

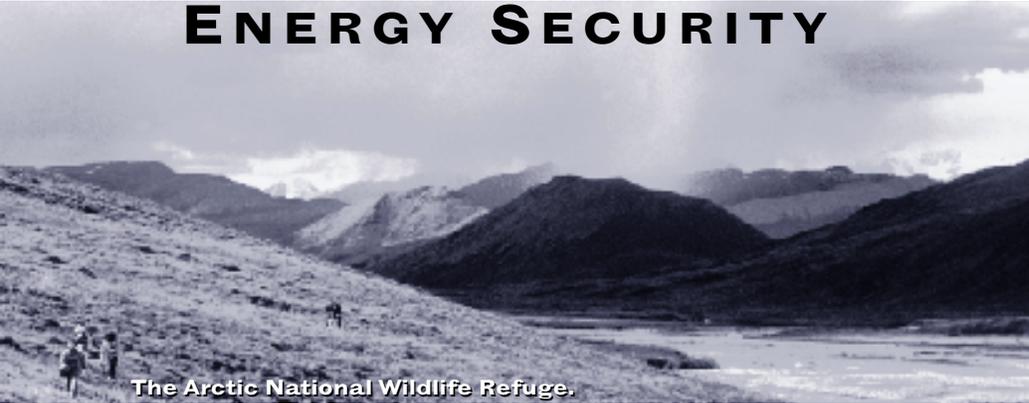


# RMI Solutions

## NEWSLETTER

# FROZEN ASSETS?

## ALASKAN OIL'S THREAT TO NATIONAL ENERGY SECURITY



The Arctic National Wildlife Refuge.  
photo: Galen Rowell

by Amory B. Lovins  
and L. Hunter Lovins

*"We must continue, I believe, to safeguard the Arctic National Wildlife Refuge, one of the last truly wild places on Earth—the Serengeti of the Americas."*

—PRESIDENT CLINTON, JANUARY 17, 2001

**A**S YOU READ THIS ISSUE OF *RMI Solutions*, Congress is debating whether the oil potential beneath the Arctic National Wildlife Refuge (ANWR) in Alaska is worth the environmental damage caused by extracting and burning it. Largely unexamined so far are more basic questions: Is it profitable? Is it necessary? Is drilling a good idea? Is there a better way?

The rationale for drilling in the Refuge is to find a domestic oil supply, income for Alaska, and profit for private firms. The debate focuses on the environmental cost, the human rights of the threatened Gwich'in people, and opposition from Canada, which shares the migratory wildlife. Yet that energy-vs.-environment debate overlooks important reasons why drilling in the Arctic Refuge would not

improve but compromise national energy security and economic vitality, especially when compared with alternatives that benefit both and improve the environment.

### FOLLOW THE MONEY

First, the economics of drilling for Refuge oil look as unrewarding as its politics. For the oil industry to invest, the Refuge must hold a lot of oil, and the oil must sell for a high enough price for long enough to recover costs and earn profits. When drilling was last proposed in the Refuge, in 1987, the Interior Department tried to boost its case by assuming tax breaks that no longer existed, twice actual oil prices, and twice the likelihood of finding twice the oil that Alaska's state geologist forecast from more complete data.

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Despite this generous handicapping, Interior had to admit (in the fine print) that the odds were 5:1 against finding any economically recoverable oil, 15:1 against finding as much as six months' national supply, and over 100:1 against another huge Prudhoe Bay-sized find. Independent analysts using realistic assumptions later found that the expected reserves would be closer to six days' national supply and that the producers would lose money. The only point of agreement was that the Refuge's

**“Efficiency doesn't risk dry holes. It improves the environment. It will never suffer a terrorist attack. It stays profitable regardless of what oil prices are doing.”**

biological core, its small but critical Coastal Plain, would be trashed.

In 1998, the U.S. Geological Survey did an honest and modern update. It found worse geology, offset by new, fourfold cheaper production technologies. The 1987 estimated average reserve of 3.2 billion barrels of oil could probably still be profitably recovered—if, for decades to come, it fetched an average price of at least \$22 a barrel (in December 2000 dollars, delivered to Los Angeles). Historic world oil prices FOB Saudi Arabia have broken the \$22 mark only a few times in the past three decades, and tend toward the teens. Sustaining \$22+ a barrel for decades would contradict practically every industry and government forecast—and the forecasts are trending down, not up.

The Alaska Department of Revenue earnestly hopes for Refuge drilling so its citizens will keep getting rebates instead of paying income taxes. Yet in December

2000, the Department projected a steady decline in the L.A. price of Alaskan crude oil to less than \$13 a barrel in 2009. The latest Federal forecast calls for oil to stay below \$22 until nearly 2020; when Alaska last published such a forecast in 1998, it was only \$18. That means less economically recoverable oil. Indeed, the USGS says that below \$16 (plus any lease fee paid to the Treasury), no economically recoverable oil is likely to be found. Alaska now forecasts prices below \$16 throughout 2005–10, so why drill?

Of course, any forecast of oil prices can be wrong, and most are.

Oil prices have fluctuated randomly for at least 115 years. Oil companies routinely assess that risk—though in the Refuge, it's not simply a business decision but also a choice about such public goods as environment and national

energy security. But some fundamentals can cut through the forecasting fog.

Astounding advances continue in the technology of finding and extracting oil—super-computer visualization like X-ray eyes, and precision-guided drilling to snake between pockets of oil. Oil resources, both domestic and global, have therefore stopped declining and started expanding markedly, halving Federal forecasts of 2020 oil prices—now only two-fifths of what Interior assumed in 1987.

Could that new technology tip the economics back in favor of Refuge oil? Most industry experts think not. The more they look at their proprietary Refuge data, the more it seems a multi-billion-dollar gamble not worth taking. That's because the same technological advances that might make Refuge oil worth seeking can also be applied elsewhere. Oil exploration is a global business. With oil everywhere getting rapidly cheaper to find and lift, why

look in one of the most hostile and remote places on earth? Practically anywhere else would be cheaper.

During 1998–99, while oil prices soared from \$10 to \$25 a barrel, the big U.S. energy companies slashed their exploration budgets by 38% worldwide, 66% in onshore America. They see technology becoming ever more powerful, oil more abundant, and long-term prices ever lower, so only the lowest-cost provinces can compete—not drilling above the Arctic Circle. If oil companies believed in high long-term oil prices, they'd be drilling everywhere. They're not.

### **DEPENDENCE ON OPEC OIL?**

The second rationale for drilling in the Refuge—relieving dependence on OPEC oil—has also waned. OPEC's percentage of the oil the U.S. imports has dropped by a third since the high-water-mark of imports in 1977. Only one-fourth of U.S. oil now comes from OPEC. Most imports come from more stable Western sources, and are so diversified that a full-scale war in the Persian Gulf in 1991 caused no gas lines at home. We're not as dependent on OPEC as some imply.

Nor are we short of fuels. A White House aide on January 21 provoked merriment in energy circles by claiming that Arctic Refuge drilling was urgent because, as California's electricity crisis showed, the nation “desperately needs more fuel.” How much of California's electricity is in fact made from oil? One percent. Of the nation's electricity? Two to three percent. How much of the nation's oil makes electricity? Two percent. California isn't short of fuel. What California is short of is cheap electricity.

If oil-import dependence or oil shortages were a serious problem, though, would the solution to domestic depletion be to deplete faster? Or might other solutions arrive sooner and cost less? If Arctic Refuge oil isn't the cheapest way to provide the services now provided by imported oil, then



drilling in the Refuge will make the oil-import problem worse than it could have been. That's because each dollar spent on the costly option could have bought more of the cheap option instead. Choosing the costlier option therefore results in using and importing more oil than if we'd bought the best buys first.

### **EFFICIENCY: ENERGY WITHOUT RISK**

Better buys aren't hard to find. In fact, we've already bought a lot of them, though far more remain untapped. Specifically, the past quarter-century's efficiency revolution is now "producing" over four times as much energy as the entire domestic oil industry (and ten times the oil the U.S. imports from the Persian Gulf) simply by using less energy to do more work in smarter ways. More than half the nation's energy services now come from efficient use. Each barrel of oil supports three-quarters more GDP than it did in 1975—and that's just for starters.

Efficiency doesn't risk dry holes. It protects the climate and improves the environment. It will never suffer a terrorist attack. It creates a uniquely flexible and perennially profitable form of all-American energy security. In fact, it cut oil imports from the Persian Gulf by 87% during 1976–85 alone. Yet efficiency is strangely invisible in today's Refuge-oil debate.

The energy policies of the early '70s and the mid-1980s painfully demonstrated how quickly energy gluts happen when customers seek efficiency. Even relatively small efficiency gains offer an enormous potential opportunity to policymakers and entrepreneurs—but a serious risk to energy producers and investors.

The early 1980s saw a two-pronged approach to energy: the government increased supply while customers increased efficiency. Both efforts succeeded—supply modestly, efficiency beyond anyone's wildest dreams. Between 1979 and 1986,



GDP rose by 20 percent while the nation's total energy use fell by 5½ percent. This stuck the suppliers with costly new supplies without the revenue to pay for them. The resulting energy glut crashed energy prices in 1986, sending many producers into insolvency. Efficiency providers suffered too: as attention waned, many energy-saving programs, products, and services faded from view for the next 14 years.

Yet in the last four of those years (1996–99), almost unnoticed, efficiency unexpectedly came back. Despite record-low and falling energy prices, the pace of U.S. energy savings averaged 3.2 percent per year—nearly matching its early-1980s all-time peak when energy prices were at record highs and rising. Meanwhile, a cluster of random events caused routine blips in oil and natural gas prices just as California's botched restructuring sent Western electricity prices soaring. Those triple price hikes will further accelerate energy efficiency's late-1990s revival.

All this sets the stage for a rerun of a very bad movie—the 1986 price crash that ruined so many energy producers. That crash was caused by mixing two ingredients: an underlying efficiency trend plus a Federal supply stimulus. The first ingredient is now here; the second is promised by President Bush. There's no reason to

expect a result different from the past couple of times we've tried the same recipe. The light at the end of the energy tunnel is an oncoming train. The resulting wreck will not be healthy for the domestic energy industries, whose financial stability is an important element of national energy security.

As in the early 1980s, supply expansions will be far less prompt and effective than energy efficiency. This is especially true for Refuge oil, which can produce nothing for nearly a decade anyway, and then, briefly, about one percent of the world's oil. Efficiency, however, is such a vast resource that capturing just a few percent of it could crash the oil price and displace any oil that might lurk beneath the Refuge.

### **AUTOMOBILE POTENTIAL**

Let's suppose that a compliant Congress, steady high oil prices, and successful exploration did find the hoped-for 3.2 billion barrels of profitably recoverable oil beneath the Refuge. Over a typical 30-year field life, that averages 292,000 barrels per day, enough to produce about 156,000 barrels of gasoline per day. That would run just two percent of America's present fleet of cars and light (non-commercial) trucks. That much gasoline could be saved by making those vehicles a mere 0.4 mpg more efficient. During 1979–85, new light vehicles gained 0.4 mpg every five months. This trend ended when President Reagan rolled back the efficiency standards—thereby wasting one Refuge's worth of oil, and promptly doubling oil imports from the Persian Gulf. Had the efficiency trend continued, America wouldn't have needed a drop of oil from the Gulf since 1985.

Even with no improvement in vehicle efficiency, just adopting aftermarket tires as efficient as the originals would save several Refuges' worth of oil. So would equipping appropriate U.S. buildings with superwin-

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# hypercar makes its MOVE

DRIVING  
FOR A  
PROTOTYPE



by Jason Denner and Thammy Evans

**F**OR THE PAST 16 MONTHS, UNDER a veil of secrecy, RMI's latest for-profit spinoff has quietly been building a revolution. On 9 January 2001 that veil was partly lifted by a front-page feature in *The Wall Street Journal*, covering the development of Hypercar, Inc.

Hypercar, Inc. successfully completed a \$4.3-million startup phase in November 2000 and it completed a conceptual design that met stringent goals and industry standards. Using the computer simulation capabilities of an industry-leading engineering, automaking, and Formula One firm, the company was able to show that the concept car met all performance expectations, including occupant safety in collisions with much heavier steel cars. This is an encouraging outcome for the young team, proving to themselves, potential clients, and the general public that the Hypercar<sup>SM</sup> concept can become a commercial reality.

The company successfully courted tech-

nology partners and suppliers at an automotive e-commerce trade show held in Las Vegas in November. There, Hypercar, Inc. displayed a two-fifths scale model of a concept car, called the Revolution, developed in the start-up phase. The model proved to be a focal point of the show, just as the full-scale model (above) has done with shareholders and potential investors.

### BUILDING PARTNERSHIPS

The startup phase has also built partnerships with investors, clients, and technology suppliers eager to help germinate an entirely new approach to automaking. Such capable industrial partners as Sun Microsystems and BP Amoco provide important support, both technical and otherwise. Collaboration with potential end-users also helps to ensure that the vehicles being designed are tailored to their needs.

Why are customers excited about Hypercar, Inc.'s vehicles? For starters, the first con-

cept car is an Explorer-sized vehicle—a mid-sized SUV replacement. It will achieve fuel efficiency equivalent to 99 mpg of gasoline (five times the efficiency of a similar-sized Lexus RX300), accelerate from 0 to 60 mph in 8.2 seconds, and haul over half a ton, even up a 44-percent grade. It will run silently with zero emissions for 330 miles on electricity made in a fuel-cell from 7.5 pounds of hydrogen compressed in ultra-safe tanks. Its dent- and rust-free body will meet U.S. federal safety standards for occupant safety in a 30-mph fixed-barrier crash, even in a head-on collision with a vehicle twice its weight, each going 30 mph. A fixed-barrier crash at 35 mph won't even damage the passenger compartment. And the design is consistent with a 200,000-mile warranty. These and other key attributes don't appear to have been combined previously in a single vehicle by established automakers. The Revolution appears to be the world's first uncompromised super-efficient concept vehicle.

Future customers and investors are taking seriously the market potential for Hypercar Inc.'s eventual products. Seriously enough to stir the interest of Jeff Ball, *The Wall Street Journal's* lead automotive industry reporter. Jeff spent two weeks with Amory and Hypercar staff researching an article that was published as a front-page, column-one profile of the ten-person startup.

## HYBRID HYPE

The auto industry also seems to be taking notice of the potential for Hypercar technology. News coverage of Detroit's annual North American International Auto Show has been headlined with high-mileage hybrid-electric production vehicles and even a pre-production (expected in showrooms in 2004) fuel-cell vehicle from Ford called the FCV. GM executives, sporting matching green sweaters, announced a hybrid-electric sedan for 2001 and a fuel-cell vehicle slated for 2004. At the Los Angeles Auto Show in early January, both Ford and Dodge unveiled hybrid-electric SUVs: the Ford Escape, due in showrooms in 2003, and Dodge's hybrid prototype, the Powerbox which uses compressed natural gas. Auto industry pundits are agreeing there is a revolution underway in automotive technology. Hypercar, Inc. is on its cusp.

The core of the Hypercar, Inc. technical team was originally assembled at RMI. Timothy Moore, Dr. Jonathan Fox-Rubin, Michael Brylawski, and David Cramer all came to work at the Institute between 1993 and 1997. (Fuel-cell expert Brett Williams was also a key member of the original group at RMI but is now pursuing



a doctorate at the University of California at Davis.) In \$2 million worth of research, funded by grants, donations, and earnings over eight years, the group developed

**“GM executives, sporting matching green sweaters, announced a hybrid-electric sedan for 2001.”**

Amory Lovins's theories about efficient auto design, publishing numerous professional papers and, in 1996, the landmark tome *Hypercars: Materials, Manufacturing, and Policy Implications*, which was sold to interested automakers for \$10,000 per copy.

The buzz about hybrid-electric vehicles and fuel-cells at this year's auto shows is in substantial part a result of much of this work. Many of the gratifying interim achievements made by the auto and related industries are chronicled at [www.rmi.org/sitepages/pid414.asp](http://www.rmi.org/sitepages/pid414.asp).

## GREAT EXPECTATIONS

By 1998, it was clear to the team that while the race had begun with great promise, established automakers faced

many cultural barriers in rapidly adopting uncompromised Hypercar designs. This opened an opportunity to stimulate and support the industry's transition by creating a wholly new product true to the Hypercar strategy. With the help of Amory's network of contacts, a seasoned governance and executive team was assembled and Hypercar, Inc. was spun off in August 1999. Product development was led by David Taggart, a composites innovator from the famed Lockheed Martin Skunk Works®. He led the team that developed a 95%-carbon-fiber-composite fighter aircraft, one-third lighter but two-thirds cheaper than its 72%-metal predecessor. Hypercar, Inc. mixed his aerospace skills and organizational methods with the ex-RMI team's knowledge, industrial partners' skills, racecars, and software. The recipe proved successful.

With the startup phase successfully completed and the manufacturable concept car designed, the team is now raising additional private equity for a two-year, \$50-million phase that will produce numerous working vehicle prototypes by the end of 2002. To help manage and fund this phase,

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## THE NATURAL CAPITALIST | CONSUMER

*“Laugh about it, shout about it, when you’ve got to choose; any way you look at it you lose.”*  
—PAUL SIMON, “MRS. ROBINSON”

**W**HEN PAUL SIMON SANG those words in “Mrs. Robinson,” he was referring to choices among political candidates. But many people feel the same when it comes to the product choices the marketplace has given them. Truly environmentally innovative autos, the Honda and Toyota hybrids, are only now appearing after the concepts were prototyped in the early 1980s. As a marketplace protest vote, this author has never bought a new car, but I’d buy a Toyota Prius or Honda Insight today to encourage them.

Germany’s Blue Angel symbol for “products with environmental features” is now into its third decade and appears on 4,000 products, but its standards are arguably weak when measured against true sustainability models like Natural Capitalism. The fact is, U.S. consumers have little to guide them except spotty materials lists and “green” marketing claims with varying levels of authenticity. When you are buying pro-

ducts or services, either for an organization or for yourself, which choices, if any, are really worthy of your hard-earned marketplace vote?

Natural Capitalism is a new business model developed by RMI’s Hunter and Amory Lovins and business author Paul Hawken that promotes prosperity while preserving, and ultimately restoring, the natural capital that all life and wealth-generation depends upon. RMI’s primary mission at present is spreading this new model throughout the world.

Based on four synergistic, down-to-earth principles (see inset), Natural Capitalism can also be an effective guide for the marketplace votes of our daily lives—guiding our purchasing choices, our investments, and our advocacy.

When making Natural Capitalist consumer decisions, simply ask yourself if your choice of product or service involves:

- a minimum of energy and materials to get the job done;
- natural (non-toxic and life-temperature) materials and processes;
- materials that can be used again, easily recycled or biodegraded; and
- enhancing rather than depleting what

living beings will need from the planet’s natural capital in the future.

To keep your imagination keen and your cynicism muted, always wonder: what’s the real service I want from this product, and how could this service be provided more elegantly—more simply and directly at lower long-term cost—and restore nature’s assets in the process? If you come up with ideas, let the provider know, since imagination may be more of a limiting factor in progress than governments or market economics. (Let RMI know too—we might be talking with the firm’s CEO.)

The phrase “Natural Capitalist consumer” is actually something of an oxymoron. The Natural Capitalist seeks not to “consume” something, but rather to obtain the desired services with a minimum of materials and energy use and natural capital loss. Where possible, this means substituting nature’s means for industrial fixes, and getting the services without owning a product. Try to leave product ownership throughout its life-cycle with the manufacturers—giving them clear economic incentives to minimize its operating and disposal costs.

For example, daylight in a well-designed building, or through retrofitted sunlight

### BEST RESOURCES FOR INDIVIDUAL OR SMALL BUSINESS PURCHASING

**[www.buygreen.com](http://www.buygreen.com)** This site has links to the key credible environmental product assessment systems in Canada, the U.S., and Germany. A good single-stop shop.

**[www.environment.about.com](http://www.environment.about.com)** is a linking site to 700 sites about environmental issues, many of which give guidance regarding environmental consumption.

**[www.newdream.org](http://www.newdream.org)** The Center for A New American Dream helps individuals and institutions reduce their consumption and pick products and services wisely, with the ultimate goal of enhancing quality of life and protecting the environment.

**[www.responsible shopper.org](http://www.responsible shopper.org)** is a joint site provided by Working Assets and Co-op America providing general ratings of companies (from Council on Economic Priorities) and consumer tips for specific industries.

**[www.blauer-engel.de/Englisch/index.htm](http://www.blauer-engel.de/Englisch/index.htm)** is the site of the Blue Angel environmental product attribute label based in Germany. The standards used for awarding the label are helpful to consumers wondering what to look for.

pipes instead of light fixtures, provides superior visibility. You don't want light bulbs, you want full-spectrum light services. Carbon-fiber Hypercar<sup>SM</sup> bodies can be beautifully colored without paint coats; you don't want a painted car as much as a durably beautiful car. Native stone can make your home instead of cement derived from a 2,700-degree process. Software services can be leased from the provider over the internet instead of bought and hassled with. Businesses and individuals will often be surprised at how easily needs can be met by thoughtful whole-system design, frequently using low-tech tools derived through biomimicry from nature's proven techniques.

This is as true of large organizations as it is in small households. Every organization has at least one, and sometimes thousands, of purchasing decision-makers, operating in a mad scramble governed by policies and procedures to get retail shelves stocked, supply closets filled, raw materials delivered, products distributed, and facilities powered.



**Labels generally don't say much about how products are created.**  
photo: Cameron Burns

These folks are making the same choices that individuals are struggling with, but are further burdened by a maze of regulations, policies, time constraints, and technical specifications. Their difficult jobs are at the heart of the daily messages that businesses send to one another regarding the importance of environmental responsibility. The challenge all purchasers face is how to make informed decisions without excessive "transaction" costs that slow down and/or

inflate the total cost through administrivia. Purchasers, whether in organizations or as individuals, wield tremendous power. Ultimately, businesses will choose the Natural Capitalism model when their leader(s) clearly say to do so. What drives leaders are customers, investors, family, and perceived peers (other business or community leaders, sometimes talented employees). Note that customers are first

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## THE FOUR PRINCIPLES OF NATURAL CAPITALISM

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

### ■ Principle 1: Radical Resource Productivity

**Radically increase the productivity of natural resources through a whole-system design mentality that fundamentally changes facilities, production processes, and products.**

### ■ Principle 2: Biomimicry

**Shift production to biologically-inspired patterns that close materials loops, eliminate waste and toxicity, and minimize throughput.**

### ■ Principle 3: "Solutions Economy" Business Model

**Move to a solutions-based business model that delivers value as a continuous flow of services rather than the sale of goods—rewarding both the provider and the customer for doing more and better with less for longer.**

### ■ Principle 4: Reinvest in Natural and Human Capital

**Reinvest in natural and human capital, which is ultimately the basis of future prosperity, yet is in increasingly short supply—and whose copious production by nature is automatic if unimpeded.**

## a letter from

# OZ

by Rick Heede

photo: Norm Clasen



IT IS EASY TO LOVE AUSTRALIA. The people are real, they look you in the eye, they don't beat around the bush, they are passionate about life and everything Australian, and they spend serious time at the beach. Aussies also make great converts in the energy game. In America, we spend a lot of winter inside, preserving calories. In Australia, with some of the mildest winters on earth and truly spectacular summers, one is constantly outside, enjoying the natural environment. They are—as the late Edward Abbey liked to say—forever dipping back into the well, replenishing the passion for a clean natural world.

It's good they're so interested in keeping the sandbox clean. It makes RMI's job easy. And our job is getting so big Down Under that we're going to need all the positive energy, so to speak, we can get. For all of Australia's great take on life, Aussies—like us—have a serious problem: carbon emissions. Australia and the United States share top honors in emissions of greenhouse gases per capita. Australia dumped 503 million tons (53,600 pounds per person per year) of carbon dioxide-equivalent into the sky in 1998. Eighty-four percent of the nation's electricity comes from burning

coal; the rest is from natural gas and hydroelectric sources.

### HOW I SPENT MY SUMMER VACATION

Twice last year I had the pleasure of visiting Australia. The first visit, in July, was a whirlwind speaking tour with Amory: 36 engagements in eight business days in six cities (plus numerous media interviews)—think of the phrase “drinking from a fire hose” and you get a sense of the intensity of traveling with Amory. The purpose of the second trip, in November, when I traveled alone, was to work with our colleagues in Newcastle on their progressive projects to reduce greenhouse gas emissions in this city of 120,000 people. RMI signed a memorandum of understanding with the City of Newcastle and the University of Newcastle during our July visit to collaborate on projects of mutual interest, principally climate change.

Officially, RMI serves as a technical and policy advisor to the Australian Municipal Energy Improvement Facility (AMEIF), Newcastle City Council's “business unit” on climate abatement and energy efficiency. My November trip was to dig deeper into the City of Newcastle's opportunities to

reduce city and community emissions of greenhouse gases. We met to discuss the “Billboard Project,” which informs the community about progress to reduce emissions. The electric utility (EnergyAustralia), as well as the Hunter Water Board, Hunter Waste Management Board, and the City's Road and Traffic Authority, have all agreed to supply raw data on resource flows to AMEIF. So the question becomes: how do you portray such information dynamically? We decided to start with the Web: more adaptable, flexible, fluid, changeable. We met with University of Newcastle staff on our Memorandum of Understanding on further collaboration; we are, preliminarily, considering offering a University-funded scholarship to research and deliver a more detailed greenhouse gas emissions inventory for Newcastle (the existing inventory uses proxies and general factors, which means that progress can't be accurately measured and reported).

It wasn't all just numbers, statistics, and planning. One blustery day we climbed the 50-meter tower of EnergyAustralia's 600-kW wind turbine in Newcastle. It's the first grid-connected turbine in Australia, and supplies electricity to the equivalent of 110 homes—or it could supply electricity to

300–400 homes if they were made more efficient, which is one of AMEIF’s next projects. As we watched the instrument panel (indicating winds increasing from 4 to 12 m/s), Paul Myors, a staffer in EnergyAustralia’s Sustainable Energy Division in Newcastle, guided us into our coveralls and harnesses. He then led Rachel O’Leary and Peter Dormand from AMEIF and myself up the inside of the cold, clanking 4m-diameter steel tube on which the fiberglass nacelle is mounted on a turntable. Our forearms tired from pulling ourselves up the aluminum ladder. We poked our heads into the rumbling superstructure which housed the generator. Up there, we got a sense of the immense energy blowing past our ears, more or less constantly, as it powered the swooshing 23-meter blades. Though liquid-cooled, the machinery was hot to the touch. I climbed over to open the top vent and saw the inescapable irony of this turbine. There, across the Hunter River, were defunct steel works and still-active coal-loading facilities (Newcastle is the world’s largest coal-shipping harbor). Amid the wreckage of the fossil-fuel era, Newcastle, with its rich renewable resources and smart leaders, may achieve its goal of becoming Australia’s premier sustainable energy community. RMI will be there to help.

### **RMI HELP COUNTRYWIDE**

Australia offers enormous opportunities for improvement. RMI has developed some deep friendships throughout Australia over the years, and we see our involvement as strategically influencing key corporate and government (Commonwealth, state, and local) constituencies on principles of Natural Capitalism and profitable climate mitigation.

Most business and government leaders we met are keenly interested in incorporating principles of sustainable development and removing barriers to efficient and sensible

behavior. They know what needs to be done and are actively engaged in making it happen.

The regulatory reform of the electric industry is gaining steam (pun intended), although Australian utilities are still building coal-fired power plants. The New South Wales utility—EnergyAustralia—is now working with the City of Newcastle to replace underinsulated and oversized electric storage water heaters. Those often exceed 50 percent of a home’s total electric consumption, compared to 25 percent in the States. They’ll be swapped for solar-assisted gas-fired units.

Canberra, Melbourne, Hobart, and Brisbane—and a hundred other Australian local councils—are, like Newcastle, committed to dramatically reducing emissions of greenhouse gases. RMI is likely to expand its collaboration with a number of councils.

Already the City of Melbourne, Australia’s cultural equivalent of San Francisco, has hired RMI’s Green Development Services to review

and improve a design for an exemplary new administrative building for the City. The life of Melbourne meanders along the Yarra River; electricity is cheap in Victoria, and the reflections of coal burned in the Minemouth power plants of the Latrobe Valley shimmer on the lazy water.

Another of the ideas I went to Australia to discuss is to create a “collaborative competition” between pairs of Australian and New Zealand cities to reduce greenhouse emissions. Currently, RMI’s role is to help establish and facilitate the competitions and, if cities such as Christchurch and Newcastle sign an agreement, coordinate the creation of fair rules of the game.

### **OKAY, THEN. MY REAL SUMMER VACATION!**

Yet the lasting impression of my trip is not the projects (which I am passionate about), nor the real progress being made, but my personal experiences. The Australian approach to life is so infectious that it makes working for the environment spectacularly fun.

Every day, my Newcastle mates and I would take a swim at noon (rain or shine), and if the offshore winds were up we’d have a “board meeting” in lieu of lunch. In the middle of my two-week stay in Newcastle I flew down to Hobart for a series of meetings on the state’s transportation policies and climate mitigation opportunities. Serious bureaucratic obstacles to real change abound (sound familiar?). Yet I could feel in my new friends a love of life and appreciation of their breathtaking surroundings.



**RMI’s Rick Heede doing climate research off the Tasmanian Coast. photo: Heede Collection**

We ventured out sea-kayaking off Fortescue Bay in southeastern Tasmania on a calm weekend day. I have sea salt in my veins, being Norwegian, so I took to the heaving seas immediately and aimed for the rocks, where the action is, at the seam of sea, air, and land. This is where the danger is, of course, and where the water is roughest. But, learned in the undulation of the sea, I skirted the rocks and caves for hours. I felt at home in a new land.

During my stay, John Cole, Director of the Queensland Environmental Protection Agency’s Sustainable Industries Division, invited me up to Brisbane. He and his

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by Huston Eubank

## Not All Who Wander are Lost

GREEN DEVELOPMENT STAFF BUILDS UNDERSTANDING IN EUROPE

**S**TAND THE AVERAGE AMERICAN building next to a comparable European building, and some interesting differences are likely to appear. Since we first cracked Sir Banister Fletcher's *History of Architecture on the Comparative Method*, most architects know that architecture and development on opposite sides of the Atlantic are different animals. This is especially true in the green development area. And as with any good rivalry, each side's green architects and development specialists are certain they're ahead of the other. Who's right, what are the important differences, and what can we learn from this rivalry?

For three weeks last fall, Bill Browning, Alexis Karolides, Ben Shepherd, and I trekked across northern Europe, feeding the passion for green development that fuels our work and seeking to learn from these differences. Along the way we discovered some stunning examples of green development and architecture.

The trip's genesis was the second international Green Building Challenge Conference, in the Dutch city of Maastricht. In preparation for our explorations we identified and mapped 160 green projects, and laid out an ambitious itinerary—quickly dubbed the “death march”—to take us to more than 30 of the best. Bill Browning's vast store of frequent-flyer miles got us across “The Pond.” Accumulated “comp” time and vacation took care of another chunk of the costs; important learning opportunities justified the rest.

Maastricht was intense, informative, and fun; this event brings together some of the best intelligence on green development from around the world. Exhibits, lectures, discussion, and of course hob-nobbing with some of the most interesting minds in the green building business had us swimming with new possibilities and curiosity.

Our friend Kevin Hyde of Keen Engineering humorously summed up the discussions: “International green building is a lot like teen sex: everyone thinks that everyone else is doing more of it, and everyone thinks that

everyone else is getting farther.” Nevertheless, the volume and quality of work and interest represented at the conference was mind-boggling and encouraging.

The environment got top billing at the World Expo in Hannover. While the exhibits were generally shallow and uninformative, there were many interesting (and beautiful) concepts among the buildings.

Space limitations prohibit description and discussion of the more than 30 projects we visited. It is even difficult to pick out highlights: almost every project we visited would make the list. (If you are interested in more detail, please see the Spring 2001 Newsletter page of the RMI website, [www.rmi.org](http://www.rmi.org), for a catalogue with descriptions, some photographs, and references.)

Several green themes ran consistently among the varied projects we visited. Daylight was a primary one. Northern Europeans make it a top priority. Reducing dependence on mechanical and electrical energy was another. In addition to optimal use of daylighting, this was usually accomplished through natural ventilation, frequently achieved by the use of “double-skinned” façades—finely detailed, some simple, some very complex. The relatively high cost of energy and scarcity of daylight in northern Europe are touted as a primary reason for these themes, but there seems to be a higher ethic at work.

We saw innovative uses of water both indoors and out. Landscape architect Herbert Dreiseitl describes it as turning

CONTINUED ON PAGE 23



Author and GDS team in an affordable hotel warmed by biomass alone. Phone in every room! photo: GDS Collection

# Bill Browning Gets Honorary AIA Membership

**B**ill Browning was recently recognized by his peers, when in January he received an honorary membership to the American Institute of Architects. The honorary membership is only bestowed on those non-architects who have made significant contributions in the field of architecture and to the AIA. Only a handful of the coveted appointments are made each year.

“It is a great honor, and something of a surprise,” he said. “From what little I know of the process, it requires a number of influential folks doing behind-the-scenes lobbying to make it happen. So it is a testament to our partners and clients as well.”

Of course, Bill is a familiar face to most readers. He is currently Senior Associate of RMI’s Green Development Services group (GDS), which consults on major architectural and development projects around the globe. Bill founded GDS in 1991.

“I was interested in the relationship between the built and natural environments and felt that the conflicts in the industry were based on a lack of understanding about the opportunities to improve environmental performance,” Bill said. “The big surprise along the way was the significant opportunities for productivity and financial improvements.”

Since then, Bill has led or supported innovative design and development efforts for scores of clients, including the Sydney 2000 Olympics, Wal-Mart, the White House, the Pentagon, Monsanto, Hines, and Lucasfilm. He co-authored *A Primer on*

*Sustainable Building* (1995)—an introduction to green building; “Greening the Building and the Bottom Line”—a 1994 study of increased worker productivity in energy-efficient buildings; and, *Green Development: Integrating Ecology and Real Estate* (1998)—an acclaimed textbook.

Gregory Franta, FAIA, of the Boulder-based Ensar Group, might have summarized what Bill does best when he noted: “Bill has provided more service to the architectural profession than any non-architect that I know and more than most of the architects that I know. Bill travels the country spreading the word to architects, building owners, and others in the building industry about high-performance buildings that are energy-efficient, have healthy productive interiors, and minimize our ecological footprint on the planet. He uses successful, best-practice examples from our profession to illustrate to other architects how it can be done. I have seen him totally motivate architects to change their practice—to design buildings that are sustainable.”

In recent years, GDS has seen its consulting business increase as more developers, corporations, and government agencies understand the values of green development. Part of this is due to the establishment of the U.S. Green Building Council’s LEED Green Building Rating System, a system for defining and benchmarking the environmental soundness of



**Bill Browning**

construction in the United States. Bill has had key roles in creating both the USGBC and LEED, and is active on the USGBC Board and LEED committees. In addition to an extensive consulting and lecturing schedule throughout the year, Bill advises The Trust for Public Land on sustainable development issues related to TPL properties, and he serves on the Board of Directors of Greening America, a nonprofit group dedicated to spreading the messages developed from the Greening of the White House.

Although Bill Browning has been working primarily as an advocate for over a decade, his own sustainable building and development beliefs are being put into action in Haymount, a “New Urbanist” town development in Virginia. 

# DEAR ROCKY

## HYDROGEN OVER SOLAR POWER?

Dear Rocky,

*A year ago with the Foundation's donation check we sought information on hydrogen as a substitute for propane. Your former Hypercar Center® staff graciously responded. However, it did appear that not much was available for an off-the-grid solar powered application. We are eight years off the electrical grid. Now we want to get on with the rest of the job. We do hear Ballard in Vancouver now has a residential division. Do you have any news on this front?*

*Bob and Hope Stevens, Helena, Montana*

Dear Bob and Hope,

Unfortunately, there are no companies offering residential fuel-cell systems on a commercial basis yet. The leading companies in this market are H-Power ([www.hpower.com](http://www.hpower.com)) and Plug Power ([www.plugpower.com](http://www.plugpower.com)), which have some demonstration units in operation. These systems generally rely on “reformer” technology to convert a fossil fuel, such as natural gas or propane, into hydrogen for the fuel-cell.

You indicate that your home is already off-grid. I assume you are using a photovoltaic array with a battery storage system to provide electric power in your home. A fuel-cell system could eliminate or reduce your reliance on the battery storage system, but would require a source of hydrogen fuel.

You would need to truck or pipe in a fossil fuel to produce hydrogen, or create it on-site with an electrolyzer using excess electricity from your solar array.

Near-term fuel-cell/electrolyzer systems are not as efficient at storing and releasing elec-

tricity as are today's batteries. It is not a clear-cut decision between batteries or hydrogen storage; it depends upon how you use and produce your electrical power over the year. When residential fuel-cell systems become commercially available, retail companies, such as Real Goods or Jade Mountain, will probably offer design services for homeowners.

Ballard Generation Systems, a division of Ballard, Inc. ([www.ballard.com](http://www.ballard.com)), has developed a 250-kW fuel-cell powerplant aimed at industrial operations and large commercial buildings. Ballard's 250-kW system could also be used to provide electricity to a neighborhood. It runs on natural gas, and can reliably and quietly produce electricity while creating very little air pollution.

## HEMP-POWERED HYPERCARS<sup>SM</sup>?

Dear Rocky,

*I have recently been investigating the many benefits of industrialized hemp, including nutritional and energy benefits, as well as clothing fiber use and recycle ability.*

*Has biomass energy been considered in transportation fuel as an alternative or step toward fuel-cells (as proposed in the Hypercar)?*

*Does RMI have a stance on the hemp issue?*

*Mindy Parker, Atlanta, Georgia*

Dear Mindy,

Biomass is also considered a potential source for hydrogen fuel that doesn't create global warming. Hydrogen combined with fuel-cells is clearly the future fuel/power generation technology for transportation.

Several methods of extraction are currently



by  
**Jason Denner**  
**RMI**  
**Outreach**  
**Associate**

being studied that can economically turn biomass into hydrogen. Gasification (heating to 700° Celsius in a low-oxygen atmosphere) is the closest method to commercialization. A relatively new method, using bacterial enzymes, is being researched at Oak Ridge National Laboratory.

The main impediment to commercialization of biomass-derived hydrogen is cost. Currently, steam-reforming of natural gas is generally the most cost-competitive method for producing hydrogen.

Although carbon dioxide is a byproduct of steam-reforming natural gas, this is not necessarily as bad as it sounds. Researchers at Princeton University have shown that if the steam-reforming is done at the wellhead, the carbon dioxide produced as a byproduct can be reinjected into the gas field, sequestering the carbon dioxide in the earth's crust. At the same time, the carbon dioxide repressurizes the gas field, yielding more natural gas—about enough, in fact, to offset the extra cost of reinjecting the carbon dioxide.

A jump in natural gas prices or a breakthrough in biomass processing could turn the tables, making biomass the most economical method for hydrogen production.

As far as I know, RMI does not have a position on the hemp issue. However, we do support natural solutions to resource issues. *Natural Capitalism's* Chapter 9, “Nature's Filaments,” is devoted to the subject of natural fiber sources; you may find it useful for your research. This chapter is available as a free download from our website at [www.natcap.org](http://www.natcap.org).

**“Near-term fuel cell/electrolyzer systems are not as efficient at storing and releasing electricity as are today’s batteries.”**

#### A FEW THOUGHTS ON COMPUTERS AND TELEVISIONS

Dear Rocky:

*Once or twice a year, I receive an idea. They usually don't go very far because (often) they are not that good or because I don't know how to put them into circulation.*

*I'm sharing this idea with you (you can judge the merit) because you seem to be in the business of making good ideas available to people who can implement them.*

*First, the problem: recently, I participated in an electronics-recycling event here in Chicago. I was struck by the huge number of computers and televisions we saved from the landfill.*

*As we all know, computers have a short useful life, perhaps two to four years. Though usually still functional, they become obsolete by the latest technology. Computers are and will be thrown away by the millions each year.*

*Here is my idea. The plastic housings of computers, televisions, and other various electronic devices can be made out of good old renewable and biodegradable paper. Paper can be molded or pressed into complex shapes. It can be manufactured thick enough for the low strength needed for*

*these devices' housings. Reinforcing gussets and screw inserts can be molded in. Paper can be painted with any color paint, including anti-EMF coatings.*

*The task, then, is to get this idea out to Apple, Dell, Gateway, Georgia Pacific, Weyerhaeuser, and Monsanto.*

*This is where I must bow to your expertise. Do you think this idea has merit?*

*Marc Bonem, Arlington Heights, Illinois*

Dear Marc,

Your idea is a good one. In fact a few companies are working in this direction, notably MBA Polymers of Richmond, CA ([www.MBAPolymers.com](http://www.MBAPolymers.com)).

Many of the plastics used for housings of electronic products have excellent recycling properties. The chief impediment is designing the products for disassembly and developing distribution networks capable of handling a return stream of outmoded, obsolete products.

Using paper in place of molded plastic computer housings is a possible application of *Natural Capitalism's* Principle 2, Biomimicry. However, unlike plastic cycling, which would occur within a man-made environment, a paper computer-housing would cycle through a natural ecosystem; careful attention would need to be paid to the additives and paints. There would certainly be other challenges for paper-based housing material associated with thin wall molding, complex internal features and surface finish, which are economically achievable only in plastic parts today.

For current electronics manufacturers, plastic (ABS and PC) will probably remain the most competitive material. One interesting recent development is “bioplastics,” made from corn- and soy-based polylactic acid, e.g. by Cargil-Dow.

Also, the ubiquitous beige plastic computer housing has left much room for interesting

innovation (e.g. iMac). Although many of the big computer companies are not nimble enough to take advantage of a market niche for housings made from natural materials, a small company may.

## RMI Solutions Online

**Like many organizations,** we are trying to decrease our use of resources. Thus, we encourage you to get the Newsletter online, where it can be downloaded in PDF form.



Once on RMI's website, at [www.rmi.org](http://www.rmi.org), scroll down the menu on the left side of your screen and click on “Newsletter.” Then click on the issue you want, and it will download onto your computer as a PDF file. To read a PDF file you must have Adobe Acrobat Reader installed on your computer—it's available free from Adobe Systems, which is linked from our Newsletter page. (Click on “Adobe Systems.”) Back issues are clearly listed.

## the evolution of a water doctor

by John Todd

HAVE ALWAYS WANTED TO SERVE THE water. My first career job involved looking at animal life that dwells in the bottom gravel and mud of rivers and lakes. I was to investigate the environmental impact of industrial discharges in the waters of Southern Canada. My clients were the polluters who wanted a leg up on the regulators. The experience taught me two things. First, that many aquatic forms of life were in danger and that deep down most of my clients didn't really care. Second, I realized that I did not know enough about living systems and ecology. So I left that job and went on to take a doctorate. I specialized in the study of waters and the field of animal behavior.



John Todd

My doctoral thesis work resulted in two discoveries. The first was that catfish could navigate through the sensation of taste. Their bodies are covered with taste buds and they "see" their way through the water by this unusual mode of orientation. I subsequently observed that catfish organize their social lives through the sense of smell. They recognize individuals through exquisitely sensitive olfactory mechanisms, and even remember prior events such as combat defeats and triumphs for months after the event. For me it was a strange new reality, made even stranger by another set of facts.

Regulatory agencies set standards for pollution loads and tolerance on tests called LD50s. This term means the lethal dose at which 50 percent of the organisms being tested die. (Various animals including selected species of fish are used.) I found that in some cases these tests were, from the perspective of survival of an animal species, meaningless. Some toxins in water, including pesticides, were capable of disrupting critical social functions among fishes at levels four orders of magnitude below the official lethal dose. For example, fish species that parent their young, often by harboring them in their mouths for protection, would no longer recognize their offspring even at these extremely low poison concentrations. They would eat them instead. The social bonds between the parents and their young, often mediated by chemical signals, were severed by the poisons. I was dismayed

and shaken to realize that extinction in real life is silent, almost invisible. I knew then that to serve the water would require an unconventional strategy.

### COMPLEX ORCHESTRATIONS

My view of nature had to change from that of perceiving ecosystems as collections of species assembled together in various habitats. Instead, life appeared to me as incredibly complex orchestrations of various and diverse biological forms. They contain an immense variety of phylogenetic levels working in concert. Self-organization and self-design in nature are incredibly powerful. This power of organization makes natural systems at once more robust and more vulnerable. They are more robust because they can lose species after species and still be able to self-organize and self-design. But they are also more vulnerable because this intrinsic power, combined with the multiplicity of species, makes their unraveling at the hands of destructive forces less apparent. There is very little warning before one system collapses into another in an altered state. The old system simply is no more.

In 1981, with Nancy Jack Todd, I founded Ocean Arks International. Our plan was to take the ideas developed by ourselves and our colleagues at the New Alchemy Institute, our first organization, out into the Third World. It was at the urging of our friend, the anthropologist Margaret Mead, that we did so. For several years we worked on coastal ecological development projects in Guyana in South America and Costa Rica in Central America.

Then events at home changed our lives. By the mid-1980s, several of our friends had

died of cancer. To me it was obvious that the emerging cancer epidemic was caused in part by industrial chemicals getting into our food and water sources. At New Alchemy we had discovered how to grow food without agricultural poisons. But the waters were a different story; they are so vast, ubiquitous, and ever-changing. The dance of water is the great hydrological cycle of the Earth itself. It is the source and sustenance of all living things.

I had a belief that water could be scrubbed clean and healed through ecological means. I started to hunt around for evidence. A former student of mine, Steve Serfling, had created aquatic plant-based waste treatment systems for sewage purification. While his work and reputation were not yet acknowledged in those days, I knew that his ecological approach was sound. He was a real pioneer. Another former student, Karl Ehrlich, was making breakthroughs in water purification through his understanding and application of microbial ecologies. A friend introduced me to the work of the German researcher Kathe Seidel of the Max Planck Institute, who had discovered that a number of species of marsh plants have remarkable water-purifying capabilities. I was off to a good start, but what I still lacked was proof that species-rich whole ecologies could truly restore damaged waters.

## SUMMER OF CHANGE

The summer of 1988 changed all that. In the town dump at Harwich on Cape Cod were yawning fetid lagoons where untreated wastes were stored. Tanker trucks dumped the residues from septic tanks, restaurants, institutions, and small businesses directly into these open pits. At times the smell was close to unbearable. The pits themselves lay in coarse, sandy soils. They were not lined. The soil was extremely permeable, and the pits were situated directly above the drinking water table of the town. I was horrified when I

first saw the lagoons. There was a link to cancer staring right at me. Samples from the pits turned up the majority of the USEPA's fifteen priority pollutants, including several known carcinogens.

With the agreement of the town, we set up on that site 21 seven-hundred-gallon, clear-sided tanks. We connected the tanks together with piping, like beads on a string. In the middle we built a raised wooden aqueduct and filled it with sand and marsh plants. We engineered the movement of the water so that it could flow by gravity from one end of the system to the other. Then we filled the tanks with water from a nearby pond, unfortunately also contaminated by leachate from the lagoons.

## GATHERING SPECIES

I reasoned that, once we started pumping wastes from the lagoons into our system tank by tank, the life forms in them would experience a set of conditions for which they had no evolutionary experience. That argued for foraging for organisms from as many different wet and aquatic environments as possible and seeding them into the tanks. This entailed gathering thousands of species. To do this we visited a dozen or so local habitats that ranged from salt marshes to wet hollows in the woods, to kettle hole ponds, to farm animal wallows. From each of them we collected different forms of life.

Then we began pumping the wastes from the main cesspool lagoon into the first of the clear-sided tanks. At first we added only small volumes to give the system a chance to adapt. My strategy was to avoid overwhelming the life forms and give them a chance to adapt to the wastes. On the sur-



**Water tanks at Harwich's town dump.**  
photo: John Todd collection

face of the tanks we floated water-tolerant plants, placed in specially designed rafts.

What happened over the following weeks was nothing short of a miracle. In each of the first seven tanks upstream of the marsh aqueduct, a unique ecology evolved. The life forms within were responding to the strength and constituency of the wastes they were receiving from the upstream tank. Each tank looked to be different. The outstanding biologist Lynn Margulis investigated the communities that had formed on the sides of the tank. The communities she observed in her microscope were unique to science. Although they were made up of known life forms, the way in which they had organized and designed themselves into communities on the clear walls of the tanks, in the presence of differing combinations and concentrations of wastes and nutrients, was unprecedented. She predicted that it would take years to decode the information and the living architecture that was being revealed by the microscope. When I left her teaching laboratory after talking with her, the excitement I felt was incredible. I had seen Nature as ecological designer up close.

The best news was yet to come. We sent samples of the treated water from our water purification efforts to be tested by a U. S. Environmental Protection Agency cer-

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# DONOR SPOTLIGHT

“OUR GUIDING PRINCIPLE IS TO ARRANGE FOR OUR ESTATE TO SELF-DESTRUCT ON THE DEATH OF THE SECOND SPOUSE. MEANWHILE, HAVING EXPLAINED THIS TO OUR HEIRS, WE DISPENSE SOME LARGESSE WHILE WE ARE ALIVE, MAKING IT OBVIOUS THAT WE ARE WORTH MORE ALIVE THAN DEAD, SO OUR GOOD HEALTH IS MORE CORDIALLY HOPED FOR.”

**T**hese sage words are from John Frantz, who at 78 is a practicing internist at the Monroe Clinic in Monroe, Wisconsin. John and his wife Mary, also a practicing internist, are long-time and innovative donors to RMI.

Just how far out of the box the Frantzes think was illustrated, John reminded me, when several years ago RMI’s Treasurer, Amory Lovins, called to ask if the couple would consider a loan to RMI for capital expenses at below market rate interest—something several dozen friends of the Institute have done over the years so we can finance long-term items instead of having them burden operating cashflow. John said that he told Amory he and Mary would think about it and call him back.

The next day John called Amory back with a better idea: “How about if we loan you the money with no interest at all?”

That was several years ago, and today John and Mary Frantz have made loans to RMI totaling \$250,000, the legal limit, all without interest.

“Interest-free loans to charity have also helped, because the increase on the amount loaned accrues to the charity and does not represent income to the lender,” writes John in an article entitled “Atypical Thoughts on Taxes and Estate Planning.”

Since the Frantzes pioneered the idea, several other donors have provided interest-free loans to RMI for other capital improvements to our buildings and equipment.

John and Mary Frantz are innovators, travel addicts, philanthropists, parents of three daughters, sea kayakers, and former Peace Corps volunteers. They went when they were in their 40s with their daughters, to Afghanistan, where they taught in a small medical college.

John is an alderperson for the City of Monroe. Ever the advocate for new ideas, when an RMI staff member visited the Frantzes, John invited the mayor and another alderman to his house to hear about RMI’s Economic Renewal efforts. Monroe is losing several plants and businesses, so the community is trying to figure out how to get new businesses to relocate there.

Mary Frantz works about 20 hours a week, John 20–30, at the Monroe Clinic. They always walk or bike the several blocks to work. Mary has a second job: gardening for the Literacy Council and Planned Parenthood. She knits while visiting and traveling.

Their arrangement with the clinic allows them plenty of time to travel. Already planned for spring is a trip to Tasmania and New Zealand.

Both are avid readers, particularly in their medical specialty. John writes as well to keep his mind supple, often challenging accepted wisdom. His titles include: *Evolutionary Biology for Amateurs*, *Herbal Remedies from Elephants to Modern Man*, *Diet and Exercise*, and *A Family Conversation about the Drug War*.

True RMItes, the Frantzes’ home is energy-efficient, with passive solar heat and a



**John and Mary Frantz**

wood-burning stove. They say their annual heating bill for natural gas runs about \$20. The Frantzes tried three years running to grow blueberries, but their soil wasn’t acid enough and John wasn’t wild about adding artificial stuff to it. So in the third year, they dug down about four feet and lined the bed with black plastic, put in drainage piping, then filled it with 85 gallons of soil dug from a pine forest. Not wanting to use resources unnecessarily just to obtain the soil (like driving a car to collect it), John and Mary dug up soil and filled five-gallon containers while on canoeing and hiking trips and brought the bucket home. After each adventure, they added five gallons of soil to their new blueberry patch.

Now, that’s a lot of hiking and canoeing!

Amory called John and Mary, after this interest-free loan idea, the next year and asked if they had any other bright ideas. (They did. They always do.) After all, even legendary researchers like Amory need fresh views of the world when they can get them.

—Dale Levy

# Change Is in the Air

**W**e here at RMI are redefining our mission. In the new millennium, you'll see an RMI even more active in the corporate arena than before. We have set ourselves the task of making Natural Capitalism the central organizing principle of business worldwide over the next five years.

Just a few weeks ago, George W. Bush was sworn in as President. Some colleagues on the left side of the aisle are concerned, especially when it comes to the President's environmental and energy policies.

After all, President Clinton was the most knowledgeable president the United States ever had concerning global warming, and former Vice President Al Gore was likely the most knowledgeable politician *ever* on the subject. Yet, as Bill McKibben recently

pointed out in *The New York Times*, these two leaders "accomplished nothing, simply because global warming was too politically painful to address head-on."

We see this as a time of opportunity, a time to prove that Natural Capitalism is so solid a business ideal that Democrats and Republicans alike can grasp its goals. We hope Natural Capitalism becomes the business model—the life model—for the new century. We hope it will also become a model for the Bush administration.

Finally, I want to mention Phillip Semmer. The saddest thing I've read lately is the story of Phillip's death. He was a bright and caring young man, between his last two years at Northwestern University. Phillip hoped to work at RMI after graduation.



**Cameron M. Burns,**  
Editor

Phillip deserved to work here more than many of us, and certainly more than I. I came to RMI because I was offered a job; Phillip would have come because he had the desire to help the planet.

They say that you learn from your elders; today, in writing about this remarkable young man, about half my age, I've gained more wisdom in the course of a few hours than I have in the past few years.



**W**ow! So many have sent donations of \$20, \$40, and more within the last three months. Each contributor receives three issues of *RMI Solutions* as a benefit of RMI donorship, as announced in our Fall/Winter 2000 issue.

We have progressed from servicing a subscriber list to responding to those who actively support RMI's work and vision. If you are already a donor of \$20 or more, you don't need to do anything except enjoy the Newsletters. We thank you for your support!

If you are not currently a supporter of RMI, but enjoy reading the Newsletter, either in print or online at [www.rmi.org](http://www.rmi.org), we encourage you to send a donation of at least \$20. This will ensure that you receive *RMI Solutions* three times a year. Please use the enclosed envelope to send your contribution.

■ "Please remind us late this year about the option of giving stock because that's the way we want to give to RMI . . . and because we can give more," said a donor from Illinois in late December.

## Hearty Thanks To All

by Dale Levy, Director of Development

Many individuals decided in 2000 to take advantage of giving appreciated securities to RMI for two reasons: 1) savings of capital gains tax; and 2) tax deduction based on the current value of the gifted securities.

Many donors were able to transfer stock from their broker directly to RMI's account at Charles Schwab.

■ Profound thanks to all those hundreds of individuals, foundations, and corporations who supported RMI's activities in the year 2000. We are humbled by the generosity and creativity of our donors, from Holly Lewis and Neal McBurnett, who gave us an interest-free loan of \$100,000 which we used (at their suggestion) to repay higher-interest loans and generate savings that will fund a three-month intern, to Peak Experiences International, Inc., which has a link on its company website to RMI's website, to board member Adam Albright and his wife Rachel, who successfully challenged Board members to double their giving in 2000.

If you have any questions about donations, feel free to write ([dalelevy@rmi.org](mailto:dalelevy@rmi.org)) or call, 970-927-3851.

## RMI's Resident Poet Releases New Book

In September, New Issues Press published *Tactile*



*Values*, the first collection of poems by RMI's Development Associate, Mark Scott. Mark has been with us since October 1998,

writing foundation grant proposals and reports. Mark, who holds a BA from the University of Colorado and a PhD from Rutgers University, has had poems published in *Poetry*, *The Paris Review*, *Raritan*, and other journals. Among his early influences were E.E. Cummings, Dylan Thomas, and Gerard Manley



Hopkins. The lyric poems in *Tactile Values* explore various senses of the word “touch”—one of the longer entries in the Oxford English Dictionary—and the curious interplay between speech and touch. The book (\$14) can be ordered from amazon.com, any independent bookseller, or Mark (msscott@rmi.org).

## Hypercar<sup>SM</sup> Pages Take Off

We've been pretty proud of our new Hypercar<sup>SM</sup> pages on the RMI website, but we had no idea exactly how popular they'd become. Apparently so popular that they are now the eighth most visited portion of www.rmi.org. Upon learning this, we decided to add a news service to the site, “Recent Hypercar<sup>SM</sup> News” ([www.rmi.org/sitepages/pid388.asp](http://www.rmi.org/sitepages/pid388.asp)).

The articles you'll see posted in “Recent Hypercar News” are collected by RMI staff from news sources around the world. They cover a broad range of alternative transportation technology and fuel-related issues, and—while these articles might not necessarily reflect the views or research activities of RMI—they are certainly worth reading for anyone interested in Hypercar, alternative fuels and fuel-cells, and transportation in general.

## NatCap Team Goes Back To School

In January, a team of RMItes visited Oberlin College in Ohio to start Phase 2 of the “Oberlin: Climate Neutral by 2020” project that our old friend David Orr initiated. He hired RMI's Climate Services (with financial support from the Educational Foundation of America) to evaluate the technical and economic feasibility of achieving net zero emissions of greenhouse gases by 2020 and help smooth the way for the College's realization of this “bleeding-edge” objective. Phase 1 focused on determining the College's greenhouse gas emissions, carefully setting the system's boundaries, and gathering reams of data.

The two-day visit in January was a hectic “walk-through” audit of nine of Oberlin's sixty-six buildings and comprised nearly a quarter of the campus's 2.4 million square feet of buildings. The purpose was to gain some insight into Oberlin's cost-saving opportunities to improve the energy efficiency of its buildings, which account for about two-thirds of its total greenhouse emissions.

Fueled by awful coffee and an ambitious schedule under a bleak midwestern sky, Ken Wicker and Joanie Henderson did the lighting audit, Chris Lotspeich and RMI network consultant Ron Perkins crawled around air handlers and mechanical rooms, and Bill Browning and Ben Shepherd surveyed building shells. Holly Harlan (on loan from WIRE-Net in Cleveland) covered ubiquitous plug loads, Doug Grant (from the consulting group TurboSteam) evaluated the museum-grade coal-fired steam plant, and Project Leader Rick Heede cracked the whip.

“The Oberlin staff have been gratifyingly supportive,” said Rick, “and we are excited about the many opportunities to improve energy services while lowering costs. We are really stoked by our role in helping this historic college blaze a new path of climate responsibility in the 21st Century.”

## RMI In the Army Now

This winter, RMI's Research and Consulting team delivered Natural Capitalism training to a group of Army environmental managers assigned to U.S. Army Forces Command (FORSCOM) facilities. FORSCOM installations, like Fort Stewart, Georgia, and Fort Hood, Texas, are typically large communities of tens of thousands of soldiers living and training on large

military bases. These facilities have a major environmental, economic, and social impact in the communities where they are located. The managers, who work at Army installations across the United States, were gathered at a workshop in New Orleans in December.

Karl Rábago and Huston Eubank spent two days with the group teaching the principles and concepts of Natural Capitalism. The environmental managers will be developing new environmental management plans that we hope will incorporate RMI's best thinking on sustainability. Karl, who spent 13 years in the Army, and Huston, who spent four and a half years in the Navy, were quite at home with group, and enjoyed the challenge. Their training modules included an overview of Natural Capitalism and detailed presentations on energy, water, green development, resource efficiency, and community issues.

In addition, Karl and Huston led the group through a process that developed a solution to a hypothetical problem, itself designed to bring all the concepts together. By all accounts, the training session was a great success, with Karl and Huston feeling they learned as much as they taught. Several new Natural Capitalists were born! Karl was even re-acquainted with one now-retired Army Colonel who manages environmental issues for Fort Lewis, Washington, whom he had known while they were both on active duty at Fort Polk, Louisiana.

## The Road Worth Taking

by Amanda Ayres

**As one of the last remaining** open spaces in the Roaring Fork Valley, the 957-acre Windstar Land Conservancy represents a diversity of ecosystems and serves as vital habitat for wildlife. Now it is poised to become a center of environmental education in the local community. In December 1996, RMI, with the help of over 1,600 supporters, completed the purchase of the Windstar land. RMI then partnered with The Windstar Foundation to create a new nonprofit organization—The Windstar Land Conservancy—which placed a conservation easement on the land to protect it from development in perpetuity. Now that the property is protected, a major effort is underway to restore the land to its original productive condition. Advised by a distinguished scientific panel, a long-term management plan was completed in 1997, providing guidance for the restoration program.

RMI launched into parts of the restoration program immediately upon acquisition of the property. Land Steward Paul Buch and the land management team really got active in 2000 with the financial support of many individuals and groups. The existing pond was dredged, removing approximately 20,000 cubic yards of soil and increasing the depth from six inches to fifteen feet in some areas. The soil from the pond was used to fill in old, unused irrigation channels bordering the valley floor. Doing this will restore much of the high alpine wetland that once filled the valley. We also installed a highly efficient underground irrigation system that allows us to reduce erosion while bringing water to more areas on

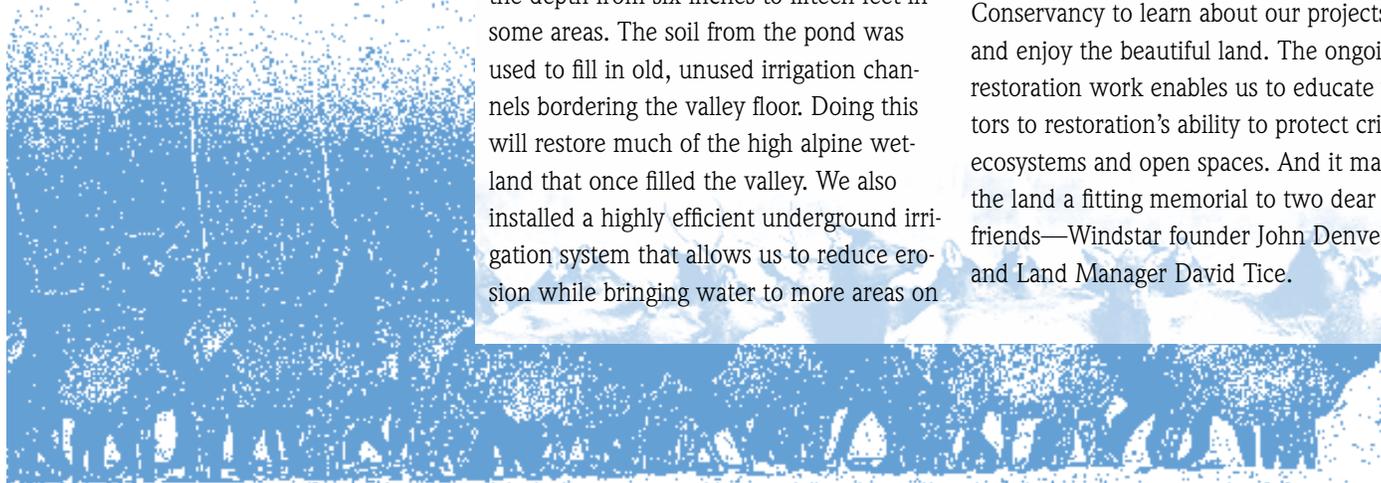


the property. Other significant improvements in erosion control were also made, including the construction of 35 hay-bale checkdams on the upland, highly erodible Mancos shale slopes. This area was also seeded to revegetate and stabilize it.

In summer 2000, we drafted an integrated weed management plan that will employ grazing with goats, cutting, pulling, and other methods. The first phase of a major wetland revegetation plan was also completed in summer 2000. With the help of volunteer groups, more than 20,000 trees, grasses, and forbs were planted in what was, and will soon be again, a rare alpine wetland along the valley floor.

Most recently we have begun using a working computer map (Geographic Information System) for the land that will help bring more information and less conjecture to the restoration process. Also, in summer 2001, we will be building a two-mile interpretive nature trail with a grant from Aspen Skiing Company's Environment Foundation. We will also implement a program of holistic, intensive grazing to reclaim damaged pastureland, and will continue with the wetland revegetation.

As always, visitors are welcome at the Conservancy to learn about our projects and enjoy the beautiful land. The ongoing restoration work enables us to educate visitors to restoration's ability to protect critical ecosystems and open spaces. And it makes the land a fitting memorial to two dear friends—Windstar founder John Denver and Land Manager David Tice.



CONTINUED FROM PAGE 3

dows, like the 1983 models that have let us harvest 27 banana crops inside RMI's headquarters with no furnace. Super-windows also make buildings more comfortable and cheaper to construct. These are just two examples of hundreds of available efficiency options. In 1989, RMI added up all the main U.S. efficiency options then available (automobiles, buildings, industries—everything). The total was equivalent nowadays to 54 Refuges' worth of oil, at one-sixth the cost.

**MOBILITY WITHOUT OIL**

New technologies for saving energy are creating opportunities faster than the old ones are used up—just like the technologies of finding and extracting oil, only faster.

Energy efficiency is outpacing oil production so quickly that even cheap oil is simply becoming uncompetitive. In the not too distant future, we won't need expensive oil because oil, for the most part, won't be in demand. That's especially likely because the biggest efficiency gains are now targeted at oil's biggest user—cars.

The average new American car last year might have been the highest expression of the Iron Age, but its 24-mpg efficiency rating tied for a 20-year low. The auto industry can do better, and is starting to. Briskly selling hybrid-electric cars now include a Corolla-class 48-mpg five-seater and a CRX-class 67-mpg two-seater. An American light vehicle fleet as efficient as those Toyota Priuses or Honda Insights would respectively save gasoline equivalent to the average output of 26 or 33 Refuges' worth of crude oil.

General Motors, Ford, and DaimlerChrysler have already tested family sedans that achieve 72–80 mpg, now headed towards production. For those who prefer small city cars, VW is already selling a 78-mpg model in Europe and plans a 2003 version at

around 235 mpg (not a typo). Beyond such straightforward improvements are the stunning advances in fuel-cell cars, now slated for 2003–05 production by eight mainstream automakers. The chairs of four major oil companies have already acknowledged the start of the oil endgame and the dawning of the Hydrogen Age.

By combining fuel cells with sleek, carbon-fiber body materials, the start-up company Hypercar, Inc. has designed a spacious, uncompromised concept car that offers everything you'd find in a midsize sport utility vehicle, but uses 82% less fuel. (For more on Hypercar, Inc., see page 4.) A full 1999 U.S. fleet of such efficient vehicles would save 42 Refuges' worth of oil. Ultimately, globally, they'd save all the oil OPEC now sells.

Hydrogen-powered fuel-cell vehicles could also serve as portable power stations. A full fleet of them, when parked (about 96% of the time), would have enough generating capacity to displace the world's coal and nuclear power plants 5–10 times over. They could help pay for themselves through electricity sales, while halting up to two-thirds of climate change. As fuel-cell pioneer Geoffrey Ballard, Shell Hydrogen CEO Don Huberts, and ex-Saudi Oil Minister Sheikh Yamani successively remarked, the Stone Age did not end because the world ran out of stones, and the Oil Age will not end because the world runs out of oil.

**THE INSECURITY OF NORTH SLOPE OIL**

A further argument for drilling in the Refuge has been to make full use of the Trans-Alaska Pipeline System (TAPS), likely to keep running at half-capacity through at least 2008 as declining Prudhoe Bay output is offset by new oil from other North Slope fields outside the Refuge. If you'd spent \$8 billion (in 1977 dollars) for an 800-mile-

long, four-foot diameter pipe over some of the most rugged terrain on the planet, you'd want to see it kept busy for as long as possible too. But that business logic compromises national energy security. In 1981, we authored a study for the Pentagon called *Brittle Power: Energy Strategy for National Security*, which concluded that the Trans-Alaska Pipeline System was among the gravest threats to U.S. energy security. It still is, and Refuge oil would make it more so.

TAPS' operator notes with pride that “without this vital link ... the entire nation would be affected.” All too true, alas: TAPS carries 18% of domestic oil. And if its flow were redoubled with Refuge oil, it would bring about as much oil to American refineries as the Strait of Hormuz does now. But of these two chokepoints, TAPS is worse: it has no alternative route, and is easy to disrupt but hard to fix. Disruption of any key point in midwinter, when it can't be mended, would cause its waxy oil, over some weeks, to cool, stop flowing, and congeal into a nine-million-barrel, 800-mile-long candle.

The pipeline has uniquely vulnerable facilities at both ends. In between, over half its length is aboveground, accessible, and (says the Army) indefensible. It's already been tampered with, shot at, and bombed twice but incompetently. (The Oklahoma City and *USS Cole* bombers were busy elsewhere.) A technician accidentally blew up a non-critical pumping station in 1979. Why on earth would the United States want to create another Strait of Hormuz? One is quite enough.

**TAPS'S RETIREMENT PLAN?**

Even if a kinder, gentler world were assured, TAPS's clock is still ticking. The 23-year-old pipeline—now well into middle age and nearing its originally intended retirement age—hasn't aged gracefully.

## FROZEN ASSETS

Corrosion, erosion, and the sheer stress of pumping gooier oil are taking their toll. Accidents seem to be rising. Last April, a pressure hammer moved the pipe 23 inches, a serious event that went unnoticed for almost a month. In July, a quarter-ton, four-foot-across, two-inch-thick steel valve ring was stretched into an oval by accidentally being dragged through the pipeline for 400 miles. Then, in October, unsupervised workers set off a spark that could easily have blown up the Valdez oil terminal at the pipeline's south end.

Federal studies of TAPS's maintenance and life expectancy will guide possible renewal of its original 30-year permits, due to expire in 2004. But Refuge oil couldn't start flowing until nearly 2010. By the time it peaked in 2030–40, the pipeline would be 53–63 years old. When Refuge oil tapered off, the pipeline would be nearing its centenary. Does this sound like a prudent way to deliver something supposedly so vital to national security?

When scrutinized from every perspective *besides* environment—energy security, economic fundamentals, technological advance, the financial soundness of the domestic energy industry—Arctic Refuge oil is a risk the nation can't afford. Its benefits could be achieved by tapping just a few percent of the proven energy efficiency reserves—the cheaper, faster alternatives that are becoming the market success stories of the 21st Century. These alternatives offer economic security and competitive advantage, immunity to price shocks and supply manipulations, and environmental benefits rather than costs.

If any oil exists under the Arctic Wildlife Refuge, its best, safest, and most economic use will be forever holding up the ground under America's last great wildland. 

## HYPERCAR

CONTINUED FROM PAGE 5

Hypercar, Inc. recently hired Peggy Corcillo as CFO and Sandy Selman as Senior Vice President of Finance.

Hypercar, Inc. is a technology development company that intends to license its intellectual property and engineering services to other automotive suppliers and automakers. The team at Hypercar, Inc. is a leader in the revolution shaking the largest industry in the world. Ultimately,



**Hypercar<sup>SM</sup> is almost off the drawing board.**

vehicles traceable to its lineage will save as much oil as OPEC now sells, decouple road transport from climate and air quality, and provide enough plug-in fuel-cell generating capacity when parked to displace the world's coal and nuclear power plants many times over. The adventure continues. 

*For further information on Hypercar, Inc., please visit [www.hypercar.com](http://www.hypercar.com). General information on the Hypercar concept and history are at [www.rmi.org](http://www.rmi.org) under Transportation. Click on Hypercar Center. Hypercar is a service mark of Rocky Mountain Institute.*

## NAT CAP CONSUMER

CONTINUED FROM PAGE 7

on the list. Well-run, lean manufacturers get their values from their customers and produce only when their customers pull. Large customers (government or business) can have dramatic effect. It wasn't an individual refrigerator purchaser that shocked Electrolux, the world's largest appliance maker, onto its ground-breaking environmental path—it was a major commercial refrigeration customer that decided it simply wasn't going to use CFCs any longer and so wouldn't buy from Electrolux's commercial division until it offered products with substitutes. You never know when your decision will change a global company's strategy.

Electrolux has begun experimenting with providing in-home “washing machine services” to customers in Sweden as part of its corporate environmental program. Electrolux charges customers by the wash, and provides the machine, the electricity, and the detergent. This system gives the firm an incentive to design maximum efficiency into its machines—both efficiency of operation and maintenance, and remanufacturing or recyclability. We hope that other major goods and services providers will create similar pilot projects and get comfortable with this new paradigm.

Electrolux has recently become the first to certify the environmental attributes of appliances with a third party—the Swedish Environmental Management Council (see [www.environdec.com](http://www.environdec.com)). However, until publicly available life-cycle assessment becomes consistent and widespread, purchasers will benefit from broader guidelines, such as Natural Capitalism Principles combined with existing investor and consumer evaluation services.

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Because businesses and governments have enormous purchasing power, as well as the power to design products that restore rather than damage natural capital, RMI's Natural Capitalism Practice has devised a whole-system supply chain management tool to ease the implementation process. Supply chain environmental management is increasingly important since many manu-

**“If Americans really want to buy smart, we'd do well to emulate the Germans.”**

facturers are “farming out” assembly operations to a few major suppliers, reducing the total number of suppliers to cut costs and hassle. Whether a circuit board manufacturer in Vietnam uses environmentally-sound practices will be largely determined by whether the circuit board buyer, working for the brand name that you recognize and can influence with your dollar votes and letters, demands it. So be sure that you communicate your desires.

Businesses are under constant pressure to decrease their operating costs, and supply chain management is no exception. E-commerce is a tantalizing means for businesses to find quickly and efficiently global low-bid suppliers of the products they need, whether it's office paper or silver ingots. However, this efficiency may compromise efforts of responsible companies to purchase from environmentally, or socially responsible vendors. The higher transaction costs of responsible purchasing must be justified by a strong business case. If the customers of the final product care and take the time

to make their preferences known, that can lay a primary foundation for efforts which bring Natural Capitalism to supply chains.

Therefore, part of RMI's supply chain management tool is a simple survey allowing companies to assess a supplier's approach to using natural capital without requiring them to know Natural Capitalism Principles (see box, pg. 7). This same set of questions can be used by individuals to guide their own consumer choices and let product providers know they care about our rapidly diminishing natural capital.

Responsible product choices revolve around two issues: one, who the manufacturer is, and where the manufacturing takes place; and two, the product's or service's natural and human capital impacts throughout its lifecycle. Purchases from corporate heavyweights can be quickly, if imperfectly, checked through investor-related evaluations like the Dow Jones Sustainability Index or Portfolio 21 business sustainability screens. Try to purchase from only the top-ranked companies in each industry. Be sure to tell the businesses you are avoiding why they're being shunned. But beware: this convenient selection system runs the risk of endorsing the best of a mediocre group.

Going a bit deeper, the Council on Economic Priorities has rated approximately 300 major corporations for three decades, giving out report cards on disclosure, environment, minority and female advancement, workplace, family benefits, and charitable giving practices. Other guides can be found through linkage services such as [www.buygreen.com](http://www.buygreen.com).

Check the website of the company for its environmental policy, goals, innovations, and general attitude. One quick way to read between the “green” lines is to examine whether the vendor has an environmental policy clearly recognizing Natural Capitalism or sustainable develop-

ment goals. Second, and perhaps more important, is whether the company has specific environmental performance goals it will publicly report progress towards. Finally, ask yourself if you are seeing signs of a truly comprehensive approach; if not, the company is probably doing only what's necessary to survive instead of taking the environmental leadership role that leading businesses embrace.

### **Rate Your Supplier's NatCap IQ:**

Run the following requests by your supplier if you're a business, or your provider if you're an individual consumer. The responses will provide a pretty clear picture of whether the company is taking pro-active steps to preserve and restore natural capital and be globally competitive. The supplier doesn't need to be familiar with the Natural Capitalism model to respond, but may need a basic definition of natural capital. These queries go to the heart of a supplier's intent and actual performance.

#### **Please provide evidence of:**

- A publicly announced company policy.
- A corporate-wide system to implement the policy.
- Adequate resources and top-management involvement.

#### **Regarding the following:**

- Maximizing the productivity of energy and materials;
- Aligning company operations with natural systems, specifically reductions or elimination of toxics and reducing/reusing/recycling of waste;
- Structuring of supplier and customer relationships to reward materials/energy productivity and reduce toxics, waste, and customer liabilities;
- Sustaining, restoring, and expanding stocks of essential natural capital.

For products—such as appliances—that consume energy, water, and materials while providing their services, up to 90 percent of the products' total lifecycle environmental impact can be the inputs it requires to operate. Buying an efficient device will often save many dollars in the near future and send an unmistakable vote for products that minimize impacts.

If Americans really want to buy smart, we'd do well to emulate the Germans. According to Blue Angel (*Blauer Engel*), a broad alliance of German social and economic institutions has recently pledged to work together to introduce "permanent" sustainable consumption (see [www.blauerengel.de/Englisch/index.htm](http://www.blauerengel.de/Englisch/index.htm)). A similar U.S. movement based on Natural Capitalism principles would stimulate major leaps forward toward responsible purchasing and consumption patterns. RMI looks forward to joining others to create such a movement in the United States.

We are part of the way there already. Two-thirds of U.S. consumers (according to a 1999 study cited in *Business Week*) would switch to a brand or company backing a good cause if price and quality were equal. The Wirthlin Report (1999) found that 56% of Americans are sympathetic to environmental concerns while only 4% say they are "unsympathetic." People around the world dislike waste, want to leave a viable planet for their children, and understand that we aren't close to being sustainable now. With luck (and the hard work that creates it), Natural Capitalism may one day become the basis for a majority of consumer choices, big and small, near and far, organizational and individual. 

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what was once considered a liability into an art form. For instance, at the mixed-use development Prisma in Nürnberg, Studio Dreiseitl uses small waterfalls in beautiful art-glass enclosures to pull outside air into the building. The water cleanses and humidifies incoming air, while the relatively constant temperature of the ground water cools it.

A high percentage of projects we visited were capped with green roofs (rooftop gardens). Limited buildable area in Europe has been a driving force for years, so many brownfield properties are being reclaimed. We visited a variety of projects in the enormous IBA Emscher Park reclamation project stretching approximately 60 miles along the Ruhr River.

While much excellent research on indoor air quality and low impact materials comes from Europe, we were struck by several disconnects. In one naturally ventilated building we noticed distracting levels of street noise, automobile exhaust, and cigarette smoke from the exterior. In another we choked on paint fumes in a freshly painted stairwell. One highly innovative and conscientious environmental engineer we visited challenged the "American focus on materials," as if water and energy were the only issues.

Europeans harvest wind energy in a big way. Clusters of wind turbines as large as one megawatt spin beautifully and silently in all the countries we visited, often with modern turbines adjacent to ancient windmills in a natural evolution of the technology.

The trend towards compact, well-defined villages and urban areas, coupled with obvious love and respect lavished on the open, green spaces in between, was an especially compelling theme for smart-growth advocates. This was not universal, but when encountered it was much appreciated. In an expression of frustration stemming from our U.S. experience of unchecked sprawl, we practically wore out our cameras taking pictures of well-designed projects.

In general, Europeans seem to understand better and employ more regularly the principles of integrated design, whole-systems thinking, smart growth, and life-cycle costing. The conventional wisdom is that Europeans expect and are willing to spend more for higher quality and longer life in their buildings. We certainly saw evidence supporting these higher quality expectations.

The reasons for these important differences are neither clear nor simple. Debate about them is feeding ongoing discussion, research, and presentations as we try to determine the value of the many ideas we saw demonstrated. Who's more efficient? Why? Which parts are they especially good at? Can we get better at those parts?

Most importantly, how can we combine the best of European practice with our best to provide valuable new insights into green development? We are continuing to work on it, reinvigorated by our experiences on this incredible trip. 

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tified laboratory and awaited the results. They were better than we had dared hope.



**Harwich Facilities operator Ruth Ann Fletcher with one of the many water samples.**

photo: John Todd collection

After eleven days in the system, the water flowing out the far end of our ecological technology was incredibly clean. The priority organic pollutants had been a hundred percent removed—with one exception, which was 99.9 percent eliminated. The heavy metals that had entered in high concentrations had been sequestered somewhere within the system and were absent from the effluent or final product. After several years of research, we learned where

most of the metals had been stored. They have an affinity for—tend to stick to and be incorporated into—algal mat communities that formed on the tank walls. If our tanks at Harwich had not been clear-sided, the algal mats would not have formed and we might have been less effective at removing metals. Thanks to my contained ecosystems, I was learning fast.

We further learned that coliform bacterial counts, which are indicators of human sewage contamination, plummeted from the tens of millions in the beginning to fewer than two hundred counts in the effluent from our system. We were achieving water standards for bacteria above swimming standards. Other nutrients, including nitrogen, were also reduced to very low levels. In fact, most nutrient levels of our effluent met advanced wastewater standards. Receiving this data was made all the sweeter knowing that it was our first attempt to work with high-strength and toxic wastes.

By late that fall, as the first experiment at the Harwich dump was ending, I found the insight for which I had been searching. I

knew then that, in the long run, the purification of waters would not come about through mechanical, or chemical, or narrowly-based biological approaches or technologies. The transformations of the Earth's waters could only come about through a new human partnership with Nature. This partnership would consciously substitute the ecological information and intelligence that is housed within the plants, animals, and microbes, for today's energy-, chemical-, and hardware-intensive technologies.

The Harwich experience changed me forever. I felt less helpless in the face of the environmental crises caused by contemporary society's lack of respect for the natural world and all the non-human beings with which we share the Earth. I became confident that there is an alternative path to the present industrial/technological mindset. I knew that the sustainable paradigm must be ecological and all-encompassing.

Perhaps most importantly, I learned that it is possible to do good things in bad places. And that for me was a start. ☺

## New RMI Staff

RMI has recently added a number of new people to the staff. Pictured at right are (clockwise from lower left): Julie Jacob, Ken Wicker, Eliza Eubank, Amanda Ayres, Jill Randall, Randi Lowenthal, Chris Page, Jessica Hood, Dale Levy, Cameron Burns, David Payne, Kate Parrot, Thammy Evans, Joanie Henderson, and Ben Boyd.



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Minister of Environment and Heritage, the Hon. Rod Welford (for whom Amory and I had established a deep appreciation during our July visit), aim to transform Brisbane into a world-renowned hub of sustainable business practice and know-how. They're focusing on Natural Capitalism for inspiration and practical advice.

Who can go to Queensland without getting out in the bush, if only for a weekend? My friend Frank Barram, of Integrated Energy Services, kindly offered me a trip to Fraser Island, a four-hour drive north of Brisbane, to see one of his stand-alone electric installations powering a small resort in this arcing 100-by-20-km island National Park. The island is also a World Heritage site for its remarkable "perched lakes." Freshwater lakes are possible in this and a few other sandy islands in the world due to the thick layer of compressed organic material (remnants of rainforest detritus) underlying the island. Hence dozens of clear (although some are tea-colored from the leaching of organics) lakes abound between the rainforest-clad dunes in the center of the island, and water is either seeping or running in creeks across the thundering beach.

The 1933 wreck of the *Maheno*, the "champagne" tide pools, scrawny dingoes, and a heart-soaring white sea eagle topped off my visual experiences. There are no roads, but Australians, like us Westerners, love to blaze off-road trails, much to the chagrin of conservation-minded Queenslanders.

Australia showed me a lot of wonderful things, but my visit confirmed perhaps the most important element of what we do here at RMI: to create change, you need a culture and a nation that agrees with your message, and wants to be influenced. In Australians, I think we've found both. 

**How to reconcile** a fascination with technology with the desire to preserve wild nature?

Like many of us associated with RMI, Board Chair Michael Edesess spent his early years roaming wild places and appreciating both nature's perfect design and people's place within it—in his case, he spent his youth hiking, winter mountaineering, and rock climbing in New Hampshire's White Mountains.

After earning a Ph.D. in mathematics in 1971, Edesess expected to head toward the hard sciences or technology, but they "seemed to have only negative consequences, like bombing people back to the

just opened in Golden, Colorado (now the National Renewable Energy Laboratory). There he became one of the few world specialists in salt-gradient solar ponds.

He returned to investments, maintaining a side interest in energy, environment, and international development. In 1995, he was a co-founder of a new firm, Lockwood Financial Group, which continues to grow, and recently ("finally," he says) became profitable.

Because of these dual backgrounds, Michael's activities have ranged from writing on the stock market in *The Wall Street Journal* and appearing on CNBC, to spearheading projects in Brazil to process

# BOARD SPOTLIGHT

## Michael Edesess

RMI BOARD CHAIR



Michael Edesess

Stone Age and polluting rivers," he says. "So I took a job applying mathematics to one of the softest of 'sciences,' namely finance and investment."

But soon, driven by a desire to find a way to use technology to preserve and improve the environment, Edesess took a job at the Solar Energy Research Institute, which had

nuts and fruits in small Amazonian villages. But he still remains an avid hiker, mountain climber, and cross-country skier.

"Chairing the RMI Board sure helps the reconciliation process," Michael said. "The Institute is in the business of reconciling technology with the environment and is, perhaps, the foremost leader in it."

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**Our sincere appreciation is offered to these friends who have contributed to RMI between 1 September and 31 December 2000. 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.**

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

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

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

# The Sandler Family Supporting Foundation Challenge Grant

**Herb Sandler and his family** can be a pretty challenging group. But we like them that way. Last April Herb and Marion and their son Jim and his wife Gretchen visited RMI and apparently liked what they saw. So in June, they extended to RMI a challenge grant through the Sandler Family Supporting Foundation. The Sandlers challenged RMI to raise \$200,000 from new donors of \$10,000 or more during calendar year 2000. If we could meet that goal, then Herb and his family would match that amount with an additional \$100,000.

Of course, everything we do at RMI is a challenge of some kind or other, but this one was important in another way. It made us go out and find people who believe our work is compelling enough to donate \$10,000. We were very pleased at the results.

After a long chat with Amory, Josh Mailman from New York City contributed \$50,000; the Overbrook Foundation, also in New York City, learned of our new work in Brazil, and made a first-time donation of \$50,000. Likewise, the Washington DC-based Summit Foundation made a first-time foundation grant of \$75,000, also for RMI's work in Brazil. Atlanta-based Coca-Cola Company donated \$10,000.

## DONOR SPOTLIGHT



From left to right: Directors of the Sandler Family Supporting Foundation are Alan Stein, Phyllis Cook, Susan Sandler, Jim Sandler, Marion Sandler, Herb Sandler, and Robert Friend.

By 28 December, our total toward the challenge was \$185,000, just \$15,000 shy of the \$200,000 goal. With only two working days before the deadline, a like-minded soul, Eric McCallum of Anchorage, Alaska, learned the status of our efforts and, with his wife Robin Smith, immediately committed \$16,000—enough to meet Herb's challenge. We even had a little breathing room to spare. Whew!

Our sincerest thanks go to these five donors, who helped RMI meet the wonderful Sandler Family Supporting Foundation challenge, and we look forward to more challenges that might be dreamed up in the coming year.

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## Semmer Endowment

### RMI's deepest condolences

go out to Phillip and Joan Semmer of Wayzata, Minn. Last summer, their son Phillip, 21, died in an automobile accident while visiting Australia with his best friend.

Phillip was an intelligent and compassionate young man. He was about to start his senior year at Northwestern University, where he was studying industrial engineering. He was concerned about the fate of the earth, and was driven to seek solutions. Phillip had hoped, after graduation, to work here at the Institute. We wish he had had that opportunity.

But perhaps the most telling thing about Phillip was his approach—his life motto came from Yoda, of *Star Wars* fame: “Do or do not; there is no try.”

“He wouldn’t just put his toe in the water and try it,” said Joan Semmer, Phillip’s

mother. “He would just do it.”

Phillip would have been comfortable here at RMI, because we share a similar way of doing things: just do it, keep doing it, learn quickly.

In honor of Phillip, the Semmer family has created an endowment at RMI called the Rocky Mountain Institute Phillip Austin Semmer Memorial Internship Fund. Family and friends of Phillip have already contributed or committed almost \$89,000 toward the Internship Fund. This includes matching funds from General Mills, where Phillip’s father works. The \$100,000 endowment will be used to support one intern for three months each year, assisting with housing and food expenses and a modest monthly stipend. Each intern will assist in research projects that advance the mission of RMI. We hope to select young people for the Phillip Austin Semmer Memorial Internship who, in their own way, share many of Phillip’s dreams. The



**Phillip Austin Semmer**

first such intern will be selected in the spring and should be working here during the summer months.

RMI is grateful to the Semmers for the lasting impact this Internship Fund will have not only on the Institute but also on our planet.

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**Within the last few months, Rocky Mountain Institute received numerous gifts given in memory of William Putnam Bundy, a distinguished public servant and former editor of *Foreign Affairs*, and Phillip Austin Semmer. These two individuals believed in the goals of RMI, and as such, their loss is our loss. We thank their families, Mary Bundy, and Joan and Phillip Semmer, and their many friends and associates, who found some respite by supporting the work of the Institute. We are honored.**

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### Dear RMI Readers and Supporters,

In an effort to update the information that you receive, RMI recently upgraded its database. We apologize if you received your copy of *RMI Solutions* at the wrong address, or if you requested an e-mail notification and instead received a hard copy in the mail. Please, if you would like changes made in your mailing address or in how you receive RMI information, contact Ruth Klock at 970-927-3807, or e-mail her at [ruth@rmi.org](mailto:ruth@rmi.org). Thank you for your patience with our evolving process.

## staff spotlight | Ken Wicker

**Most RMItes are big on formative** experiences.

Ken Wicker—an RMI Associate—is no exception. In fact, his whole life has become one.

After growing up in Kansas, Ken ran for the hills: in his case, a summer of mountaineering with the National Outdoor Leadership School in Alaska, in 1988. After earning a B.A. in Environmental Studies in 1989 from the University of Kansas, Ken was hired to research the breeding biology of sparrows in the Canadian Arctic. While there, he also tracked caribou, musk oxen, grizzlies, and wolves. “I can remember sitting on top of a hill looking down upon the vast stretch of wilderness and making a commitment to always work on environmental objectives,” he said.

In winter 1991, Ken moved to Wisconsin to restore Whooping Crane habitat for six months, then it was on to Colorado to become an Outward Bound instructor, which he did for three years while teaching environmental education in Northern California during the winter.

Ken’s formative experiences didn’t end there. In the early ’90s, Ken headed south. One winter saw him climbing Mexico’s volcanoes, one was spent hitchhiking to Guatemala and Honduras to

study Spanish and learn SCUBA diving. In the fall of 1993, Ken followed up an interest in renewable energy and earned a Certificate in Energy Management and Design at Sonoma State University. He then became an energy consultant working on contracts for PG&E, the Salt River Project, Arizona Public Service, and Houston Light & Power. Several careers later, he earned his Master’s Degree—in Environmental and Energy Policy—from the University of Delaware.

In 1995, Ken followed his dream to join the Peace Corps and spent two years living in the Pacific island nation of Tonga, where he implemented and managed installation of several large-scale solar photovoltaic projects on the outer islands. To date, he has worked on renewable energy and solar projects in Bhutan, India, Thailand, Mexico, China, Sri Lanka, and the United States. And if he hasn’t been there on a working trip, he’s likely trekked or cycled through it. Ken now lives in Aspen and enjoys being back on the Western Slope of Colorado.



THE FOLLOWING EXCERPTS WERE DELIVERED BY AMORY AND L. HUNTER LOVINS AT DAVID BROWER'S MEMORIAL SERVICE, DEC. 2, 2000, IN BERKELEY, CALIFORNIA.

**S**OME WISE BIOLOGIST, PERHAPS E.O. Wilson, remarked that bees, ants, and termites, though not very smart individually, display high intelligence collectively—while people seem just the opposite. Yet every now and then, the search for intelligent life on earth turns up a promising specimen—a much higher primate who, by logic and love, by humor and passion, awakens the rest of us to our potential and responsibility to enrich our habitat and each other. Such a rare creature was Dave Brower—our generation's Thoreau or Emerson or Muir. His death has left many of us feeling lost, bewildered, and adrift. But Dave himself

and all the philosophy and tools of principled effectiveness.

I [Amory] didn't meet Dave until 31 years ago, when he was four years older than I am now. Yet his infectious dedication quickly pried me loose from an academic

“Which is more valuable, the moon or the sun?” He replied, “Why, the moon, of course!” “And why is that, great mullah?” “Oh, because it shines at night, when we need the light more!” Dave shone at night. The more hopeless the cause seemed, the



## remembering **David Brower**

Amory B. Lovins and L. Hunter Lovins

David Brower at Lake Baikal, in southeastern Siberia. photo: Michael Kinsley

more he lit it up with faith, hope, and clarity. The greater the challenge, the more he empowered us all to improvise, innovate, and rise to

seemed to lack such concerns, quoting from Robinson Jeffers in the Exhibit Format Series book on Big Sur, *Not Man Apart*:

*“ . . . And we know that the enormous invulnerable beauty of things Is the face of God, to live gladly in its presence, And die without grief or fear knowing it survives us.”*

We are just two of the thousands whom Dave inspired to join his movement to save the world, then mentored in how to do it, have fun at it, and not take ourselves too seriously. Charismatic and reflective, funny and profound, Dave taught a floating world-class graduate seminar in everything. He instilled strategy and stamina, quality and integrity, diversity and connectedness,

career studying things that were interesting but not important. As his envoy in London, I was free to do whatever needed doing, however I chose—just so it was honest and fun and got results. Of course, it was also a perpetual adventure: when Dave came to town, it was important to bring along a toothbrush and passport, because there was no telling where he'd unexpectedly whisk me off to. Dave was a manager, but more importantly, he was an extraordinary leader, and he taught us all the difference. His free-form, intuitive, even anarchic style of recruiting and liberating talented people was exhilarating; the people it attracted were exceptional; and so were the results. Someone once asked Mullah Nasruddin, a fictional wise fool of the Sufi tradition,

the occasion.

Dave kept the precious gifts of hope and wisdom moving through the generations by teaching the design genius of 3.8 billion years of life, in which whatever doesn't work gets recalled by the Manufacturer. His awe for life rested on a conviction that, as Alphonse Nagourney put it, “I've seen the past, and it works.”

Dave spoke to the earth, and in his eloquence the earth spoke back through him as a prophet. He spoke of the earth and for the earth. Like the Lorax, Dave spoke for the trees. Like Wendell Berry, what he stood for was what he stood on.

In one of Dave's last interviews he noted Gretchen Daily's estimate that nature's services are worth at least \$34 trillion a

year, and he added: "There is no program to pay nature back. Before too long nature will say your credit is no damned good." But by teaching millions of us why and how to commit ourselves irrevocably to the brave and necessary agenda of global restoration, Dave made a big down payment. Dave's legacy is the inspiring example and the realistic hope that the rest of us will carry on.

**"Dave spoke to the earth, and in his eloquence the earth spoke back through him as a prophet. He spoke of the earth and for the earth. Like the Lorax, Dave spoke for the trees. Like Wendell Berry, what he stood for was what he stood on."**

For us at Rocky Mountain Institute, there is little choice. We exist because of Dave. Nineteen years ago, Dave was in one of his periodic fights with his Board of Directors at Friends of the Earth. Some beleaguered member pleaded, "Dave, be reasonable." To which he replied: "Reasonable people have never accomplished anything!" By early 1982, it was clear that Dave was going to lose that fight, and we, who had committed our lives to Dave, would be fired as well. This was not the financial catastrophe that it might seem, as Friends

of the Earth paid us about enough to pay the phone bill. We made our living running about the earth on Dave's missions, speaking, consulting, and laying the foundations for what is now RMI's work in Natural Capitalism. But Amory and I [Hunter] agreed that it would be nice to have a title.

So we asked, "What would Dave do?" The obvious answer is that he would create a new organization. So

we did. Dave was RMI's first Special Advisor, and remained so for the rest of his life. And of course he created his own organization, too, Earth Island Institute, in his own uncompromising image. Dave will remain a part of the many great organizations he helped to create.

A member of the Steelworkers Union, thinking that there might be some way in which the issues of justice and the environment overlapped, once asked for Dave's guidance. When they approached Dave and said that they needed to talk to him, Dave answered: "Not as much as I need to talk to you." That conversation inspired the creation of

the Alliance for Sustainable Jobs and the Environment. Dave influenced not only steelworkers, but a world's worth of people, from politicians to journalists, from artists to miners, from ranchers to environmentalists. And through his many writings, Dave will continue to inspire generations to come.

Dave is now a part of each of us who knew and loved him, studied under him and served him. As Walter Link, an-industrialist-turned-social-and-financial-entrepreneur, said of Dave, "Wouldn't it be an implau-



**The Archdruid with two members of his tribe at the Bioneers Conference, October 1999.**  
photo: Dave Kupfer

sible failing of evolution that a species like ours could come to be, that it would evolve to have a consciousness that can grow, that can spend a lifetime learning, as Dave did, how to be effective, and then have the individuals of that species die in such a way that all that is lost to the universe?"

Dave will always be with us. He is a part of the pelicans that used to come watch him and Anne at Sinbad's as they all had lunch together. His great spirit is what Robinson Jeffers wrote of in the "Inscription for a Gravestone" that Dave's Big Sur book quoted:

*I admired the beauty  
While I was human,  
now I am part of the beauty.  
I wander in the air,  
Being mostly gas and water,  
and flow in the ocean,  
Touch you and Asia  
At the same moment,  
have a hand in the sunrises  
And the glow of this grass.  
I left the light  
precipitate of ashes to earth  
For a love-token.* 🌐

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# RMI *Solutions*

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