The US shale revolution and its economic impact

Sylvie Cornot-Gandolphe

Groupe Idées, Rueil Malmaison, 16 mars 2015

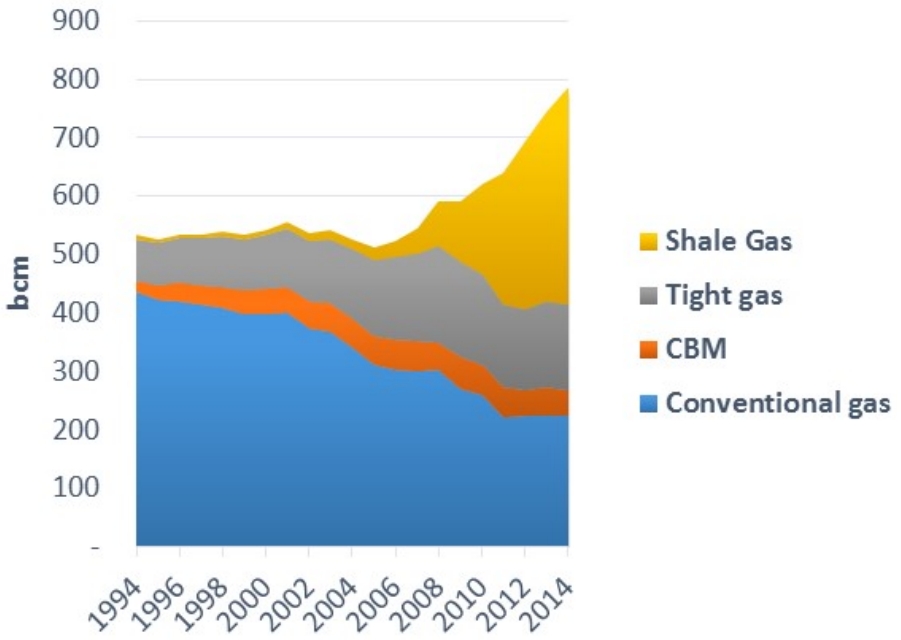
ifri
Paris Bruxelles
Institut français des relations internationales

The US shale revolution and its economic impact

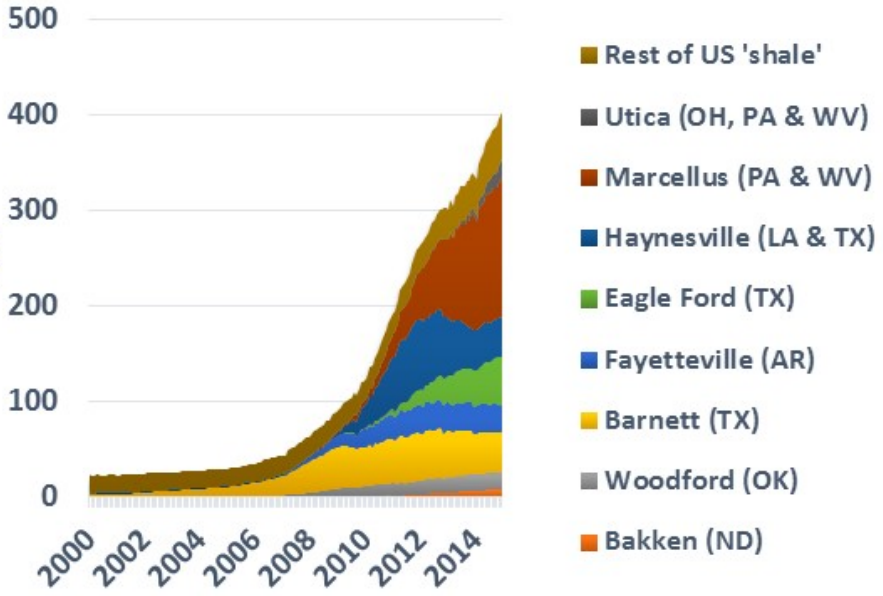
1. Shale gas
   - ❑ Coal-to-gas switching and new gas outlets
   - ❑ LNG exports
2. Natural Gas Liquids (NGLs)
   - ❑ A revival of the chemical industry
3. Light Tight Oil (LTO)
   - ❑ A boon for the refining industry
   - ❑ Toward energy independence
   - ❑ Test of the LTO business model
4. Concluding remarks: the US as the swing oil producer

The US has become the world's largest gas producer

US natural gas production



US shale gas production



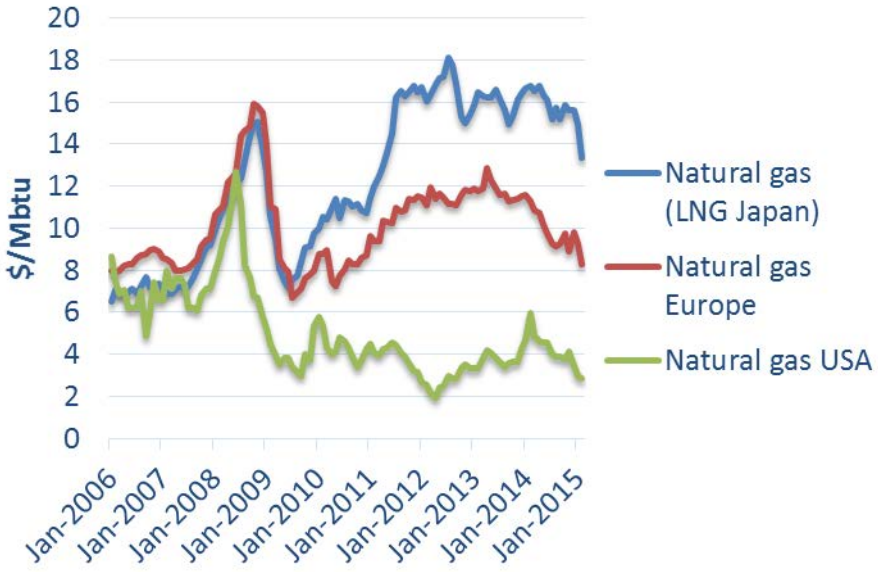
Source: US Energy Information Administration (EIA)

Natural gas production[(a)] reached 800 bcm in 2014
Shale gas accounts for almost half of total production

(a) Marketed production (wet) minus extraction losses

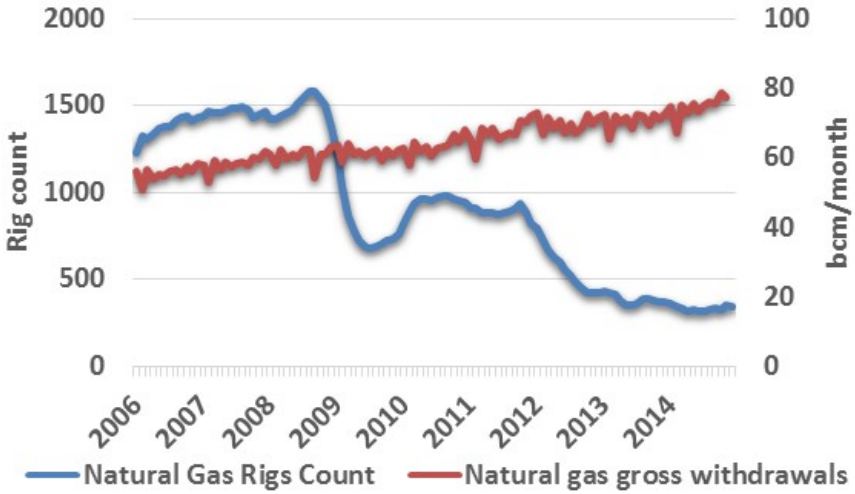
The increase has occurred despite the decline in gas prices and gas drilling activity

Natural gas prices



Source: World Bank, EIA

Natural gas drilling activity



Source: Baker Hughes, EIA

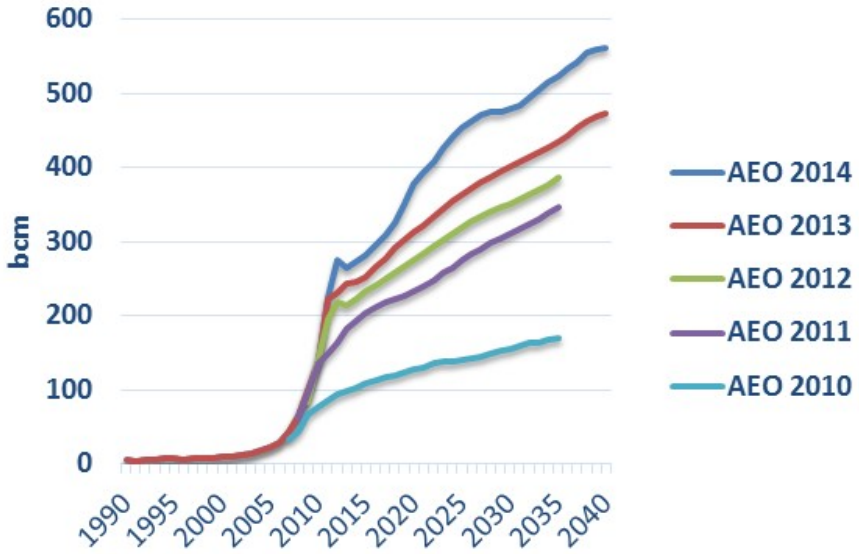
Despite the plunge in gas prices and drilling activity since 2009, production has grown thanks to cost reductions and a focus on core plays and wet gas/NGLs

Despite the reduction in worldwide gas prices, US gas prices are still much lower than Japanese and European prices

Outlook for shale gas production

Shale gas production

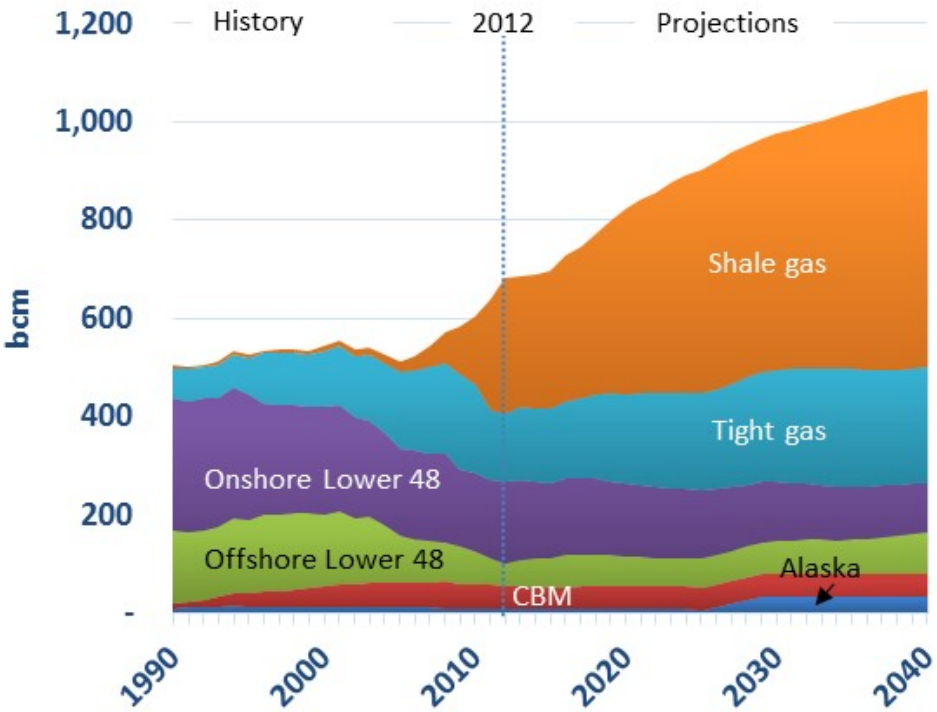
EIA Reference case, AEO 2010 to AEO 2014



Source: EIA, Annual Energy Outlook, 2010 to 2014

Natural gas production

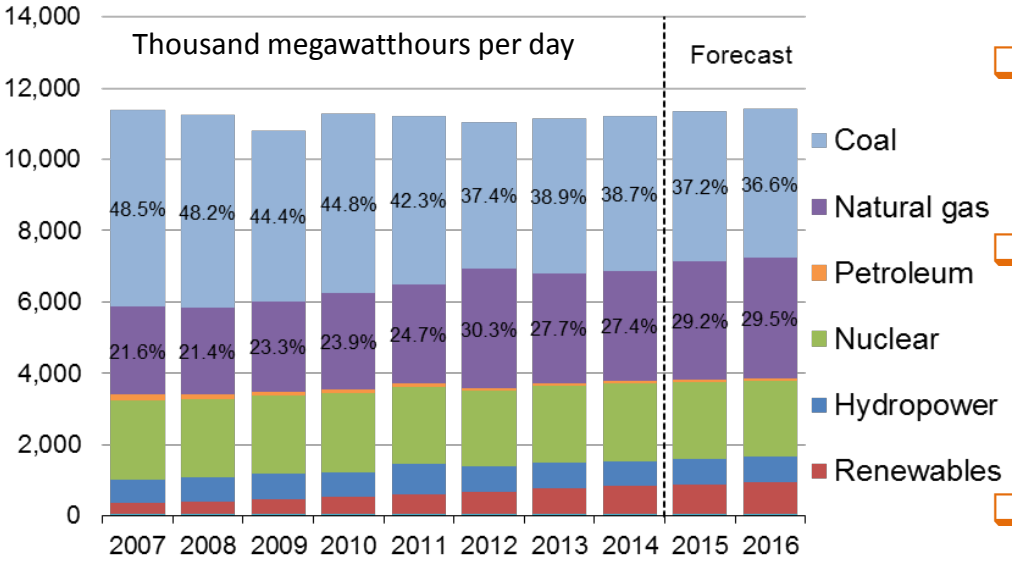
EIA Reference case



Shale gas production is expected to grow rapidly thanks to continued productivity gains and a high resource base

Gas competitiveness
The US economy switches to gas

US Electricity generation by fuel



Source: Short-Term Energy Outlook, March 2015.

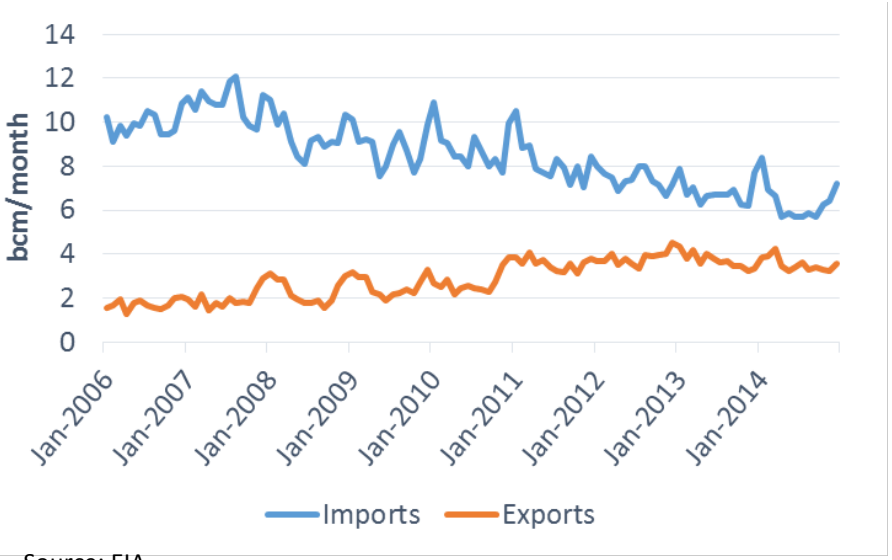
Renewed industrial markets and new outlets for natural gas

- **Shale gas boom makes direct-reduced iron (DRI) steel a new option**
  - Lower cost vs. scrap steel
  - $2B+ in new US projects
- **U.S. methanol production – 10 projects announced**
  - Captures price spread between low-cost natural gas and methanol
  - US currently represents 10% of the global market demand and imports 89% of its supply
- **Natural gas is a feedstock for ammonia production**
  - Represents ~70% of cash costs
  - 12 Mt new domestic manufacturing capacity announced
  - Imports will quickly be displaced
- **Transportation is emerging as a new outlet**

Reduction in CO_2 emissions (US/China agreement of November 2014)
US « reindustrialization » and positive impact on the commercial trade balance

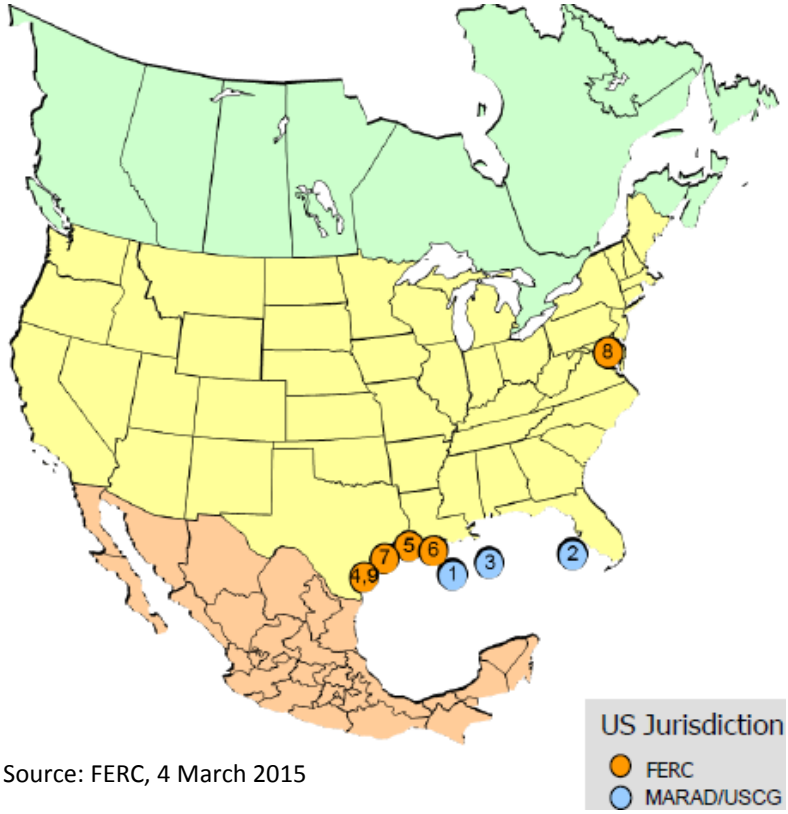
Gas abundance
From a net importer to a net exporter

US Imports and Exports



Source: EIA

US LNG approved projects

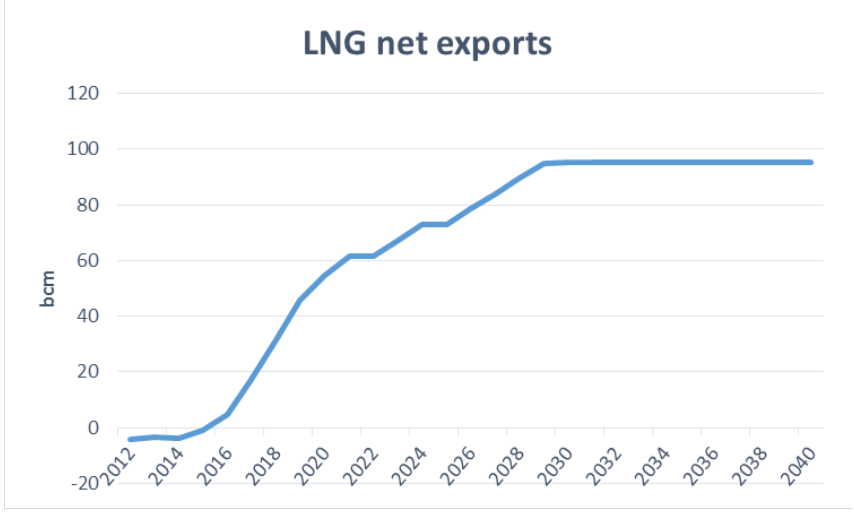


Source: FERC, 4 March 2015

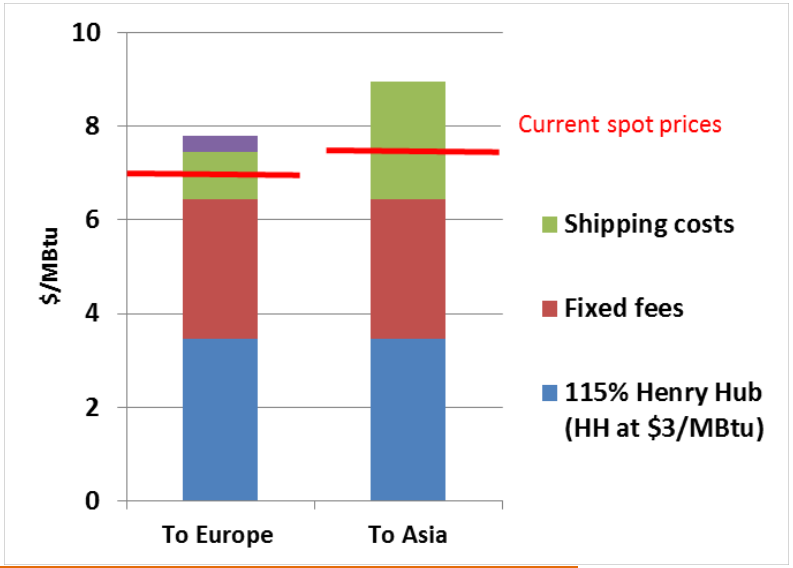
First round of US LNG exports: five LNG projects under construction (Sabine Pass, Cameron LNG, Freeport LNG, Cove Point LNG, Corpus Christi LNG) . Export Capacity: around 100 bcm
In addition, there are 15 proposed projects and 13 potential projects

Impact on global LNG market and prices

- Pressure on traditional LNG exporters and oil indexation
- Toward Henry Hub / hybrid indexation
- But not an alignment of gas prices (LNG transportation and liquefaction costs)
- **Impact of lower oil prices**
- Low oil prices make US LNG imports less attractive
- Asian LNG market slowdown
- But imports are also motivated by security of supply and diversification objectives (Europe)
- First round of US projects secured by long-term purchase agreements
- One project put on hold: Excelerate's floating 8 mtpa export plant moored at Lavaca Bay, Texas. The project was initially due to begin exports in 2018.

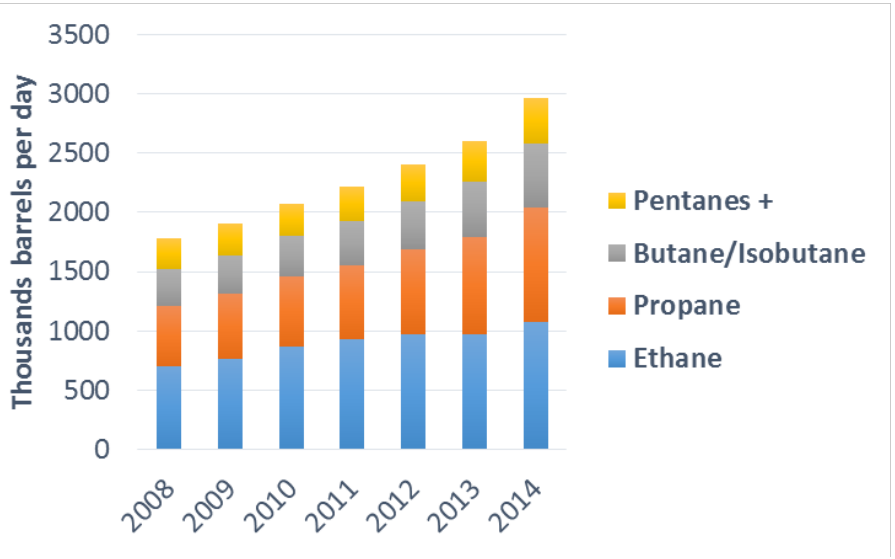


Source EIA, Annual Energy Outlook, 2014 (reference scenario)



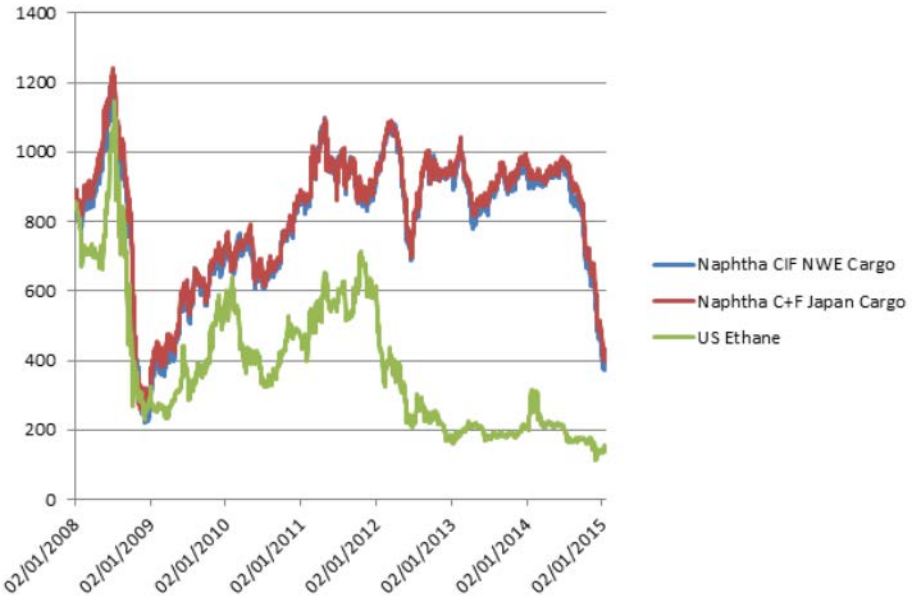
The NGLs revolution and the competitive position of the US petrochemical industry

Production of NGLs from gas plants



Source: EIA

Ethane and Naphta prices

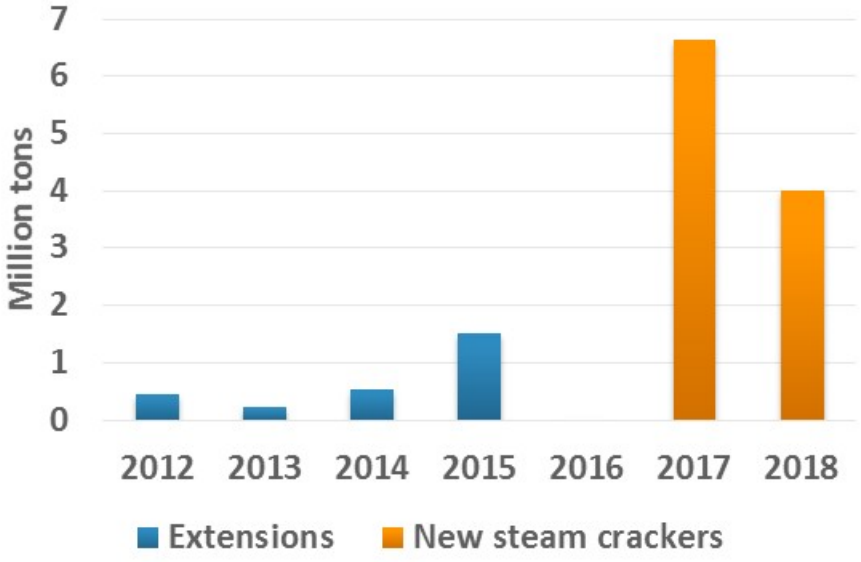


Source: Platts

The US shale gas boom has brought a renewed competitive advantage to the petrochemical industry, thanks to favorable oil-to-gas price ratio (naphta vs. ethane crakers)
European naphtha prices were four times higher than US ethane prices (until the recent fall).

The revival of the US petrochemical industry

US Ethylene projects



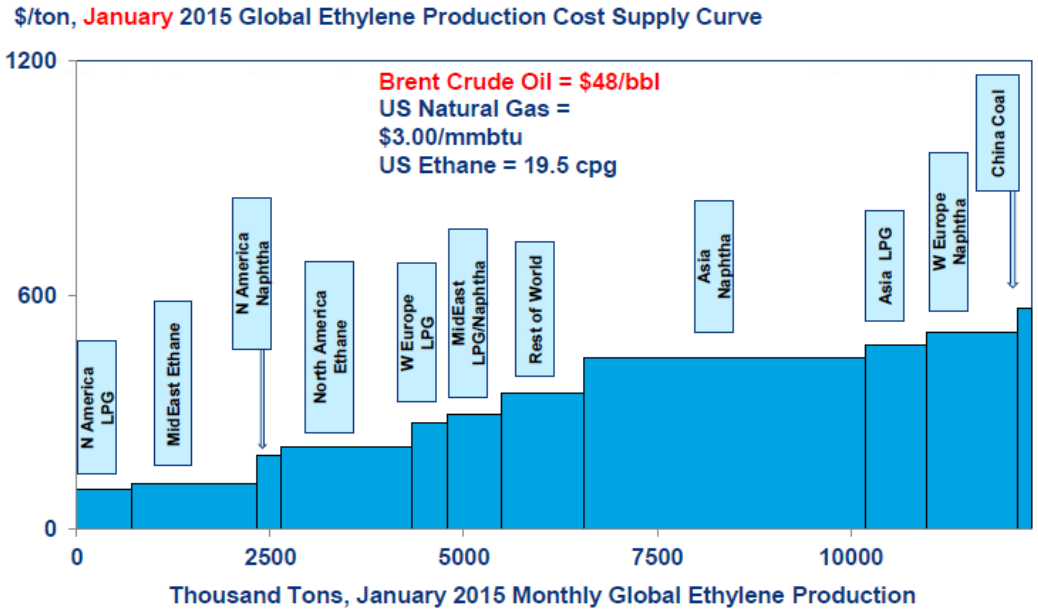
- North America's favorable cost position is driving chemical production growth.
- More than 215 new chemical production projects valued at over $135 billion have been announced in the US (ACC, January 2015)
- Capital spending surged nearly 12% in 2014 to more than $33 billion.

Current capacity: 28.5 Mt
Ehtylene capacity could expand by 52% by 2018 and polyethylene capacity by 47%

Gross exports of chemical products, including plastics, are projected to double, from $60 billion in 2014 to $123 billion by 2030 (ACC, January 2015)

But the fall in naphta/PE prices makes ethane crackers/polyethylene exports less attractive

Global ethylene cost curve (January 2015)



Source: Wood Mackenzie

- North America remains very competitive at the low end of the global ethylene cost curve.
- Cheaper ethane and especially propane costs have mitigated near-term pressure on U.S. ethylene margins.
- But its cost advantage has significantly declined (naphtha and LPG prices collapse since July 2014)

Challenges:

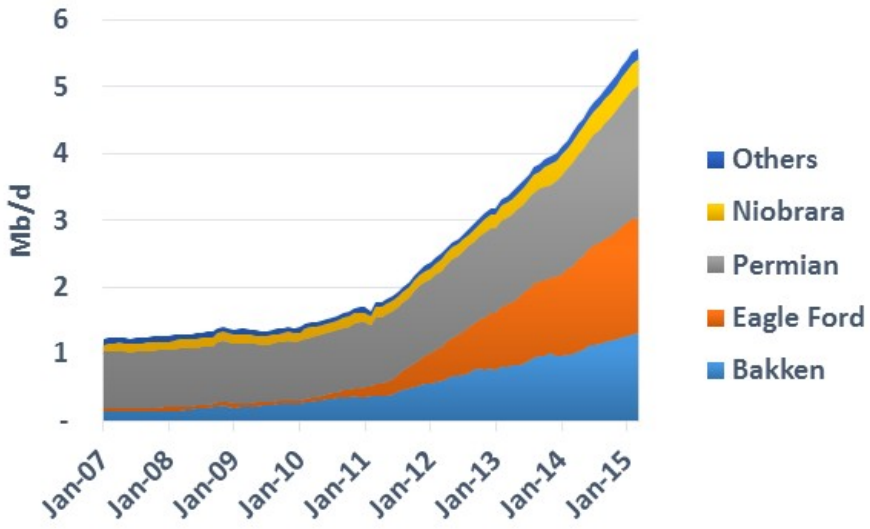
Strength of the US dollar and exports of petrochemicals?

Sustainability of inexpensive U.S. NGLs after 2017/18?

Postponment/cancellation of projects

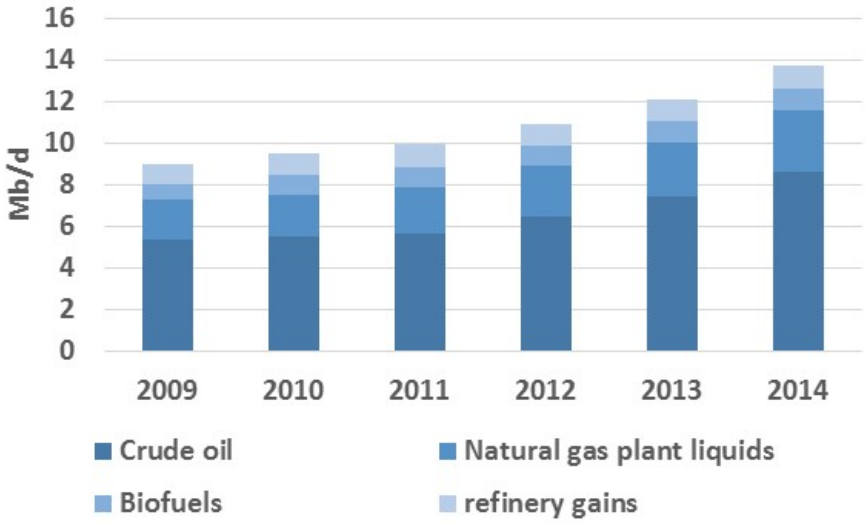
Fracking has also allowed the US shale oil revolution and the US has become the world's largest petroleum producer

US LTO production



Source: EIA

US total liquids production

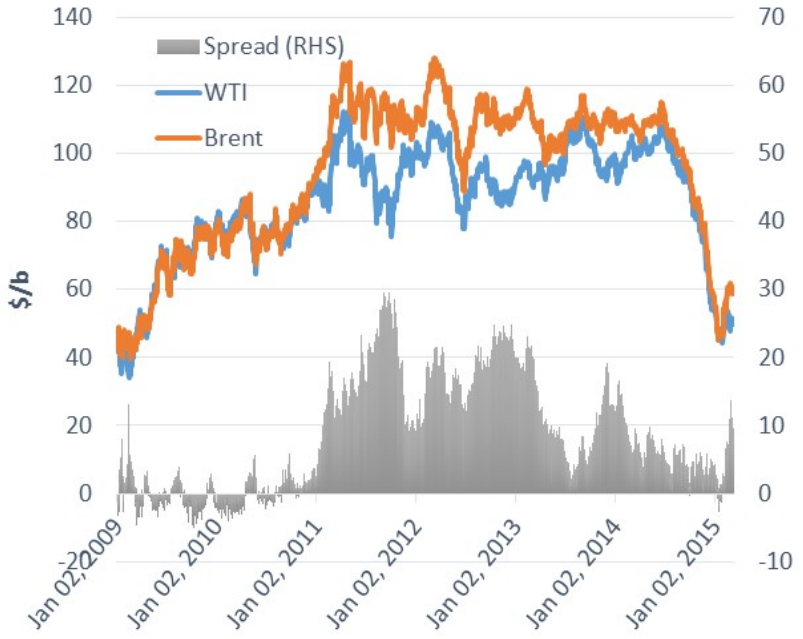


Source: EIA

Crude oil production reached 8.6 Mb/d in 2014
LTO production accounts for more than half of total production (currently: 5.5 Mb/d)
US total liquids production reached 14 Mb/d in 2014, an increase of 4.5 Mb/d since 2010

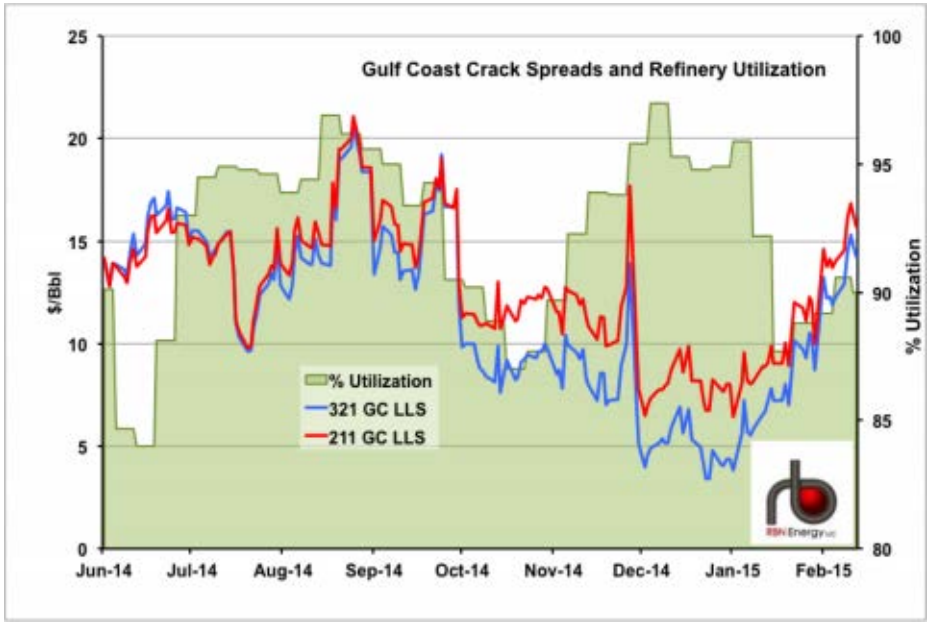
The inexpensive feedstock has been a boon to US refineries

Brent/WTI spreads



Source: EIA

Refining margins



Source: RBN Energy

The increasing spread between Brent and WTI and lower energy costs have allowed high refinery utilization rates and strong refining margins

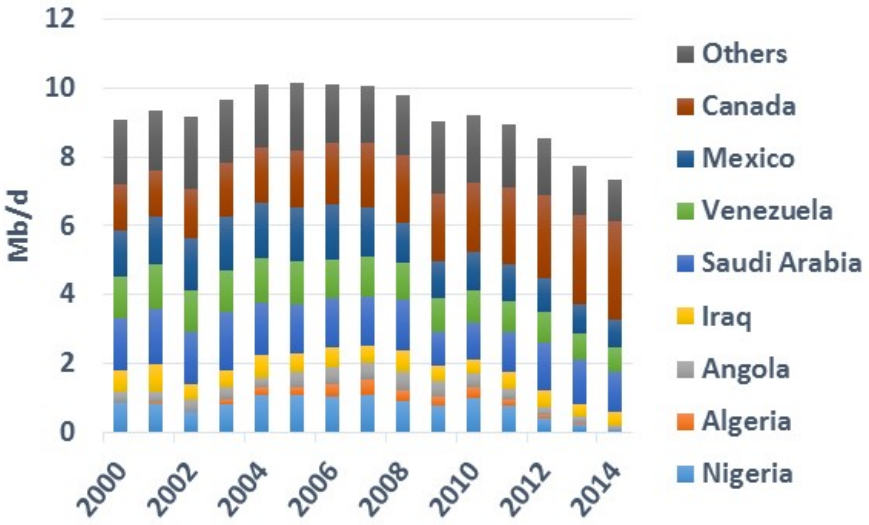
Challenges:

Will US refining lost its competitive edge in export markets?

How the US market will respond to lower prices?

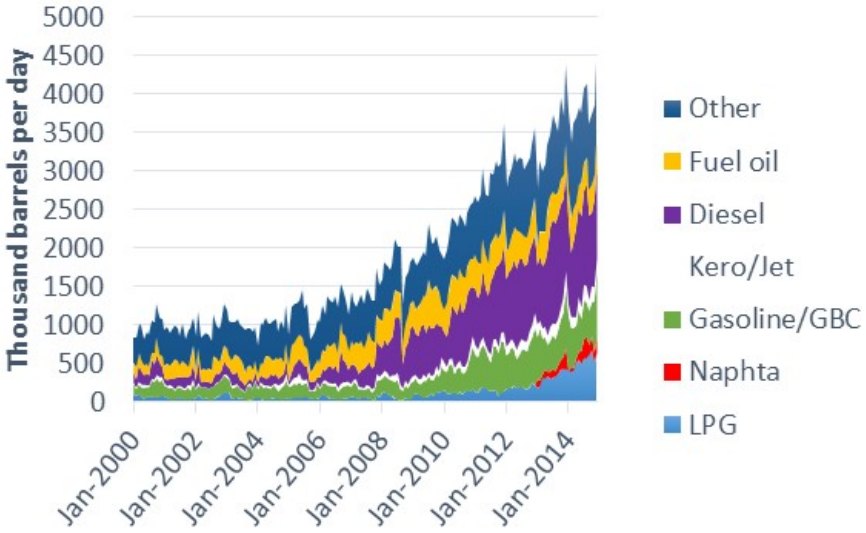
The surge in US oil production has led to a radical change in US (and global) trade patterns

US crude oil imports



Source: EIA

US exports of NGLs and refined products



Source: EIA

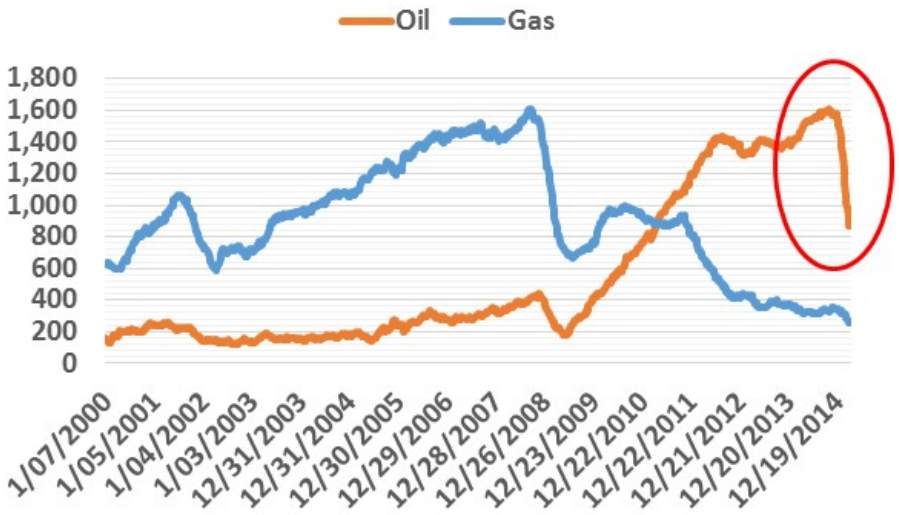
US oil import dependence has decreased dramatically.
The share of US oil and petroleum products consumption covered by imports fell from 60% in 2005 to 27% in 2014.
Oil import trade balance: from $332 billion in 2011 to $246 billion in 2014

Significant cuts in CAPEX and a steep decline in oil drilling activity

LTO Business Model

- High initial production rate (IP) and rapid decline in production after the first year → requires continuous drilling programs to support production
- Short investment cycle and payback time and low upfront capital costs (per well) → very flexible and modular
- Highly sensitive to oil prices in the first year of production → breakeven prices
- US oil independents offer contrasted financial situations (free cash flows, debt, hedging strategies)
- Significant cuts in CAPEX/drilling activity for all of them (from 20% to 50% for large independents)
- Bankruptcy and consolidation move

Decline in oil drilling activity

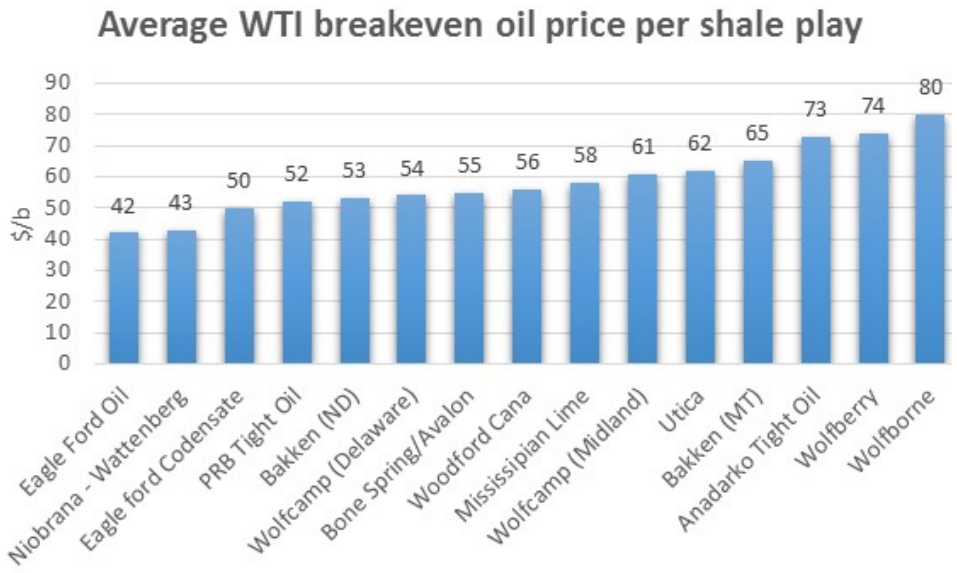


Source: Baker Hughes, 13 March 2015

The oil rig count is down 46% from its October peak.
But most companies still forecast an increase in oil production in 2015 (but much less than in 2014) by focusing their activity on sweet spots

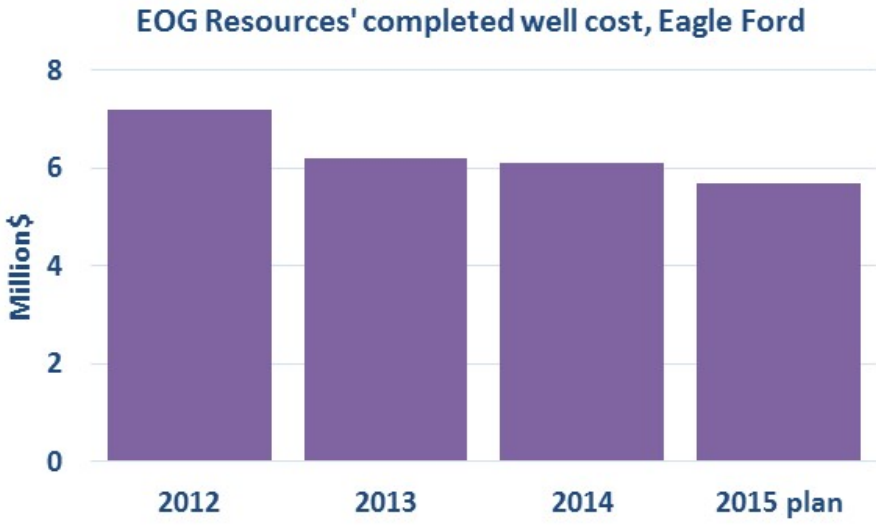
Breakeven prices: no single answer as they vary from area to area and well to well

Wide range of breakeven prices



Source: Rystad, January 2015

Breakeven prices are falling



Source: EOG Resources

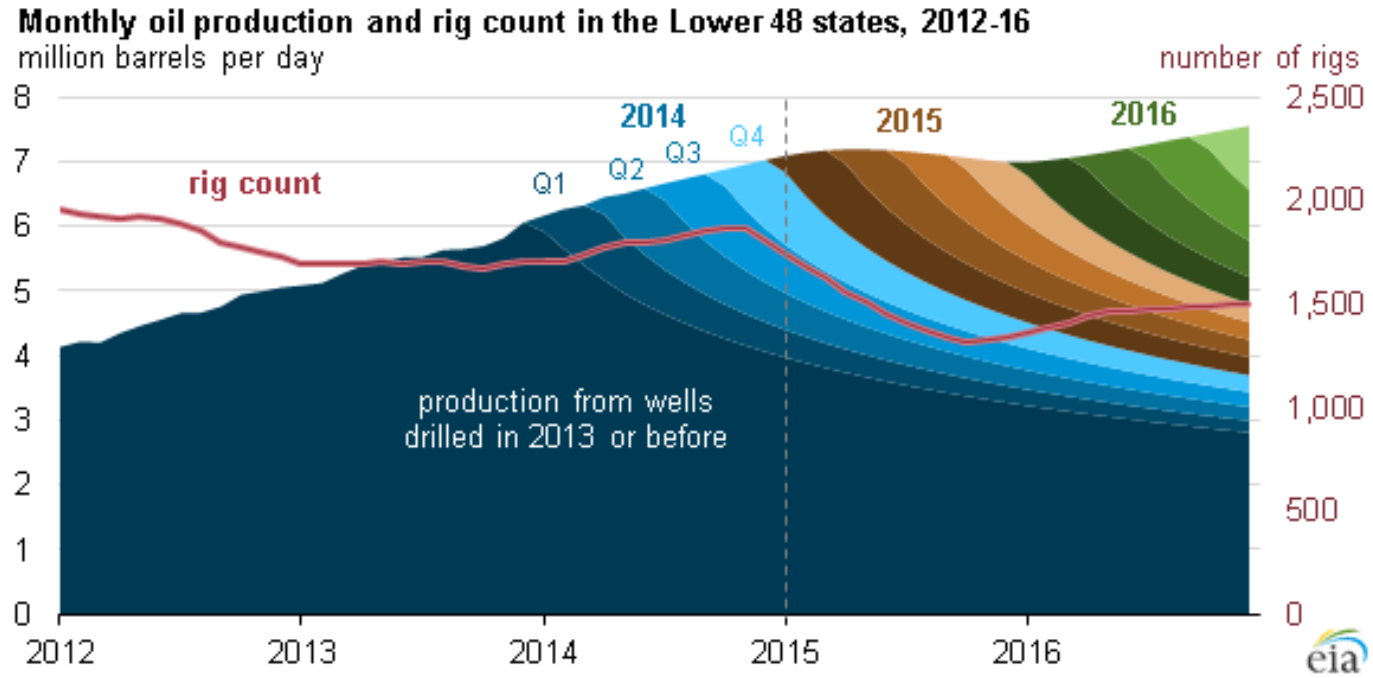
Widely diverse geological conditions (and costs) among plays and within a play

->Wide variation in breakeven prices, even within a play (Eagle Ford from less than $50 to $100)

They also differ from one operator to another (first movers have lower costs)

They have fallen thanks to technological gains and are expected to fall further

US oil production reflects more than just the rig count



Source: EIA, Today in Energy, 26 January 2015

US crude oil output

	Crude oil output	Annual growth	
	Mb/d	Mb/d	%
2013	7.44	0.94	14%
2014	8.65	1.21	16%
2015	9.35	0.7	8%
2016	9.49	0.14	1%

EIA STEO March 2015: Impact less severe than drilling activity provided that oil prices rebound later this year

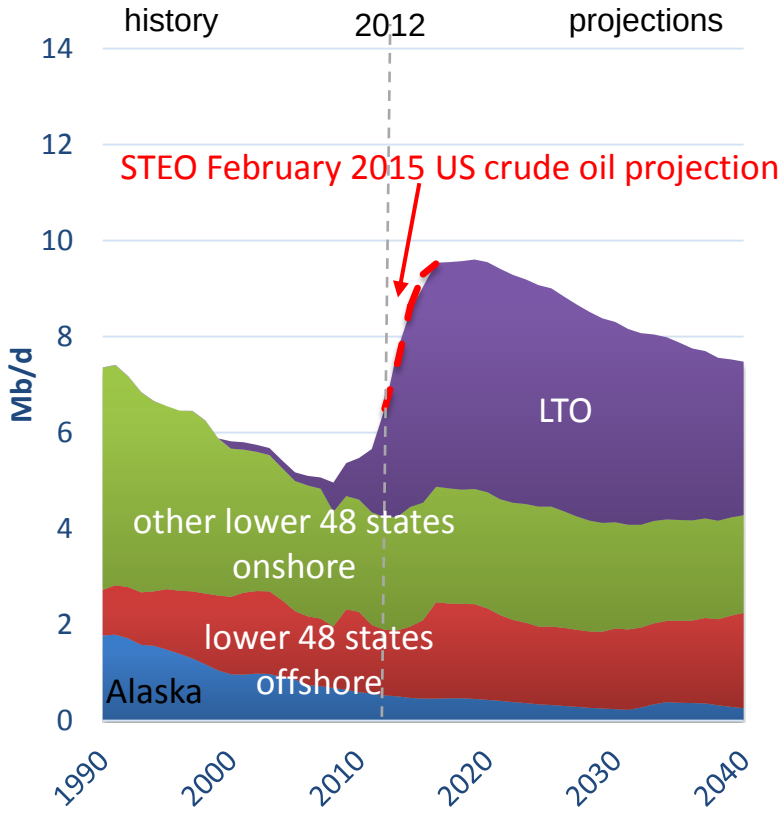
US crude oil production growth is decelerating (production starts to decline in H2 2015)

NB: The fall in drilling activity is steeper than expected

Resource and technology assumptions, and the level of oil prices, have major implications in the mid/long term

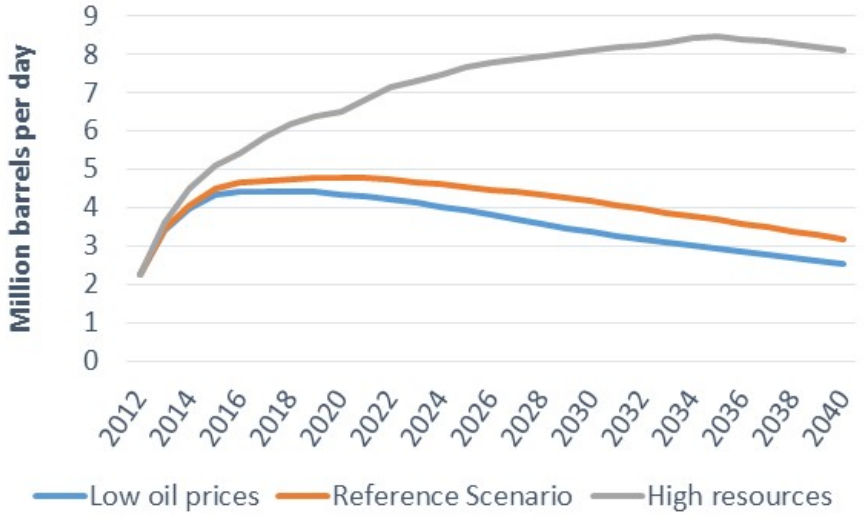
Crude oil production

EIA Reference case



LTO production

EIA High Resources case and Low Prices cases



Source: EIA, Annual Energy Outlook, 2014

With current technology, growth in US LTO is expected to flatten out in coming years, reflecting high well decline, low recovery rates and less extensive resources than gas. Without breakthrough in technology and lower prices, LTO production may shift permanently

Conclusion: the test of the shale business model is underway

- **The US shale revolution is a game changer**
  - **The USA has regained a competitive advantage over other regions**
  - **It has become a key player on international export market**
- **So is the drop in oil prices**
  - **The test of the shale business model is underway (its capacity to adapt to a low price environment and to oil cycles)**
- **Shale producers**
  - Surviving 2015
  - Thanks to its short lead-time and low upfront capital costs, LTO may prove quicker to ramp up production than conventional supply as soon as oil prices recover
- **This flexibility gives a new role to US producers and the United States: balancing the global oil market**

Groupe Idées, Rueil Malmaison, 16 mars 2015

Thank you for your attention

Reports on shale oil and gas available at www.ifri.org

Sylvie.cornot-gandolphe@orange.fr

ifri
Paris Bruxelles
Institut français des relations internationales