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Peak Everything: Preface to the paperback edition

by Richard Heinberg

In titling this book "Peak Everything," I was suggesting that humanity has achieved an unsustainable pinnacle of population size and consumption rates, and that the road ahead will be mostly downhill—at least for the next few decades, until our species has learned to live within Earth's resource limits. I argued that the industrial expansion of the past century or two was mainly due to our accelerating use of the concentrated energies of cheap fossil fuels; and that as oil, coal, and natural gas cease to be cheap and abundant, economic growth will phase into contraction. I further pointed out that world oil production was at, or very nearly at its peak, and that the imminent decline in extraction rates will be decisive, because global transport is nearly all oil-dependent, and there is currently no adequate substitute for petroleum. Finally, I noted that the shift from growth to contraction will impact every aspect of human existence—financial systems, food systems, global trade—at both the macro and micro levels, threatening even our personal psychological coping mechanisms.

Nothing has happened in the past three years to change that outlook—but much has transpired to confirm it.

A good case can now be made that the year 2007, when this book originally appeared, was indeed the year, if not of "peak everything," then at least of "peak many things." Since then we have begun a scary descent from the giddy heights of consumption achieved in the early years of this century.

Worldwide economic activity began to decline in 2008 and does not appear set to return to 2007 levels any time soon. Global energy consumption likewise achieved its zenith in the years 2005 through 2007; since then, consumption growth has been confined to the Asian economies and a few oil and gas exporting nations. Personal income in the U.S. (excluding government benefits) is still far below total and per capita levels registered in 2007. Worldwide shipping, a good index of global trade and manufacturing, peaked in 2007.

Of course it is simplistic to argue that *everything* has peaked (though *Peak Everything* makes for a better book title than "Some Things Peaking Now, Most Others Soon"). Perhaps the most glaring exception is human population, which continues to grow and is virtually certain to pass the seven billion mark within the next couple of years.

Here's another non-peak: China's economy is still growing rapidly, at the astonishing rate of 8 to 10 percent per year. That means it is more than doubling in size every ten years. Indeed, China consumes more than twice as much coal as it did a decade ago—the same with iron ore and oil.

That nation now has four times as many highways as it did, and almost five times as many cars. How long this can go on is anyone's guess. But surely not many more doublings in consumption rates can occur before China has used up its key resources.

For what it's worth, my forecast is for China's continuing boom to be very short-lived. As I argued in my recent book *Blackout*, there are hard limits to China's coal supplies (the world as a whole will experience peak coal consumption within the next two decades, but China will get there sooner than most other countries because of its extraordinary consumption rate—currently three times that of the U.S.). Since China has no viable short-term alternatives to coal to fuel its industrial machine, by 2020 or so (and possibly much sooner) that country will have joined the rest of the world in a process of economic contraction that will continue until levels of consumption can be maintained by renewable resources harvested at sustainable rates.

World population growth may likewise continue for a shorter period than is commonly believed, if global food production and economic activity peak soon in response to declining energy availability. In short, the world has changed in a fundamental way in the past three years, and the reverberations will continue for decades to come. Indeed, we have just seen the beginning of an overwhelming transformation of life as we've known it. Let's look at a few specific factors driving this transformation, starting with limits to world supplies of petroleum.

Oil Spike Triggers Economic Crisis

It is still unclear whether world oil extraction rates have reached their absolute maximum level. As of this writing, the record year for world crude oil production was 2005, and the record month was July 2008. The 2005 to 2008 leveling-off of extraction rates occurred in the context of steadily rising oil prices; indeed, in July 2008 oil prices spiked 50 percent higher than the previous inflation-adjusted record, set in the 1970s. As a result of that price spike, the global airline industry went into a tailspin and the auto industry crashed and burned.

The only serious argument that world oil production *could theoretically* continue to grow for more than a very few years is put forward by parties who explain away the evidence of declining discoveries, depleting oilfields, and stagnating total production by claiming that it is *demand* for oil that has peaked, not supply—a distinction that hinges on the fact that oil prices these days are so high as to discourage demand. But since high prices for a commodity are usually a sign of scarcity, the "peak demand" argument really amounts to a distinction without a difference.

The oil situation is dire enough that one might assume it would be dominating headlines daily. Yet in fact it garners little attention. That's because the world's ongoing and worsening oil crisis has been obscured by a more dramatic and obvious financial catastrophe. As we all know only

too well, Wall Street banks—which had spent the past couple of decades giddily building themselves a quadrillion-dollar house of cards—went into a free-fall swoon in the latter half of 2008 (right after the oil price spike), only to be temporarily rescued with trillions of dollars of government bailouts and guarantees. It was a spine-tingling show—and would have amounted to months of fine entertainment, had it not been for the fact that millions of jobs, thousands of small businesses, and the economies of several sovereign nations also came tumbling down, and there just weren't enough trillions available to rescue all of them (it obviously pays to be "too big to fail" and to have friends in high places).

The financial aspects of the crisis were so Byzantine, and the cast of players so opulently and impudently villainous, that it was easy to forget the simple truism that all money is, in the end, merely a claim on resources, energy, and labor. A financial system built on staggering amounts of debt and the anticipation of both unending economic growth and absurdly high returns on investments can only work if labor is always getting cheaper, and supplies of energy and resources are always growing—and even then occasional hiccups are to be expected. But that set of conditions is *so* last century.

While the oil price run-up was hardly the sole cause of the ongoing world economic crisis, it has effectively imposed a limit to any possibility of "recovery": as soon as economic activity advances, oil prices will again spike, causing yet another financial crunch. Thus Peak Oil likely represents the first of the limits to growth that will turn a century of economic expansion into decades of contraction. But more constraints are lining up in the stage wings, ready to make their entrance.

Evidence of Peak Non-Renewable Resources

In the original edition of this book, increasing scarcity of non-energy minerals was barely mentioned. In the three years since, the subject has received increasing attention from researchers and journalists. One report, "Increasing Global Nonrenewable Natural Resource Scarcity," by Chris Clugston (a former corporate executive), deserves a couple of quotes here. Clugston analyzed 57 non-renewable natural resources (NNRs) in terms of production levels and price. He begins his report by pointing out that

> *...During the 20th century, global production levels associated with 56 of the 57 analyzed NNRs (98%) increased annually, while global price levels associated with 45 of the 57 analyzed NNRs (79%) decreased annually. Generally increasing global NNR production levels in conjunction with generally decreasing global NNR price levels indicate relative global NNR abundance during the 20th century. On the whole, global NNR supplies kept pace with ever-increasing global demand during the 20th century.*

So far, so good. But that's changing. Generally slowing or declining global NNR production growth in conjunction with generally increasing global NNR prices indicate increasing NNR scarcity during the early years of the 21st century. Annual global production levels increased during the 20th century, then decreased during the 21st century; while annual price levels decreased during the 20th century, then increased during the 21st century. Clugston's conclusion: "We are not about to 'run out' of any NNR; we are about to run 'critically short' of many."

The same message appeared in a prominent article in *New Scientist* magazine on May 23, 2007, "Earth's Natural Wealth: An Audit." Here's a useful tidbit from that article: *Take the metal gallium, which along with indium is used to make indium gallium arsenide. This is the semiconducting material at the heart of a new generation of solar cells that promise to be up to twice as efficient as conventional designs. Reserves of both metals are disputed, but in a recent report René Kleijn, a chemist at Leiden University in the Netherlands, concludes that current reserves "would not allow a substantial contribution of these cells" to the future supply of solar electricity. He estimates gallium and indium will probably contribute to less than 1 per cent of all future solar cells—a limitation imposed purely by a lack of raw material.*

The specifics with regard to supplies of a host of nonrenewable resources can be examined easily with a few mouse clicks using the ***U.S. Minerals Databrowser,*** which features data from the U.S. Geological Survey.

The Resource Pyramid

When presented with evidence of depleting stores of fossil fuels and minerals, some still object: New technology will enable us to continue increasing the amount of energy available to us. And if we have enough energy, we can solve our other supply problems: We can desalinate ocean water, grow crops in multi-storey greenhouses, and breed limitless supplies of fish in captivity. We can capture mineral resources from very low-grade ores. We can even mine gold and uranium from ocean water. We can harvest minerals on other planets and ferry them back to Earth. With enough energy, anything is possible!

As an example of what can be done with technology, just consider what has happened in the natural gas industry in the past couple of years: horizontal drilling and "fracking" (fracturing dense gas-bearing rocks with water and chemicals) have expanded U.S. gas reserves and production rates, at a time when energy pessimists had been forecasting a supply collapse. This "unconventional" gas is more than making up for declines in conventional natural gas.

In fact, however, the natural gas situation offers an instructive example of what depletion looks like. Depletion of oil, gas, coal, and other nonrenewable resources is often wrongly portrayed as

“running out,” as though it indicated the complete exhaustion of the substance. What we are really talking about are the inevitable consequences of the tendency of resource extractors to take the low-hanging fruit first, and to leave difficult, expensive, low-quality, and environmentally ruinous resources to be extracted later. Unconventional gas is more expensive to produce than conventional gas, and extracting it has worse environmental impacts (due to the need to inject a toxic brew of chemicals underground to break up the rock). The result: “fracking” technology may have enabled the industry to gain access to new sources of gas, but natural gas prices will have to rise significantly to make the business of producing this new gas profitable over the long run—and no one knows how long that “long run” is likely to be, given the rapid depletion rates of most unconventional gas wells.

Geologists and others who routinely deal with mineral ores and fossil fuels commonly speak of a “resource pyramid”: the capstone represents the easily and cheaply extracted portion of the resource; the next layer is the portion of the resource base that can be extracted with more difficulty and expense, and with worse environmental impacts; while the remaining bulk of the pyramid represents resources unlikely to be extracted under any realistic pricing scenario. The optimist may assume that the entire pyramid will eventually be usable, but this is simply not realistic. We have built a society on the basis of *cheap* energy and materials. At some point, as we move down the layers of the resource pyramid, rising commodity prices and increasing environmental cleanup costs (think Deepwater Horizon) will undercut both demand for resources and economic activity in general. As that happens, we see not just higher prices, but more volatile prices.

This is exactly what happened with the oil price spike of 2008. Many commentators who understand the essence of the Peak Oil dilemma have tended to assume that, as petroleum and other resources become scarcer, commodity prices will simply escalate in a linear fashion. What we saw instead was a rapid rise in prices (driven by rising demand and falling supply, and then exacerbated by speculation) precipitating an economic crash, followed by collapsing oil prices and curtailed investment in oil exploration—which, in due course, will provoke another rapid price rise. The cycle begins again. Each time the cycle churns, it will likely have an even more devastating economic impact.

The same will happen with natural gas as conventional gas grows scarce and the industry is forced to rely on quickly depleting and expensive-to-produce shale gas; and the same will happen with copper, uranium, indium, and rare-earth elements. Meanwhile, we will puzzle over the fact that the economy just doesn’t seem to work the way it once did. Instead of having plenty of energy with which to mine gold from seawater, we will find we don’t have enough cheap fuel

to keep the airline industry aloft. Alternative non-fossil energy sources will come on line, but not quickly enough to keep up with the depletion of oil, coal, and gas. Prices of energy and raw materials will gyrate giddily, but the actual amounts consumed will be dropping. In general, labor costs will be falling and raw materials prices rising—the exact reverse of what occurred during the 20th century; but the adjustments will be anything but gradual. It will take most folks a while to realize the simple fact that conventional economic growth is over. Done. Dead. Extinct.

The End of Growth—and What Comes After

The economic crash of 2008 is commonly perceived as another in a long series of recessions, from which a recovery will inevitably ensue. Recessions always end with recovery; of course this one will as well—or so we are told.

Yet now the situation is different. With oil production peaking, climate changing, and fresh water, soil, fish, and minerals depleting at alarming rates, the computer-based scenarios of the 1972 *Limits to Growth* study seem thoroughly and frighteningly confirmed. Decades of expansion fueled by consumption and debt are ending; the time has come to pay bills, tighten belts, and prepare for a future of economic downsizing. Now and again we may see a year that boasts higher economic activity than the previous one. But we will probably never see aggregate activity higher than that in 2007. The Asian economies of China and India will be brief hold-outs from this general trend; but, as coal supplies in that part of the world tighten, even the "Asian tigers" will soon be forced to confront limits to growth.

Contemplating the end of growth—not as a theoretical possibility, but as a *fait accompli*, forced upon us by circumstances largely of our own making—is of course a bit depressing. The 20th century was one long expansionary surge interrupted by a couple of nasty World Wars and a Depression. At the beginning of that century world population stood at a little over 1.5 billion; by century's end, it was 6 billion. In the industrialized West, per capita GDP grew from an average of $5000 to nearly $30,000 (in inflation-adjusted terms). We all came to believe that "progress" would go on like this more or less forever. We would build colonies on the Moon, other planets, maybe even in other solar systems; we would conquer disease and hunger—it was only a matter of time.

But while we were planning for utopia, we were in fact setting the stage for collapse. We were depleting our planet's usable resources and altering the composition of Earth's atmosphere. And we were building a global financial regime built on the expectation of perpetually expanding consumption and debt, a regime that could not function in a condition of stasis or contraction without generating billowing crises of default, insolvency, and foreclosure.

So, instead of being characterized by a continuation of the upward trajectory we have all grown accustomed to, the 21st century is destined to be one long downward glide punctuated by moments of financial, political, and geopolitical panic. And in retrospect, we'll all probably eventually agree that our descent began in 2008. We really have reached Peak Everything . . . but we've barely had a chance to enjoy the view; how brief was our moment at the apex! From here on, it's going to be a bumpy downward roller-coaster ride.

What's the Point?

Why bother to mention any of this? Is it just to wallow in cynicism? Clearly, the only useful purpose would be to somehow improve our collective prospects. Further economic growth may not be an option for global society, but that doesn't necessarily signify the end of the world. Indeed, the range of possible futures arrayed ahead of us is still wide, encompassing everything from (at one end of the scale) graceful industrial decline leading to a mature, sustainable world community of re-localized cultures, to (at the other end) human extinction, or something very close to it.

It's not hard to see what could lead to the latter outcome. If we are all still planning for expansion and it doesn't ensue, many people will likely become furious and look for someone to blame. Politicians, seeking to avoid that blame and channel citizens' anger for purposes of their own aggrandizement, will offer scapegoats. Some of those will be domestic, some foreign. Scape-goating of nations, religions, and ethnicities will lead to global violence. Meanwhile very little attention will go toward addressing the underlying problems of resource depletion and environmental degradation (the death of the oceans, collapsing agricultural production due to climate change and desertification, etc.)—problems that warfare will only exacerbate. Add nuclear weapons, stir vigorously, and voila: a recipe for utter and complete destruction.

It doesn't have to end that way.

If we understand the nature of the limits we are confronting, it is still possible to back our way out of the population-resources *cul de sac* humanity has entered. In other words, if we plan for contraction, we are likely to do a much better job of transitioning to a sustainable level of population and consumption than if we are still planning for growth and are continually finding our plans frustrated.

The first thing we must do to plan successfully for contraction is to set achievable goals, using sensible indicators. We must cease aiming for increases in scale, amplitude, and speed with regard to nearly every material parameter of the economy. We must aim instead to increase society's resilience—its ability to absorb shocks while continuing to function. That means re-

localizing much economic activity. We must aim also to shore up basic support services, education, and cultural benefits, while de-emphasizing economic activity that entails non-essential consumption of resources.

Attainment of these goals will be greatly facilitated by the adoption of appropriate indicators. Currently, nearly all nations use Gross Domestic Product (GDP) as their primary economic indicator. GDP represents the total market value of all final goods and services produced in a country in a given year, and a rising GDP is generally taken as a sign of progress. If GDP is set to decline relentlessly in a post-growth world, then we need a way to focus our collective attention on non-consumptive aspects of economic and civic life so as to motivate useful action in directions where progress is still possible.

Fortunately, alternative economic indicators are beginning to garner attention in cities and nations around the world. I discuss the Genuine Progress Indicator (GPI) on page 17 of the Introduction of this book, but it's also important to mention Gross National Happiness (GNH). That term was coined in 1972 by Bhutan's former King Jigme Singye Wangchuck to signal his commitment to building an economy that would preserve Bhutan's Buddhist culture as the nation opened trade with the West. Canadian health epidemiologist Michael Pennock helped design GNH, and has advocated the adoption of a "de-Bhutanized" version of it in his home city of Victoria, British Columbia. Recently, Seattle has also expressed interest in adopting GNH.

Med Jones, President of International Institute of Management, has elaborated on GNH, measuring socioeconomic development across seven areas, including the nation's mental and emotional health:

Economic Wellness: Indicated via direct survey and statistical measurement of consumer debt, average income to consumer price index ratio, and income distribution;

Environmental Wellness: Indicated via direct survey and statistical measurement of environmental metrics such as pollution, noise, and traffic;

- Physical Wellness: Indicated via statistical measurement of physical health metrics such as severe illnesses;
- Mental Wellness: Indicated via direct survey and statistical measurement of mental health metrics such as usage of antidepressants and rise or decline in number of psychotherapy patients;
- Workplace Wellness: Indicated via direct survey and statistical measurement of labor metrics such as jobless claims, job change, workplace complaints, and lawsuits;
- Social Wellness: Indicated via direct survey and statistical measurement of social metrics such as discrimination, safety, divorce rates, complaints of domestic conflicts and family

lawsuits, public lawsuits, and crime rates; and

- Political Wellness: Indicated via direct survey and statistical measurement of political metrics such as the quality of local democracy, individual freedom, and foreign conflicts.

Contraction in population levels and consumption rates doesn't sound like much fun, but a few decades of improvement in Gross National Happiness—potentially achievable at least in five or six of the above metrics—should be an attractive notion to most people.

The related idea that life can be better without fossil fuels is a core tenet of the Transition Town movement, which started in England in 2005 (I quote its founder, Rob Hopkins, on pages 135-136). Transition Initiatives are grassroots efforts to wean communities off dependence on oil and other carbon fuels by promoting local resilience (through development of things like local food systems and ride-share programs). Transitioners realize that it is probably futile to wait for elected officials to take the lead in planning for the great energy shift, given that very few politicians understand our predicament—and given also that, even if they did, the measures they would likely propose would be deeply unpopular unless the populace were educated about constraints on fossil-fueled growth. The genius of the movement lies in its engagement of the citizenry first. The Transition Initiatives appear to be taking off virally, with nearly 300 official sites around the world and over 70 in North America (as of mid-2010).

During the past two years, car sales in North America have declined while bicycle sales have soared; the number of young people taking up farming has increased for the first time in decades; and organic seed companies have had a tough time keeping up with mushrooming demand from home gardeners. These trends show that higher fuel prices and public awareness will indeed motivate behavior change. But we have a very long way to go before we, the people of the world, have broken our dependency on fossil fuels, scaled back our use of other resources, and sufficiently reduced our impact on natural systems. Meanwhile, public education and citizen-led efforts (like the Transition Initiatives) are essential now to build community resilience so as to absorb the economic and environmental shocks that at on their way, and to help us all adjust to life after growth.

The peak has happened. Get over it—and get to work.