



#9 - Shale Oil: The Latest Insights

Posted by [Rembrandt](#) on December 25, 2012 - 6:00am

The Oil Drum staff wishes a Merry Christmas to all in our readership community. We are on a brief hiatus in this period, and will be back with our regular publications early in the new year. In the meantime, we present the top ten of best read Oil Drum posts in 2012. The second in this series is a summary by Rembrandt on [shale oil developments and production expectations](#).

The impact of unconventional fuels like shale oil on the global energy system is still an issue of great uncertainty. Not so much because of the size of the tank (the resource base), but due to the large physical effort necessary to obtain a sizeable supply of this type of fossil fuel. For instance, to exploit tight shale oil formations we need large capital expenditures to obtain relatively low flow rates from many horizontally drilled wells.

The developments of all things shale oil were discussed at a seminar organized by [Allen & Overy and their Future Energy Strategies Group](#) in London on 16 October, of which **a summary and key take-away points can be found below the fold**. With many thanks to both [Allen & Overy](#) and the speakers at this event for sharing their knowledge on these important developments in a public setting.

Key take-away points from speakers at Allen & Overy meeting:

- There is a large existing shale oil (and shale gas) resource base but whether the resources can be developed economically at sufficient scale in many countries is still an issue of uncertainty.
- Two promising shale oil plays outside of the US are the Vaca Muerta in Argentina and Bazhenov Shale which both have double digit figures of potentially recoverable resources, with large players like Chevron, Statoil etc. engaging in their development.
- The marginal cost to develop shale oil in the US is around 90 USD per barrel with average cost of most plays around 60 USD per barrel.
- The effects of the abundance of shale gas in the US, which sent natural gas prices plunging, is unlikely to be replicated in the oil market because of its different market structure (globally connected oil market versus fairly closed domestic gas market).
- The US may not produce as much natural gas as currently anticipated in the future, because the industry will be more motivated to drill for shale oil than shale gas, given the availability of drilling rigs, because it is more profitable.
- We already see a shift today from dry shale gas basins being drilled to shale oil basins being drilled, including those with associated gas.
- In the UK, a report is about to be released by the British Geological Survey on shale gas resources and reserves. Of the studied basins, the most promising one is expected to be the Lancashire shale basin because geological studies indicate the reservoir to be more than 1000 feet thick, as opposed to US-based shale plays, which are in exceptional cases up to a hundred feet in thickness.
- There is a wide spectrum of views on the potential for shale oil production in the United States, with the pessimistic end being a maximum of 1.8 million b/d (of which 0.9 million is

already in production) from Corelabs, and the optimistic spectrum expecting 3 to 4 million b/d from shale oil in the longer run (2020s).

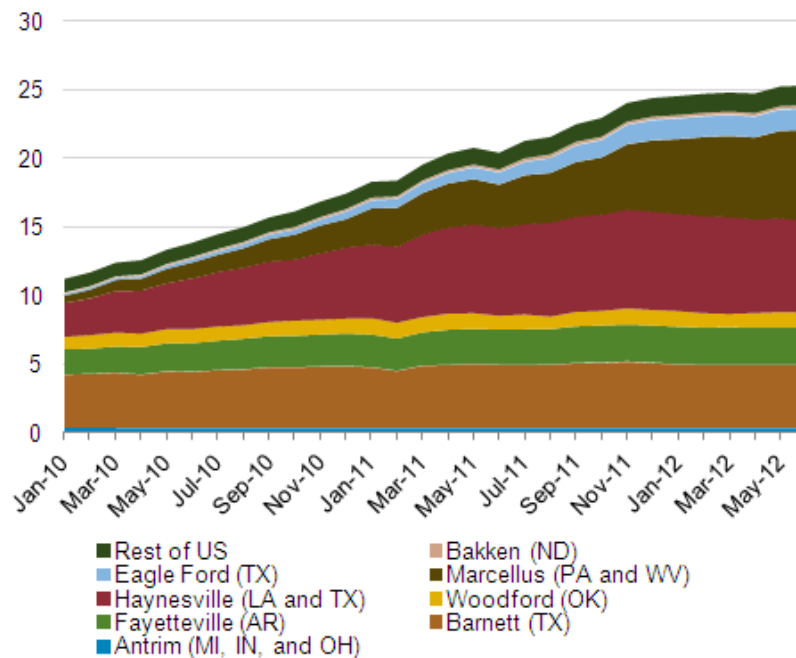
- If the more optimistic scenarios become reality, the consequence would be a substantial decline in US oil imports, falling from 10 million b/d to 6 or 7 million b/d from 2008 to 2015.

Presentation (1) Justin Jacobs, Journalist or the Petroleum Economist

The first presentation about the big picture on shale oil was given by Justin Jacobs, journalist at the Petroleum Economist. He highlighted the importance of the US Eagle Ford and Bakken plays (approx. 27% and 63% of total shale oil supply), and emphasized large production expectations in the short term, with the EIA forecasting 1.5 million b/d shale oil production in 2013.

Monthly dry shale gas production

billion cubic feet per day



Source: Lippman Consulting, Inc. Gross withdrawal estimates are as of August 2012 and converted to dry production estimates with EIA-calculated average

Figure 1 – Monthly dry shale gas production from January 2010 to June 2012 in the US.

The Petroleum Economist recently made a first map of oil & gas unconventional resources across the world, [to be found here](#), which Jacobs used to demonstrate the large number of unconventional resource plays in the world. He picked two of the most important shale oil plays to keep an eye on for the future:

- Vaca Muerta in Argentina, one of the largest discovered outside of the US. Its development cost is 250 billion USD over 10 years (with production potentially amounting to 200,000 b/d by 2020). The Repsol YPF section of the basin holds 22 billion barrels of oil equivalent of recoverable resources according to a Repsol YPF initiated Ryder Scott assessment.

At present development has been slowed by the nationalisation of Repsol YPF [by the Argentinian government who took a majority share](#). Because the investment required is at minimum several billions YPF is trying to find big players who are willing to invest, including Chinese firms and Chevron.

- The Bazhenov Shale in Russia, has drawn interest from ExxonMobil and Statoil who have

agreements in place for exploration and geological studies with Rosneft. The first exploratory drilling is to take place in 2013, and the licenses under investigation are expected to contain 15-20 billion barrels of resources. Total resources of the play have been estimated by BofA Merrill Lynch at 60 to 140 billion, whereas Jacobs noted that these are wild early stage estimates, but that the shale play's large size is beyond doubt. He cited Statoil estimating 2014 as an earliest possible production date, however, in his view attractive fiscal terms then currently offered by the Russian government would be necessary for development to take place. The play has also attracted attention from Lukoil, Ruspetro and TNK-BP.

The key issue according to Jacobs is whether the large existing resources can be developed economically at sufficient scale. The development requires thousands of wells due to the steep decline rate, which necessitates the on-going development of a new services sector in the majority of countries with plays. Similar to calculations by [Rune Likvern](#) as well as [Arthur Berman and Lynn Pittinger](#) published at the Oil Drum, he cited shale oil development to require high oil prices at 80-90+ USD per barrel.

Another relevant point brought forward was that the abundance of shale gas in the US sent natural gas prices plunging. The effect is unlikely to be replicated in the oil market. The reason is the difference in market structure. The oil market is fungible in its imports and exports and requires a high oil price to meet demand. In contrast the US gas market is fairly closed with production being sufficient to meet domestic demand.

Presentation (2) Richard Sarsfield-Hall, [Pöyry Management Consulting](#)

The second presentation was given by Richard Sarsfield-Hall from [Pöyry Management Consulting](#), who posed the question "Is shale oil the brave new hydrocarbon frontier?" He reiterated important common points on the US gas market:

- The current low price level of [3 USD per MMBtu](#).
- The much higher marginal cost as opposed to current price levels.
- The oversupply of gas caused by a over-drilling given the cost-price imbalance.
- The growth of shale oil and shale gas requires more and more wells to be drilled to maintain and grow production (see Rune Likvern and Arthur Berman's articles linked to above for more details).

The key issue presented by Sarsfield-Hall was about internal dynamics in the US market, as he sees a drilling competition occurring between the developments of dry shale gas reservoirs (Haynesville, Fayetteville) as opposed to shale oil reservoirs with associated natural gas (Eagle Ford) and shale gas reservoirs with associated liquids (Utica). This occurs because of more favourable economics for one versus the other in today's market conditions (high oil price, low natural gas price in US). This is also possible because exactly the same type of rig is used for shale gas well drilling and shale oil well drilling. According to Sarsfield-Hall we already see this happening in today's market, a point quantitatively further emphasised by the third speaker Tim Guinness, Founder Guinness Asset Management. He showed that well drilling has been overtly dropping in dry shale gas plays, while it has been constant or increasing in shale oil and shale oil with associated gas plays.

Weekly natural gas rig count and average spot Henry Hub

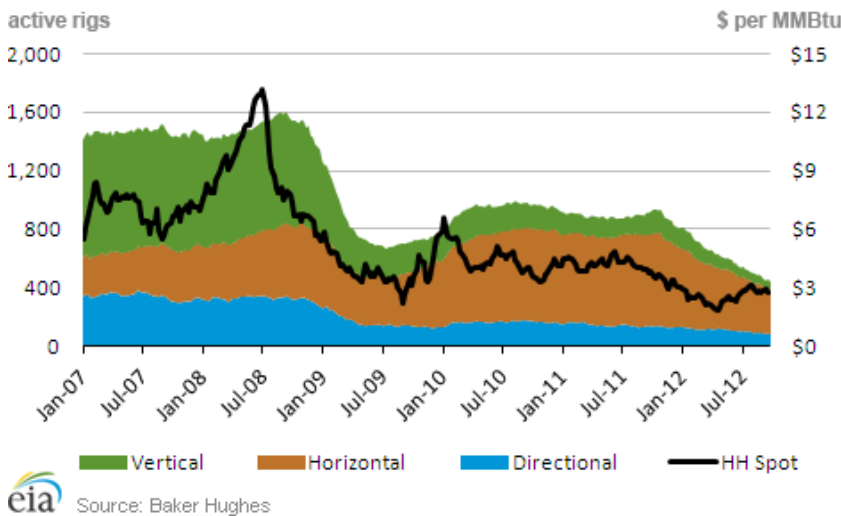
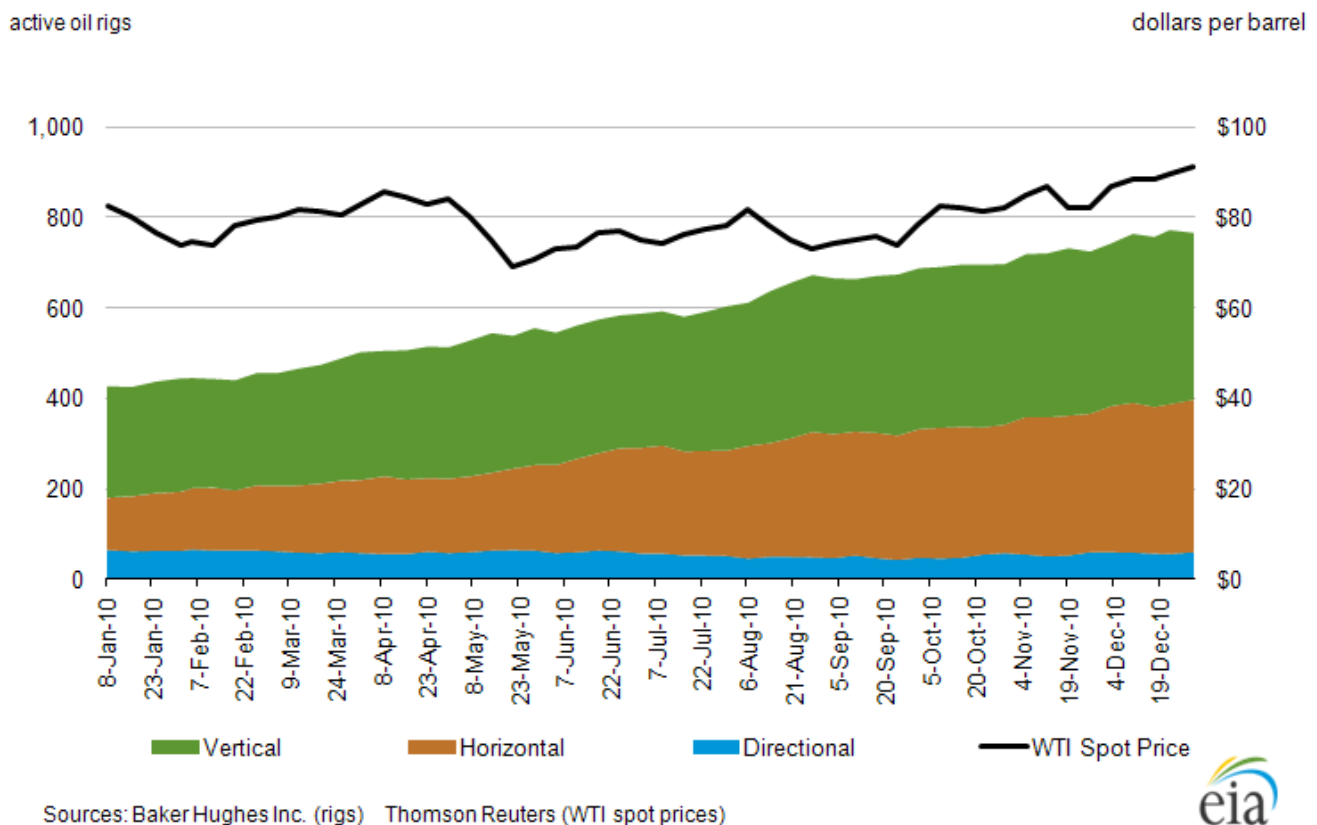


Figure 2 – Weekly US natural gas rig count and average spot Henry Hub price.

Figure 3. U.S. weekly oil rig count and average spot price of West Texas Intermediate crude oil

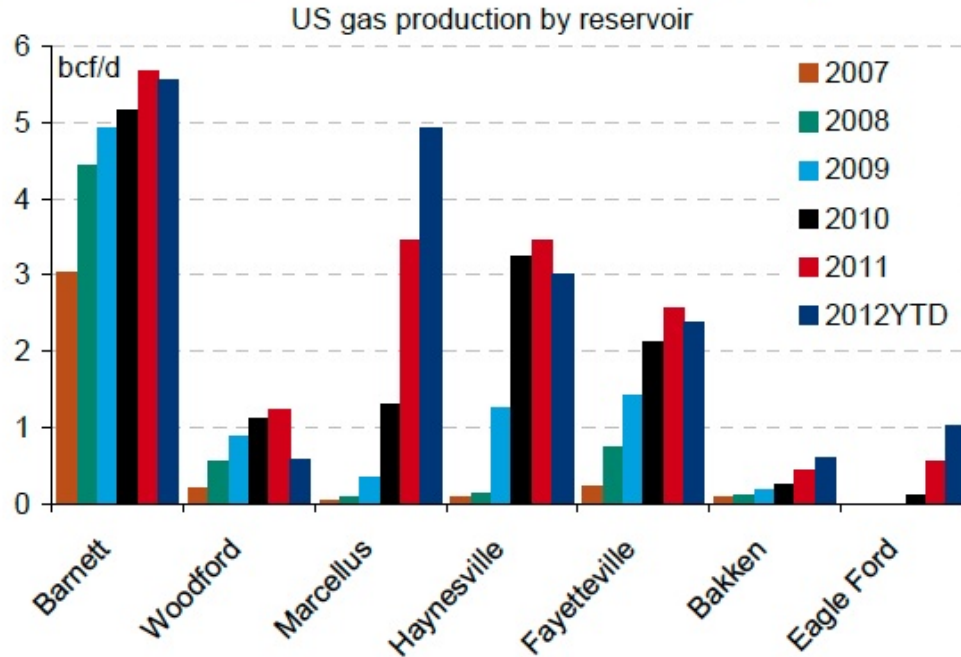


Sources: Baker Hughes Inc. (rigs) Thomson Reuters (WTI spot prices)



Figure 3 – Weekly US oil rig count and average spot price of WTI crude oil.

Chart 7: Producers continue to shift rigs into liquid or more oily plays like the Marcellus, Eagle Ford or Bakken, boosting gas output



Source: HPDI, BofA Merrill Lynch Global Commodities Research

Figure 4 - Production of natural gas from various shale plays in the US from 2007 to 2012.

The implications of this competition are primarily affecting the expectations of institutes and market players, as the US may not produce as much natural gas as currently anticipated in the future, because the industry will be more motivated to drill for shale oil than shale gas. As Sarsfield-Hall puts it “There is a definite move of drilling from dry shale gas into shale oil with associated gas, the rush to shale oil potentially means insufficient shale gas delivered, which may result in higher gas prices and/or insufficient volumes to feed potential US LNG exports”. In addition Sarsfield-Hall showed EIA estimates which are primarily dry gas based increases, with little increase in associated gas from the expansion in shale oil. In terms of shale oil we are talking about a 10%-25% production share of total oil production in the coming decades according to EIA projections.

There were some numbers displayed. One key projection was for dry shale gas production, [from a firm called ARC Financial](#), which showed decline expectation of 0.6 bcf/d up to 2013 from a current level of 23 bcf/d for dry shale gas production. Also some US associated gas production numbers were presented as per table 1, which is gas produced from oil fields (either free gas or dissolved in oil as a solution).

Table 1 – Expected US Associated gas production from oil wells shown by Sarsfield-Hall.

Bcf/d	2006	2011	2012	2013
	3.8	9.0	12.0	14.6

In the last part of his presentation he highlighted work POYPRY has been conducting for Cuadrilla, one of the major players in the EU which is trying to get shale gas production off the ground in multiple countries. The study was conducted to calculate the impact of shale gas development in Lancashire in the United Kingdom, the results of which will be published in a couple of weeks. The Lancashire shale basin is interesting according to Sarsfield-Hall because geological studies indicate the reservoir to be more than a 1000 feet thick, as opposed to US based shale plays which are in exceptional cases up to a hundred feet in thickness. This would in

theory make UK shale gas in Lancashire much cheaper to develop. The information provided is preliminary, with full details about to be released by the British Geological Survey (BGS) in a report on UK shale gas resources and reserves.

In using Cuadrilla's scenario for production POYPRY found that UK natural gas imports could be reduced by 21% by 2020-2025 through shale gas developments. Their conclusions were that this could drive natural gas prices in the UK 4-6% lower which would save consumers 810 million pounds per annum. It would not in his view impact the UK achieving its 2020 renewable targets and alter its power generation at the volumes discussed.

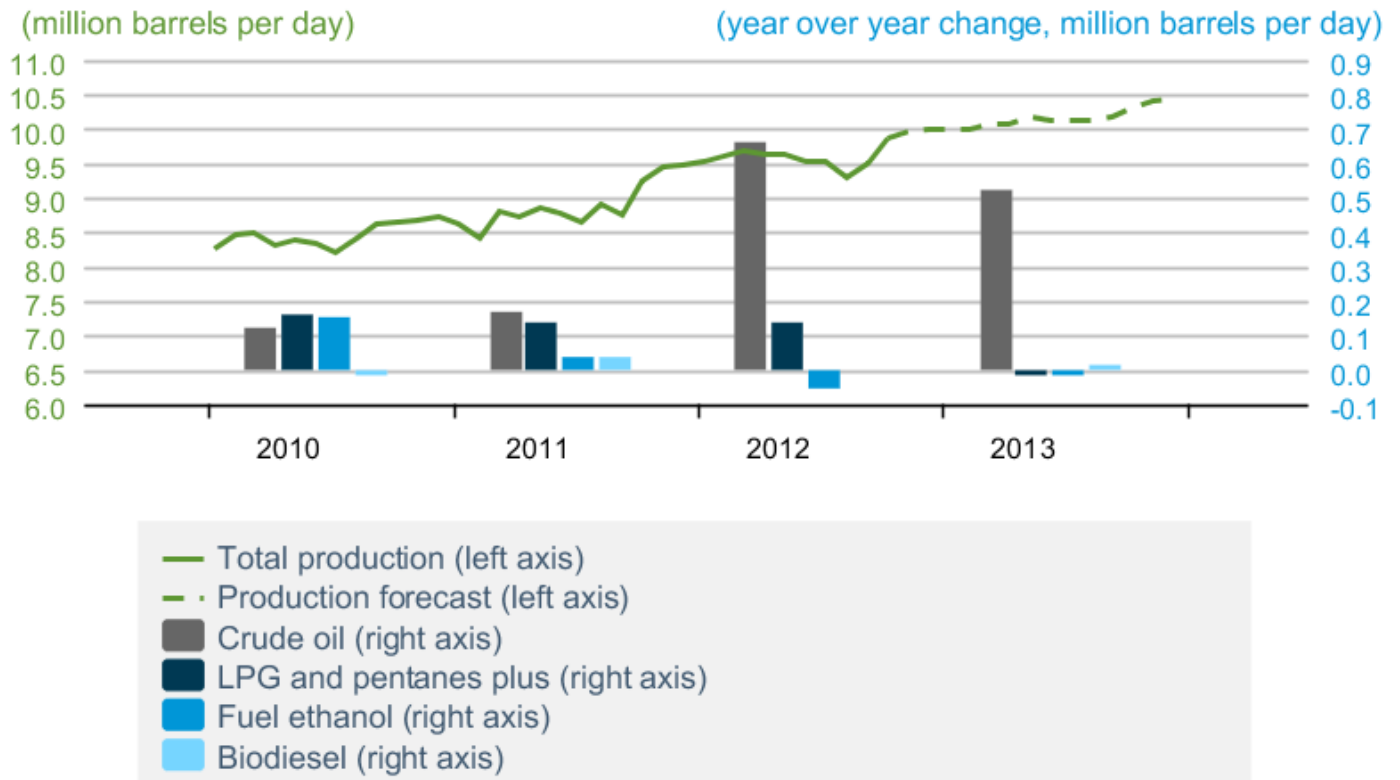
Presentation (3) Tim Guinness, Founder Guinness Asset Management.

The last presentation was from an investors' perspective, with [Tim Guinness](#), chairman and founder of Guinness Asset management, and lead manager of their [Global Energy Fund](#), presenting his views. He began by reiterating the reasons why the US has been able to develop their shale plays as:

- Improvement in ability to steer the drill bit.
- Development of ability to drill horizontally.
- Discovery of how to use hydraulic fracturing.
- US land and mineral rights.
- Relatively low population density.
- Adequate access to water.
- Existence of large successful oil & gas service industry and independent exploration & production sector.

He confirmed the switch from dry gas to shale oil/liquid rich shales with associated gas that is occurring, displaying rig figures per type of shale basin (predominantly shale oil, shale gas, and liquid rich with oil + associated gas). In addition he noted that the growth in gas supply has stopped in the US and is on a plateau, whereas oil production is growing substantially due to shale oil. He cited an onshore production estimate for December 2012 at 4.8 million barrels per day, which has been growing since 2008 after 38 years of decline since the peak in the 1970s, of which about 1.2 million b/d is from shale oil.

U.S. Crude Oil and Liquid Fuels Production



Source: Short-Term Energy Outlook, October 2012

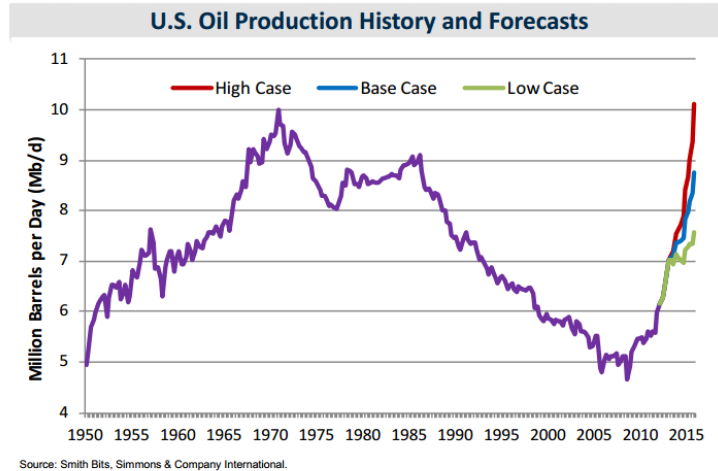
Figure 5 – US crude oil production to 2012 and forecasts from the EIA.

In his synthesis he compared three different estimates for shale oil production:

- Sandford Bernstein Oil Shale Forecasts, who expect 3 million b/d in 2016, maintained up to 2024, and peaking around 3.7 million b/d, which would come mainly from Bakken (1.5 million b.d), Mississippi Lime (0.9 million b/d), and Eagle Ford (0.7 million b/d). With a cautionary note from Guinness that the forecast by now is 9 months out of date.
- Corelabs, who expect 1.8 million b/d at maximum from shale oil, of which 900.000 was already in production at the time of forecast (1.2 mb/d at present). In other words we can expect about a 600.000 b/d increase yet to come. The reason is that the sweet spots according to Corelabs are much smaller than people think (too much extrapolation of the good areas).
- Simmons & Co, who see US shale oil production growing to 1.9 mb/d in 3 years, and 8.3 million b/d of total oil production in 2015. The consequence of the Simmons & Co scenario would be for US oil imports to fall from 10 million b/d to 6-7 million b/d from 2008 to 2015. ([see details in this presentation](#)).

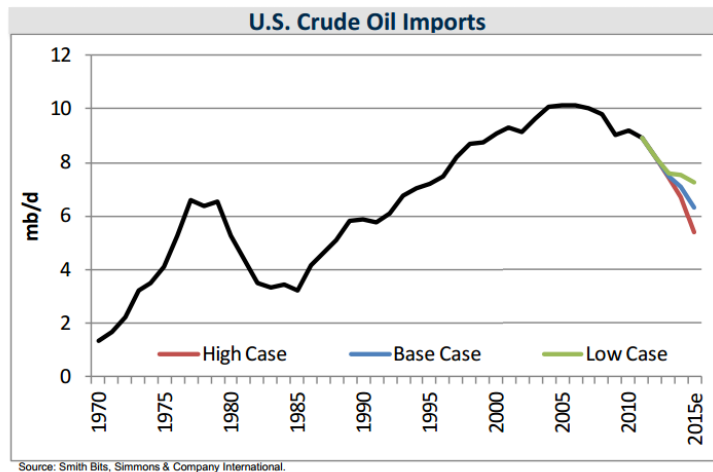
Table 2 – US oil production forecast for 2015 from Simmons & Co. Expectation based on 85 USD per barrel of oil and 3.50 USD per McF of natural gas.

Production regions	Production ('000 b/d)
Williston	1145
Eagle ford	933
Permian	1948
DJ	105
Anadarko	272
Alaska	548
GOM	1554
L48/Other	1811
Total	8316



Source: Smith Bits, Simmons & Company International.

Figure 6 - US oil production forecast from 2015 from Simmons & Co, with low, medium and high range scenario's varying due to oil price levels (75, 85, and 100 USD) and service industry drilling rate expectations.



Source: Smith Bits, Simmons & Company International.

Figure 7 - US oil import forecast up to 2015 from Simmons & Co as per the low, medium, and high range scenarios.

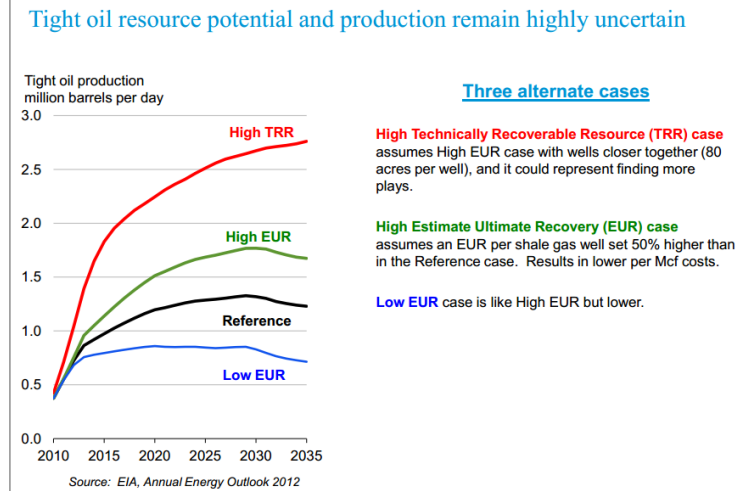


Figure 8 - US oil production forecast from shale oil from EIA.

The final point Tim Guinness discussed was marginal cost, which according to Tudor Pickering for the majority of shale oil plays requires 60 USD, with the highest costing ones amounting to 85-90 USD (see figure 9 for details). He also cited Bernstein Energy research which shows cumulative resources of 30 billion barrels of US shale oil to be available at a cost below 150 USD per barrel. Some of the plays have a very low cost range, such as the Eagle Ford, where a figure of 40 USD per barrel was cited (Tudor Pickering shows this play around 60 USD).

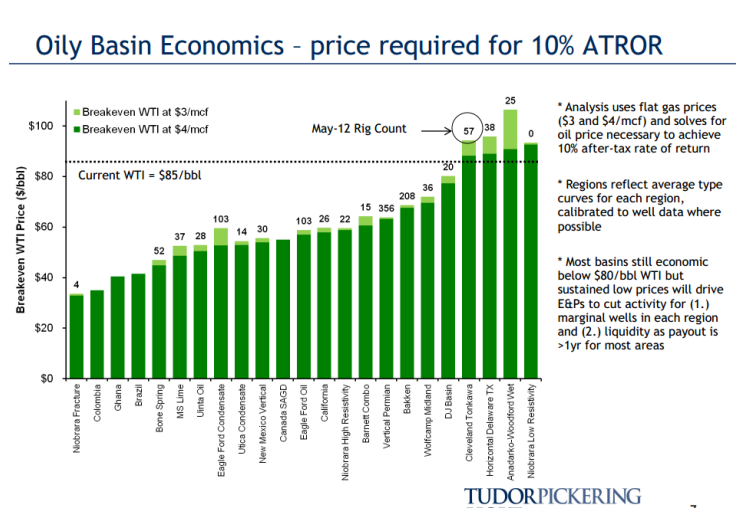


Figure 9 – marginal cost in oily shale plays and other oil basins in the world per comparison from Tudor Pickering.

Marginal Cost - 2013 Cumulative Rig Count

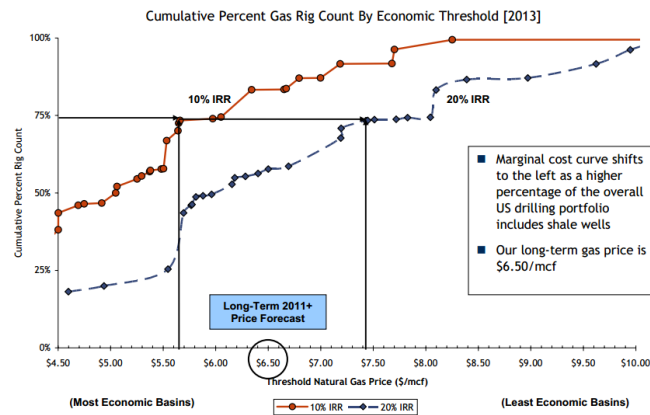


Figure 10 – marginal cost for shale gas plays according to Tudor Pickering.

Finally in his conclusion, as per recent Bernstein Energy research, Tim Guinness stated that shale oil is not a game changer for these specific reasons:

- Quality drilling locations are finite.
- Shale oil cost structure is high.
- Drilling efficiency gains harder to obtain than in gas shales.
- The industry structure (OPEC) is better for oil.
- Scale of US shale oil find relative to the oil market is small.

In Tim Guinness' words: "It is akin to something like the discovery of the North Sea, Alaska or GOM. A useful addition but not a game changer, as the world needs 5 new North Seas every 20 years to provide enough oil to meet growing demand."

Previous articles on Shale Oil and Shale Gas at The Oil Drum

- September 25, 2012, Rune Likvern, [Is Shale Oil Production from Bakken Headed for a Run with "The Red Queen"?](#)
- August 15, 2012, Ruud Weijermans & Matthew Hulbert, [Shale Gas Assets - Overpriced Or a Liquid Turn for Mining Giant BHP?](#)
- January 26, 2012, David Hughes, [With Gas So Cheap and Well Drilling Down, Why Is Gas Production So High?.](#)
- August 15, 2011, Arthur Berman, [U.S. Shale Gas: Less Abundance, Higher Cost.](#)
- July 24, 2011, Heading Out, [Tech Talk: natural gas production, as shale gas arrives.](#)
- April 17, 2011, Heading out, [Tech Talk - the new EIA Shale gas report.](#)
- December 19, 2011, Heading Out, [Tech Talk: When oil isn't crude and gas isn't gas, the Eagle Ford Shale play.](#)
- October 28, 2010, Arthur Berman, [Shale Gas—Abundance or Mirage? Why The Marcellus Shale Will Disappoint Expectations.](#)
- July 28, 2010, Gail the Actuary, [Arthur Berman talks about Shale Gas.](#)
- December 13, 2009, Heading Out, [Shale gas and water.](#)
- November 15, 2009, Heading Out, [Horizontal wells and gas shales.](#)

- November 8, 2009, Heading Out, [Shales and the gas within them.](#)



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