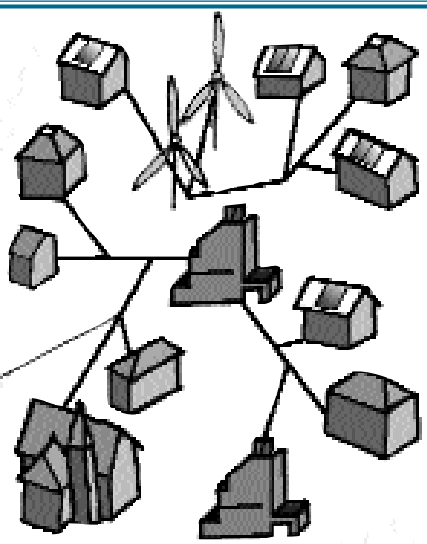
# SMALL IS PROFITABLE

## *Why Our Bigger-is-Better Electricity System's Days Are Numbered*

Last summer, two massive power outages blacked out millions of homes and businesses in the western United States. Electric utilities insisted these were freak events, but pledged to take steps to prevent future occurrences.

In each case, the ostensible cause was a minor failure at a time of peak demand. But ultimately the blackouts trace back to this: today's centralized electricity systems were designed for a world that went out with the Studebaker.



They date from a time, in the immediate postwar period, when electricity demand was growing rapidly, supply was getting cheaper, heavy industry was in vogue, and nuclear power was the bee's knees. All of which favored big power plants and big, high-voltage transmission grids, all centrally planned and controlled.

Consider today's realities. Demand is growing more slowly and much less predictably. The cost of supplying it from giant coal and nuclear stations didn't continue to decline as expected, owing to whopping cost overruns, environmental regulations, local opposition, and the albatross of nuclear power. Meanwhile, the cost of small-scale alternatives, such as photovoltaic panels, wind turbines, and fuel cells, is steadily coming down.

Gee, maybe it's time to re-examine our assumptions.

Three years ago, RMI started doing just that with a grant from The Pew Charitable Trusts to study "distributed resources"—an alternative approach to delivering electricity with smaller, decentralized power sources (see the Summer 1994 *Newsletter*). This winter, after various interruptions to pursue promising spinoffs in other fields, researcher André Lehmann and research director Amory Lovins teamed up to write the most thorough synthesis to date on distributed resources. Their study, *Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size*, will be published by RMI this summer.

### A QUESTION OF SCALE

The thinking behind distributed resources challenges several basic assumptions that produced our present electricity system.

First, it turns the concept of economy of scale on its head, emphasizing *mass production* instead of *unit size*. Centralized electricity generation is based on the reasonable-sounding proposition that the bigger the power plant, the cheaper the capital cost per kilowatt and the higher the efficiency. Unfortunately, a few big plants can easily prove more expensive to build than a lot of smaller ones, because they require more customized design, are prone to higher cost overruns, take longer to build, entail premium siting costs, attract stronger opposition, and are often less reliable.

In contrast, distributed resources such as photovoltaics and wind turbines exploit the benefits of mass production. Building power plants more like cars than cathedrals moves labor from the field, where productivity gains are small and diminishing, to the factory, where they're huge—and where quick incorporation of improvements can compress many generations of technology into a short time.

A second tenet underlying distributed resources is that energy sources should be of a scale appropriate to their end uses. Would you try to run

***(continued on page 8)***

### INSIDE

## The *Newsletter*

The Rocky Mountain Institute *Newsletter* is published three times a year and distributed to more than 22,000 readers in the U.S. and throughout the world.



### LETTERS TO THE EDITOR

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

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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 40 full-time, 45 total. The Institute focuses its work in seven main areas—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, http://www.esource.com) is the leading source of information on advanced techniques for electric efficiency.

# INSTITUTIONAL WISDOM

By L. Hunter Lovins, Executive Director

RMI turns 15 this April. That's young in human years, but institutions mature faster than humans (thank heaven) and this one has packed a lot into its short span.

This newsletter has shared some of the knowledge that's come our way these 15 years. But there's another kind of knowledge that we rarely take stock of, much less communicate. Call it institutional wisdom. A sampling:

*PERSPECTIVES*

**People are hungry for hope.** They want solutions, not a depressing litany of the problems. Most people are doing the best they can to get by in this world, and hectoring them about the problems they're causing only puts them on the defensive.

The problems are real and large, but so, therefore, are the opportunities. And in fact the solutions to climate change, water shortages, inefficient transportation, and many other issues RMI studies are all so attractive that we should be doing them anyway, whether or not there's a problem.

But it's a disservice to dispense false hope. At RMI, we're most effective focusing on practical solutions that are in individuals' own power and interest to pursue. That creates real hope, and hope leads to action.

**Being in the right place at the right time is no accident.** An idea may simmer for years before suddenly taking hold—and forever changing the way things work. Look at the fall of apartheid, or the collapse of the Soviet Union.

But such paradigm shifts don't come out of the blue. They're the long-term product of hidden connections, intolerable contradictions, driving forces, and the actions of dedicated people working for change. The better we understand these forces operating in a system, the more effectively we can create change.

Many people, from Buckminster Fuller to Dana Meadows, have taught us to target the "leverage points" in a system and to be alert for the "teachable moment"—in other words, to be in the right place at the right time. It can be done, but it takes an open mind, an eye for interconnections, and a belief that real change is possible, even if it seems improbable.

**Good ideas should sell themselves.** Solutions that rely on guilt or altruism probably won't fly, even if they're given away. On the other hand, people will pay for pragmatic solutions.

RMI's specialty is market-oriented solutions. They work better and their results are more easily measured. Selling them subjects us to a healthy dose of market discipline, and also earns income (lately approaching half our total revenue) to enable us to develop more solutions.

One caveat: the market is not the perfect, all-knowing mechanism beloved by theoretical economists. That's partly why we sell our information when we can, but donate over half our time to helping the market work better.

**No one can do it alone.** You start out thinking you can save the world. You take some knocks and wrestle with doubt, but if you stick it out long enough, you realize that anything worth accomplishing builds on the work of others.

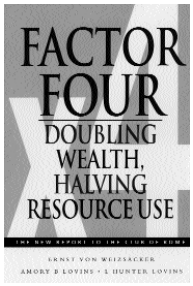
Peter Coors tells the story of a guy walking down a road. Seeing a turtle sitting up on a fence post, he says to himself, "You know darn well that turtle didn't get there by itself." Well, neither did we.

Likewise, those who say, "This is my idea, you can't have it," are limiting their effectiveness. We try, now, to be grateful when someone "steals" our ideas. We also try to acknowledge all those whose earlier work has made ours possible.

To all of you who have given us both knowledge and wisdom these past 15 years, I'm grateful. I hope we're able to reflect at least some part of it.

# MAKE WEALTH, NOT WASTE

## *Seven Reasons for Being More Efficient*




Since the Industrial Revolution, progress has generally been defined as labor productivity. By that measure, we've made enormous progress in two centuries. But we've gone too far, wastefully overusing such resources as energy, materials, water, soil, and air, and overwhelming the living systems that provide those resources and absorb our wastes.

It's time to shift the balance back from *labor* to *resource* productivity.

That, in a nutshell, is the message of *Factor Four: Doubling Wealth, Halving Resource Use*, by Ernst Ulrich von Weizsäcker and RMI's Amory and Hunter Lovins. Originally released in German a year and a half ago, the book will be published in English on 28 May by the British publisher Earthscan.

Why bother being efficient with resources when we've made so much "progress" being inefficient? The following seven reasons from *Factor Four* fairly sum up RMI's whole philosophy:

**1. Live better.** Resource efficiency improves the quality of life. We can see better with efficient lighting, produce better goods in efficient factories, travel more safely and comfortably in efficient vehicles, feel better in efficient buildings, and be better nourished by efficiently grown crops.

**2. Pollute and deplete less.** Everything must go somewhere. Wasted resources pollute the air, water, or land. Efficiency combats waste and thus reduces pollution, which is simply a resource out of place. Resource efficiency can greatly contribute to solving such huge problems as acid rain and climatic change, deforestation, loss of soil fertility, and congested streets. Efficiency can also buy much *time* in which we can learn to deal thoughtfully, sensibly, and sequentially with the world's problems.

**3. Make money.** Resource efficiency is usually profitable: you don't have to pay now for the resources that aren't being turned into pollutants, and you don't have to pay later to clean them up.

**4. Harness markets and enlist business.** Since resource efficiency has the potential of being profitable, much of it can be implemented largely in the marketplace, driven by individual choice and business competition, rather than requiring governments to tell everyone how to live.

**5. Multiply use of scarce capital.** The money freed up by preventing waste can be used to solve other problems. Developing countries in particular, with less of their capital sunk in inefficient infrastructure, are in an excellent position to multiply the use of scarce capital. For many countries, this could be the only realistic way to achieve prosperity in a reasonable timespan.

**6. Increase security.** Competition for resources causes or worsens international conflict. Efficiency stretches resources to meet more needs, and reduces unhealthy resource dependencies that fuel political instability. Efficiency can reduce international sources of conflict over oil, cobalt, forests, water—whatever someone has that someone else wants. Energy efficiency can even indirectly help block the spread of nuclear weapons by providing cheaper and inherently non-military substitutes for nuclear power plants.

**7. Be equitable and create more employment.** Wasting resources is the other face of a distorted economy that increasingly splits society into those who have work and those who don't. Either way, human energy and talent are being tragically misspent. Yet a major cause of this waste of people is the wrong and profligate thrust of technological progress. We are using up more resources to make ever fewer people more "productive." We need a rational economic incentive that allows us to employ more people *and* fewer resources, solving two critical problems at once.

Contrary to a report in an earlier newsletter, *Factor Four*, though not published in North America, can be purchased via RMI's Publications Department. The price is $35.00, including shipping and handling from England to you.

## *Questioning Capitalism*

Is capitalism due for an overhaul? Two prominent capitalists think so.

"One is tempted to say that there is nothing wrong with capitalism except that it has never been tried," writes entrepreneur and business author Paul Hawken in the March/April issue of *Mother Jones*.

Conventional economics came into being at a time when people and capital were scarce, while natural resources were regarded as essentially free and infinite. Now, Hawken argues, the situation has reversed. Industrialized societies are reaching a point where increased prosperity is limited not by man-made capital but by "natural capital."

"Natural Capitalism" is the title of Hawken's *Mother Jones* cover story, and is also the working title for the book he is currently co-authoring with Amory and Hunter Lovins, which will be a complementary sequel to *Factor Four* (see above).

*The Atlantic Monthly*'s February cover story questions the economic status quo too, warning that unfettered capitalism has now replaced communism as the chief enemy of the open society. Its author: billionaire financier George Soros. As any currency dealer will tell you, when George Soros is selling something short, take heed.

*The Economist* wrote a blistering editorial on Soros's piece—but followed in its 22 February issue with a critical but largely favorable full-page profile of Amory Lovins.

# GREEN GAMES

## *The Sydney Olympics Lead a List of Showcase Projects*

RMI's Green Development Services team has a new high-profile assignment: helping design the solar-powered athletes' village for the 2000 Summer Olympics in Sydney, Australia.

The village is Sydney's best chance to make good on the environmental commitments it made to win the millennial Games. Built to house all 15,000 athletes and officials, it will be one of the largest solar-powered residential developments ever built, and will showcase renewable and resource-efficient technologies to hundreds of millions of viewers. After the Games are over, the onetime Navy ammunitions depot will be partly redeveloped into a model green suburb for 5,000 residents.

The consortium developing the site plans to install enough roof-mounted photovoltaic arrays—665 kilowatts' worth—to meet the permanent village's average electricity demand. In effect, the entire community will function as a dispersed power plant (see cover story).

Though the solar panels will probably capture most of the attention, they won't be cost-effective, nor fully achieve the project's environmental goals, if they aren't accompanied by strong end-use efficiency. Green Development Services' role will be to provide international benchmarking on the integration of passive solar, solar thermal water heating, natural ventilation, and other energy- and water-efficient measures into the building designs.

The combination of renewable energy and efficiency will cut total energy use and greenhouse-gas emissions by 50 percent—less than what's possible in many individual buildings, but not bad for an entire community in a moderate climate.

Sunny Australia is a natural place for a large-scale demonstration of solar power, and this one comes at a crucial time. Most industrialized nations are doing little to meet the emissions-reduction targets for 2000 that they agreed to in the UN climate-change convention, and Australia has pointedly refused to sign the convention at all. The Sydney Olympic village will show how reducing greenhouse gases can be not only affordable but profitable.

In another high-visibility project, GDS consultant Bill Browning is serving as an environmental advisor to the Smithsonian Institution's National Museum of the American Indian in Washington, DC.

Slated for completion in 2002, the museum will occupy the last available site on the Mall, between the National Air and Space Museum and the Capitol. Input from native peoples has given the museum's designers a clear mandate to make it a green building.

Browning, who is part Mohawk, has provided *pro bono* advice on optimizing the building's environmental performance within the constraints imposed by special lighting, space, and humidity-control needs. But perhaps the greatest expression of the museum's environmental responsiveness is its landscaping, which will restore much of the site to the wetlands, forest, and native meadows that covered the area before the arrival of Europeans.

Finally, GDS consultant Gunnar Hubbard traveled to Singapore in February as part of a team hired to recommend ways to incorporate green design into the renovation and expansion of United World College.

Squeezed for space and reliant on imported water and energy, Singapore is a prime candidate for efficiency. Lee Eng Lock, a longtime friend of the Institute, has played a key role in bringing green design to East Asia from his base in Singapore, and his firm, Super Solutions, assembled the team for this project.

After showing the college and its design team how to save $1 million in capital and operating costs, the team spent three days addressing developers, businesspeople, and government officials on the economic benefits of green development.

### Is This What We Want?

"Architect Dan Solomon discovered something that says a lot about our priorities. Zoning in a Bay Area community in which he was working called for parking for 2.2 cars per residential unit. The General Plan called for libraries to have 2.8 books per 1,000 residents. Based on these figures, he computed that his 4,000-unit neighborhood development, with 2.7 people per unit, would generate needs for 30 books—and 8,800 parking spaces."

—*Urban Ecologist*, No. 4, 1996

### Update: Performance-Based Fees

RMI has secured a third test project for its multi-year performance-based fees experiment, and is closing in on the fourth.

As explained in the Summer 1996 *Newsletter,* the experiment's purpose is to demonstrate how architects and engineers can be contractually rewarded for the extra time spent making commercial buildings more efficient. The first two projects will test the concept in a New York skyscraper and a Texas state building.

The third, North Clackamas High School in Portland, Oregon, will serve as a model for the vast educational sector. The main focus here will be daylighting in classrooms, which not only saves energy costs but also, according to recent studies, can actually boost learning and improve discipline and health.

The fourth project, which was still in negotiation at presstime, is a federal courthouse in Fresno, California. Again, the leverage is huge—the courthouse is one of 500,000 buildings owned by Uncle Sam.

# KNOCK, KNOCK: GREEN DEVELOPMENT CALLING

## *A Win-Win Approach to Community Planning*

You hear the same story again and again. A developer proposes a project that no one seems to want, yet the community is powerless to stop it. Although the community has other crying needs, local officials can't tell the developer what to do with his or her land; all they can do is review the proposal that's presented and make it as good as it can be.

As a rule, communities get what developers offer, not necessarily what the community needs. The hodgepodge that results is akin to what you'd get if, say, you furnished your home exclusively with products peddled by door-to-door salesmen.

Wouldn't it be great if there were a way to coordinate the developer's financial goals with the community's and the environment's needs?

In February, the nonprofit Florida House Foundation gathered a panel of experts in sustainable community design, including RMI's Michael Kinsley and Bill Browning, to explore ways to do just that.

The goal of the February meeting was to test a pilot process for redefining the "highest and best use" of a 1,000-acre parcel near Sarasota, Florida. Future meetings are planned to test the process on three additional sites.

What's new about Florida House's process is that it's proactive instead of reactive: instead of waiting for the landowner's proposal, the community analyzes the site's potential according to its own demographic, ecological, fiscal, and other criteria. From that analysis and input from the landowner emerges a list of possible uses of the land, which are then run through a "filter" for community desirability and finally refined into a proposed site plan.

It remains to be seen whether the process works in practice. But if all goes well, the community gets a project more in keeping with its needs, and establishes a more intelligent and efficient pattern of development. The developer wins, too, by being spared much of the expense and brain damage of the traditionally adversarial approvals process.

The project straddles two important areas of RMI's work, sustainable community development and green building design. Kinsley, author of *The Economic Renewal Guide*, and Browning, founder of RMI's Green Development Services, are authorities in those areas, respectively.

## Sustainable Energy Choices

Renew America's February teleconference on "Sustainable Energy Choices" was right up RMI's alley, prompting a number of collaborations. Executive director Hunter Lovins and researcher Rick Heede wrote a position paper for the conference, research director Amory Lovins served as one of the panelists during the nationally downlinked discussion, and other RMI researchers provided some of the questions posed to the panelists.

Renew America conducts an annual teleconference on issues related to sustainability and community-level action, broadcasting the proceedings to participants at more than 70 satellite-downlink sites. RMI organized the Denver downlink for Renew America's first conference, "Jobs and the Environment," in 1995 (Spring 1995 *Newsletter*), and wrote a position paper for last year's "Environmentally Sustainable Communities" conference.

## Cool Tools from Economic Renewal

More good news for folks trying to get sustainable economic development going in their community: RMI has released two new tools to accompany the revised third edition of *The Economic Renewal Guide*.

"RMI's Economic Renewal Program: An Introduction"—a full chapter excerpted from the book—can now be ordered separately. It can also be viewed at RMI's Web site, as can "Sustainable Development: Prosperity Without Growth," another chapter from the book.

And for those who've already bought the book and are gearing up to launch Economic Renewal in their community, author Michael Kinsley has created a set of 37 text slides to support any public presentation of the process.

RMI is extending the reach of its Economic Renewal program through a growing line of do-it-yourself materials. These amount to an instant sustainable-development toolkit: just add activist and stir.

For ordering information, please see page 12.

## Attention Logging Towns

Do logging or other forest-products industries form an important part of your local economy? Do you know of forest-products companies that have found ways to boost their profits by using resources more efficiently? Has your community learned lessons about strengthening the local economy through sustainable forestry practices?

If so, RMI's Michael Kinsley and Kipchoge Spencer want to talk to you. They're preparing a supplement to *The Economic Renewal Guide* for forest-dependent towns, and are looking for successful case studies.

# Ask RMI

***Will hypercars have air conditioning (highly desirable for Southern drivers)?*** —Phil Reinhart, Decatur, Georgia

Absolutely. From the start, our philosophy has been that hypercars—the ultralight, ultra-efficient vehicles RMI has been developing conceptually since 1991—must meet or beat all the standards set by conventional cars. If hypercars achieved their efficiency at the expense of comfort, they simply wouldn't sell.

But to be sure, a hypercar would have to use different technologies. It's been estimated that a conventional heating, ventilation, and air-conditioning (HVAC) system would draw so much power—relative to a hypercar's frugal needs—that it could cut the vehicle's fuel efficiency by almost half.

When you get into a car that's been parked in the sun all afternoon, it's not, strictly speaking, air conditioning that you want. What you want is to feel cool. Air conditioning is a means to that end, but it's a very energy-intensive means. It should be used sparingly, and only as the last of four steps.

The first step is to reduce the cooling "load"—the amount of heat the AC system will have to remove. Many of the passive cooling techniques that work so well in buildings, such as insulation and selective glass coatings (which admit visible light while reflecting infrared radiation), appear to be suitable for cars. Another simple and relatively cheap option: an extractor fan, powered by a small roof-mounted photovoltaic array, to help keep the car interior from turning into an oven in the first place.

Second, exploit ways to make the car's occupants *feel* cool. It takes much less energy to do that than to cool the entire car. Ventilative mesh seats can cool the skin by 7 F°, while air directed at the back of the head and circulated through breathable materials in the seat can expand the comfort range by even more. Selective glass coatings help a lot, too, by screening the sun's rays.

Considered on their own, the above measures would add to the cost of a hypercar, but they pay off in the end because they reduce the size, and therefore the cost and weight, of the air conditioning unit and its energy use. (And, incidentally, they would make any car more comfortable in those first few minutes before the AC comes to the rescue.)

Step three is to use waste heat where possible, instead of precious shaftpower. Desiccant cooling technologies developed for the aerospace industry may be appropriate for cars. These systems use waste heat to remove humidity from the air and can then use the resulting water for evaporative cooling.

Having minimized the cooling load, the HVAC unit can be much smaller, need not be on as much of the time, and need not use as much energy when it is on. New HVAC units already being designed into some upcoming cars weigh as little as 16 kg, contain no CFCs, and use less energy per unit of cooling—so clean, efficient, lightweight technology already exists.

Our research on this subject is still largely theoretical, but based on our experience with buildings, we believe it should be possible to reduce automotive cooling loads by 60–90 percent, making a hypercar's cooling system as efficient as its propulsion.

* * *

Update to last issue's question, "When can I buy a hypercar?": GM has announced that its EV-1 will be the first of a series of battery- and hybrid-electric cars with halved weight and drag—early hypercars in all but name. By year-end, Toyota plans to release in Japan the most efficient (around 80 mpg) production-quantity car yet, a heavy hybrid. Also by year-end, Ford will have a dozen Taurus-class prototypes on the road, 40 percent ligher and including hybrids.

## The New-Car Dilemma

Which is better for the environment: buying an efficient new car, which saves fuel and reduces pollution, or holding onto your inefficient old one, thus saving materials? If you've ever wrestled with that dilemma, you're not alone.

According to a 1995 study by Ford's Scientific Research Laboratories, about 90 percent of the energy a car uses over its lifetime goes into running it; only 10 percent is used in manufacturing it. Figuratively speaking, the average car eats its weight in gasoline about every 14 months.

If that were the only consideration, it would be worth trading up if the new car got just 10 percent better gas mileage and emitted correspondingly less pollution. But that assumes your old car will go entirely to waste, which it won't. In North America, more than 90 percent of cars are recycled at the end of their lives, with about 75 percent of their materials reused or recycled (though not necessarily for automotive uses). This recovery rate further reduces the environmental impact of bringing a new car into the world.

Hypercars, being at least three times more fuel-efficient, would certainly be worth trading up to. By the same token, with proportionately more of their lifecycle energy consumption (though probably a smaller absolute amount) embodied in their materials, they'd be more worth keeping on the road. All the more reason to make them upgradable, like computers.

Can't afford a new car? Again, you're not alone. To accelerate the uptake of efficient new cars and other technologies, RMI advocates "feebates"—sales taxes charged or rebated on a sliding scale based on how much more efficient the new vehicle is than the old. Expect to hear more about feebates as hypercars enter the market.

In the meantime, you can increase your vehicle's efficiency significantly simply by taking it in for regular tune-ups and emissions checks. Studies show that well-maintained old cars can run cleaner than poorly maintained newer ones.

# ENSURING THE FUTURE

## *Windstar Campaign's Final Goal: $1 Million Endowment*

It's official: the Windstar land is now permanently protected. On 30 December, RMI paid the National Wildlife Federation $1.5 million for its undivided half-interest in the 957-acre Windstar property, located about a mile from the Institute's headquarters.

But protecting the land was only the first goal of RMI's Securing the Future Campaign. The second is to create an endowment to pay for its permanent stewardship by its new owner, the nonprofit Windstar Land Conservancy.

Kate Mink

*The Windstar land is open to the public for cross-country skiing, hiking, horseback riding, and other non-motorized recreation.*

As we went to press, the Securing the Future Campaign had received $2.06 million in donations and pledges out of its total goal of $3 million. A complete list of contributors to the campaign up to 31 December is given on pages 13–14.

The Windstar purchase provides a permanent home for both RMI and one of the largest migratory elk herds on the continent. About two-thirds of RMI's staff now work in the Windstar building, situated in the cultivated bottom corner of the property. The elk, as well as deer, bear, badger, bobcat, and numerous smaller inhabitants, have the run of the other 900-odd acres.

As described in previous newsletters, the Windstar land has been degraded by habitat fragmentation, changed migration patterns, overgrazing, and lack of wildfire. RMI plans to restore and manage it to maximize its ecological value as wildlife habitat and, secondarily, as open space for non-motorized recreation. The property will be used for environmental education and as a demonstration site for organic land-restoration techniques and sustainable agriculture.

After all, RMI's mission is to foster the efficient and sustainable use of resources—including land.

About $250,000 is budgeted for initial restoration work. An endowment of $1 million will ensure the land's permanent health by providing enough annual income to employ a full-time and a seasonal land worker and to carry out ongoing restoration and maintenance.

Two "challenge" grants—$350,000 from the Kresge Foundation and $75,000 from the Gates Foundation—place a deadline of 1 April 1998 on this final phase of the campaign. RMI will lose these grants unless it reaches its $3-million total goal by then.

As a rule, the second half of a fund-raising campaign is more challenging than the first. Additional foundation or government grants (other than Kresge's and Gates') are unlikely at this stage, so the bulk of the remaining money will have to come from individual donors.

As an RMI newsletter subscriber, you will be receiving a special Securing the Future appeal in the mail. We appreciate whatever gift or pledge you may be able to make. If you have a question, want an illustrated color brochure, or would like to help, please contact RMI executive director Hunter Lovins or campaign coordinator Judy Moffatt.

### UPCOMING EVENTS

The Windstar Foundation, in cooperation with RMI and the Windstar Land Conservancy, will present a full schedule of courses on the land this summer, including Camp Windstar for Kids, an introduction to holistic management, and a week-long experiential workshop on sustainability for K–8 teachers. For a full schedule and course details, please contact the Windstar Foundation at 970/927-4777.

Two other upcoming events…20 April: Windstar will be the venue for low-key Earth Day activities…22 June: RMI will host its second annual Solstice Celebration at the nearby Elk Ridge Ranch in Old Snowmass.

## *Tip: TOES in Denver*

The leaders of the G7 industrialized nations will gather for their annual meeting in Denver 20–22 June, and once again The Other Economic Summit (TOES) will convene its annual international conference there too, making the case for sustainable alternatives to economics-as-usual.

Since Denver is just over the hill, RMI will probably participate in the TOES program in some way. (Research director Amory Lovins was the keynote speaker at the 1990 Houston TOES.) For a current schedule of events, visit the TOES Web site at http://pender.ee.upenn.edu/~rabii/toes/.

## SMALL IS PROFITABLE *continued from page 1*

smelter with a bunch of wind turbines? It makes as little sense to power a house with a ,000-megawatt power plant.

In *Small Is Beautiful*, E.F. Schumacher's point wasn't that everything should be small, but rather that everything should be the right size for the job—and that, incidentally, most jobs are small. RMI's research indicates that that's certainly the case with jobs involving electricity: three-fourths of households use less than 1.5 average kilowatts, and three-fourths of businesses less than 10 average kilowatts. Being well matched in scale to those modest-sized jobs, distributed resources are uniquely portable, flexible, diversifiable, controllable, and accountable to end users.

The question of appropriate scale is an extremely important (though often overlooked) theme that runs through RMI's work on everything from cars to communities.

### COSTS AND BENEFITS

But the most powerful logic behind distributed resources is that they avoid many of the hidden costs of centralization. The main purpose of *Small Is Profitable* is to bring those costs—and the corresponding benefits of distributed resources—to the electric utility industry's attention.

Take risk. If someone offered to sell you a bank bond paying 8 percent or a Treasury bill paying the same rate, which would you choose?

That's a silly question, you say. The market would never offer the same rate of return on two investments with such different risks. Or would it?

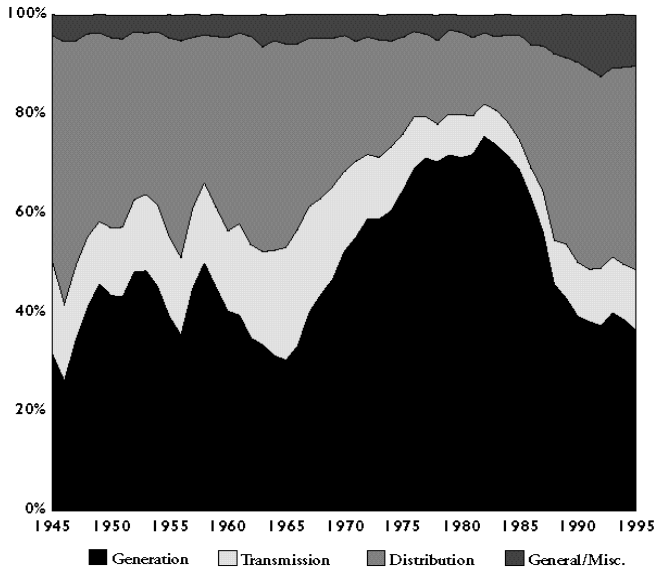
Actually, that's pretty much the way utilities—most of which are monopolies, and are only indirectly accountable to their customers—have made investment decisions for years. They face an array of risks, many of them quantifiable: fuel-price volatility, forecasting uncertainty, regulatory uncertainty, technical failure, and so on. Amazingly, they seldom factor any of these risks into the economics of their decision-making processes.

In many ways, small-scale technologies entail less risk. They can be installed quickly, minimizing many of the economic, planning, and construction uncertainties that plague big power plants, which typically take a decade or more to plan and build. Being smaller and cheaper, they diversify financial risk among many units, in many locations, and among various technologies. Being modular, they enable utilities to increase capacity in small increments as needed, rather than making billion-dollar, bet-the-company commitments. Being dispersed, they reduce delivery costs and make more efficient use of the existing grid.

Small-scale doesn't automatically mean less risky. Proper risk accounting favors a diverse portfolio of technologies, including a certain component of small-scale ones. That way, the utility covers its bets whatever happens.

## GRID? WHAT GRID?

**Composition of Investor-Owned Utilities' Construction Expenditures (Excluding Nuclear Fuel)**




***Most electric utilities don't fully value the benefits of distributed resources because they remain focused on the cost of generating electricity, not delivering it. Yet as this graph shows, utilities have historically invested more in the grid than in power plants—except during the nuclear fad of the '70s and early '80s—and the grid's share is on the rise. Source: EEI Historical Statistics and Statistical Yearbook 1996.***

### RISK VS. RELIABILITY

Distributed resources also lower technical risks—that is, they increase reliability. About 95 percent of power failures occur in transmission or distribution. But generating power closer to where it's used—on the roof or in the backyard, ideally—reduces transmission and distribution distances, and therefore the risk of failure. (Incidentally, efficiency is the ultimate distributed resource, because it "generates" electricity right where it's used.)

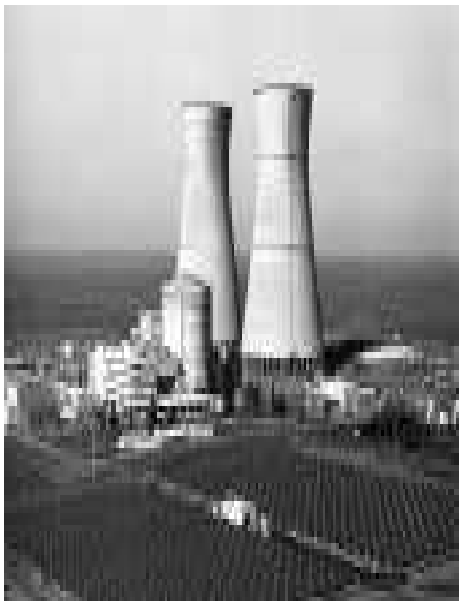
Last summer's blackouts raised questions about the reliability of centralized electricity systems, which, after all, are based on an old-fashioned philosophy that favors quantity over quality. They weren't designed to deliver the sort of premium-quality power that high-tech users increasingly demand. The restructuring of the electricity industry, which is opening the door to third-party marketing of electricity, is likely to make customer satisfaction all the more important.

(Distributed resources also have their technical drawbacks. For example, more localized electricity sources means more connections to the grid, which can result in more localized outages. Fortunately, the automation technologies needed to reverse this risk are getting cheaper all the time, and their spread will tend to favor distributed resources, partly by helping power to flow both ways.)

### A QUIET REVOLUTION

The diseconomies of giant power plants have been apparent (though not widely acknowledged) for 20 years. The average size of new plants in the United States peaked in the late 1970s, and the past decade has seen a rapid shift to smaller, cheaper, more modular combined-cycle gas turbines. Non-utility electricity generation is even on the rise, for the first time in a century.

## SMALL IS PROFITABLE *continued from page 1*



George Turner, SMUD

***An early proponent of distributed resources, the Sacramento (Calif.) Municipal Utility District erected a grid-connected photovoltaic array on the grounds of its abandoned Rancho Seco nuclear power plant. Residential PVs make its grid more stable.***

The era of the giant thermal power plant has quietly ended, says *Small Is Profitable*, and a quiet revolution of smaller, dispersed resources is already under way.

Several utilities—notably California's Sacramento Municipal Utility District—are already working to diversify their portfolios and disperse their resources. The prospect of industry restructuring, for all its drawbacks, is forcing all utilities to behave more competitively, and that's likely to encourage them to assign market values to the benefits of distributed resources.

The Electric Power Research Institute, the electricity utilities' own think tank, has begun to study distributed resources on a technical level, and E SOURCE, RMI's electric-information subsidiary, is at work on a strategic issue paper examining the policy implications of distributed resources. Some consulting services now specialize in advising utilities on distributed resources.

So interest in the subject is finally catching up with its importance. There's only one thing missing: synthesis. Virtually all industry studies of distributed benefits have focused on one or another benefit in isolation, ignored or underestimated the full range, and treated many data as trade secrets.

*Small Is Profitable* evaluates about 50 types of distributed benefits, and concludes that, properly valued, they make renewable energy sources a better deal than conventional ones in nearly all new supply, and in many cases where existing supply needs replacement.

### A BETTER WORLD

Some of the biggest benefits of distributed resources, though hard to measure in dollars, are environmental and social ones.

A full accounting of risk and other factors levels the playing field between all forms of electricity supply. Doing that reveals renewable energy and efficiency to be cost-effective in many more situations than was previously thought. That should speed their uptake and help offset the many problems associated with using non-renewable energy. As volume production of renewables increases, unit costs will come down, making them cost-effective in even more situations, and hastening the inevitable transition from an economy based on fossil fuel and nuclear power to one powered by the sun.

Like so much of RMI's work, *Small Is Profitable* describes a better world, but one that doesn't exist. Not yet, anyway.

Utilities are understandably reluctant to change the way they do business without proof that it's worked for somebody else. That's why the final section of *Small Is Profitable* profiles a half-dozen utilities that have begun to experiment with distributed resources. None is the long-awaited "distributed utility," but their efforts affirm the late economist Kenneth Boulding's dictum that "Whatever exists is possible."

The transformation of the electricity industry will be measured in decades, not years. Power plants and transmission grids are among the most enduring types of infrastructure. Decisions in this field, once made, live on for generations.

All the more reason, then, to ensure that the electricity system we build today isn't a white elephant for our children.

## Technology Atlases Unbound

Until recently, if you wanted detailed, independent technical information on energy use in buildings, you had to join E SOURCE, a members-only information service. Now nonmembers can buy E SOURCE's 1,700-page *Technology Atlas* series separately.

The most definitive reference work available on advanced energy efficiency in buildings, the five-volume series covers lighting, cooling, heating, drivepower, and appliances. E SOURCE is promoting the stand-alone series to consultants, architects, engineers, facility managers, educators, and reference libraries.

It comes in a softbound printed version and a companion CD-ROM that contains the entire contents in a searchable, printable format. The price is $750 for the books or the CD, or $950 for both.

The series combines up-to-date technical information with practical case studies and guidelines for application. Each volume provides an extensive review of technologies, design fundamentals, product data, and numerous tables, charts, and illustrations. Market trends and other data are discussed where appropriate.

Formerly an in-house division of RMI, E SOURCE now operates as a for-profit subsidiary based in Boulder, Colorado. To order the *Technology Atlas* series or to find out more about E SOURCE, call 1-800-E SOURCE or visit www.esource.com.

## New E SOURCE President

E SOURCE has announced the appointment of Wayne Greenberg as its new president. The former president of Shepard's/McGraw Hill, a $100-million legal publishing company, Greenberg brings leadership experience in the publishing and information services sectors to E SOURCE at a time when the five-year-old company is primed for further expansion. Former E SOURCE president James Newcomb has been elevated to the strategic role of chief executive officer.

# VICTORY IN VICTORIA

## *Controversial Canadian Dam is Down but Not Out*

Influenced in part by testimony from RMI, the government of British Columbia has put a dam expansion on hold and ordered local officials to explore water efficiency instead. It's a victory for sustainability, biodiversity, and sensible land use—but will the controversial decision stick?

RMI entered the fray in the fall of 1995, when the Sea-to-Sea Greenbelt Society, a small nonprofit organization on British Columbia's Vancouver Island, asked if researcher Scott Chaplin would review a report on water efficiency by the Greater Victoria Water District.

The water district wanted to raise the height of its Sooke Lake Dam by 5 meters. The report, which fulfilled the district's obligation to consider alternatives to the dam-raising, dismissed water efficiency as a serious option for meeting the growing demand for water in southern Vancouver Island.

Sea-to-Sea and other groups opposed the dam expansion on several grounds. First, the decision to expand had been made on the basis of inadequate information and limited public input, and entailed risks to water quality. Further, it would encourage more growth by incurring debt that could only be paid off by increasing the number of water ratepayers. Instead, Sea-to-Sea called for a comprehensive and rigorous demand-management program, as well as full protection of the area surrounding the catchment lands as a forested green belt and a barrier to urban sprawl in greater Victoria.

Last March, the province's comptroller of water rights held a hearing on whether the water district should be allowed to raise its rates to pay for the expansion and other supply projects. RMI's Chaplin, speaking as the only water-efficiency expert at the hearing, testified that water efficiency might render the dam unnecessary. Many other groups subsequently echoed his points.

In May, responding to public concern, the province appointed a special commission to explore water-efficiency alternatives. In September, the commission released 19 recommendations, notably that the potential for demand-side management to defer the reservoir expansion be a priority, that the area around the catchment lands be preserved as a park, and the water district be disbanded and replaced by a regional water commission assigned the task of serious consideration of demand-side management.

The province's final decision was delayed until late January, but it was worth waiting for. British Columbia's finance minister not only accepted every one of the commission's recommendations, but also "formally requested" that the water district—and the entity that will replace it—stop all work on planning the dam.

"RMI's involvement was invaluable because it gave credibility and respect to many of the issues that we had been raising for years," says Mehdi Najari, a longtime opponent of the project.

He adds: "When utilities propose supply expansions, citizen groups need to look at the underlying reasons, and push for independent studies of their economic viability and of the economic viability of efficiency alternatives."

But big supply-side projects rarely die; they just get put on the shelf. The Two Forks dam project southwest of Denver, which was vetoed by the EPA in 1990 after opposition from RMI and many others, still has the support of many water officials and may someday be revived.

The backers of the Sooke Lake expansion haven't given up either. After the January decision, they began appealing to the public's fears that demand-side management will hamper economic growth and lead to water rationing. Let's hope that the new water commission steers an enlightened course, efficiency gets a chance to prove its worth, and RMI adds a fourth negadam to earlier victories in Colorado, British Columbia, and Maine.

## CLOSING THE LOOP ON 'BIOSOLIDS'

There's no such thing as waste, only misplaced resources. Could the old saying be true even for human waste?

It's a question that divides environmentalists. Some regard landfilling and incineration of sewage sludge—standard practices in industrialized countries—as a waste of perfectly good organic material. Instead of being treated as the end of the line for food produced by extractive, unsustainable farming practices, they say, human waste should be returned to the soil to fertilize the next crop.

Others caution that directly applying "biosolids" to the land can spread pathogens, harmful nutrients, heavy metals, and possibly endocrine disrupters (chemicals that interfere with human hormonal functions) into river systems and drinking-water supplies.

RMI researcher Richard Pinkham is helping the Water Environment Research Foundation and the U.S. Environmental Protection Agency delve into this sensitive subject. With colleagues from Minnesota-based Sustainability International, he facilitated a workshop in February that drew on RMI's scenario-planning experience (see the Fall/Winter 1995 *Newsletter*) to consider ways biosolids could be safely used.

Separately, RMI's newly formed Water Associates unit is making scenario planning an important element of its consulting services. A November presentation on scenarios to Public Officials for Water and Environmental Reform garnered much interest and a potentially important involvement with a California water district.

# VISIT US (VIRTUALLY)

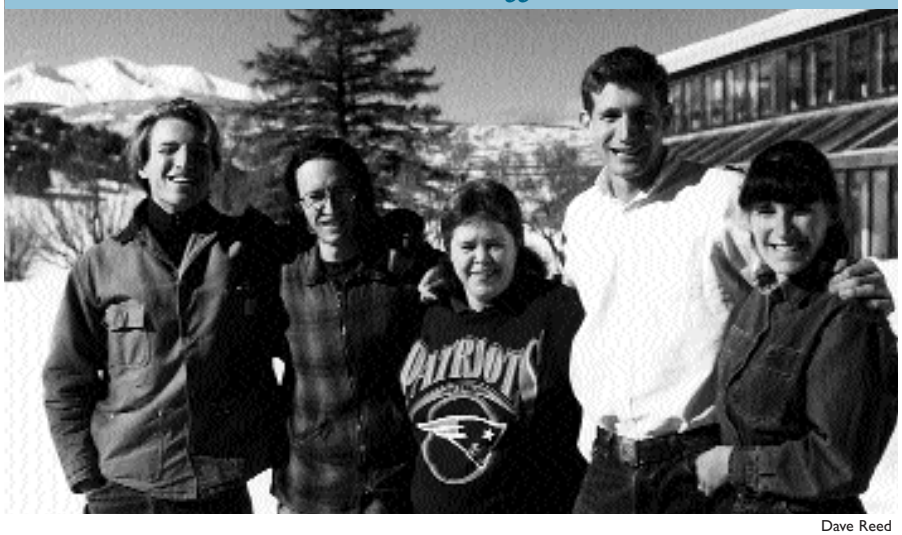
If you haven't visited RMI's Web site recently, do drop in—we've not only redesigned it to make it easier to use, but also added tons more information.

The leaner, cleaner home page (http://www.rmi.org) links to the following sections:

- **About RMI.** Information about our research activities and facilities, with further links to our annual report, staff biographies, and related RMI publications posted online.
- **Frequently Asked Questions.** The biggest and most useful addition to the site, this monumental section answers more than 70 questions on all aspects of RMI's work. If you're thinking of calling us with a question, please check out the FAQ first. If we don't have the answer, we link you to an organization that does.
- **The RMI *Newsletter*.** Yep, this newsletter is posted at our site, photos and all (see box).
- **RMI Publications.** Our online catalog is now secure for credit-card transactions, thanks to the Center for Renewable Energy and Sustainable Technology (CREST), which generously hosts our site. We've also posted the full text of about a dozen of our publications at the site, and we plan to add more.
- **Consulting Services.** Links to descriptions of RMI's services in green real-estate development, sustainable community development, water and energy efficiency, and hypercar development.
- **What's New.** Click on this link to find out what we've added since you last visited: new publications, the latest edition of the newsletter, and other timely features. (This section is in development.)
- **How You Can Help RMI.** Of course we'd be remiss if we didn't tell visitors how to use our spiffy new secure online donations form.

Please bear with us if you encounter construction activity. This work is currently unfunded, so we're rebuilding the site as funds allow, mindful of its greater convenience, lower outreach cost, and potentially global reach.

## *New Staff*




Dave Reed

*RMI welcomes several new members of staff (left to right): researchers Kipchoge Spencer and Jonathan Fox; housekeeper Patty LeBlanc; outreach specialist Auden Schendler; and comptroller Christy Otis. We'd also like to bid farewell to Owen Bailey, Michael Brylawski, Maureen Cureton, Gunnar Hubbard, Louie Saletan, and Lysa Usher.*

## *Be the First on Your Block…*

…to get the RMI *Newsletter!* If you have access to the World Wide Web, you can read it a week before the hard-copy edition is out—and save paper to boot.

If you'd like to be notified by email when each new edition of the newsletter has been posted to our Web site, simply email us at: newsletter@rmi.org. In the subject field write "subscribe newsletter," and in the body of your message please be sure to give your name and your address as it appears on your paper newsletter's mailing label.

We need to know your name and address so we can delete you from our regular (paper) mailing list. In the interest of saving resources, we will stop sending you the paper newsletter unless you tell us you really want to keep getting it. Either way, though, we need to know who you are!

There's no charge for this email service (apart from the usual suggested minimum $10 annual donation for the newsletter).

If you requested this service and haven't yet received a message, we apologize. Please send us a reminder and we'll get right on it.

## AS YOU WERE

In last summer's reader survey, when we asked whether you would join RMI if we became a membership organization, most of you answered with a question: why?

At its most recent meeting, the RMI Board agreed with you. The Board didn't see enough advantages to offering memberships to outweigh the extra costs and headaches of doing so, so the idea has been shelved.

So too has the proposal to increase the suggested minimum donation for the newsletter, since it appears that very few of you give just the minimum.

# 1996 FINANCIAL RECAP

By most measurements, 1996 was a financially successful year for RMI. Revenues grew faster than expenses, producing another annual surplus, while the Institute's first capital campaign met its target to raise $1.5 million by year-end.

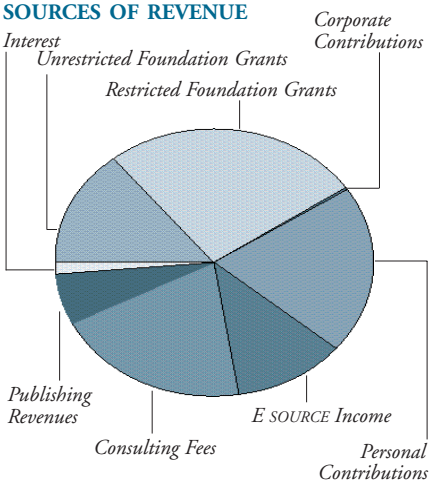
We're grateful to all the donors who helped us achieve these gratifying results.

Here's a snapshot of key financial indicators for 1996, based on unaudited accounts (audited figures are due in May):

- Expenses rose from $2.25 million in 1995 to $2.47 million in 1996, a 9.8-percent increase attributable mainly to expansion of green development and hypercar staffs.
- Revenues increased by 15.9 percent to $2.75 million, excluding a prior-year $210,000 income item credited in 1996 and a $158,000 extraordinary item from the net effect of the capital campaign.
- The resulting $274,000 surplus was the Institute's ninth in 15 years.
- Total assets rose from $3.79 million to $4.2 million; net worth rose from $1.0 million to $1.34 million.
- RMI's main source of income was foundation grants, totaling 41 percent of the pie.
- Individual contributions jumped from 8 to 20 percent of revenues, thanks to an anonymous $325,000 trust gift.
- Earned income declined from 45 to 39 percent due to that gift and timing details, but remained above 1994's 26 percent.
- Of the $2.06 million raised to date by the Securing the Future Campaign (see page 7), $1.51 million was accrued or received in 1996, the rest pledged.
- Capital-campaign fundraising expenses of $143,000 were largely covered by a special $100,000 grant from the MacArthur Foundation.

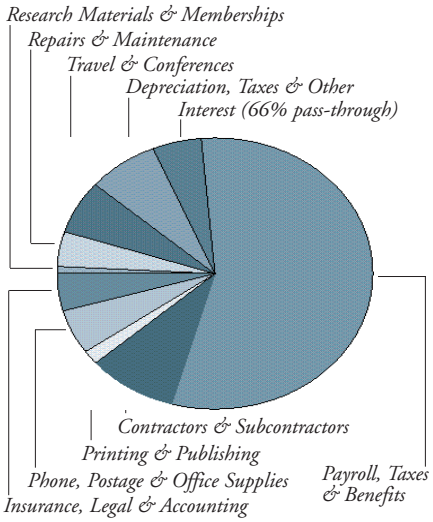
RMI remains a lean organization with cash reserves averaging two weeks' operations. Covering daily expenses of $6,773 continues to be a challenge. A cashflow-stabilization fund established by the Joyce Mertz-Gilmore Foundation has provided the Institute with a welcome safety net since 1994, but will expire this summer. RMI is seeking a loan or gift to replace it.

**SOURCES OF REVENUE**



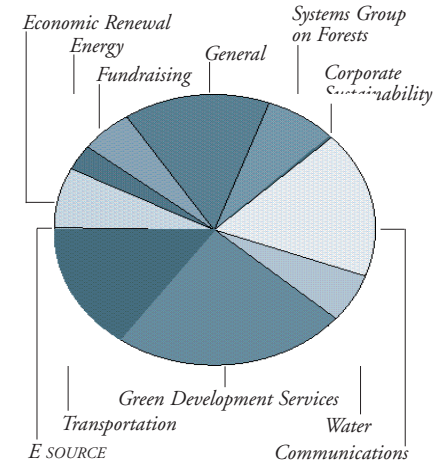

**Total Accrued Revenue: $2,746,700**

**EXPENDITURES BY CATEGORY**




**Total Accrued Expenditures: $2,472,280**

**EXPENDITURES BY PROGRAM**




**Total Accrued Expenditures: $2,472,280**

*Note: graphs exclude $209,597 of prior-year income and $157,984 of extraordinary net expenditure for the Windstar land purchase.*

## *New Publications*

*For a full list of publications, please call us at 970/927-3851 or visit our Web site at http://www.rmi.org. (Note: prices do not include shipping and handling charges.)*

### TRANSPORTATION

**New Cars for the New Millennium/Lightness is All.** Two columns on hypercars by *Automobile*'s design editor Robert Cumberford. T96-13 2 pp, $1.50

**Ultralight-Hybrid Vehicle Design: Implications for the Recycling Industry.** Hypercar design, recycling, and durability; for the American Society of Plastics Manufacturers. T96-14 8 pp, $4.00

**Hypercars: Answers to Frequently Asked Questions.** A completely revised and updated introduction (also posted at our Web site). T97-4 11 pp, $4.00

**Hypercars: A Market-Oriented Approach to Meeting Lifecycle Environmental Goals.** How whole-system design can minimize lifecycle costs; for the Society of Automotive Engineers. T97-5 8 pp, $4.00

### ECONOMIC RENEWAL

**RMI's Economic Renewal Program: An Introduction.** Excerpted from RMI's new *Economic Renewal Guide* (also posted at our Web site). ER97-3 19 pp, $5.00

**Economic Renewal Overheads.** A set of 37 35-mm slides summarizing basic principles. ER97-6 $75.00 (or $15.00 to rent)

### ENERGY

**Home Energy Brief: Home Cooling.** A summary of do-it-yourself energy-saving measures, excerpted from the RMI book *Homemade Money*. E97-1 4 pp, $2.00

# SECURING THE FUTURE CAMPAIGN
# 1995–96 GIFTS AND PLEDGES (as of 31 December 1996)

*RMI appreciates the generosity of all the anonymous donors.*

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The bad news is that our ongoing Securing the Future capital campaign and the usual yearend increase in giving has made our donor lists longer than ever, pushing the newsletter up to 16 pages.

But the good news, of course, is that all those names mean more money for RMI's research and other programs. It's a problem we like to have.

Some readers have said they'd rather we did away with the names in the newsletter. But we want to acknowledge everyone who gives to RMI. Printing their names in the newsletter is the least we can do to show our appreciation to the people whose generosity has made our work possible.

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