MR. GREEN

Environmentalism's most optimistic guru.

BY ELIZABETH KOLBERT

Amory Lovins's home, which also serves as his office and "bioshelter," is open for self-guided tours weekdays from nine o'clock in the morning until four in the afternoon. Built into a mountainside above Snowmass, Colorado, it has curved stone walls, a flat roof, and several sets of solar panels, some of which rotate to track the angle of the sun. The building's double-paned windows are lined with a polyester film that allows visible light to pass in but prevents thermal radiation from getting out, and the space between the panes has been filled with krypton. Although wintertime temperatures on the mountain routinely drop below zero, the building has no furnace; it is warmed by sunlight and by heat that has been collected in, among other places, a pond that lies between the Xerox machine and the dining room. The first time I visited, Lovins had just finished doing some laundry in his front-loaded, energy-saving washing machine. He took the damp clothes out of the washer and hung them in a little glass-ceilinged room. It was a bright blue morning, and Lovins predicted that the clothes would be ready to wear by nightfall. In the winter, if the sky is overcast, it can take up to two days for items like bluejeans to dry completely, but this is no problem, he assured me, provided one is capable of thinking more than twenty-four hours in advance.

Lovins is a short man with a salt-and-pepper mustache, a fringe of tousled black hair, and droopy brown eyes that give him a passing resemblance to Einstein. He wears Coke-bottle eyeglasses, a necklace of turquoise beads, and a watch that is supposed to prevent jet lag by sending out an electromagnetic signal exactly the same frequency as the earth's. He is routinely described, even by people who don't particularly like or admire him, as a "genius."

Lovins first came to national attention in 1976, when he was twenty-eight. In an essay published in *Foreign Affairs*, he asserted that the United States could completely phase out its use of fossil fuels and do so not at a cost but at a profit. "We stand here confronted," he wrote, quoting Pogo, "by insurmountable opportunities." At the time, the country was in the midst of what might now be called the first energy crisis, and the article created a stir; testifying on Capitol Hill, Lovins emerged as the demand-side management version of a rock star. Symposia were held to debate his ideas, and critiques were published by, among others, the physicist and Nobel Laureate Hans Bethe. (Lovins, in turn, wrote a response twice as long as Bethe's critique, and Bethe conceded several points.)

Thirty years later, the world faces another energy crisis, and Lovins still sees limitless opportunity. He maintains that the U.S. can eliminate its use of oil by 2050, even while reducing its coal and natural-gas consumption, enjoying unprecedented prosperity, and preserving the Arctic National Wildlife Refuge. Although Lovins was one of the first to appreciate the dangers of global warming, he believes that the problem seems so daunting only because those studying it have got the math wrong. "Climate protection, like the Hubble space telescope, has been spoiled by a sign error," he told me.

"I don't do problems," Amory Lovins says. "I do solutions."

Lovins is a prolific writer—of books, of articles, and of technical treatises. During my first visit with him, he informed me that he had picked out a few of the most important ones for me to take home: papers on topics like microgeneration, "superefficient" building practices, and data-center design were arranged in stacks that covered nearly the entire surface of a large dining-room table. That day, we ended up talking for several hours, and as I was packing up my things to go Lovins went to check on his laundry. It was nearly dry, he reported cheerfully. As I was driving back down the mountain in my rental car, it occurred to me that Lovins might be the most impractical person I had ever met. Then it occurred to me that he might be the only truly practical one.

This year, Americans will consume close to four trillion kilowatt hours of electricity. In addition, we will burn through a hundred and forty-three billion gallons of gasoline, which at current retail

prices will cost us some three hundred and sixty billion dollars, and twenty-six billion gallons of jet fuel, worth fifty billion dollars. To heat our homes and businesses this winter, we will purchase sixty-two billion dollars' worth of natural gas and heating oil, and just to grill our weenies we will buy some seven hundred and seventy-one million dollars' worth of charcoal briquettes. In 2007, total energy expenditures in the U.S. will come to more than a quadrillion dollars, or roughly a tenth of the country's gross domestic product.

With so much at stake, basic economics suggests that any significant inefficiencies should have been wrung out of the system long ago. It follows that further efforts will cost more than they will return. This reasoning is pervasive in the U.S., its most prominent spokesman being Vice-President Dick Cheney, who once dismissed energy conservation as a "sign of personal virtue." Lovins's fundamental premise is that this fundamental premise is wrong.

"You know, there's this old joke about the economist who's taking his mannerly granddaughter for a walk," he told me. "She says, 'Oh, Grandpa, I see a twenty-dollar bill lying in the street. May I go pick it up, please?' He says, 'Don't worry, my dear. If it were real, somebody would have picked it up already.'" Lovins likes to say that he takes economics "seriously, not literally." In his view, the streets are littered with twenty-dollar bills.

Lovins makes his living as the C.E.O. of the Rocky Mountain Institute, a consulting firm that he founded twenty-five years ago with his wife at the time, Hunter. R.M.I. used to operate out of Lovins's Snowmass home; in recent years it has outgrown these quarters—it now employs more than fifty people—and has expanded into new offices, some in Boulder and the rest down the road from his house, in a building that once belonged to a foundation created by John Denver. Lovins calls the firm an "entrepreneurial nonprofit," and its stated goal, which he often recites word for word, is to foster "the efficient and restorative use of resources to make the world secure, just, prosperous, and life-sustaining." Some of R.M.I.'s clients embrace this goal in its entirety, others at best selectively. (While I was visiting Lovins, he delivered the "efficient and restorative" spiel to a representative of the Singaporean government who had come to discuss manufacturing; her response was to giggle nervously.)

R.M.I., for its part, does not demand commonality of purpose. In "Why We Work with the Military," an essay posted on R.M.I.'s Web site, Lovins rejects the criticism—sometimes voiced by his own employees—that by consulting for the Department of Defense the institute is simply helping to kill people in a more energy-efficient manner. "A molecule of oil burned or carbon dioxide released has the same consequences no matter who used it," he observes. Other R.M.I. clients have included San Diego Gas & Electric, Royal Dutch Shell, and Anglo American PLC, one of the world's largest mining companies. A few years ago, Texas Instruments hired R.M.I. to help design a new chip-manufacturing plant in Richardson, Texas. It is expected to use twenty per cent less energy and thirty-five per cent less water than a typical chip factory of comparable size. It also cost thirty per cent less to build.

"Amory doesn't take a bullying, negative approach," Paul Westbrook, Texas Instruments' manager for sustainable development, told me. "He just says, 'Here's a better way, and here's why it works.' And you think, Well, we'd be kind of dumb not to do that." One of the ways the new Texas Instruments plant will save energy is by capturing heat that normally would have been discarded as waste. "We implemented heat recovery, and, lo and behold, we didn't need as many boilers," Westbrook said.

A lot of Lovins's ideas sound radical and futuristic—ultra-light cars made of carbon fibres, vehicles that generate electricity when they're not on the road, an economy powered by hydrogen. At the same time, he is a passionate advocate of what he calls "good, old-fashioned Victorian engineering," and believes that a great many problems can be solved using high-school physics. (Lovins can spend hours describing the energy savings that follow from steps as simple as increasing the diameter of pipes.) This combination of high- and low-tech enthusiasms makes his outlook difficult to categorize. Once, when I casually used the phrase "thinking outside the box," Lovins interrupted me. "There is no box," he said.

Perhaps R.M.I.'s most influential client these days is Wal-Mart. Just to cart around goods that it sells in its stores, the

company employs some sixty-eight hundred trucks, which annually consume at least a hundred and twenty-five million gallons of diesel fuel. In 2005, after consulting with Lovins, Wal-Mart announced plans to double its fleet's fuel efficiency over the next ten years, from an average of six and a half miles per gallon to thirteen. Already, all of the company's trucks have been outfitted with auxiliary power units so that the driver doesn't have to keep the engine idling just to run the air-conditioner.

"In a room of ten people talking about why it can't be done, Amory is the one working on the five ways to get there," Andy Ruben, Wal-Mart's vice-president for corporate strategy and sustainability, told me.

"I don't do problems" is how Lovins once put it to me. "I do solutions."

Lovins, who is fifty-nine, grew up in towns along the Eastern Seaboard; when he was a child, his family moved from Silver Spring, Maryland, to Elmsford, New York, and then from Montclair, New Jersey, to Amherst, Massachusetts. His father, who designed optical equipment, spent a lot of time in his home workshop, tinkering, and in this way Lovins, too, became interested in gadgets. While he was still in high school, he built a nuclear magnetic-resonance spectrometer in his basement, and discovered what he calls a "peculiar and still unexplained solid-state effect" having to do with cobalt. When he went off to Harvard, he helped pay his way by doing consulting work in experimental physics for, among others, the Lincoln Laboratory at M.I.T. Lovins enjoyed college—in addition to physics, he studied law, linguistics, and chemistry. But when, in his junior year, he was told he would have to complete a major he dropped out and moved to England. He attended Oxford until he was once again pushed toward a prescribed course of study, at which point he quit school again.

By this time—1971—Lovins had come under the influence of David Brower, the charismatic founder of Friends of the Earth, and he went to work for the organization in London. One of Britain's largest mining companies, Rio Tinto, announced a plan to mine for copper in a national park in Wales, and at Brower's urging Lovins spent a year writing a book about the park. The book, "Eryri, the Mountains of Longing," was instrumental in blocking Rio Tinto's plan. In the process of writing it, Lovins began to question the utility of his earlier research. (Today, Rio Tinto is a client of R.M.I.)

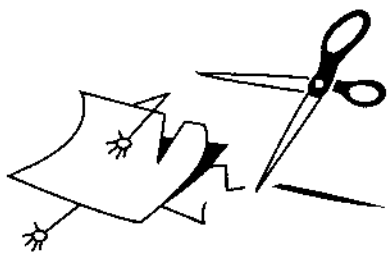
"It gradually occurred to me that the problems I was working on, whether they were tertiary structure of proteins or straight physics, were interesting but not very important," he recalled. "Even understanding mitochondrial-membrane kinetics, which I briefly dabbled in, would be not nearly as important as solving basic problems of energy resources, environment, development, and security. Because it didn't much matter how well we understood these other matters if we weren't here."

Much of Lovins's early work centered on atomic energy. He wrote a series of papers arguing that the whole "atoms for peace" idea was misguided: there was no way to promote nuclear power without also promoting nuclear proliferation. (One of these papers spent two years under review by the U.S. government, which feared that Lovins had drawn the connection between processed fuel and bombmaking a little too clearly; the paper eventually appeared in *Nature*.) In his 1976 *Foreign Affairs* article, which was titled "Energy Strategy: The Road Not Taken?," Lovins urged that the U.S. stop exporting nuclear technology and, simultaneously, that it phase out its own atomic-energy program. In the same piece, he warned that some of the alternatives to nuclear power were no less dangerous. At a time when the phrase "global warming" was barely in circulation, he observed:

> The commitment to a long-term coal economy many times the scale of today's makes the doubling of atmospheric carbon dioxide concentration early in the next century virtually unavoidable, with the prospect then or soon thereafter of substantial and perhaps irreversible changes in global climate. Only the exact date of such changes is in question.

Lovins's opposition to both nuclear and coal-fired plants raised an obvious problem. How did he expect an energy-intensive economy like the U.S.'s to function? The way out of this bind, Lovins argued, was to reimagine it. People weren't interested in energy for its own sake but, rather, for the benefits—hot showers, cold drinks, dry clothes—that it conferred. If Americans could get the same benefits using less energy, then they would, in effect, have found a new energy source. Meanwhile, instead of building large centralized power stations, they could gradually shift to localized sources of renewable power, like solar cells. Lovins labelled a future dominated by an ever greater number of ever larger power plants "the hard path"; the alternative he called "the soft path."

"The hard path entails serious environmental risks, many of which are poorly understood and some of which have probably not yet been thought of," he wrote. "The soft path . . . hedges our bets. Its environmental impacts are relatively small, tractable and reversible." Several years later, perusing a report put out by the Colorado Public Utilities Commission, Lovins came upon a misprint: someone had typed an "n" for an "m" in the word "megawatt." He coined another new term: "negawatt." A negawatt is a watt of electricity that does not have to be generated because an energy-saving measure has obviated the need for it. By replacing a seventy-five-watt incandescent light bulb with a fourteen-watt compact fluorescent bulb, an individual can, for example, produce sixty-one negawatts. By replacing ten incandescent bulbs with ten compact fluorescents, the individual can generate six hundred and ten negawatts. Negawatts tend to produce more negawatts; for instance, a house lit with compact fluorescents requires less air-conditioning, since fluorescent bulbs emit a fraction of the heat of incandescents. The same principle can be applied to all forms of energy, including oil. Lovins likes to call the United States the "Saudi Arabia of nega-barrels."



This past fall, Lovins came to Manhattan for a conference sponsored by former President Bill Clinton. The evening before the conference began, I went out to dinner with him at a Japanese restaurant in midtown. We were ushered into a room in the back. A cone-shaped light fixture hanging from the ceiling cast

a pallid gleam onto the table. A few feet away, a row of recessed lights threw circles of brightness onto nothing in particular.

"This is what happens if your lighting is designed by electricians," Lovins told me, glancing around. "Who wants spots of light on the carpet?" He noted that all the bulbs were incandescents, and that the bulb hanging over the table was on a dimmer, which further reduced its already minimal efficiency. Lovins estimated that a better-designed system could cut the restaurant's lighting costs by eighty per cent. "There's upwards of a hundred giant power plants to be saved by proper lighting systems," he observed, before turning his attention to the sushi menu.

"Could we up the dosage? I still have feelings."

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To spend time with Lovins is to see the world as one long string of bad decisions. Waste and profligacy are everywhere: in inefficient lights, heat-leaking windows, gas-guzzling trucks, poorly designed eateries. It's not that people are stupid, exactly. It's that their intelligence is limited. When they make decisions, they tend to worry only about their own self-interest, which they see in such narrow terms that they miss the larger opportunities all around.

Take, for example, the electrical system of an average office building. "If we were to dig into the ceiling of most offices where the wiring is for the lighting, we'd probably find that the wire size was specced by the low-bid electrician to meet the National Electrical Code," Lovins told me. "The code says you need wire so fat for so much current. Well, it turns out that wire-size code is meant to prevent fires. What would be economically optimal in terms of resistance losses would be wire twice as fat, which means four times as much copper. Now, the electrician isn't going to pay your electric bills, right? If you had such an altruistic electrician that they were willing to put in four times as many pounds of copper to get you a one-year payback on your electric bills, they wouldn't get the job, because they wouldn't be the low-bid electrician anymore."

The problem here is what's known as a split incentive, but might better be called a mis-incentive. If the parties figured out how to divvy up the savings, they could both make money, but, because of ingrained habits, or a lack of creativity, these savings are never realized.

"Let me give you a specific case—a two-hundred-thousand-square-foot curtain-wall office tower near Chicago," Lovins said. "Chicago is cold in the winter and hot in the summer, and this was a very uncomfortable building all year round. In the winter, it had frost growing on the walls. The window seals were starting to fail, because they were twenty years old, so they were going to have to reglaze the whole glass curtain wall. Normally, you would put in the same glass that's already there, which in this case was dark, double-bronze, heat-absorbing glass with a gray film. It let in nine per cent of the light, so the place was as gloomy as a cave. We designed a super-window that would let in nearly six times as much visible light but a tenth less unwanted heat. It cost an extra seventy-eight cents per square foot of glass. If you combined those super-windows with retrofits that bounced the daylight all the way through the floor plate and with very efficient lights and lighting controls and office equipment, you could cut the peak cooling load on the hottest afternoon more than fourfold. That meant that instead of just renovating the big old air-conditioning system you could replace it with one that's four times smaller. And that would cost two hundred thousand bucks less, and that money could then pay for the better windows and the retrofitting of the lighting and other improvements. So you'd end up saving three-quarters of the energy at a slightly lower cost than the regular renovation—the payback time was minus five months. So we proposed that to the owner. They liked it, and we all thought it was going to be implemented. Surprise! It never happened. Why not? Because that particular building was controlled by a leasing agent whose incentive was deal flow. Whenever a floor got leased up, the agent would pocket a commission. And, not wanting to interrupt the commissions for a few months, the leasing agent vetoed the retrofit.

"It was a lovely lesson in how real such perverse incentives are—and how pervasive," Lovins went on. "Each one is a showstopper, and each one is a business opportunity."

The Clinton Global Initiative is part of the Renaissance Weekend–Sun Valley–Davos circuit, and it combines, freely, elements from the Council on Foreign Relations and the *Vanity Fair* Oscar party. (On my way to meet Lovins, I happened upon Richard Branson salaaming, "Wayne's World" style, to Archbishop Desmond Tutu.) The day the conference began, Lovins slept in, missing speeches by Bill Clinton and Laura Bush, but showed up for a working lunch devoted to energy and climate change. He was wearing a black suit and carrying a duffelbag-size briefcase. At his table were an executive from Cisco, the head of a Norwegian philanthropy, and the chairman of a group called SmartTransportation.org, who told me that Lovins's work had inspired him to form the organization. The lunch was served on plates made from organically grown bamboo, and the table linens had been woven from compostable hemp. While the fair-trade coffee was being served, Warren Buffett walked in. Lovins unzipped his case, which turned out to contain, in addition to a laptop, a small library of R.M.I.-produced books and papers. He picked out a three-hundred-page book titled "Winning the Oil

Endgame" and made a beeline for Buffett. When Buffett declined to take the volume—he asked that it be sent to him at his office—Lovins seemed disappointed. But he recovered almost immediately. "That's smart of him," he whispered to me. "He doesn't take anything too heavy."

After lunch, everyone switched tables. This time, Lovins ended up sitting with several executives from Ford; Purnendu Chatterjee, the head of a private equity firm; and William McDonough, one of the preëminent "green" architects in the United States. In the front of the room, executives from the Swiss Reinsurance Company and DuPont were holding a panel discussion on energy-saving companies with the former NATO commander General Wesley Clark. Lovins spent most of the discussion sending e-mails. One was to the Norwegian philanthropist he had just met. The philanthropist owned a cheese farm; Lovins attached a paper on energy-efficient dairy farming. When General Clark said something he disagreed with, Lovins sent him a long e-mail outlining why. During a brief break in the program, Lovins sought out Thomas Friedman, the *Times* columnist, and Rick Fedrizzi, the president of the U.S. Green Building Council, to give them a PowerPoint on a school R.M.I. had redesigned in Brazil. According to Lovins, the redesign had not only saved money but also improved students' test scores and, somewhat more mysteriously, their dental health. During another break, he presented the mayor of San Francisco, Gavin Newsom, with an inch-thick pile of articles. As Newsom took the articles, he laughingly alluded to an equally thick pile of reading material Lovins had handed him several weeks earlier, in Davos.

"Amory is my hero," José María Figueres, the former President of Costa Rica, told me. "He is just so much fun. I love the way he takes advantage of the opportunity to push his agenda in the most"—he paused for a moment—"wholesome way."

After the formal program ended, Lovins stayed on to talk to Purnendu Chatterjee. Among many other things, Chatterjee's firm holds a controlling interest in a refinery in India. Lovins told him that typically, in a refinery retrofit, R.M.I. had been able to cut energy use by more than forty per cent. "Wow!" Chatterjee exclaimed. He said that he was thinking of building a new refinery. Lovins licked his lips and handed Chatterjee a stack of literature.

That night, there was a huge gala for conference participants at the Museum of Modern Art. Lovins arrived with another copy of "Winning the Oil Endgame" under his arm. It's not easy to eat a plateful of canapés while holding on to a three-hundred-page book, but somehow he managed. He chatted with the head of an Australian automotive company about vehicle efficiency; to an official of Habitat for Humanity about low-cost homes that can be made from bamboo; and to an executive from Coca-Cola (another R.M.I. client). At one point, I told Lovins that a man who happened to be standing near us was one of New York's largest real-estate owners. Lovins headed straight for him. He delivered his usual pitch about making money by saving energy. The man pointed out that as a landlord he didn't benefit from gains in efficiency; his tenants did. Lovins advised him to restructure his leasing agreements so that both parties could share in the gains. The man took Lovins's business card.

As the evening wore on, and most people fell to drinking and schmoozing with their friends, Lovins continued to work the room. When the dessert trays were being wheeled out, I lost track of him. By the time I caught up with him again, he had managed to give away his book.

"Winning the Oil Endgame" is a characteristic Lovinsian project—ostensibly hard-nosed and at the same time shamelessly utopian. The book's foreword is by the former Secretary of State George Shultz, who notes that "Amory Lovins loves to be a bull in a china closet—anybody's china closet," and the epigraph is by Antoine de Saint-Exupéry: "If you want to build a ship, don't drum up the men to gather wood, divide the work and give orders. Instead, teach them to yearn for the vast and endless sea." The book's premise is a variation on the theme Lovins first laid out back in 1976, this time applied to petroleum. The U.S., he argues, can cut its oil imports to zero by 2040, eliminate oil use entirely by 2050, and make money in the process.

In December, Lovins travelled to Washington, D.C., to give a talk on the book. I met him at the airport, and on the way into town we stopped at his hotel to drop off his suitcase. When Lovins opened the door to his room, he was met by a blast of hot air. The room had its own thermostat, which had been set to seventy-nine degrees. A lamp by the desk was burning cheerfully. Lovins peered under the shade. "It's an incandescent," he said, switching it off.

Lovins's speech took place in a hotel not far from the Pentagon. The crowd that greeted him in the ballroom was an eclectic mix: representatives from organizations like the Northern Virginia Con-

servation Trust and the Post Carbon Institute were sitting next to officials from the Defense Department and the Government Accountability Office. (The research for "Winning the Oil Endgame" was partly funded by the Office of the Secretary of Defense.)

Lovins began with a slide showing an Army tent on a patch of sand—presumably in Iraq or Afghanistan. The tent was completely uninsulated. In front of it stood a five-ton air-conditioning unit, and somewhere in the distance an oil-fired generator was producing the electricity to power the unit. The oil for the generator had had to be hauled a great distance, at great peril to those guarding it, and yet most of the energy was going, in Lovins's words, into "air-conditioning the desert."

From the desert, Lovins turned to the seas to tell one of his favorite stories, about whale hunting. "In 1850, the fifth-biggest industry in our country was whaling, and most houses were lit by whale-oil lamps," he said. "But as whales started to get shy or scarce and the price of whale oil drifted up, this started to elicit competition, particularly from coal-based oil and gas." By 1859, these competitors had seized five-sixths of the whale-oil-lighting market. "This was a real shock to the whalers. They never expected to run out of customers before they ran out of whales. But that's what happened, and they were soon reduced to begging for subsidies on national-security grounds.

"Oil feels a little like this now," Lovins continued. "We've spent over thirty years amassing a very powerful portfolio of new ways to save oil or substitute for oil, but no one had bothered to add it up. And when we did so we found it was enough to save all the oil we use and more."

The largest share of oil consumed in the U.S.—nearly seventy per cent—is eaten up by transportation. By Lovins's reckoning, most of that is wasted. The power needed to propel a car is a function of its weight, so building a vehicle out of steel means using energy largely to move metal. Lovins proposes making cars instead out of ultra-light carbon composites. An ultra-light car with a Prius-style hybrid engine could—in theory, at least—get upward of seventy miles per gallon. Lovins has been pushing an ultra-light vehicle of his own invention, which he calls a Hypercar, for the past fifteen years, and has created a company, named Fiberforge, to license the technology needed to manufacture the necessary parts. But so far no one has been willing to finance a prototype. (Lovins himself gets around in a hybrid Honda Insight, which sports the bumper sticker "I'd rather be driving a Hypercar.")

According to Lovins, by switching to ultra-light vehicles (including airplanes) and implementing a variety of other "end-use efficiency" technologies the U.S. could eliminate half of its oil needs. It could eliminate another twenty per cent by substituting biofuels for oil, and the last thirty per cent by replacing oil with natural gas. (Saving enough natural gas to replace a third of the country's oil could be easily accomplished, he maintains, by, among other things, reducing electricity consumption.) The cost of eliminating oil use entirely would, by his calculations, come to half of what, by official forecasts, would be spent on purchasing it. Meanwhile, the U.S.'s CO_2 emissions would drop by twenty-five per cent.

"We know this sort of thing works, because we've done it before," Lovins assured the crowd in Washington. He gestured toward a graph of oil consumption that had been projected onto a screen behind him. "Look at how steeply oil use and imports fell the last time we paid attention, which was from 1977 to 1985. In those eight years, the economy grew twenty-seven per cent while oil use fell seventeen per cent.

"All this can be done with all the same economic growth and the same growth in driving, in flying, in huge houses, and so on, that's in the government forecasts," he continued. "No new invention and no changes in life style. And it could all be done without new taxes, mandates, subsidies, federal laws, or anything else either party doesn't like or could mess up." Lovins went on in this vein for nearly ninety minutes, ending with a quote from Marshall McLuhan: "Only puny secrets need protection. Big discoveries are protected by public incredulity."

Lovins's talk had gone on so long that there wasn't much time for Q. & A. The few questions asked—most of them comments, really—ranged from mildly skeptical to aggressively so. One man demanded to know why Lovins would not "accept the fact" that there had been many advances in nuclear-power safety. A second man stood up and said that as long as he could afford it he was going to continue to drive his Jeep, his Jaguar, and his Harley. He said that the only way he could see to move the U.S. off oil was to raise the price. Afterward, while Lovins was handing out more copies of "Winning the Oil Endgame," I got to talking to David Goldstein, the president of the Electric Vehicle Association of Greater Washington. He said that he did not expect to see ultra-light cars on the road anytime soon.

"Amory doesn't understand some of the practical realities of how the world works," he told me. "I want to believe him, but . . ."

Lovins's promise that apparently intractable problems—oil dependence, global warming, nuclear proliferation—can be profitably resolved is both the great appeal of his approach and its biggest liability. Much of what he recommends sounds just too good to be true, the econometric version of "Shed pounds by eating chocolate!"

John Holdren, the president of the American Association for the Advancement of Science, has known Lovins for more than thirty years and considers him a friend. He says that Lovins's contention that a great deal more work could be wrung from the energy we consume is "absolutely unassailable."

"Amory has been more energetic, more persistent, and more creative in thinking about ways to make this happen than anyone else," he told me. "But Amory has always believed—seemed to believe—that free-market economics alone, rationally applied, will solve the problem. And I don't believe that." Holdren observed that current projections suggest that global energy consumption will reach eighteen hundred exajoules by 2100. In order to hold atmospheric CO_2 levels at a "tolerable" level, the world will need to produce five times the amount of energy it now gets from fossil fuels, using sources that produce no carbon dioxide. The only conceivable way to achieve this, he said, is to make the use of fossil fuels much more costly. "We just aren't going to do it unless there's a price on carbon."

Marty Hoffert, a professor emeritus

of physics at New York University who has written extensively on energy demand and global warming, is also on cordial terms with Lovins. "I support virtually all of Amory's calls for efficiency," Hoffert told me. "It's an important thing to have people thinking about efficiency. But I don't think that's going to get us there. If we do things more efficiently, people may just consume more."

This hypothetical problem is not merely hypothetical. Since the mid-nineteen-seventies, the American economy *has* grown steadily more energy efficient. What's called the economy's "energy intensity"—the ratio of B.T.U.s to G.D.P.—has been dropping by roughly one and a half per cent a year, for a total of nearly forty-six per cent over three decades. These savings have, however, been more than offset by people thinking up new ways to use energy, so that in that same period the country's total energy consumption has risen by thirty-nine per cent and its CO_2 emissions by roughly the same proportion.

Meanwhile, the example Lovins likes to point to—the drop in oil use in the early nineteen-eighties—is, at best, equivocal. As Lovins notes in his book, what made people "pay attention" to oil consumption was the 1973 Arab oil embargo and the second, even more severe 1979 oil shock. Part of the drop was due to structural shifts in the economy away from oil-intensive activities. Part of it was fuel substitution by both individual consumers and industry, as homeowners and factories switched from oil to, for example, natural gas. The largest part of it was increased fuel efficiency in both automobiles and buildings, led by the creation of federal auto efficiency standards in 1975. And, finally, part of it was a change in consumer behavior as Americans bought smaller cars and turned down their thermostats. Thus what Lovins offers as a demonstration that federal regulation and new taxes are unnecessary could just as plausibly be seen as evidence of exactly the opposite.

Lovins knows all these arguments and is unmoved by them. "Sometimes after I give a talk, some folks get irked that I talk only about solutions and not about problems," he told me. "And typically someone will get up and give a long riff about all the bad things happening and all the suffering in the universe, which is basically true. And the only way I've found to deal with that sincere and well-founded concern is to let the person run down after a while and then ask as gently as I can whether feeling that way makes them more effective.

"What I think people are most hungry for—and trying hardest to locate—is practical and profitable solutions. And that's where I can make a distinctive contribution. It's a very pragmatic approach."

After his speech, Lovins still had, by his accounting, eight hours of work remaining on a report that was due the following day. I went with him to his hotel to ask a few last questions. This time, when he opened the door the room was freezing; by turning down the heat he had apparently turned on the air-conditioner. I asked Lovins how his plan to save the world through energy efficiency could accommodate the open-ended nature of human desire. If, as he claims, conservation is profitable, what was to stop the profits from going straight toward more consumption?

"It doesn't automatically prevent that," he said. But, he added, "you might plow the money back into more efficiency rather than more powerboats and helicopter skiing. After all, you don't rewash your clean clothes in the cheaper-to-run washing machine, because your clothes are already clean. At some point, I think you get jaded by continuous trips to Bali.

"Your neighbors might point out that what you're doing is increasingly antisocial," he continued. "On a moral or spiritual level, at some point you may discover you're not all that happy having more stuff or more travel. Trying to meet nonmaterial needs by material means is stupid and futile. Every faith tradition that I know decries materialism.

"Markets are meant to be greedy, not fair. Efficient, not sufficient. They're very good at short-term allocation of scarce resources, but that's all they're good at. They were never meant to tell you how much is enough or how to fulfill the higher purpose of a human being."

It was getting late, and I was keeping Lovins from his report. As I prepared to leave, he recalled another line, this one from Wallace Stevens: "After the final no there comes a yes and on that yes the future world depends." ♦