MuseLetter

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This month's Museletter is made up of two short essays. The first is about the perilous state of the U.S. economy; the second makes the case for urgent energy conservation.

Our Economic Black Hole

In recent months economist and former Labor Secretary Robert Reich has been saying that the American economy is "in the gravitational pull of the Great Recession". It's an interesting metaphor. The U.S. economy is assumed to be a satellite of some heavy object, and just needs a little more push (in the form of Federal stimulus) in order to achieve escape velocity and go on its merry way.

Perhaps the metaphor makes more sense if it's reframed slightly. Maybe it is more accurate to think of the economy itself as the black hole. At its heart is a great sucking void created in 2008 by the destruction of trillions of dollars' worth of capital. The economy used to be a star, spewing out light and heat (profits and consumer goods), but it imploded on itself. Now its gaping maw will inevitably draw all surrounding matter into itself.

You can't see the black hole, of course; it's invisible. It is composed largely of unrepayable debt in the form of mortgages, and of toxic assets (mortgage-backed securities and related derivatives) on the books of major financial institutions, all of which are carefully hidden from view not just by the institutions themselves but by the Treasury and the Fed. Added to those there is also a growing super-gravitational field of resource depletion—which is again invisible to nearly everyone, though it does create noticeable secondary effects in the form of rising energy and food prices.

The Treasury and Fed are perhaps best thought of as a pair of powerful Battlestars orbiting just outside the singularity, zapping propulsive jolts of energy (in the forms of stimulus packages, bailouts, and quantitative easing programs) at hapless spaceships (banks and businesses) in the vicinity in order to keep them from falling into default, bankruptcy, and foreclosure. Unfortunately, the Battlestars—with their limited and depleting energy sources—are ultimately no match for the black hole, whose power grows silently and invisibly with every further addition to its hidden mass. The Battlestars will themselves eventually be assimilated.

What are we puny, rank-and-file space voyagers to do? Sadly, we

must resign ourselves to being absorbed by the black hole at some point. There's at least the theoretical possibility, though, that at the heart of the singularity there exists a wormhole—a magical pathway to some other reality. In that alternate universe the economic rules are entirely different: money is not based on interest-bearing debt, and the economy is assumed to be a subset of the ecosystem, rather than the other way around. Unfortunately, it is impossible to get to this through-the-looking-glass world without passing through the singularity.

However, what we do now may have some bearing on our prospects: a few physicists reportedly believe that there are many alternate realities, and by visualizing and acting according to the rules of the reality we prefer, we might be attracted toward it rather than some other.

At least that's the way it works in science fiction.

Conservation: There Is No Alternative

Energy conservation is our best strategy for pre-adapting to an inevitably energy-constrained future. And it may be our only significant option for averting economic, social, and environmental ruin.

The world will face limits to energy production in decades ahead regardless of the energy pathway chosen by policy makers. Consider the two extreme options—carbon minimum and carbon maximum.

If we re-build our global energy infrastructure to minimize carbon emissions with the aim of combating climate change, this will mean removing incentives and subsidies from oil, coal, and gas and transferring them to renewable energy sources like solar, wind, and geothermal. Where fossil fuels are still used, we will need to capture and bury the carbon dioxide emissions.

Some say we might look to nuclear for a bit of help along the way—but it likely wouldn't provide much. Moreover, the ongoing nuclear catastrophe in Japan has highlighted a host of unresolved safety issues, including spent fuel storage and vulnerability to extended grid power outages. Even ignoring those issues, atomic power is expensive, and supplies of high-grade uranium ore are limited.

The low-carbon path is littered with other obstacles as well. Solar and wind power are plagued by intermittency, a problem that can be solved only with substantial investment in energy storage or long-distance transmission. Currently renewables account for only a tiny portion of global energy, so the low-carbon path requires a high rate of growth in that expensive sector, and therefore high rates of investment. Governments would have to jump-start the transition with subsidies—a tough order in a world where most governments are financially overstretched and investment capital is scarce.

For transport, the low-carbon option is even thornier. Biofuels suffer from problems of high cost and requirement for the diversion of agricultural land, and the transition to electric cars will take decades

and will again be expensive (sorry, electric airliners are not feasible).

Carbon capture and storage will also be costly and will likewise take decades to implement. Moreover, the *energy* costs of building and operating an enormous new infrastructure of CO2 pumps, pipelines, and compressors will be substantial, meaning we will be extracting more and more fossil fuels just to produce the same amount of energy useful to society—a big problem if fossil fuels are getting more expensive anyway (more on that in a moment).

So, in the final analysis, a low-carbon future is also almost certainly a low-energy future.

All right then, what if we forget about the climate? This might seem to be the path of least resistance. After all, fossil fuels have a history of being cheap and abundant, and we already have the infrastructure to burn them. If climate mitigation would be expensive and politically contentious, why not just double down on the high-carbon path we're already on? Damn the environment! Full speed ahead!

Not an option. Problem is, the world of fossil fuels is changing fast.

The quandary we face with a high-carbon energy path can be summed up in the metaphor of the low-hanging fruit. We have extracted the highest quality, cheapest-to-produce, most accessible hydrocarbon resources first, and have left the lower quality, expensive-to-produce, less accessible resources for later. Well, now it's *later*. Enormous amounts of coal, oil, gas, and other fossil fuels still remain underground, but each new increment will cost significantly more to extract (in terms of both money and energy) than was the case only a decade ago.

This predicament is perhaps clearest for oil. After the Deepwater Horizon oil disaster of 2010 and the Middle East-North African uprisings of early 2011, almost no one still believes that oil will be as cheap and plentiful in the future as it was decades ago.

For coal, the wake-up call is coming from China—which now burns almost half the world's total and is starting to import enormous quantities, driving up prices worldwide. Meanwhile, recent studies suggest that global coal production will max out in the next few years and start to decline.

New extraction techniques for natural gas (horizontal drilling and "fracking") have temporarily increased supplies of this fuel in the U.S., but the companies that specialize in "unconventional" gas appear to be subsisting on investment capital: prices are currently too low to enable them to turn much of a profit on production. Costs of production and per-well depletion rates are high, which means that rosy projections for a 40-year lifetime of typical wells is probably highly unrealistic—unless gas prices rise dramatically. We can get a lot of this gas out of the ground at a slow rate and at a high price, or we can get a short burst at low prices from the "sweet spots." What we *can't* have is high rates of production lasting for decades, and at low prices—though that is what is being promised.

Exotic hydrocarbons like gas hydrates, bitumen, and kerogen will

require extraordinary effort and investment for their development, and will entail environmental risks far higher than those for conventional fossil fuels. That means more expensive energy.

But if the hydrocarbon molecules are there and society needs the energy, won't we just bite the bullet and come up with whatever levels of investment are required to keep energy flows growing? Not necessarily. As we move toward lower quality resources (conventional or unconventional), we have to use more energy to acquire energy. As net energy yields decline, both energy and investment capital have to be cannibalized from other sectors of society in order to keep extraction processes expanding. After a certain point, even if gross energy production is still climbing, the amount of energy actually useful to society starts to decline anyway. From then on, it is impossible to increase the amount of *useful* energy available to society no matter what sacrifices we make. And the signs suggest we're not far from that point.

In one sense it matters a great deal whether we choose the low-carbon or high-carbon path: one way, we lay the groundwork for a sustainable (if modest) energy future; the other, we destabilize Earth's climate while shackling ourselves even more tightly to energy sources that can only become dirtier and more expensive as time goes on. However, in another sense, it *doesn't* matter which path we choose: either way, we will have less energy to burn. Plot any scenario between the low-carbon and high-carbon extremes and that conclusion still holds.

That's less energy for transport, agriculture, and for heating and cooling homes. Less energy for making and using electronic gadgets. Less energy for building and maintaining cities.

Research has been proceeding for decades on how to reduce energy inputs for all sorts of processes and activities. Just one example: the electricity needed for illumination has declined by up to 90 percent due to the introduction of compact fluorescent light bulbs and now LED lights.

The problem is that efficiency efforts are subject to the law of diminishing returns: we can't make and transport goods with *no* energy, and each step toward greater efficiency typically costs more. Achieving 100 percent efficiency would, in theory, require infinite effort. So while we *can* increase efficiency and reduce total energy consumption, we can't do those things *and* produce continual economic growth at the same time.

We're at a crossroads. Up to this point, cheap and abundant energy has fueled consistent economic growth. The only real discussion among the managerial elite was *how* to grow the economy—whether in planned or unplanned ways, whether with sensitivity to the environment or without.

Now the discussion must center on how to contract. Sadly, that discussion is radioactive—no one wants to touch it. It's hard to imagine a more suicidal strategy for a politician than to base his or her election campaign on the promise of economic contraction. Instead, discussions in policy circles tend to turn on how to maintain

the *illusion* of growth. Denial runs deep, but sooner or later reality will make itself known.

And sooner or later we must make conservation the centerpiece of economic and energy policy. The term conservation implies "efficiency" in the usual sense—building cars and appliances that use less energy. But it also means cutting out non-essential uses of energy. Rather than continuing to increase economic demand by stimulating human wants, we must begin to think about how to meet basic human needs with minimum consumption of resources, while discouraging extravagance.

This is of course amounts to a profound change of course for our economic system, and it will not be undertaken except by necessity. But necessity is inevitably approaching. We will have less energy, like it or not. And with less energy, we will no longer be able to operate a consumer society. The kind of society we *will* be able to operate will almost certainly be as different from the industrial society of recent decades as that was from the agrarian society of the 19th century.

As we move toward renewable and intermittent energy sources, a larger portion of society's effort will have to be spent on processes of energy capture. Energy production will require more land, and a greater proportion of society's total labor and investment. We will need more food producers, but fewer managers and salespeople. We will be less mobile, and each of us will own fewer manufactured products—though hopefully of higher quality—which we will re-use and repair as long as possible before replacing them.

The transition would go much better if we were to plan for it, pre-adapting to a low-energy global economic regime. However, little of that planning is likely to occur, simply because nearly everyone—from investors to policy makers to ordinary consumers—wants the fossil fuel-fed fiesta of manic consumption to continue as long as possible. So we are most likely in for a wrenching shift.

Still, wherever it is possible for households and communities to pre-adapt, and wherever clever people are able to show innovative ways of meeting human needs with a minimum of consumption, there will be advantages to be enjoyed and shared. Eventually, as we begin to measure success not by the amount of our consumption, but by the quality of our culture, the beauty of our built environment, and the health of our ecosystems, we could end up being significantly happier than we are today, even as we gobble up far less of Earth's bounty. But the road from here to there hasn't yet been built.

The End of Growth

Upcoming Museletters will contain further serializations of my new book The End of Growth which is set for publication by New Society Publishers in September 2011. In the meantime you may find it interesting to watch a recent presentation related to the book which I made in Toronto — Life After Growth: Why the Economy is Shrinking and What to do About it.