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Issue Menu

Search

- Current Issue
- About OnEarth
- Subscribe/Join

- Letter from the Editor
- Email the Editor
- Full Table of Contents
- Back Issues

- NRDC Home
- NRDC Membership

DEPARTMENTS

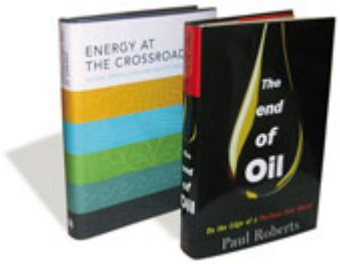
Reviews

MOTHER OF ALL HEADACHES

Remaking the global energy system means reimagining the way we live. Are we up to the task?

THE END OF OIL
On the Edge of a Perilous New World
by Paul Roberts
Houghton Mifflin, 389 pp., $26

ENERGY AT THE CROSSROADS
Global Perspectives and Uncertainties
by Vaclav Smil
MIT Press, 427 pp., $34.95



reviewed by Jeffrey D. Sachs

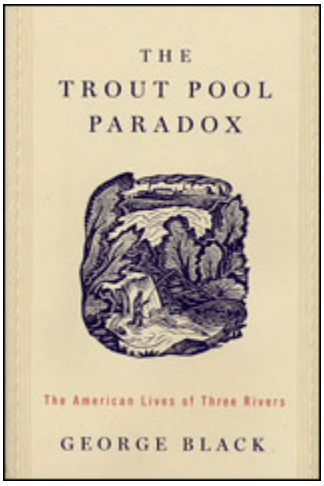
In the course of the next quarter century, we will have to remake the global energy system before it irreparably damages our economic well-being, global political stability, and the health of the planet. Accomplishing this will be an enormous challenge, and much can go wrong. Our entire economy depends on massive supplies of energy at affordable prices, yet the solution of the past century -- ready availability of growing supplies of oil -- is clearly becoming untenable. Global oil supplies are tightening and are heavily concentrated in the Middle East, which (not coincidentally) is the world's most unstable region. If the supply problems were not enough, the use of oil and other fossil fuels gravely threatens the world's ecosystems by contributing to long-term climate change.

It is hard to think of a public policy problem of greater complexity than the overhaul of the global energy system. Energy touches every sector of every economy, and securing adequate energy supplies that are also environmentally safe will require the world to look ahead several decades, since the shifts in energy sources and technologies will take decades to be put into place. Substantial government spending on research and development will be required, along with an effective regulatory system to underpin the new technologies. Global cooperation is imperative, since fears over energy security among the major powers could trigger

EXPLORE OTHER DEPARTMENTS
- Living Green
- Open Space
- Poetry
- Reviews

REVIEWED IN THIS ISSUE
- The End of Oil
- Energy at the Crossroads
- Faith in Nature

FROM OUR CONTRIBUTORS



"The hillsides were dark. Inexplicably, a solitary maple still had its leaves, which were the color of clementines. The road was out of sight, and the hard granite walls of the valley channeled the flow into two successive bends, one to the north of me and another to the south, so that the prospect of the river was blocked in each direction by a curtain wall of forest and mountain. I felt enclosed in a tunnel, where the only sounds were the soughing of the wind in the trees and the steady sibilant whisper of the water.

great geopolitical rivalries and risks of conflict (as they have during the past 100 years).

As traditional oil supplies wane, other fossil fuels will have to take their place. Whether we like it or not, coal will be an increasingly important source of energy for the world in this century, and we will have to develop new technologies for its use if we are to avoid catastrophic environmental consequences. Renewable energies -- ranging from photovoltaics and wind to nuclear power and biomass (fuels made from crop waste, wood chips, and other plant-based sources) -- offer some promise, yet the prospects for all these technologies are highly uncertain, and they are unlikely to substitute for fossil fuels for decades to come. In short, this massive economic and technological uncertainty, which in the worst case could lead to public policy paralysis and geopolitical strife, will be our greatest challenge in solving the gargantuan and complex problem of our future energy needs.

Given the huge stakes involved, it's encouraging to see the growing number of books on the topic, and in the wake of the Iraq war, it seems safe to predict that many more will soon be on the way. Two especially worthy recent contributions to the debate are Vaclav Smil's *Energy at the Crossroads* and Paul Roberts's *The End of Oil*.

Smil, who is distinguished professor of geography at the University of Manitoba, is a remarkable polymath, and *Energy at the Crossroads* is the latest in a series of impressive volumes of synthesis that he has written in recent years on the interplay of the physical environment, technology, and society. The book's subtitle, *Global Perspectives and Uncertainties*, is aptly chosen, since one of Smil's main themes is the difficulty of forecasting energy patterns, of both supply and demand. After documenting the fundamental importance of energy in modern economic development, he recounts in detail why it has been so hard to make valid forecasts about technologies and energy supplies and shows convincingly how badly many recent "point forecasts" have erred.

This does not mean that Smil is against thinking ahead. Arguing for sophisticated alternative visions of the future rather than single "best" forecasts, he comes out strongly in favor of "normative scenarios" -- outlining what should happen rather than what is likely to happen. He believes that we need to prepare for the flexible introduction of fuels other than traditional petroleum. While this is no easy task, Smil asserts emphatically that such a transition is possible. "There is no reason, historical, economic or technical," he writes, "to interpret the demise of today's cheap oil as a harbinger of unmanageable civilizational difficulties." Smil takes the reader through a learned analysis of what we might expect from these various kinds of energy supplies, both fossil and renewable, and the technological problems that will have to be overcome to ensure their safe and effective use. He speaks with great wisdom about the need to address climate change and other man-made threats to the environment, the vast and unnecessary gaps between rich and poor nations in their access to energy, and the great value to global society of planning ahead to accomplish the transition that is required. *Energy at the Crossroads* is a tour de force, executed with accuracy, novelty, and consistently clear and

It was a wild and solemn place, but it was not wilderness. On the contrary, humans had shaped it and worked it and changed its smallest particulars, and I found it oddly satisfying to think that we would continue to do so and that the river would do the same to us.

"As I stood there, waist-deep in the Housatonic, the wind picked up and gusted down the valley, bringing a sudden chill, a message of winter from the Arctic. The force of the squall shook loose an uncountable volume of oak leaves, and they filled the air with a great whirring sound, like a rain stick as long as the valley. For a full minute, the dense, rattling cloud of leaves darkened the sky. Then the wind dropped as suddenly as it had begun, and the air crackled with ozone. The first large drops of rain splashed onto my face, and the whole unending hydrologic cycle -- precipitation, percolation, evaporation, transpiration, precipitation -- began all over again."

-- From *The Trout Pool Paradox: The American Lives of Three Rivers*, by George Black (Houghton Mifflin, April 2004). With this issue, Black joins *OnEarth* as articles editor.

informative graphics.

While it lacks the grand, scholarly reach of Smil's work, Paul Roberts's *The End of Oil* is a lively journalistic account of the many intersecting issues of global oil supplies, alternative energy sources, future technologies such as hydrogen fuel cells, and the challenges of climate change. Roberts brings to the subject marvelous reportorial skills, fine writing, and good judgment in moving among technological, economic, and political perspectives. Moreover, he correctly explains that the world cannot run on conventional petroleum reserves throughout the twenty-first century, and that we should begin without further delay to prepare for and invest in a smooth transition to alternative energy sources.

Roberts sets the stage in the prologue by reporting on the growing difficulties of oil production in Saudi Arabia's Ghawar oil field, the world's largest. This account of troubles at the very center of global oil production is so dramatic that it immediately captures our attention. He follows up with an informative tour of possible alternatives: natural gas, renewables such as photovoltaics and wind power, clean coal technologies, and the use of hydrogen as an energy carrier (though not, of course, a primary source, since energy from elsewhere must be used in hydrogen production).

Roberts is fully aware that future energy systems will be shaped by many interacting constraints: the economics of new energy supplies, environmental imperatives regarding greenhouse gas emissions and other air pollutants, and geopolitical competition. "In the simplest terms," he writes, "the energy challenge of the 21st century will be to satisfy a dramatically larger demand for energy while producing dramatically less carbon. Yet the availability of carbon-free energy on a mass scale -- whether produced from renewable sources, like solar or wind, or from decarbonized fossil fuels -- will not happen without significant technological developments."

Page: 1 2

Jeffrey D. Sachs is director of the Earth Institute at Columbia University and special adviser to U.N. Secretary-General Kofi Annan on the Millennium Development Goals. In April 2004, *Time* magazine named him one of the 100 most influential people in the world.

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