MuseLetter

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This month's Museletter brings you Part 2 of my extended essay Our Renewable Future Or, What I've Learned in 12 Years Writing about Energy [read part 1 here]. I'm also including a post I wrote on the state of the peak oil debate, and finally my tribute to Bill Catton, author of 'Overshoot: The Ecological Basis of Revolutionary Change', who died recently.

Our Renewable Future Or, What I've Learned in 12 Years Writing about Energy - Part 2

4. A Possible Outcome of Current Energy Trends

The price of renewable energy is falling while the cost of producing fossil fuels is rising. The crossover point, where fossil fuels cease to be cost competitive, could come soon—perhaps in the next decade.

What happens then? As batteries get cheaper, electric cars could become the industry standard; reduced gasoline demand would likely force the price of oil below its marginal production cost. If falling demand periodically outpaced declining supply (and vice versa), the result would be increasingly volatile petroleum prices, which would be bad for everyone. Meanwhile as more businesses and homes installed cost-competitive solar-and-battery systems, conventional utilities could go bankrupt.

The result: we would have green energy technology, but not the energy means to maintain and reproduce it over the long run (since every aspect of the renewable energy deployment process currently relies on fossil fuels — particularly oil— because of their unique energy density characteristics).

During the transition, what proportion of the world's people would be able to afford the up-front investment required for entry into the renewable energy club? It's likely that many (including poor people in rich countries) would not, especially given current trends toward increasing economic inequality; for these folks, conventional fossil-based grid power would likewise become unaffordable, or simply unavailable.

What if renewable energy optimists are right in saying that solar and wind are disruptive technologies against which fossil fuels cannot ultimately compete, but renewables critics are correct in arguing that solar and wind are inherently incapable of powering industrial societies as currently configured, absent a support infrastructure (mines, smelters, forges, ships, trucks, and so on) running on fossil fuels?

5. Googling Questions

The combined quantity and quality issues of our renewable energy future are sufficiently daunting that Google engineers who, in 2007, embarked on an ambitious, well-funded project to solve the world's climate and energy problems, effectively gave up. It seems that money, brainpower, and a willingness to think outside the box weren't enough. "We felt that with steady improvements to today's renewable energy technologies, our society could stave off catastrophic climate change," write Ross Koningstein and David Fork, key members of the RE<C project team. "We now know that to be a false hope."

The Google team defined "success" as identifying a renewable energy system that could compete economically with coal and could also be deployed fast enough to stave off the worst climate change impacts. The team concluded that renewable energy isn't up to that job. In their article, Koningstein and Fork put on a brave face, hoping that some currently unknown energy source will appear at the last minute to save the day. But putting one's faith in a currently non-existent energy source seems less realistic than working for dramatic improvements to solar and wind technologies. A completely new source would require decades for development, testing, and deployment. Realistically, our choice of replacements for fossil fuels is limited to energy sources that can be harnessed with current technology, even if they can't keep the industrial growth engine humming.

In inquiring whether renewable energy can solve the climate crisis at essentially no net economic cost, Koningstein and Fork may have been posing the wrong question. They were, in effect, asking whether renewables can support our current growth-based industrial economy while saving the environment. They might more profitably have inquired what kind of economy renewable energy *can* support. We humans got by on renewable sources of energy for millennia, achieving high levels of civilization and culture using wind, sun, water, wood, and animal power alone (though earlier civilizations often faced depletion dilemmas with regard to resources other than fossil fuels). The depletion/climate drawbacks of fossil fuels ensure that, as the century progresses, we will indeed return to a renewables-based economy of some sort, running on hydropower, solar, wind, and a suite of other, more marginal renewable sources including biomass, geothermal, wave, microhydro, and tidal power.

We always adapt our energy sources, as much as we can, to suit the ways we want to use energy. It is therefore understandable that most people would like somehow to make solar and wind act just like fossil fuels, which have shaped our current consumption patterns. But that leads us back to the problems of energy storage, capacity redundancy, grid redesign, transport electrification, and so on. Weissbach's study suggests that the costs of enabling solar and wind to act like fossil fuels are so great as to virtually cancel out these renewables' very real benefits. Reluctantly but increasingly, we may have to *adapt the ways we use energy* to suit the quantities and inherent qualities of the energy available to us.

Fossil fuels shaped our current infrastructure of mines, smelters, forges, factories, pipelines, grids, farms, highways, airports, pumps, shopping malls, suburbs, warehouses, furnaces, office buildings, houses, and more. We built the modern world with the assumption that we would always have more energy with similar characteristics to maintain, operate, and replace this staggering and still-growing array of machines, structures, and support systems. Where it is absolutely essential to maintain these systems in their current form, we will certainly make every effort to adapt our new energy sources to the job (using batteries, for example); where systems can themselves be adapted to using less energy or energy that is intermittently available, we will adapt those systems. But in many instances it may be unaffordable to adapt either the energy source or the usage system; in those cases, we will simply do without services we had become accustomed to.

This may be the renewable future that awaits us. To prepare for that likelihood, we need to build large numbers of solar panels and wind turbines while also beginning a process of industrial-economic triage.

Reconfiguring civilization to operate on less energy and on energy with different characteristics is a big job—one that, paradoxically, may itself require a substantial amount of energy. If the necessity of expending energy on a civilization rebuild coincides with a reduction in available energy, that would again mean that our renewable future will *not* be an extension of the expansive economic thrust of the 20th century. We may be headed into lean times.

Granted, there is a lot of uncertainty here. Some countries are better placed to harvest ambient natural energy sources than others. Some academic studies paint an over-optimistic picture of renewables, because they focus only on electricity and ignore or understate the costs of variability mitigation; other studies arrive at unfairly pessimistic assessments of renewables because they use obsolete price data. It's hard to portray our renewable future in a way that one analyst or another will not dispute, at least in terms of detail. Nevertheless, *most* energy experts would probably agree with the *general* outline of renewable energy's potential that I've traced here.

I consider myself a renewable energy advocate: after all, I work for an organization called Post Carbon Institute. I have no interest in discouraging the energy transition—quite the contrary. But I've concluded that many of us, like Koningstein and Fork, have been asking the wrong questions of renewables. We've been demanding that they continue to power a growth-based consumer economy that is inherently unsustainable for a variety of reasons (the most obvious one being that we live on a small planet with finite resources). The fact that renewables can't do that shouldn't actually be surprising.

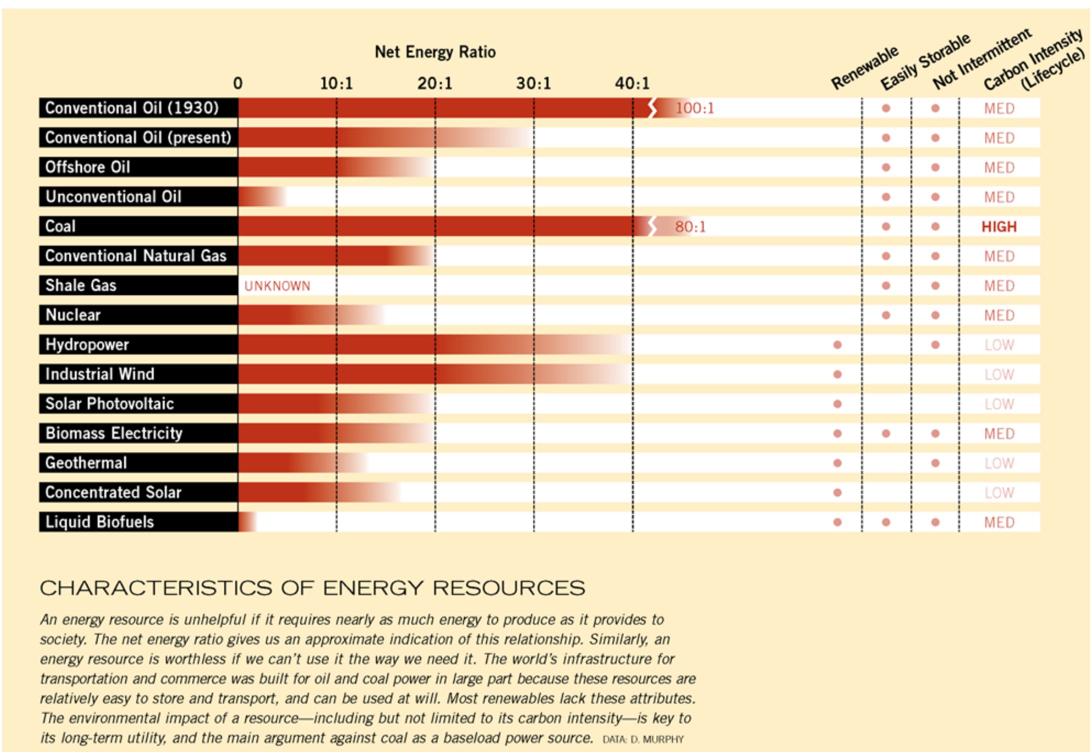
What are the right questions? The first, already noted, is: What kind of society *can* up-to-date renewable energy sources power? The second, which is just as important: How do we go about becoming that sort of society?

As we'll see, once we begin to frame the picture this way, it turns out to be anything but bleak.

6. A Couple of Key Concepts

Our degree of success in this all-encompassing transition will partly depend on our ability to master a couple of simple energy concepts. The first is *energy returned on energy invested* (EROI or EROEI). It takes energy to get energy: for example, energy is needed to drill an oil well or build a solar panel. The historic economic bonanza resulting from society's use of fossil fuels partly ensued from the fact that, in the 20th century, only trivial amounts of energy were required for drilling or mining as compared to the gush of energy yielded. High EROEI ratios (in the range of 20:1 to 50:1 or more) for society's energy-obtaining efforts meant that relatively little capital and labor were needed in order to supply all the energy that society could use. As a result, many people could be freed up from basic energy-producing activities (like farming), their labor being substituted by fuel-fed machines. Channeled into manufacturing and managerial jobs, these people found ways to use abundant, cheap energy to produce more goods and services. The middle class mushroomed, as did cities and suburbs. In the process, we discovered an unintended consequence of having an abundance of cheap "energy slaves" in the forms of tons of coal, barrels of oil, and cubic feet of natural gas: as manufacturing and other sectors of the economy became mechanized, many pre-industrial professions disappeared.

The EROEI ratios for fossil fuels are declining because the best-quality resources are being used up; meanwhile, the energy return figures of most renewable energy sources are relatively low compared to fossil fuels in their heyday (and this is especially true when buffering technologies—such as storage equipment, redundant capacity, and grid expansions—are accounted for).



Characteristics of energy resources (source: David Murphy). "Net Energy Ratio" in this chart is essentially the same as EROEI.

The practical result of *declining overall societal EROEI will be the need to devote proportionally more capital and labor to energy production processes*. This is likely to translate, for example, to the requirement for more farm labor, and to fewer opportunities in professions not centered on directly productive activities: we'll need more people making or growing things, and fewer people marketing, advertising, financing, regulating, and litigating them. For folks who think we have way too much marketing, advertising, financialization, regulation, and litigation in our current society, this may not seem like such a bad thing; prospects are likewise favorable for those who desire more control over their time, labor, and sources of sustenance (food and energy).

A second essential energy concept has to do with the difference between embodied and operational energy. When we contemplate the energy required by an automobile, for example, we are likely to think only of the gasoline in its tank. However, a substantial amount of energy was expended in the car's construction, in the mining of ores from which its metal components were made, in the making of the mining equipment, and so on. Further, enormous amounts of energy were spent in building the infrastructure that enables us to use the car—the systems of roads and highways, the networks of service stations, refineries, pipelines, and oil wells. The car's gasoline supplies operational energy, but much more energy is embodied in the car itself and its support systems. This latter energy expenditure is easily overlooked.

The energy glut of the 20th century enabled us to embody energy in a mind-numbing array of buildings, infrastructure, machines, gadgets, and packaging. Middle-class families got used to buying and discarding enormous quantities of manufactured goods representing generous portions of previously expended energy. If we have less energy available to us in our renewable future, this will impact more than the operation of our machines and the lighting and heating of our buildings. It will also translate to a shrinking flow of manufactured goods that embody past energy expenditure, and a reduced ability to construct high energy-input structures. We might find we need to purchase fewer items of clothing and furniture, and fewer electronic devices, and inhabit smaller spaces. We might also use old goods longer, and re-use and re-purpose whatever can be repaired. We might need to get used to buying more basic foods again, rather than highly processed and excessively packaged food products. Exactly how far these trends might proceed is impossible to say: we are almost surely headed toward a simpler society, but no one knows ultimately how simple. Nevertheless, it's fair to assume that this overall shift would constitute the end of consumerism (i.e., our current economic model that depends on ever-increasing consumption of consumer goods and services). Here again, there are more than a few people who believe that advanced industrial nations consume excessively, and that some simplification of rich- and middle-class lifestyles would be a good thing.

7. Transitioning Nine Sectors

When we start applying these energy principles to the systems that surround us and support our daily existence, the implications really start to get interesting. Let's take a quick tour:

Food: Fossil fuels are currently used at every stage of growing, transporting, processing, packaging, preparing, and storing food. As those inputs are removed from food systems, it will be necessary to bring growers and consumers closer together, and to replace petrochemical-based fertilizers, herbicides, and pesticides with agro-ecological farming methods that rely on crop rotation, intercropping, companion planting, mulching, composting, beneficial insects, and promotion of microbial activity in soils. As mentioned earlier, we will need many more farmers, especially ones with extensive practical, local ecological knowledge.

Water: Enormous amounts of energy are used in extracting, moving, and treating water; conversely, water is used in most energy production processes. We face converging water crises arising from aging infrastructure and climate change-related droughts and floods. All this suggests we must become far more water thrifty, find ways to reduce the energy used in water management, use intermittent energy sources for pumping water, and use water reservoirs for storing energy.

Resource extraction (mining, forestry, fishing): Currently, extractive industries rely almost entirely on petroleum-based fuels. Since, as we have seen, there are no good and comprehensive substitutes for these fuels, we will have to reduce resource extraction rates, reuse and recycle materials wherever possible, and employ more muscle power where possible in those extractive processes that must continue (such as forestry).

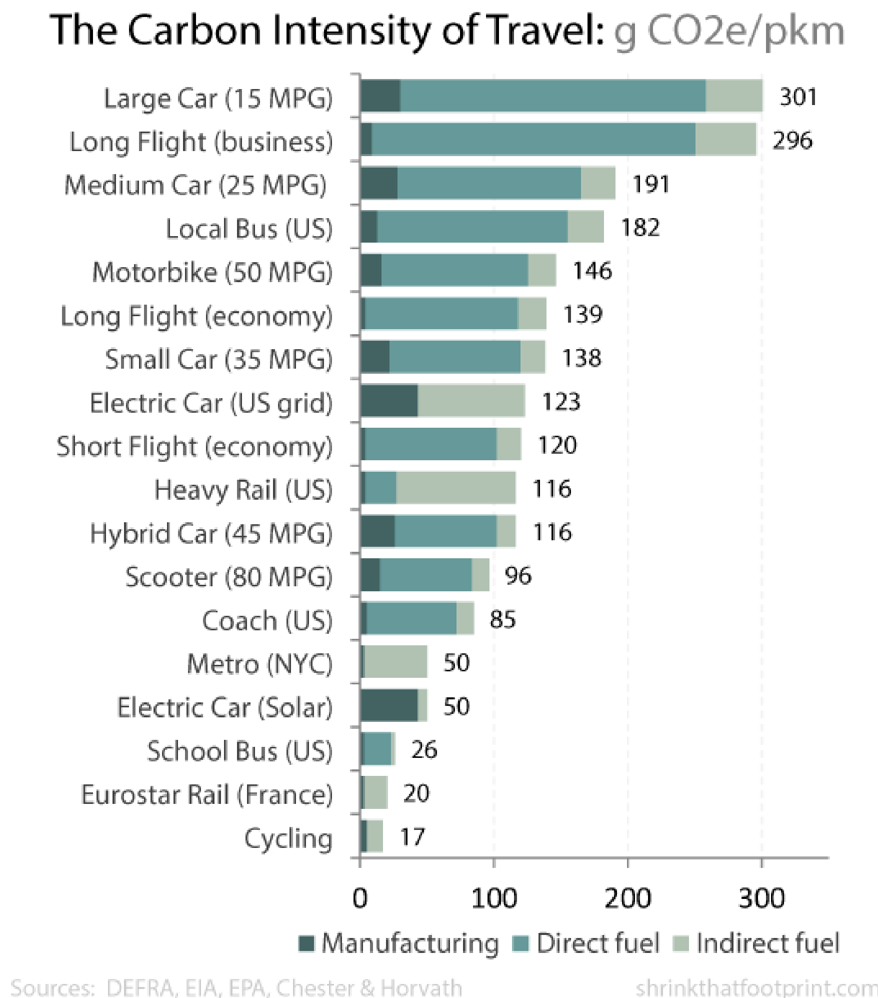
Building construction: Cement, iron, and road-building materials embody substantial amounts of energy, while large construction equipment (cranes, booms, bulldozers) requires concentrated energy for its operation. We must shift to using natural, locally available building materials, and more labor-intensive construction methods, while dramatically reducing the rate of new construction. The amount of enclosed space per person (home, work, shopping) will shrink.

Building operations: We've gotten used to actively heating, cooling, ventilating, and lighting our buildings with cheap, on-demand energy. We will need to maximize our passive capture of ambient, variable, solar energy using south-facing glazing, superinsulation, and thermal mass. Whatever active energy use is still required will employ efficient heat pumps and low-energy LED lighting, powered mostly by solar cells and wind turbines with minimal storage and redundancy (so as to maximize EROEI).

Manufacturing: Our current system is globalized (relying on oil-based transport systems); consumes natural gas, electricity, and oil in manufacturing processes; and uses materials that embody large amounts of energy and that are often made from fossil fuels (i.e., plastics). Lots of energy is used also in dealing with substantial flows of waste in the forms of packaging and discarded products. The economy has been fine-tuned to maximize consumption. We must shift to shortened supply chains, more localized manufacture of goods (shipping information, not products), materials with low embodied energy, and minimal packaging, while increasing our products' reuse and repair potential. This will be, in effect, an economy fine-tuned to minimize consumption.

Health care: The high dollar cost of modern health care is a rough indication of its energy intensity. As the energy transition gains momentum, it will be necessary to identify low-energy sanitation and care options, and prioritize prevention and local disaster response preparedness. Eventually, high-energy diagnostics and extreme end-of-life interventions may simply become unaffordable. Treatment of chronic conditions may rely increasingly on herbs and other traditional therapies (in instances where their efficacy can be verified) as the pharmaceutical industry gradually loses its capability to mobilize billions of dollars to develop new, targeted drugs.

Transportation: The energy transition will require us to prioritize transport modes according to operational and embodied energy efficiency: whereas automobile and truck traffic have been richly subsidized through road building in the last seven decades, governments should instead devote funds toward electrified rail networks for both freight and passenger travel. We must also design economic and urban systems so as to reduce the need for motorized transportation—for example, by planning communities so that most essential services are within walking distance.



Source: Shrinkthatfootprint.com (data from DEFRA, EIA, EPA, Chester & Horvath)

Finance: It would appear that comparatively little energy is needed to run financial systems, as a few taps on a computer keyboard can create millions of dollars instantly and move them around the globe. Nevertheless, the energy transition has enormous implications for finance: heightened debt levels imply an increased ability to consume now with the requirement to pay later. In effect, a high-finance society stimulates consumption, whereas we need to reduce consumption. Transition strategies should therefore include goals such as the cancelation of much existing debt and reduction of the size and role of the financial system. Increasingly, we must direct investment capital toward projects that will tangibly benefit communities, rather than leaving capital investment primarily in the hands of profit-seeking individuals and corporations.

You may have noticed that suggestions in each of these categories are far from new. Organized efforts to reduce both operational and embodied energy consumption throughout society started in the 1970s, at the time of the first oil price shocks. Today there are many NGOs and university programs devoted to research on energy efficiency, and to life cycle analysis (which seeks to identify and quantify energy consumption and environmental impacts of products and industrial processes, from "cradle to grave"). Industrial ecology, biomimicry, "cradle-to-cradle" manufacturing, local food, voluntary simplicity, permaculture, and green building are just a few of the strategies have emerged in the last few decades to guide us toward a more energy-thrifty future. Most major cities now have bicycle advocacy groups, farmers markets, and energy efficiency programs. These all represent steps in the right direction.

Yet what is being done so far barely scratches the surface of what's needed. There could be only one meaningful indication of success in all these efforts, and that would be a decline in society's overall energy use. So far, we have seen energy declines primarily in times of severe economic recession—hardly ever purely as a result efficiency programs. What we need is not just to trim energy use here and there so as to save money, but to reconfigure entire systems to dramatically slash consumption while making much of the remaining energy consumption amenable to intermittent inputs.

Another insight that comes from scanning energy reduction strategies in various societal sectors is that efforts already underway along these lines often have side benefits. There are tangible psychological, social, and cultural payoffs associated with local food and voluntary simplicity programs, and health improvements can follow from natural, energy-efficient dwellings, walking, bicycling, and gardening. A successful energy transition will require that we find ways to maximize and celebrate these benefits, while honestly acknowledging the full human and environmental costs of our decades-long, fossil-fueled joyride.

In the march toward our energy future, the PR war between the fossil fuel industry and renewables advocates gets much of the attention. But it will be our effectiveness in the hard work of dramatically reducing and reconfiguring energy consumption—sector by sector, farm by farm, building by building, household by household, community by community—that will largely determine our overall success in what is likely to be history's most difficult and crucially important economic shift.

8. Neither Utopia Nor Extinction

This is all politically charged. Some renewable energy advocates (particularly in the US) soft-pedal the "use less" message because we still inhabit an economy in which jobs and profits depend on stoking consumption, not cutting it. "Less" also implies "fewer": if the amount of energy available contracts but human population continues growing, that will translate to an even sharper *per capita* hit. This suggests we need to start reducing population, and doing so quickly—but economists hate population decline because it compromises GDP and results in smaller generational cohorts of young workers supporting larger cohorts of retirees. Here is yet another message that just doesn't sell. A contraction of energy, population, and the economy has only two things going for it: necessity and inevitability.

From a political standpoint, some solar and wind advocates apparently believe it makes good strategic sense to claim that a renewable future will deliver comfort, convenience, jobs, and growth—an extension of the oil-fueled 20th century, but now energized by wind and solar electrons. Regardless of whether it's true, it is a message that appeals to a broad swath of the public. Yet most serious renewable energy scientists and analysts acknowledge that the energy transition will require changes throughout society. This latter attitude is especially prevalent in Europe, which now has practical experience integrating larger percentages of solar and wind power into electricity markets. Here in the US, though, it is common to find passionate but poorly informed climate activists who loudly proclaim that the transition can be easily and fully accomplished at no net cost. Again, this may be an effective message for rallying troops, but it ends up denying oxygen to energy conservation efforts, which are just as important.

I have good friends in the renewable energy industry who say that emphasizing the intermittency challenges of solar and wind amounts to giving more ammunition to the fossil fuel lobby. Barry Goldwater famously proclaimed that "Extremism in the defense of liberty is no vice"; in a similar spirit, some solar and wind boosters might say that a little exaggeration of renewable energy's potential, uttered in defense of the Earth, is no sin. After all, fossil fuel interests are not bound by the need for strict veracity: they continually make absurd claims that the world has centuries' worth of coal and gas, and decades of oil. It's not a fair or equal fight: the size and resources of the fossil fuel industry vastly outweigh those of the renewables camp. And there could hardly be more at stake: this is war for the survival of our current civilization-supporting climate regime. Nevertheless, we will ultimately have to deal with the reality of what solar and wind can actually provide, and we will do so far more successfully if we plan and prepare ahead of time.

There are a lot of smart, dedicated people working hard to solve the problems with renewables—that is, to make it cheaper and easier for these energy sources to mimic the 24/7 reliability of fossil fuels through improvements in energy storage and related technologies. None of what I have said in this essay is meant to discourage them from that important work. The more progress they make, the better for all of us. But they'll have more chance of success in the long run if society starts investing significant effort into adapting its energy usage to lower consumption levels, more variable sources, and more localized, distributed inputs.

The problem is, the gap between our current way of life and one that can be sustained with future energy supplies is likely to be significant. If energy declines, so will economic activity, and that will create severe political and geopolitical strains; arguably some of those are already becoming apparent. We may be headed into a crucial bottleneck; if so, our decisions now will have enormous repercussions. We therefore need an honest view of the constraints and opportunities ahead.

At this point I must address a few words to "collapsitarians" or "doomers," who say that only utter ruin, perhaps extinction, awaits us, and that renewables won't work at all. They may be correct in thinking that the trajectory of society this century will be comparable to the collapse of historic civilizations. However, even if that is the case, there is still a wide range of possible futures. The prospects for humanity, and the fates of many other species, hang on our actions.

What's needed now is neither fatalism nor utopianism, but a suite of practical pathways for families and communities that lead to a real and sustainable renewable future—parachutes that will get us from a 17,000-watt society to a 2,000-watt society. We need public messages that emphasize the personal and community benefits of energy conservation, and visions of an attractive future where human needs are met with a fraction of the operational and embodied energy that industrial nations currently use. We need detailed transition plans for each major sector of the economy. We need inspiring examples, engaging stories, and opportunities for learning in depth. The transition to our real renewable future deserves a prominent, persistent place at the center of public conversation.

The Transition Network, The Arthur Morgan Institute for Community Solutions, The Simplicity Institute, and many other organizations have already begun pioneering this work, and deserve support and attention. However, more framing and analysis of the issues, along the lines of this essay but in much greater depth, could also help. My organization, Post Carbon Institute, is embarking on a collaborative project to provide this. If you don't hear much from me for a while, it's because I'm working on it. Stay tuned.

After the Peak

Nearly 17 years ago the modern peak oil movement began with the publication of "The End of Cheap Oil" by petroleum geologists Colin Campbell and Jean Laherrère in the March, 1998 issue of Scientific American. Campbell coined the term "peak oil" to describe the inevitable moment when the world petroleum industry would produce oil at its historic maximum rate. From then on, production would decline as the overall quality of available resources deteriorated, and as increasing investments produced diminishing returns. Unless society had dramatically and proactively reduced its reliance on oil, the result would be a series of economic shocks that would devastate industrial societies.

Campbell estimated that global conventional oil production would reach its maximum rate sometime before the year 2010. In later publications, Laherrère added that the peak in conventional oil would cause prices to rise, creating the incentive to develop more unconventional petroleum resources. The result would be a delayed peak for "all liquid fuels," which he estimated would occur around the year 2015.

Today we may be very nearly at that latter peak. Slightly ahead of forecast, conventional oil production started drifting lower in 2005, resulting in several years of record high prices—which led the industry to develop technology to extract tar sands and tight oil, and also incentivized the US and Brazil to begin producing large quantities of biofuels. But high petroleum prices also gradually weakened the economies of oil-dependent industrial nations, reducing their demand for liquid fuels. The resulting mismatch between growing supply and moderating demand has resulted in a temporary market glut and falling oil prices.

Crashing prices are in turn forcing the industry to cut back on drilling. As a result of idled rigs, global crude production will probably contract in the last half of 2015 through the first half of 2016. Even if prices recover as a result of falling output, production will probably not return to its recent upward trajectory, because the US tight oil boom is set to go bust around 2016 in any case. And banks, once burned in their lavish support for marginally profitable drilling projects, are unlikely to jump back into the unconventionals arena with both feet.

Ironically, just as the rate of the world's liquid fuels production may be about to crest the curve, we're hearing that warnings of peak oil were wrongheaded all along. The world is in the midst of a supply glut and prices are declining, tireless resource optimists remind us. Surely this disproves those pessimistic prophets of peril! However, as long-time peakist commentator Ron Patterson notes:

> *Peak oil will be the point in time when more oil is produced than has ever been produced in the history of the world, or ever will be in the future of the world. It is far more likely that this period will be thought of as a time of an oil glut rather than a time of an oil shortage.*

Within a couple of years, those of us who have spent most of the past two decades warning about the approaching peak may see vindication by data, if not by public opinion. So should we prepare to gloat? I don't plan to. After all, the purpose of the exercise was not to score points, but to warn society. We were seeking to change the industrial system in such a way as to reduce the scale of the coming economic shock. There's no sign we succeeded in doing that. We spent most of our efforts just battling to be heard; our actual impact on energy policy was minimal.

There's no cause for shame in that: the deck was stacked against us. The economics profession, which has a stranglehold on government policy, steadfastly continues to insist that energy is a fully substitutable ingredient in the economy, and that resource depletion poses no limit to economic growth. Believing this to be true, policy makers have effectively had their fingers jammed in their ears.

A cynic might conclude that now is a good time for peak oil veterans to declare victory, hunker down, and watch the tragedy unfold. But for serious participants in the discussion this is where the real work commences.

During these past 17 years, as the peak oil debate roiled energy experts, climate change emerged as an issue of ecosystem survival, providing another compelling reason to reduce our reliance not just on oil, but all fossil fuels. However, the world's response to the climate issue was roughly the same as for peak oil: denial and waffling.

Today, society is about to begin its inevitable, wrenching adaptation to having less energy and mobility, just as the impacts of fossil fuel-driven climate change are starting to hit home. How will those of us who have spent the past years in warning mode contribute to this next crucial chapter in the unfolding human drama?

Despite peakists' inability to change government policy, our project was far from being a waste of time and effort. The world is better off today than it would have been if we had done nothing—though clearly not as much better as we would have liked. A few million people understood the message, and at least tens of thousands changed their lives and will be better prepared for what's coming. One could say the same for climate activism.

If our main goal during the past 17 years was to alert the world about looming challenges, now it is to foster adaptation to fundamental shifts that are currently under way. The questions that need exploration now are:

1. How can we help build resilience throughout society, starting locally, assuming we will have little or no access to the reins of national policy?
2. How can we help society adapt to climate change while building a zero-emissions energy infrastructure?
3. How can we help adapt society's energy consumption to the quantities and qualities of energy that renewable sources will actually be able to provide?

We have to assume that this work will have to be undertaken in the midst of accelerating economic decay, ecological disruption, and periodic crises—far from ideal operating conditions.

On the other hand, there is the possibility that crisis could act in our favor. As their routines and expectations are disturbed, many people may be open to new explanations of their predicament and to new behaviors to help them adapt to energy and monetary poverty. Our challenge will be to frame unfolding events persuasively in ecological terms (energy, habitat, population) rather than conventional political terms (good guys, bad guys), and to offer practical solutions to the burgeoning everyday problems of survival—solutions that reduce ecological strains rather than worsening them. Our goal should not be to preserve industrial societies or middle-class lifestyles as we have known them (that's impossible anyway), but to offer a "prosperous way down," as Howard Odum put it, while preserving whatever cultural goods that can be salvaged and that deserve the effort.

As with our recent efforts to warn society about peak oil, there is no guarantee of success. But it's what needs doing.

Thanks, Bill.

I learned today of the passing of William Catton, author of *Overshoot: The Ecological Basis of Revolutionary Change* (1982), and *Bottleneck: Humanity's Impending Impasse* (2009). (For a biography of Catton, see Wikipedia). I didn't read *Overshoot* until around 1999; when I did, it made an enormous impression. My book *The Party's Over* owed a great deal to it: I summarize Catton's arguments in Chapter 1 which, in retrospect, is the core of the book. It was an honor to have an opportunity to introduce roughly 50,000 readers to his ideas; I only hope that a significant number of those readers took the trouble to seek out Catton's book for themselves.

John Michael Greer, in his latest blog, has already said of Catton much of what I would say. I met Bill at two or three conferences; he was soft-spoken and friendly—hardly a fire-breathing rebel—though his book calls into question the very foundations of industrial civilization in a more radical fashion than *Das Kapital*.

An entire cohort of ecological authors and activists who were active in the 1970s and '80s is now retiring or passing away. A couple of weeks ago I heard that Lester Brown is reducing his workload substantially. Catton and Brown, along with others of their generation including Paul Ehrlich, Walter Youngquist, Jerry Mander, Herman Daly, and Wendell Berry deserve acknowledgement for their extraordinarily important contributions. More names spill from memory: Colin Campbell, Jean Laherrère, James Hanson, E.O. Wilson, Silvia Earle, James Lovelock (not all of these folks see eye to eye on every issue). Perhaps you would like to add to the list in the comments section that follows. It's especially important that these folks hear that appreciation while they're still with us.