



RMI *Solutions* NEWSLETTER

BAD NEWS, GOOD NEWS

WHEN IT COMES TO CLIMATE, UNEXPECTED
FLIP-FLOPS CUT BOTH WAYS

Here in Colorado, we're coming to the end of our mildest winter in history.

Snow depths were far below average for the second straight year. One of our local ski areas was rumored to be on the verge of closing in January, just before an unprecedented two-week thaw broke.

We expect the occasional dry winter, but two in a row is worrying. Most folks put it down to La Niña—we've all become experts lately in prognosticating La Niñas and El Niños—but few care to broach the larger, scarier subject of climate change.

No one wants to think that a two-year La Niña might be part of a larger pattern.

All around the country, people have their weird-weather anecdotes. They recall the colder temperatures, the deeper snows of childhood (or did the snow just seem deeper to a child?). They shake their heads about killer tornadoes in February and mounting hurricane damage claims (or is it just that more people have insurance now?). The pessimists interpret each blizzard and heat wave as evidence of climate change, while the optimists say it's all in a day's work for Mother Nature.

Aspen Mountain in December 1999. The snow came late to almost all Western ski resorts. Photo: Ross Kribbs



THE HEAT IS ON

But there is no scientific doubt that the atmosphere is warming. The only questions are whether human activity is to blame—and even on that score there is almost no dispute among mainstream scientists—and how, exactly, the climate will change.

New evidence emerging in the past few months suggests that climate change may be even more rapid and serious than expected.

Depending on which study you read, 1999 was either the fifth or the sixth warmest on record globally (1998 was the all-time warmest). Seven of the ten warmest years since record-keeping began were in the 1990s, and analysis of tree rings, ice cores,

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and so on suggests that the decade was the warmest of the millennium. A National Academy of Sciences study released in January concluded that “the warming trend in global-surface temperature observations during the past 20 years is undoubtedly real and is substantially greater than the average rate of warming during the 20th century.”

Nature recently reported that the southern half of the Greenland ice cap—the second-biggest land-bound ice sheet on earth, after Antarctica—has shrunk substantially in the past five years. Antarctic ice shelves are breaking off in Rhode Island-sized chunks. Scientists analyzing data collected by nuclear submarines reported last November that the Arctic sea ice has lost 40 percent of its thickness in the past four decades. Other studies in recent years have revealed that the Alaskan permafrost is melting and that glaciers in Alaska, the Andes, and the Alps are receding at record rates.

Yet if the earth’s climate is a complex system that can suddenly flip, so too is human society.

The temperature data indicate that the rate of warming is accelerating. The reports of melting ice and permafrost carry even more disturbing implications, because they may be the harbingers of sudden flip-flops in the global climate-control system. Scientists speculate that an infusion of fresh water from melting ice sheets could cause dramatic, long-term shifts to ocean currents; a shift in the Gulf Stream, for

example, could make Europe’s weather much colder. Melting permafrost releases carbon dioxide and methane, further warming the climate. An ice-free Arctic Ocean could also “lock” into that condition.

Some experts believe that the mechanisms of climate change are already so far along that anything we do at this point will have little effect. They note that it takes a decade or more for the political system to react, several decades to retire climate-affecting infrastructure (such as power plants and factories), and many decades if not centuries for the climate to right itself again. When you see ice caps melting, they warn, the horse is already out of the barn.

DECARBONIZATION

Yet there is reason to be hopeful. If the earth’s climate is a complex system that can suddenly flip, so too is human society. A number of trends—some that RMI and colleague organizations have long been encouraging and predicting, others unforeseen—seem likely to converge to bring about faster-than-expected reductions in

human-caused greenhouse emissions.

To start with, there’s the long-term shift toward lower-carbon fuels. The industrial age has seen a steady progression from

wood to coal to oil to natural gas, each one producing lower carbon emissions per unit of energy released.

Coal is already defunct or on the way out in most of the world. Its use is now falling even in the United States, China, Russia, and Eastern and Western Europe. In all but a few centrally planned energy systems, almost all new power plants burn natural gas, not coal. Besides being more econom-

ical, the gas plants are also much more efficient—they convert up to 60 percent of the fuel’s energy into electricity, compared with 36–38 percent for coal plants—and the

CLIMATE

gas that they burn contains about half as much carbon dioxide as coal does. Increasingly popular combined-cycle gas plants, which recover waste heat, produce only a third the emissions of the best coal plants.

In the United States, most of these new plants are being ordered not by utilities but rather by entrepreneurial non-utility energy companies, which are much quicker to grasp the bottom-line benefits of new technologies. Utility restructuring is providing added incentives for non-utilities to enter the market, and giving a boost to market-driven “green power” programs (see page 21).

China, meanwhile, is defying the pundits who until recently were predicting its coal use would keep rising exponentially. Moving with a speed perhaps possible only in a command economy, the government is taking decisive action to reduce coal burning, primarily for health reasons. Its development of hydroelectricity with the notorious Three Gorges Dam is of course well known, but it’s also installing gas-fired plants and rapidly creating a national natural-gas infrastructure. A campaign to clean up Beijing’s air for the Party’s 50th anniversary has proved so successful that it’s been extended to four other major cities, with most of the effort going into restrictions on coal burning and conversion to natural gas. According to the World-watch Institute, China’s coal use actually declined by nearly 8 percent in 1999, as subsidies were removed and air-pollution standards tightened. Coal output is officially projected to fall by a further 12 percent this year—back to the 1986 level.

SHOP ONLINE AND SAVE— ENERGY THAT IS

Does the Internet economy use more electricity, or less? It's an interesting question, and Mark Mills and Peter Huber deserve credit for raising it in an article in *Forbes* last May. Too bad their answer was wrong—so provocatively so that it touched off a firestorm of controversy that took the rest of the year to resolve.

Mills and Huber's article, "Dig More Coal—the PCs are Coming," portrayed the Internet as a voracious energy hog, consuming 8 percent of U.S. electric output and growing at an unspecified but apparently rapid rate. "It's now reasonable to project that half of the electric grid will be powering the digital-Internet economy within the next decade," they claimed, requiring billions of dollars worth of new power stations. Such a conclusion wasn't altogether surprising, coming from Mills, a scientific advisor to the Greening Earth Society (a propaganda arm of the Western Fuels Association) and long active in promoting nuclear power, and Huber, author of *Hard Green* (see page 7).

Emails immediately started flying as energy experts from RMI, Lawrence Berkeley Laboratory, the Worldwatch Institute, and other organizations tried to track down Mills and Huber's sources and understand their methodology.

The consensus that emerged, after much detective work and number-crunching, was that Mills and Huber had overstated Internet electricity consumption by a factor of at least *eight*. It's hard to imagine how they could have been so far off, but it seems they grossly inflated average equipment power demands, ignored the rapid improvements in computer efficiencies,



assumed unrealistically high amounts of time spent online, and most seriously, assumed that all time spent on home computers was attributable to the Internet.

The silver lining to this sorry episode is that it prompted Joseph Romm of the Center for Energy and Climate Solutions to write an 80-page analysis of the Internet economy's impacts on energy consumption and greenhouse-gas emissions.

While cautioning that his calculations are based on incomplete data, Romm says his best guess is that the Internet saves about as much *electricity* as it uses—but reduces total *energy* consumption and greenhouse-gas emissions. Here's why:

■ **E-commerce replaces retail stores** with warehouses, which use one-sixteenth the energy. By 2007, it's expected to eliminate the need for about 5 percent of commercial building space, saving on construction-related energy too.

■ **Internet shopping saves delivery energy.** Surface delivery uses a tenth as much energy as an average trip to the store by car; even overnight air uses 40 percent less fuel. Some products—software and music, for example—can be "delivered" digitally over the Internet.

■ **Web advertising and catalogs** reduce the need to print and mail catalogs and direct mail pieces. That could save 2.7 million tons of paper annually by 2003, and cut greenhouse-gas emissions as much as taking 2 million cars off the road.

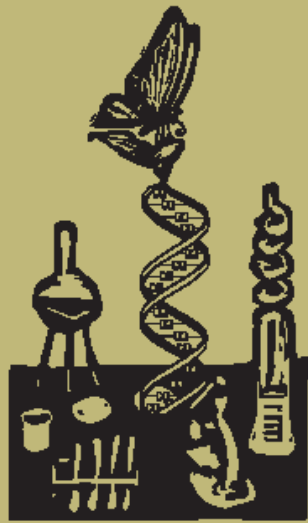
■ **Business-to-business e-commerce** (which is five to ten times larger than the more familiar retail side of the business) enables companies to reduce inventories, avoid overproduction and unnecessary capital purchases, and achieve greater output with less energy.

■ **The Internet promotes greater use of home offices**, enabling workers to avoid commuting and employers to reduce office space. The energy savings in transportation and office construction and operation more than offset the extra energy used in the home.

This is not to say that e-commerce is all good; by favoring big, central retailers, it undermines community-based businesses and local economies. Though Romm's article doesn't address this vital issue, no doubt we'll be hearing more about it anon.

"The Internet Economy and Global Warming," by Joseph Romm, is available from www.cool-companies.org.

TRANSGENIC AGRICULTURE



attack

OF THE GENETICALLY
MODIFIED
ORGANISMS

Every now and then the human race invents a big, flashy, silver-bullet technology that's beyond its ability to understand or control. We've done it again with genetically altered crops. A solution in search of a problem—in fact, a net producer of problems—transgenic crops show disturbing parallels with another expensive failure, nuclear power.

In both enterprises, technical ability has evolved faster than social institutions; skill has outrun wisdom. Both have overreached—too far, too fast, too uncritical. And both are unnecessary distractions from the simpler, cheaper, and more effective—though less monopolizable—alternatives.

The rise and fall of such technologies seems to go something like this:

1. Promoters promise public benefits. Commercial enthusiasm and pride,

bolstered by government promotion, draw huge investments. Advocates shield the promoters from political and market accountability, suppress dissent, and reject independent assessment. Rapid growth compromises regulatory independence.

2. Initial technical stumbles and troublesome questions elicit public concern, deflected by PR. Public concern increases as the more people find out about the innovation, the less they like it. The PR grows stronger but less persuasive. Whistleblowers raise awkward questions. Many bad surprises dwarf the few benefits.

3. Operational disappointments abound as it becomes clear that the technology's flaws are fundamental. Simultaneously, many people realize that the alternatives, often long known, actually work better and cost less.

4. Smart money and insurance

coverage exit. The product can be sold only by concealing its identity—a mockery of economic principles. Almost everyone realizes the business is dying of an incurable attack of market forces.

5. With insubstantial benefits, mediocre performance, real risks, and unrewarding economics finally undeniable, the technology fades away, leaving behind socialized hazards, failed firms, disappointed investors, delegitimized institutions, and a cynical public.

Where's the "You Are Here" sign for transgenics? Europe is already at stage 4. The United States is around stage 2, with stage 3 starting to emerge.

CONCERNS

Transgenic foods—also known as genetically modified organisms, or GMOs—are created when the genes of one species are spliced into another. In the past few years, biotech companies have used this technique to incorporate the insect-killing qualities of certain bacteria into patented new strains of corn, potatoes and other crops, and even the frost resistance of an arctic fish into strawberries. Monsanto, the leader in the field, has spent billions developing a line of crops with genetically enhanced resistance to its own Roundup weed-killer.

The use of transgenic seeds in agriculture has skyrocketed since their commercial introduction in 1996. Over half the world's soybeans, and a third of the corn, now contain genes borrowed from other forms of life. Thousands of new transgenic varieties are in the pipeline.

Promoters say transgenic crops represent the greatest hope for feeding the world's billions. The U.S. government, seeing the technology as a growth industry and key export, has vigorously defended it in international trade forums and taken a largely laissez-faire approach to regulation. And until recently, Americans, uninformed by labeling, seemed unconcerned.

Not so in Europe, where farmers see transgenic crops as an attack on their livelihood by transnational companies, and especially in Britain, where the eating public has learned to be skeptical after a string of food scares including mad cow disease. Many developing countries are opposed, too, accusing the biotech companies of making poor farmers dependent on the expensive new seeds and inputs, in the same way that some companies push infant formula to replace mothers' milk.

And then there are the concerns about the fundamental soundness of the science.

First, there is no convincing scientific basis for asserting either food safety or environmental safety: tests are few, short-term, seldom independent, and submitted to compromised regulators. No U.S. agency tests or certifies genetically modified foods' safety, which skates between jurisdictions. Many claims of safety rest on the simplistic assumption that one gene expresses one trait, so adding a gene will have no unexpected side effects. This now appears to be untrue.

But food safety may prove to be a lesser concern than ecological safety. Studies have shown that herbicide-resistance genes can escape to breed "super-weeds," and insecticide-making genes can kill beyond their intended targets. Spliced genes seem unusually likely to spread to other organisms: canola pollen can waft them more than a mile, and common crops can swap genes with related weeds. Gene-spliced *Bt* insecticide in corn pollen can kill Monarch butterflies; that insecticide, unlike its natural forbear, can build up in soil; and corn borers' resistance to it is apparently a dominant trait, so planned anti-resistance procedures won't work.

It could get worse. Division into species seems to be nature's way of keeping pathogens in a box where they behave properly (they learn that it's a bad strategy to kill your host). Transgenics may let pathogens

vault the species barrier and enter new realms where they have no idea how to behave. It's so hard to eradicate an unwanted set of wild genes that we've intentionally done it only once—with the smallpox virus.

Shotgunning alien genes into random sites in the genome is thus like introducing exotic species into an ecosystem. (Such invasives are among the top threats to global biodiversity today.) It's unwise to assume, as "genetic engineers" generally do, that 90-plus percent of the genome is "junk" because they don't know its function. That mysterious, messy, ancient stuff is the context that influences how genes express traits. It's the genetic version of biodiversity, which in larger ecosystems is the source of resilience and endurance.

Transgenic crops transform the rules of evolution. They align the development of plants not with their evolutionary success (survival and resilience) but with their economic success (profit)—survival of the fattest, not the fittest. Worse, gene splicing enormously accelerates the pace of biological evolution, from the millions of years Nature takes to test new "products" to the frenetic pace of next quarter's earnings report. This haste makes it impossible to foresee and forestall: errors become detectable only after they've taken on a life of their own, spreading and reproducing out of control.

DECLINE AND FALL

Public and scientific concern has caught up with transgenic agriculture much faster than it did with nuclear power. The past year has brought a series of stunning rever-

sals to this former technological darling.

Significantly, it was commercial pressures, not political ones, that turned the tide. Last May, in an influential report titled "GMOs are Dead," Deutsche Bank Research advised its investors to dump their stocks in transgenic companies. The report warned that public fears would force farmers and processors to sell their GM foods at a discount—not the premium prices they'd been led to expect—which would translate into a swift backlash against GM seeds.



American firms such as Gerber and Heinz have moved to protect their brands by announcing they'll avoid using GM ingredients.

That's exactly what has happened. Many international buyers now refuse to accept GM crops, drastically lowering demand for them and forcing their prices downward (while at the same time placing a premium on *non*-GM crops). The price spread swallows up the biotech companies' hoped-for profits. Following the lead of European companies, such American firms as Gerber and Heinz have moved to protect their brands by announcing they'll avoid using GM ingredients.

The technology that was supposed to be a boon for U.S. agriculture actually cost it \$1 billion in lost exports in 1999. (It would be interesting to know how much the U.S. farm crisis, which just prompted a \$7-billion Congressional bailout, was exacer-

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ENERGY

You'd think that boosters of nuclear power would have given up by now. What with ballooning costs, public resistance, weapons proliferation, and the political quagmire of waste disposal, the energy source that was supposed to be "too cheap to meter" has turned out to be too expensive to compete. Nuclear power has failed in the marketplace—in the United States,

do now would cause unacceptable environmental damage, including climate change and acid rain. Replacing dirty coal-fired plants with cleaner ones that burn natural gas will help, Rhodes and Beller say, but the only way to beat climate change is to meet most of the new demand with nuclear power. That's because nuclear plants emit no greenhouse gases or other air pollution (at least not directly:

Huber—that leaves more land for trees, which abate climate change by absorbing carbon dioxide. Not only is nuclear power without sin, it actually offers salvation.

Like any sales pitch, this one has a kernel of truth. A massive shift to nuclear power *would* help reduce greenhouse-gas emissions. But at what price? Don't expect Rhodes, Beller, and Huber to call your attention to the fine print. They make

nuclear power look like a bargain only by downplaying its costs, risks, and long-term consequences, while at the same time portraying the alterna-

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RETURN OF THE NUCLEAR SALESMEN

GLOBAL WARMING GIVES THEM A NEW SALES PITCH

there hasn't been a new plant built or ordered since 1978. Despite U.S. taxpayer expenditures of \$1 trillion, nukes deliver less energy than biomass (wood, ethanol, and other fuels derived from living matter). But the nuclear salesmen are knocking at the door again, peddling the same product but with a trendy new claim: it cures global warming. In an election year, they might just get some takers.

Richard Rhodes and Denis Beller make the hard sell for nukes to an influential policy audience in the January/February issue of *Foreign Affairs*. With world population growing and an increasing proportion of it gaining access to electricity, they argue, "even with vigorous conservation, world energy production would have to triple by 2050 to support consumption at a mere one-third of today's U.S. per capita rate." Generating all that electricity the way we

they do indirectly through uranium mining and processing), and because other non-polluting energy sources, such as efficiency and renewables, are deemed impractical and uncompetitive.

Peter Huber makes the same claim in his new book, *Hard Green* (see opposite), but with an extra twist. Huber's thesis is that land is the only permanently scarce resource, so environmental policy should focus on the efficient use of land, not of energy or other resources. Since nuclear reactors extract maximum energy from a minimum of the earth's surface—so says



HARD GREEN SOFT LOGIC

Hard Green: Saving the Environment from the Environmentalists, by

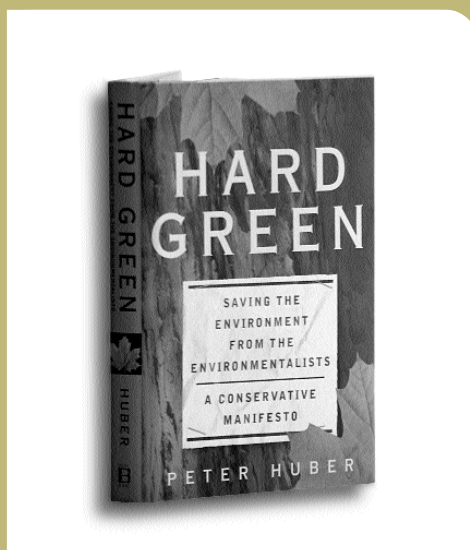
Manhattan Institute fellow, attorney, and *Forbes* columnist Peter Huber, offers a “conservative environmental manifesto” that boils down to this.

“Soft” greens—that’s Huber’s epithet for environmentalists—actually harm the environment by holding back progress. Theirs is an environmentalism of things too small to see, too long-term to concern us now, or unprovable with current science. “Hard” greens reject the softs’ “precautionary principle,” and instead assume all new technologies to be innocent of harm until proven guilty. Hard greens aren’t concerned about resource efficiency because there is no inherent scarcity of either resources or places to put wastes: as long as we have a free market that spurs continuous innovation, the human economy can keep growing indefinitely, without reliance on the environment. The only green that matters is wild spaces, and only because we humans find them pleasant. Hard greens therefore advocate using the most concentrated (hardest) forms of energy and technology available, such as nuclear power and genetically modified, pesticide-assisted agriculture. The land thus saved, and the wealth generated, enables society to set aside more wilderness for human enjoyment and as a way of “loading up the ark” in case of human-caused disaster.

There’s a shrewd political calculus behind this daft “manifesto.” The liberals have owned the environment as a political issue for decades. This November, Huber is telling his conservative readers, let’s reclaim it by advancing a really simplistic message that basically rationalizes the status quo but plays well with the masses and affords our candidates photo ops in

front of natural parks invoking the legacy of hard greens’ conservationist model, Teddy Roosevelt.

Hard Green’s fallacies are so numerous, systematic, and apparently deliberate that it would take another book to refute them all. But let’s take a look at one that relates directly to RMI’s work: resource efficiency. Efficiency is clearly a bugbear of Huber’s, because he devotes an entire chapter and portions of several others to it. He starts out by arguing that saving resources is like



drinking Diet Coke: it only enables you to splurge on something else. “With all that money saved by your [efficient] gas furnace in the basement, you fly to Aspen for a weekend in the snow.”

Huber may not know it, but the so-called “rebound” fallacy has been making the rounds for decades. It’s a logical sleight of hand. The easiest way to show what’s wrong with it is to flip it around: if it were true, then we should all try to be as *inefficient* as possible. By doing less with more, we’d have less money left over and our standard of living would go down. How’s that for progress?

In the final analysis, we live better *and* use fewer resources than we would have had we not improved our efficiency. Obviously many of the resources saved end up being used for other purposes, as

Huber notes, but there’s a net trade-up to more efficient uses, plus an overall improvement in living standards (which was the purpose of using resources in the first place). A leveling-off in total resource use would be made more likely if markets reflected the true costs of depletion and disposal, and if more equitable policies encouraged not only efficiency but *sufficiency* for all—subjects daintily side-stepped by *Hard Green*.

Huber is so sold on this theoretical idea of rebound that he’s blind to the figures that disprove it. “Electric power—the hard kind—is inseparably linked to economic growth,” he writes. “...Hard power and economic output march hand in hand. They are joined at the hip. Efficiency doesn’t affect them at all.” That’s what you’d expect to find if all savings from efficiency were simply spent on other inefficiencies. But it’s not what the figures show. Huber is apparently unaware that the quarter-century’s decoupling of U.S. energy use from economic output has lately been joined by an electric decoupling too, and that California actually cut its electric intensity by 18 percent during 1977–86. And Huber’s vigorous assertion to the contrary, “hard” power is not uniquely qualified for contributing to economic output. In fact, the energy source that’s best for the economy is the one that’s cheapest, and that ain’t nuclear—it’s efficiency.

(By the way, Huber himself doesn’t believe in the rebound effect. If he did, he couldn’t argue that “hard” technologies, by using land more efficiently, allow more of it to be set aside as wilderness.)

Later in the book, Huber seems to have a change of heart. Efficiency is now a good thing as long as it creates wealth and isn’t “coerced” by government regulations or market-distorting subsidies. Of course all credit for this “good” efficiency goes to

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tives as too small, dangerous, or expensive. Here's a brief look at the key assumptions that underpin their argument:

■ **Demand for energy is growing inexorably.** Forecasts of ever-rising energy demand are as unreliable today as they were in the 1970s and early '80s, and for the same reason. Then, suppliers saw demand for services rising exponentially

ENERGY

and reasoned that supply would have to increase at the same rate. Demand for services did indeed rise exponentially, but thanks to efficiency and structural improvements, the demand for *energy* grew only modestly—or to put it another way, almost all of the new “supply” (95 percent during 1996–98) came from efficiency improvements. Rhodes and Beller seem genuinely unaware of the simple truth that a watt saved is a watt earned, and don't fully appreciate the power of market forces that favor efficiency over inefficiency. The efficiency gains they consider “only marginal” are now the nation's largest energy source—by 1998, 28 percent bigger than oil and more than six times bigger than nuclear power.

It's significant that Rhodes and Beller published their article in *Foreign Affairs*; that's where, in 1976, a young Amory Lovins published “Energy Strategy: The Road Not Taken?,” the article that opened up a national debate over energy policy and signaled the beginning of the end of nuclear power. In it, Lovins, now co-CEO of RMI, suggested that efficient use could cut officially projected U.S. energy needs in the year 2000 by 46 percent. It actually cut them by 50 percent. There's no end in sight to efficiency improvements, and in fact the pace is accelerating: during 1997–99, at a time of record-low and falling energy prices, the rate of improving

aggregate U.S. energy efficiency set a new three-year record.

■ **Nuclear power is competitive.** Rhodes and Beller like to quote the operating costs of nuclear plants, but gloss over the vast expense of building and decommissioning them and disposing of their wastes. Implicitly acknowledging this, they concede that new nuclear plants aren't competitive with fossil-fuel ones, but say that's only because nukes are required to maintain costly systems to keep their radioactivity from the environment—if coal or gas plants were similarly required to contain all their pollutants, they'd cost more. While that's true—and incidentally, forcing fossil-fuel plants to internalize their pollution costs is a fine idea—doing so would only strengthen the economics of efficiency and renewables. In fact, efficiency and the cheapest renewables (wind) are already vastly more economical than nuclear power, and even beat coal-fired plants.

If you want a truly impartial assessment of the economics of nuclear power, just ask the market. In the United States and Britain, actual transactions reveal that investors value existing nuclear plants at approximately zero, and nobody is buying new ones. Nobody wants to make a multi-billion-dollar, bet-the-company investment and wait ten years to find out if they were right. And Rhodes and Beller's safety claims to the contrary, nobody wants to take on the open-ended liability of waste disposal and decommissioning (which in a sense is the market's way of expressing society's scientific and moral unease about the long-term hazards of burying or

entombing radioactive wastes).

■ **Nuclear power is safe.** Rhodes and Beller claim that nuclear accidents have been “few and minimal,” the Chernobyl meltdown was a result of sloppy Soviet design and could never happen here, and safety procedures have in any case improved since then. Huber complains that nuclear power is unfairly hobbled by what he views as the public's irrational fear of accidents. All three writers believe that the potential grievousness of a nuclear accident is outweighed by the tiny chance of its happening.

One would hope that the nuclear advocates aren't suggesting that the government impose upon the public a technology it doesn't want and isn't willing to pay for.

But events carrying such extreme consequences, however unlikely, necessarily become questions of policy. The public, policy makers, and the insurance industry (which, tellingly, excludes such risks from virtually all its coverage) have weighed the risk differently, but no less rationally. Rhodes, Beller, and Huber are of course free to try to change the public's mind, but if they fail, they shouldn't blame it on the public. (That would be like blaming the failure of, say, earwax-flavored jellybeans on consumers' finicky tastes.) Huber, in particular, is an arch-foe of socialistic central planning and manipulation of the markets, so one would hope he isn't suggesting that the government impose upon the public a technology it doesn't want and

The protests against the World Trade Organization last November in Seattle left almost everyone, except perhaps a few anarchists, dissatisfied. (For an eloquent description of what really happened in Seattle, see the article by our co-author Paul Hawken now posted at www.natcap.org.) Many in the streets demanded the abolition of the WTO, rightly pointing out that its dictates are profoundly anti-democratic, and if successful, will gut whatever environmental protections countries and regions have finally implemented.

But the WTO isn't going to go away. More fundamentally, the reality of corporate giantism isn't likely to change. Like it or not, more than half of the hundred largest economic entities in the world today are companies, not

the larger issue of globalism. The WTO is a recent phenomenon, founded on the proposition that the best way to improve people's lives worldwide is to promote free and unfettered trade. It's the epitome of capitalism. But as we argue in our book, today's capitalism is an aberration. Not because it's capitalistic—it is, after all, the greatest system of wealth creation the world has ever known—but because as now practiced, it's violating its own logic. It's liquidating, rather than valuing, its most important forms of capital: natural and human. Even by very conservative estimates, each of these is worth more than all financial and manufactured capital, yet they appear on no balance sheet.

So the ideology underlying the WTO is dangerously inadequate. Unless natural and human capital are fully valued, or



by **L. Hunter Lovins,**
Co-CEO (Strategy)

the most profitable and competitive, then the same forces that created the institution of world trade should themselves eventually implement this new business model. So RMItes are working with dozens of companies to enable them to put natural capitalism into profitable practice. (If you know of any companies that could benefit from this approach, please have them contact Tom Feiler or Karl Rábago, the Managing Directors of our Natural Capitalism Corporate Consulting Practice.)

Natural capitalism is a powerful lever. Now the challenge is to develop the intellectual fulcrum on which to place that lever to budge the WTO. The downside of this work is the 4 am paranoia that perhaps we're on a fool's errand. But having recently sat with senior executives of a number of major industrial companies and listened to them present business plans that could have been written by eco-activists, I think the rock is about to roll.

WTO GIVE ME A FULCRUM

countries. What is the role of an individual—or a government—in such a world?

RMI's role, I'm convinced, is to put its shoulder to the corporate sector—that's where the leverage is. That belief led Paul, Amory, and me to write *Natural Capitalism*, and RMI to launch its Natural Capitalism Practice to show companies how to profit and gain competitive advantage from the principles laid out in the book.

With the Practice successfully up and running, my attention is turning to

companies and the rules governing them behave as if they were (as our book describes how to do), a world trading as freely as it can is impoverishing itself. Even the wealthy cannot prosper for long on a planet whose life-support systems are dying.

Getting the WTO to augment its underlying ideology and change its rules accordingly will be a mite tricky. Amory and I have made several overtures to those who most ardently support the WTO, but haven't yet found the crack in the rock.

If we're correct that companies practicing natural capitalism will come to be seen as

NATURAL CAPITALISM

Update: *Natural Capitalism* Makes Waves

Early indications are that *Natural Capitalism: Creating the Next Industrial Revolution* (last issue's cover story), by Paul Hawken and RMI founders Amory and Hunter Lovins, is awakening a major shift in the corporate mindset.

The book's message of profitable environmental leadership seems to be rippling through many companies, often starting at the top. RMI's Natural Capitalism Practice, a consulting service launched last year, has been inundated with requests for proposals and has already started on several major contracts. (The client list must remain confidential for the time being.) Many other firms are implementing elements of natural capitalism without any help from us (see opposite).

Interest in speeches and seminars on natural capitalism has skyrocketed since the book's publication. The authors have spoken to countless audiences, including the World Economic Forum, Young Presidents Organization, Society of Environmental Journalists, Bioneers Conference, Global Environmental Management Initiative, Social Venture Network, Sustainable Enterprise Summit, Sustainable Business Conference, International Exchange Conference, Royal Society and Construction Industry Council (London), and Helsinki School of Economics.

Natural Capitalism has made waves in policy circles, too. At the invitation of a bipartisan pair of U.S. Representatives, Amory Lovins presented a breakfast briefing to members of Congress in

February. (If you support the book's message, please urge your elected representatives to read it: we've sent a copy to every member of Congress.)

President Clinton has been one of the book's biggest boosters. In November he told an audience in Florence, Italy: "I have been very convinced for years that it is no longer necessary to choose between growing the economy and preserving, and

President Clinton has been one of the book's biggest boosters.

even improving, the environment. But it is quite necessary to abandon the Industrial Age energy use patterns.... So I urge you to all read a book—I'll hawk a book here—*Natural Capitalism*, by Paul Hawken and Amory and Hunter Lovins. It basically proves beyond any argument that there are presently available technologies, and those just on the horizon, which will permit us to get richer by cleaning, not by spoiling, the environment."

Not everything has gone smoothly. *Natural Capitalism*'s U.S. publisher, Little, Brown, was bought by Time Warner just before the launch date, causing major publicity and distribution hiccups and forcing us to mount a publicity campaign at our own expense.

As a result the book has not been reviewed by as many mainstream print media as it should have been, but the reviews have been almost unanimously ecstatic. Writes William Greider in *The Nation* (28 February): "*Natural Capitalism* is so informative and provocative—and so unfashionably optimistic about the future of the planet—that I wonder why

everyone in public life is not reading it and arguing over the implications. The President did volunteer a nice plug for the book when it came out a few months ago, but it has yet to be reviewed by virtually any leading publication.... The book will find its audience, regardless. It is that important." Meanwhile, the authors have done dozens of radio interviews and several TV appearances (including a CNN "Visions" special).

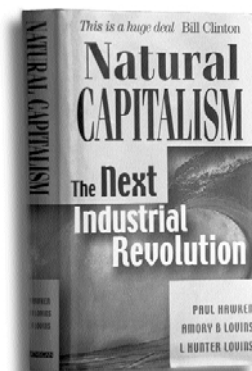
More than 37,000 hardcover copies of *Natural Capitalism* are now in print, and the American edition of the book is about to go into its fifth printing. The book is doing so well in hard-

back that the paperback release has been postponed. A German edition was released in March; translations into Japanese, French, Russian, Chinese, and Portuguese are under way or planned.

—Dave Reed

For more book reviews, a growing number of case studies, lively discussion groups, a calendar of upcoming author appearances, and updates, please see the Natural Capitalism website, www.natcap.org.

The U.K. edition of *Natural Capitalism* (published by Earthscan) is also selling well.



Natural Capitalism in Practice

A growing number of companies are putting the principles of natural capitalism into practice, perhaps without even knowing it. Here are a few examples reported recently in two excellent online magazines, *Grist* (www.gristmagazine.com) and *Sustainable Business Insider* (www.sustainablebusiness.com):

■ **United Parcel Service** has developed a reusable delivery envelope and increased its use of recycled materials, moves that are cutting energy consumption and solid waste, saving 2,200 trees a year, and cutting \$1.6 million in costs annually.

■ **Electrolux** is in effect leasing clothes-washing services instead of selling washing machines in a pilot program on the Swedish island of Gotland. The manufacturer has installed specially wired washing machines in 7,000 households for free, and charges the users per wash. Customers may exchange their machine for a new one after 1,000 washes.

■ **DuPont** has announced that by 2010 it plans to reduce its greenhouse gas emissions by 65 percent, use no more energy than it did in 1990, and meet 10 percent of its energy needs and 25 percent of its materials inputs with renewable sources.

■ **Cargill Dow Polymers**, a joint venture between Cargill Inc. and the Dow Chemical Company, is investing \$300 mil-

lion in a Nebraska plant that will produce raw material for plastic cups, packaging, and fabric from corn. The fully biodegradable products are expected to compete with petroleum-based ones on price and performance.

Heard any good natural capitalism stories lately? We'd like to make "Natural Capitalism in Practice" a regular feature of RMI Solutions, and hope to post longer case studies at the Natural Capitalism website, www.natcap.org. Please send all ideas to us at the coordinates given on page 13.

THE FOUR PRINCIPLES OF NATURAL CAPITALISM

Natural capitalism is a new business model that involves four interrelated shifts in business practices:

- **Radically increase the productivity of natural resources** through fundamental changes in facilities, production processes, and products.
- **Shift to biologically inspired production models** that close materials loops, eliminate waste, and minimize throughput.
- **Move to a solutions-based business model** that delivers value as a continuous flow of services rather than the sale of goods—rewarding both the provider and the customer for doing more and better with less for longer.
- **Reinvest in natural capital**, which is ultimately the basis of future prosperity and is in increasingly short supply.

Natural Capitalism Seminars Offered

If you get this newsletter in time and you live in Iowa, you're most welcome to attend the latest in RMI's series of one-day "Natural Capitalism for Community and Business" seminars on April 11 in Des Moines.

Offered through Rebuild Iowa, a Department of Energy and Iowa Department of Natural Resources Energy Bureau initiative, the seminar will focus on community and business strategies to achieve economic and environmental sustainability.

Morning presentations will include an introduction to natural capitalism and discussions of community-business connections and ways to overcome organizational and market barriers. In the afternoon, participants can attend one of three workshops on resource-efficiency techniques, healthy community strategies, and green real-estate development.

Future seminars are tentatively planned for the summer and fall in Minneapolis, Philadelphia, and Virginia. For more information on any of these events, please contact Jen Uncapher at jenu@rmi.org.

In addition, Amory Lovins will lead multi-day sessions on natural capitalism at Schumacher College (www.gn.apc.org/schumachercollege) in Devon, England the week of September 17; and at the Esalen Institute (www.esalen.org) in Big Sur, California on November 3–5.



CARWATCH:

MOVE OVER, DINOSAURS

The 2000 North American Auto Show in January was Detroit's showcase of our automotive future: techno music, flat-panel computer screens, gleaming steel-and-glass structures, and show cars that would look comfortable in a Star Wars sequel. But being there, I got a sense of being in the past—like, in the Cretaceous period.

At that time, dinosaurs ruled the Earth, but furry new life forms—mammals—were starting to scurry beneath the dinosaurs' scaly feet. And before you could say "mass extinction," mammals went on to dominate the landscape.

The dinosaurs at the show were numerous. Hummer, Chevy, Toyota, Dodge, and others showed brand-new full-sized SUVs and trucks, all barely reaching the mid-teens in miles per gallon. Ford topped them

"out there" 80-mpg hybrid with outstanding aerodynamics (one of the lowest coefficient of drags ever demonstrated) and a fuel-cell version (a more advanced mammal estimated to get more than 100 mpg on hydrogen) planned soon.

At least a half-dozen automakers showed fuel-cell vehicle prototypes or displays, from Honda's FCX to Ford's FC5 show cars (well, they don't score points on naming creativity). And Ford, partially to atone for its Excursion, announced plans for a whole family (or genus?) of advanced vehicles with its Think! brand. Initially selling golf carts, electric bikes, and small electric vehicles, Think! plans to "revolutionize" the

way we drive with "no-compromise" vehicles that offer exceptional performance and environmental friendliness. It's a page right out of one of RMI's early HypercarSM papers.

While it will take several years for these advanced concepts to filter into the market, two forerunners of

the new breed are already in production. At Detroit, Honda and Toyota showed off their hybrids, the Insight and Prius (see "Halfway to Hypercars," spring 1998), both bound for showrooms this year.

Watching people at the show look in awe at the EPA fuel ratings on the Honda Insight—61 mpg city, 70 mpg highway—brought new meaning to the phrase "sticker shock."



The Ford Prodigy, a mid-sized hybrid sedan that gets 70 mpg, will be in showrooms by 2003.

Of course, the mammals at Detroit tended to be small (the Honda Insight, for instance, is a two-seater), but things evolve—we should be seeing "American-sized" ultralight-hybrid vehicles soon. In the meantime, you can catalyze this progress by visiting your local Toyota and Honda dealers and checking out their exciting Hypercar-like vehicles.

Update: DaimlerChrysler unveiled its latest Hypercar-like creation in late February (after the show). The ESX3 is a stylish, Intrepid-sized hybrid that gets 72 mpg, thanks in part to a mostly plastic body that weighs 46 percent less (and costs 15 percent less) than a comparable steel one. But its most notable evolutionary advance is its price: While the original 1996 ESX was estimated to cost \$60,000 more than a comparable conventional car, this third-generation prototype would carry only about a \$7,500 premium. With progress like that, Hypercars could be evolving faster than even *we* think.

—Michael Brylawski

Ed note: A former RMI Hypercar Center researcher, Michael now manages Market Development and Commercialization at Hypercar, Inc.



The GM Precept, possessor of one of the world's lowest aerodynamic drag coefficients.

all with its just-released four-ton, 10-mpg Excursion. But here and there, almost lost among the gleaming grilles and hulking 19-inch off-road tires, were signs of the next evolutionary development.

Beside Ford's army of SUVs was its Prodigy, an attractive Taurus-class, hybrid-electric vehicle that gets 70 mpg and is promised to be in showrooms in 2003. Across from the Hummer was GM's Precept, a more

Seeing Daylight: Resurrecting Lost Waterways

The modern era has not been kind to streams. As humankind has enlarged agricultural areas, built roads, and clustered into cities large and small, it has diverted and straightened streams, confined them in concrete channels, put them into pipes, filled their associated wetlands, and otherwise used and abused them, often beyond recognition.

These habits are beginning to change, though, as citizens and governments rediscover the benefits of open, natural waterways. The most radical expression of the new ethic of stream restoration is the relatively recent movement to “daylight”—resurface—formerly culverted or buried streams.

As part of a Boston-area demonstration project funded by the Environmental Protection Agency, RMI has published a report designed to inspire more communities to resurrect lost waterways. “Daylighting: New Life for Buried Streams,” by Richard Pinkham, analyzes the environmental, economic, political, and social implications of the practice through case studies of 18 completed projects and a number of others in the works.

The report shows that daylighting can provide multiple benefits—tangible and intangible—for every dollar expended. These include improvements to the functional values of waterways and urban stormwater systems through increased hydraulic capacity for flood control, lowering of water velocities to reduce downstream erosion, removal of water from combined sewers, improvements to water quality, and more. Daylighting can improve aquatic habitat and provide “new” riparian corridors for wildlife. It can revitalize neighborhoods, increase property values, and benefit nearby businesses. It can be cost effective compared to the expense of repairing a failing culvert. Daylighting projects help educate children and adults alike about the workings and values of stream corridors and wetlands. In doing so, they foster stewardship of natural resources and energize people with a sense of “setting things right.”

“Daylighting: New Life for Buried Streams” is available from RMI for \$19 plus \$6.50 shipping and handling.



Before and after views of a Swiss daylighting project.

RMI Solutions

RMI Solutions is published three times a year and distributed to more than 20,000 readers in the United States and throughout the world.

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LETTERS TO THE EDITOR

We want to hear your comments, criticism, or praise. Please address all correspondence to:

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ABOUT THE INSTITUTE

Rocky Mountain Institute is an entrepreneurial nonprofit organization that fosters the efficient and restorative use of resources to create a more secure, prosperous, and life-sustaining world.

Our staff show corporations, communities, individuals, and governments how to create more wealth and employment, protect and enhance natural and human capital, increase profit and competitive advantage, and enjoy many other benefits—largely by doing what they do more efficiently.

Our work is independent, nonadversarial, and transideological, with a strong emphasis on market-based solutions.

Founded in 1982, Rocky Mountain Institute is a §501(c)(3) /509(a)(1) public charity. It has a staff of approximately 45 full-time, 48 total. The Institute focuses its work in several main areas—business practices, climate, community economic development, energy, real-estate development, security, transportation, and water—and carries on international outreach and technical-exchange programs.

1999: RMI's YEAR IN REVIEW

WHAT EXACTLY DOES RMI DO? ARTICLES IN THIS NEWSLETTER SPOTLIGHT RMI'S MOST NOTEWORTHY ACTIVITIES, BUT SOME READERS MIGHT WANT A MORE THOROUGH RECKONING. HERE'S A SUMMARY OF ACTIVITIES IN 1999.

Energy

- Coordinated a team of consultants that provided STMicroelectronics—the world's ninth-largest chipmaker—with technical and strategic advice that helped it commit to zero net carbon emissions by 2010.

- Helped Anheuser-Busch, Nike, British cider maker HP Bulmer, Brazilian and Canadian oil producers, and other clients assess or adopt advanced energy productivity.

- Delivered “A Strategy for the Hydrogen Transition,” an influential roadmap that's profitable at each step (starting now), to the National Hydrogen Association and other key audiences, and helped major energy and auto firms start adopting it.

- Testified in support of efficient alternatives to a proposed power plant on the island of Maui.

- Keynoted Canada's national conference on energy efficiency.

- Published “Energy Surprises for the 21st Century” and a critique of nuclear economics.

- Received the World Technology Award for the Environment and the Lindbergh Award for Amory Lovins's work in energy efficiency and technology.

Water

- Led a Pittsburgh design workshop showing how alternative measures can solve the trillion-dollar national problem of “combined sewer overflows” while restoring urban watersheds and revitalizing

communities; and published the report “Re-evaluating Stormwater: The Nine Mile Run Model for Restorative Development.”

- Helped the U.S. Environmental Protection Agency develop Boston-area demonstration sites for “daylighting” streams, and compiled case studies in “Daylighting: New Life for Buried Streams” (page 13).



Amory Lovins received the 1999 Lindbergh Award.

- Described water efficiency, water futures, and urban watershed restoration to audiences ranging from the American Society of Landscape Architects to the Public Officials for Water and Environmental Reform.

- Restructured our water work as a “virtual” program conducted by out-of-house staff.

Climate Protection

- Encouraged corporate leadership in profitable climate protection through behind-the-scenes work with many major energy, car, and manufacturing firms.

- Attended the Conference of the Parties of the United Nations climate negotiations and related events in Bonn, Germany.

- Provided briefings on climate protection to Japan's Emperor, Empress, and Prime Minister, the City of Newcastle (Australia), the British Science Museum, and China's State Development Planning Commission.

- Keynoted the Alberta Roundtable on Climate, inspiring a commitment to make Alberta the energy-efficiency leader of Canada to protect the climate at a profit.

- Presented “Household Opportunities to Cool Global Warming” at the Affordable Comfort Conference, and similar talks to the California Energy Commission, Aspen Global Change Institute, and other audiences.

Buildings & Land Development

- Served as a principal member of a team designing the Letterman Digital Arts Center, an innovative “green” facility for Lucasfilm at San Francisco's Presidio.

- Helped incorporate green features into a new convention center in Boston.

- Participated in all four of the finalist teams for the design of a new California state office building in Sacramento.

- Worked with a major supermarket chain to develop a prototype daylit store and to cut its outlets' energy by two-thirds.

- Improved the environmental performance of several school facilities, including a new University of Texas nursing school.

- Presented seminars on green buildings in Dubai and Paris.

- Helped devise a prototype office building whose human, environmental, and economic advantages are expected to reshape the market.

- Received a National Award for Sustainability from the President's Council on Sustainable Development and the national environmental nonprofit Renew America, and another award from Louisiana-Pacific.

- Converted RMI's staff housing from electric space and water heating to high-efficiency gas boilers donated by Carrier.

- Obtained a preliminary permit from the U.S. Army Corps of Engineers to restore 30 acres of wetlands within the Windstar Land Conservancy, a former ranch whose permanent protection we secured in 1997.

Transportation

- Launched Hypercar, Inc., a for-profit company, to advance RMI's HypercarSM concept by exerting direct competitive pressure on the market.

- Began studying the feasibility of further transportation work for the Hypercar Center[®] in the wake of the Hypercar, Inc. spinoff.

- Presented "Uncommon Knowledge: Automotive Platform Sharing's Potential Impact on Advanced Technologies" to the International Society for the Advancement of Material and Process Engineering.

Business Practices

- Published and promoted *Natural Capitalism* (see box).

- Launched the Natural Capitalism Practice, a nonprofit consulting service for

corporations and public-sector clients, and recruited three new senior staff to develop a business plan and manage the unit.

- Continued advising Interface, Inc. on new products, business models, and other strategic issues to continue the company's leadership in practicing natural capitalism.

- Presented natural capitalism workshops to business audiences in Michigan and Pennsylvania, and initiated relationships with such companies as Steelcase, Herman Miller, Ronningen, Donnelly, ESCO, and InterfaceAR to explore applying natural capitalism to their business.

Communities

- Guided community leaders and residents of Calaveras County, California through the Economic Renewal process to choose sustainable development projects.

- Worked with business leaders in three central Oregon counties to mitigate poverty through sustainable development.

- Organized a series of Y2K preparedness meetings in three Colorado towns.

- Addressed the annual conference of the American Economic Development Council on sustainable economic development.

Other Issues

- Called attention to the ecological dangers of transgenic crops through articles, a private briefing with the President and First Lady, and a keynote presentation at a World Resources Institute conference.

- Delivered a presentation on "Retaining Forests in the Chesapeake Bay Watershed" to representatives of state and federal agencies and area land trusts.

- Wrote more than 50 scripts on resource issues for Eco-Essays, a series of short radio spots heard by 7 million listeners.

Organizational Restructuring

- Embarked on a major strategic planning

process that shifted our primary emphasis from education to consulting.

- Created new co-CEO positions for Amory and Hunter Lovins, and promoted Marty Pickett to Executive Director.

- Spun off most of our Hypercar program into a new for-profit venture (see above).

- Sold our interest in E SOURCE, a for-profit subsidiary, to secure a modest reserve fund.

- Initiated a thorough internal analysis of opportunities for implementing the principles of natural capitalism in our own operations.

Natural Capitalism

Arguably our proudest achievement in 1999 was completing and publishing *Natural Capitalism: Creating the Next Industrial Revolution*, an influential book showing how corporations can profitably protect the environment. Related activities:

- Published numerous popular articles on natural capitalism, including a high-profile feature in *The Harvard Business Review*.

- Created a multimedia natural capitalism "road show" and presented it to dozens of audiences.

- Briefed President Bill Clinton and Vice President Al Gore on *Natural Capitalism*. (The President has since endorsed the book in speeches—see page 10.)

- Hired two public-relations firms to coordinate a media campaign for *Natural Capitalism* that resulted in dozens of print reviews and broadcast appearances.

- Sent copies of *Natural Capitalism* to every member of Congress, the Western Governors, every major presidential candidate, and dozens of top business leaders.

- Created an extensive website (www.natcap.org) to promote the book, make its entire contents available, and serve as a center of ongoing discussion of natural capitalism in practice.

Heroes for the Planet



RMI co-founders Amory and Hunter Lovins will be featured in *Time*'s "Heroes for the Planet" series in the magazine's Earth Day (April 17) issue.

A formal "induction" ceremony will be held in San Francisco on April 15, when the heroes will participate in a variety of promotional activities.

Separately, Amory received the first-ever World Technology Award for the Environment in November. He was recognized for his work promoting the efficient use of energy and resources and exploring the links between resource productivity and the environment, development, and security. He was also a finalist in the Energy category.

The World Technology Awards—billed as "the technology world's version of the Nobel Peace Prize"—honor leaders in 20 categories ranging from information technology to ethics.

Condolences

Tina Robinson, an RMI Board member and wife of another Board member, Chip Bupp, died on February 20 after a long and heroic battle with cancer. Our warmest sympathy goes out to Chip.

In lieu of flowers, donations should be made to California State University Long Beach Foundation for Dr. Robert Nagourney, 6300 State University Drive, Suite 332, Long Beach, CA 90815 (Attn: Ms. Janna Tenenbaum).

Earth Day Events

Amory Lovins will be one of the headliners at Chicago's 30th Earth Day festivities on April 22 in Lincoln Park. He's expected to take the stage between 3 and 4 pm. RMI will also have a booth at the event, which typically draws 50,000 people.

In other appearances leading up to Earth Day, Hunter Lovins will speak to the Environmental Summit of Business Opportunities for the 21st Century on April 13 and 14 at the Missouri Botanical Gardens in St. Louis. A reception on the second day will be open to the public.

New RMI Website

Coming soon: a new and (we hope) vastly improved RMI website!

The new site—www.rmi.org—should be much easier to navigate, nicer to look at, more informative, and have a search engine that actually works. New features will include comprehensive sections on each of our activity areas, a "library" with free downloadable RMI publications (in PDF format), downloadable media materials, and (eventually) sound clips, a calendar, and discussion groups.

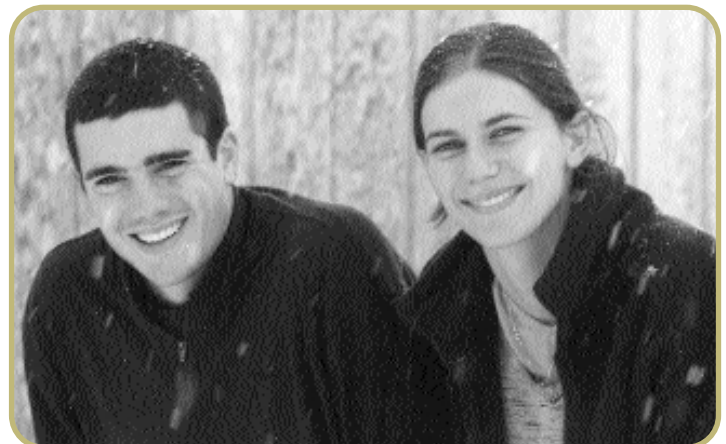
The new site should go live in April. Expect some construction activity through the spring and early summer as we refine the site.

RMI Goes Wireless

Thanks to a generous donation from the Allen-Heath Memorial Foundation, RMI has just completed installation of a high-speed wireless data bridge linking its five buildings. The bridge provides users in the headquarters building with always-on high-speed Internet access and vastly faster connections with servers located in the Windstar building. It also allows the Institute to shed five telephone lines previously used for modems and to bring its email server in house, eliminating Internet service provider charges while increasing flexibility.

INTERNS— COMING AND GOING

David Kaplan, a junior at the University of Vermont, served valiantly in the Communications department for several weeks this winter. Just as he was leaving, **Rachel O'Leary** arrived from Newcastle, Australia for a six-week stint working with RMI climate researcher **Rick Heede** to finalize Newcastle's aggressive climate action plan. Rachel is a staff member with the Newcastle City Council's Australian Municipal Energy Improvement Facility, a cutting-edge organization with which RMI is exchanging research.



RMI in Print

Notable recent articles on or by RMI in the media:

- “A Tale of Two Botanies,” *Wired*, April 2000. A critique of GMOs (see page 4).
- “Power Switch,” *Environment*, March 2000. Response to an earlier article on electric utility restructuring.
- “Business Creates Eco-Side!,” *The Nation*, February 28, 2000. Rave review of *Natural Capitalism* (see page 10).
- “Natural Capitalism,” *Yes! A Journal of Positive Futures*, spring 2000. Somewhat critical review of the book.
- “Inventing a Revolution,” *Atlanta Journal-Constitution*, February 6, 2000. What RMI’s ideas could mean for Atlanta.
- “Natural Capitalism,” *Resurgence*, January/February 2000. Interview of Amory Lovins by editor Satish Kumar. The same issue also contains a review of the book.
- “The Greening of Human Settlements,” *Town & Country Planning*, January 2000. The implications of natural capitalism for community design.
- “Prophet of Profit,” *Management OHS&E*, December/January 2000. Shortened version of RMI’s paper, “Climate: Making Sense and Making Money.”
- “The Red-Hot Centers of Genius,” *Esquire*, November 1999. Ranks RMI as one of “26 places in America that are inventing the future.”

New RMI Brochure

RMI has a new-look brochure to reflect the new direction and work emerging from its ongoing strategic planning. Please call the office if you’d like copies.

LIFE AT RMI

Coming of Age



by **Marty Pickett,**
Executive Director

As this newsletter goes to press, I’m preparing for RMI’s spring Board meeting. I look forward to these twice-a-year gatherings: our Board members and advisers are experts in various fields, and they bring fresh perspectives to RMI’s governance.

This meeting will mark the completion of my first year as the Institute’s Executive Director, and will also coincide with a much more important milestone: RMI’s 18th birthday!

Rocky Mountain Institute is coming of age, and I don’t just mean that figuratively. This past year I’ve watched it undergo a transition from institutional adolescence to adulthood. It’s still led by founders Amory and Hunter Lovins, but with their blessing, RMI has become emancipated and now has a life apart from “mom and pop.”

The catalyst for this has been the strategic planning process that formally got under way at last April’s Board meeting. I’ve compared our strategic planning work with our consultants to having a personal fitness trainer who motivates you to get fit while setting long-term goals for health and strength. Part coaching, part family counseling, the process has helped us see the Institute’s strengths and weaknesses and has jelled our thinking about what we want it to become.

Previously, we thought of RMI as a “research and educational” organization. Now we realize that those two activities are only half the story. Strategic influence—behind-the-scenes, high-level work to “influence the influential”—has long been an important, but largely unacknowledged, part of our modus operandi. And consulting—putting our ideas into practice through direct implementation—is becoming our flagship activity.

Thinking strategically about how RMI can maximize its effectiveness in these four areas is getting so many neurons firing that it’s hard to keep track of everything that’s happening. On their last visit here, our strategic planning consultants remarked—only half-jokingly—that we were moving too fast for them!

The Natural Capitalism Practice, in particular, has taken on a momentum of its own. Not only has it served as the vehicle for RMI’s consulting work, it’s also enabled us to bring on several new senior staff members, who in turn have enhanced our research and strategic influence capabilities and also lessened our reliance on Amory and Hunter. Meanwhile, longtime RMIites continue to mature with more experience and strengthened abilities.

Our educational and outreach efforts are also being bolstered enormously by the Communications team’s creative work. I hope you like the new look of this newsletter—it’s the latest in a string of improvements to our annual report, brochure, website, and other materials.

All in all, it’s been a busy 18th year. I’ll keep you posted on further developments as we continue to refine and implement our strategic vision.

David Tice, 1952–1999

David Tice, land and facilities manager for Rocky Mountain Institute and the Windstar Land Conservancy, died on December 8 after a prolonged battle with lymphoma cancer. He was 46.

the staff, when he was the lead environmental planner on a real-estate project in Virginia that also involved RMI's Green Development Services. He subsequently participated in several other projects with RMI, including the Greening of the White

30 acres of wetlands, initiated major wildlife habitat enhancement efforts, and began efforts to control erosion and invasive weeds. Even during the long months of chemotherapy, when he was bed-bound most of the time, David continued to lead these efforts by phone and email.

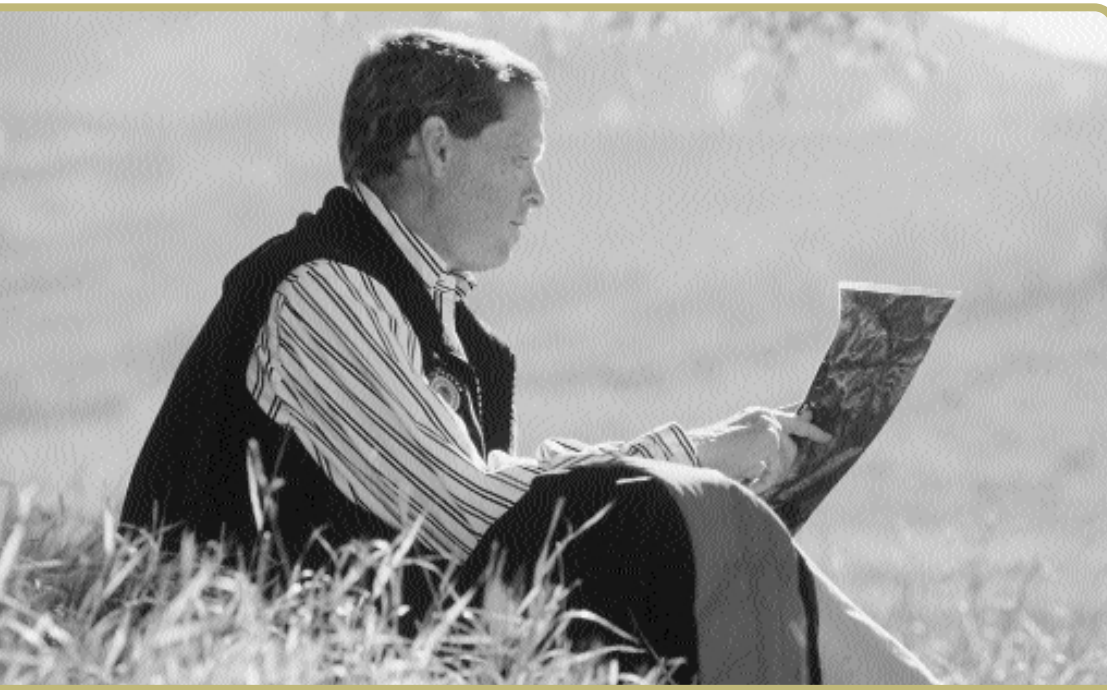
Interviewed for a profile in the RMI annual report, David conveyed his enthusiasm for his work: "I've been practicing land management for 25 years and have had the opportunity to work on a lot of really exciting properties. RMI gives me the ability to expand on that, and apply holistic land management in a way that can have an impact not only regionally but even globally.

"What excites me here is to be able to bring to the whole area of land management the same sort of systems thinking that RMI has applied to energy and other areas of resource planning.

Now, with Windstar protected and endowed, not only can we talk about a holistic approach to land management, we have a nearly 1,000-acre model land base on which to actually show people how to do it."

Funeral services were held in Charlottesville, Virginia. A Colorado memorial service will be held at a date to be determined later this spring.

David's family asks that all donations be made to RMI for the David Tice Memorial Fund or to the Virginia chapter of The Nature Conservancy, 1233 Cedars Ct., Charlottesville, VA 22903.



"David left an inspiring legacy for all of us here at RMI," Executive Director Marty Pickett said. "We are deeply honored to realize, in retrospect, that he chose to spend the last year and a half of his life working at the Institute. He will be remembered both for his special personality—his quiet thoughtfulness, gentle demeanor, and rock-solid integrity—and for his passionate professional commitment to holistic land management."

In his honor, RMI has established the David Tice Memorial Fund to support an annual summer land-management internship.

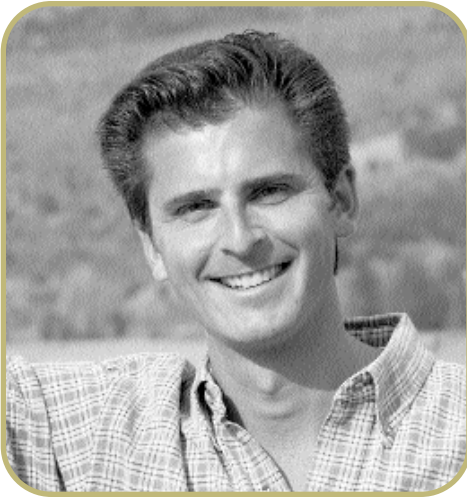
David's involvement with the Institute actually began several years before joining

House, the Pentagon renovation, a Department of Energy project in Washington, and the redevelopment of flood-damaged Patonsburg, Missouri.

The relationship deepened in early 1998, when David relocated to the area to work on a temporary contract for RMI. In August, he was hired to fill the vacant position of facilities manager for RMI and the Windstar Land Conservancy.

"Dave threw himself into it with quiet determination and seemingly boundless energy," recalls Pickett. "Looking back on it, it's incredible how much he got done in just his first few months in the job, before the cancer was diagnosed." He developed a comprehensive management plan and planning documents for the restoration of

WHAT ARE YOU READING?



Bill Simon, web coordinator:

“A couple of years ago I read *Stuff: The Secret Lives of Everyday Things*, which was a real eye-opener for me because it showed the global impacts of our consumer choices. I’ve just finished *Seven Wonders: Everyday Things for a Healthier Planet* (John C. Ryan, Northwest Environment Watch/Sierra Club, 1999), a sort of a sequel that takes a more positive tack by highlighting seven simple technologies that improve people’s lives without overtaxing the planet. It’s a quick read, but it packs a lot of important and thought-provoking information.”



Dan Bakal, associate, Natural Capitalism Practice:

“Lately I’ve been reading mostly business books, like *The Learning Paradox: Gaining Success and Security in a World of Change* (Jim Harris, Macmillan Canada, 1998) and *The Cluetrain Manifesto: The End of Business as Usual* (Rick Levine et al., Perseus, 2000).

“*The Learning Paradox* provides a lot of good advice on how companies can deal with accelerating change through continuous learning, and how employees fit into that. I’d recommend it for people who are thinking long-term about their careers in the private sector.

“*Cluetrain* is certainly a more provocative book. Its theory is that the Internet is tearing down the walls of corporate propaganda, forcing companies—the ones with a clue—to engage in genuine conversation with their customers. I think it’s a valid point, though what bothered me about the book is that it polarizes and simplifies the issue, and I think it gives the Internet too much of the credit for this trend.”



Karl Rábago, managing director, Natural Capitalism Corporate Consulting:

“I recently read *The Carbon War: Despatches From The End Of The Oil Century* (Penguin, 1999), by Jeremy Leggett, who has been at the front lines for many years in the battle to awaken governments and industries to the need for action on global climate change. *The Carbon War* chronicles those efforts in an easy-to-read, highly personalized account. Reading the book, I realized that the campaign to save the climate is a drama of epic proportions, pitting mere humans against mighty giants, and that there’s much more to the story than what we’re told by the popular media.”

BAD NEWS, GOOD NEWS

CONTINUED FROM PAGE 2

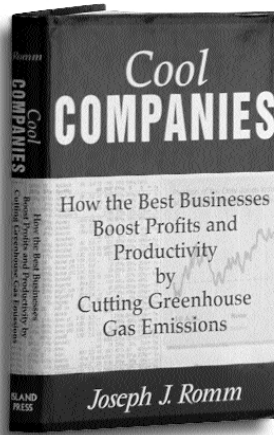
India, another major coal user, has lately become active in gas too, and is among the world's top users of windpower.

The "decarbonization" trend looks set to continue, as low-carbon fuels give way to hydrogen and renewable energy. Most of the major oil companies are now actively preparing for the inevitable transition to hydrogen. Scenario planners at Royal Dutch/Shell, one of the world's biggest energy companies, now think it likely that

CLIMATE

half the world's energy could come from renewables by 2050. Two years ago, RMI helped the firm conduct a feasibility study that led it to invest \$500 million in renewables and launch a new hydrogen division, and helped start similar work at BP.

The transportation sector, which accounts for nearly one-third of U.S. greenhouse-gas emissions, is still heavily reliant on oil. Most climate forecasts are as gloomy as they are because they assume no change in that situation. Yet here, too, the system seems poised on the brink of a major "flip": new hybrid-electric vehicles are likely to sweep the market in the next decade or so, significantly reducing oil consumption; they in turn will enable a switch from gasoline-powered internal combustion engines to hydrogen-powered fuel cells. John Williams, then the leader of General Motors' internal team on global climate issues, has stated that his company has "embraced fuel cells as the technology of choice" over the long term. (RMI's Hypercar concept has played a leading role in decarbonizing the auto industry—see the summer 1997 newsletter.)



COOL COMPANIES

Separately, a host of economic and competitive forces favor a shift toward dramatically more resource-efficient business practices that promises to lessen the climate threat. Recent books like *Cool Companies* (by RMI alum Joseph Romm) and *Natural Capitalism* (see page 10) show how the transformation is already under way at dozens of major corporations, including DuPont, 3M, Toyota, Compaq, and Xerox. And their success stories are inspiring many others to follow suit.

If the clients of RMI's Natural Capitalism Practice are anything to go by, many firms are already far along in forming plans to reduce or offset their greenhouse-gas emissions. Some are motivated by the prospect of improving their bottom lines, others are hoping to bank carbon credits, and still others see a chance to reap the PR benefits of being climate leaders.

Romm's research indicates that the "coolest companies" are making annual returns on their climate investments of 50

percent or more through lower energy costs and higher productivity. And that doesn't count what they might eventually make from selling carbon credits. Even though the Kyoto climate treaty's carbon-trading system has yet to be implemented, demonstrated carbon reductions are already trading on futures markets at a few dollars to tens of dollars per ton. (One senior timber executive commented recently that his company stands to earn three times as much money by growing forests for carbon sequestration credits as by cutting them down for timber or pulp.)

As these profit-making opportunities become better known, fewer companies are wasting their time complaining about the "costs" of climate protection. GM, Texaco, Ford, and DaimlerChrysler are the most recent companies to quit the Global

As these profit-making opportunities become better known, fewer companies are wasting their time complaining about the "costs" of climate protection.

Climate Coalition, an industry group that lobbies against restrictions on greenhouse-gas emissions. After GM's defection, in March, the GCC all but threw in the towel when it declared only trade associations will be eligible for membership.

Structural changes in the economy also appear to be restraining greenhouse-gas emissions in ways that still aren't fully understood. According to Romm, the growth of the Internet and e-commerce could be responsible for reducing emissions relative to economic output by a

quarter to a third (see page 3). Companies' upgrading to more efficient computers and office equipment continues to outpace expectations, as do telecommuting, "hoteling" (sharing office cubicles among roving employees), and other changes in work styles.

DECOUPLING

These trends are in a sense anecdotal, much like mild winters and severe hurricanes. What do the actual statistics say?

In 1998, the world economy grew by 2.5 percent while global emissions *fell* by 0.5 percent. Analysts assume some of the emissions decline was only temporary, due

to Asia's economic slump; but preliminary 1999 figures appear to confirm this decoupling. Indeed, global carbon emissions from burning fossil fuel appear in 1999 to have fallen slightly below the 1996 level—the biggest decrease since the oil crisis of 1979–80.

The decoupling is also reflected in U.S. economic figures. According to a recent Federal Energy Information Administration report, U.S. carbon dioxide emissions increased by an average of 1.37 percent a year in the 1990s—only about half the 2.6-percent economic growth rate. (The report noted a similar decoupling in China.) And the trend seems to be accel-

erating. An analysis by the American Council for an Energy-Efficient Economy found that energy use—not the same as carbon emissions, but close—increased only 2 percent between 1996 and 1999, even as economic output rose 13 percent. That was the fastest rate of efficiency improvement since 1979–86, when energy prices were high and rising; yet this time, prices were low and falling. What's more, industrial energy use didn't grow at all.

These figures lay to rest the old myth that an increase in economic output requires a corresponding increase in energy, or must

CONTINUED ON NEXT PAGE

Green Power Markets Taking Off

Consumers are enjoying increasing opportunities to reflect their environmental preferences in the goods and services they buy. Recycled paper, sustainably harvested lumber, and organic foods now occupy regular spots on store shelves.

Add electricity to that list. Driven by customer demand and industry restructuring, an increasing number of utilities are offering "green" power—electricity derived from renewable sources such as wind, solar, geothermal, and biomass. One in four electricity customers in the United States now has the option of buying green power, either from their electric utility or from competitive energy service providers in restructured electricity markets like California and Pennsylvania. That figure is expected to double within five years.

Early signs of customer interest have been strong. In California, more than 90 percent of the customers who chose competitive energy services have enrolled with a green power provider. The Los Angeles Department of Water & Power has signed up more 20,000 customers for its green power program, and that number is projected to grow to 200,000 in the next three years. Nationwide, about 500,000 households currently purchase at least some of their electricity from a green provider—a small number compared to the total, but not too shabby for an industry barely five years old.

RMI is one of 11,000 Colorado electricity customers participating in a program that has financed the construction of a

wind farm in the eastern part of the state. We pay a \$92.50 surcharge per month to buy a fixed amount of green power that works out to be about a quarter of the electricity we get from the grid (we also generate a lot of our own electricity with onsite solar panels). Since 80 percent of our utility's non-green electricity comes from coal, that means we're keeping nearly 45 tons of carbon dioxide out of the atmosphere per year.

Incidentally, that works out to about \$25 per ton of avoided carbon dioxide emissions, which is on the high side. As we at RMI never cease to point out, reducing demand through efficiency is almost always a better deal than increasing supply (even if it's green). So we're continuing to fix up our old buildings, too.

More than 50 utilities and new market entrants have jumped on the green power bandwagon, leading to the construction of 112 megawatts of new renewable energy generating facilities so far. Another 100 MW of new capacity is planned for the coming year—about enough energy to serve 100,000 American homes. Those estimates don't include existing renewable resources that are being marketed as green power: the Automated Power Exchange, for example, reports that 700 MW of renewable energy is being traded through its California green power exchange.

Contact your utility to find out how you can buy green power, or for general information visit the Green-e website, www.green-e.org.

—Karl R. Rábago

RMI's Karl Rábago chairs the independent, nonprofit Green Power Board and the Green Pricing Accreditation Board.

produce a corresponding increase in greenhouse-gas emissions. There's no reason to suppose that we can't continue to prosper while actually *reducing* greenhouse-gas emissions. We've done it before: during 1979–88, real GDP rose 19 percent while primary energy use *fell* 6 percent. And perhaps most interestingly, in the past five years, *electricity* usage in both the United States and China has begun to decouple from GDP—good news because delivering one unit of electricity requires several units of fossil fuels, mostly coal, to be burned at the power plant.

By some estimates, humans will have to slash their greenhouse-gas emissions by 60 percent or more in short order to avert climate disaster. Given that the Kyoto climate treaty calls for an average reduction of just 7 percent, and few nations are on target to achieve even that, you can see why the pessimists think we've already lost the war on climate change.

But RMI has long argued that at least half of all energy use and carbon emissions can be eliminated—profitably—using existing technologies and techniques. *That alone would solve the problem.* A functioning climate-change treaty would help. So would any number of policy changes to level the playing field for all sources of energy, including efficiency. But until then, there are more than enough profitable opportunities to be getting on with.

Will that be enough to avoid serious climate change? No one knows. But whether it is or isn't, promoting and exploiting those opportunities is the easiest (and therefore the best) way to make a difference, and well worth doing regardless.

—Dave Reed

For more information, see RMI's paper "Energy Surprises for the 21st Century" and the Cool Companies website, www.cool-companies.com.

ATTACK OF THE GMOS

CONTINUED FROM PAGE 5

bated by the dumping of unexportable GM crops onto the domestic market, depressing both crop and livestock prices.) Farmers have been quick to react: after spectacular growth in the previous four years, worldwide planting of GMOs is projected to drop by as much as 25 percent in 2000, according to the Worldwatch Institute. The upheaval has been hardest on farmers in the United States, Canada, and Argentina, where 99 percent of the world's transgenic crops are grown.

Recent developments spell further shrinkage for GM crops. In November, 30 farm groups including the American Corn Growers Association issued a warning that farmers risked "massive liability" if their genetically altered crops caused ecological damage. Insurance companies, society's most hard-nosed risk experts, have consistently refused to cover liability against harm caused by GM products on the ground that the risks are unknowable and potentially unlimited—quite the opposite of what the industry and regulators would have us believe.

Also in November, government documents released in a lawsuit confirmed suspicions that the Food and Drug Administration had fast-tracked the permitting of GM foods. The revelation received scant attention in the American media, but fueled unease in Europe and stoked the looming battle over labeling.

The question of whether retail GM foods can, should, or must be labeled as such has been a flashpoint of controversy in both domestic regulation and international trade rules. Companies that sell GM seeds or products have fought labeling tooth and nail, arguing that it's impossible to segregate gene-altered crops from conventional ones. U.S. regulators have concurred on

the basis of "substantial equivalence," meaning that GM crops are similar enough to make identical food (but different enough to patent, of course). That's why the U.S. Food and Drug Administration doesn't regulate or require labeling of GM products. Meanwhile, U.S. trade negotiators valiantly fought trade rules that would allow other countries to require transgenic imports to be labeled, on the ground that such requirements constituted a trade barrier; that position was essentially overturned by an international biosafety accord signed in January.

It's no secret that the real reason GMO companies oppose labeling is because it will further depress prices for their products. But to call labeling a trade barrier is a perversion of market principles, one of which is the availability of product information. The doctrine of substantial equivalence, which limits the labeling discussion to the physical characteristics of products, is similarly anti-market (as well as anti-scientific). Consumers have a right to know *how* their purchases were created, and producers have a right to tell them. Two handmade carpets may look identical, but the fact that one was made by child labor is a significant bit of product information. Nor does any trade bureaucracy tell utilities they can't market green power (see page 21), even though the electrons are "substantially equivalent."

All this has had a predictably disastrous effect on the financial standing of corporations that were banking heavily on biotech. Monsanto paid for its leadership by seeing its share price plummet, forcing it into a shotgun merger with Pharmacia & Upjohn in December. The merger terms imply a valuation of Monsanto's biotech division at approximately zero. European giants Novartis and AstraZeneca likewise decided to combine their biotech divisions into a single unit and sell it off, "effectively washing their hands of crop biotech-

nology,” according to the *Wall Street Journal*.

THE OPPOSITE OF NATURAL CAPITALISM

Despite all these setbacks, supporters of transgenic agriculture still make a moral case for their technology. While it’s heartening that moral arguments are at least being aired, this one doesn’t hold water. It’s nuked all over again.

Just as nuclear power was supposed to be the only way to fuel global development and end energy shortages, transgenics are said to be needed to boost agricultural yields for a hungry and increasingly populous world. A related claim is that higher yields from genetically altered crops, chemical fertilizers, and pesticides saves land for biodiversity and wilderness.

Transgenic crops are unwanted, uneconomic, and morally unsupported. The good news is that they’re also unnecessary.

But even before all the unknowns and imponderables have been counted, genetically modified crops are proving too expensive for the world’s poor. And there is no credible evidence that they increase yields per acre; rather, they increase yields per *farmer*, and that only by consolidating farms and increasing chemical inputs.

Substituting scarce resources for abundant labor is the opposite of natural capitalism, and the opposite of what the world needs.

The cause of hunger is poverty, not a lack of food. Farmers are raising one and a half times as much food as the world’s six billion people need for an adequate and nutritious diet, but many people can’t afford it, so one in seven go to bed hungry. Moreover, yield growth is flagging, especially in developing countries, as soils tire

and biocides breed resistant pests. The fraction of U.S. crops lost to insects is now nearly twice what it was in the 1940s, when synthetic pesticides were introduced.

Transgenic crops are integral to the same development pattern that displaces subsistence with cash crops, raises farm debt, depletes soil, and destroys both cultural and biological diversity. They’re designed to extend suppliers’ seed and chemical monopolies, not to boost yields or save land. And they’re meant not to help subsistence farmers feed themselves but rather to feed more livestock (which eat one-third of the world’s cereals) for the already overfed rich.

Therein lies another danger, one that’s not fashionable to speak of: excessive corporate control. If they have their way, five biotech companies will control nearly 100 percent of the world grain market and most of the seed and agricultural pesticide market. This not only worsens the inequity that is at the root of hunger, but also decreases the diversity and security of the world’s food supply—much the way nuclear power produces a “brittle” energy system.

ALTERNATIVES

So transgenic crops are unwanted, uneconomic, and morally insupportable. But the good news is that they’re also unnecessary.

With transgenic crops as with nuclear fission, the key choices are not between unwelcome alternatives—nuclear warheads or subjugation, nuclear power or freezing in the dark, transgenic crops or starvation—but between those bad choices and attractive ones outside the orthodoxy. For crops, the best choice would be fairer, more localized distribu-

tion of food grown by a respectful and biologically informed agriculture that stops treating soil like dirt.

A large body of scientific literature proves that organic farming in a vast range of crops, soils, and climates, after a few years’ restoration of impoverished soil biota,

TRANSGENIC AGRICULTURE

matches or beats the yields of chemical farming, but with higher and more stable farm profits. High-yield seeds for this purpose abound; transgenic crops are being created not because they’re productive but because they’re patentable. Organic bio-intensive gardening techniques can produce twice the net farm income while using vastly less land and energy. Indeed, organic farming works so well, with sales growing by 20 percent a year in the United States, that its chemicalized competitors keep trying to steal its brand equity by diluting its certification rules to embrace their nonorganic practices.

But sound choices tend to emerge and get adopted in time only if we take seriously the discipline of mindful markets and the wisdom of informed democracy. We need to see beyond molecules and genes to plants and ecosystems. We need to understand the vital differences between biology and biotechnology—between the foundations of traditional botanical science and the smart-aleck, scientifically immature, but commercially hell-for-leather enterprise, a billion times younger, that aims to replace it.

—Dave Reed

RMI is considering starting a biotechnology research program. This article was adapted from a column by Amory Lovins, Hunter Lovins, and Paul Hawken that was invited (but not published) by WorldLink, the online magazine of the World Economic Forum.

CONTINUED FROM PAGE 8

isn't willing to pay for.

■ **Nuclear proliferation isn't a problem.** Rhodes and Beller claim that it's beyond the capability of terrorists to process reactor-bred plutonium into explosives, and go on to state that, in any case, proliferation would still be a risk even if nuclear power ceased to exist—as if the *size* of the risk were immaterial. Yet the link between nuclear power and nuclear bombs has been well established, by RMI

Even setting aside its accident risks, proliferation dangers, and waste problems, nuclear power is just plain too expensive, and in all likelihood always will be.

and others (see “A Treaty Whose Time Has Come,” summer 1995). The risk of terrorists or rogue governments turning stolen plutonium into bombs has increased since the breakup of the Soviet Union, while many nations (Pakistan, India, Iran, Iraq, and North Korea come to mind) have used their civilian nuclear power programs as covers for making weapons.

Rhodes and Beller also use a good deal of ink contending that coal-fired power plants emit more radioactive materials than nuclear plants do. This argument is so scientifically lame—equating diffuse, low-radiation, short-lived, nonexplosive natural uranium and thorium in coal fly-ash with the vast flows of plutonium in their pro-

posed nuclear future is like comparing apples to whole orange groves—that the only conceivable reason for making it is to divert attention from nuclear plants' obvious role in proliferation.

■ **Nuclear power uses less land.** Huber's central thesis is wrong because it counts only the area taken up by the power plant—ignoring the much larger area consumed by all the activities to mine and process uranium into concentrated nuclear fuel. A 1981 study led by nuclear advocate Wolf Häfele found that, when their entire fuel cycles are taken into account, solar, coal, and long-run nuclear

energy systems consume roughly the same amount of land per unit of electricity produced (and the efficiency of solar power has improved since then). And contrary to what the nuclear apologists like to claim, there is nothing inherently better about processed nuclear fuel just because it's

so concentrated. Consider this: a pound of silicon processed into solar cells will produce more electricity over the cells' lifetime than a pound of uranium consumed in a light-water reactor.

Huber further stacks the deck by assuming that solar panels couldn't be mounted on roofs and therefore would have to be placed in huge, land-gobbling arrays. Actually, there's no reason why panels can't be placed on or integrated into roofs or other idle surfaces. That's what we do with ours at RMI. In fact, the ease of siting solar panels right next to where the electricity is used is one of their chief economic advantages over central power plants.

■ **The alternatives won't cut it.**

Efficiency generally saves electricity more cheaply than any sort of power plant can produce it. And although Rhodes and Beller effectively ignore it, and Huber positively pooh-poohs it, efficiency is and will continue to be the largest source of “new” energy and electricity for many years to come.

As for other sources of new supply, the nuclear salesmen acknowledge the market-driven rise of “combined-cycle” natural-gas-fired power plants, but warn that

burning gas still gives off carbon dioxide (albeit less than coal). This raises an interesting question. If natural-gas plants beat nuclear plants so roundly in so many ways—they're much cheaper and quicker to build, more modular, and twice as efficient—what could possibly cause nuclear power to succeed in the market? Perhaps another \$1 trillion in subsidies? Rhodes and Beller, who tut-tut about the \$30–40 billion spent over two decades on efficiency subsidies and renewable energy research, and Huber, the scourge of central planning and government intervention, are strangely silent on this matter.

They likewise overlook, or ignore, the growing cost-effectiveness of two other alternatives to nuclear power. At least as cheap per delivered kilowatt-hour as combined-cycle gas plants are new natural-gas-powered micro-turbines, which when installed onsite also provide heat as a valuable byproduct. Edging into that price range, too, are well-sited wind turbines. True, wind power isn't a panacea, but Rhodes and Beller are way off in saying it produces electricity at “double or triple the cost of fossil fuels”—in fact, they got the ratio about right in size, but backwards. Not only do these alternatives deliver electricity more cheaply than any new and many existing nuclear power plants,

ENERGY

they're also smaller, more modular, and faster to deploy, resulting in a host of other financial benefits.

Finally, Rhodes and Beller make a nod to fuel cells, which they imply could be powered by hydrogen produced with nuclear electricity to create a "minimally polluting infrastructure." Indeed, RMI has for several years envisioned the same scenario, except with the hydrogen produced from renewable electricity, or from natural gas in a way that reinjects the separated carbon dioxide back into the gas wells so that it doesn't enter the atmosphere. But the fact is that the hydrogen will be produced with whatever electricity the market favors, and as we've seen, nuclear

electricity is probably the least favorable of all. Fuel cells, far from reviving nuclear power, will only hasten its demise.

The bottom line of all this? Even setting aside its accident risks, proliferation dangers, and waste problems, nuclear power is just plain too expensive, and in all likelihood always will be. And because it's so expensive, investing in it makes climate change *worse*.

Why? Because capital is finite: sinking it into an expensive solution means it's not available for cheaper ones. In the United States, each dollar invested in electric efficiency displaces nearly seven times as much carbon dioxide as a dollar invested in nuclear power—without any nasty side

effects. (Efficient natural-gas technologies also beat nuclear power for the same reason, though not by as much.) It's better for the climate, as well as the economy, to pursue the best buys first.

If climate change is the problem, nuclear power isn't the solution. It's an expensive, one-size-fits-all technology that diverts money and time from cheaper, safer, more resilient alternatives.

—Dave Reed

RMI's Amory Lovins and Daniel Kammen, director of the Renewable and Appropriate Energy Laboratory at the University of California, Berkeley, have submitted a detailed rebuttal of Rhodes and Beller's article to Foreign Affairs.

Oil prices: taking the long view

So oil and gasoline are expensive again. Funny, only two years ago we ran a story ("Oil, Oil Everywhere," spring 1998) about how *cheap* they were. What's changed? Fundamentally very little. We said it then and we'll say it again: short-term oil price fluctuations signify very little; passively waiting for high prices or shortages to force savings is dumb; actively hiking prices is politically tough; but fortunately it's possible and profitable to make the transition away from oil even when prices are low.

The cheap oil and gasoline of a year or two ago certainly wasn't a good thing, environmentally speaking, since it made it easier for people to justify buying gas-guzzling SUVs and make other wasteful choices. The welcome effect of today's higher prices is that they should encourage some people to switch to more efficient vehicles, and perhaps even to use them less.

But alas, the price of oil is a sandy founda-

tion on which to base an argument for efficiency at the political level: high prices are only temporary, and they can just as easily be used to justify drilling for more oil.

Better to stay focused on the long term, where it's obvious that reducing demand for oil is better in every way than increasing supply.

Much of the world's remaining cheap oil is in the Middle East, so the supply-side strategy would inevitably worsen American dependence on imported oil, now back to early-1970s levels. Resubsidizing domestic oil output to boost supply would hasten the depletion that's supposedly the problem, while also suppressing cheaper oil savings—a doubly stupid policy.

Drilling in the Arctic National Wildlife Refuge, as Alaska's legislators call for every time gas prices go up, would fuel just a few extra weeks' worth of U.S. consumption (or nothing if, as key oil companies suspect, the area is unpromising). And ultimately, increasing oil extraction only encourages more consumption, and delays the inevitable transition to sustainable energy sources.

In contrast, reducing demand through effi-

ciency and substitution lessens the risk of cartel action and war, avoids climate-changing carbon emissions and other pollution, saves money, and strengthens the economy. In fact, it's thanks largely to efficiency improvements that there haven't been any major oil shortages since the 1970s.

As with almost all the issues RMI takes on, this is not a case of *ifbut when*, and sooner is better than later. The ingredients are already in place. Vastly more efficient vehicles are already in the pipeline (see page 12), and have the potential to quadruple average vehicle fuel economy over the next 20 years or so. And it's looking increasingly likely that those vehicles will run on hydrogen produced from low-carbon natural gas and zero-carbon renewable electricity, not on gasoline.

That's why oil prices and shortages are ultimately beside the point. We may never run out of oil—not because of infinite supply, but rather declining demand. As Don Huberts, head of Shell Hydrogen, has put it, "The Stone Age did not end because the world ran out of stones, and the Oil Age will not end because the world runs out of oil."

HARD GREEN, SOFT LOGIC

CONTINUED
FROM PAGE 7

hard greens because, by Huber's definition, soft greens are all coercive, regulation-happy, socialistic market-distorters. (In one incredible passage, he actually manages to equate environmentalists with the rulers of the former East Germany.)

Given Huber's lengthy discussions of resource efficiency in *Hard Green*, it's not surprising that he mentions RMI's Amory Lovins. Indeed, Huber notes that he borrowed his central hard/soft metaphor from Lovins's "soft path" writings, and he invokes Lovins's name far more often than any other (even Al Gore's). What *is* surprising, though, is Huber's portrayal of Lovins as some sort of high priest of environmental coercion. As any reader of this newsletter will know, Lovins and RMI specialize in market-based solutions that *avoid* the need for regulations and seek to *correct* market distortions.

Why does Peter Huber hate efficiency so much? And why is he out to get Amory Lovins? Psychoanalysis is beyond the scope of this article, but I have a theory.

Although Huber gives several examples of "hard" technologies, it's clearly nuclear power that's closest to his

heart. The entire hard green thesis seems little more than an elaborate justification for reviving nuclear power. But to do that, one must do battle with the forces that reduced it to its current dishonored state. Many people and organizations helped clip nuclear power's wings in the 1970s and '80s, but none was more effective than Amory Lovins, who introduced the idea of efficient use as the equivalent of supply. That economic logic, which is as valid today as it was then, exposes nuclear power's fundamental uncompetitiveness. It makes all other arguments moot.

Hard Green appears to be Peter Huber's attempt to turn the clock back to 1976 and re-argue the energy debate that the nuclear industry lost. Amory Lovins is his nemesis. If he can discredit Lovins and his pesky efficiency arguments, nuclear power will be set free. He knows he can't win the argument, but like the attorney that he is, he knows his best tactic is to try to raise a reasonable doubt. Will it work? You're the jury.

—Dave Reed

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memory of John Denver
Christa & Richard E. Robinson
Joan Russell, in memory of John Denver
Sara & Leonard A. Schlager, in memory
of John Denver
Christie A. Smith, in memory of John
Denver
Yvonne & Stewart Springfield, in
memory of John Denver
Eloise & William R. Stierman, in
remembrance of John Denver
Jane Stone, in memory of John Denver
Geraldine & Joseph B. Tellie, in memory
of John Denver
Joan M. Theroux, in memory of John
Denver
Valerie A. Wahlstrom
Barry Wertz
Barbara & Charles M. White, in memory
of John Denver
Ruth Whyte
Cynthia & Lawrence Woytowicz (2),
in memory of John Denver and in
honor of John's Birthday

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