Shale Oil and Gas: The Contrarian View

By Robert U. Ayres, Sandoz (Novartis) Professor of Economics and Technology Management, Emeritus

No one is questioning the fact that we have either reached or will soon reach “peak oil”; that existing fields are being depleted at the rapid rate of 7 percent a year, and that the search is on for “unconventional oil” as alternative forms of energy are slow to reach critical mass.

There are many kinds of “unconventional oil” – meaning hydrocarbons that are not found in fluid form, but that can be “fluidised” in a straightforward way (unlike coal, for instance). These resources include Venezuelan heavy oil and Canadian tar sands.

But the big change in the last two decades is shale gas and “tight oil” - a liquid, trapped in shale (rock), where it doesn’t flow naturally but can be extracted by horizontal drilling and “fracking”. Fracking uses high-pressure water to fracture the shale and then chemicals that reduce the viscosity of the oil trapped in the interstices of the rock and allow it to flow.

Roots of the Mystique

The shale gas enthusiasm has been inspired partly by an advertising campaign financed by T.Boone Pickens (“The Pickens Plan”). Some say it goes back to widely publicised report by Leonardo Maugeri, a former industry CEO, now at Harvard’s Belfer Center. Then the head of the IEA bought this story and gave it the imprimatur of official acceptance with a forecast of the coming of “Saudi America”, projecting that the US would be producing 10 million bbl/day of natural gas liquids by 2020 before resuming the long-term decline. Citigroup went even further, predicting 4 billion bbl/day of oil by 2022. Since then the media has converted it into a gusher with headlines like George Monbiot’s article in the Guardian: “We were wrong on peak oil. There’s enough to fry us all” [The Guardian, Monday July 2, 2012].

The result is, there is now a vociferous group of shale-gas (and oil) enthusiasts who have created a mini-bubble in shale. They insist that above US$70 per barrel (well below the current price) shale gas reserves are worth exploring. Investment in shale in 2010 and 2011 was apparently a trillion dollars, with another US$600 billion scheduled for 2012.

Indeed, it does appear at first glance that the kinds of shale deposits that contain recoverable gas and oil are very large. The Bakken and Eagle Ford shales under Montana and North Dakota contain up to 700 billion barrels of fluid oil bound tightly into sandstone. According to the current wisdom of the U.S. Geological Survey, 3 to 4.3 billion barrels of the oil will be recoverable, amounting to 6 months or so of current U.S. consumption. Even if the recovery rate is doubled or quadrupled, it would take care of perhaps two years of current US consumption.

Peaks and Declines

Complicating the issue is the fact that shale gas (and oil) wells peak and decline much more rapidly than conventional wells. The Bakken play declined about 69 percent in the first year, 39 percent in the second year, 26 percent in the third year, etc. Based on experience, if no new wells had been drilled after 2010, the Bakken shale oil output would have declined from the peak of just over 350,000 bbl/day in 2010 to 200,000 bbl/day two years later. (Remember that production at peak was not all from new wells. It represented a number of older wells that were already declining. This is a much faster rate of decline than the afore-mentioned 7 percent per annum decline in conventional oil-fields.[1]

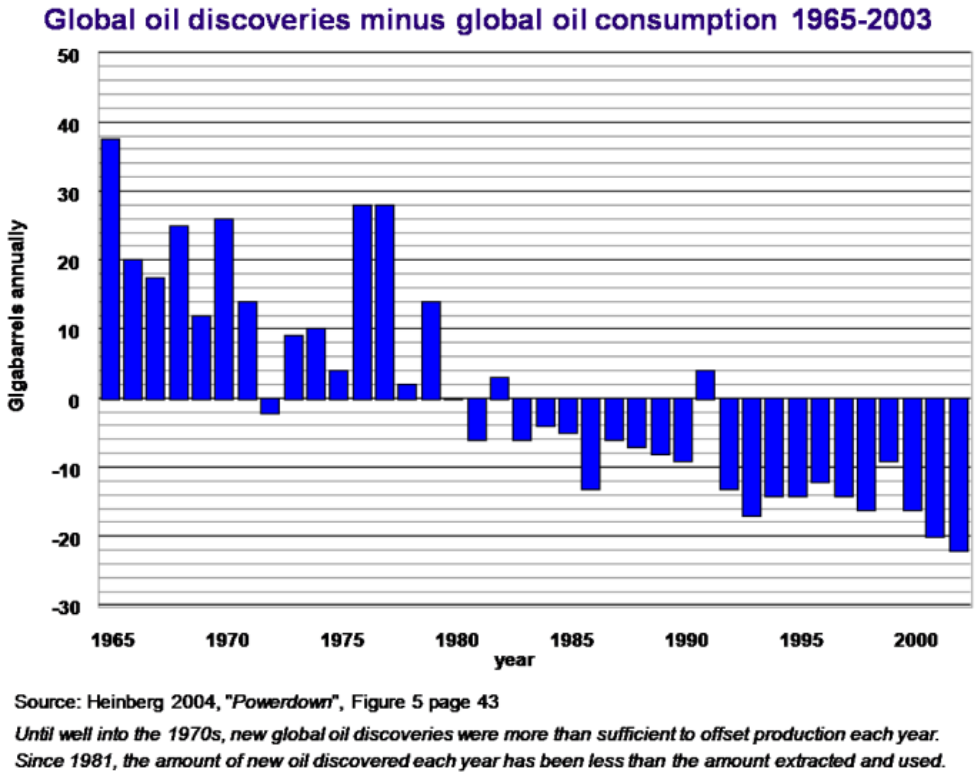

Figure 1: Global oil discoveries minus global oil consumption

The longest experience in shale gas comes from the Barnett shale play under Dallas-Fort Worth, Texas. It peaked in 2009, when over 12,000 wells had been drilled costing US$2 to US$4 million each. Production rates were high at first, but declined rapidly, typically down 65 percent in the first year.

This ratcheting up and down explains why drilling for gas in the US trebled from 2000 to 2009, while the quantity of gas recovered remained virtually constant. Drilling for oil in the US in 2012 was at the rate of 25,000 new wells per year, just to keep output at the same level as it was in the year 2000, when only 5,000 wells were drilled.

Will shale oil and gas prompt a major shift of global petrochemical operations from Europe to the U.S.? Given that a state-of-the art petrochemical plant probably costs several billion dollars, I doubt it.

On the one hand, the price differential for gas, at present is, indeed, quite large, and at a time when demand is weak, some marginal ethylene plants in

Europe might close down. However most ethylene is produced in petroleum refineries from naphtha and is used in downstream chemical operations located nearby. The petrochemical sector is probably the most integrated of all industries, because every operation generates by-products that can be used in other processes, provided that they are co-located. One example is carbon monoxide, which is a valuable fuel or feedstock if it can be used near the source, but is too cheap to be worth transporting any significant distance.

Energy and Environment

The real question yet to be answered is how much energy is required to extract that gas or oil? Will it be more, for example, than the energy required to extract oil from Canadian tar sands?

Each “fracking” well drilled into shale (which costs US$3 to US$10 million, with oil wells costing on the high side) has a much shorter useful lifetime than a well drilled into a liquid petroleum or a gas deposit. The optimists are assuming well lifetimes of 40 years, as compared to experience thus far in Texas which suggests that 8 years is more likely (**Hughes 2010**).

The environmental effects of fracking are as yet unknown. The water requirements are very large, and the waste water may be a problem in itself. The shale-gas industry has been very reluctant to identify the chemicals in use on grounds of proprietary secrecy. There is an obvious threat to aquifers.

There will surely be a boomlet in shale gas and oil, but my opinion, for what it is worth, is that the fracking boom is partly – perhaps largely – hype, and that a lot of the small investors now being solicited by various investment publications will lose their shirts. I think the head of the IEA has been quite irresponsible in attaching her institution’s good name to such a dubious proposition. To put it in quantitative terms, I accept David Hughes conclusion that the peak of shale oil will occur (circa 2020) but will be around only about one third of the IEA’s 10 million bbl/day estimate for natural gas liquids and a similar fraction of Citi-Group’s bloated estimate of about 4 million bbl/day for U.S. shale oil.

The EEC is prone to view the world in terms of competitiveness *vis a vis* the U.S.A. more than it should. Shale gas will be a benefit mainly for U.S. householders, and secondarily for electric power producers. The European petrochemical industry, which is based on oil refining, will experience a very

slight headwind, at most.

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[1] Some of the material in this paragraph was taken from a guest posting by Prof. James Hamilton in Econbrowser, of data taken from J.David Hughes presentation at the American Geophysical Union (AGU) annual meeting in December, 2012 [http://www.econbrowser.com/archives/2012/12/future_producti.html].

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