

Book Reviews

Smil, Vaclav. *Energy at the Crossroads: Global Perspectives and Uncertainties*. Cambridge, MA: MIT Press, 2003. 427 pp. \$34.95 (cloth). ISBN 0-262-19492-9.

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“The world’s energy use is at an epochal crossroads,” writes Vaclav Smil. “The new century cannot be an energetic replica of the old one and reshaping the old practices and putting in place new energy foundations is bound to redefine our connection to the universe” (p. 373). What the old (present) energy foundation looks like, how the old foundation is changing, and why the old energy foundation cannot be replicated in the 21st century are the subjects of this book.

Energy at the Crossroads clearly, carefully, and technically dissects both the old and new energy foundations for the world. The old foundation, according to British Petroleum statistics, consists of an ever-growing demand for primary energy supplies. In 2003, for instance, the world consumed 9.8 billion tons of oil equivalent energy sources. Thirty-seven percent of that primary energy was petroleum. Natural gas and coal each produced about 25% of the world’s primary energy. Nuclear energy and hydroelectric production each supplied 6% of the world’s energy in 2003.

This statistical picture of the world’s current primary energy foundation, however, does not include the commercial and noncommercial biomass energy sources used by much of the population in the Global South—wood, charcoal, and grain residues. Biomass provides at least 80% of the energy for countries in sub-Saharan Africa and 30 to 56% of the primary energy in rural South and East Asia.

Smil does not foresee the emergence of a new foundation for the world’s primary energy mix—one where natural gas overtakes the current role of petroleum; one where renewable energy sources come to play a major role in the mix—much before 2050. With already massive volumes of worldwide primary energy consumption and growth, fuel sources now playing such a minor role in world primary commercial energy production will require many years of high growth rates before the renewables can make a significant contribution to the world primary energy mix.

Because petroleum plays such a predominant role in the world’s current energy mix, Smil’s view on the future of the world petroleum supply is worth a look. In the literature that addresses the question of the limits to world oil supply, Smil identifies two paradigms, two dominant perspectives. The cornucopian perspective reads: “As far as crude oil is concerned, the cost of translating its resources into reserves does not seem to be giving any signals of immanent exhaustion” (186). Oil abundance reflects “the commanding role of prices, unceasing human inventiveness, and the surpassing power of technical fixes” (186–187). One hears the voice of the late Julian Simon in the cornucopian paradigm.

Smil also identifies a paradigm dubbed the "catastrophist prophecy." The futurist L. F. Ivanhoe would say that "modern civilization has already moved very close to, or perhaps even beyond, the point of no return as it rushes toward exhaustion of nonrenewable resources, irreparable deterioration of the global environment, and deepening social crises" (187). The "catastrophist prophecy" echoes the sound of the late Donella Meadows and her colleagues in their much publicized, early 1970s book, *The Limits to Growth*.

Smil himself has a moderate view, a perspective somewhere between cornucopianism and catastrophism, about the petroleum question. Relying heavily on important work by Colin Campbell and Jean LeHerrere published in *Scientific American* in 1998, Smil contends that world petroleum production will peak around the year 2010. Petroleum production levels at that time, however, will be so high—peaking somewhere between 10 and 12 billion tons annually—that oil production will continue to play a significant role in the global fuel mix throughout the 21st century. "There is a large mass of oil," Smil writes, "in the Earth's crust and, although oil's contribution to total hydrocarbon supply will be declining, substantial amounts of crude oil will remain on the world market throughout the twenty-first century" (210).

One of the most exciting parts of Smil's comprehensive analysis of world energy consumption is his treatment of current trends in the renewable energy sources—the signs of the impending crossroads. The most promising of the signs, to date, are the giant wind turbines pioneered in California during the 1980s. The largest of these facilities at the time was in Altamont Pass, CA. The facility has the capacity to provide electricity to 250,000 persons annually.

"In contrast to the 1980s," according to Smil, "new U.S. installations have been growing slowly compared to the rapid advances in several European countries, above all in Germany, Denmark, and Spain where new laws guarantee fixed prices for wind-generated electricity" (272–273). Denmark, in 2000, produced 13% of the nation's electricity using over 6000 wind turbines. Germany, in the same year, operated 9000 wind turbines to produce 2.5% of the nation's electricity. "Wind-driven electricity generation is seen as the most promising of all new renewable conversions, being far ahead of other solar-based technologies both in terms of operating reliability and unit cost" (274).

The 21st century, in Smil's account, cannot be an energetic replica of the 20th century for two main reasons. The first of these reasons is ecological. For decades now, scientists have been documenting the pernicious environmental impact of sulfates, nitrates, and suspended particulate matter from the combustion of coal and petroleum. Changes in soil chemistry, the acidification of streams and lakes, and the accompanying loss of biotic life, as well as increased loss of forest resources, especially conifers, are the continuing consequences of the current world fuel mix. Yet, as Smil writes, "fuel and electricity costs still ignore, or greatly undervalue, these externalities" (88).

The second main reason why the 20th-century energy mix cannot be replicated again in the 21st century is a sociological one. As Smil frames this issue, the question is "how to reduce energy use among those who are grossly over-consuming fuels and electricity and boost [fuel consumption] among those who can only dream about dignified lives" (367). Thus, for Smil, the energy crossroads of the 21st century involve more, not less, primary energy consumption. This growth in energy consumption is necessary "in order to bring about the badly needed improvements in the quality of life of the world's low income population and to narrow the intolerably huge gap between the rich and the poor countries" (365).

Energy at the Crossroads is a very current, comprehensive global analysis of energy trends written by a leading energy scholar. "Against Forecasting," an early chapter in the book, extensively documents the pitfalls of predicting energy supply and demand. The World Energy Conference, one of the world's oldest energy institutes, published the *Study Group Report on World Energy Demand* in 1978. By the year 2000, according to the conference report, world primary energy consumption would be in the 12.3 to 13.9 billion tons of oil equivalent units. With an actual consumption level of 8.75 billion tons of oil equivalent units, the conference estimates are between 40 and 60% off the mark. An International Institute for Applied Systems Analysis estimate, published in 1981, missed the estimated total primary energy consumption in 2000 by as much as 68%.

Errors of this magnitude in predicting primary energy consumption reflect tumultuous, unpredictable social changes affecting energy consumption: the post-1990 decline in the Japanese economy; the decline in energy consumption in the moribund economies of the former Soviet republics; and, more recently, dramatic declines in carbon emissions in the rapidly growing Chinese economy. "Some forecasters may get a few quantities approximately right," writes Smil, "but they will miss the real qualities arising from subtly to profoundly altered wholes" (167).

An alternative approach to this problem—the problem of seeing what will be at the crossroads in the 21st century—is to construct norms about what this new century energy mix should be. "Normative scenarios must combine the recognition of numerous limits and uncertainties of the real world with sensible aspiration for higher quality of life with commitments to preserving the biosphere's integrity" (179). Those scenarios, however, are more implicit than explicit in this otherwise very comprehensive, even-handed analysis of world energy consumption. Perhaps the scenarios will be forthcoming in the distinguished professor's 19th book.

Holland, Marjorie M., Elizabeth R. Blood, and Lawrence R. Shaffer, eds. *Achieving Sustainable Freshwater Systems: A Web of Connections*. Washington, DC: Island Press, 2003. 351 pp. \$30.00 (paper). ISBN 1-55963-929-6.

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The goal of sustainable development is hard to define and even harder to reach. Holland, Blood, and Shaffer explain it as the need "to balance the resource needs of economic growth and the ability of nature to provide them while also preserving environmental quality" (12). The *Dictionary of Natural Resources Management* defines it as a "not a fixed state of harmony, but rather a process of change in which the exploitation of resources, their renewability, the direction of investments, the orientation of technological development, and institutional needs are made consistent with future as well as present needs" (Dunster and Dunster 1996, 308). Depending on how thin you want to slice the concept of sustainable development, several nuances are seen. More importantly, there exist various possible interpretations

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