**Energy Policy**

### Arithmetic, Population and Energy, Part 5

Revision B, 2021

**For the love of the human race.**

### Our Thesis

New and shifting data may require new mappings. When situations are altered, new maps must be used. There is nothing wrong with the old maps, they may simply be inapplicable to the new situation. Failing to understand this is like trying to find a place in Denver from a map of Cleveland.

Nevertheless, opponents of truth persist in discrediting and marginalizing legitimate practices of mathematics and science, by conveniently ignoring the need for appropriate mapping. This abuse is then made into the political or popular lever for claiming that the mathematics and science are incorrect, the mathematicians and scientists are to blame: they put forth a false theory, cried wolf, and lied to the populace. However, it is not usually the mathematician or scientist who lied, but rather the individuals who found it powerful or profitable to spin the truth to their individual advantage.

### Arithmetic, Population and Energy, Part 5

<http://www.albartlett.org/presentations/arithmetic_population_energy_video1.html> Better results were achieved by playing the video clip directly from this site, rather than by linking through YouTube. Click on the arrow in the middle of the picture, rather than on the black bar at the top. This is Part 5.

**“Energy industries agree that to achieve some form of energy self-sufficiency the U. S. must mine all the coal that it can.”**[[1]](#footnote-1)

Clearly, the editors at Time Magazine are full of hot air.

David Brower (1912-2000)[[2]](#footnote-2) called this the policy of “strength through exhaustion.”

I liken this to driving at sixty miles per hour; learning that there is an immovable concrete barrier thirty miles ahead; then deciding to increase speed by 7% a mile.

***t = 1 / ln (b) \* ln [ln (b) \* R / y0 + 1]***

***T ≈ 1 / r \* ln [r \* R / y0 + 1]***

This reduces the remaining time until collision from 30 minutes to 16 minutes, increases the impact velocity to 182 miles per hour, and triples the momentum. It also guarantees that no one will be maimed in the accident. The 182 mile per hour impact velocity pretty much guarantees that all living occupants will be vaporized or reduced to dust. Any remains for burial will have to be located with a sponge or a vacuum cleaner. Instant cremation and dispersion of ashes in one swift motion.

Strength through exhaustion, simply won’t work. The sensible person slows down and puts on the brakes.

**“1994 was the first year in our nation’s history in which we had to import more oil than we were able to get out of our own ground.”**[[3]](#footnote-3)

Now Dr. Bartlett introduces the concept of peak growth. Until this point our mapping has only considered exponential growth. Government, business, industrial leaders, and many individuals assume the exponential growth will continue indefinitely. These prognosticators are evidently oblivious to the cartoon where the exponential curve blows a hole in the ceiling. If these movers and shakers could possibly be successful at selling their insane schemes of indefinite growth, they would proceed with their plans until every last ounce of any given commodity was consumed. Then the graph would come to a screeching halt. The car would hit the barricade. Everyone on board would be killed and that would be that.

Such an infinitely sloped decrease or increase in mathematics is called a discontinuity. It is easily drawn on a graph. Fortunately, discontinuity is nearly impossible to achieve in nature. Almost all things have some mass, even electrons, and they cannot be made to change direction abruptly. In the case of our car crash model, we could observe this using high-speed, time-lapse photography, and we could watch the car and human bodies being reshaped as energy was dissipated.

In any case, there can be no question that a peak was, or someday will be reached. It is impossible to make exponential curves continue indefinitely: all of them approach infinity at terrifying speed. Finite man, simply has no capacity for infinity, which is exactly what the word means: no finiteness. Infinity is usually, perhaps always, the result of trying to divide by zero, it cannot be done. So there must be a peak. There must also be a path back downward to zero, either catastrophic or more sloped. I our last session we showed how to calculate the maximum peak for an exponential curve. Simply calculate t from this formula.

***t = 1 / ln (b) \* ln [ln (b) \* R / y0 + 1]***

Then use t to calculate the maximum peak from this formula.

***y (t) = a \* bt***

The shape of the downward curve is determined largely by human decision, as is the case with the upward curve. The mathematician and the scientist simply create a map to explain what is happening. As human decisions change, new maps must be created.

**This does not mean that either the math or the science was wrong. It simply means that some decision makers changed their minds. It is the height of foolishness to abandon or discredit the math because of a decision change made by business and political leaders.**

A peak will occur. Multiple peaks may occur. The time and size of these peaks are determined by human decision and the availability of the remaining resource, and not by the mathematician or scientist. The mathematician and scientist are simply trying to provide a reasonable means of prediction based on contemporary decision policy, and predicted reserves.

Even if the peak is reached abruptly, the crash will take some time as local storage is used up. The resource producer will be the first to realize that he is out of business. The end user will have his last tank to budget as he tries to plan his escape and survival. So a downward slope is inevitable. It may be skewed, it may have bumps, it may be bimodal, it may be slow, but it probably won’t be abrupt. Why?

We hope to have a good idea where the remaining reserves are located, and what their size is.[[4]](#footnote-4) Most of these reserves are not yet in production. Starting production costs money and takes time. Decision makers are the ones who determine when and where it is a good financial decision to open a new mine, buy new equipment, invest in a new process, or build a new refinery. Several of these reserves are shale oil. Shale oil is not processed the same way as crude bubbling up out of the ground. Light tight oil must be fracked to recover. Deep mines are operated differently than strip mines.

Technological obstacles also exist. This is why we can only get 50% of the coal out of the ground. Even if we know how, costs may be prohibitive. The value of coal will have to increase dramatically to motivate going after it. Not many years ago the depth of wells was limited by pressure to roughly 3,000 psi. Hydraulic equipment was designed for those pressures. When deeper drilling was desired, new technology was developed, pushing pressures beyond 3,000 toward 6,000 and even 10,000 psi. Oil is a very dangerous substance at 3,000 psi: the presence of any air guarantees a fire. At 6,000 or 10,000 psi explosions can be guaranteed, and the limits of material strength are being reached. Common steel can only withstand around 36,000 psi of pressure: so things wear out more rapidly, it takes more force to pump at such pressures. The costs go up, and progress goes down. It takes time and money to solve such technological problems.

Popular obstacles also exist. The neighbors will probably object to an operation destroying the view from their picture window, cutting down their favorite forest, muddying their water supply, locating a nuclear reactor in their back yard, or fracking next door. Public outrage can slow, modify, or even stop a project.

**All of these factors militate that the downward slope will become progressively slower as it becomes harder and harder to locate and develop new reserves. The obvious mathematical map is some kind of a negative growth curve for much of its path. An even better, more realistic map is that of a Gaussian curve, a bell curve, which accounts for the necessary negative growth rate changes on the bottom path.**

So it is impossible to deny the reality of peak theory. Granted, this is a bit like trying to map a bumpy emergency crash landing, but it would still be nice to have something to aim at: like a nice soft pasture, or a convenient highway with no traffic.

### The problem with the Peak Oil theory

Dr. Bartlett notes that possibly 3.2 G-bbl of crude oil exist in the Arctic Wildlife Refuge: about a 15 month supply at current consumption. The peak in the extraction rate of U. S. crude oil was predicted to occur between 1966 and 1971. This prediction was made by Dr. Hubbert in 1956 when oil consumption was still growing steadily at 7.04% per year. The U. S. Department of Energy fixed the actual U. S. peak at about 3.5 G-bbl per year in 1970. The Alaska reserves were discovered around 1982.

**The curve development was dramatically shifted by the Alaskan discovery and OPEC increases in world oil prices, which prompted the U. S. energy crisis.**

Dr. Bartlett continues. “The estimated U. S. supply [of crude oil] from undiscovered resources and demonstrated reserves is 36 years at present rates of production or 19 years in the absence of imports.”[[5]](#footnote-5) We have demonstrated from 2012 data that the U. S. has only an estimated 10 year supply without considering imports. According to presently known data, the world is, at best, only good for 85 years. “Please note that this is tracking faithfully down the back slope of the Peak Oil curve.”3 This will certainly continue to be a major problem for us, our children, grandchildren and great-grandchildren. By refusing to deal with this emergency crisis we are mortgaging the future to the detriment of world society.

**“…These reserves and the estimated undiscovered oil represent only a 16 years supply, with imports…providing 50% of U. S. needs…the domestic supply stretches to 32 years.”**[[6]](#footnote-6)

In 1998, U. S. Energy Secretary Federico Pena “issued his comprehensive … strategy … halting the slide in … production by 2005.”3 We conclude that Secretary Pena was compelled to lie.

**“Modern agriculture is the use of land to convert petroleum into food.”**3

When the oil supply stops, food production will change dramatically. Not only will we return to cultural conditions similar to those in 1850, we will do so with a startling deficit. Along the way, in our rush to be wealthy, we have radically changed our environment. We have reduced our oxygen levels. We have created resistant bacteria, noxious insects, and noxious plants. When the restraints of chemical herbicides and insecticides are removed, nature will strike back with vengeance. Blights and diseases may reemerge as major plagues. The land which we have abused, and depleted of nutrients, will not be able to sustain the food supply, without chemical fertilizers. The bees, and other species that we have abused, will not be available to pollinate or attend plant life. The waters that we have polluted, will not be fit to drink or irrigate.

**The obvious solution is to reduce consumption drastically.**

No one will (like this solution, but it is necessary to preserve life. An additional $3.00 per gallon tax on gasoline will make people far more energy conscious. Increasing that tax by another $3.00 per gallon per year until a maximum between $15 and $21 per gallon is reached should help bring consumption under control. We should at least equalize our gasoline costs with those of Europe. A hefty tax on cubic inches or milliliters of engine size should help consumers make better automobile, truck, ship, and industrial engine buying decisions. Rationing fuel should be a final resort. Other measures will also help: for example, the recall of all military to within U. S. borders.

**We no longer have sufficient wealth to be the world’s enforcer of all things moral. It’s time to face the fact that we are dying very rapidly.**

In 1972 Dr. Hubbert predicted that the peak of world production would occur around 1995. The U. S. Department of Energy observed the temporary world peak at about 23 G-bbl per year in 1979 with a second peak in 1990, the delay being caused by OPEC. We are not yet over the actual peak.

Dr. Bartlett proceeds, “The consensus among petroleum geologists is that the total world supply of oil is around 2,000 G-bbl.” This is an educated conjecture with an inherent uncertainty. If we allow for errors of 50% and 100%, the total world supply of oil would be 3,000 G-bbl and 4,000 G-bbl, respectively. Armed with these figures Dr. Bartlett is able to produce three different potential curve fits: with peak oil occurring in 2004, 2019, and 2030, depending on which total world supply of oil is chosen. It is highly improbable that world peak oil would fall outside of this 26 year range. Factors that influence the actual peak are: the actual total world supply of oil, oil prices, the timing of future discoveries, production technology, plant capacity, consumer demand.

**We, the consumers of oil, can change the occurrence of peak oil by changing our use habits. A 50% reduction in gasoline consumption would move the graph considerably.**

### Our Conclusion

Dr. Bartlett’s defense of Peak Oil theory is correct. The attempts to discredit this theory will finally prove to be vain. The final shape of the curve may not be known: the size and time of the peak, bimodal behavior, and a degree of skewness or kurtosis are all possible within the practical application of this math. That being said, the peak or peaks have or will take place, and the downhill progression is inevitable. The final shape of such bell shaped curves is ultimately determined by decision makers, not by scientists; but, once the downhill slide is begun it cannot be halted by decisions. Instead of a crash, this is more like that sickening feeling you get when you run out of gas in the middle of nowhere. You are hopelessly out of control as your engine sputters, and you coast to a stop.

Our leaders are not taking the sensible steps to put on the brakes and manage this crisis. We should be operating on reduced growth conservation plans, negative percentages. Our federal budget should be considering a -5% budget, instead of a +5% budget. Our president should be pushing for cuts, rather than performing draconian theatrics to get the increases he wants. Officers like Pena lied or were forced to lie to the American public. The falsification of records continues, unabated.

**Where are the real leaders who will stand up and face this crisis honestly and head on?**

1. *Time Magazine*, May 19, 1975, page 55 [↑](#footnote-ref-1)
2. http://en.wikipedia.org/wiki/David\_Brower [↑](#footnote-ref-2)
3. Dr. Bartlett [↑](#footnote-ref-3)
4. This may be a vain hope in light of the fact that the power players are so very adept at hiding energy reserves and other data in plain sight. [↑](#footnote-ref-4)
5. *Science*, January 27, 1984, page 382 [↑](#footnote-ref-5)
6. 1989 oil reporting [↑](#footnote-ref-6)