

Modernity Means More Stuff

Ronald Bailey | Feb. 21, 2014 1:30 pm



PBS/Menzel

From 1900 to 2000, the U.S. population quadrupled while the economy expanded 26-fold. As a result, U.S. per capita consumption of materials rose from 1.9 tons in 1900 to 5.6 tons in 1950 to 12 tons in 2000. In *Making the Modern World*, the University of Manitoba natural scientist Vaclav Smil cites data suggesting that global annual output now comprises about 10 billion different products. Nevertheless, the majority of people on the planet have not yet achieved the material abundance enjoyed by Americans, Europeans, and the Japanese. Can humanity find, transform, and deploy enough resources to lift those people into affluence?

Smil thinks that the prospects are uncertain but that human ingenuity could achieve that goal. He points out that modern technology allows us to create ever more value using less and less material. Today, for example, it takes only 20 percent of the energy it took in 1900 to produce a ton of steel. Similarly, it now takes 70 percent less energy to make a ton of aluminum or cement and 80 percent less to synthesize nitrogen fertilizer. Excluding construction materials, Smil calculates that in the U.S. it took about 10 ounces of materials back in 1920 to produce a dollar's worth of value. That is now accomplished using only about 2.5 ounces, a 75 percent decline in material intensity.

While the ever more efficient use of energy and materials results in relative dematerialization—less stuff yielding more value—the overall trend has been to extract more and more materials from the earth and the biosphere. “There can be no doubt that relative dematerialization has been the key (and not infrequently the dominant) factor promoting often massive expansion of material consumption,” Smil writes. “Less has thus been an enabling agent of more.” For example, the 11 million cellphones in use in 1990 each bulked about 21 ounces for total overall mass of 7,000 tons. By 2011 cellphones averaged about 4 ounces, but the total weight of all 6 billion had increased a 100-fold to 700,000 tons. As increases in efficiency make goods cheaper, people demand more of them.

But Smil rejects Malthusian predictions that the world is about to run out of critical resources. In

2008, the German think tank the Energy Watch Group issued a report declaring that global production of crude oil had reached its peak in 2006 and would now decline at a rate of 3 percent per year, falling by half by 2030. Smil points out that recent increases in petroleum production have refuted such dire forecasts. Similarly, the U.S. Geological Survey reports that known reserves of copper will last 42 years at current rates of production. In fact, the USGS had reported nearly identical figures for copper reserves in 1995 and 1980. In other words, miners find and develop new mineral reserves as needed.

Smil also counters the more recent claims that modern agriculture will soon collapse because the world is about to reach peak production of two fertilizing minerals, phosphorous and potash. In fact, a comprehensive analysis of phosphorous reserves shows that known supplies should last 300 to 400 years; the USGS estimates that potash reserves can provide for humanity's needs for 250 years. "In reality, our civilization is in no danger of running out of any major mineral, not imminently (in years), not in the near term (in one or two decades), and not on a scale of average human lifespan (60-80 years)," Smil concludes.

Despite this, Smil believes the "pursuit of endless growth is, obviously, an unsustainable strategy." At the same time, he points out that "too many people still live in conditions of degrading and unacceptable material poverty" and that "all of those people...need to consume more materials per capita in order to enjoy a decent life." Given these pressing needs, Smil doubts that the current trajectory of dematerialization will speed up enough to allow relative declines in material consumption to translate into aggregate declines—that is, using less and less material while creating more value in goods and services.

As a plausible scenario of how demand for materials could rise, Smil calculates that if automobile ownership in currently poor countries rises to 200 per 1,000 people (a third of Japan's current level of 600 vehicles per 1,000 people) that would double the global fleet to 2.2 billion vehicles. But will demand for trucks and cars follow such a path? Perhaps not. The advent of self-driving vehicles could provide a technological end-run around such projections of a growing vehicle fleet. Instead of sitting idle for most of every day as the vast majority of automobiles do now, cars could be rented on demand. This could actually lead to the shrinkage of the world's vehicle fleet, as more people forego the costs and hassles of ownership. In addition, such vehicles could be much smaller and packed more tightly on roads, since they can travel safely at higher speeds than human-driven automobiles. Such a switch would imply the construction of far less material heavy transportation infrastructure.

Some trends do, in fact, indicate that humanity is withdrawing from the natural world. Recent research by Jesse Ausubel, the director of the Program for the Human Environment at Rockefeller University, suggests that humanity has reached peak farmland. Crop productivity is rising so much that farmers will increasingly leave more and more land for nature. "The 21st

century will see release of vast areas of land, hundreds of millions of hectares, more than twice the area of France for nature,” Ausubel declared in 2012. In addition, requirements for synthesized nitrogen fertilizer may moderate as crop plants bioengineered to be nitrogen-sparing are deployed. The development of lab-grown meat could well obviate Smil’s advocacy of a more or less vegetarian diet in order to reduce environmentally damaging material flows. Researchers argue that cultured meat would require up to 99 percent less land, 96 percent less water, 45 percent less energy, and produce up to 96 percent less greenhouse gas emissions.

Oddly, Smil largely disregards the effectiveness of the market price system in guiding how people use materials. If the price of a material rises, consumers will tend to use less, producers will look for more, and technologists will work to create substitutes.

Can a 21st Century modernity be made using less? “As yet, nothing has been irretrievably foreclosed,” Smil concludes. *Making the Modern World* is an excellent primer on the process by which a significant portion of humanity has managed to lift itself out our natural state of abject poverty—and on the issues that must be confronted in order to achieve the same goal for the rest of the species.