

BRITTLE POWER
by Amory B. Lovins
and L. Hunter Lovins

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Albert L. Huebner

When German U-boats began sinking coastal oil tankers during World War II, the nation's response was to build long-distance oil and gas pipelines, ignoring their serious vulnerabilities. The 1973-74 Arab oil embargo alerted millions of Americans to energy vulnerability, but in the panic that followed, policy-makers rushed to relieve foreign oil dependence without considering the new vulnerabilities that their substitutes created. This pattern was repeated in 1979, driven by a 1 per cent reduction in world oil availability during the Iranian revolution that brought gasoline lines and a 120 per cent price increase in the United States.

Amory and L. Hunter Lovins claim that, in clinging to the narrow view, we have heedlessly—and needlessly—imposed on ourselves an energy system that is perilously fragile. A reliable system would supply "all kinds of energy in the face of all

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possible disruptions—foreign or domestic, civil or military, accidental or deliberate, foreseen or unforeseen." In contrast, the energy that runs America is brittle: easily shattered by accident or malice.

Brittle Power, based on research commissioned by the Federal Energy Management Agency, begins by tracing this pattern of proliferating vulnerabilities. World War II is a logical place to start. In retrospect, one of the costliest strategic errors made by the Allies was the failure to bomb major power plants in Germany. High Nazi officials, including Goering and Speer, acknowledged that systematic targeting would have curtailed the war, perhaps by as much as two years.

A study done a few years ago by Britain's Royal Commission on Environmental Pollution provided a new insight. It concluded that if nuclear power had been in widespread use during World War II, some areas of Central Europe would still be uninhabitable because of contamination. Today's weapon systems could cause this kind of contamination anywhere in the developed world, even if no nuclear bombs were used.

Not that anything like full-scale military operations are necessary to shatter the nation's fragile energy supply. By official count of the Department of Energy, terrorist attacks on energy facilities in the U.S. are occurring at the rate of one every three weeks. This makes it more than a little disturbing to read that:

- a small group could shut off three-quarters of the natural gas to the eastern U.S. in a few hours without leaving Louisiana;
- a terrorist squad could seriously disrupt much of the oil supply to the nation;
- one saboteur could incinerate a city by attacking certain natural gas systems;
- a few people could release enough radioactivity to make much of the U.S. uninhabitable; and
- a single hydrogen bomb could probably do all these things simultaneously.

Malicious acts aren't needed to produce widespread suffering and disruption, however; if the system is brittle enough, accidents will do. For example, the accident at Three-Mile Island imposed an enormous psychological burden on nearby residents, depressed property values sharply, drained the public utility's finances, and crippled the entire nuclear power industry. Page after page of *Brittle Power* recounts similar, if less widely reported, horror stories.

Despite this depressing catalogue of disasters, the book kindles hope. Fragile systems can be replaced by those that are resilient—that is, systems that rebound from stress without collapsing or, better yet, that

can profit from stress by using it to improve their ability to rebound. The Lovinses employ an innovative synthesis of biological and engineering models to determine the elements that contribute to resiliency. They arrive at a long list that includes fine-grained, modular structure, redundancy, diversity, simplicity, accessibility, and understandability. The centralized power systems that supplied virtually all energy in the U.S. until a few years ago lack most of these qualities, which is precisely why our power is so brittle.

The quickest and easiest way to improve resiliency is by increasing the efficiency of energy use, a move that reduces the need for energy without imposing any burden on the user. Next in line is a mix of small-scale, renewable sources, such as solar, wind, and small hydro systems. Ironically, power development has proceeded in exactly the reverse order, favoring the most brittle systems and ignoring the most resilient.

This began changing in the late 1970s. Resilient energy technologies are also the consumer's best buy, while brittle systems are the worst. That's why increased energy efficiency and small renewable sources have provided new energy about a hundred times as fast as centralized-supply projects during the past few years. If all options are allowed to compete on an equal basis, operation of a free market will automatically improve the resilience of the energy system and make it environmentally more benign as well.

Brittle Power would be worthwhile reading even if its authors used their considerable expertise merely to show that our vast, technologically sophisticated energy network, rather than promoting our security, threatens it at every level. That they go on to lay the solid foundation for a solution to this problem makes the book indispensable. WJ

STAFFING FOR FOREIGN AFFAIRS
by William I. Bacchus

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The emphasis of this book, as its author stresses, is on systems, not individuals. The result is an excellent survey of the various schemes by which the United States Government has attempted to staff itself for carrying on foreign relations. Needs, weaknesses, and strengths of the personnel sys-