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MuseLetter #339 / May 2021 by Richard Heinberg

The Most Colossal Planning Failure in Human History

A couple of days ago I happened to pick up an old book gathering dust on one of my office shelves—Palmer Putnam's *Energy in the Future*, published in 1953. Here was a time capsule of energy concerns from nearly a lifetime ago—and it got me to thinking along the lines of Howard Baker's famous question during the Watergate hearings: "What did [w]e know, and when did [w]e know it?" That is, what did we know back then about the climate and energy conundrum that threatens to undermine civilization today?

The fossil fuel age had begun over a century prior to 1953, and it was known by then that coal, oil, and natural gas represent millions of years' worth of stored ancient sunlight. At the start, these fuels had appeared capable of supplying useful energy to society in seemingly endless quantities. Since everything we do depends on energy, having much more of it meant we could do far more farming, mining, fishing, manufacturing, and transporting than was previously possible. The result was an economic miracle. Between 1820 and today, human population has grown eight-fold, while per-capita energy usage has also grown eight-fold. We went from horse-drawn carts to jetliners in just a few generations.

But there were a couple of snags. One was that, though initially abundant, fossil fuels are nonrenewable and therefore subject to depletion. The second was that extracting and burning these fuels pollutes air and water, subtly but surely changing the chemistry of our planet's atmosphere and oceans. Neither issue seemed compelling to the majority of people who first benefitted from coal, oil, and gas.

So, back to Putnam's book. This thick tome wasn't a best seller, but it was considered authoritative, and it found a place on the desks of serious policy makers. Remarkably, it explored both of the core drawbacks of fossil fuels, though these were as yet on almost no one else's radar screen.

Putnam understood that the fossil fuel age would be relatively brief. With regard to coal, he wrote: ". . . costs of extraction continue to rise, while the average heat value in a ton of coal has begun to decline, at least in the United States." Similar symptoms of depletion would inevitably overtake the oil and gas industry, the author noted, even if the tar sands of Canada and shale oil

(Putnam used these specific terms), as well as improvements in exploration and production technology, were all accounted for.

In a section at the very end of the book, titled, "The Combustion of Fossil Fuels, the Climate and Sea Level," Putnam wrote, "Perhaps such a derangement of the CO_2 cycle would lead to an increased CO_2 content of the atmosphere great enough to affect the climate and cause a further rise of sea level. We do not know this. We ought to know it." Now we know, and it turns out that a lot more than just a hike in sea level is in the offing. But we still haven't done much to change the worrisome trend of soaring greenhouse gas emissions.

While the writing and publication of *Energy in the Future* were paid for by the United States Atomic Energy Commission, Putnam was not a single-minded proponent of nuclear power as a substitute for fossil fuels. The subject did get substantial treatment in his book, but he spent as much ink on limits and downsides as he did on the potential of nuclear sources to meet energy needs. Putnam concluded that, "Based on present knowledge, it does not appear likely that the fission of uranium or thorium could ever support more than 10 to 20 per cent of the energy system of the United States patterned as at present. The figures for the world energy system would hardly be higher." Today, the US gets about 8 percent of its total energy from nuclear power, while the global figure is closer to 4 percent.

Putnam explored a range of alternative energy sources, including fuel wood, farm wastes, wind power, solar heat collectors, solar photovoltaics, tidal power, and heat pumps, but judged that these would not be sufficient to propel the continued economic growth of modern societies. Putnam, who died in 1984, was himself a pioneer in the development of wind power.

Energy in the Future was favorably reviewed in the prestigious journal *Science,* but it had negligible impact on public policy. And here we are, seven decades later, using fossil fuels globally at roughly three times the rate we were depleting and burning them in 1953. They still supply 85 percent of global energy.

Here's the essence of our planning failure: we have built up civilization to a scale that can temporarily be supported by finite and polluting energy sources, and we have simply assumed that this scale of activity can continue to be supported by other energy sources that haven't yet been developed or substantially deployed. Further, we have incorporated limitless growth into the requirements for civilization's success and maintenance—despite the overwhelming likelihood that growth can occur for only a historically brief interval.

Failing to plan is often the equivalent of planning to fail. Planning is a function of language and reason—of which we humans are certainly capable. We plan all sorts of things, from weddings to the construction of giant hydroelectric dams. Yet we are also subject to cognitive dysfunctions—denial and delusion—which seem to plague our thinking when it comes to issues of population and consumption, and their implications for the future. In effect, we have collectively bet our fate on the vague hope that "somebody will come up with something."

Our failure continues—now with regard to the transition to renewable energy sources, primarily solar photovoltaics and wind power. Putnam himself, after surveying the limits to fossil fuels and nuclear power, seemed to settle on solar as humanity's long-term hope; yet he acknowledged that the realization of this hope depended on the development of technologies to make solar electricity available "in more useful forms and at lower costs than now appear possible." His wording suggests that he was grasping at straws.

There have indeed been significant technical improvements in wind and solar PV technology, along with huge cost reductions. Nevertheless, limits still exist. Sunlight and wind are themselves renewable, but the machines we build to capture ambient energy and convert it to electricity are made from non-renewable minerals and metals. Making these collectors requires energy for raw materials extraction, processing, manufacturing, transport, and installation. And renewable energy sources require considerably more land area than is needed for fossil fuel infrastructure. Further, solar and wind power sources are inherently intermittent, since the sun doesn't always shine nor the wind always blow; so, energy storage, source redundancy, and a major electrical grid upgrade are needed. There are work-arounds for each of these issues, but the difficulty of deploying the needed work-arounds increases dramatically as the scale of renewable energy production increases.

Without planning, this is what will most likely happen: we'll fail to produce enough renewable energy to power society at the level at which we want it to operate. So, we'll continue to get most of our energy from fossil fuels—until we can't, due to depletion. Then, as the economy crashes and the planet heats, the full impacts of our planning failure will finally hit home.

It may already be too late to avert that scenario. But let's assume there is indeed enough time, and that we suddenly get serious about planning. What should we do?

We should start with conservative estimates of how much energy solar and wind can provide. No one has a definitive figure, but for industrial nations like the US, it would be wise to assume some fraction of the energy currently provided by fossil fuels: half, for example, would be a highly ambitious goal (one of the first projects of the planning process would be to come up with a more precise estimate). Then, planners would explore ways to reduce energy usage to that level, with a minimum of disruption to people's lives. Planners would also seek to determine approximately the scale of population that can be supported long-term by these sources without degradation of the environment (yes, Putnam discussed the relationship between population and energy back in 1953), and then create and implement policies to begin matching population to those levels in a way that reduces, rather than worsening, existing social inequities.

A comprehensive plan would detail the amount of investment required, and over what period of time, and would specify the sources of the money.

Finally, as I have suggested elsewhere, good planning would entail the creation of a pilot project, in which a medium-sized industrial city is transitioned to get all its energy (for food, manufacturing, heating and cooling, and transportation) from renewables. Such a project would itself require subsidy and planning, but it would yield invaluable practical data.

It's gob-smacking to think that such a planning process actually could have started as early as 70 years ago, and that, at this late date, it has still barely begun. Instead, today's policy makers mostly just extrapolate PV price trends, hope for further technological improvements, and assume that huge systems for supplying society's needs using renewable energy rather than fossil fuels will somehow self-assemble in an optimum way and at full scale—all in just a couple of decades.

Without planning, it just won't happen.

Addendum

Some readers may be thinking: Wasn't agriculture, rather than the adoption of fossil fuels, the biggest planning failure in human history? After all, if we hadn't adopted grain crops, we wouldn't have developed full-time division of labor and all the specialized knowledge and skills that were required to mine coal and drill for oil and gas, and to apply these fuels to the solution of practical problems. True enough. However, from a quantitative standpoint, it's clear that fossil fuels have enabled much higher population growth during the past two centuries than occurred during the previous 10,000 years. The same could be said for per capita consumption rates and environmental damage. Agriculture may have set us humans on an unsustainable path, but fossil fuels broadened that path to a superhighway.