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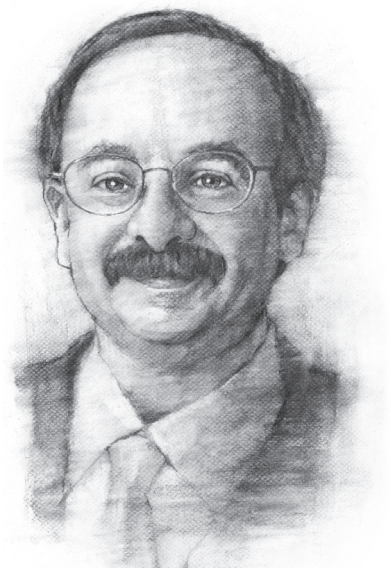

ENERGY, RESOURCES, MATERIALS

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Using energy more efficiently: An interview with the Rocky Mountain Institute's Amory Lovins

Amory Lovins argues that market forces, not regulation, will play the key role in promoting more efficient energy consumption.

Matt J. Hirschland, Jeremy M. Oppenheim, and Allen P. Webb

Article at a glance

Companies, governments, and consumers around the world are grappling with high energy prices. Amory Lovins, cofounder and chairman of the Rocky Mountain Institute, a nonprofit, has spent more than three decades searching for innovative ways to boost energy efficiency and alleviate this pressure.

In this interview, he offers suggestions to CEOs who want to plump up the bottom line by getting their organizations to use energy more efficiently.

He also suggests that regulators channel the power of market forces to promote more efficient energy consumption.

McKinsey&Company

Saving energy went out of style when oil prices plunged during the second half of the 1980s and much of the 1990s. But Amory Lovins and the Rocky Mountain Institute—an entrepreneurial, nonprofit think tank he cofounded in 1982 to develop and implement advanced solutions for energy and resource efficiency—soldiered on.

Today's surging energy costs are helping the always outspoken and sometimes controversial Lovins to find an increasingly interested audience when he exhorts business executives to look for savings in the nooks and crannies of offices and factories.

In an interview with McKinsey's Matt Hirschland, Jeremy Oppenheim, and Allen Webb, Lovins argues that businesses acting quickly to make their operations more efficient will gain a significant competitive advantage. He also discusses why executives often overlook seemingly simple energy- and money-saving solutions, describes the relationship between energy and carbon efficiency, and suggests that companies and their markets will outpace policy makers in the race for solutions.

The *Quarterly*: Given the economic benefits of saving energy, why haven't companies already seized all the opportunities available to them?

Amory Lovins: Most chief executives assume that smart engineers are already doing everything they should to cut costs. CEOs don't see all the market failures operating both in the C-suite and several levels down.

For example, most companies behave as if they're capital constrained, so they defer or simply don't approve these investments. Even without risk-adjusting your discount rates, saving energy is among the highest-return investments anywhere. But it tends not to get attention, because energy is only 1 or 2 percent of the cost of doing business, unless you're doing something like smelting aluminum. It just doesn't rise to the priority level most strategists care about.

And I'm astonished how often chief executives confuse the top and bottom lines. Years ago, I was talking to the head of a Fortune 50 company and was able to tell him about an engineer who had just cut $3.50 per square foot per year off the energy costs in one of the company's plants. The CEO quickly and correctly translated that into $3.5 million in cost savings. But in the next breath, he said he couldn't get excited about energy, because it was only 2 percent of his cost of doing business! He forgot where saved overhead goes—straight to the bottom line.

I had to do the arithmetic and show him that if he hypothetically achieved the same result in his 92 million square feet of facilities worldwide, his total net earnings would rise by more than 50 percent. That got his attention. He promoted the

engineer, who spread his practices all over the company. Until then, that idea had never occurred to top management, because energy wasn't an important factor cost.

Amory Lovins

Vital Statistics

Born November 13, 1947, in Washington, DC

Education

Studied at Harvard College, 1964–67, and Oxford University, 1968–71, where he was a Junior Research Fellow

Career highlights

Rocky Mountain Institute (1982–present)

- Cofounder, chairman, and chief scientist

Fast Facts

- Visiting professor and lecturer at universities (1978–present), including the University of California at Berkeley and Riverside, the University of British Columbia, Dartmouth College, the University of Colorado at Boulder, the University of St. Gallen, Peking University (now University of Beijing), and Stanford University
- MacArthur Fellowship recipient (1993)
- Has written 29 books on diverse topics, mainly energy related
- Recipient of the Blue Planet, Volvo, Onassis, Nissan, Shingo, and Mitchell prizes; the Benjamin Franklin and Happold medals; ten honorary doctorates; honorary membership in the American Institute of Architects; Foreign Membership of the Royal Swedish Academy of Engineering Sciences; and the Heinz, Lindbergh, Jean Meyer, Time Hero for the Planet, World Technology, and Right Livelihood awards

The *Quarterly*: What should top executives do to focus attention on these kinds of details?

Amory Lovins: When Ken Nelson was at Dow Louisiana, he held a contest on the shop floor to see who could come up with the best ideas for saving energy and reducing waste. The employees came up with ideas that yielded a 173 percent return on investment. Twelve years and nearly 900 implemented projects later, they had

added $110 million a year to Dow Louisiana's bottom line. Their average ROI was over 200 percent, confirmed by audit. Toward the end of Nelson's tenure, the returns and the savings were trending upward because he had created a culture of measurement, curiosity, and improvement.

Ken had the interesting theory—which I expect was right for that culture but may not be everywhere—that you should not give people bonuses for suggesting such savings, because then they might think it's not part of their job descriptions. And he had the even more interesting theory that he shouldn't tell other executives and managers what he was doing, because management attention would spawn all sorts of management mantras and bureaucratic procedures that would slow things down.

The *Quarterly*: So if your boss doesn't know about it and you're not getting paid more for it, what's the incentive to suggest improvements?

Amory Lovins: It's why you became an engineer in the first place: the joy of doing great engineering and coming up with really cool stuff that works better and costs less. When engineers experience whole-system design—optimizing not just parts but entire systems, giving rise to higher savings at lower cost—they'll never do things the old way again. It irreversibly rearranges their mental furniture. They're really being creative and not functioning as mere cogs. Unleashing human creativity is an irreversible process.

Creating a culture of curiosity and measurement is immensely important. Here's an example. I was once in a building that had a 50-kilowatt load of unknown origin. We had to trace all the wires to find the cause: an electric snow melter, under the parking lot, that was running 24/7, every day of the year, including the blazing summer, just eating electricity. Nobody knew it was there. Such waste is all over the place! And until you have a culture of measurement and curiosity, you won't find it.

The *Quarterly*: Do you have any tactical suggestions for executives trying to create such a culture?

Amory Lovins: I would set up a lending library of measuring tools and give a weekly prize for the person who came up with the most fascinating number about how the company's processes were actually working in ways other than the ways it thought they were working. Then I'd give a Goof-of-the-Month prize to the person who took the most intelligent risk that didn't work and didn't compromise safety.

The *Quarterly*: More broadly, how do you think CEOs should be approaching energy efficiency today?

Amory Lovins: Aggressively. They should think of energy and resource efficiency as a key source of competitive advantage. In my team's latest redesigns for $30 billion worth of facilities in 29 sectors, we consistently found about 30 to 60 percent energy savings that could be captured through retrofits, which paid for themselves in two to three years. In new facilities, 40 to 90 percent savings could be gleaned—and with nearly always lower capital cost.

Moreover, seldom-counted side benefits can be far more valuable than the direct savings. For instance, a typical office pays about 160 times as much for people as for energy, so a 0.6 percent gain in labor productivity would have the same bottom-line effect as eliminating the energy bill. But we routinely see not a 0.6 but a 6 to 16 percent gain in labor productivity in efficient buildings with better thermal, visual, and acoustic comfort. When people can see what they're doing, hear themselves think, breathe cleaner air, and feel more comfortable, they do more and better work. We also see 40 percent higher retail sales in well day-lit[1] stores, 20-odd percent faster learning in well day-lit schools, and better clinical outcomes in green and efficient hospitals. These often overlooked side benefits are frequently worth tens or hundreds of times more than the actual reduction in energy costs.

For instance, a famous aerospace building designed for day lighting gave a far faster payback than expected, because it spurred 15 percent higher productivity and 15 percent less absenteeism. The higher productivity and reduced overhead of the green building gave the company a competitive advantage in a tough contract bid. Winning that contract generated enough profit to pay for the whole building. When the *Wall Street Journal* was writing its third article about the building, the *Journal's* reporter called me and said, "They've clammed up. I can't get any data. Can you find out what's going on?" Well, the CEO had realized that the building was an important source of competitive advantage and that they'd already said way too much about it.

The *Quarterly*: Do you see any regional trends in the ways companies behave?

Amory Lovins: Yes, there are some important differences. For example, motors are generally oversized, which makes them costlier and less efficient. Why are the motors oversized? Because the sizing is seldom well calculated or based on measurement. Then the size is marked up by several successive approval layers. Nobody got fired for making a motor too big—only for making it too small—so everybody adds another safety margin. But this matters because a big motor uses its own capital cost's worth of electricity every few weeks.

In Japan, despite its generally superior efficiency, most industrial motors are more oversized than they are elsewhere. Why? Because there are more layers of bureaucracy marking it up. Yet in Japan, if I go into a factory and ask the chief engineer about a specific motor, he will call over a colleague who can tell me all its

performance numbers throughout its life. In an American factory, even if the motor were nearer to the right size, the engineers might not have any measurements, so they're flying blind. Industry in the United States wastes billions of dollars a year on motors damaged by bad repairs that no one knows about, because the performance of motors isn't measured in a systematic way.

The motor practices in Western Europe are generally better than those of Japan and the United States. Cogeneration—combining power production with useful heat recovery to cut cost, fuel, and emissions by about half—is generally much more prevalent too. But big, cheap motor system savings can be found across all geographies.

The *Quarterly*: In your experience, to what extent can reducing carbon emissions be as financially attractive for businesses as reducing energy consumption?

Amory Lovins: Energy efficiency is the most important part of a profitable carbon strategy, but carbon emissions also depend on what kind of energy you use. Early movers in more diverse, dispersed, renewable or other low-carbon forms of energy are finding strong competitive advantage. These choices may, for example, insulate you from energy supply problems such as power failures or gas interruptions. They can eliminate fuel price volatility. And they can earn you carbon credits that you can sell to your competitors.

Interface, a global manufacturer of carpets and interior furnishings, is a great example. They built the least oil-dependent cost structure in the industry while cutting their greenhouse gas emissions by 82 percent in 11 years. With today's oil prices, feedstock costs and fuel costs are killing the company's competitors, but Interface is nearly indifferent to these costs. A quarter of its profit comes from systematically eliminating waste. Its strategic goals include using zero fossil fuel—taking nothing, wasting nothing, doing no harm, and doing very well, at the expense not of the Earth but of competitors.

The *Quarterly*: What should companies be thinking about when it comes to alternative energy?

Amory Lovins: I don't think most executives realize that a sixth of the world's electricity and a third of new electricity now come from micropower—by which I mean on-site or decentralized energy production, such as waste-heat or gas-fired cogeneration, wind and solar power, geothermal, small hydro, and waste- or biomass-fueled plants—rather than from central thermal stations. Micropower is beating the central model because it's cheaper and has far lower financial risk; it now provides from one-sixth to over half of all electricity in 12 industrial countries. The United States lags with 6 percent.

What about the alleged nuclear renaissance? In 2006, nuclear's added net capacity—1.44 gigawatts—was less than that of solar cells and a tenth that of wind power. Micropower added 43 to 58 gigawatts and surpassed nuclear's output. Distributed renewables alone got $56 billion of private risk capital. Nuclear, as usual, got nothing: it's only bought by central planners. The world now has more wind capacity than the United States has nuclear capacity. In addition, the United States in 2007 added more wind power than it has added coal power in the past five years combined—or than the world added nuclear power over the same period. For anybody who takes the market seriously, what part of that story don't you understand? These market trends also are good for our climate because new nuclear power buys you two to ten times *less* coal displacement per dollar than does micropower or improved end-use efficiency, and at a pace that is significantly slower.

The *Quarterly*: What role do you see for regulators in promoting energy efficiency and low carbon emissions?

Amory Lovins: Traditional environmental regulations are becoming antiquated. Over time, the companies those rules are directed toward will go out of business, having spent too much money creating waste and emissions that nobody wants. To focus our minds on why we produce waste in the first place and how to design waste out, we should call it "unsaleable production."

We increasingly need policies that support, and don't distort, business logic. New cars are a prime example. Most consumers' implicit real discount rate is probably upward of 60 percent, so if you buy a new car you only look at the first year or two of fuel savings. In your mind, long-term fuel savings are about as unimportant as whether to buy floor mats. But if the car lasts 14 years, society has a huge interest in your buying an efficient one. A "feebate"—a combination of fee and rebate—arbitrages that spread between the discount rates of individuals and society. When you go to the dealer, you see that vehicles of the size you want have various efficiencies. Purchasers of the inefficient ones will pay a corresponding fee. That revenue is then used to pay a rebate to buyers of the efficient models.

Automakers would actually make more money this way. After all, they will want their models to be more efficient so that buyers get rebates rather than paying fees. This often means adding more technology content, which has an inherently higher margin than the rest of the vehicle, so the total margin goes up. And of course, the manufacturers that do this first and best will also gain market share.

Feebates, successfully introduced for automobiles in 2008 in France and now proposed there for 20 other products, aren't a new idea but may have better odds of catching on in today's high-fuel-cost environment. The same logic applies to aviation. About half the airline industry can't afford to buy efficient new planes. If

you wanted to help airlines do that, a good method would be federal loan guarantees specifically for that purpose. But for every plane so financed, you would scrap an inefficient old plane that's parked in the desert. If those clunkers go into the air, they waste more fuel and retard the purchase and development of more efficient new planes. So they're worth more dead than alive.

And for the electricity sector—which emits two-fifths of fossil-fuel carbon, the same as the burning of oil does—the most important policy innovation is decoupling the profits of utilities from their sales volumes. Some states are adopting this policy, which allows the utilities to keep a small share of the savings they achieve for their customers. In other words, the utilities are rewarded for cutting your bill, not for selling you more energy.

The *Quarterly*: What are the implications for the regulatory strategies of companies?

Amory Lovins: Environmental strategy is not about manipulating regulatory systems to put your competitor at a disadvantage. It's about redesigning your company's processes and products so that regulation is relevant only to your competitor, not yourself. The real leaders are going to be smart companies that see the competitive advantage in leading energy transformation in their sectors. The private market is so dynamic that it will be an immensely more responsive, powerful, creative force than public policy, which will continue to play catch-up.

About the Authors

Matt Hirschland is a consultant in McKinsey's Brussels office, **Jeremy Oppenheim** is a director in the London office, and **Allen Webb** is a member of *The McKinsey Quarterly*'s board of editors.

Notes

[1] The light is derived from sources such as windows and skylights.

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