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Plain peaking

"Formula for success: rise early, work hard, strike oil."

- J. Paul Getty

Imagine bacteria growing steadily in a bottle. The bacteria double in number every minute (the so-called 'doubling time', in other words, is one minute). At 11 o'clock, there is just one bacterium in the bottle. At 12 o'clock, the bottle is full of bacteria.

Question 1: at what time was the bottle half full ?

Question 2: if you were one of the bacteria in the bottle [if any bankers are reading this, the question effectively goes beyond the hypothetical], at what time would you first realize that you were running out of space ?

Question 3: suppose that at 11.58, some of the more far-sighted and progressive bacteria [evidently not bacterial politicians] realize that they are running out of room. So they launch a great search for new bottles. They search offshore, on the outer continental shelf, and in the arctic, and in wildlife preserves, and they end up finding three new bottles – a "colossal new discovery". How long can the bacterial growth continue as a result of the discovery of three new bottles (a quadrupling of the proven resource) ?

Answer to Question 1: the bottle was half-full at 11.59.

Answer to Question 2: the question is rhetorical.

Answer to Question 3: at 11.55 the bottle is just 1/32 full. With just five minutes left until the bottle is completely full, the bottle is actually 31/32 empty ! But all of the bottles are completely full by 12.02. Those extra three bottles bought our bacteria ***just two extra minutes***. That is the power and challenge of the exponential function.

Question 4: what happens if we are not really talking about bacteria at all, but actually talking about global oil reserves ?

The bacteria analogy belongs to Dr. Albert Bartlett, emeritus Professor of Physics at the University of Colorado at Boulder, USA. As his Wikipedia entry points out, Dr. Bartlett has lectured at some length on the topic of sustainable growth (which he views as a contradiction in terms: once any entity has achieved maturity, and he would view society in exactly the same

terms, further growth equates to either fat, or cancer). He has also made two statements about sustainability that give pause for thought:

"The greatest shortcoming of the human race is our inability to understand the exponential function." [An exponential function is simply one in which a variable increases at a fixed rate or percentage per time period: the sequence 1,2,4,8,16,32.. demonstrates exponential growth.]

and

"Can you think of any problem in any area of human endeavour on any scale, from microscopic to global, whose long-term solution is in any demonstrable way aided, assisted or advanced by further increases in population, locally, nationally, or globally ?"

To see more of Dr. Bartlett, visit the YouTube presentation which, for once, has a title consistent with its message: The most important video you'll ever see.

Why the reference to Dr. Bartlett ? Well, apart from the presentation above, which is one of the most compelling and certainly thought-provoking you are likely to see, because of what James Schlesinger, US Secretary of Energy, told Time Magazine in April 1977, perhaps the last time that Americans were truly worried about running out of oil. Schlesinger said that in the energy crisis of the 1970s triggered by OPEC oil price hikes,

"we have a classic case of exponential growth against a finite source."

At which point, tradition dictates that we should mention the late Dr. M. King Hubbert. One of the most celebrated geophysicists made his reputation on the back of a startling prediction, first made public in 1949, that the era of fossil fuels would be surprisingly short-lived. In 1956 Hubbert predicted that US oil production would peak in around 1970 and decline thereafter.

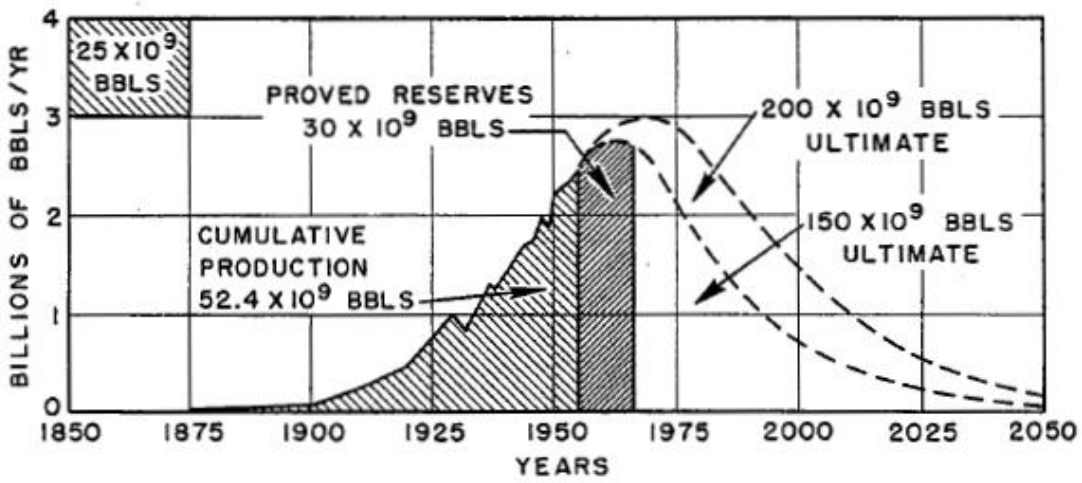

Figure 21 – Ultimate United States crude-oil production based on assumed initial reserves of 150 and 200 billion barrels.

US oil production did indeed peak in 1970, although as James Howard Kunstler points out in his book 'The Long Emergency', it took a year for the peak to be detected, when lower production figures started to be reported. Peak US oil production in 1970 amounted to 11.3 million barrels per day (bpd). That was the high watermark for the US oil industry; production would fall by

several per cent per year thereafter. By the mid-1980s, total US crude oil production had fallen below 9 million bpd, and is now running at approximately 6 million bpd.

But the problem is not restricted to the US alone. Dr. Hubbert went on to forecast that global oil production would peak between 1990 and 2000. Colin Campbell, retired chief of research for Shell Oil, estimated that global peak oil would occur in 2007, and Kenneth Deffeyes of Princeton forecast the global peak at 2005. It may well be that the global oil peak is already behind us. (This may hold for gold too, despite the rise in gold prices since the turn of the millennium.)

And not all of the oil below ground will ever be pumped out. Long before an oil field runs completely dry, the oil contained within it becomes so difficult or expensive to pump that it takes more than a barrel of oil's worth of energy to pump out one barrel. Even at peak oil, there will be plenty of oil left in the ground, but in Kunstler's words it will be

"the half that is deeper down, harder and costlier to extract, sitting under harsh and remote parts of the world, owned in some cases by people with a grudge against [the West], and this remaining oil will be contested by everyone. At peak and just beyond, there is massive potential for system failures of all kinds, social, economic and political. Peak is quite literally a tipping point. Beyond peak, things unravel and the centre does not hold. Beyond peak, all bets are off about civilisation's future."

Admittedly, oil science continues to make leaps and bounds in terms of extractive efficiency, but it cannot defer the inevitable, because we are dealing with the finite. And whatever one thinks about the brilliance of the human mind, creativity and innovation are not infinite, either.

If 'peak oil' is a real phenomenon (we believe it is), it is a huge deal. We are not facing the end of fossil fuels, but if peak oil is real, we are facing the end of cheap fossil fuels. Some would maintain that it is only the discovery and exploitation of cheap oil that has made the industrial and post-industrial revolutions possible. Try and identify a single facet of modern western life that doesn't have its origins or continued existence courtesy of cheap oil and natural gas: central heating; air conditioning; cars and the fuel that drives them; powered flight; electric lighting; agriculture and fertilizers.. In what Kunstler calls 'the long emergency', man may face a compelling pressure to revert to a more localised existence because anything more 'global' might be simply unsustainable – that word again – once the next oil shock hits. We may have to get used to an altogether more 'local' economy, one in which year-round strawberries and distant commutes are a thing of the luxuried past. (Jeremy Grantham, in his latest GMO quarterly letter, goes even further, to suggest that all forms of natural resources, and not just oil, have undergone a permanent shift higher in their value. We incline to the commodity supercycle argument but are so far sympathetic but agnostic on Grantham's wider thesis.)

The natural response to fears about peak oil is to highlight alternative energies, whether in the form of wind, tide, solar, nuclear or hydrogen. There are obviously environmental benefits to these alternative fuel technologies (Fukushima notwithstanding), but typical discussion of their implementation, most recently by Niels Jensen in his Absolute Return Letter, ignores one critical fact. No single alternative energy source can remotely begin to replace oil over either the short or medium term – because the installed base of hydrocarbon infrastructure is simply too vast. Even if scientists were to create, suddenly out of nowhere, a magical new energy source that was effectively free to use, it would take decades and likely trillions of dollars to replace the existing hydrocarbon infrastructure – the network of tens of thousands of petrol stations that support the auto economy, for example.

Are people living in denial about the severity of the oil challenge facing the global economy ? While reading Dr. Bartlett's book, 'The Essential Exponential', this writer happened to stumble upon a review for Colin Campbell's 2004 book, 'The truth about oil and the looming energy crisis'. It is currently unavailable on Amazon, which doesn't know when or if the book will ever be back in stock.

Another anecdotal offering. While on holiday in Italy last autumn, we visited the remains of the Roman villa at Desenzano, Lake Garda, one of the most significant Roman villas in the north of the country. The museum's description of its establishment was striking:

"At the end of the Roman era, the general economic crisis destroyed the small and medium sized country estates and favoured the formation of a limited number of large villae, an expression of a strong concentration of agrarian property. Their proprietors left the city to move onto their land, where.. they regained all the authority which they had lost in the deterioration of the political system."

Not much has changed with the passing of two thousand years. Now, as then, the wealthy are retreating to farmland in a general focus on real assets amidst monetary and political confusion.

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