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Small Is Beautiful—So Go Nuclear

As environmentally friendly as they sound, biofuels and wind power squander land and other resources.

By ROBERT BRYCE

Nearly four decades ago, British economist E.F. Schumacher stated the essence of environmental protection in three words: Small is beautiful. As Schumacher argued in his famous book by that title, man-made disturbances of the natural world—farms, for example, and power plants—should have the smallest possible footprints.

But how can that ideal be realized in a world that must produce more and more food and energy for its growing population? The answer, in just one word, is density.

Over the course of the last century, human beings have found ways to concentrate crops and energy production within smaller and smaller areas, conserving land while meeting the ever-growing global demand for calories and watts. But this approach runs counter to the entrenched beliefs of many environmental activists and politicians, whose "organic" and "renewable" policies, as nature-friendly as they sound, squander land and other resources.

Food cultivation exemplifies the virtues of density. During the second half of the 20th century, hybrid

seeds and synthetic fertilizers, along with better methods of planting and harvesting, produced stunning increases in agricultural productivity. Between the mid-1960s and mid-2000s, global production of all cereal crops doubled, according to U.N. data, even though the amount of cultivated acreage remained about the same.

Indur Goklany, a policy analyst for the U.S. Department of the Interior, estimates that if agriculture had remained at its early 1960s level of productivity, feeding the world's population in 1998 would have required nearly eight billion acres of farmland, instead of the 3.7 billion acres that were actually under cultivation. Where in the world—literally—would we have found an extra 4.3 billion acres, an area slightly smaller than South America?

Meanwhile, a recent analysis of U.S. Department of Agriculture data, by plant pathologist Steve Savage, found that land devoted to organic farming produces about 29% less corn and 38% less winter wheat than the same acreage conventionally farmed. Since world population is growing and food prices are already at near-record highs, mandates for organic farming could be disastrous. For example, low-density agriculture could increase deforestation as farmers desperately seek more farmland—a result that should disturb environmentalists.

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Now consider biofuels, which are supposed to reduce carbon-dioxide emissions. The domestic biofuel craze began in 1976, when Amory Lovins, co-founder of the Rocky Mountain Institute and a darling of the greens, declared that "developments in the conversion of agricultural, forestry and urban wastes to methanol and other liquid and gaseous fuels now offer practical, economically interesting technologies sufficient to run an efficient U.S. transport sector."

Today, Mr. Lovins still promotes this mirage—and unfortunately so do many others, including Secretary of Energy Steven Chu. But a bit of elementary math shows that large-scale biofuels production is a fool's errand.

Assume you wanted to replace one-tenth of U.S. oil consumption with fuel derived from switch grass, a plant often mentioned during discussions of cellulosic ethanol. That would require cultivating some 37

million acres of land—an area roughly the size of Illinois—in nothing but switch grass.

The problem with biofuels is low power density, a term that refers to the amount of energy flow that can be harnessed from a given area, volume or mass. The power density of plants such as corn or switch grass is fractions of a watt per square meter. Some energy analysts estimate the power density of corn ethanol to be as low as 0.05 watts per square meter of farmland. By comparison, a relatively small natural-gas well that produces just 60,000 cubic feet of gas per day has a power density of 28 watts per square meter.

Wind turbines have a power density of about one watt per square meter. Compare that with the two nuclear reactors at Indian Point, which provide as much as 30% of New York City's electricity. Even if you include the entire footprint of the Indian Point project—about 250 acres—the site's power density exceeds 2,000 watts per square meter. To generate as much electricity as Indian Point does, you'd need to cover about 770 square miles of land with wind turbines, an area slightly smaller than Rhode Island.

The virtues of density can also be seen in nuclear waste, a leading bugaboo of groups like Greenpeace and the Sierra Club. According to the Nuclear Energy Institute, an industry group, the American commercial nuclear-power industry, over its entire history, has produced about 62,000 tons of high-level waste. Stacked to a depth of about 20 feet, that would cover a single football field. Coal-fired power plants in the United States, by contrast, generate about 130 million tons of coal ash in a single year.

True, radioactive waste is toxic and long-lived, but it can be stored safely. France produces about 80% of its electricity from nuclear fission, and all of its high-level waste is stored in a single building about the size of a soccer field.

The greenness of density leads to two conclusions. First, those who make environmental policy should consider density a desirable goal in nearly all the issues that they confront. And second, the real environmentalists aren't the headline-seeking advocacy groups. They're the farmers, urban planners, agronomists—and yes, even natural-gas drillers and nuclear engineers.

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