environmental risks that must be mitigated successfully...

## Environmental issue

## Lever

**Water contamination from fracking chemical fluids**

- Public disclosure of fracking chemicals used
- Centers of excellence to disseminate best practices in industry



**Water intensity and scarcity**

- Supply chain optimization
- Sustainable resource management



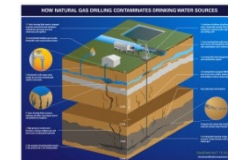
**Fugitive methane**

- Clarify fugitive methane risk and best practices for mitigating it



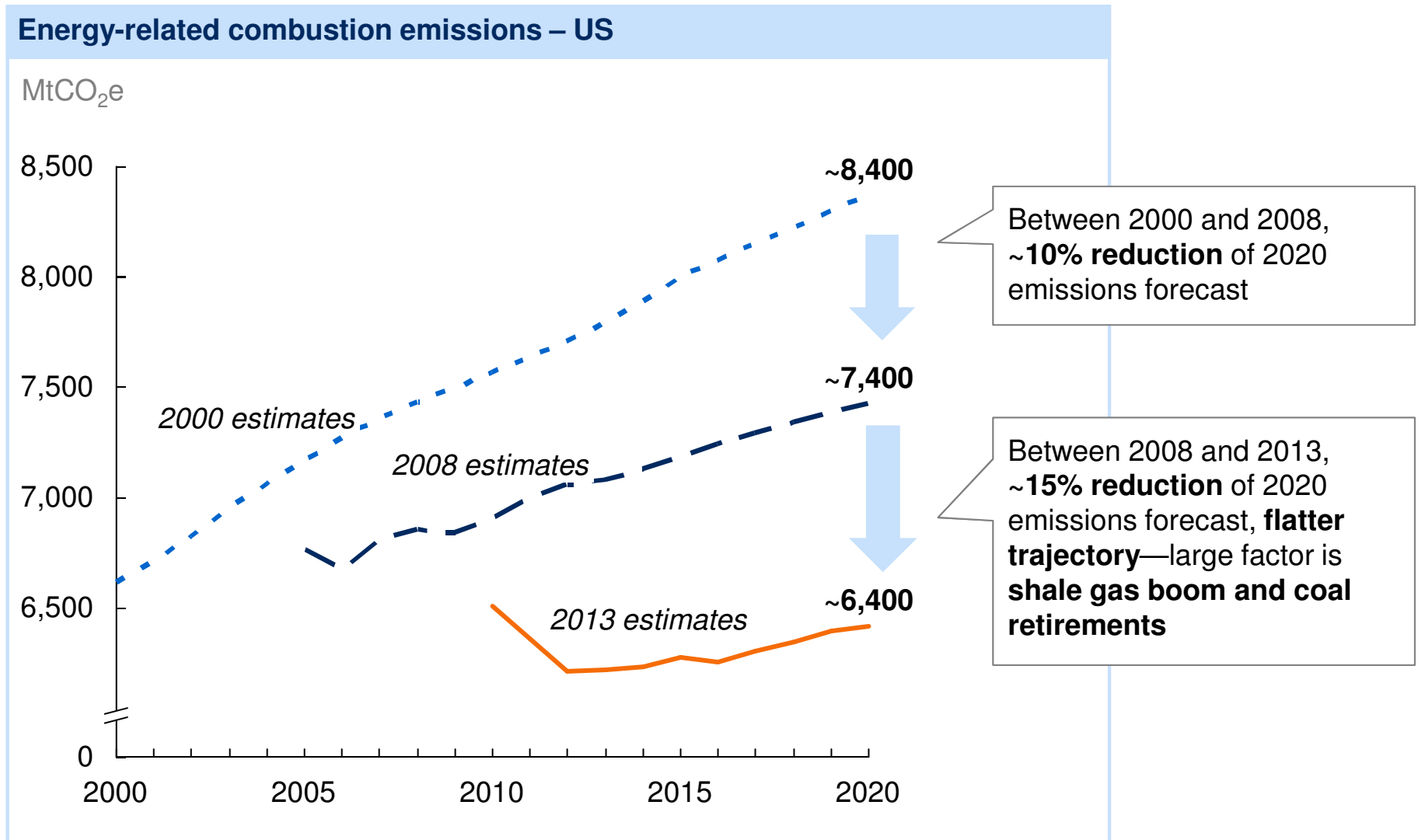
**Seismicity**

- Condition based monitoring
- Predictive maintenance
- Centers of excellence





## In turn, the shale boom has environmental benefits, and is expected to enable a significant reduction in US GHG emissions through 2020



## Summary: Key findings of our recent Game Changers work...



- **North American shale gas and tight oil production have each grown by 50% annually** in recent years, and are expected to continue to grow
- If environmental risks can be mitigated, **shale gas and tight oil can have a game-changing impact on the US economy** by providing low natural gas prices for power generation and downstream industries, reducing energy imports / increasing exports, and creating jobs
- We estimate that it could add **2-4% to annual GDP by 2020** (\$400-700 billion), up to **1.7 million jobs**, and reduce US energy imports