Impact of U.S. Shale Oil Revolution on the Global Oil Market, the Price of Oil & Peak Oil

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Introduction

Much has been written about the United States shale oil revolution. Some sources like the International Energy Agency (IEA) went as far as to predict that the United States will overtake Saudi Arabia and Russia to become the world's biggest oil producer by 2020 and energy self-sufficient by 2030.[1] Others called it a game changer with a new emerging balance of power in the global oil market. Yet others were in such a state of euphoria about the success of American shale oil production to say that it may deny OPEC the power to set global oil prices and that the world oil industry won't be the same in the wake of shale. Some also claimed that the idea of peak oil had gone in flames. The above claims aside, given recent increases in U.S. shale oil and gas production, it is now clear that these resources might play some role in non-OPEC supply prospects.

However, it begs the questions: what is the potential contribution of shale oil to future global oil supply? Will the high development costs, and environmental impacts and challenges affect this potential? And will it be possible to replicate the U.S. success story globally?

U.S. shale oil production is projected to increase from about 1 million barrels a day (mbd) in 2012 to 2 mbd in 2020 possibly reaching 3 mbd by 2025.[2] However, this increase would hardly offset the normal annual depletion rate of 3%-5% in U.S. conventional oil production, estimated at 1.2 mbd–2.0 mbd during the same period.[3]

With regard to the economics of U.S. shale oil development, the drilling and completion costs for a horizontal shale oil well currently range from $4 to $6 million. This relatively high cost arises from the steep first year decline rate of 70% - 90% for the wells. Nevertheless, a break-even oil price of $72-$80/barrel suggests that most shale oil plays are profitable at current oil price levels.[4]

This article will argue that U.S. shale oil production would hardly make a dent in the global oil supplies as it would largely offset the decline in U.S. conventional oil production. It will also argue that the U.S. would never be able to overtake Saudi Arabia or Russia in oil production and would continue to be dependent on oil imports for the foreseeable future. The article will conclude that the U.S. shale oil boom would not be easy to replicate in the rest of the world nor would it invalidate the peak oil concept.

Shale Oil Reserves

Although no serious attempts have been made yet to analyze the size of the U.S. shale resources, it seems that even if the in-place volumes are large, reserves will not be as high due to very low recovery factors, presently in the range of 1% to 10% with few exceptions. It is one thing having huge resources of shale oil in-place and quite another turning them into a sizeable production capacity.[5]

According to the U.S. Energy Information Administration's (EIA's) 2012 Energy Outlook, the unproved technically-recoverable shale and tight oil resources in the U.S. were estimated in 2010 at 33 billion barrels (bb), with recoverable shale gas resources about 480 trillion cubic feet (tcf). For the latter, it is worth mentioning that this level is almost half that reported (827 tcf) a year earlier. It is a further indication of the large uncertainties still associated with recoverable resource estimates.[6]

U.S. Shale Oil Potential

U.S. shale oil production is projected to increase from about 1 mbd in 2012 to 2 mbd in 2020 before it plateaus at 3 mbd by 2025 and then starts its downward trend.

Total U.S. oil production is projected to increase from 6.41 mbd in 2012 to a projected 7.50 mbd in 2019 (see Table 1). After 2020 production begins declining gradually to 6.1 mbd by 2035 through to 2040 as producers develop sweet spots first and then move to less productive or less profitable drilling areas.[7]

Oil imports are projected to decline from 65% of consumption in 2012 to 60% by 2019 before they resume their rise reaching 68% by 2035. This means that there is neither a chance for the United States ever to become self-sufficient in oil nor to overtake either Saudi Arabia or Russia in oil production.

Assessing the producible reserves of a shale/tight oil formation is a compli-

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See footnotes at end of text.

	2012	2013	2014	2015	2016	2019	2020	2025	2030	2035
Production	6.41	6.64	6.88	7.04	7.21	7.50	7.40	6.93	6.49	6.10
Consumption	18.46	18.48	18.50	18.52	18.54	18.60	18.62	19.50	19.11	18.86
Net Imports	12.05	11.84	11.62	11.48	11.33	11.10	11.22	12.57	12.62	12.76
As a % of Consumption		65%	64%	63%	62%	61%	60%	60%	64%	66%	68%

Table 1
U.S. Current & Projected Crude Oil Production, Consumption & Imports, 2012-2035

Sources: OPEC World Oil Outlook 2112 / BP Statistical Review of World Energy, June 2012 / EIA Early Overview of Annual Energy Outlook 2013 (AEO2013) / Author's Estimates.

cated process. Each shale formation is different and the properties within an individual field (porosity, permeability, etc.) can sometimes vary from well to well. Furthermore, the rapid output increase and decline of shale/tight oil-producing wells further complicates matters and makes shale/tight oil operations a "drilling-intensive" activity thus significantly adding to the costs of production.[8]

Can the U.S. Overtake Saudi Arabia & Russia as Top Oil Producer?

Reports about the U.S. shale oil boom being a game changer have proliferated after the November 2012's prediction by the IEA that the United States will overtake Saudi Arabia and Russia to become the world's biggest oil producer by 2020 and energy self-sufficient by 2030. While such rosy forecasts play well to the IEA's audience, which is largely American, they are not borne out by the realities of the global oil market.

The IEA said it saw U.S. oil production rising to 11.10 mbd by 2020 and overtaking Saudi Arabia and Russia at 10.60 mbd and 10.00 mbd respectively (see Table 2).

	(mbd)		
	2015	**2020**	**2035**
United States	10.00	11.10	9.20
Saudi Arabia	10.90	10.60	12.30
Russia	10.00	10.00	9.00

Table 2
IEA Projections of U.S., Saudi Arabia & Russia's Oil Production 2015-2035

Source: IEA's Annual Energy Outlook 2012.

Allowing for the slow shale oil production and the steep depletion in U.S. conventional oil production ranging from 3%-5% per annum, the projected U.S. production by 2020 would amount to no more than 7.40 mbd, far less than the IEA projection of 11.10 mbd and far below the projected production of Saudi Arabia and Russia. Moreover, that level of shale oil production is probably only sustainable for a couple of years because of the early peak and steep first year decline in shale production rates in new wells.

Another claim that does not stand up to scrutiny is that the success of American shale oil production has the potential to deny OPEC the power to set global oil prices and could also shift the balance of power in global energy markets.[9] That is not going to happen since the world is projected to become increasingly dependent after 2020 on OPEC whose share of world oil production will rise to 48% from 42% now.

	2012	**2014**	**2015**	**2016**	**2020**	**2025**	**2030**	**203**
World Oil Demand	88.70	90.70	91.80	92.90	96.90	100.90	104.20	107.39
World Oil Supply	84.40	84.63	85.37	85.17	87.91	89.62	90.05	90.06
Non-OPEC	46.60	47.70	47.90	47.90	48.68	48.92	49.16	49.31
OPEC	36.80	35.80	36.20	36.00	37.23	37.70	37.89	38.00
U.S. Shale oil	1.00	1.13	1.27	1.27	2.00	3.00	3.00	2.75
Demand / Supply Deficit *	-4.30	-6.07	-6.43	-7.73	-8.99	-11.28	-14.15	-17.33
Shale oil as % of Global Supply	1%	1%	1%	1%	2%	3%	3%	3%

Table 3
World Oil Demand & Supply, 2012-2035

Source: OPEC: World Oil Outlook 2012 / IEA, World Energy Outlook 2012 / BP Statistical Review of World Energy, June 2012 / EIA, Energy Outlook 2012 / Author's projections.

* The demand/supply deficit is accounted for by stock changes, consumption of non-petroleum additives and substitute fuels. Otherwise it will be reflected in higher oil prices.

U.S. Shale Oil Contribution to Global Oil Supplies

In 2012 U.S. shale oil production contributed 1% to global oil supplies and this is projected to rise to 2% by 2019 possibly reaching 3% by 2025 (see Table 3). Such a level of production will hardly make a dent in global oil supplies.

Total non-OPEC supply increases by 1.3 mbd over the 2012-2016 period. The key sources of supply driving this growth are rising shale oil production from the U.S., Canadian oil sands and crude oil from the Caspian and Brazil.

Impact on the U.S. Economy

So far the only estimate of the broader impacts of the combined shale oil and gas production on the U.S. economy has been made by Citigroup, according to which "the cumulative impact of new production and reduced consumption could increase real U.S.

GDP by 2% to 3.3%, or by $370 bn to $624 bn and add as many as 3.6 million new jobs by 2020".[10] In addition, the shale oil & gas revolution may substantially help reduce the U.S. account deficit which, "currently is running a negative 3% of GDP, by anywhere from 1.2% of GDP to 2.4% of GDP".[11]

A surprise bonus of the shale gas boom in the U.S. is a coal boom overseas according to IEA sources. U.S. Coal, displaced at home by shale gas, is finding its way overseas particularly to the European Union, India and China.

Meanwhile, manufacturers in the U.S. have announced more than $90 bn worth of investments to take advantage of cheap natural gas which appears to be driving the country's industrial renaissance.[12]

Can OPEC Disrupt U.S. Shale Oil Production Surge?

According to OPEC Secretary General Abdullah Al-Badry, OPEC does not see increased U.S. oil output as a threat to its interests but is skeptical about industry estimates that U.S. shale production could amount to 3 mbd within 20 years as well as forecasts of U.S. energy independence.[13]

Fears that OPEC will boost output to push down oil prices are misplaced. OPEC's ability to push prices lower to disrupt new emerging sources of supply is constrained by members' higher fiscal needs, a result of the social turmoil unleashed by the Arab Spring.[14]

Saudi Arabia and other major OPEC producers need oil prices on average at $95/barrel to sustain the extra spending. On the other hand, U.S. shale developments need prices of $72-$80/barrel to break even.

Even if U.S. benchmark West Texas Intermediate (WTI) oil drops 30% from the current price of $86/barrel, U.S. shale oil producers would continue producing. Saudi Arabia can't afford a decline of that magnitude after the government pledged an unprecedented $630 bn on social welfare and building projects. The Kingdom couldn't meet these commitments if prices fell 25% from the current $111/barrel.

The Problems Looming over U.S. Shale Oil

Among the major obstacles to unlocking the huge potential of the shale oil plays in the U.S. is the lack of an adequate infrastructure to transport and refine oil and the rules governing overall U.S. domestic oil movements. Oil can't move freely throughout the United States or be exported from the country.[15]

Theoretically, the possibility of exporting U.S. crude oil could address these questions, but U.S. laws ban oil exports for the sake of national security except for modest volumes which must be authorized by federal authorities. There is also the difficulty of what to do in the future with the excess natural gas associated with shale/tight oil production. This has already led to the collapse of gas prices in early 2012 and could in the future complicate the overall economics of shale/tight oil production and even the feasibility of fully deploying its potential.[16]

Another looming problem would be the inevitable rising costs of services, rigs, labour and pipelines, caused by inflationary pressure from the frenetic activity throughout the shale/tight oil and gas sector.[17]

The Environmental Impact of Shale Oil Production

Shale oil and gas are extracted by pumping water, sand and chemicals into the ground at high pressure to crack rocks open, a process known as hydraulic fracturing, or "fracking."

However, hydraulic fracturing is increasingly perceived as contributing to water and land contamination, causing natural gas infiltration into fresh water aquifers, and even triggering earthquakes. Moreover, the intensive use of water will increasingly impose additional costs and could threaten the viability of projects for shale oil and gas. A shale oil well requires between 4 and 5 million gallons of water.[18] This may exacerbate water shortages in states where water availability is already a problem.

Therefore, the oil industry needs to develop technological solutions to minimize water use, minimize and report chemical use, and carefully monitor production sites. However, if such a collective effort by industry does not materialize, the government may respond with more onerous regulation in the near future that could impact U.S. shale oil production

U.S. Oil Independence

Since the first oil crisis in 1973, the notion of U.S. oil independence has been of great importance in U.S. political debate. Yet oil self-sufficiency may be important only in cases of major wars, when the disruption of sizeable foreign oil supplies could endanger the military effort or the country's self-defence. In all other cases, one must never forget that the oil market is global and fungible, and a country can't be insulated from what is happening in the rest of the world even if it is self-sufficient in oil.

Oil independence is not really the issue confronting the U.S. economy. The real issue is the price needed to get the oil out of the ground.[19] American oil independence is not going to change the reality of

triple-digit oil prices. On the contrary, oil prices may have to climb much higher, possibly to $200/barrel for the IEA's forecast about U.S. shale oil production to come true.

U.S. Shale Oil Production Versus the Oil Price

With U.S. shale oil production surging and profitability for U.S. domestic oil producers high and also with no change in sight to U.S. rules preventing crude oil exports, it is projected that WTI prices could fall to $50/barrel over the next 24 months to force a slowdown in supply growth or a change in crude oil export rules.

The U.S. crude oil market could come to resemble the natural gas market where a huge shale gas production has led to a collapse of the gas prices in the U.S.

This is exactly the situation with shale oil production now. U.S. shale oil producers have no reason to stop pumping. So the bottom line is: large production, low breakeven costs, low financing costs, and tight capacity across the entire petroleum infrastructure. The ingredients are there for a price collapse.

The real issue facing the U.S. economy isn't the availability of oil but the price needed to get it out of the ground. That Brent oil is hovering near $111 /barrel is a clear signal of U.S. growing dependence on the very unconventional sources of supply being championed in the IEA report.

Getting oil out of the ground has never been more expensive. Just look at the pullback in capital spending among oil sands operators in Canada. And costs are only going up from here. Forecasts of exponential growth in U.S. shale oil ignore some very real challenges with it – such as wells that deplete at a rate of more than 40%, even in rich fields like Eagle Ford in Texas and the Bakken in North Dakota.

The real reason that once-marginal sources of supply such as shale oil have been catapulted to prominence is soaring global oil prices. Without higher prices, no one would be chasing shale oil.

However, the higher the price of oil, the less of it our economies can afford to burn. If global economic growth is already grinding to a halt when oil prices are around $111/barrel, what do you think would happen to economic growth – and hence global oil demand – if prices reached the even higher levels needed to make the IEA's supply dreams come true.

Just like the forecasts the IEA made a decade ago about the much anticipated increase in deep-water production from the Gulf of Mexico, the agency's hopes for another game changer are unlikely to pan out.

Has U.S. Shale Oil Production Made Peak Oil Redundant?

Claims that the idea of peak oil had gone in flames as a result of surging U.S. shale oil production, are not borne out by the realities in the global oil market.

Conventional oil production peaked in 2006. Also nine of the top oil producers in the world have already peaked: USA peaked in 1971, Canada 1973, Iran 1974, Indonesia 1977, Russia in 1987, UK 1999, Norway 2001, Mexico 2002 and Saudi Arabia 2005. Moreover, three of the world's largest oilfields have already peaked: Kuwait's Burgan, Mexico's Cantarell and Saudi Arabia's Ghawar.[20]

The world is currently consuming just over 32 bb a year, yet on average finding just over 6.80 bb a year. Over the period 1992-2011, only 23 percent of the global oil production has been replaced by new discoveries or by enhanced oil recovery (EOR).

Should we worry about peak oil? Our world is completely dependent on oil. The most critical factor determining the performance of the world economy is access to inexpensive oil.

With more than fifty oil-producing countries now in decline, focus on the oil-rich Middle East has sharpened dramatically but as this region nears its own oil peak probably this year, any relief it can provide is limited and temporary. Therefore, the pressure on the oil price will continue unabated in coming years.

However, the fact that the oil price has been hovering near $110-$111/barrel for the last three years despite the worst global recession the world has ever witnessed, and the rush for the development of expensive unconventional oil resources are a proof that the peak oil theory is valid and alive.

Can the U.S. Shale Success be Replicated Elsewhere?

The U.S. shale success can't be easily replicated in other areas of the world – at least in a short period of time – due not only to the huge resource base of shale oil existing in the U.S., but also to some unique features of the U.S. oil industry and market.[21]

In the U.S. individuals and companies may own property rights on mineral resources, while in most parts of the world these rights belong to states only. This fact gives a huge incentive to land owners to lease their property rights and to the oil industry to lease or buy them.

Another major feature is the presence of thousands of independent oil companies that historically played the role of pioneering new frontiers. Yet another feature is the presence of several financial institutions, funds, capital ventures, and equity firms that are eager to fund independent companies.

A final unique feature is the broad availability and flexible market of drilling rigs and other essential tools of exploration and production. For instance, the U.S. and Canada have about 65% of all drilling rigs existing in the world.[22]

These features which don't exist in other parts of the world make the U.S. a sort of unique play for experimentation and innovation.

Conclusions

While U.S. shale oil production will probably have a positive impact on domestic oil production and the level of oil imports, it will hardly make a dent in the global oil supply.

Total U.S. oil production oil will peak at 7.50 mbd in 2019 before it starts to decline reaching 6.10 mbd by 2035. This means that there is neither a chance for the United States ever to become self-sufficient in oil nor to overtake either Saudi Arabia or Russia in oil production. Moreover, the U.S. will never be in a position to deny OPEC the power to set global oil prices.

However, the biggest obstacles to an expansion of U.S. shale oil production would be a backlash against its adverse impact on the environment, lack of oil transport and refining infrastructure and rising costs of production. Without higher prices exceeding $100/barrel, no one would be chasing shale oil.

The U.S. shale oil boom would not be easy to replicate in the rest of the world nor will it invalidate the concept of peak oil.

Footnotes

[1] The International Energy Agency's (IEA's) Annual Energy Outlook 2012.

[2] OPEC's World Oil Outlook 2012, pp.121-122.

[3] This is calculated on the basis of 3%-5% annual depletion rate of U.S. conventional oil production between 2012 & 2020 and estimated at 1.2 mbd-2.0 mbd. A1 mbd increase in shale oil production during the same period will partially offset the decline in conventional oil but leave a deficit of 200,000 b/d -1 mbd.

[4] OPEC's World Oil Outlook 2012, p.122.

[5] Ibid., p. 121.

[6] Ibid., pp. 121-122.

[7] EIA's Annual Energy Outlook 2013 Early Overview (AEO2013), released on 5 December, 2012, p.8.

[8] Leonardo Maugeri, Oil: The Next Revolution (a paper published by Belfer Centre for Science & International Affairs at Harvard Kennedy School, June 2012), p. 45.

[9] Bloomberg report accessed through http://www.crainscleveland.com/article/20121211/BLOGS03/121219978

[10] Leonardo Maugeri, Oil: The Next Revolution, p. 45 & p. 63.

[11] Ed Morse, Move Over OPEC – Here We Come, Wall Street Journal, March 20, 2012.

[12] ED Crooks, Financial Times, December 14, 2012.

[13] That is what OPEC Secretary General, Mr Abdullah Al-Badry told a press conference held during the OPEC oil Ministers conference in December, 2012 and reported by Associated Press (AP) on 13 December, 2012.

[14] Javier Blas, OPEC Unlikely to Disrupt U.S. Shale Boom, Financial Times, December 12, 2012.

[15] Leonardo Maugeri, Oil: The Next Revolution, p. 55.

[16] Ibid., p.57.

[17] Ibid., p.58.

[18] Ibid., pp. 59-60.

[19] Jeff Rubin, When Shale Oil Won't Save You at the Pumps, the Globe & Mail, Toronto, Canada, November 22, 2012.

[20] Mamdouh G Salameh, The Changing Oil Fundamentals: Impact on the Global Oil Market & Energy Security (A paper given at the ECSSR 17th Annual Conference, November 1-2, 2011, Abu Dhabi, UAE), p.7.

[21] Leonardo Maugeri, Oil: The Next Revolution, p. 45.

[22] Ibid., p. 46.