

America's New Energy Future: The Unconventional Oil and Natural Gas Revolution and the US Economy



Fueling Significant Growth?

Mohsen Bonakdarpour
IHS Economics

A Presentation
to:



February 27, 2014

Agenda



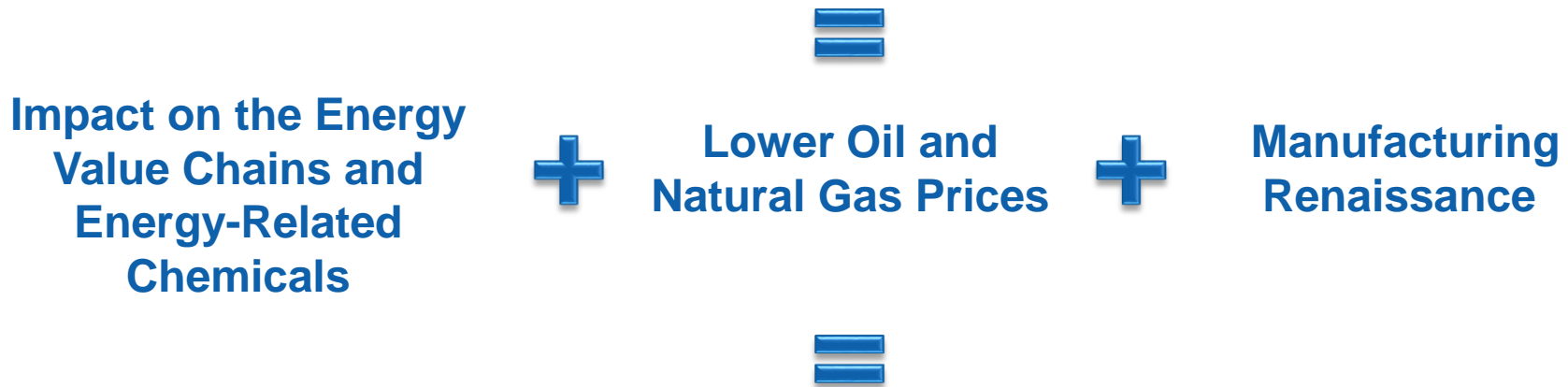
- IHS Studies
- Background on Unconventional Energy in the US
- Economic Contribution & The Manufacturing Renaissance
- Conclusions

IHS Assessed the Contribution of Unconventional Oil and Natural Gas Activity to the US Economy on Three levels



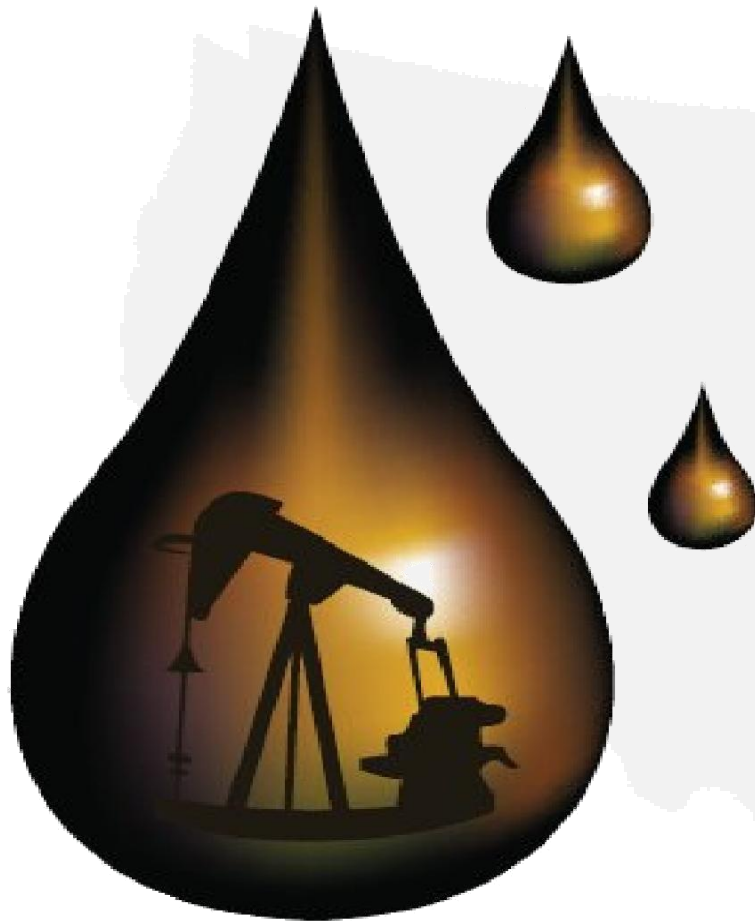
- **October 2012: National Economic Contributions**
 - The direct, indirect and induced contribution of upstream unconventional oil and natural gas activity on the US economy as measured in jobs, GDP contribution, labor income and government revenue.
- **December 2012: State Economic Contributions**
 - The national level contribution assessment is further broken down to the state level. The use of extensive domestic supply chains means benefits will accrue even to states that are not unconventional energy producers.
- **September 2013: A Manufacturing Renaissance**
 - An assessment of how unconventional oil and natural gas (as both an energy source and industrial feedstock) will make significant contributions to the US economy while enhancing the global competitiveness of US manufacturing.

Domestic Unconventional Oil and Natural Gas



Transformation of both US Energy and the US Economy

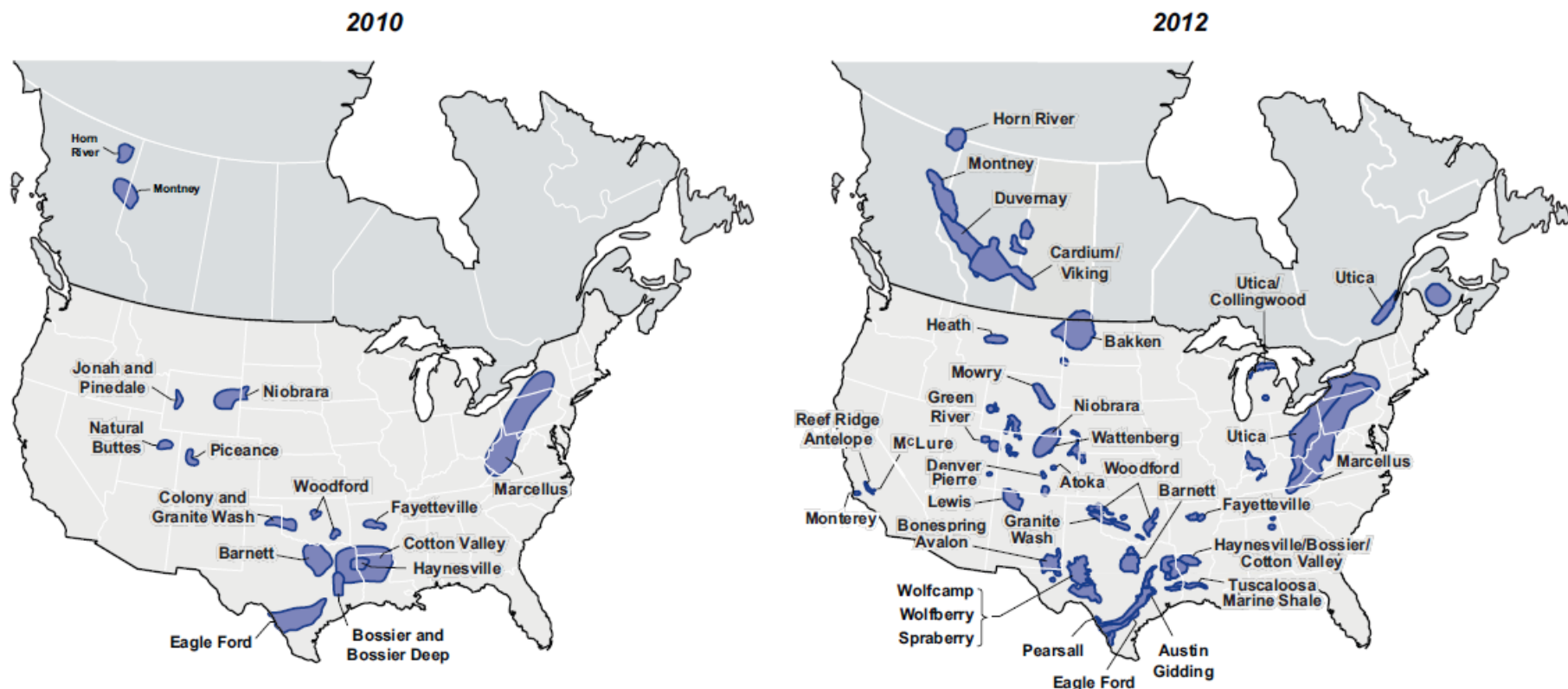
Snapshot of US Energy Landscape



- Unconventional oil sources have increased oil production by 25% from 2008.
- Twelve years ago, shale gas production was only 2% of total US natural gas production, today it represents 37%.
- The increase in US natural gas production from shale gas and tight gas plays is making it possible that the United States will become a net exporter of gas by the end of this decade
- US Employment attributable to unconventional energy will account for more than **3.9 million jobs** and add over **\$500 billion to US GDP** in 2025.

Unconventional Oil and Gas Plays in North America

Unconventional Hydrocarbon Plays in North America: Then and Now



Source: IHS CERA.
11013-1B

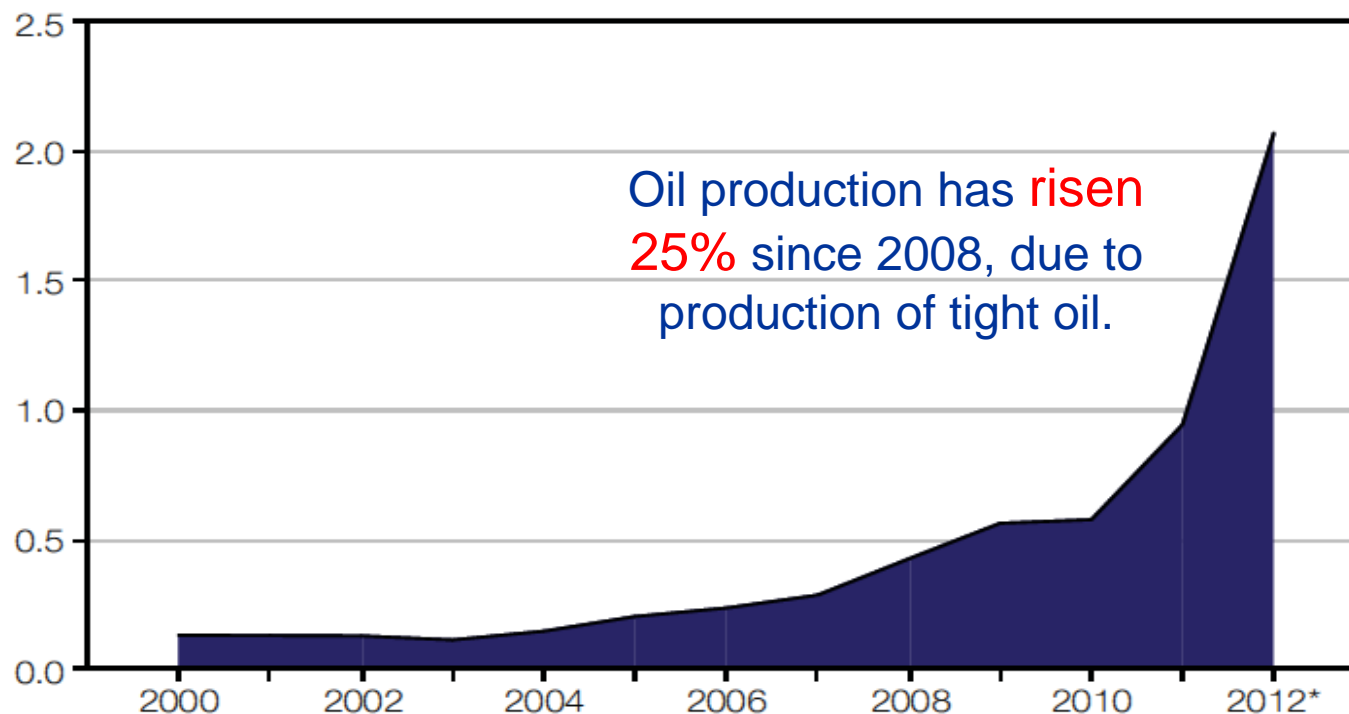
Enough to satisfy more than 100 years of consumption at current rates

Unconventional Oil is Unlocking New Domestic Sources of Supply

From 1970 to 2008, crude oil production fell from 9.6 mbd to 5 mbd. Unconventional oil has played a significant role in reversing oil production decline.

Average Daily US Tight Oil Production: 2000 to 2012

Million Barrels per Day



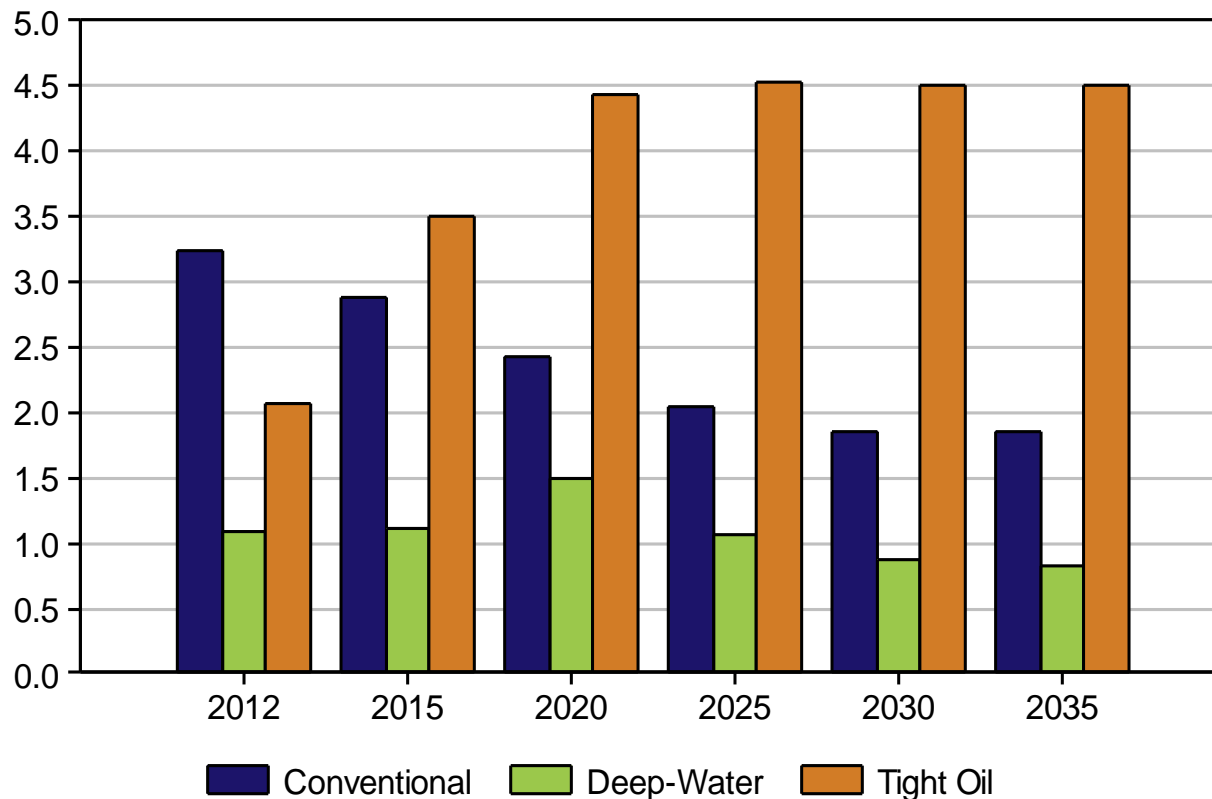
*Projections, Source: IHS CERA



Unconventional Tight Oil Will Dominate US by 2015

US Tight Oil Production Outlook: 2012 to 2035

Million Barrels per Day



Tight Oil production share

32% in 2012

53% in 2020

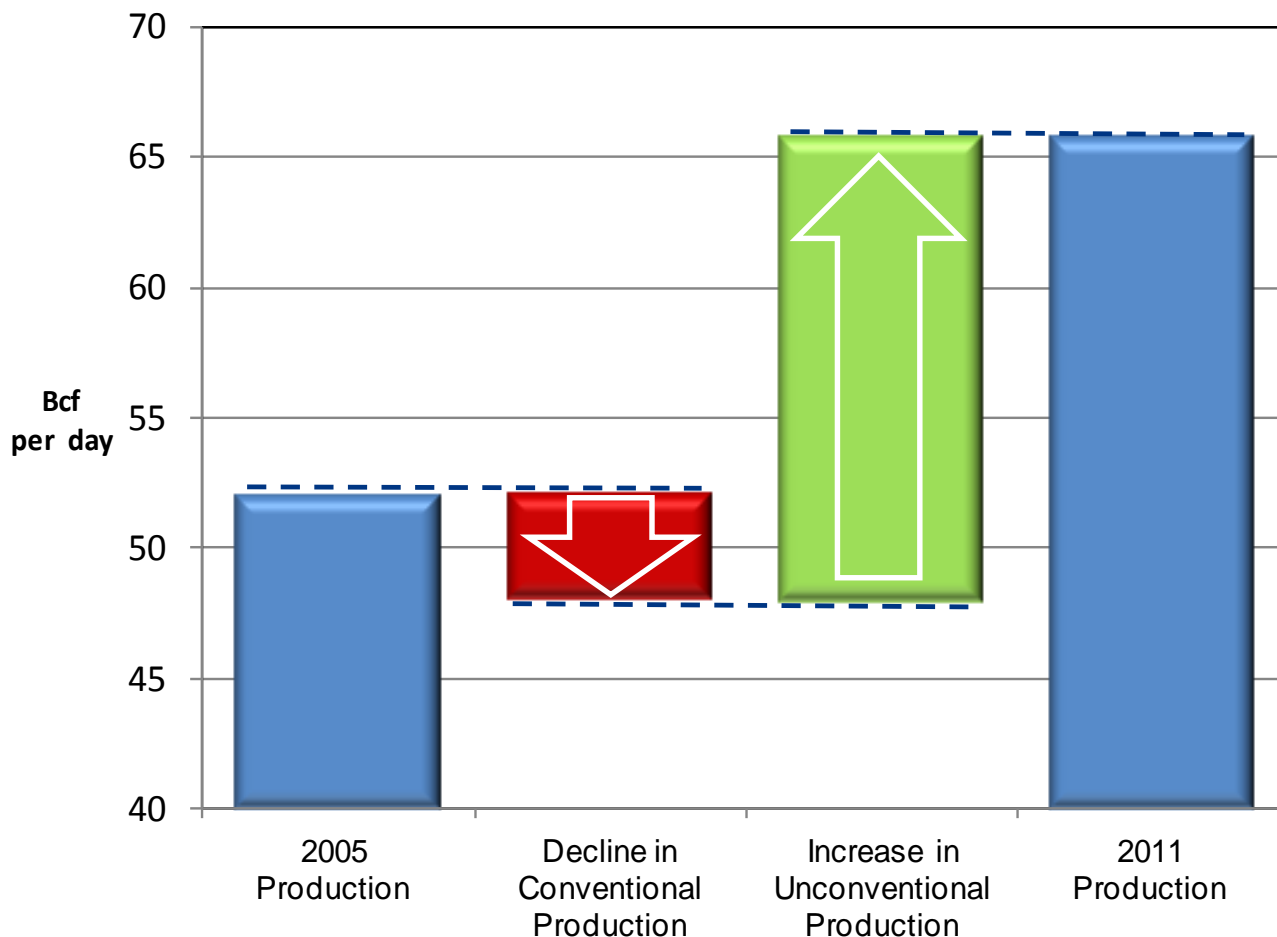
63% in 2035

US Oil import requirements down from 60% in 2005 to 42% today.



United States a Net Exporter of Gas by the End of Decade.

Sources of Changes in Annual Gas Production Levels, 2005 - 2011



US natural gas production **up 25%** from 2005 to today

Five years ago the US was on track to spend \$100B annual on LNG imports

US Upstream Energy Assumptions

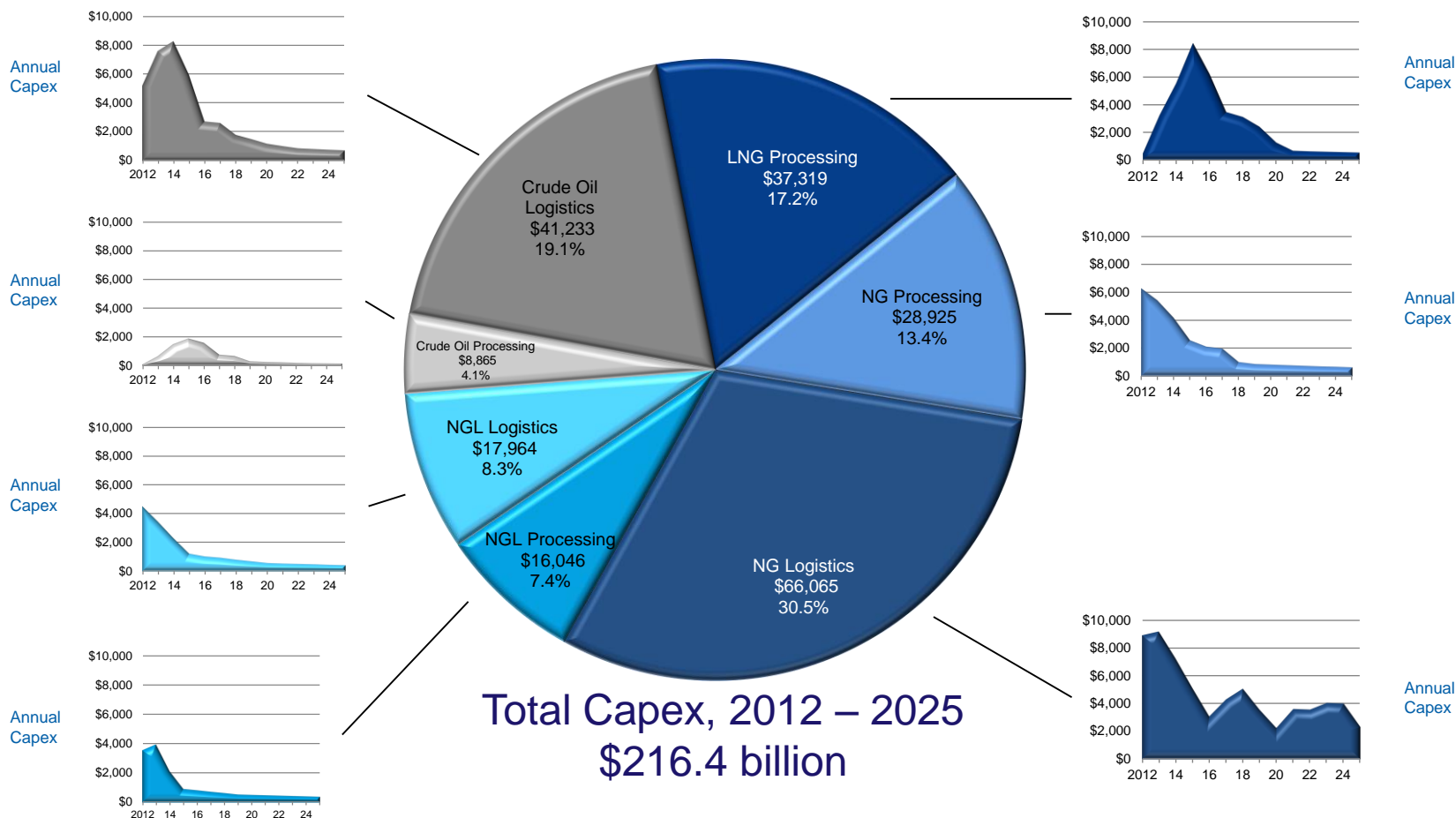


US Lower 48 Annual Unconventional Activity Assumptions				
	2012	2015	2020	2025
PRODUCTION				
Unconventional Oil* (mbd)	2.07	3.50	4.43	4.53
Tight Oil	1.49	2.65	3.28	3.29
Shale Gas Condensate	0.30	0.49	0.71	0.81
Tight Gas Condensate	0.28	0.36	0.44	0.43
Unconventional Gas** (Bcf per day)	36.12	44.27	59.53	69.61
Associated Gas***	2.59	4.90	6.62	6.96
Shale Gas	23.83	27.82	37.67	46.47
Tight Gas	9.70	11.54	15.25	16.18
Natural Gas Liquids (Contained)**** (mbdoe per day)	1.81	2.67	3.82	4.47
Associated Gas	0.44	0.84	1.10	1.13
Shale Gas	0.85	1.13	1.67	2.09
Tight Gas	0.52	0.70	1.06	1.26
WELL COMPLETIONS				
Unconventional Oil †	7,179	8,472	8,636	9,156
Unconventional Gas ††	7,766	9,004	10,210	10,435
Shale Gas	5,086	5,545	6,688	7,207
Tight Gas	2,681	3,459	3,521	3,228
CAPITAL EXPENDITURE (Current \$M)				
Drilling Capital Expenditure	28,027	41,463	57,680	78,261
Drilling	18,778	27,780	38,646	52,435
Support Services	9,249	13,683	19,035	25,826
Completion Capital Expenditure	46,873	67,194	92,322	121,089
Hydraulic Fracturing	37,498	53,756	73,858	96,872
Other	9,375	13,439	18,464	24,218
Facilities Capital Expenditure	6,701	9,568	12,620	16,282
Material	4,020	5,741	7,572	9,769
Fabricaton	1,675	2,392	3,155	4,071
Project Management	335	478	631	814
Other	670	957	1,262	1,628
Gathering System Capital Expenditure	5,701	8,063	9,919	12,034
TOTAL UPSTREAM CAPITAL EXPENDITURE	87,301	126,288	172,542	227,667

Midstream and Downstream Capital Expenditures



Initially, infrastructure expansion will be undertaken to support upstream activity – by the end of the forecast, capital expenditures moderates.



US Based Energy-Related Chemicals Expands



- As energy infrastructure is built, capacity expansion in energy-related chemicals peaks mid-decade, leading to production gains toward the end of the forecast period.

Energy-Related Chemicals Value of Production and Capital Expenditures: United States

(Current \$M)

	2012	2015	2020	2025	2012-2025
Value of Production					
Acrylics	114	329	744	1,531	10,807
Nitrogen Fertilizers	333	697	5,003	6,411	53,747
Chlor-alkali	386	1,428	1,551	2,094	20,072
Olefins	28	436	3,720	5,890	36,990
Polyolefins	174	1,469	24,221	34,875	244,455
Vinyls Chain	112	705	4,706	7,969	49,893
Glycols Chain	378	731	3,648	4,360	35,457
Methanol Chain	170	1,914	5,041	6,524	53,342
Aromatics Chain	0	0	59	108	587
Total Value of Production	1,695	7,709	48,694	69,761	505,350
Total Capital Expenditures	4,818	12,787	9,408	7,427	129,305

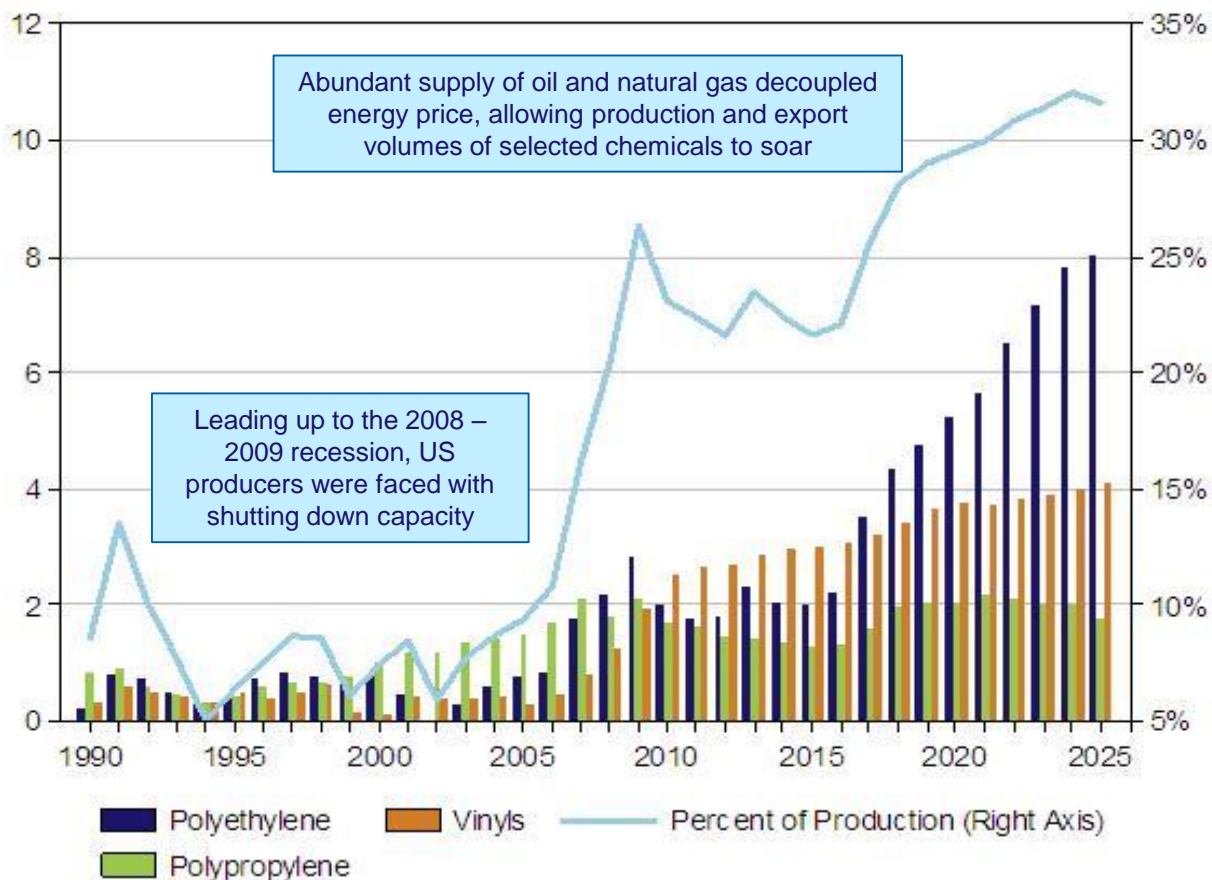
Source: IHS Chemical

Unconventional Energy Provides US Chemical Producers with a Competitive Feedstock Position



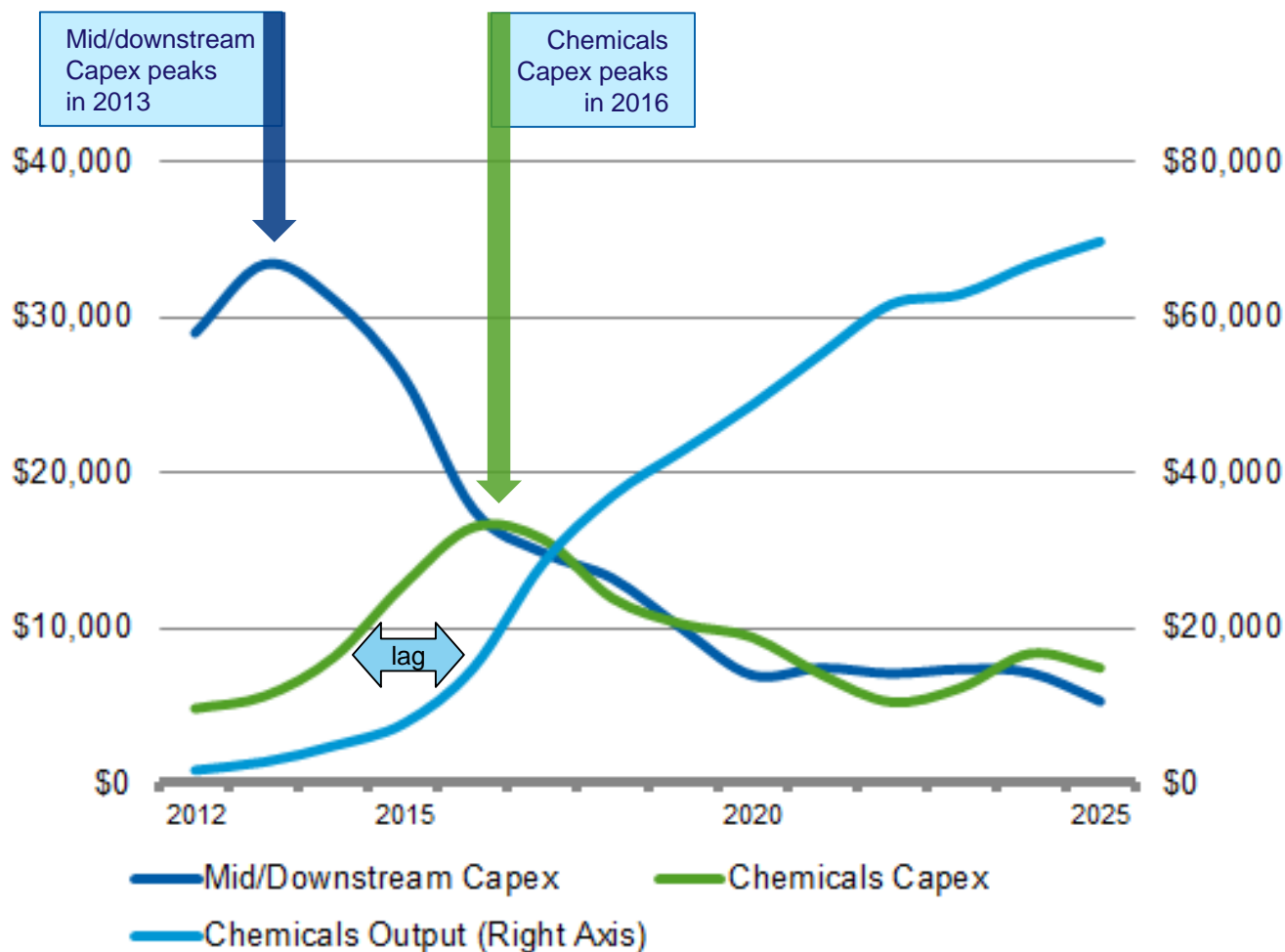
US Net Exports for Selected Products

Million metric tons



Source: IHS Chemical

The ramp up in Chemicals production will necessarily lag capex investment cycles

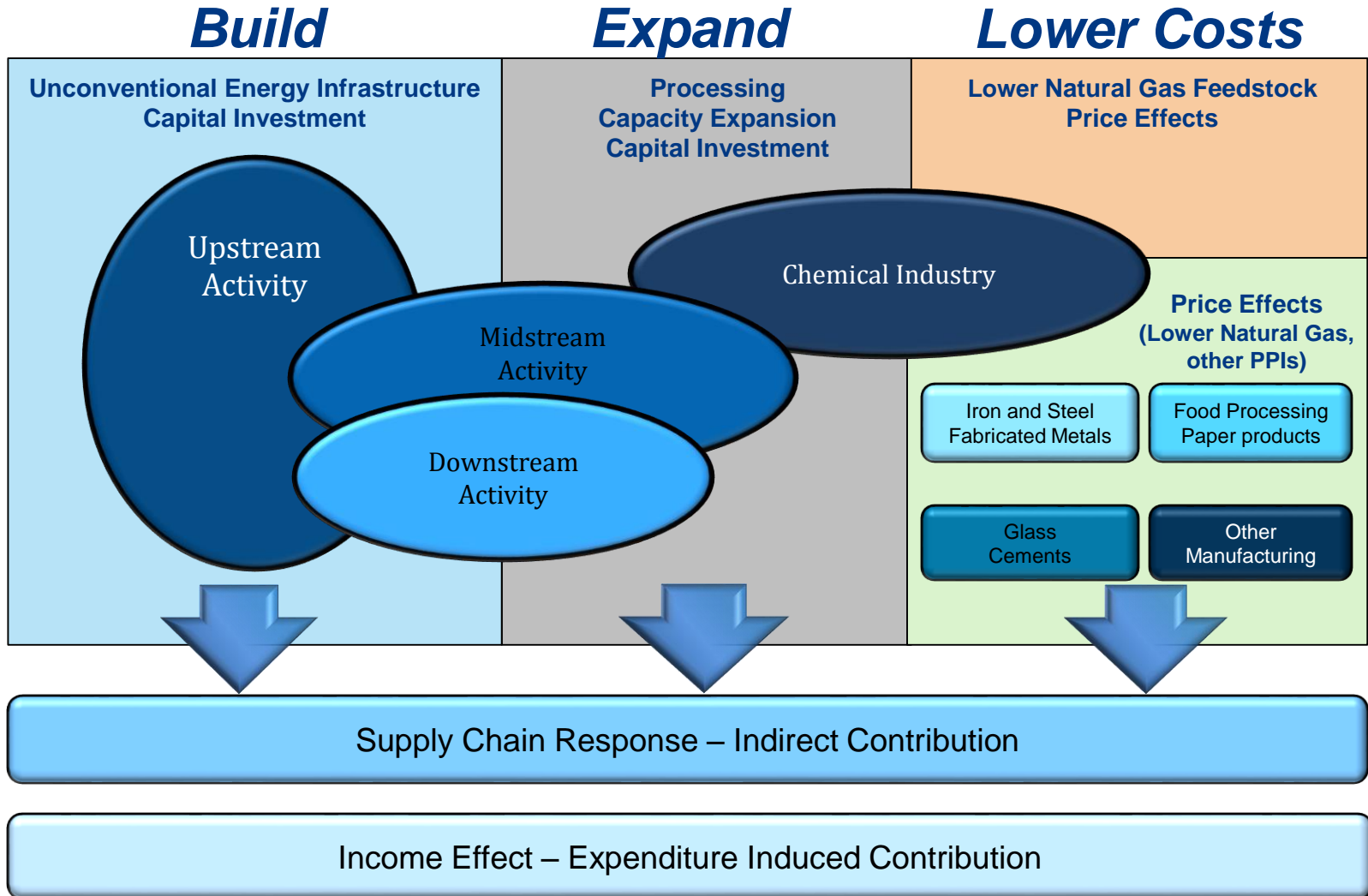


Source: IHS



Economic Contribution & A Manufacturing Renaissance

Impact of Unconventional Activity on US Manufacturing

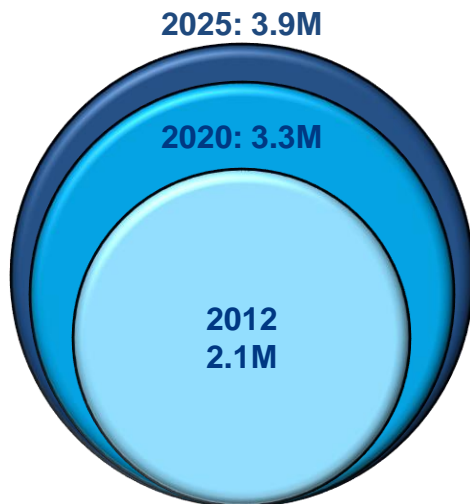


Measuring the Transformative Contribution of Unconventional Energy to the US Economy



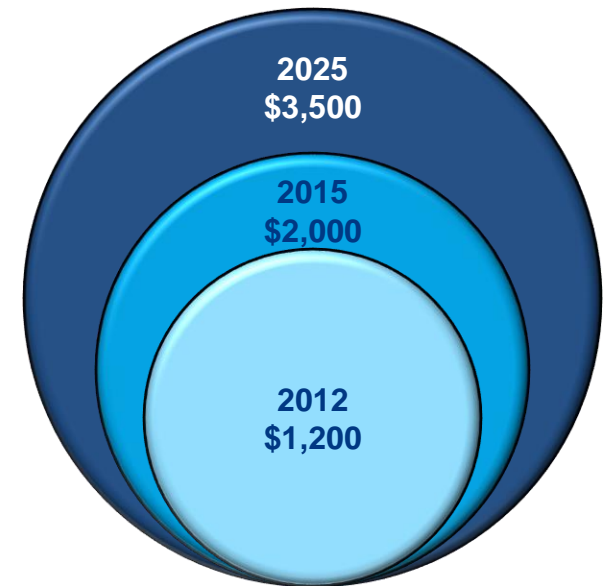
- Unconventional oil and natural gas activity is reshaping America's energy future and bringing significant benefits to the US economy in terms of jobs, government revenues, and GDP.
- A new era of affordable and abundant energy is creating significant competitive advantages for the US in both energy-intensive industries and industries that rely on natural gas derivatives as critical production feedstock.

Employment Contribution



- **Jobs:** 2.1 million jobs in 2012, 3.3 million in 2020 and 3.9 million in 2025.
- **GDP:** annual contributions will nearly double from \$284 billion in 2012 to \$533 billion in 2025.
- **Government revenues:** average \$115 billion annually, totaling over \$1.6 trillion from 2012 to 2025.
- **Real household disposable income:** increase of more than \$1,200 in 2012, \$2,000 in 2015 to more than \$3,500 in 2025

Contribution to Household Income



Segments of the Value Chain have Different Employment Contribution Trends



- The employment contribution trends of midstream and downstream energy versus energy-related chemicals reflect these industries' differing capacity expansion and production outlooks.
- During the forecast period, the employment contribution is expected to moderate in the midstream and downstream energy value chain while the energy-related chemicals value chain is expected to gain strength.

Employment Contribution due to the Unconventional Activity Value Chain: Base Case*

(Number of workers)

	2012	2020	2025
Upstream Energy Activity	1,748,604	2,985,168	3,498,678
Midstream and Downstream Energy Activity	323,648	73,530	56,989
Energy-Related Chemicals Activity	53,252	277,356	318,748
Total Activity	2,125,504	3,336,055	3,874,415

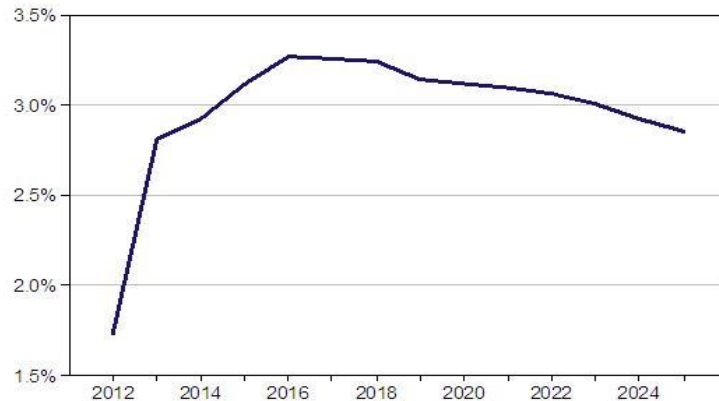
A Counterfactual Assessment of Unconventional's Contribution to the US Economy



Insights derived by comparing the US economy with unconventional activity to a counterfactual analysis that removes unconventional activity.

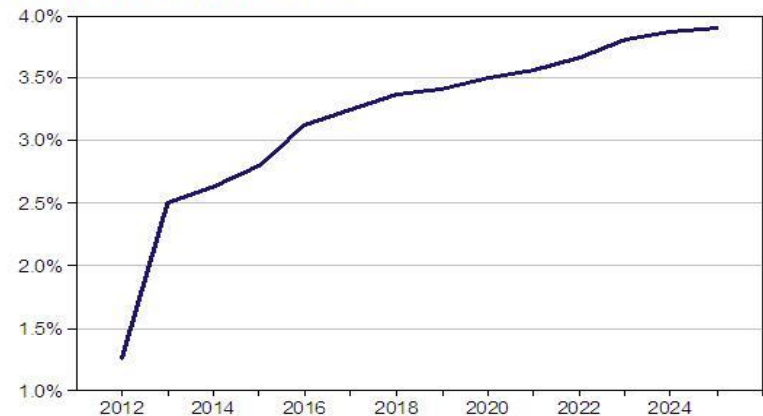
IHS estimates that, on average, unconventional energy will contribute 0.1% to annual GDP growth rates over the next decade.

Change in Gross Domestic Product due to the Unconventional Activity Value Chain: Base Case*



- GDP contribution under the unconventional revolution conditions will be higher, peaking at 3.2% in 2016 before moderating for the rest of the forecast period.

Change in Industrial Production Index due to the Unconventional Activity Value Chain: Base Case*

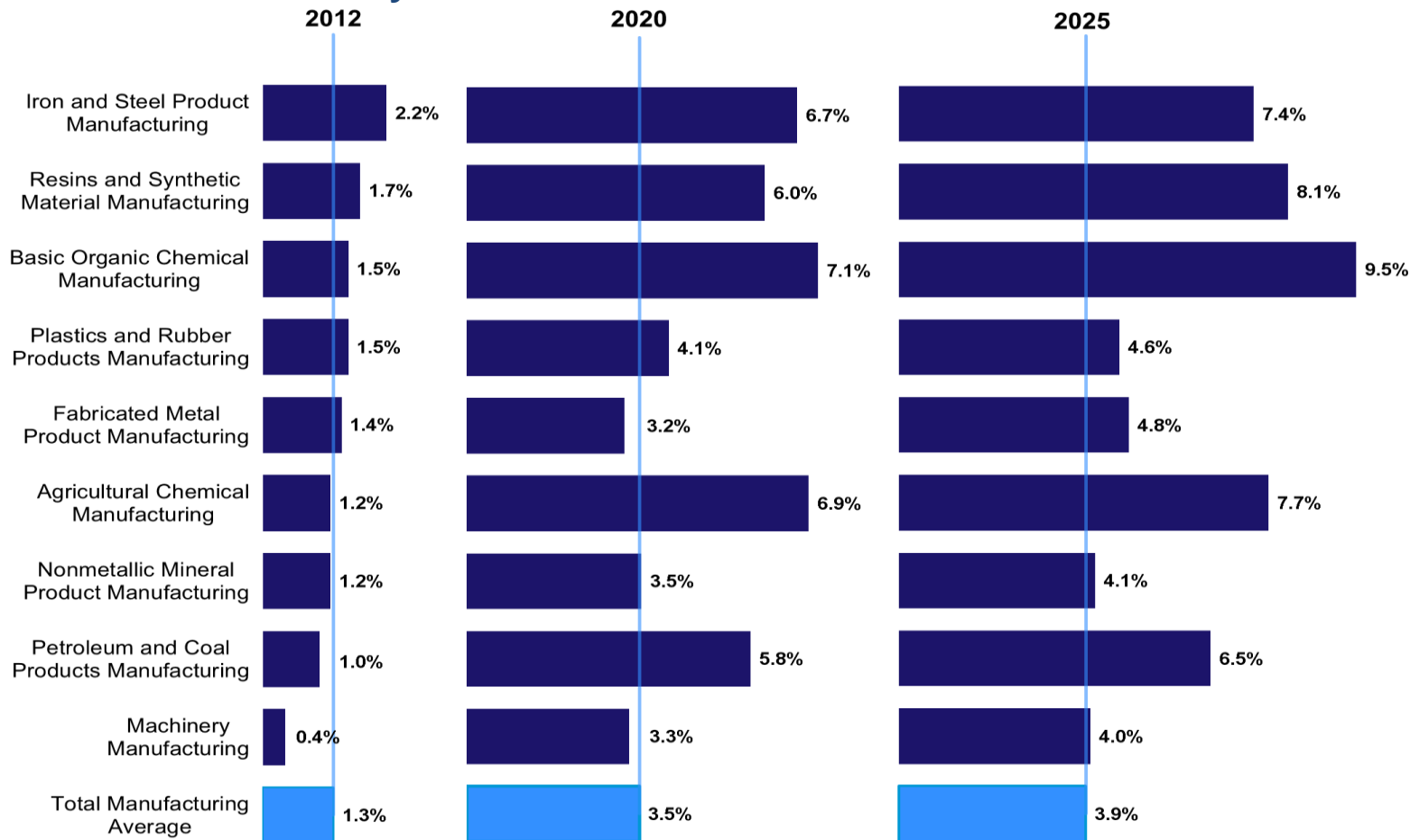


- The unconventional revolution will continue to benefit US manufacturing industries over longer term as the cost of energy plays a major role for many of the manufacturing sectors.

The Impact of the Unconventional Revolution over the Forecast Period is More Pronounced in Energy-Intensive Industries



Percent Increase to Selected Industrial Production Indices due to the Unconventional Activity Value Chain



Manufacturing Employment Contribution



- Manufacturing will benefit from supply chain impacts and price effects attributable to unconventional development, which will help create and sustain jobs.
- Over the entire forecast period, IHS estimates that one out of every eight US jobs supported by unconventional oil and natural gas development will be in manufacturing.
- By 2015, 3.2% of all US manufacturing jobs will be linked to unconventional development. By 2025, this share will jump to 4.2%.
 - This means that unconventional development will support close to 400,000 manufacturing jobs in 2015 and just over 500,000 in 2025.

Many Factors are in Concert with a US Manufacturing Renaissance



A confluence of many factors helped US manufacturing rebound from its 2009 recessionary trough and enter the manufacturing renaissance currently under way in the United States:

- Productivity gains for US workers,
- Significant technological advances, and
- Slower growth in hourly compensation relative to our global competitors.

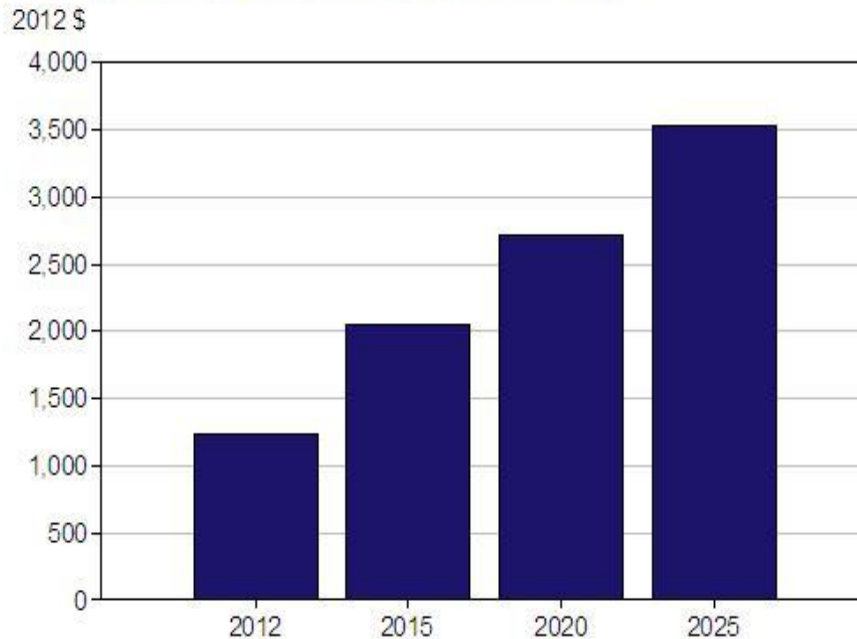
These factors, in combination with the profound impacts of increasing unconventional oil and natural gas production, are revitalizing critical segments of the US manufacturing base.

- US manufacturers are benefitting from the availability of a secure supply of low-cost natural gas, especially manufacturers in energy-intensive industries.
- Energy-related chemicals, petroleum refining, aluminum, steel, glass, cement, and the food industry – these are key energy-intensive sectors that are expected to invest and increase their US operations in response to declining prices for their energy inputs.

The Unconventional Revolution Increases US Household Income – Most Tangible Benefit for Many Americans



Change in Disposable Income per Household due to the Unconventional Activity Value Chain: Base Case*



Cumulative impact of increasing household wages and decreasing costs for energy and energy-intensive products.

- Wages increase as the manufacturing renaissance increases industrial activity.
- Direct consumption costs are reduced as natural gas used to heat homes and water becomes less expensive.
- Input costs for manufacturers of various consumer goods, including electricity prices, decline, reducing indirect costs for consumers.

These economic contributions are more significant when viewed against the backdrop of a struggling US economy, with slow growth and an unemployment rate that hovers above 7.5%, with 12 million individuals out of work and seeking employment.

Conclusion



- Unconventional oil and natural gas activity is reshaping America's energy future and bringing significant benefits to the US economy in terms of jobs, government revenues, and GDP.
- A new era of affordable and abundant energy is creating significant competitive advantages for the US in both energy-intensive industries and industries that rely on natural gas derivatives as critical production feedstock.
- The composite economic contributions include:
 - Jobs: 2.1 million jobs in 2012, 3.3 million by the end of the decade, and almost 3.9 million by 2025.
 - GDP: annual contributions will nearly double from \$284 billion in 2012 to \$533 billion in 2025.
 - Government revenues: average \$115 billion annually, totaling over \$1.6 trillion from 2012 to 2025.
 - Real household disposable income: increase of more than \$1,200 in 2012, just over \$2,000 in 2015 and more than \$3,500 in 2025.
 - With 120 million households in the country, this equates to an aggregate annual boost of over \$163 billion.



Thank You!

Mohsen Bonakdarpour

IHS Economics

Mohsen.bonakdarpour@HS.com

Phone: 215-789-7412