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HAPPY DAYS ARE HERE AGAIN?

An NPG Forum Paper

by Lindsey Grant

There has been a welter of celebratory stories in the popular press claiming that, because of the advent of fracking, our energy problems are over, that we are on the way to ending our dependence on foreign energy sources, and that – as a consequence – any worries about the limits to growth and the transition from fossil fuels are no longer relevant.

I will present a less ecstatic analysis.[1]

EUPHORIA

The Press. An energy story appeared in the *New York Times* on March 13th. Titled "U.S. Inches Toward Goal of Energy Independence" and drawing more on anecdote than on data, it quoted a wildcatter in West Texas as saying "To not be concerned with where our oil is going to come from is probably the biggest home run for the country in a hundred years." An epochal overstatement (as I will document below), but of course the wildcatter had a vested interest in talking up the industry.

On April 10, the *New York Times* ran a spate of stories that, if not quite so vivid, were at least as optimistic as the wildcatter. "Fuel to Burn. What Now?" argued that "the promise of abundant and cheaper fuel...could have profound effects on what people drive, domestic manufacturing and America's foreign policy. Cheaper fuel produced domestically could reduce the cost of shipping and manufacturing, trim heating and cooling bills, improve the auto market", reestablish American industry and transform our foreign trade deficit. It argued that all these benefits would far outweigh any environmental concerns. It quoted the CEO of Exxon as saying that "The transformation unfolding in North America represents a potentially decisive shift in the history of energy," and cited a claim that "as many as 3.6 million new jobs might be created by 2020 thanks to the energy boom." (It did not point out that that is far too few jobs to solve the unemployment problem or even to absorb the intervening growth anticipated in the numbers of job seekers. It quoted a figure of 9 million barrels per day (mb/d) for current U.S. oil production – (the correct figure is 5.5 mb/d) – and predicted that U.S. production could reach 15.6 million barrels a day by 2020. It wound up calling the U.S. "an energy-rich superpower."

Another *New York Times* article in that issue described the expectations of an oil/gas bonanza in Africa and, indeed, most of the world. It consisted mostly of statements about companies' investment plans, and offered no figures to document the supposed bonanza.

Taken together, the articles spelled out hopes that defy both history and logic. That is a bubble.

The politicians have joined the press in the general enthusiasm. They want to please the voters and perhaps to persuade themselves that energy independence is around the corner, that there are no limits to growth, and that all we need do is to get the growth machine going again. The Republicans have been offering "drill, baby, drill" as the solution to high gasoline prices, and accusing the President of insufficient enthusiasm for their remedy.

The President, in turn, has been announcing the opening of new areas to oil and gas exploration. And, in his 2012 State of the Union address, he announced that we have "nearly a hundred years" supply of natural gas.

That figure may have been extrapolated from a paper last year sponsored by a consortium of companies with investments in oil and gas exploitation. It projected 2170 trillion cubic feet (tcf) of "proved", "probable", "possible" and "speculative" potential natural gas resources in the United States,[2] Consumption in 2011 was 23.52 tcf. At that rate, the estimated resource would last 93 years. (That itself is a flawed measure, because it assumes that production and consumption levels will stay constant – which they won't – but it offers a graphic way to visualize huge numbers.)

THE FACTS

Any effort to estimate unproven oil and gas resources is simply a compilation of educated guesses about dozens of fields, each with a range of error that can be tenfold or more. The median (or the 50% confidence level) estimates are used to compile the national and global data. The U.S. Geological Survey (USGS) is the most widely cited source of such estimates, and the U.S. Energy Information Administration (EIA) is the principal source of projections of U.S. annual supply and demand. Their view of the future is much more conservative than the press stories.

The USGS' 1995 National Assessment of U.S. Oil and Gas Resources is still its latest consolidated estimate of U.S. oil and gas reserves, projected reserve growth, and recoverable resources.[3] USGS has, however, been updating the recoverable resource estimates, field by field, since then. Together, they provide a picture of the present assessment, though that picture is incomplete and internally inconsistent.

Oil. In 1995, the mean estimate of total available crude oil was 191 billion barrels. Since then, we have pumped about 30 billion barrels of that oil. The projected production through 2035 (see below) is nearly 60 billion barrels, suggesting that nearly half our remaining oil will have been exhausted by 2035. New USGS estimates, however, raise the "undiscovered, recoverable conventional oil resources" by 30%, to 108 b/b.[4] That growth reflects a reevaluation of the oil recoverable with new technologies offshore in the Arctic and the Gulf of Mexico.

Those estimates do not include shale oil recovered by fracking. A new USGS compilation of onshore resources does include shale oil. It doesn't add much, raising the estimate of recoverable onshore resources (also by 30%) to 35 b/b[5], which is less than five years' annual U.S. crude oil consumption.

We have a little more time, but not much.

The U.S. Energy Information Administration (DOE/EIA) focuses on energy demand and how it will be met. It has been over-optimistic before, but its analysis of the current boom is modest. It observes that, after a long decline, U.S. crude oil production rose from 5.1 million barrels per day (mb/d) in 2005 to 5.5 mb/d in 2010, or 8%. As a result of fracking and the new offshore sources, it expects production to rise another 22% to 6.7 mb/d by 2020 and then decline to 6.1 mb/d by 2035.

"Import dependency" can be measured in various ways. By the EIA's measure, it peaked at 60% in 2005, declined to 49% in 2010, and may be down to 36% in 2035. That 36% is achieved with a little manipulation. Conventional crude oil production used to be the standard indicator for oil production. Now, however, the EIA talks of "U.S. liquid fuels supply", adding shale oil, natural gas liquids, heavy and super-heavy oils, tars, kerogen, liquified coal and gases, and liquid biofuels to conventional crude oil. The change in nomenclature helps to lower the import percentage, but -- to reach that 36% – EIA assumes that U.S. liquid biofuel production will more than double. That is a questionable projection. It ignores the limits on biofuel supply, and we have already seen what the U.S. corn-to-ethanol experiment has done to worldwide corn prices. My advice: be very skeptical.

That projection may be a distraction. In barrels of oil, which is the key number in the oil trade, crude oil imports in 2035 are projected to be 83% of the 2010 level – if we can find suppliers. Domestic production will again be declining, and the need for imports again rising, in a sellers' market. That is not "energy independence".

There is a demographic angle to all this. Per capita petroleum consumption has been falling since the 1970s. The EIA expects the decline to continue. However, that decline is wiped out by population growth. The Census Bureau expects our population to grow 25% from 2010-2035. The total projected crude oil consumption – unlike the per capita projection -- is nearly flat. If population were stable, oil imports in 2035 could be less than half the EIA projection. We are allowing population growth to wipe out the gains from conservation and increased domestic crude oil production. And the population will still be there – and probably growing – when the less painful conservation measures and the production gains are exhausted.

Gas. The news about gas is much better, although estimates of gas resources are notoriously unreliable. The 1995 study put total U.S. natural gas availability at just over a quadrillion cubic feet, with undiscovered recoverable resources at about 527 trillion cubic feet (tcf). They now have a new estimate of the undiscovered conventional recoverable resources (not including reserves or unconventional oils such as shale oil). It is 786 tcf, of which 388 tcf are in onshore and 398 tcf in offshore fields (Note 4). That is 49% higher than in 1995.

The USGS culture is more scientific than governmental, and it is quite willing to report studies with differing results. A 2011 field-by-field summary of onshore resources (Note 5) puts them at 1025 tcf, including 336 tcf of shale gas. That leaves 689 tcf of conventional resources, or almost twice the figure above, and it is the first national estimate we have from USGS for shale gas. Combining the two estimates as best I can – assuming that there will be little if any fracking in deep water, and adding the 1995 estimates of reserves and reserve growth – one comes up with a ballpark figure of something like 1650 to 1950 tcf. That is some 60% to 85% higher than the consolidated estimate of 1995. It represents 70 to 83 years' consumption at the current rate, or about 46 to 52 years if one accepts and extends the EIA expectation (below) of rising total consumption.

The EIA projects annual natural gas production only out to 2035. Shale gas presently constitutes 23% of the total. By 2035, it is projected to more than double, providing 49% (or 13.6 tcf/year) of U.S. natural gas output. The projected production from 2010-2035 would consume 252 tcf of shale gas, which is 75% of the USGS' 336 tcf of recoverable onshore resources. And the rest would go much faster, as the effort is made to extract shale gas to make up for the anticipated decline of other natural gas sources. Moreover, the EIA has just lowered its estimate of recoverable shale gas in the critical Marcellus formation by 42%.[6] One wonders if the EIA has fully absorbed the implications of that dramatic downward revision.

The EIA traditionally fits its supply projections to its estimates of consumption, so it is under pressure to identify sources of gas to meet projected demand, but the gas may not be there for long.

Some experts believe that the whole set of shale gas statistics, from drillers' production and reserve estimates to the EIA sampling techniques, are systemically inflated.[7]

The arithmetical exercise above is indicative, but hardly definitive. There may be new and unexpected discoveries, or another technological break comparable to fracking, or deep sea drilling, or enhanced recovery, which would raise the definition of "recoverable". On the other hand, the amount recoverable will decline with rising costs as exploration enters increasingly inaccessible environments. It takes more and more energy to extract the remaining energy, which lessens the real energy available to the economy. And there is no assurance as to how much

of the nation's and the world's shale will be susceptible to fracking. Environmental constraints may keep some resources off limits. And finally, the estimates above of recoverable resources are "technically recoverable." They are not necessarily economically recoverable

The Economics of Exploitation. Since one exercise in 1998, the USGS has not tried to estimate how much of the resources may be economically recoverable. It may turn out to be rather small.

At some point, there is a wall when the energy return on energy invested (EROEI) approaches 1:1, whatever the price. (Already, it is said to be down to something like 1.5:1 for heavy oils and tar sands.) Well before that happens, drilling will not be worth the investment. Coal will follow oil and gas, and we will be at the end of the fossil fuel era even though some fossil fuels will remain in the ground and may be tapped for high-value (mostly non-fuel) uses. But there is nothing in sight that changes the basic arithmetic of exhaustion. Fossil energy resources are finite, and we are approaching their end.

Population growth is a much more fundamental source of our energy problems than that single calculation about imports (above) suggests. It has been the fundamental driver of the decline in natural resource availability that has been becoming increasingly evident, and future population growth will accelerate the decline.

THE LESSONS TO BE LEARNED

What are the lessons from this brief exercise? The euphoria is momentary. The U.S. has more recoverable energy than it did before fracking -- for better or perhaps worse, because it will cause more environmental damage and global warming. We don't really know just how much more energy. For crude oil, the USGS does not see much of an energy bonus from fracking, and EIA's estimates suggest that the bonus will begin to decline in eight years. We will continue to need large imports, and dependence becomes more and more dangerous in an increasingly fragile and energy hungry world. For natural gas, a temporary glut has happened in the United States, but it is a result of investment generated by the current euphoria and may be very temporary, judging by the official estimates of recoverable resources. The market price is now below the cost of production, and the three principal natural gas producers in North America have already begun to adjust to the glut by cutting production and diverting their emphasis to liquid fuels.

The Dilemma. The reality remains: fossil energy is not forever. We are in the transition from fossil energy, and the momentary euphoria should not obscure the shortness of the reprieve offered by fracking. Daydreams of a permanent surplus of oil and gas are just daydreams.

... or perhaps nightmares would be a better word. The press and the politicians seem to have forgotten about anthropogenic climate change. We face a dilemma of truly awesome dimensions. The more fossil fuels we consume, the more rapid and terrifying will be their impact on climate change. If in fact the supply is more limited than the present euphoria would have us believe, the less time we will have to bring our population and our consumption patterns down to levels that can survive the painful transition to renewable sources.

The Hansen Proposal. James Hansen is a leading student of climate change. He has just written an OpEd detailing the immediate and long-term impacts of climate change.[8] He starts with the sentence: "Global warming isn't a prediction. It is happening." He cites the recent droughts and heat waves as evidence, and goes on to describe a future with higher sea levels and intolerable temperatures. "Civilization would be at risk...If this sounds apocalyptic, it is."

Hansen writes that the Canadian tar sands contain more oil than the world has consumed in its history, and U.S. "tar shales" (oil shales) contain even more. If these are burned, they will make catastrophic global warming a certainty. (On this point, I would demur. The EROEI calculation I described above puts limits on exploiting all those bitumens. Their presence has long been known, as have the limits. The World Energy Council years ago cited an even higher figure for Canadian and Venezuelan tar sands and heavy oils, but it estimated that only 1.3% of the total are proven, economically recoverable reserves, with another 5.4% "probable".[9] Nevertheless, Hansen's argument stands, even if those particular statements may be questionable.)

As to what to do about it, Hansen offers a policy with which I thoroughly agree. "We should impose a gradually rising carbon fee, collected from fossil fuel companies, then distribute 100 percent of the collections to all Americans on a per-capita basis every month." That distribution, he says, would more than compensate most people for the increased cost of energy. I am not so sure of that, but I strongly believe that a carbon tax – and perhaps not so gradual – should be a central feature of any serious effort to address the problems we face. It would reshape America and, indeed, the world. It would begin to address the climate issue, seriously, for the first time. It would be painful, but it would work, whatever one's beliefs as to the amount of oil and gas we have left.

The Ticking Clock. Time is running out. We must deal with both sides of the dilemma. Present policies are leading us into a climate crisis. They will lead us into an energy crisis if we run through our fossil energy resources before we have reduced our numbers and changed our lifestyle to survive in a leaner world with a diminished flow of energy. We cannot count on imports, because most of the world faces just as desperate a future, and even sooner than we do. (The USGS conventional oil and gas survey cited above [Note 4] also produced estimates for the rest of the world. It came up with a decline of 8% from the 2000 estimate for oil, and an increase of only 29% for gas.)

The refusal of the press and politicians to admit those facts and change their policies on development, economic growth, population growth – and on the mass immigration that has been driving population growth -- guarantees that the transition will be more abrupt and more brutal.

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NOTES

1. This paper extends my November 2011 NPG FORUM paper "Is Fracking the Answer? To What?" To rebut the widespread current misapprehension that shale oil and gas provide a permanent answer to the fossil energy transition.
2. The Potential Gas Committee, http://potentialgas.org. Critiqued in Slate: Future Tense, "What the Frack? Is there really 100 years' worth of natural gas beneath the United States?" By Chris Nelder. Posted Thursday, Dec. 29, 2011, at 6:37 AM ET. The 2170 tcf estimate is the highest I have seen. The White House staff should have checked the source and the prediction, but perhaps they were not asked.
3. See Grant, *The Collapsing Bubble: Growth and Fossil Energy* (Santa Ana, CA: Seven Locks Press, 2005), p. 25 for a table of the USGS 1995 U.S. and 2000 world projections of oil and gas resources. Or go to the original source: "Executive Summary by USGS World Energy Assessment Team. In USGS Digital Series 60. Table 1. World level summary of petroleum estimates for undiscovered conventional petroleum and reserve growth for oil, gas, and natural gas liquids (NGL)." at http://pubs.usgs.gov/dds/dds-060/ESpt4.html.
4. USGS Science Feature, 4-18-2012, 2:42pm EDT: "World's Oil and Gas Endowment", by Jessica Robertson. Note the shift in coverage. The 191 b/b included known reserves and anticipated technological reserve growth, plus undiscovered recoverable resources of 83 b/b. The new study covers only undiscovered recoverable resources, estimated now at 108 b/b. Revised data on known reserves are not yet published.
5. USGS NATIONAL ASSESSMENT OF OIL AND GAS RESOURCES UPDATE (August 2011): TOTAL OIL AND GAS RESOURCES (Sum of conventional and continuous resources.)
6. DOE/EIA, AEO2012 Early Release Overview. Release Date: January 23, 2012. Report Number: DOE/EIA-0383ER.
7. See Note 1. The individual skeptics quoted are Arthur Berman and Lynn Pittinger.
8. James Hansen, director of the NASA Goddard Institute for Space Studies: New York Times OpEd p.29, May 10, 2012, titled "Game Over for the Climate."
9. Grant, *The Collapsing Bubble: Growth and Fossil Energy* (Note 3), p.30.

About the author: Lindsey Grant is a writer and former Deputy Assistant Secretary of State for Environment and Population.

His books include: *VALEDICTORY: The Age Of Overshoot, The Collapsing Bubble: Growth and Fossil Energy, The Case for Fewer People: The NPG Forum Papers* (editor), *Too Many People: The Case for Reversing Growth, Juggernaut: Growth on a Finite Planet, How Many Americans?, Elephants in the Volkswagen,* and *Foresight and National Decisions: the Horseman and the Bureaucrat.*

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