

ROCKY MOUNTAIN INSTITUTE NEWSLETTER

HALFWAY TO HYPERCARS Automakers Are Already on the Right Road

with the several of things called "hypercars," to the point where it probably sounded like we were crying wolf. Well, what do you know: recent announcements at the Tokyo and Detroit auto shows reveal that several major car companies have already made the first of two big leaps toward producing hypercars.

Suddenly, the talk is of fullsized, full-featured passenger cars that get 60 or even 80 miles per gallon—two to three times the current average. These are not concept cars that will never be built, but models that are in development or (in Japan) already on the market.

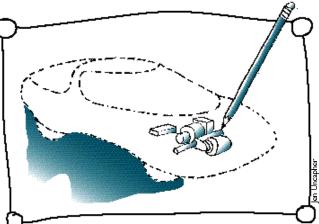
To understand what a revolution that is, you only have to think back a few years, when the Big Three had to be dragged kicking and screaming into admitting even a 10-percent increase in fuel efficiency was practically possible. If they're now showing or verbally committing to making doubled- or tripled-efficiency cars, just imagine what they're working on in secret.

HOPPING ON THE BANDWAGON

Why the change of tune? The main reason is a technological one: manufacturers have finally woken up to hybrid-electric drive—one half of the hypercar concept.

Hybrid-electric vehicles challenge conven-

tional drivetrain arrangements entrenched for the past century. Instead of relaying the engine's power to the wheels mechanically (via driveshaft, gears, differentials, and axles), a hybrid's engine generates electricity to power special motors that drive the wheels.



(In some hybrids, the electric drive supplements, rather than replaces, the mechanical drive.)

Decoupling the engine from the wheels, smoothing the energy flow with a small, high-powered electrical storage device, enables the engine to be smaller and to run more efficiently. It also permits braking energy to be recovered by the motor(s), and opens the door to even more efficient power sources such as fuel cells.

And why the sudden interest in hybrids? Pick a reason. Global warming, and the Kyoto agreement to reward reductions in

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THEY IS WE By L. Hunter Lovins, Executive Director

Final terms the state of the second s

fire or rescue services that a neighbor is in need. On-call or available firefighters, emergency medical technicians, and mountain rescue members drop what they're doing and bolt for the door. Rarely convenient, these calls always take priority over the papers or conversations that get abandoned.

People ask: don't you think **PERSPECTIVES** you guys are doing enough already? One red

Nope. I've a long-standing belief that each of us is responsible for the world around us and should do whatever we can to deal with its problems. That used to be how all communities worked. But as people left rural life where neighbors looked out for one another, it became fashionable to decline to get involved, saying, "They'll take care of it." I've always though that attitude seemed inadequate. Who's "they"? They is me. If a problem occurs on my watch, it's my job to fix it, if I can.

That's why I so admire Dick Recchia of Mitsubishi Motor Sales America. Rainforest Action Network chose to mount a civil disobedience campaign against his company, which sells cars, because another Mitsubishi company, which cuts trees, wasn't susceptible to a consumer boycott. Dick could have answered, "This is not my problem, go away or I'll have you arrested." Instead, he accepted the conflict as an opportunity to reassess how his company does business, how to move it toward greater sustainability, and how he can help other Mitsubishi companies address their problems (see page 8).

That's leadership. It's also part of a growing movement of individuals and companies who realize that "they" aren't doing enough to solve the problems we all face, and that the only way to find solutions is for each of us to do more.

We try to do the same here at RMI,



both as an organization and as individuals, locally as well as globally. The participation of eight of our staff in various local emergency services is a testament to their willingness to pitch in and take responsibility for their world. RMI has long encouraged this by giving employees paid time to serve on the volunteer fire department.

One recent afternoon, as several of us raced off to respond to a car wreck on the highway, our office manager Jennifer Cairns mused, "I wish I could get RMI time to serve the community in my own way." The logic was inescapable. We implemented the new policy described on page 3. Now all our employees can be a part of making their little piece of the world a better place.

RMI is by no means the first organization to do this. In our book *Green Development* we profile the Inn of the Anasazi, which instituted a similar policy several years ago. The Santa Fe-based hotel has found that such measures to empower its staff have played an important part in creating a devoted workforce in an industry that typically has high turnover.

How about you? Ask your boss to consider letting you become part of the solution, too. Or if you are the boss, give it a try: invite your staff to become even more responsible. I think you'll find it's contagious. And I guarantee you, there's no cheaper way to feel good about yourself.

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greenhouse emissions (see page 4). Gulf jitters. Choking smog and the high price of gasoline in emerging markets. A backlash against sport-utility gas guzzlers. The fear that a competitor will do it first. RMI's Hypercar Center is constantly reminding automakers of these threats and opportunities.

Whatever the reasons, automakers are heading in the right direction—fast.

Toyota has led the pack with its Car-ofthe-Year-winning Prius hybrid (see the fall/winter 1997 newsletter), which dominated the Tokyo Motor Show and went on sale in Japan in December. Its 66 city miles per gallon got attention, but what really created a buzz was Toyota's prediction that hybrids will gain a one-third world market share by 2005.

During November and December, meanwhile, Audi, Honda, Mazda, Mercedes, Nissan, and Subaru all showed hybrids or announced their intentions to do so.

Giving critical mass to the hybrid-electric movement was January's Detroit Auto Show, where General Motors, Ford, and Chrysler all made serious hybrid announcements aimed at products by 2000–01. GM is the world's largest automaker—it sells one out of every six cars and trucks on the planet—so when it jumps on a bandwagon, you can bet there's a parade. The next day a front-page headline in the *Wall Street Journal* summed up a determined new mood: "Auto Industry Reaches Surprising Consensus: It Needs New Engines."

GM's three 60–80-mpg hybrid concept cars, said its vice chairman, indicate "deadly serious intent." So they should, given Toyota's and Honda's virtual declaration that they intend to do to Detroit all over again what they did in the '70s. Only this time, Detroit is smarter and more agile and RMI has been quietly preparing it for hypercars since 1991.

DROPPING THE OTHER SHOE

So the first half of the hypercar concept is coming to pass. The second shoe is going to drop in the next few years, as designers learn to make cars much lighter and lower in drag, which makes hybrid-electric drive work better and cost less. Ford is already making a good start with its 40-percentlighter P2000 hybrids, and three Chrysler concept cars shown recently incorporate lightweight polymers. GM's hybrids, while heavy, boast low-drag aerodynamics and tires.

RMI's hypercar concept *starts* with ultralight, low-drag design, for sound engineering reasons.

Because five to seven units of fuel are needed to deliver one unit of energy to the wheels of a conventional car, saving energy at the wheels offers immensely amplified savings in fuel. The way to minimize wheelpower losses is to make the car very light, aerodynamically slippery, and low in rolling resistance, and then recover most of its braking energy. Such a design can cut the amount of power needed to move the car by half or more, which then reduces the size, weight, and cost of the drivesystem and other components, which in turn reduces mass and wheelpower requirements, hence cost, and so on.

Hybrid-electric drive and ultralight, lowdrag design are both worth doing in their own right, but combining the two yields synergies—snowballing savings in weight, complexity, and cost—too good to pass up. And ever stronger evidence is confirming that the ultralight materials' extraordinary strength can make such cars at least as crashworthy as the heavy steel cars with which they may collide.

Whatever the reason for the car industry's newfound interest in hybrid-electric drive, it doesn't appear to be a vision of creating better, more marketable cars. As a result, manufacturers are backing into hypercars, starting with the drivesystem and working downstream instead of the other way around. That's a slower route to an optimized vehicle, because it lowballs the benefits and exaggerates the costs and difficulties of the entire package.

There's a danger that automakers, who come from an incrementalist, componentbased, this-year's-model culture, and who have billions of dollars sunk into conventional manufacturing assets, might simply stop halfway. The job of RMI's Hypercar Center is to make sure they don't.

THE RIGHT DIRECTION

These ideas are not new. Ferdinand Porsche designed a hybrid-electric car as long ago as 1900; more recently, such design pioneers as Paul MacCready have championed hybrid technologies that take advantage of modern materials and electronics. There have been many lightweight concept cars in the past decade, GM's 1991 Ultralite being the best example so far announced by a major automaker.

RMI's contribution has been to show how all the pieces fit together synergistically, and to propose a commercially and strategically compelling approach to manufacturing and marketing ultralight-hybrid hypercars.

The hypercar is an idea whose time has come. Like Amory Lovins's "soft energy path" of the 1970s, it was initially derided by an entrenched industry because it challenged deeply held assumptions, but it's so full of common sense and competitive advantage that it's inevitably catching on.

One of the preconditions for such a concept to crystallize is that people must be aware-at least subliminally-of the unsupportability of business-as-usual. Conventional cars simply can't meet important societal goals such as greenhouse-gas reduction and oil security, nor do they acknowledge the past couple of decades' dizzving advances in electronics and materials. Car manufacturers are now waking up to the impending threat from competitors, both inside and outside their industry, and are increasingly aware that their customers aren't going to put up with ever more costly, heavy, and complicated versions of the same basic product.

The auto industry is finally moving in the right direction, and RMI is making sure it keeps heading that way. We hope to be able to report on more exciting developments in future newsletters.

RMI's Spirit of Volunteerism

RMItes Dave Cramer (at center in helmet), Brett Williams (helmetless behind Dave), and Chris Lotspeich (helmet visible behind Brett) in action during a rescue last August. They are among nine staff who serve in or sit on the boards of local volunteer fire, ambulance, or mountain rescue services



Dylan Coker

This winter, RMI instituted a progressive new policy allowing each employee eight hours per month of paid volunteer time for community service.

The policy is a recognition of the considerable amount of service RMItes already do, and an incentive to do more. Many RMItes have long served as volunteer firefighters and emergency medical technicians; since local rescue workers often can't afford to leave their jobs during office hours for emergencies, it's particularly helpful to the department that RMI allows staff to respond during the day. Other staff volunteer their time to local planning commissions, library boards, environmental organizations, and social-service efforts.

"It's a great adventure of service," says Chris Lotspeich, who serves on the Basalt Volunteer Fire District. "The immediate, hands-on nature of the work nicely complements the research and consulting we do at RMI."

RETHINKING AUTOMOBILITY

By Jonathan Fox-Rubin

I know I can't buy a hypercar yet, but what can I do in the meantime to minimize my car's environmental impact?

There are two basic techniques for reducing the adverse effects of automobiles: smart driving and "negadriving." Smart driving simply means operating your car in a way that

reduces the wear and tear, emissions, and costs of driving. Negadriving means reducing the amount you drive by using alternative ways of getting where you're going (or not needing to, because you're *already* where you want to be).

SMART DRIVING

• Keep your car well tuned. Old cars aren't neces-

sarily the worst polluters. Poorly maintained or malfunctioning vehicles are even relatively new ones. Regular tuneups pay for themselves in longer vehicle life and reduced repair costs, not to mention better mileage.

• Drive gently for the first few minutes. This minimizes cold-start emissions, which account for about half of the emissions from an average 10-mile trip. *Don't* warm up your car in neutral, as this delays "light-off" of the catalytic converter and increases emissions.

• If you're driving for less than five minutes, don't! Short trips hurt the oil's lubricating capabilities and decrease the life of the engine. Unburned gasoline gets in the oil when the engine is cold, then boils off once it gets hot.

• **Combine trips.** Your car's catalytic converter cools down after about 10–15 minutes. Park in a central location and then run your errands to avoid unnecessary cold starts.

• **Don't idle for more than a minute.** It wastes fuel and increases emissions, even accounting for restarting the engine.

• Don't drive aggressively. Flooring

the accelerator puts the car into "enrichment mode," which drastically increases fuel consumption and emissions (not to mention accidents!).

• Keep tires properly inflated. Underinflated tires can decrease fuel economy by 10–20 percent, and also compromise safety.

NEGADRIVING

• Take public transit. Per passenger, buses and trains are much more efficient than cars. Even if you can't use transit, support it: it reduces congestion for those who must drive.

• **Car- or van-pool.** It saves energy, road space, vehicle wear and tear, parking fees, and even time (if your commute is on a highway

with high-occupancy-vehicle lanes).

• Work on flextime or telecommute. If each single-occupancy driver stayed off the roads one day a week, congestion would decrease by 20 percent—even more during rush hour, since extra cars disproportionately slow the flow as a highway nears its peak capacity.

• **Bicycle or walk.** Perfect for getting to transit stops or for going short distances. Biking and walking use renewable energy, promote mental and physical fitness, and create no emissions (at least 1 pound of carbon dioxide is saved per mile compared with driving).

• **Plan your next move** so you live closer to public transit and to where you and your family shop, work, and play.

• Sell your car—the ultimate negadriving technique! The financial benefits are considerable: the average vehicle in the United States costs \$6,000 a year in interest payments, depreciation, insurance, repairs, maintenance, and fuel. That's enough to cover the payments on an extra \$70,000 of mortgage, enabling you to buy a better, more efficient, transit-friendly home.

CLIMATE CHANGE

AFTER KYOTO Making The Targets Moot

e'd be disappointed with the targets set at December's Kyoto climate-change conference if it weren't for one thing—the targets aren't very important.

What *is* important is that the Kyoto treaty establishes a "cap-and-trade" framework that will specifically reward carbon reductions, best buys first. As more nations ratify the treaty and more firms behave as if it were ratified, trading will add yet another bottom-line reason to reduce greenhouse-gas emissions, whatever the targets, and give RMI yet another argument for profitable climate protection (see the fall/winter 1997 newsletter).

And there's every reason to believe that this trading system will make the targets moot. Remember the battles in Congress in 1990 over sulfur dioxide emissions targets? Of course you don't; nobody does. The targets are ancient history, because industry is already exceeding them by 40 percent, and at *less than 10 percent of the initial cost projections*

How? Cap and trade. Set a total permissible emission level and let polluters buy and sell the rights to emit. Once you let folks profit from reducing their emissions, they find ingenious ways to do so. The models that predict such dire economic consequences almost always fail to take market-driven innovation into account.

A similar story can be told about CFCs, the ozone-depleting gases that are being phased out by another international treaty. Companies that once argued that there were no substitutes for CFCs are finding there's almost always an alternative that costs the same or less and does the job as well or better—they're turning lemons into lemonade. It matters not (except politically) where you set the target, so long as you

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DEAR ROCKY

A CHANGE IN THE BUSINESS CLIMATE?

n the wake of the December Kyoto climate conference, RMI drafted the following letter to help rally corporate America around profitable climate protection. As of press time, senior executives of

22 corporations had signed it. We'll list all the signatories in a future newsletter.

We've annotated the letter here to highlight some of its important themes.

RMI's "aikido" approach to climate change is to unite corporations around win-win solutions. As President Clinton said before the Kyoto conference, paraphrasing ŘMI, "Climate change can bring us together around what America does best."

This is created wealth. Efficiency innovations enable the sort of economic development that's in everyone's interestin fact, it's the best sort of economic development, because it creates wealth and jobs without creatingnew problems

A classic "no regrets" proposition: we have nothing to lose but our waste!

A Message from Corporate Leaders about Climate and Business As senior executives and as citizens, we strive for corporate profitability and for prudent statuardakin Compating these scale might seem to conflict. In proventing potential cli-As senior executives and as cruzens, we surve for corporate promability and for produce stewardship. Sometimes these goals might seem to conflict. In preventing potential climate change, however, they need not. Our enterprises use energy efficiency as a practical tool to reduce expenses, enhance pro-Our encerprises use energy enciency as a practical tool to reduce expenses, ennance pr ductivity and competitiveness, and return value to shareholders. Efficient technologies and improved practices and processes, offer expanding opportunities to provide more and and improved practices and processes, other expanding opportunities to provide more and better services while using less fossil fuel. And since saving fuel generally costs less than the service fuel the events protocting to be fuel and show on the profit better services while using less rossil rule. And since saving rule generally costs less the bissing fuel, the climate-protecting benefits of burning less fuel are achieved at a profit. Already, America's strong economy is saving \$150-200 billion worth of energy every year Aneaoy, America's suong economy is saving Q130-200 binion worm of energy every compared with 1973 levels of efficiency. But the economy can grow still stronger by analytic and the top in compared with 1273 revers of enciency, but the economy can grow sun sublight by applying even better techniques. Last February, eight Nobel Prize-winners led more than a son fattor, according that shallow ontions avist that would slow elimete applying even better techniques. Last redruary, eight twoter Frize-winners ied more than 2,500 fellow-economists in declaring that "policy options exist that would slow climate that the standards and that there is a standard show that the standard show that the standard show that the standard show that the standard show the standard s 2,500 renow-economists in occaring that policy options exist that would slow climate change without harming American living standards, and that these measures may in fact instructions in the tensor run." improve U.S. productivity in the longer run." That conclusion is correct—but making it happen requires changes. Dozens of needless that conclusion is concer-out making it happen requires changes. Dozens of meetices barriers are now slowing the adoption of innovative technologies. The business communibarners are now stowing the adoption or innovative econologies, the obstacles contained to using the climate problem. But we need the partnership of notice makers to nee prover the obstacles into comparisial encodingities. ty can go iar towaru promany sorving the cumate proment, our we need the particular of policymakers to use proven ways to furn the obstacles into commercial opportunities and help the marketplace work properly. Together, business and government can capture major energy-efficiency gains which are Profitable today. Doing this can also keep America's energy prices low. Their 15% drop promatic today. Doing this can also keep America's energy prices low. Their 15% diop since 1990 is due in no small measure to energy efficiency's prior successes, notably dur-ing 1970. 26 when CDD group 10% while anarow use should 60% Careful attention have Since 1990 is due in no small measure to energy environcy 5 prior successes, industry our-ing 1979. 86 when GDP grew 19% while energy use shrank 6% Careful attention, barri-in busting and today's botton toshnotoging can report and avrand that engaged and at the ing 1979-86, when GDF grew 1976 while energy use smank 070. Careful auchion, batter er-busting, and today's better technologies can repeat and expand that success, and at the same time responsibly address the climate challenge. In business, we often make decisions under uncertainty. Yet if protecting the climate is not In ousiness, we often make occisions under uncertainty. Yet it projecting the crimate is a burden but a boon, then the uncertainties of climate science don't matter because we account to the projection of the transfer because we a burden out a boon, then the uncertainties of crimate science don't matter, because we should do the same things anyway to raise profits, create jobs, improve living standards, and the top don't but the body in the body i snouid do the same things anyway to raise promis, create jobs, improve fiving standards and gain competitive advantage. It also won't matter who goes first—but the leaders in and gam competitive advantage. It also won't matter who goes motion on the readers in making energy efficiency a strategic priority will capture the earliest and greatest rewards. We intend to be among those leaders. This is a bottom-line concern for business. Just look at Toyota, which has invested hun-

This is the central message of RMI's recent paper; "Climate: Making Sense <u>and Making</u> Money"-turning barriers into opportunities.

In other words, economic growth no longer depends on energy consumption—in fact, efficient new technologies and methods are one of the prime engines of today's burgeoning economy. (Another is the way efficient use keeps forcing energy prices ever lower.)

dreds of millions of dollars to be the first to

market with a hybrid-electric vehicle.

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create a market mechanism to encourage the behavior you want.

There are two reasons why carbon dioxide will be even easier to abate than sulfur. First, energy efficiency is banned by law from the sulfur trading—only "end-ofpipe" measures (such as scrubbers and fuel mixes) count. So while the sulfur trading regime artificially restricts companies to some of the most expensive options, Kyoto's carbon-dioxide scheme makes efficiency—almost always the cheapest option—its foundation. Second, carbon dioxide is inherently more profitable than sulfur to abate, because doing so saves fuel, and fuel costs money.

The climate treaty negotiated in Kyoto

and the U.S. Administration's position both call on businesses to take the lead with innovation and technology. Emerging policy will strongly favor early adopters of efficiency, and will strengthen the business case for sustainability.

The sooner the private sector gets the message, the better. Post-Kyoto, RMI is working all the more closely with forward-thinking companies to help them grasp these opportunities and thereby force their competitors to do the same. The corporate climate-change statement (page 5) is one tactic. RMI's burgeoning Corporate Sustainability consulting service, which shows clients how to make their industrial processes and facilities more efficient (below), is another.

CORPORATE SUSTAINABILITY

AND FOR OUR NEXT TRICK... Greening the Semiconductor Industry

Tagine a Dickensian textile mill, smokestack spewing filth, downtrodden workers slaving in inhuman conditions. A classic opportunity for efficiency savings, right? Sure, but that's a no-brainer. What about modern industry—microchip plants, for example, where workers in gleaming white "bunny suits" glide through state-ofthe-art facilities? Now that's a challenge. Such a high-tech industry must have the efficiency market cornered already, right? Wrong. In fact, just the opposite.

Tremendous pressure to stay ahead in a rapidly changing industry means expedience is paramount. To beat competitors to market, manufacturers plan and build new billion-dollar plants in 12 to 18 months. Designers are more likely to copy an old plant than chew their pencils worrying about efficiency. There's a term for what results: infectious repetitis. The same bad design is copied over and over again: not only are efficiency opportunities missed, but inefficiency is perpetuated. RMI, its for-profit subsidiary E SOURCE, and their colleagues are now working to take advantage of this tremendous savings potential.

A little background. Computer microchip fabrication plants, or "fabs," are the engine of modern alchemy, turning sand into money. According to E SOURCE, "Over the course of its trip through a fab, a typical silicon wafer purchased for \$200 may increase in value to \$30,000 or more." Global sales of semiconductors (silicon chips) were \$129 billion in 1996, with sales of \$1 trillion expected by 2005.

Worldwide, \$169 billion worth of new (inefficient) plants are on the drawing boards—as planned, they'll consume as much energy as five Chernobyl-sized power plants, worth roughly \$2 billion annually. Electricity use per square foot can approach 100 times that of a modern office. Saving electricity can also provide the most cherished side benefits: higher product yield and (in new plants) faster and cheaper construction. To help realize those opportunities, E SOURCE has just completed the first part of a two-part study, *Delivering Energy Services* to Semiconductor and Related High-Tech Industries This first installment is an assessment of the marketplace: in order to provide better service, energy service companies (firms that help companies reduce their energy bills for a cut of the savings) need to know how the industry will grow and use energy. The second installment, due in late April, will examine the technology available to provide high-quality power and energy efficiency in cleanrooms, airhandling systems, and production tools.

Chris Robertson, one of the authors of the paper and an occasional RMI partner, recently received a \$700,000, two-year grant from the Northwest Energy Efficiency Alliance to transform energy efficiency practices in the semiconductor and microelectronics industry. RMI's Corporate Sustainability services helped him kick off his project in February: Amory Lovins, Robertson, and other members of a semiconductor "dream team" taught a major chip maker's energy staff about advanced techniques for energy efficiency.

What kind of savings are we talking? That's confidential, but at Advanced Micro Devices' Fab 25, an energy service company proposed \$250,000 worth of modifications to air-handling, lighting, and compressed-air systems that will save \$580,000 a year. That's an annual rate of return of better than 200 percent!

The opportunities for savings are so big because of the nature of the industry. Since dust particles can destroy sensitive circuits, chips are made in "cleanrooms" where air is thoroughly filtered—an extremely energyintensive process. Energy-conscious designers can apply the same tricks used in superefficient air-conditioning systems: simplified layout, blowing air slowly through big coils and filters rather than quickly through small ones, better fans and controls, and aerodynamics that smooth airflow. The most efficient cleanrooms use one-fourth the energy of normal ones, and are cheaper, more reliable, smaller, and *cleaner*.

Heard this kind of thing before? It's a new chip off the old block. S

ENERGY

OIL, OIL EVERYWHERE... Are We Running Out of It or Aren't We?

n March, the inflation-adjusted price of gasoline in the United States hit an alltime low. The same month, *Scientific American* published a special report titled "The End of Cheap Oil," warning of a permanent worldwide petroleum shortage beginning by 2010.

Mixed messages or what?

Not exactly. Clearly we're glutted with oil right now, but just as clearly, we can expect to run out of it at some point—it's a finite resource, after all. The real question is, is the you-know-what really going to hit the fan as early as 2010, or indeed ever?

Debate over such resource questions is all too often polarized by ideology. The prospect of an oil crunch fits environmentalists' sense of ecological limits, and bolsters their argument that humankind must change its ways to live within those limits.

On the other side, "cornucopians" aren't worried about ever running out of oil. Human ingenuity, technology, and market forces, they say, will work together to produce more oil, make it last longer, and invent substitutes for it (or for the machines that use it) before it's depleted.

We tend toward the cornucopians. There are many good reasons the world should be weaning itself away from oil, but scarcity isn't one of them.

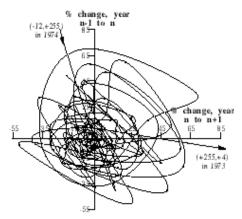
However, an oil crunch *is* what we'll get if we don't make a conscious effort to change our present course. The cornucopia isn't automatic: you have to turn the crank.

RISE AND FALL

Historically, resource depletion tends to follow a standard bell curve, whether for a single oil field, a group of fields, or a country. The *Scientific American* authors assume that global oil supplies will follow the same rise and inevitable fall.

The rub is that they predict the oil

crunch will come long before we're on the downhill slide—it'll start, in fact, at the point of maximum output, when supply will stop keeping up with rising demand, so prices must rise to keep demand in check. The global economy will then have to adjust to a sudden reversal in centurylong oil growth, and to the concentration of most of the remaining oil in the hands of a few Middle Eastern nations.



Don't bet on oil prices: they've fluctuated perfectly randomly for 113 years (1881–1993).

And that point will come sooner than we think, the authors predict, because they contend worldwide oil reserves have been inflated over the past decade or so for political reasons (the more reserves OPEC nations report, the more oil they can sell).

The result, "and soon, is the end of the abundant and cheap oil on which all industrial nations depend."

LOAVES AND FISHES

Right—but wrong and irrelevant. Here's why.

First, the supply side. Reserves are *increasing*, and probably will continue to do so for the foreseeable future, according to Irvin "Chip" Bupp, managing director of Cambridge Energy Research Associates and an RMI Board member.

That's because the definition of "reserves" is a technical and economic one, not a geological one: improved technology or higher oil prices boost reserves because more of the oil is worth finding and extracting. Alleged fiddling with reserve estimates is thus a red herring, Bupp says.

And while it's true that new discoveries can trail consumption at times, he adds, that's simply a function of the shifting economics of oil exploration. Whether the cost of finding and lifting oil falls faster or slower than the price of oil determines when it's worth paying to seek more oil.

Nor do oil depletion curves capture the nuances of demand. Most economists assume demand will just keep rising until higher prices dampen it. "Demand" for what? Oil doesn't equal the end uses it provides. It's not the only way to power a car or heat a building. In fact, efficient use and substitution can restrain demand and prolong supplies, perhaps indefinitely.

Efficiency remains a huge source of "negabarrels" of oil, and is getting cheaper even faster than oil. Case in point: hypercars, which RMI predicts will eventually be four to eight times more efficient than comparable current vehicles, yet cost no more. Since light vehicles dominate transport, the major oil use, even a gradual shift to hypercars could offset the projected increase in oil demand. A rapid shift could even send oil prices tumbling.

Substitution need not wait for the youknow-what to hit the fan, either. Abundant natural gas is already replacing oil for many uses. Renewable energy will take over next, speeded by hypercars and fuel cells, which are also suited to solar hydrogen.

RMI research director Amory Lovins believes the forces of efficiency and substitution are so powerful that they'll outpace depletion. "It's now plausible that oil—like uranium—will become uncompetitive even at low prices before it becomes unavailable even at high prices," he says.

Oil scarcity isn't a non-problem, but it's probably the weakest reason for making the transition away from oil. Profit, climate protection, security, and quality of life are all more relevant and defensible.

ECONOMIC RENEWAL

FALLING OFF A LOG RMI Helps Timber-Dependent Towns Diversify

The plight of timber-dependent communities has become a familiar theme—unemployed loggers and endangered species, jobs versus the environment.

If these communities were merely logging camps, the choice would be stark: move on or cut more trees. Fortunately, permanent communities have more—and better—options. When people are committed to a place and their neighbors, they go to great lengths to stay and survive. They've got a support system; they're not just statistics.

For 15 years, RMI's Economic Renewal program has been harnessing the staying power of communities to help them build stronger, more sustainable economies. Recently the team has begun tailoring "ER" for timber-dependent communities, conducting fieldwork in Oregon and Pennsylvania, and writing a book on the subject.

Options available to timber communities vary from place to place. In southern Oregon's Applegate Valley—where timber jobs have dramatically declined and traditional agriculture is just hanging on or selling out—RMI is working with group of progressive farmers who believe that a prosperous future in the Applegate looks like lots of small farms, instead of subdivisions full of California refugees.

The Applegate is famous as one of the few communities where the "timber wars" were, at least temporarily, resolved through an extraordinary homegrown mediation effort called the Applegate Partnership. Among other successes, it designed an environmentally sensitive timber sale that went unchallenged, the only one of its kind.

Rainforest Update

After more than three years of negotiations, which began through RMI's mediation (see the summer 1995 newsletter), Rainforest Action Network and two Mitsubishi companies have settled their differences.

In a landmark agreement announced in February, RAN dropped its long-running consumer boycott against Mitsubishi Electric America and Mitsubishi Motor Sales America (but not against other Mitsubishi companies). RAN had targeted the entire Mitsubishi trading conglomerate, alleging unsustainable logging practices.

For their part, the two Mitsubishi companies pledged to undertake an unprecedented, top-to-bottom environmental review of their business activities; end their use of old-growth forest products; phase out their use of tree-based paper and packaging products by 2002; and fund a program to restore and preserve the world's remaining ancient forests and their indigenous inhabitants.

Mitsubishi Electric America executive John Savage called the agreement "an affirmation on our part that progressive, environmentally responsible efforts make good business sense, as well as being positive for the long-term health of our ecosystems. We hope that other companies will join us in these efforts."

Meanwhile, reports by the Systems Group on Forests (spring 1996 newsletter), an RMI-led panel that grew out of the RAN-Mitsubishi negotiations, are nearing completion—more news soon. This winter, Applegaters worked with RMI's Economic Renewal team and the Rogue Institute to develop a strategy to strengthen and expand the fledgling local organic and specialty agriculture industry. They plan to build a cooperative processing facility on an old industrial site and launch a powerful marketing effort that will include an Applegate label for all local products, farmstands in the valley, and a delivery service for the wider Rogue Valley.

While many western communities are passively succumbing to an expensive and congested future of ranches swallowed by sprawl, creative Applegaters have chosen a challenging but sustainable future.

RMI's Applegate work is supported by the Bullitt Foundation and the GAG Charitable Trust. By the time you receive this newsletter, RMI will be deep into a similar effort in Kane, Pennsylvania partnered with the Headwaters Charitable Trust and supported by the Howard Heinz Endowment.

The new Economic Renewal book, provisionally titled *Beyond Timber Dependency: How Ten Communities are Creating Jobs and Protecting the Environment*, will be published this fall. 🕥

New Publications

Advanced Composites: The Car Is at the Crossroads. Strategic recommendations for composite firms seeking to join the lightweight automotive materials competition. Available early June. 14 pages. T98-1. \$5.00 plus shipping & handling (see p. 11)

Climate: Making Sense and Making

Money (E97-13), discussed in the previous newsletter, can now be downloaded for free from RMI's website at www.rmi.org/catalog/climate.htm. Also downloadable is a set of overhead transparencies digested from the paper.

Small is Profitable, RMI's book-length proprietary report on the benefits of distributed electricity supplies, is now expected to be ready in June. Sorry for the delay.

RMI NEWS

MISSION ACCOMPLISHED Windstar Campaign Meets Its Goal

R MI's Securing the Future capital campaign has officially reached its goal, at least on paper. Hundreds of gifts and grants have pushed the two-anda-half-year campaign comfortably past its target of \$3.1 million.

The successful completion of the campaign ensures the permanent protection and stewardship of the 957-acre Windstar property, a former ranch located a mile from RMI headquarters that provides critical habitat for elk and other wildlife, and office space for most RMI staff.

Windstar was purchased in late 1996 with the first \$1.5 million raised by the campaign, and its ownership was immediately transferred to the Windstar Land Conservancy, a nonprofit land trust managed by RMI and the Windstar Foundation. The money raised after the purchase is earmarked for urgent land restoration work and the establishment of a \$1-million endowment to provide for the land's longterm operating expenses. (Without an endowment, those expenses would have to come out of RMI's operating budget.)

The success of the second half of the campaign was due in large part to grants from the Richard King Mellon Foundation, the Kettering Family Foundation, and Pitkin County Open Space and Trails, plus a gift from Amory and Hunter Lovins (see box). A portion of a major grant to RMI from the William and Flora Hewlett Foundation has also been applied to the campaign.

Our sincere appreciation goes out to the more than 1,600 individuals and organizations that helped the campaign reach its goal. The names of all contributors as of 31 December are listed on pages 13–16; gifts received after that date will be acknowledged in future newsletters.

We'd also like to express our gratitude to

campaign coordinator Judy Moffatt, whose expertise and professionalism were vital to the effort's success, and RMI Board members Jimmy Mills and Carol Noyes, who graciously served as campaign co-chairs.

Gifts to the Securing the Future campaign are still most welcome: they will cover borrowings against pledges (to be received over the next few years) and will allow more of the Hewlett grant to be shifted to RMI operating support.

And although the campaign has reached the financial goal set two years ago, that estimate has turned out to be low. RMI will continue to raise money to cover these extra expenses. So if you were feeling left out because you hadn't yet sent a donation, there is still a need.

ONWARD THROUGH THE WEEDS

With funding assured, RMI this winter hired a full-time land manager, Mike Villa, who has been busily mapping out a 10year plan of restoration work for the land.

Villa, a wildlife biologist with expertise in range and wetlands ecology, says his main priorities will be the restoration of natural ecosystems and the establishment of an environmental education and research facility on the land.

The first order of business remains the eradication of invading weeds, which crowd out native species, reduce wildlife forage, and deplete the soil of water and nutrients. Villa plans to continue the bat-tle—started with much gusto last summer—against various species of thistle, knapweed, tansy, and toadflax.

Equally important over the long term will be the restoration of degraded wetlands and overgrazed uplands. A number of related activities are planned for this summer, including irrigation and ditch improvements, streambank contouring, pond restoration, and forage enhancement.

Many of the land's problems, Villa believes, can be traced to past practices based on the belief that humans are separate from nature, and that natural processes should be allowed to unfold without human intervention. While that may be an appropriate strategy for intact, wild ecosystems, it doesn't work when applied to a former working ranch.

Villa sees in Windstar the potential to act as a large-scale laboratory to demonstrate and monitor management practices for transforming degraded western rangelands into self-sustaining, productive ecosystems. He is currently seeking further grant funding to support this effort.

Easy Come, Easy Go

Amory Lovins lists his priorities as "saving the world, having fun, and making money—in that order."

He put his priorities into practice in January. Upon learning he'd won a \$250,000 Heinz Award, he and RMI executive director Hunter Lovins promptly donated the full amount to the Windstar Land Conservancy.

"I hope it will signal to others the importance that we assign to the Conservancy," he said of his gift.

RMI's co-founder and research director, Lovins was named the recipient of the 1997 Heinz Award in the Environment category for his "contribution to the understanding of energy use and alternatives to traditional fossil fuels and nuclear power."

The Heinz Award is only the latest of many accolades for Lovins, who is also the recipient of a 1993 MacArthur "genius" fellowship, an Onassis Prize, and, with Hunter Lovins, a Right Livelihood Award, a Mitchell Prize, and a Nissan Prize.

Although the Heinz Award specifically names him, Amory said, "it recognizes Hunter's achievements as much as mine. We have been a team since 1979."

ZEN AND THE ART OF FUND-RAISING A Salute to Farley Sheldon, an RMI Original

Realized Sheldon is standing on her porch on a warm February day. There's a hint of cowboy in her maybe it's the boots and slacks, maybe it's the stance, arms akimbo, one heel kicked out. When a group of RMI visitors come by, she welcomes them: "These boards are

made from a mixture of wood scraps and recycled soda bottles," she says, scuffing at the new decking with her toe. "It looks just like wood but won't rot. It doesn't seem to get too slick in the rain. I like it just fine." RMI's director of development for 12 years, Farley has not lost her enthusiasm for the Institute's mission.

It's high time we acknowledge Farley's contribution to RMI. Since 1986 she has done a difficult job—asking for money—gracefully, not through multiple mass-mailings and dinnertime phone calls but with an approach that has alternately been called "aikido," "Zen," "Taoist," and even "jedi" fund-raising. In a time when nonprofits are increasingly prone to the hard sell, Farley has stood by her guns.

"We have a motto," she says, "'putting all our begs in one askit,' where we make just one appeal a year for individual operating support. Obviously we need money to operate, but we try not to make it the focal point of RMI's image. So many excellent environmentally oriented nonprofits have ruined their images by pushing too hard. We try to avoid that as far as possible." That strategy has paid off: RMI has met payroll every month since 1982 (though often not by much), and gifts are often accompanied by notes expressing appreciation for the Institute's low-key approach.

At 84, Farley is on her 14th career. She has shown hunters and jumpers in Madison Square Garden, flown her own plane, and founded and run the Sequoia School. She was a probation officer, an alcoholism researcher, and one of the top women in the Los Angeles County government. The Pentagon Papers were photocopied on her Xerox. She even once tried, inadvertently, to shut down the Manhattan

Project. (Ask her about it.)

If one were to describe Farley's life in one word, it would be "principled." She took a Duke law degree with Richard Nixon, then, alone out of 32 classmates, declined an invitation to the White House because she didn't agree with his policy in Vietnam.

Hunter Lovins, who happens to be Farley's daughter, says: "Farley has been a major influence on my life, always encouraging me to seek ways to make the world a better place, from early advice to leave a campsite cleaner than I found it, to always doing more than her share of whatever work there was to be done. She is a believer in Jeffersonianism, and an enemy of cynicism. She's also a great friend."

Many staff children younger than Hunter haunt the Institute. One, a threeyear-old named Lily, is shy enough to hide behind her mother's legs in the kitchen. Visiting for lunch one afternoon, Lily whispers: "I want to sit next to Farley." There are few better indicators of the effectiveness of the soft sell, of kindness, and of the quality of people.

"Why I love to give to RMI: Aside from their low-key fundraising, RMI doesn't waste their energy on blaming, criticizing, and attacking....Instead RMI asks, 'How can I help? What can we do to make things better?' This is the attitude that brings real and lasting solutions." — Reader Tim McNerney

NOW YOU SEE IT...

Some problems we love to have. The first print run of RMI's latest book, *Green Development: Integrating Ecology and Real Estate* (fall/winter 1997 newsletter), sold out in an astounding two months, sending publisher John Wiley & Sons scrambling to reprint, and annoying many would-be readers.

That short-term inconvenience aside, the book's success is good news for the long term. *Green Development* is selling mainly to realestate developers, architects, financiers,



and university professors: its ideas are already finding their way onto drawing boards and course curricula, and will increasingly be seen on the ground in the next few years. Many observers are already predicting that green development will eventually become the norm in the realestate industry, and RMI's book will be the standard reference work.

Co-authors Jen Uncapher and Bill Browning, who kept up a whirlwind schedule of press conferences and professional speaking engagements in November and December, deserve credit for giving the book a strong sendoff. Yet most of the press coverage generated by their tour didn't even appear until *after* the first 3,000-book printing had sold out, suggesting that there was an even greater untapped demand for information on green real-estate development than we had dared hope.

Now RMI's Green Development Services is bracing for a corresponding boom in consulting work—another problem we'd love to have.

We apologize to those of you who had to join the waiting list in January and February. All back orders should have been cleared by now, and the book and companion CD-ROM may once again be ordered through RMI. The book costs \$54.95 and the CD \$7.00 plus shipping and handling (see page 11). *Please note that our supply of free CDs has run out.*



Farley Sheldon, captured in a rare photo

taken at last June's Solstice Celebration.

THANKS IN-KINDLY

Thanks go out to Carrier Corporation and Maytag Appliances for their very welcome recent in-kind donations.

Carrier's gift was an efficient propane boiler to replace the woefully inefficient electric heating and hot-water system at RMI's newly purchased employee-housing building. The new unit is projected to cut monthly energy bills in half, even after the addition of extra living space and two bathrooms. Superinsulation will soon save more.

Later this year, with Carrier's help, we hope to carry out similar retrofits at RMI's other staff-housing building and at the Windstar office building.

Maytag, meanwhile, donated one of its energy- and water-efficient Neptune washing machines as a demonstration model for the headquarters building.

One of the new wave of front-loading "horizontal-axis" machines, the Neptune turns laundry on its side and tumbles clothes through a relatively shallow depth of water. (The drum of a vertical-axis machine has to fill up entirely to get clothes clean.) As a result, Maytag's machine uses 40 percent less water and 75 percent less hot water than a comparable conventional model, reducing total energy use by 65 percent.

NEW SHIPPING & HANDLING RATES

We're sorry that increased U.S. mail and UPS rates require RMI to increase its shipping and handling charges. The new charges are as follows:

Order Amount	U.S.	Canada
\$ 0.00-12.00	\$3.50	\$4.00
12.01-20.00	4.00	5.00
20.01-35.00	5.00	6.00
35.01-50.00	7.00	8.00
50.01-100.00	8.50	9.75

We normally ship by first-class mail or UPS. For larger orders, express delivery, or shipments outside North America, please call RMI for shipping and handling charges. All charges are in U.S. currency.

1997 FINANCIALS

Historically, RMI has published a recap of unaudited financial results for the previous year in the spring newsletter. This year we're going to wait until the summer issue and use audited figures. As always, full financial results will be published in the annual report, available in late June.

Preliminary results suggest an operating surplus in 1997, the Institute's third in a row.



RMI welcomes (left to right) housekeeper Erica Johns, information systems operator Steve Elman, hypercar researcher Christine Schubert, and land manager Mike Villa. (Not pictured: electrician John Anderson and computer assistant Marty Hagen.) And farewell to Patty LeBlanc, Kipchoge Spencer; and A.J. Thompson.

Dave Reed

The Newsletter

The Rocky Mountain Institute *Newsletter* is published three times a year and distributed to more than 20,000 readers in the U.S. and throughout the world. Please ask us before reproducing, with

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About the Institute

Rocky Mountain Institute is an independent, nonpartisan, nonprofit research and educational foundation with a vision across boundaries.

Seeking ideas that transcend ideology, and harnessing the problem-solving power of free-market economics, our goal is to foster the efficient and sustainable use of resources as a path to global security.

Rocky Mountain Institute believes that people can solve complex problems through collective action and their own common sense, and that understanding interconnections between resource issues can often solve many problems at once.

Founded in 1982, Rocky Mountain Institute is a \$501(c)(3) / 509(a)(1) public charity (tax-exempt #74-2244146). It has a staff of approximately 45 full-time, 48 total. The Institute focuses its work in several main areas-climate, corporate practices, community economic development, energy, real-estate development, security, transportation, and water-and carries on international outreach and technical-exchange programs. Its E SOURCE subsidiary (1033 Walnut, Boulder, CO 80302-5114, 1-800-E SOURCE, esource@esource.com, www.esource.com) is the leading source of information on advanced techniques for electric efficiency.

INSTITUTE SUPPORTERS

Our sincere appreciation is offered to these friends who have contributed to RMI. Please let us know if your name has been omitted or misspelled so it can be corrected in the next issue.

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Donations received between 1 September and 31 December 1997 are listed. Numbers in parentheses indicate multiple donations.

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SECURING THE FUTURE CAMPAIGN

Included are all gifts and pledges received as of 31 December 1997. RMI appreciates the generosity of all the anonymous donors.

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Marie Seiverinsue

Polly Ann Shelley

JoAnn Simms

Catherine Ann Simon

Juanita & Larry Sipe

Beth-Ann C. Smith

Gregg M. Smith

Michael E. Smith

Dr. Keith H. Soring

Deborah & David Spurgeon

Deborah & Floyd F Stearns

Sue & David J. Stevenson

Eloise & William R. Stierman

Valerie & John L. Switzer

Jane & Doug Taylor Geraldine & Joseph B. Tellie

Susan & Larry Stewart

Jerry Smith

Jane Stone

Amy M. Shroyer Phyllis & Joseph E. Sikorsky

Jack W. Ross

Ann Robin & Bobby Riley

Margaret & James M. Robb