



# Book Crossing the Energy Divide

## Moving from Fossil Fuel Dependence to a Clean-Energy Future

Robert U. Ayres and Edward H. Ayres  
Wharton School Publishing, 2009

---

### Recommendation

This book deserves widespread attention for its new arguments about how energy costs affect economic growth. Robert U. Ayres and Edward H. Ayres dispel dominant energy and economic myths. They espouse making better use of existing energy until alternatives become available in about 50 years' time. The authors' simple proposal is cheap to implement, and modeled on existing projects now underway worldwide. While the text can be repetitive, the book challenges conventional wisdom, and identifies the regulatory and policy impediments that hinder the implementation of new approaches. *BooksInShort* recommends this book to those seeking to recharge the discussion about energy conservation, and to Americans who want to accelerate the U.S.'s energy independence.

### Take-Aways

- Improving the U.S.'s energy service can accelerate the nation's economic recovery.
- The wasteful U.S. energy power system operates at an average of 35% efficiency.
- Techniques exist to double the amount of energy derived from a barrel of oil by improving large fossil fuel users' energy management.
- The U.S. could save \$100-\$200 billion by using decentralized energy production.
- Systems that put decentralized gas turbines nearer to end users produce 50% of the electricity in Denmark, 39% in the Netherlands, 37% in Finland and 18% in China.
- Solar, wind, biofuel and geothermal energy systems generated just 2.7% of the U.S.'s electric power in 2007.
- Public policy should encourage private production of alternative energy, yet sending electricity through a private utility wire is illegal in all 50 states.
- Building design should focus on energy and resource conservation.
- Forging an efficient national energy policy requires politicians to confront the secretive, powerful utility industry.
- Firms that develop energy-aware strategies will prosper. The rest will fail.

### Summary

#### Ending Dependence on Fossil Fuels

Despite all the claims that the United States is on the verge of a "green revolution," the reality is that fossil fuels will remain America's dominant energy source for at least two decades. While alternative sources of energy – solar, wind, biofuels and geothermal – have received an inordinate amount of publicity, they accounted for only 2.7% of the fuel that generated electric power in the U.S. in 2007.

"Any country that loses its energy is at risk of social and economic breakdown."

Reaching full independence from fossil fuels could take up to 50 years. Meanwhile, by changing their fuel-use habits, Americans can decrease their dependence on fossil fuels. For example, improving the energy management practices of existing large-volume fossil fuel users and pollution emitters could double the amount of energy derived from a barrel of oil. In fact, undertaking these improvements could double the nation's fuel efficiency from its current level of 13% without any additional technology or new fossil fuel sources, thus reducing emissions and increasing America's energy independence. Arcelor Mittal, the world's largest steel company, and U.S. Steel separately employ "co-generation": systems that capture "waste blast-furnace gas" to generate "emissions-free electric power." These steel giants designed

and built their systems in less than two years, and, in 2005, they generated more electricity than the entire solar-voltaic industry.

“All economic activity begins with physical materials and energy carriers (fuels and electric power).”

Such “energy service” – generating proportionately more output per unit of energy – is the prime cause of economic expansion; it creates more growth than capital investment or labor. Acknowledging the importance of energy service can accelerate America’s economic recovery, though rising fossil fuel costs could stunt its growth. The potential for prioritizing energy service challenges the assumptions that bailouts, new capital or rising consumer spending will renew the economy.

“Energy services aren’t just a large part of the economy; they’re a major part of what drives the economy.”

Improved energy management can reverse the forces that hinder economic growth. Industries such as steel production, smelting, oil refining and chemical processing, among others, can readily implement the co-generation process to recover and reuse waste heat. Petroleum refineries typically burn off flammable gas in wasteful “flares.” Instead, they could recapture this gas to generate cheap electricity. For example, U.S. Steel’s facility in Gary, Indiana, powers an electricity-producing steam turbine with gases from its blast-furnace process.

“The path to energy independence lies in the institutional and legal structure of the U.S. energy system, not under the ocean bottom.”

The electrical energy process suffers from inherent waste. Today, the conventional U.S. energy power system operates at an average rate of 35% efficiency, and only one-third of the energy those inefficient plants produce reaches consumers as electricity. The remaining two-thirds is discarded as waste heat. An alternative is to produce power closer to the households and businesses that use it. This eliminates costly transmission power lines and the construction of expensive central power plants.

“Even if the use of electric cars and solar roof panels were to grow as fast as the internet did, they would still account for only a drop in the ocean of energy we will use during the next two decades.”

In contrast, a system of gas turbines that produces energy nearer to end users supplies 50% of the electricity in Denmark, 39% in the Netherlands, 37% in Finland and 18% in China. A 2008 report by the International Energy Association found that if the U.S. adopted decentralized energy production, it could save \$100-\$200 billion in capital costs, while simultaneously raising energy efficiency from 33% to 60%.

## Until Alternative Energy Arrives

The U.S. has not developed sufficient alternative energy sources, and will not for about 20 years. In the interim, it should rely on these eight energy initiatives:

1. **Make efficient use of waste energy** – About 1,000 U.S. companies reuse their own waste energy, but some 10,000 more could. That would produce about 10% of the energy the U.S. needs, without consuming any additional fossil fuel.
2. **Combine heat and power processes to recapture wasted heat** – Politicians rarely discuss this tactic, but it benefits electricity users and reduces the erosion of air quality.
3. **Improve energy processes, engineering and equipment** – This would increase energy efficiency and produce immediate returns on investments.
4. **Increase energy awareness among consumers** – Encourage the use of fluorescent lights, hybrid cars, energy-efficient appliances and insulated windows.
5. **Allow small businesses, boats, cars and residences to produce micropower** – Breaking the public utility monopoly will facilitate this process and spur current advances that can alter the source of future electricity.
6. **Separate energy needs from energy-based services** – Consumers do not want coal, gasoline or natural gas per se. They want the energy these mechanisms produce.
7. **Build structures that need dramatically less energy and benefit from density** – This is already taking place in Europe, but planners should anticipate problems as sea levels rise and the possibility of flooding increases.
8. **Develop new water management techniques** – Such changes also could produce more energy.

## Cutting Consumption by Improving Efficiency

During the 2009 presidential campaign, neither Barack Obama nor John McCain emphasized the need for improved energy efficiency as a means of reducing fossil fuel consumption. Instead, they emphasized the need for more oil drilling, or the construction of coal or nuclear power facilities. To urge those courses of action ignores the need to improve American energy efficiency. The U.S.’s energy efficiency is estimated at only 13%, compared to Japan’s 20%. Companies can improve their revenue streams by reducing energy expenses.

## Price-Fixing Utilities

After the Arab oil embargo of 1973 and 1974, the U.S. Congress passed the Public Utilities Regulatory Policy Act (Purpa) to stimulate competition among utilities and spur the development of alternative energy sources, such as solar and wind – at least in theory. In practice, Purpa failed to break up price-fixing among electric utility systems. Since no one had authority to enforce Purpa, providers of alternative energy sources faced restrictions on how much they could earn for the energy they generated. Also, although Purpa mandates that states develop alternative energy, few states took the initiative. For example, Louisiana, which is dominated by oil and gas companies, ignored Purpa.

“The utility industry is not only one of the largest sectors of the U.S. economy, but also one of the most opaque and secretive.”

In one case, a producer of carbon black, which is used to produce tires, wanted to build a heat-energy recycling plant that would cut its pollution and electricity consumption, and produce energy it could sell. On paper it seemed like a win-win situation. However, the local utility company that made money by encouraging customers to increase their fuel consumption, objected to the plan. The local utility blocked the efficient energy plan for years until its cancellation. In the interim, the carbon-black company pumped carbon emissions into the sky. To correct public utility intransigence and make the nation more energy efficient, politicians must

confront the secretive, powerful utility industry and the coal companies.

“One of the most egregious wastes of water in the United States is the production of corn ethanol, which from irrigation to processing consumes 10,000 gallons of water for each gallon of fuel produced.”

To ease the transition until better alternative energy sources become practical, consumers can adopt new energy-saving habits. Several European nations have bicycle-sharing programs, which allow users to pick up and drop off bikes at designated sites. In China, which has 420 million bicycles, about 2,000 companies are making electric, battery-powered bikes with speeds of 9 to 13 miles per hour. In the U.S., three companies make e-bikes, which sell for \$11,000 and can reach 62 mph. The U.S. has 18 car-sharing programs with 4,000 members sharing 7,000 cars.

## Preparing for the Worst

Over the next 25 years, climate-related disasters will affect millions in the world’s cities. The end result will be flooding, dangers to food and water supplies, epidemics and ecological instability. To prepare for these inevitable disruptions, urban residents should start upgrading their energy-efficiency preparations by pursuing four goals:

1. **Raise ground-floor elevation of new construction** – This can prevent flooding. To cut energy costs, reduce the distance between residences, offices, shopping and entertainment areas. Planners should minimize the amount of concrete and asphalt pavement to reduce an area’s heat signature.
2. **Expand public transportation to revitalize neighborhoods** – Construct more metro train and bus lines, car-sharing sites and electric car plug-in stations.
3. **Reclaim space formerly needed by cars** – As more urban space is devoted to bikes and pedestrian trails, traffic planners can reallocate space to make neighborhoods greener and more compact.
4. **Build new efficient low-energy, low-emission buildings** – Studies of passive energy houses in Europe show that new construction produces greater benefits than retrofitting existing homes.

## Water Wars

Disputes are simmering about access to drinkable water. In India, farmers clashed with a local Coca-Cola bottler over water usage. California, Colorado, Mexico, Nevada and Arizona continue to fight about Colorado River water rights.

“The micropower revolution won’t displace the grid, but it will greatly improve its efficiency.”

Most of the world’s freshwater supply resides in ice – located in Greenland, Antarctica, and in mountain glaciers in the Andes and Himalayas – and in lakes. Seasonal snow- and ice-melts drain into rivers. The remaining source of freshwater is precipitation. But because rain and melting is seasonal, providers store the water used for energy production in reservoirs, cisterns and aquifers. However, rapidly declining water levels in reservoirs and irrigation aquifers affect agricultural production. Producing 1,000 tons of grain requires 1,000 tons of water. One food research study estimated that it takes about 500 gallons of water per day to produce enough food to feed each American.

“We are entering an era when conflicts over access to either fresh water or petroleum (or gas) can lead to war.”

While that is a staggering amount, irrigated water use differs by location. In the U.S., 80% of all water consumption goes to food production, but most of the water needed for agriculture comes from rain. In China, four-fifths of the food comes from irrigated fields; in India, it’s three-fifths. Since China and India’s population are eight times higher than the U.S.’s, their water demands are quickly depleting their reservoirs and aquifers. Thus, they require more imported grain from other nations with rising populations and declining water sources. Diminishing amounts of water means an increase in non-arable land. Less precipitation also leads to more intense forest fires. Meanwhile, rising ocean levels are introducing salt water into freshwater areas along the coasts.

## Positive Incentives

Positive incentives are the key to building effective new energy technologies. Current economic incentives have the opposite effect. Oil and coal companies reap rewards for selling more carbon fuels. Electric utilities strive to build higher rate bases, and builders continue to erect large energy-consuming homes. Rural states, which are disproportionately represented in Congress, largely determine U.S. energy policies. A change in these policies could revitalize the economy and accelerate the move toward energy independence.

## Business Strategies

Not enough corporate leaders understand that a gain in energy efficiency is more profitable than a gain in labor productivity. Executives need to understand energy as “a controllable cost of production and [a] source of recoverable earnings.” During the crisis over the future of General Motors, for example, policy makers paid little attention to the differences in energy costs during GM’s heyday and at the time of its collapse. Few at GM, and ever fewer outside the company, computed rising energy expenditures into their financial analysis. Company leaders must be aware that, “The coming energy transition will affect every kind of business.” In previous decades, energy costs remained relatively stable, allowing managers to make accurate long-term projections. But the epoch of stable energy prices is over. Such long-term projections are no longer viable. Those with the most energy-aware strategies will prosper. Those who do not maximize energy service will not.

## About the Authors

**Robert U. Ayres** is Emeritus Professor of Economics, Political Science and Technology Management at INSEAD. He founded the Centre for the Management of Environmental Resources. **Edward H. Ayres** wrote *God’s Last Offer: Negotiating for a Sustainable Future*.