

Citizen Action Monitor

Posted on December 4, 2014December 4, 2014 | counterpower of one, evidence based counterpower, leadership, sustainability

Question — Can we find a full-scale replacement for fossil fuels soon and sustain it indefinitely?

Answer – Not likely. Given our pathetic historical track record for sustainable living, future prospects look bleak

No 1202 Posted by fw, December 4, 2014

‘Sustainability’ has become everyone’s favourite buzz word. But few know what the hell it means.

In the following article, *Sustainable Means Bunkty to Me*, physics prof Tom Murphy claims that “*not one among our [earth-bound] host of 7 billion really knows what our world would look like if we lived in a truly sustainable fashion.*” Then he sets out “*to come to terms with what it [sustainability] might actually mean*”, taking the reader on a bumpy ride over some very unfamiliar cognitive territory.

Murphy opens with a question reflecting the relationship between human sustainability and energy levels, and immediately follows up with a surprising answer –

“So the big question is: can we transition to a truly sustainable lifestyle for the long haul at an energy level akin to what we enjoy today—or even several times higher? No one knows the answer, and thus a true understanding of ‘sustainable’ remains elusive.”

In his article, **Murphy** sets out to discover and explain – with numbers — what it will take to transition to a “truly sustainable lifestyle.” Readers won’t like his conclusions. For starters, he fears that the vast amounts of surplus fossil fuel energy we have enjoyed have made us dangerously overconfident and unable to see that we will have to cope with a diminishing supply rate that has been of paramount importance to our high-tech existence. **He concludes that we face the sobering possibility of a substantial ratcheting-down of the lifestyle to which we have become accustomed.**

To help readers navigate physicist Murphy’s rather long and challenging article, the edited version below omits graphs, includes a generous helping of excerpts from his piece, added subheadings of main ideas, and, for clarity, explanatory bridging passages. Murphy’s excerpts are italicized and bracketed within quotes. My bridging text appears in regular font. Subheading appear as hanging indents in bold italics.

To read the original post on Murphy’s blog — *Do the Math: Using physics and estimation to assess energy, growth, options* (<http://physics.ucsd.edu/do-the-math/>) — click on the following linked title.

Sustainable Means Bunkty to Me (<http://physics.ucsd.edu/do-the-math/2011/10/sustainable-means-bunkty-to-me/>) by Tom Murphy, Do the Math, May 5, 2011

What we know for certain right now is that we do not live sustainably

"I claim that not one among our host of 7 billion really knows what our world would look like if we lived in a truly sustainable fashion. Let's try to come to terms with what it might mean."



(<https://citizenactionmonitor.files.wordpress.com/2014/12/tom-murphy.jpg>)

Dr. Tom Murphy

"I think most would agree that the rapid depletion we currently witness in natural resources and services, climate stability, water availability, soil quality, and fisheries—to name a few—suggests that we do not live sustainably at present. We cannot expect to keep up our current practices with 7 billion people in this world without some major changes."

"I have made the case in the past that growth—either in physical measures (<http://physics.ucsd.edu/do-the-math/2011/07/galactic-scale-energy/>) like population, energy use, etc., or in economic terms (<http://physics.ucsd.edu/do-the-math/2011/07/can-economic-growth-last/>)—cannot continue indefinitely in our finite world. This post rounds out the trilogy."

"...a civilization that is not built on a foundation of sustainable practices is doomed to over-reach and fail".

Here's Tom's big question — to which we have no meaningful answer

"So the big question is: can we transition to a truly sustainable lifestyle for the long haul at an energy level akin to what we enjoy today—or even several times higher? No one knows the answer, and thus a true understanding of 'sustainable' remains elusive."

If we are not sustainable today, how could we possibly achieve sustainability under the burden of a ten-fold increase in total energy scale?

*"Our dream is that the poor of the world can improve their standard of living toward first-world norms" However, "the average U.S. citizen uses energy at five times the rate of the average global citizen. For everyone to get [to] where we are today in the U.S. would require a five-fold increase in the total energy expenditure of the planet. Make that 7-fold, allowing the population to swell to 10 billion. And even that requires a freeze in growth at the top end (the U.S.). Since that's not about to happen—at least not voluntarily—we should call it a **ten-fold increase** for everyone to get what they want."*

"If we are not sustainable today, how could we possibly achieve sustainability under the burden of a ten-fold increase in scale?"

Even if we drop the burden to a five-fold energy increase, improving efficiency won't get us there

Feeling generous, the author reduces the previously prescribed ten-fold increase down to a needed **five-fold increase**, after accounting for efficiency improvements and other oversights.

The author has demonstrated in a previous post ([post on the necessary end to economic growth](http://physics.ucsd.edu/do-the-math/2011/07/can-economic-growth-last/) (<http://physics.ucsd.edu/do-the-math/2011/07/can-economic-growth-last/>)) that **"efficiency improvements might gain us only a factor of two (taking about 70 years to do this at historical rates of efficiency improvement of 1% per year). Also, according to Jevons paradox (http://en.wikipedia.org/wiki/Jevons_paradox), "efficiency improvements in the past have tended to lead to a greater expenditure of energy than before the "improvements."**

So far no one has demonstrated how we can turn today's unsustainable practices into sustainable ones at five times the present total energy scale

"So in the absence of anyone being able to define how we turn today's unsustainable practices into sustainable ones at five times the present scale, you'll forgive me if I remain skeptical. If we could demonstrate the ability to seize control of the current scale and live sustainably today, I might grant that we have some hope of managing a similar trick at five times that scale. Instead, we intend to race headlong into a bigger tomorrow without proving ourselves capable of handling today's world."

A bunch of 1% solutions can't produce a needed 500% total energy change

The author questions whether a bunch of 1% solutions can produce the 500% change being sought. ***"If we don't focus on the big picture, these little acts are mere distractions"***.

The human tendency to maximize the rate of economic growth has blown through our resources. We're in overshoot.

"We are tearing through one-time resources like mineral deposits, aquifers, and the big one: fossil fuels. The easy stuff is grabbed first, and it gets harder and harder as time passes. In fact, our social and political structures have typically worked to maximize the rate of growth, which has the effect of blowing through resources as fast as may be managed."

Humans never managed to live sustainably even in the pre-fossil fuel era

"The era before fossil fuels used firewood, animals, and human (often slave) labor as sources of energy. Some supplemental energy came from wind, water, and animal fats as well. ... Even then, deforestation and hunting some animals to extinction (or to scarcity) still happened"

The energy challenge ahead – find a full-scale replacement for fossil fuels soon and sustain it indefinitely

"...we have to find a full-scale replacement for fossil fuels in a relatively short period, and sustain it indefinitely. Today, only 15% of our energy comes from non-fossil origins—almost all of it hydroelectric and nuclear. Only hydroelectric is renewable (ignoring the detail that dams silt up), but all the main prizes have been taken, so that this sector generally cannot be expanded by even a factor of two. Uranium limits nuclear fission to short-term (< 100 years), unless proliferation-prone breeder programs are adopted, or fusion pans out in time to make a difference."

Solar and wind "tend to be expensive or difficult options"

Of course solar and wind could become more prominent. But all these are primarily useful for electricity, and tend to be expensive or difficult options. The freebee days will end, and we'll have to work harder to satisfy our energy demand year by year."

Leveling off near today's global rate of energy use spells a large decline in US living standards

"Leveling off near today's global rate of energy use spells an eventual decline in the U.S. standard of living by a large factor. Remember our premise at the beginning: if the goal is to pull up the world population to American standards of living, we need something more like a factor of five (five-fold) increase in scale."

"My skepticism that we can make it to the 5× sustainable future has led me to anticipate that Americans will have to reduce their energy, material, and dietary consumption. I have reacted by modifying my own behavior, and in so doing have proven to myself that the challenge is one that can be met at a personal level while maintaining a less-than-primitive lifestyle. Choices in diet, indoor temperature, transportation, hot water use, household appliances, etc. have reduced my home impact by a factor of four or more, and this gives me great hope. But I am cheating by riding on top of an energy-rich society."

It's not clear that energy-poor societies will be able to ratchet down energy use and remain functional

It is not as clear that an entire civilization can ratchet down by a similar factor and maintain today's basic functionality."

It's distressing that we don't have a plan for living within our means at today's level of activity. How will we ever manage in the coming five-fold expansion?

"...we have enough solar input to allow sustained energy use at high rates (though not sustained growth). That's the good news. But we would still strain the throughput of materials harvested from the planet. Pollution will continue to pile up; arable land will be lost to erosion, desertification, salinity increase, and exhaustion of ancient aquifers; fisheries will collapse; important metals will become ever harder to find and extract; we will learn too late that species driven to extinction by climate change and other human impositions are actually vital to our well-being. No one knows for sure what the ultimate carrying capacity of the Earth is: many estimates indicate that we have already exceeded it. And it is distressing that we do not have a plan for living within our means at today's level of industrial activity, let alone a 5× expansion."

Fossil fuel based expansion has made us dangerously overconfident about our dominance over nature. This era is about to end

"...this century is the one in which we must confront the thorniest issue ever presented to the human race. This moment is special because we have dramatically built up our population, technology, science, medicine, and democratic institutions as a direct result of vast amounts of surplus energy stemming from a one-time resource. The fossil fuel experience has made us **dangerously confident** about our cleverness and dominance over nature."

It's crunch time – time to ratchet down the lifestyles to which we have become accustomed

"Only by looking at the sober possibility that we risk reverting to a low-tech existence after the fossil fuels are spent can we make honest plans for our future. Those honest plans may well involve a substantial ratcheting-down of the lifestyle to which we have

become accustomed. And that same honesty suggests refraining from using the term “sustainable” until we better understand what it actually means”

[Tom Murphy \(http://physics.ucsd.edu/do-the-math/tom-murphy-profile/\)](http://physics.ucsd.edu/do-the-math/tom-murphy-profile/) is an associate professor of physics at the University of California, San Diego. Murphy’s keen interest in energy topics began with his teaching a course on energy and the environment for non-science majors at UCSD. Motivated by the unprecedented challenges we face, he has applied his instrumentation skills to exploring alternative energy and associated measurement schemes. Following his natural instincts to educate, Murphy is eager to get people thinking about the quantitatively convincing case that our pursuit of an ever-bigger scale of life faces gigantic challenges and carries significant risks.

SEE ALSO

- [Can Joseph Tainter save us from ourselves? Pt 3/7: How complex societies can remain sustainable](https://citizenactionmonitor.wordpress.com/2011/02/14/can-joseph-tainter-save-us-from-ourselves-pt-3-how-complex-societies-can-remain-sustainable/) (https://citizenactionmonitor.wordpress.com/2011/02/14/can-joseph-tainter-save-us-from-ourselves-pt-3-how-complex-societies-can-remain-sustainable/) posted on February 14, 2011. In this post, Tainter sets out to explain what it means for a society to be both practical and sustainable. Following his detailed analysis, he concludes – “To remain sustainable, complex societies require a sustainable system of problem solving financed by an increase in the effective per capita supply of energy.”

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