Peak Oil is History

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Publisher's note: Dmitry Orlov authored Reinventing Collapse, based on his firsthand observations of the collapse of the USSR and the socioeconomic prospects for the U.S. His new article describes the key physical, social, political and economic factors which energy industry analysts must take into account when forecasting oil production in order for their forecasts to be meaningful. Peak Oil is History is exclusively on CultureChange.org until November 1. - JL

The marketing blurb on the back cover of the first edition of my first book, Reinventing Collapse, described me as "a leading Peak Oil theorist." When I first saw it, my jaw dropped -- and remained hanging.

You see, if you run through a list of bona fide leading Peak Oil theorists -- your Hubberts, your Campbells, Laherrères, Heinbergs, Simmonses and a few others worth mentioning, you will not find a single Orlov among them. In vain would you search the annals and conference proceedings of the Association for the Study of Peak Oil for any trace of your humble author. But now that this howler is in print and circulated in so many copies, I suppose I have no choice but to try to live up to the expectation it set.

My disqualifications aside, now does seem to be an auspicious moment to hold forth with a new piece of Peak Oil theory, because this is the year when, for the first time, just about everyone is ready to admit that Peak Oil is real, in essence, though some are not quite ready to call it by that name. Just five years ago everyone from government officials to oil company executives treated Peak Oil theory as the work of a lunatic fringe, but now that conventional world oil production peaked in 2005, and all liquids world production peaked in 2008, everyone is ready to concede that there are serious problems with growing the global oil supply. And although some people still feel skittish about using the term Peak Oil (and a few experts still insist that the peak must be referred to as "an undulating plateau," which, if anything, is a graceful turn of phrase) the differences of opinion now largely stem from a refusal to accept the terminology of Peak Oil rather than the substance of peaking global oil production. This is, of course, quite understandable: it is awkward to suddenly jump from shouting "Peak Oil is bunk!" to shouting "Peak Oil is history!" in a single bound. Such acrobatics are only safe if you happen to be a politician or an economist.

Now that the matter has been largely settled, I feel that the time is ripe for me to weigh in on the subject and declare, unequivocally, that Peak Oil is indeed bunk. Not the part about global oil production reaching a peak sometime right around now then declining inexorably: that part seems true enough. Nor the part about oil production in any given province becoming constrained by geology and technology once the peak is reached: that part, under properly designed experimental conditions, seems predictive as well. In fact, the depletion model has been confirmed beautifully by the example of the continental United States minus Alaska since 1970. But the idea that this same depletion model can be applied to the planet as a whole, is, I feel, something that must be rejected as utterly and completely bogus. To see what I mean, look at a typical Peak Oil chart (Fig. 1) that shows global oil production climbing up to a peak and then declining.

Observe that the upward slope has a lot of interesting structure to it. There are world wars, depressions, imperial collapses, oil embargoes, discoveries of giant oil fields, not to mention the ugly boom and bust cycles that are the bane of capitalist economies (whereas socialist ones have sometimes been able to grow, stagnate and eventually collapse far more gracefully). It is a rugged slope, with cliffs and crevasses, craggy outcrops and steep inclines. Now look at the downward slope: is it not shockingly smooth? Its geologic origin must be completely different from that of the upward slope. It appears to be made up of a single giant moraine, piled to the angle of repose near the top, with some spreading at the base, no doubt due to erosion, with a gradual transition into what appears to be a gently sloping alluvial plain no doubt composed of silt from the runoff, which is then followed by a vast perfectly flat area, which might have been the bottom of an ancient sea. If climbing up to the peak must have required mountaineering techniques, the downward slope

looks like it could be negotiated in bathroom slippers. One could do cartwheels all the way down, and be sure of not hitting anything sharp before gently rolling to a stop sometime around 2100. Mathematically, the upward slope would have to be characterized by some high-order polynomial, whereas the downward slope is just e-t with a little bit of statistical noise. This, you must agree, is extremely suspicious: a natural phenomenon of great complexity that, just when it is forced to stop growing, turns around and becomes as simple as a pile of dirt. Where else have we observed this sort of spontaneous and sudden simplification of a complex, dynamic process? Physical death is sometimes preceded by slow decay, but sooner or later most living things go from living to dead in an abrupt transition. They don't shrivel continuously for decades on end, eventually becoming too small to be observable. And so I like to call this generic and widely accepted Peak Oil case the Rosy Scenario. It's the one in which industrial civilization, instead of keeling over promptly, joins an imaginary retirement community and spends its golden years tethered to a phantom oxygen tank and a phantom colostomy bag.

The really odd thing is that the Rosy Scenario can be quite accurate, under ideal circumstances, when applied to individual countries and oil-producing regions. For instance, suppose one of the world's largest oil producers, which started out with more oil than Saudi Arabia, reaches Peak Oil in, say, 1970, but then promptly goes off the gold standard, foists its paper currency on the rest of the world by backing it up with the threat of force including the possibility of a nuclear first strike, eventually comes to import over 60% of its petroleum, much of it on credit, and, a few decades later, goes bankrupt. Then, over the intervening decades, its domestic oil production would indeed exhibit this wonderfully gentle geologically and technologically constrained curve -- up to the point of national bankruptcy.

Past the point of national bankruptcy circumstances are bound to become decidedly non-ideal, but the implications of this remain unclear. Will that hapless country still be able continue borrowing money internationally in order to import enough oil to keep its economy functioning, and, if so, under what terms, and for how much longer? It would be nice to know how this story ends ahead of time, but unfortunately all we can do is wait and see.

But we do have another example (Fig. 3), which may offer some insights into what we mean when we say that circumstances will be “non-ideal.” The country that is currently the world's largest oil producer reached Peak Oil around 1987. Its sclerotic, geriatric, ideologically hidebound, systemically corrupt leadership was unable to grasp the importance of this fact, and just three years later the country was bankrupt and, shortly thereafter, it dissolved politically. In this case, plummeting oil production became the country's leading economic indicator: it plummeted, then the GDP plummeted, then coal and natural gas production plummeted, and a decade later the economy was down 40%. Behind these numbers was a precipitous drop in life expectancy and a pervasive atmosphere of despair in which many lives were either lost or ruined.

But as long as no messy internal or external political or economic factors interfere with the natural depletion curve, the après-Peak predictions of Peak Oil theory do seem to hold. (When I say “ideal circumstances,” I suppose that I must mean circumstances that are ideal from the point of view of sentient though irrational hydrocarbon molecules, whose desire is to be pumped out of the ground and burned up as quickly and efficiently as possible, because it is unclear who else ultimately benefits, but let's not quibble.) Since the problem of not having enough oil to go around is known to cause all sorts of nasty political and economic problems, and since this is exactly the problem we should expect to encounter soon after the world reaches Peak Oil, the base assumption on which the predictions of Peak Oil theory for global oil production rest is not realistic. The specialists who are in a position to predict Peak Oil are not able to gauge its economic and political effects, and so all they can do is give us the Rosy Scenario as an ultimate upper bound. However, this caveat is not spelled out as clearly as it should be. The result is that we might as well be working with a theory which predicts that, once global Peak Oil is reached, delicious chocolate petits fours will spontaneously bake themselves into existence and fly into our mouths on dainty gossamer wings of marzipan.

The Peak Oil theory-based explanation is that while the upward slope is economically constrained, the downward slope is only constrained by the geology of depleting oil reservoirs and by oil extraction technology, which is subject to thermodynamic limits and cannot improve forever without encountering diminishing, then negative, returns. While the oil supply is growing, oil demand fluctuates, resulting in numerous ups and downs in production superimposed on the overall upward trend as production tries to match demand. But on the downward side, demand permanently exceeds supply, and so every barrel of oil that can be produced at each instant will be produced.

When extrapolating the aftermath of local oil production declines to global Peak Oil, the unstated assumption is that the global economy will continue to function with uncanny smoothness at the level of demand that can be met, while unmet demand will be cleanly washed off into the gutter by a strong, steady stream of economic and political nonsense. This will all sort itself out spontaneously with rational market participants responding to price signals and deciding at each instant whether they should:

A. continue consuming oil in the manner to which they have become accustomed, or

B. quietly wander off and die without calling attention to themselves or making a fuss.

Where else have we seen such flawless organization, in situations where a key commodity -- like, say, food, or drinking water -- becomes critically scarce? Anywhere? Anywhere at all?

And I suppose a further unstated assumption is that a shrinking economy (what with all this unmet demand and resulting attrition among market participants) can function much as a growing one does, without suffering a financial collapse. Special financial instruments called credit-default swaps can be used as a hedge against increased counterparty risk from your counterparties dying in droves from self-inflicted wounds, although after a while these instruments would become a bit too expensive. But I don't suppose that much of anything can be done about the economic growth projections baked into every single financial plan at every level. Once these turn out to be unfounded, then all the debt pyramids will come tumbling down. And since a fiat currency (such as the US Dollar) is composed of debt -- credit advanced based on a promise of future growth -- it is unclear how and with what the remaining oil will continue to be purchased. The end of growth is an imponderable; start talking about it, and everyone suddenly decides that it's lunchtime and starts ordering drinks. At least the French have a proper word for it: décroissance (literally, “de-growth”); here in the anglophone world all we can do is gibber and mumble about “double-dips.” Perhaps Geithner and Bernanke can come up with a dance number to illustrate.

Let us look at it another way. As I mentioned, Peak Oil theory has been quite good at predicting the depletion profile of certain stable and prosperous countries and provinces. But these predictions become meaningless when extrapolated to the world as a whole, for one very obvious reason: the world cannot import oil. Let me say it again, this time in title-case, bolded and centered, to emphasize the significance of this statement:

Planet Earth Can't Import Oil

When faced with insufficient domestic oil production, an industrialized country has but two choices:

1. Import oil

2. Collapse

But when faced with insufficient global oil production, an industrialized planet has just one choice: Choice Number 2.

Some might argue that there is a third choice: start using less oil right away. However, in practice this turns out to be equivalent to Choice Number 2. Using less oil involves making some radical, often technologically challenging, politically unpopular, and therefore expensive and time-consuming changes. These may be as technologically advanced (and unrealistic) as replacing the current motor vehicle fleet with electric battery-powered vehicles and a large number of nuclear power plants to recharge their batteries, or as simple (and quite realistic) as moving to a place that is within walking or bicycling distance from your work, growing most of your own food in a kitchen garden and a chicken coop, and so on. But whatever these steps are, they all require a certain amount of preparation and expense, and a time of crisis (such as when oil supplies suddenly run short) is a notoriously difficult time to launch into long-range planning activities. By the time the crisis arrives, either a country has already prepared as much as it could or wanted to (thereby delaying the onset of collapse) or it has not, bringing the crisis on sooner, and making it more severe. The oft-cited Hirsch Report states that it would take twenty years to prepare for Peak Oil in order to avoid a severe and prolonged shortage of transportation fuels, and so, given that the peak was back in 2005, we now have minus five years left to lollygag before we have to start preparing. According to Hirsch et al., we have failed to prepare already.

Some might also wonder why a shortage of oil should automatically trigger a collapse. It turns out that, in an industrialized economy, a drop in oil consumption precipitates a proportional drop in overall economic activity. Oil is the feedstock used to make the vast majority of transportation fuels -- which are used to move products and deliver services throughout the economy. In the US in particular, there is a very strong correlation between GDP and motor vehicle miles traveled. Thus, the US economy can be said to run on oil, in a rather direct and immediate way: less oil implies a smaller economy. At what point does the economy shrink so much that it can no longer meet its own maintenance requirements? In order to continue functioning, all sorts of infrastructure, plant and equipment must be maintained and replaced in a timely manner, or it stops functioning. Once that point is reached, economic activity becomes constrained not just by the availability of transportation fuels, but also by the availability of serviceable equipment. At some point the economy shrinks so much as to invalidate the financial assumptions on which it is based, making it impossible to continue importing oil on credit. Once that point is reached, the amount of transportation fuels available is no longer limited just by the availability of oil, but also constrained by the inability to finance oil imports.

The initial shortage of transportation fuels need not be large in order to trigger this entire cascade of events, because even a small shortage triggers a number of economically destructive feedback loops. A lot of fuel is wasted by idling in line at the few gas stations that remain open. More fuel is wasted by topping off -- keeping the tank as full as possible, not knowing when and where you will be able to fill it again. Even more fuel disappears from the market because people are hoarding it in jerrycans and improvised containers. As the shortages drag on and spread, fuel is hoarded, and a black market for it develops: fuel diverted from official delivery channels and siphoned from gas tanks becomes available on the black market at inflated prices. And so the effect of even a minor initial shortage can easily snowball into an economic disruption sufficient to push the economy over physical and financial thresholds and toward collapse.

If at this point you are starting to feel despondent, then -- I am sorry to have to say this, but you must be a lightweight, because there is more -- lots more to consider. Peak Oil's Rosy Scenario may look pretty, but even a rose has its thorns. And there are a number of other issues which need to be considered and taken into account within a single, integrated view.

First, the rosy post-Peak Oil global production profile is based on reserve numbers which have been overstated. Much of the remaining oil is in the Middle East, in OPEC countries, and these countries overstated their reserves by various large amounts during OPEC's “quota wars” back in the 1980s. While other OPEC members sheepishly cooked up bogus numbers that looked vaguely real, Saddam Hussein, who was always a bit of a showboat, rounded up Iraq's reserve numbers up to a nice round number: 100 billion barrels. And so OPEC reserves turn out to have been inflated by some large amount -- about a third at a minimum. Nor is OPEC unique in overstating their reserve numbers. Energy companies in the US play much the same game in order to please Wall Street. Set your bathroom slippers aside; to negotiate Peak

Oil's downward slope you will need good mountaineering equipment.

Second, there is a phenomenon called Export Land Effect: oil-exporting countries, when their production starts to falter, have a strong tendency to cut exports before cutting into domestic consumption. To be sure, there are some countries that have surrendered their resource sovereignty to international energy companies and have lost control over their export policies. There are also some despotic regimes that starve their domestic consumers but to continue to earn the export revenue needed to prop up the regime. But most countries will only export their surplus production. This means that it will become impossible to buy oil internationally long before all the wells run dry, leaving oil importing countries out in the cold. Thus, if you live in an oil-importing country and thought you could negotiate the downward slope of Peak Oil in your hiking boots, put them aside. You will need a parachute.

Third, although total quantities of oil produced throughout the world were increasing up until 2005, the amounts of oil-based products (gasoline, diesel, etc.) delivered to their points of use peaked years earlier, in terms of usable energy derived. This was because more and more energy has been required to get a barrel of oil out of the ground and to refine it. Supplies of available crude oil have tended to become harder to extract, heavier, and more sulfur laden, plus the demand for more gasoline (as opposed to distillates or bunker fuels) with less lead for boosting octane add up to more energy being wasted. Energy Returned on Energy Invested (EROEI) went from 100:1 at the dawn of the oil age, when some strong-backed lads could dig you an oil well using picks and shovels, to an average of 10:1, now that oil production requires deepwater platforms (that sometimes blow up and poison entire ecosystems), horizontal drilling and fracturing technology, secondary and tertiary recovery using water and nitrogen injection, oil/water separation plants, and all sorts of other technical complexities which consume more and more of the energy they produce. As EROEI decreases from 10:1 toward 1:1, the oil industry comes to resemble an obese but famished wet-nurse ravenously sucking her own breast at the crib of a starving infant. At some point it will no longer be economically possible to deliver diesel or gasoline to a gas station. When that point comes is not certain, but there are some indications that 3:1 is the minimum EROEI that the oil industry requires in order to sustain itself. The effect of decreasing EROEI is to make the gentle slope of the Rosy Scenario much steeper. The slope no longer looks like a mound of pebbles -- more like lava flowing into the sea and solidifying in a cloud of steam. There may be plenty of energy left, but much of it is going to go by the wayside, and you might not be able to get close enough to it to roast your marshmallows.

Fourth, we must consider the fact that our modern global oil industry is highly integrated. If you need a certain specialty part for your drilling operation, chances are it can be sourced from just one or two global companies. Chances are this company has some very important, highly technical operations in a country that just happens to be an oil importer. The significance of this becomes clear when one considers what happens to that company's operations once Export Land Effect becomes felt. Suppose you are a national oil company in an oil-rich nation that still has enough oil left for domestic consumption, although it was recently forced to fire all of its international customers. Your oil fields are huge but mature, and you can only keep them in production by continuously drilling new horizontal wells just above the ever-rising water cut and maintaining well pressure by injecting seawater underneath. If you stop or even pause this activity, then your oil, at the wellhead, will quickly change in composition from slightly watery oil to slightly oily water, which you might as well just pump back underground. And now it turns out that the equipment you need to keep drilling horizontal wells comes from one of these unlucky countries that used to import your oil but now cannot, and the technicians who used to build your equipment have given up trying to find enough black-market gasoline to drive to work and are busy digging up their suburban backyards to grow potatoes. A short while later your drilling operations run out of spare parts, your oil production crashes, and most of your remaining reserves are left underground, contributing to an increasingly important reserve category: never-to-be-produced reserves.

When these four factors are considered together, it becomes difficult to imagine that global oil production could gently waft down from lofty heights in a graceful smooth and continuous curve spanning decades. Rather, the picture that presents itself is one of stepwise declines happening in more and more places, and eventually encompassing the entire planet. Whoever you are, and wherever you are, you are likely to experience this as a three-stage process:

Stage 1: You have your current level access to transportation fuels and services

Stage 2: You have severely limited access to transportation fuels and services

Stage 3: You have no access to transportation fuels and severely restricted transportation options

How long Stage 2 will last will vary from one place to another. Some places may go directly to Stage 3: gasoline tankers stop coming to your town, all the local gas stations close, and that is that. In other places, a thriving black market may give you some access to gasoline for a few years longer, at prices that will allow some uses, such as running an electrical generator at an emergency center. But your ability to successfully cope with Stage 2, and to survive Stage 3, will be determined largely by the changes and preparations you are able to make during Stage 1.

It should be expected that the vast majority of people will have done nothing to prepare, remaining quite unaware of the fact that this is something they should have been doing. Quite a few people can be expected to take a few small steps in a sensible direction, such as installing a wood stove, or insulating their home, or in a seemingly sensible but ultimately unhelpful direction, such as wasting their money on a new hybrid car or wasting their energies on trying to form a new political party or to lobby one of the existing ones. Some will buy a homestead, equip it for life off the grid, start growing all their own food (perhaps transporting their perishable surplus to a nearby farmer's market by cargo bicycle or by boat), and home-school their children, putting an emphasis on the classics and on agriculture, animal husbandry and other perennially useful knowledge. Some will flee to a place where transportation fuels are scarce already, and where a moped is considered a labor-saving device -- for your donkey or camel.

Unfortunately, it is hard to foresee which changes and adaptations will succeed and which will fail, because so much depends on the circumstances, which are sure to be unpredictable and vary from place to place, and on the person or persons involved: the uncertainty is just too great. But there is one thing of which we can be quite sure: that Peak Oil's Rosy Scenario, which projects a long and gradual global oil production decline, is bunk. Knowing this fact should impart a sense of urgency. Whether we use that sense of urgency foolishly or wisely is up to us, and our success may be a matter of luck, but having a sense of urgency is not at all bad. If we wish to prepare, we most likely have a few months, we may have a few years, but we certainly do not have a few decades. Let those who would have you believe otherwise first consider the issues I have raised in this article.

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Further Reading:

Petrocollapse's L-shaped post-peak curve is explained in contrast with the Hubbert Curve and John Michael Greer's stair-step post-peak decline in Our Post-Peak Oil Future, with three simple graphs, by Baylocalize.org, created by Aaron Lehmer and Jan Lundberg in September 2009.