A petroleum peak?

By Judge Richard D. Cudahy

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Of the global energy supply, 80.3 percent is hydrocarbon-based (and thus problematic for global warming); 34.3 percent of energy is derived from crude oil, while 20 percent is based on natural gas, and 25.1 percent still finds its origins in coal.

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With this overwhelming dependence on hydrocarbon fuels, led by crude oil, it's not difficult to understand the recent intense interest in how long these fuels — and particularly crude oil — can be expected to be available.

Opinions on this subject seem to cluster in two major schools. One group anticipates that crude oil supplies will soon be on the path to foreseeable exhaustion, while another aggregation of analysts views crude oil as virtually inexhaustible, and, of course, there are intermediate positions of every stripe. The sharply contrasting analyses of these schools of experts present a fascinating contrast, with each view tending to be associated with a different professional approach.

All this analysis and speculation exists against an historical backdrop punctuated by periodic alarms that the world is about to run out of oil. Always in the past these crises have melted away with the discovery of more oil reserves. So, the prevailing view in the world may well be that we just can't run out of oil and those who think otherwise are alarmists.

But a hearty coterie of "alarmists" is now broadcasting doomsday forecasts and winning hearts and minds to their view. This group finds its leadership among a cadre of petroleum geologists inspired by the late M. King Hubbert, who worked as a geologist for Shell Oil. In 1956, he published (to the consternation of his corporate bosses) what has since become a famous paper predicting that oil production in the lower 48 states would peak in about 1971. In fact, 1970 *did* see the peak of oil production in the lower 48, and production has been falling ever since.

Hubbert's analysis involves a formidable set of mathematical formulae and a bell-shaped curve, now named after Hubbert, that shows oil production typically rising at a quickening pace after first discovery to a maximum point and then falling away faster and faster after peaking.

The much-simplified explanation of this pattern lies primarily in the fact that the larger oil fields and pools are generally discovered first and yield the most immediate returns. Later, it is unlikely that large pools will have remained undiscovered, and the smaller pools that are then found will yield less oil and with more difficulty and expense.

Using an analysis patterned after King Hubbert's, some prominent petroleum geologists have forecast a peaking of global oil production as early as 2003 or at least by 2010. Colin Campbell, a colorful Oxford Ph.D. now living in the west of Ireland, argues stubbornly for a pessimistic view of oil prospects. He is joined in this view by Jean Laherrere, a geophysicist who discovered an oil field distribution law called the Parabolic Fractal, and by Kenneth Deffeyes, an emeritus geology professor at Princeton.

But the U.S. Geological Survey is more optimistic, seeing a global oil production peak as far out as 2030 or even 2040. A number of new computer-modeled studies conducted by the world's leading geologists suggest that global oil production will peak between 2010 and 2020 — with a few anticipating a peak earlier than 2010.

According to the Hubbert Bell Curve, peak production will occur when half of the ultimately recoverable oil reserves have been produced. It is anticipated that competition for the remaining half will drive prices quickly higher. This prospect seemed to have come to pass as the recent run-up in oil prices lends credibility to forecasts that oil production would peak in the early part of the 21st century.

Colin Campbell and others have warned of a highly destabilizing shock to the economy accompanying the global oil peak (which may already have occurred). L. F. Ivanhoe, a petroleum geologist and former senior adviser responsible for worldwide evaluations of oil basins for Occidental Petroleum, thinks that when production peaks around 2010, there will be a spike in crude oil and other fuel prices accompanied by global hyperinflation.

Craig Hatfield, a geologist at the University of Toledo, estimates the number of barrels of oil remaining to be produced at a level that is about 55 percent higher than the number used by Campbell and Laherrere, but Hatfield arrives at the same time line for peak global oil production as they do. Starting with 1,000 billion barrels of reported reserves, Hatfield adds 550 billion barrels of producible oil yet to be discovered and combines this sum with the 800 billion barrels already produced. Assuming the global growth rate of oil consumption continuing at 2 percent, half of ultimate oil production (and a production peak) will occur before 2010, matching Campbell and Laherrere's assessment.

Deffeyes, who was a colleague of Hubbert at the Shell Oil Research Laboratory in Houston, sees global oil production peaking as early as 2003 and as late as 2009. Deffeyes makes the further, perhaps surprising, observation that "no initiative put in place starting today can have a substantial effect on the peak production year."

According to Jeremy Rifkin, "the [geological] experts are divided into two broad camps: those who believe that production of conventional oil is likely to peak in 28 to 38 years and those who think it is likely to peak much sooner, within eight to 18 years."

A discrepancy of 10 to 30 years might seem almost immaterial in the larger scheme of things, but many commentators foresee panic as production begins to decline and a more feasible transition away from oil if the crisis can be delayed even slightly. Oil optimists predict larger reserves yet to be discovered and more thorough recovery methods to maximize the yield of existing wells.

Pessimists deprecate the possibility of significant changes in the estimates and, more significantly, argue that the Hubbert Bell Curve has allowed for and anticipated all these developments. Twenty-six of 40 super-giant oil fields are to be found in the Persian Gulf. At the end of the day and without dramatic new oil discoveries, depletion of alternative sources will leave the Middle East the producer of last resort.

So far, we have reviewed what geologists and geophysicists who adhere to there being a determinate end of the conventional oil supply believe. "Conventional" means relatively easy and economic to recover and excludes such variants as tar sands, heavy oil, oil shale and the like, which involve major additional processing and expense to yield usable crude oil.

Oil production may peak within 8 to 38 years.

Economists on the whole have a different point of view from geologists and view the crude oil supply as essentially inexhaustible. Here price and advancing technology become the crux of the matter. As oil becomes more difficult and expensive to recover, its price rises and it becomes economic, for example, to drill deeper, to drill under the deep ocean, and to drill in very cold polar areas. At the same time, demand is suppressed by higher prices.

In an economic analysis, conventional oil tends to merge with such fuel forms as tar sands and shale, which are seen as simply more expensive forms of petroleum. As oil prices rise, it also becomes economic to use more expensive secondary and tertiary recovery techniques — to salvage more oil from existing wells.

Hence, economists, not surprisingly, believe that supply can meet demand if the price is right. Because effective substitutes can be readied for resources grown too costly or too environmentally damaging, fear of physical exhaustion of the resource has been often exposed as groundless. Morris Adelman, a leading mineral economist, has declared that, "'Finite resources' is an empty slogan; only marginal cost matters."

But many geologists, who see themselves as hand-dirtiers in the pursuit of oil around the globe, seem to believe that economists miss the point that resources can be depleted and are therefore finite and not free. Colin Campbell has an entire chapter in his book, *Oil Crisis*, with the heading, *Economists Never Get It Right*. He basically believes that neoclassical economics is the science of human relationships in the market place, which ignores the role of energy and natural resources.

Another approach, distinct from the classically economic but devoted to technology and leavened by ideology, is espoused in *The Bottomless Well* by Peter W. Huber of the Manhattan Institute and Mark P. Mills, a physicist and technologist. These authors are dedicated to the view that knowledge is everything and resource scarcity is a pernicious myth. They teach that what is critical is not the primary energy supply but the order and refinement imposed on energy to fit it to advanced technological ends.

And can such "clever energy" succeed in capturing more energy than expended in the capture? "Will one unit of energy in hand capture more than one unit in the bush or less?" "Which it is — more or less — depends on two things: what's out there and how clever we are at retrieving it. What's out there we cannot change, but we can get better at retrieving."

Global warming may disqualify oil as fuel.

This approach holds that the main use of energy is not to produce such ultimate effects as lighting, locomotion or cooling; mainly energy is used to extract, refine, process and purify energy itself to produce energetic order. Carefully ordered energy fuels the voracious new technologies — transistors, semiconductors, lasers and the like — that control power flows and exemplify what might be called digital power. Technologies continue to develop, for example, for vehicular uses with the silicon electric power train that improves every aspect of performance and efficiency.

However, in general, increases in energy efficiency lead to reductions in cost, which increase usage and, in turn, increase the total consumption of energy. This seems a contradiction in the pursuit of energy conservation (but the authors regard this as an illusory goal).

In the larger scheme of things, waste is valuable — because to increase energetic order, one must add high-grade energy at one end of the process and discard some of it as low-grade (waste) heat at the other, and the discard is critical. Huber and Mills reiterate their faith in technology and the importance of energetic order: "We will never stop wanting more logic, more memory, more vision, more range — all of which depend on high-grade energy — because we are built to want more of these things, an unlimited more."

The authors, therefore, rest their case on the crucial susceptibility of energy to energetic order and the resulting yield of information, safety, health and longer life, "the span of biochemically structured order that defines [human] existence." Their thinking, however, may be unduly colored by ideological animus against regulatory efforts toward energy conservation and makes one suspect that their energy conclusions are essentially part of a larger ideological agenda. This does not, however, necessarily invalidate many of their insights.

All this thinking about the longevity of the oil supply, of course, ignores the environmental factors that may also dictate the abandonment of oil as a fuel. Global warming and other threats may disqualify oil even when it remains in abundance. There have been many prescriptions for a transition away from hydrocarbons to other sources of energy in the face of global warming.

That transition may not be much different from the one dictated by the economic crisis some analysts foresee in a declining oil supply (T. Nejat Veziroglu, a "Hydrogen Romantic," sees hydrogen as the "permanent solution" to both crises.) These may be doomsday scenarios, but they urgently demand our attention. Civilization itself is a product of energy.

Sources

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