



HYPERCARS: THE NEXT GENERATION

Is It a Car or a Mobile Power Plant?

Imagine a car whose “engine” has few or no moving parts to wear out, makes almost no noise, and emits nothing but pure water. The car’s range and performance aren’t limited by a heavy battery, nor does it need to recharge overnight. Quite the reverse: it doubles as a mobile electric power plant, earning its owner a modest income simply by being plugged into the grid while it’s parked.

Science fiction? Nope. Such a car could be built today, using existing technology. The only hitch is that it isn’t cost-effective—yet. But RMI’s hypercars could make it so.

The heart of this quiet, clean vehicle is a hydrogen fuel cell, a sophisticatedly simple device familiar to readers of *Popular Science*. Developed in the 1960s for the space program, fuel cells flamelessly combine stored hydrogen with oxygen from the air to produce an electrical current, reversing the high-school science experiment that uses electricity to split water. Unlike the combustion engine in a conventional car, a fuel cell is more like a battery that, rather than needing recharging, is supplied with fresh reactants when you step on the “gas” pedal.

Until recently, fuel-cell research focused on large, high-temperature liquid processes for stationary uses. However, in the past few years, dramatic advances have been made in solid-state proton-exchange membrane (PEM) or “polymer” fuel cells, whose high power and efficiency, modular sizes, and mild operating temperatures ideally suit them to vehicles.

RMI has long considered fuel cells a promising power source for the ultralight, hybrid-electric “hypercar” concept it has been pioneering since 1991. However, we had assumed that fuel cells would be slow to compete with existing onboard powerplants, such as internal combustion engines.

Only recently have we come to realize that fuel cells may well enter hypercars much earlier, with surprising implications for other sectors too.



TWO LEAPS IN A SINGLE BOUND

RMI’s Amory Lovins likes “leapfrog” technologies that achieve greater benefits in a single bound than a whole series of smaller, incremental steps. The hypercar is one such leapfrog. The fuel cell is another. Both imply important shifts in industry and infrastructure, yet in many ways they’re complementary—the advantages of one can help overcome the barriers to the other.

Fuel cells hold great promise as the powerplant even for traditional vehicles, notes Brett Williams, who joined RMI last winter to explore fuel-cell hypercars. A fuel-cell-powered drivetrain converts fuel into traction three to four times more efficiently than a conventional one, and requires much less maintenance. Recent studies have shown that a Ford Taurus-class vehicle equipped with a PEM fuel cell and electric motor would cost less to build and drive, even at costs likely in early, moderate-volume production.

Fuel cells’ potential has not gone unnoticed: Mercedes-Benz is believed to have spent \$200 million developing a prototype fuel-cell-powered minivan, unveiled in May. Similar announcements are expected from other manufacturers.

As for the hypercar, one of its essential features is that it generates its own electricity supply onboard, thus capturing the advantages of electric cars (like brisk acceleration and recovery of braking energy) without the disadvantages (having to lug around hundreds of pounds of batteries). That, plus ultralight construction and

(continued on page 6)

INSIDE

<i>The Tao of Systems</i>	2
<i>A Sea-Change in Snowflake</i>	3
<i>Designing Incentives</i>	4
<i>Efficiency Goes to Wall Street</i>	5
<i>Amory’s Travelogue</i>	8
<i>Windstar Update</i>	9

The Newsletter

The Rocky Mountain Institute *Newsletter* is published three times a year and distributed to nearly 26,000 readers in the U.S. and throughout the world.

Please ask us before reproducing, with attribution, material from the *Newsletter*.

LETTERS TO THE EDITOR

We want to hear your comments, criticism, or praise relating to any article printed in the *Newsletter*.

Please address all correspondence to:

Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass, CO 81654-9199
(970) 927-3851 / fax (970) 927-4178
E-mail: orders@rmi.org
Website: <http://www.rmi.org>

EDITORDave Reed
WRITERSDave Reed, Robert Alcock, RMI Staff
LAYOUTKate Mink
COVER ILLUSTRATIONJen Seal

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 40 full-time, 45 total. The Institute focuses its work in seven main areas—corporate sustainability, economic renewal, energy, green development, security, transportation, and water—and carries on international outreach and technical-exchange programs. Its E SOURCE subsidiary (1033 Walnut, Boulder, CO 80302-5114, 800/E SOURCE, 303/440-8500, fax -8502, e-mail esource@esource.com) is the leading source of information on advanced techniques for electric efficiency.

THE TAO OF SYSTEMS

By L. Hunter Lovins, Executive Director

Last December at a meeting of the Systems Group on Forests, Donella (Dana) Meadows, co-author of *Beyond the Limits* and a longtime friend of RMI, gave us a sheet titled “Places to Intervene in a System.” It was her suggestions of eight approaches to change, nominally ranked in order of importance.

What was striking about the list was that the techniques many activists emphasize—government regulations, tax rates, and so on—were near the bottom of it. “Information flows,” RMI’s stock-in-trade, was No. 4.

Dana’s No. 1 target for change? The “paradigm of those who have power over the rules.”

Dana’s list provoked a rich long-distance dialog between some of our researchers and *PERSPECTIVES* her. This from her latest e-mail missive:

What does it mean to change a paradigm? It means shaking up one’s whole world, on the Copernican model, and people are understandably resistant to letting you do it to them. So how do you do it? ...You keep pointing at the anomalies in the old paradigm, you keep coming yourself, and rather loudly, from the new one, you keep gathering evidence for the new one and evidence of how the old one doesn’t work. You insert people with the new paradigm into public power and the public discourse wherever possible. You don’t waste time arguing with reactionaries; rather, you work with active change agents and with the vast middle ground of people who are at least open-minded...

If you want to be a REAL change agent, you get people to see the paradigm that there are paradigms, and you raise kids to have paradigm flexibility. Since all paradigms are nonsense, pick the form of nonsense that produces the result you want in the world. That’s the level of mastery!

Dana’s advice is both resonantly true and truly daunting. It’s born of decades of wrestling with the world’s problems and learning that everything is interconnected and so, in essence, nothing’s going to change unless everything changes.

Of course, everything on Dana’s list is interconnected, too. For example, when we advise corporations on ways to make more profit by saving resources, we’re working down at the “information flows” level—but providing information is obviously a key step in changing a paradigm. For that matter, you don’t have much chance of changing the paradigm of the people who have power over the rules unless you’ve changed the paradigm of the society in which they operate.



So at RMI we run up and down the systems-intervention scale. When possible, we talk directly with those who have power over the rules—increasingly, corporate and financial executives. As I write this, Amory is briefing the President’s Partnership for a New Generation of Vehicles,

while the rest of the hypercar team is hosting a high-level delegation from a major automaker. I’m off to meet with several car and electronics CEOs who are seeking ways to run their companies better by becoming more sustainable.

But if we see leverage, we aim at other levels. By choice and our nonprofit charter, we don’t try to change the *people* who make the rules (No. 2 on Dana’s list), but often advocate changes in the rules themselves (No. 3). Influencing government regulations, though way down the list (No. 7), can sometimes multiply our other efforts, as when Amory stimulated California regulators to qualify hypercars alongside battery-electric cars as “equivalent zero-emission vehicles.” But which opportunity offers the best leverage?

The bottom line, I think, is that changing a paradigm is hard work. How can you possibly do everything, all at once? The natural reaction is that it’s hopeless. No one can do it alone—but no one has to if we all do what we can. 🌍

ONE COMMUNITY AT A TIME

Snowflake, Arizona, Is Finding Its Own Path to Sustainable Development

As co-founder of RMI's Economic Renewal (ER) program, Michael Kinsley spends much of his time in the field helping communities develop their economies sustainably. He recently returned from a follow-up visit to Snowflake, Arizona.

It's unusual that I get to go back to communities I've worked with to see how they've gotten on, but a generous grant from the Tides Foundation enabled me to revisit Snowflake in February. It was like a reunion. We all got together at the city hall, and everybody seemed eager to report on successes—not only projects but also less tangible results, like people just getting along better.

"I talk to people I never talked to before," said one farmer, formerly known for his dyed-in-the-wool views. "Organic farmers are now talking to conventional farmers. Hippies are talking to conservatives." One of the few local environmentalists said he was no longer trying to get the local pulp mill shut down, but instead was seeking ways to make it more sustainable.

It was quite a turnaround from my first trip to Snowflake, in January 1995. At that time, residents were up in arms over a court-ordered halt to logging in local forests (to protect endangered Mexican spotted owls) and a slowdown at the pulp mill. My first presentation at the Mormon meeting hall was immediately preceded by a rally against the Endangered Species Act, led by the Governor of Arizona.

On the face of it, it didn't seem a conducive environment for turning people on to sustainable development.

Yet time and again I've found that, while people may adopt partisan political positions on national issues, at the local level all they really want is what works. Underneath all the slogans and rhetoric, there's a strong constituency for the environment even in the most "conservative"

community: everybody has an interest in preserving clean air and water, maintaining quality of life, and ensuring that their prosperity is sustainable. Economic Renewal emphasizes the things that everybody can agree on, or at least live with,

informal sessions to get people comfortable with ER, followed by a training seminar for about 25 residents. They then went to work mobilizing the community for the series of town meetings that's the heart of the ER process.



Bruce Towl

and it provides a pragmatic, collaborative process for achieving results.

RMI had been invited to northern Arizona by the Grand Canyon Trust, which rightly realized that it stood a better chance of achieving its environmental aims if it involved local communities. We know that desperate people and communities do the greatest environmental damage, and that improving their economic prospects gives them more options to avoid doing so.

So Snowflake, a conservative, primarily Mormon town facing economic difficulties, was actually an ideal candidate for ER.

Our Snowflake contact was gung-ho town manager Roy W. Hunt, who helped me and the GCT representative, Brad Ack, set up meetings with various segments of the community. One of the things we realized during that first visit was that this effort would have to include residents not only of Snowflake but also of the adjacent town of Taylor and the outlying subdivision of Cedar Hills, who historically hadn't gotten along too well. If ER had done nothing else, just getting these people to discuss their common interests would have made it worthwhile. As it turned out, they did that and more.

During my second trip, a month later, the actual ER process got under way with

I made a third trip in April to conduct the first three of those meetings, which were scheduled back-to-back over a Friday and Saturday in the community-college gym. As in so many communities I've worked with, participants

embraced ER because it was hopeful, creative, and civil—not boring or painful, which is most people's experience with community decision-making.

Those first meetings were devoted to envisioning the community's "preferred future," identifying what the community had to work with, and discovering hidden opportunities. The latter was a fun, energizing step where we taped big sheets up on the wall of the gym listing the community's problems, needs, and assets, and had participants make connections—literally—between them. After that it was up to local leaders to facilitate the remaining meetings. By late last year, with the crucial help of GCT, these had resulted in several concrete initiatives.

When I returned this past February, a small-business mentoring project was going full steam. A dozen prospective businesspeople had gone through "business-plan boot camp," and existing business owners were giving them an extraordinary amount of advice and encouragement. The project had also inspired a number of other startups, including such enterprises as lumber recycling and solar construction.

Another project was training and certifying local tour guides, who by the time you read this should be conducting tours

(continued on p. 11)

DESIGNING INCENTIVES

RMI Tests Building Design Fees that Reward Efficiency

Why are energy-efficient buildings the exception rather than the rule? We have the technology to make buildings that are more comfortable, better lit, and far cheaper to operate. Why would anyone settle for merely meeting code?

One reason is the extra initial cost, right? Wrong! Well, mostly. As RMI has demonstrated, efficient buildings don't necessarily cost more to build, because the extra cost of efficient components is usually offset by the money saved in downsizing heating and cooling systems.

But exceptionally efficient buildings do tend to cost more to *design*, simply because of the extra time and attention required to make sure everything is properly integrated. And since designers are typically paid a fee based (often indirectly) on a percentage of the building's *cost*, they get no extra reward for working harder to make the building efficient, nor do they get a cut of the savings that result. In fact, if they succeed in reducing the building's net cost—a common outcome of green design—they could actually get paid *less*. Even if the fee is fixed in advance, they end up earning the same pay for more work.

Either way, designers have little financial incentive to push the energy-efficiency envelope.

Last October RMI hired researcher Gunnar Hubbard to coordinate a national experiment to demonstrate how architects and engineers can be compensated for the extra time spent making commercial buildings more efficient. The underlying concept is simple: the firm should be paid a bonus if the building beats a certain pre-arranged target, and should pay a penalty if it falls short. Such "performance-based" fees reward design professionals for what they save, not for what they spend—thus aligning designers' interests with owners' and tenants'.

Legally and logistically, however, linking design fees to building performance is easier said than done. A major obstacle, at least until recently, has been quantifying performance improvements. With retrofits to an existing building, the performance can be measured against historical data, but no such data exist for new buildings. Fortunately, computer modeling protocols now enable designers to estimate baseline performance.

The idea of performance-based contracts is beginning to attract interest within the commercial design field, but what's really needed to translate theory into practice is a few good showcase projects. To our knowledge, the only example of a performance-based project is the City of Oakland Administration Building. However, that building won't be completed until late



4 Times Square: at 1.6 million square feet, it will be a major test of RMI's performance-based fees concept.

1997, which illustrates the long timeframes required to introduce innovations in the building sector.

The RMI experiment, funded by The Energy Foundation, will likewise take several years to bear fruit. The first task is to locate four large test projects in different climate zones where all parties—owner, architect, engineer, building operator, and, ideally, occupants—are committed to efficiency and willing to negotiate a performance-based contract. RMI and Eley Associates, the architectural/engineering firm that helped create the performance contract for the Oakland building, will then use energy modeling to determine performance targets, and will suggest ways to meet them. The buildings are likely to take two to three years to complete, and another two to three years will be needed to see how their performance measures up.

So far, Hubbard has signed up two of the four projects. The first—a new building overlooking Times Square in New York City—is nothing if not high-profile. Forty-seven stories tall and containing 1.6 million square feet of office space, it will be one of New York's biggest buildings. Its multi-tenant occupancy will offer an exciting added challenge of designing the building's core and shell without knowing very much about its prospective occupants' energy demands, and also the opportunity for educating a number of influential tenants (and their design and construction teams) about advanced energy efficiency.

The second project, a 275,000-square-foot state building in Austin, Texas, will demonstrate ways to overcome the barriers to performance contracts in the government sector. The project has already experienced one hiccup, when it was discovered that state regulations specify that architects must be paid a set percentage of building costs, but the team helped make the deal by suggesting that the performance-based portion of the fee be paid as a separate bonus. An additional challenge will be the statutory requirement to put the construction contract out to tender, potentially hindering initial teamwork because the contractor won't be chosen until much of the design has been done.

Every large commercial project has its own unique opportunities as well as headaches. With this initiative, Hubbard is seeking out the opportunities, and hopes to convert them into high-performance buildings. With this in mind, he is in the process of signing up his third project—a 243,000-square-foot high school in Portland, Oregon. 📍

CAPITAL IDEA

Energy Efficiency Goes to Wall Street

Sixty years ago, you couldn't get a mortgage for more than 20 percent of the value of a property, and you had to pay off the loan within six years.

A similar obstacle now faces businesses and institutions seeking to finance energy-efficiency improvements. But an innovative new program looks set to help open the floodgates of capital, in the same way that FHA loan guarantees and other standardization efforts gave birth to today's vibrant mortgage market.

Energy efficiency ought to be a lending bonanza. Some \$100 billion could be invested cost-effectively in retrofitting existing buildings in the U.S. public and commercial sectors, according to Gregory Kats, an RMI alumnus who is now a senior advisor at the U.S. Department of Energy. That's not just \$100 billion worth of work that could be financed, it's \$100 billion worth of work that would generate positive cash flow: the revenue stream from saved energy costs would be more than enough to repay the loan.

"The fact that these efficiency investments are not being made is one of the largest market failures in our economy," Kats says.

Yet energy efficiency remains a "boutique industry," Kats notes, because the quality of retrofits is variable and the savings can be unreliable. That spooks lenders, and hence limits the amount of financing available for retrofits. Just as few people can afford to pay cash for their home, few institutions can afford to tie up capital for several years waiting to earn it back through lower electricity bills.

Enter the "North American Measurement and Verification Protocol," which Kats and colleagues at DOE unveiled in April. The protocol is, as Kats puts it, "in some ways a boring document," but what's important about it is that it creates a consensus among building owners, contractors, and lenders about how energy-efficient equipment is to be installed and

maintained, and how its performance is to be monitored.

That means a lot to lenders. A protocol ensures more reliable savings, reduces risk, and standardizes paperwork. Standardization allows loans to be bundled together and sold on a secondary market, as mortgages now are.


A secondary market lets the energy-efficiency boutique go wholesale. Lenders gain access to cheaper money, thanks to pooled risk and the economies of scale of large bond issues, and they can originate loans as fast as they can sell them off.

Because a qualifying retrofit will, by definition, generate net savings, it will never cost the borrower a dime, and will almost certainly bring in some revenue. That, in turn, allows the borrower to finance more investment—a gain with profound implications.

In effect, companies and institutions no longer have to choose between energy efficiency and other improvements or ventures. A cash-strapped university doesn't have to defer maintenance on its cold, leaky buildings to afford to build a new gym—it can do both, and save mon-

ey in the process. A corporation need not scrap an energy-efficiency retrofit because the capital is more urgently needed to start a new product line—it can have its cake and eat it too.

The DOE-led protocol has been enthusiastically received by Wall Street financial institutions and major bond credit-rating agencies, which see its potential for expanding their businesses. The World Bank recently used it to broker a \$300 million energy-efficiency loan to Russia, and the Chicago Board of Education is using it to borrow \$870 million to build or retrofit 500 schools.

According to Kats, energy efficiency in buildings currently attracts \$3–4 billion in financing annually in the United States. He hopes the protocol and other initiatives will increase that figure to \$10 billion within five years, which would create 100,000 jobs within a decade and yield \$20 billion a year in savings to the U.S. economy. It sounds like a pretty good investment to us. 


Free copies of the "North American Measurement and Verification Protocol" are available by calling (800) 363-3732.

HAWAII HIGH-FIVE

Residents of Hawaii's North Kohala coast are breathing easier since April, when the state's Public Utilities Commission officially closed the docket on a proposed twin diesel power plant.

As reported in the previous newsletter, Hawaii Electric Light Co. (HELCO) had been seeking to build the plants on the undeveloped northern tip of the Big Island. Local residents challenged it on public-health grounds. In January, after hearing testimony from RMI and others, the PUC barred HELCO from spending any more money on the project, and ordered the utility to provide extensive data on such "externalities" as impacts on local air and quality of life.

In April, HELCO asked for more time. The PUC denied the request, dismissed the application, and closed the docket.

Why did HELCO, which hasn't shrunk from such confrontations in the past, dither on this one? A spokesman declined to comment. But according to Greg Ball, the residents' attorney, the utility didn't want this to become a test case for externalities: North Kohala's isolation and clean air would have revealed the full extent of the impacts of power plant emissions, creating a tough precedent. Now major renewables firms are moving in with competitive proposals for clean energy. 

HYPERCARS: THE NEXT GENERATION *continued from page 1*

optimized aerodynamic design, makes a hypercar upwards of four times more efficient than a comparable conventional car.

For automakers already investing in fuel-cell-powered vehicles (such as Mercedes), the hypercar concept represents a welcome synergy. Fuel cells placed in conventional cars can't compete with combustion engines until they're almost as cheap per kilowatt—but put the fuel cell in a four-times-more-efficient hypercar and it can be manifold less powerful. Hypercars can therefore adopt fuel cells much earlier in their development, before they become nearly as small, light, and cheap per kilowatt as they will later. That could occur in the late 1990s, 15 or 20 years earlier than in conventional cars. This would, in turn, leapfrog fuel cells into volume production, resulting in even lower cost.

The hypercar's greater fuel economy also helps solve the problem of storing the hydrogen fuel. A conventional car rigged up with a fuel cell and electric motor

would require a hydrogen tank about five times the size of an ordinary gasoline tank. But in a fuel-cell-powered hypercar, the hydrogen tank could be just 50 percent bigger for the same range, threefold lighter, and (perhaps surprisingly) safer.

THE HYDROGEN ECONOMY

Of course fuel cells don't conjure up electricity out of nothing—they run on hydrogen, which must be manufactured.

Currently most hydrogen is made from natural gas, producing greenhouse gases and all the other problems of fossil fuel production and use. However, "reforming" natural gas, methanol, and other relatively clean hydrocarbons into hydrogen for use in superefficient cars, even if an intermediate step, would still cut transportation-related emissions. It's likely that fuel-cell-powered cars would, initially at least, use such a process to enable them to fill up with more readily available fuels.

Cleanest of all, solar-, wind-, or hydro-generated electricity can be used to split



Daimler-Benz AG

Mercedes's new hydrogen-fuelled NECAR II minivan pictured at the Brandenburg Gate, Berlin. The compressed-gas tanks are on top.

(or "electrolyze") water to produce hydrogen, essentially by running a fuel cell backwards. Although these renewable energy sources may look costlier than conventional power plants, RMI has shown how their true costs can often work out cheaper, thanks in part to the benefits of being "distributed" (decentralized).

Many regard the fuel cell as an essential technology in humankind's long-term transition from an economy based on polluting, unsustainable carbon-based fuels to one based on solar hydrogen. As long as storing electricity is costly, renewable sources will be held back by intermittence. But with fuel cells, renewables can be put to work generating hydrogen, which can be stored and transported relatively cheaply and easily.

By making fuel cells commercially viable 15 or 20 years sooner, hypercars could, in effect, bring on the hydrogen economy that much faster. And they could even transform the electric utility industry as we know it...

FILL 'ER UP

Even with technologies emerging today, a fuel cell is so efficient that it can convert reformed natural gas into electricity cost-effectively. In buildings, which use two-thirds of U.S. electricity, the fuel cell's

RMI WRITES THE BOOK ON HYPERCARS

The Hypercar Center's latest and greatest opus is now out. It's *Hypercars: Materials, Manufacturing, and Policy Implications*—at 450 pages, a revised and vastly expanded version of a proprietary report first published last year (see the Summer 1995 Newsletter).

Representing 12 person-years of work, the report is an extremely wide-ranging technical assessment of the ways hypercars could change the world. Moving beyond the "why" of hypercars to the much more complex "how" issues, it:

- explains what hypercars are, how they would differ from today's cars, how they would be made and from what materials, how those methods and materials could affect both automaking and society, and what issues of business and public policy these effects may raise;
- introduces the technology at a platform, system, and component level, including detailed mass and materials

budgets and a unique 91-page semi-technical integration of new techniques for high-volume, low-cost manufacturing with advanced composites; and

- analyzes hypercars' potential effects on industrial structure, macroeconomic issues such as jobs and competitiveness, repair and recycling, lifecycle flows of materials and energy, occupational and public health and safety, automaking strategy and culture, clean air, climatic change, alternative fuels and power, oil and national security, and transportation policy.

The report is meant for manufacturers, designers, industrial strategists, policy and financial analysts, government policymakers, and others seeking foresight into this potentially rapid transformation into the world's largest industry. Its price is \$10,000, but discounts are available to appropriate nonprofit organizations. E-mail hypercar@rmi.org for information. ☺

HYPERCARS: THE NEXT GENERATION

“emissions”—170°F water—can provide heating, cooling, and water-heating services that are often worth about enough to pay for the natural gas, making the electricity extremely competitive. So fuel cells have plenty of scope for displacing existing power plants.

Now think of a fuel-cell hypercar as a clean, silent 20-kilowatt power plant on wheels. It’s parked about 96 percent of the time, usually at either home or work. Having few or no moving parts, the fuel cell can run for years, even decades, without significant degradation.

Utilities will typically buy back daytime electricity at around 5¢ per kilowatt-hour. Since natural gas is often available at the equivalent of 2¢ per kilowatt-hour, it might not take long for entrepreneurs to set up curbside hookups to sell natural gas (or hydrogen) and buy electricity, yielding a net profit for the car owner.

Using a car to generate electricity in this way for, say, two-thirds of the time it’s

parked, this previously idle asset could earn its owner a couple of thousand dollars a year, which works out to about half the financing and depreciation costs of the average American car. It wouldn’t take many car owners’ doing that to put most remaining coal and nuclear power plants out of business, since the 150 million private vehicles in the United States, if powered by 20-kilowatt fuel cells, would represent about five times the total generating capacity of the national grid. (Utilities hoping to *sell* their surplus electricity to battery-electric cars may be in for a surprise.)

Cheap fuel cells rapidly introduced for hypercars would, in turn, be a big step toward creating the “distributed utility” that RMI advocates. Williams is exploring how efficiency, renewables, and fuel-cell-powered buildings and hypercars can fit with hydrogen-energy systems and their transitional natural-gas phase. He’s studying how hypercars could become the key to profitably solving both the one-third of

the climate problem due to transport *and* another third due to power plants.

As fuel cells start being mass-produced for transportation, they’ll quickly become cheap enough for wide use in stationary applications. Or they might be taken up first in buildings. In the long run, it’s probably not important which comes first: once one happens, the other will inevitably follow, thanks to mass-production and lower costs. Both uses are good news for the environment, the economy, and our common security. ☺

This article is based on concepts presented in Hypercars: Materials, Manufacturing, and Policy Implications (see box, page 6) and in a keynote address to the National Hydrogen Association’s annual conference in April by RMI’s Research Director Amory Lovins. Our work on the hypercar/fuel-cell/hydrogen link is supported by the W. Alton Jones Foundation.

OMISSIONS VS. EMISSIONS

Resource efficiency, as Amory Lovins says, isn’t just a free lunch—it’s a lunch you’re *paid* to eat. In the case of RMI’s new employee transportation program, that’s literally true.

Invented by communications assistant Louie Saletan, the “Omissions” program helps employees leave their cars at home for fun and profit. Benefits include fewer vehicle emissions, more free parking spaces, less wear and tear on vehicles, less traffic congestion, less stressful commutes, more time available to read, work, or socialize with co-workers on the journey—and free lunches.

Located in a rural valley five miles from the nearest town, RMI isn’t in the best position for employee access. Employees receive free passes for the local bus service, but the nearest bus stop is 1.7 miles downhill. Although a quarter of employees live within walking distance of the headquarters, mainly in staff housing, others commute from up to 45 miles away. Flexible work schedules make it harder to coordinate carpooling.

“Omissions” encourages creative commuting by turning transportation into a game. Each employee is issued with a card displaying 120 gas-pump symbols, and the object is to cross them all out. Employees earn points for commuting by means



other than single-occupancy motor vehicle, with different scoring zones based on distance from RMI: bicycle from Zone 2, for example, and you get to cross out four gas pumps. Cross them all out and you get a free lunch at a local restaurant.

Fun, public recognition of success, and good-natured competition are the incentives. It’s a flexible system in which everyone can benefit, not just the big scorers.

Those who manage only to carpool one day a week still earn their lunch, but more slowly.

Saletan says “Omissions” has had an effect on employee travel patterns, though not quite the one he had expected. It turns out that those who live close to work or already take the bus regularly have had little room for improvement, and those who live far away from other employees and from bus routes have found it difficult to alter their habits. The middle third of employees, though, have been improving noticeably—some of them dramatically.

The City of Aspen is looking at ways to apply the idea to other businesses in the area. Why not set one up in *your* workplace? For ideas, call Louie Saletan in Communications. ☺

AMORY FLIES EAST

Another Busy International Trip for RMI's Research Director

Amory Lovins is surely the hardest-working man in the resource-efficiency business. On his April overseas tour, he kept a schedule that would have slain a rock star.

After addressing audiences in Denver and Detroit, he hopped across the pond to speak at conferences in Prague held by Social Venture Network Europe, in Moscow on "New Directions Ten Years After Chernobyl," and in Kiev on "Lessons from Chernobyl."

Since he was in the neighborhood, he had the chance to exchange views with technical managers at three German car companies; meet old and new colleagues in Stockholm; advise ARK, a nonprofit organization promoting green technologies; and take up invitations to speak on infrastructure at Erasmus University in Rotterdam, to a Czech energy-efficiency group, and on TV programs in London and Amsterdam. He also took time out to discover his Ukrainian roots.

Much of Amory's time in Russia and Ukraine was spent hearing first-hand about the effects, ten years on, of the April

1986 Chernobyl nuclear disaster. Over 60,000 square miles of territory are officially classified as contaminated, and more than 9 million people have been exposed to substantial doses of radiation. According to a Greenpeace report, the 800,000 "liquidators" who helped clean up the site are dying at three times the normal rate.

Amory also talked to the press, ministers, and others about the value of energy efficiency for the economic recovery of the region, which is suffering a downturn worse than the Great Depression.

Ukraine, for example, has lost three-fifths of its GDP since independence. Its energy used per dollar of GDP is over seven times that of the European Union, due to pervasive inefficiency and an historic emphasis on heavy industry. And while its Parliament has the right idea—the first enacted law of the newly independent nation concerned energy efficiency—the level of waste remains staggering.

The highlight of the whole trip, Amory reports, was an unexpected meeting with a Ukrainian Army colonel during a press conference. The colonel asked

about his country's apparent dilemma of electrical supply: should Ukraine keep dangerous Chernobyl-type reactors running, at the terrible risk of another disaster, or send its hard currency to Russia for natural gas, presenting an equally grave threat to national security?

After the press conference, Amory discussed at length with the colonel how efficient end use, co- and trigeneration, and renewables could provide the equivalent of several Chernobyls safely and much more cheaply. He also suggested that the Army might make its greatest contribution to national security by using its troops, logistics, and training to insulate buildings, saving costly natural gas. The colonel said he had never heard such arguments before, was convinced by them, and would print the entire taped interview in the Army newspaper.

The conversation made an even bigger impression on several Ukrainian environmental activists who sat in on it. Used to the worst kind of confrontational encounters with the establishment, they were astonished to witness disarming persuasion and respectful "joint learning" (see box).

On his last day in Ukraine, Amory visited the redeveloped site of his great-grandfather's inn in Tarashcha, 90 kilometers south of Kiev. He was received with great warmth and hospitality by the top officials of this poor, rural town, and shown the local tourist attraction: the house of Anatoli Alexandrov, "the famous nuclear physicist." What was he famous for? Ah, he was the chief designer of the RBMK (Chernobyl-type) reactor! Now that two-thirds of the region's population is living in Contamination Zone 4 from the Chernobyl disaster, Tarashchans aren't quite as proud of him as they used to be.

And yet, as they reflected aloud, what a delicious irony—that the father of Chernobyl *and* the preeminent ambassador for antidotes to nuclear power should both be sons of Tarashcha. 🌍

AIKIDO POLITICS

Much of RMI's success stems from a quiet commitment to practice what our friend and neighbor Thomas Crum calls "aikido politics." Through his book *The Magic of Conflict*, videos, and trainings, Crum is changing the way many people deal with conflict, turning it from a source of stress and frustration into a wellspring of creativity.

Aikido is a nonviolent martial art in which you don't oppose an attacker by rigid force, but blend with the attacker's energy, helping deflect it harmlessly and harmoniously past you. Thus in aikido politics, you honor others' beliefs as you would your own, even if you don't share them. You remain centered in your values, but not fixed in a position. You

don't fight with an opponent; rather, you dance with a partner. You're committed to process, not outcome, in the belief that from a good process will emerge a better outcome than anyone thought of in the first place.

The *Tao Tê Ching* says of water, "...that which is of all things most yielding can overcome that which is most hard...Being substanceless, it can enter in even where there are no cracks." Aikido teaches us the politics of water: a way of entering, in a friendly and open spirit, into the midst of even bitter controversy. Handling conflict with respect and sincerity, we've found, can often turn it into an opportunity for mutual learning, trust-building, and resolution. 🌍

CAPITAL CAMPAIGN UPDATE

“Securing the Future” Effort Reaches \$870,000 Mark

RMI is making a special direct appeal to its 20,000 supporters for help with the Securing the Future Campaign, the Institute’s first-ever capital campaign. This effort is critical to the future of the Institute and its work.

The campaign aims to provide RMI with a permanent home, and also to protect wildlands and wildlife in perpetuity, by purchasing a half-interest in the 957-acre Windstar property in Old Snowmass. For the purchase, RMI needs to raise \$1.5 million by 31 December. Another \$1.5 million will eventually be needed for restoration and stewardship endowment.

In early July, the campaign passed the halfway mark toward purchase of the property, and stood at \$870,000 in gifts, grants, and pledges. The keystone grant was \$250,000 from Pitkin County Open Space and Trails. This local support acted as a stepping-stone to a \$230,000 grant from the Great Outdoors Colorado Trust Fund. The John D. and Catherine T. MacArthur Foundation has also made a major grant of \$100,000. These grants should stand the campaign in good stead with Colorado and national foundations.

But to ensure success, RMI also needs the help of hundreds of smaller donors from among its supporters. Any gift, whatever its size, is useful. “We are enormously grateful for the generous response so far, and optimistic that, with the continued help of RMI’s supporters, we will reach our challenging goal,” says Executive Director Hunter Lovins.

If you have a question, want a brochure, or would like to help, please contact Hunter or Campaign Coordinator Judy Moffatt. ☎



Judy Moffatt

RMI Board and Capital Campaign Committee member Michael Edesess and daughters Hilary and Ariel enjoy themselves at RMI’s Solstice Celebration and Benefit, which introduced hundreds of neighbors to the campaign.

SECURING THE FUTURE CAMPAIGN 1995–96 GIFTS AND PLEDGES

ASSOCIATES \$1 to \$99

Alan L. Boyer
Sally & Dick Brigham
Lawrence Bruk
Jennifer & Jim Cantele
Kathryn & Jefferson Carleton
Bob Carpenter
G. Allen Cook
Displays for Jewelry
Mark Gibson
Marshall Glickman
Diane Hall
David M. Halpern
Linda L. Heald
Arvid Hogen
Dana Judy
Jeffrey P. Knight
Marvina Lepianka & Charles Jaffee
Robert S. Means
Shawn Porter
Peter B. Sloan
Barbara W. Smith
Gail C. & Gregory C. Speer
Judith A. & Terry R. Valen
Diane L. Weber
David J. Whitbeck
Priscilla S. & Timothy S. White
Lorraine Wiltse
Paul Yahнке

FRIENDS \$100 to \$499

Lorraine Anderson
John L. Boehne
Joe Chovan
Amy A. & Paul Clark
David Cutler
Sarah Groves

Sonia Ruth Weinstock Hamel & Jean-Francois Hamel
Rick Heede
Dana L. Jackson
Sam Kjellman
Terry Kinzel
Gari Krogseng
Jean M. & Walter R. Lamb
Sam Luxton
Kate Mink
Susan Phillips
Basil Seaton
Christine & Bill Shahan
Michael P. Totten
John C. Twombly
Joanna Underwood
Tom Warren

SPONSORS \$500 to \$999

Barbara & Daniel J. Packard
Mark M. Paulsen, M.D.

PATRONS \$1,000 to \$2,499

Jim, Regina, Becky, & Logan Bock
Bill Browning
Annie Cooke
Richard C. Goodwin
Richard H. Goodwin Sr.
Richard L. Jentgen
Gary Mullard
Mark M. Paulsen
Cathleen & Peter Schwartz

SUPPORTERS \$2,500 to \$4,999

Susan Krivin & David Ohanesian

Judith Moffatt
Robert J. Schloss (matched by IBM)

SUSTAINERS \$5,000 to \$9,999

Ruth Kapes
Michael Stranahan
Dyan Zaslowsky & Michael Edesess

BENEFACTORS \$10,000 to \$24,999

Susanne B. Bush
Joan & John C. Fox
Lee Eng Lock
Carol Noyes
Tina Robinson & Irvin C. Bupp
Rocky Mountain Elk Foundation

GUARANTORS \$25,000 to \$49,999

Mary H. & Myron P. Curzan
Helen & James T. Mills

PHILANTHROPISTS \$50,000 to \$99,999

Hunter & Amory Lovins
Susan & Ford Schumann

LAND LEGACY CIRCLE \$100,000 and over

John D. & Catherine T. MacArthur Foundation
Pitkin County Open Space & Trails
Great Outdoors Colorado Trust Fund

LESSONS FROM THE LAND

Though the Windstar purchase has not yet been secured, RMI is already busy on the land, and the nonprofit Windstar Land Conservancy has been set up to own and protect it in perpetuity.

Earlier this summer the Institute co-sponsored three high-altitude gardening workshops at Windstar with Jerome Osen-towski, whose respected Central Rocky Mountain Permaculture Institute is located just a few miles away. A workshop on landscape drawing is being held, and a fifth, on aikido and relationships, will be on 18 August.

In addition, the nearby Aspen Camp School for the Deaf has held several overnight programs on the land, and activities with local schools are planned for the fall.

“The possibility of buying the Windstar land gives RMI a great new opportunity to diversify its activities,” says environmental education coordinator Lysa Usher. Particularly, she notes, it offers the chance to work directly with children—an exciting and rewarding new direction for the Institute.

Meanwhile, the Windstar Land Conservancy’s distinguished scientific advisory committee met in late June to start devising a long-term restoration and management plan. We’ll report on the committee’s recommendations in a future newsletter. ☎

Newsletter by E-mail?

A few readers have suggested that we offer the option of subscribing to the *RMI Newsletter* by e-mail. It saves paper, energy, postage, money, and time: it works for us. But we'd like to see a show of hands before deciding how to do it.

If you are interested in subscribing to this newsletter electronically instead of by mail, please fill out the questionnaire inserted into this newsletter or at our Website. Tell us whether you would prefer to receive the newsletter itself by e-mail, or simply receive an e-mail notification when the new newsletter (or other new information) has been posted to our Website. (Either way, rest assured that we will not sell, rent, or share our e-mail list.) Please tell us also whether you think the current \$10 annual suggested donation for the paper newsletter is a fair price for the on-line service.

We already post our newsletter to our Website <http://www.rmi.org>, and we will continue to do so. However, due to the nature of the Internet, the Website version is formatted differently. If we make the newsletter available by e-mail, it could be either text-only or a version fully formatted for a downloadable program such as Adobe Acrobat.

We'll get back to you with either a broadcast e-mail or an announcement in the next newsletter. 📧



RMI welcomes several new staff members, summer interns, and volunteers. Back row (left to right): Jason Czaja, volunteer; Swapna Sundaram, green development intern and 1996 Konheim Fellow; Prema Tretin, volunteer; and Donna Fischer, electrician. Front row: Alicia Bell-Sheeter, development assistant; Trevi Burkholder, administrative assistant; Kim Kernan, volunteer. (Not pictured: Galen "Red" Cain, maintenance.) We'd also like to bid farewell to Alice Hubbard, Sandy Rounds, and Lorraine Wiltse, who have moved on.

FAREWELL DEAN MORTON

The Very Reverend James Parks Morton, a dear friend and longtime advisor to the Institute, has announced his retirement as Dean of New York's Cathedral of St. John the Divine. An immensely energetic and creative man, Dean Morton shaped the cathedral into a vital, eclectic center of community during his quarter-century of tenure. We wish him well in all his future endeavors. 📧

FACTOR FOUR UPDATE

Factor Four, which RMI's Amory and Hunter Lovins co-authored last year with Ernst Ulrich von Weizsäcker, will at last be available in English in spring 1997 through the British publisher Earthscan. The book has been a best-seller in Germany since its release there last October.

However, the Earthscan edition will only be marketed outside of North America. Americans and Canadians must await Hyperion's revised and expanded edition, co-authored by Paul Hawken, titled *Natural Capitalism* and due in late 1997.

Other translations of *Factor Four* are under way in Czech, Spanish, Portuguese, Italian, Swedish, and Korean. 📧

New Publications

TRANSPORTATION

Hypercars: Materials, Manufacturing, and Policy Implications. Summary of RMI's 450-page proprietary hypercar book (see p. 6) (updates T95-17). T96-7 26 pp, \$8.00

Tools and Strategies for Hybrid-Electric Drivesystem Optimization. Highly technical SAE paper intended for those involved with the development of hybrid-electric vehicles or components. T96-12 18 pp, \$10.00

Hypercar Presentation to Osaka Conference. Our latest concise overview. Scholarly preprint of a paper to be presented at the 13th

International Electric Vehicle Symposium in October. T96-9 8 pp, \$4.00

Ultralight Hybrid Vehicles: Principles and Design. A demonstration of the technical feasibility of hypercars. Preprint from the Osaka IEVS in October. T96-10 8 pp, \$4.00

ENERGY

Negawatts: Twelve Transitions, Eight Improvements, and One Distraction. Invited review article for *Energy Policy's* April 1996 special issue on the future of demand-side management. U96-11 14 pp, \$7.00

ANNUAL REPORT

RMI's *1995 Annual Report* is now available. It highlights the Institute's work in 1995, profiles several staff members, describes the special niche we fill in the nonprofit world, and summarizes our finances. If you'd like a copy, please contact Ross Jacobs in Development.

*Are you receiving duplicate copies of this newsletter?
If so, please see the inserted reader survey.*

AQUEOUS SOLUTIONS: INTRODUCING RMI WATER ASSOCIATES

After nearly 14 years' experience in water management issues, RMI has launched its own water consulting service. RMI Water Associates offers expertise in water-efficient technologies, water-efficiency program implementation, and water-system planning.

RMI's water experts—Senior Research Associates Richard Pinkham and Scott Chaplin, and Research Director Amory Lovins—have worked on projects for the White House, the EPA, and the Metropolitan Water District of Southern California, and have published dozens of reports and articles on water efficiency. While research and outreach remain the core agenda for RMI's water group, offering a consulting service provides an additional avenue for disseminating RMI's information, and the

opportunity to generate funds to support research efforts.

Water Associates offers initial planning for new efficiency programs, addressing such issues as how to target the most cost-effective opportunities and avoid wastefully "cream-skimming" only the very best measures. The team can also diagnose problems in existing programs that used incorrect assumptions or inappropriate price signals. In addition, Water Associates plan to extend their recent scenario planning work with the EPA (see the Fall/Winter 1995 *Newsletter*) to the level of individual utilities.

For more information about RMI Water Associates, please contact JoAnn Glassier at (970) 927-3807, fax -4510. ☎

ONE COMMUNITY *continued from page 3*

of local historical sites. To support local agriculture, farmers had set up an informal cooperative to trade information and market their produce locally; a local farmers' market, conceived before the ER process, is now operating once a week in season.

These may not seem like earth-shaking results, but they represent a real sea-change for towns like Snowflake and Taylor. Having made these first steps, they will, I'm confident, continue to find their own appropriate path toward a sustainable local economy.

Are the people of Snowflake and Taylor now "environmentalists"? Hell, no—nor would I wish them to be. Like all of us, they're just people doing what they have to do to get by. But helping people find more sustainable ways to achieve their real-world goals is, to me, a whole lot more worthwhile than preaching to the choir. ☎

Earth Share

RMI would like to thank the more than 600 people who have supported RMI through payroll deductions to Earth Share, the environmental workplace-giving campaign, in the past year. We wish we had space here to list all their names.

Employees of more than 50 corporations, the federal government, certain state and local governments, and other institutions can now choose to contribute to RMI, or more than 40 other selected nonprofit organizations, through the Earth Share fundraising campaign. Federal employees can contribute to RMI by entering the number 0940 on Combined Federal Campaign pledge cards.

For information on how your private-, government-, or nonprofit-sector employer can participate in the Earth Share program, please contact Ross Jacobs in Development. ☎

INSTITUTE SUPPORTERS

Our sincere appreciation is offered to these friends who have contributed to RMI's support between 1 January and 30 April 1996. Numbers in parentheses indicate multiple donations. Please let us know if your name has been omitted or misspelled so it can be corrected in the next issue.

ASSOCIATES \$1 to \$99

John Accardi & Nancy Clarke
Andy Aiken (2)
Keith Allen
Barbara Alter
Mary Anderson
Anonymous
Ayil Kwei Armah
Joseph Arno
Toni Arnold
Elizabeth & Andres Aslan
Geoff Badger
Murl Barber
Earle Barnhart
Mary Louise & Joseph Bates
Thomas Alan Bennett
John Bennett
J.W. Bernsee
Jeremy Bernstein, Esq.
Sandra & Archie Bickling
Mary & Keith Blackmore (2)
John Bliese
Chris Borton

Gary Boudreaux
Dorothy & Richard Bradley
Jack Brand
Dale Brentrup
Sally & Dick Brigham
Gloria & Elias Brinks
Philip Brown
Larry Bruce
Nora & Steve Brumbaugh
Danny Buck
John Burton
Barbara Busch
Bruce, Julie, & Harv Busta
James Butler
Sally & Tom Cahill
Ralph Canaday
Jennifer & Jim Cantele
Kathryn & Jefferson Carleton
Chris Carrel
Timothy Carrigan
Suzann Clare
Steve Cohn
John Cole
Nancy Connable
Roger Cook

Peter Cook
Grace Cormons
Lesley Coughlin
John Cummings
D.J.F. Electrical Systems
Ken Dahlberg
James Dalton
Betty Ternier Daniels
Richard Darling
Holly Davenport
Maurice De Rohan
Sarah De Roode
Ross DePaola
Mary Dale & Jim Deacon
Mabel Dennison
Mark Diamond
Debbie Dicker
Martha Dickinson
Displays for Jewelry
Ryan Drum
Robert Duff
Mark Durcan
EBSCO Subscription Services
R. Reid Earley
Steve Ehret

Eric Eldering
Entasis Architects PC
Walter Epp
Cynthia Esterle
Brent Eubanks
Charles & Margaret Evans
Dave Fallow
John Faust
Allen Feryok
Leon Fisk
Terri Flaherty
Frank Folsom Smith
Food for Thought Bookstore
Peter Ford
Ken Frankel
Lon Gable
Eric Gabrielsen
C.E. Galston
George Gardner
Kip Gardner
Alejandro Garza Rangel
Glen Gelinis
Richard Gelwick
Jean Giddings
Maria Gilardin

Kevin Gilford
Richard Gilmore
T. Dale Gilpin
Glenda Goehrs, in honor of
GSD&M Advertising
Roger Good
Guy Gray
Robert Gray
Reggie Greenwood
Daryle Griffith
Josef Gruber
Paul & Joyce Gudat
Juliet Guroff
Charmaine & Kinard Haden
Phyllis & Arvid Hagen
Cherie Hales (2)
Sarah Hall
David Hamilton
Vera & John Hamm
Beth Hanson
Bob Harris
Sam Harris
Jane Harrison
Jerry Heath
Ethan Heilman

Dean Himmelreich
Alice Hine
Thomas Hitchins
Art Hobson
L. Hockemeyer
Jerry Holtman (2)
Amory Host
Wilfred & Mary Howarth
Patricia Huberty
Casper Huizenga
Fred Hutchison
IEEE Aerospace Dinner
Dan Innamorato
Charles Jaffee & Marvina
Lepianka (2)
Scott Jamison
Glen Johnson
Jared Jones
Lynn Jones
Merrill Jones
Hill Jordan
Dana Judy
Alan Kaplan
Jane Katz
Ivan Keats

INSTITUTE SUPPORTERS

William Kellogg
Maureen Kelly
Jonathan Kimmelman
Bill Kinney
Lee & Doug Kirkpatrick
Jonathan Kirschner
Helmut Kissling
Keith Klipstein, in memory of
 Marieke Becker Klipstein
Jeffrey Knight
Joel Knutson
E. Lamar Kopecky
Heather Koshinsky
Patricia Kramer
Steven Kreis
Sabra Kranzfelder Driscoll
Robert Kuchta
Richard Kuehner (2)
Steve Kurtz
W.K. Lain
Carolyn & C.T. Lange
Michael Larison
Mary Larson
Harold Lawson
M.P. Lazara
Marion Leonard
Wolfgang Lechleitner
Lisa Linden
Kathy & Tim Lindholm
Susan Linnell
Elizabeth Littler
Bob Lorenzen
Ingrid Louiselle
Paul Ludgate
Olivia Ludington
Jean Ludtke
Frances Ludwig, in memory of
 Sumner Richards
Randy Mack (2)
Meg Macleod
Rod Macvicar
Gary Marchant
Ronald Margolis
Steve Mariatt
Steve Massey
Robert Massey
Robert Mathews
Marguerite Matthews

Marie Maxwell
Dave McBride
Keith McCook
William McKinley
Ronald McLinden
Warren McNaughton
Mark Meier
Keith Merkel
Chris Merz
Gallaty Michael
Murray Miller
Murray Milne
Joseph Moffat
Nelson Monteleone (3)
James Morel
Frank Moretti
Rod Nelson
Virginia & Ray Newman
Jonathan Niermann
Kim Noble
Denny O'Brien
Buck O'Herin
Lawrence Olson (2)
Bruce Oneto
Alan Patterson
Amy & Kent Patton
Ronald Pavone
Mary & Ronald Pavone
Catherine Pawasarat
Enid Pearson
J. Petrie
Russ Pfeifle
Richard Plage (2)
Christopher Purvis
Stephen Pysz
Barbara Quirk
Debra Rahm
Bernard Raibley
Marilyn Rasmusen, in honor of
 Edward Suppes
Marilyn Reed
Gary Regester
Grant Richardson
Alice Riggs
Cecil Ringgenberg
Roger Risbrudt
Tristan Roberts
Robena Robinett

Harvey & Jennie Rosenblum
Florence Rossi
Sandy Rounds
Ellen Rubinstein
Tim Rumage
Joel Russ
H. John Russell
Amy Salzman
Reza Sasanto
David Schaller
Jackie & Edward Schmid
Joyce & David Schmoeger
Jonathan Schulz
Maria & Lewis Schwartzkopf
Carl Scott
Ashuan A.H. Seow
Kevin Sharun
Ronald Shelton
Jack Sieber
Fred Siebert
Suzanne Sippel
Rick Slater
Dave Smalley
Leslie Smith
Eric Parkman Smith
Julia Soistman
Thomas Stanton
Walter Stark
Edna Stokes
William Stone
Nada Subotincic
Beverly Swabb
Richard Sweeney
Richard Tennis
Patrick Tesch
Texas Tech University
Carol Thompson
Doug Tiller
R. Tindell
Rob Tocher
James Tolson
Kevin Townley
Daniel Tufford
Richard Tuxbury
Michael Ujcich
James William Versocki
Kim Walter
Dan Ward

Karen Warner
Liz Washburn
Rick Weeks
Judith Werner
Pat Wheat
Benjamin White
Ellie Whitney-Yaeger
Chris Wilcox
Jeffrey & Consuelo Wilkinson
Dave Williams
Bruce Williams
Joanne Williams
Sarah Wilson
Nancy Wilson
Michael Woolley
Elizabeth Yingling
Ruth Young
Stan Zaroda

SPONSORS \$100 to \$999

Robert Anderson
Harry Atkinson, in memory of
 Kenneth Atkinson
Pam & Paul Beck
Annie & Mac Bell
Fred Bimber
Barbara & Amasa Stone Bishop
John Boehne (2)
Jerry Bryan
Sebastian Buettner
Jonathan Bulkley
Louise & Tom Burns
Mary & William Busick
Peter Butler
Judy Byrns
Mark Campbell, M.D. &
 Christine Asher
Margaret & Christopher Cappy
Ralph Cavanagh & Deborah
 Rhode
Robert Clubb Sr.
Victor Daniels
Lois-ellin Datta (4)
Gary Desmond
Mary & Alan Douglass
Laurel & Andy Duncan

Mrs. Charles B. Edison
Environmental Resource
 Department of the
 Cunningham Group
Fannie Mae Foundation
Farmer's Irrigation District
Sandra & David Gerstel
Constance Getman
Noah Golden
Margie Jackson Haley
Benita Helseth
Carolyn & John Holton
Nicholas Howes
James Huffman
Charles Hummel
Colin Hutchinson
Catherine & Jud Ireland
Laura & Alfred Saunders Jaffee
Carolyn & Peter Johnson
Roger Johnson
Walter Johnston
Amy & Peter Kinder
Charles & Bernice Klosterman
Jean & Walter Lamb
Brian Larson & Renae Kofford
Sam Luxton
Jan & Robert Marker
Jean & Joel McCormack
Timothy McFlynn
Charles McQuaid
Clare Moorehead
Sauw Tet Ng
Robert Paashaas
Jane Page
Chris Quartetti
Warren Rinehart
Bruce Rittenhouse
Caroline & N.B. Robinson
Seymour Schwartz
Bill Shahan (2)
Marvin Simon
Geraldine St. Onge
Virginia Stranahan
Angelica & William Sturm, in
 honor of Hunter, Amory, &
 Farley.
David Tresemer
Sally & John Van Schaick

Barbara Warren, M.D.
Rod Welford
Melody Wilder
Charles Williams
Frances & Randall Williams
Bill Witherspoon

PATRONS \$1,000 to \$9,999

Sharmie & David Altshuler
Community Foundation of
 Santa Clara County
Earth Share
Rhonda & Jim Fackert
John Gilbin
Haymarket People's Fund
Susan & Robert Helm
Marion & Allan Hunt-Badiner
Deb Frost Larson
Leslie & John Andrew
 McQuown
Foundation for the National
 Capital Region
Jim O'Keefe (3)
Franz Reichsman
Helen Severinghaus
Smith-Weil Foundation
Frances Tyson
Harold Wit

BENEFACTORS \$10,000 and over

Nathan Cummings Foundation
William & Flora Hewlett
 Foundation
W. Alton Jones Foundation
J.M. Kaplan Fund, Inc.
Rockefeller Financial Services,
 Inc.
Tides Foundation
Emily Hall Tremaine
 Foundation
Working Assets



Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass, Colorado 81654-9199

ADDRESS CORRECTION REQUESTED

NONPROFIT ORG.
U.S. POSTAGE
PAID
DENVER, COLORADO
PERMIT NO. 1278