



# RMI Solutions

## NEWSLETTER

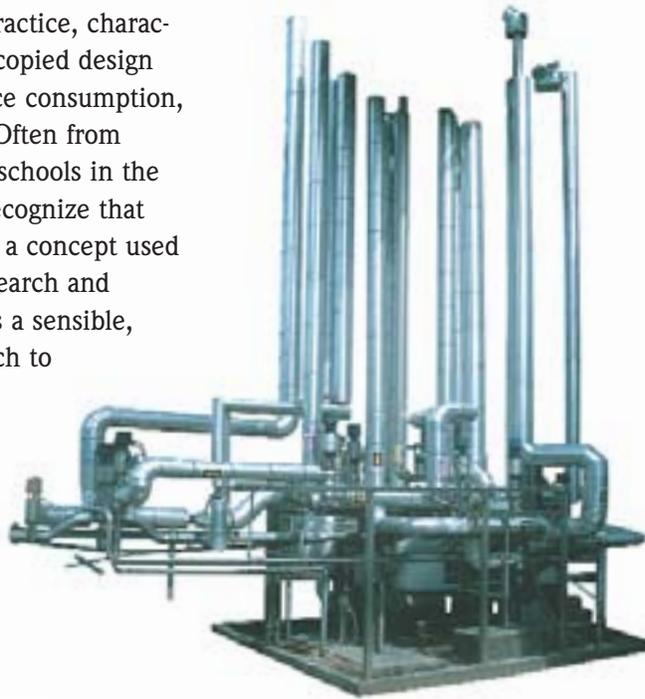
# 10XE

## “FACTOR TEN” AND THE NONVIOLENT OVERTHROW OF BAD ENGINEERING

By Andrew Kean

**E**ach year, Rocky Mountain Institute attracts a handful of devoted young engineers. Many are looking for alternatives to typical engineering practice, characterized by rushed or copied design and excessive resource consumption, pollution, and costs. Often from the best engineering schools in the United States, they recognize that whole-system design, a concept used throughout RMI's research and consulting practice, is a sensible, money-saving approach to technical challenges.

Increased resource productivity reduces our ecological footprint, creates wealth and employment, and increases global equity and security.



Engineering-as-usual not only reduces the ability of future generations to meet resource needs; it's also a root cause of many present-day environmental, political, and economic problems. Conversely, increased resource productivity—wringing the same or more services from less energy and fewer materials—reduces our ecological footprint, creates wealth and employment, and increases global equity and security. RMI believes whole-system design is the key to advanced resource productivity, and can often reduce its capital cost to zero or less. RMI's technical experts do this routinely in our work to make major corporations radically more efficient, so why can't we create the tools to equip the next generation of engineers (and retread existing ones) to do it right the first time?

Last fall, RMI kicked off Factor Ten

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### The Nonviolent Overthrow of Bad Engineering.

Whole-system design is used throughout RMI's research and consulting practice but it's seldom taught in engineering schools. Our new Factor Ten Engineering project is designed to change all that. (p. 1)

## What's Inside...

**Finding Energy, Jobs, and Money.** RMI's newest web-based tool helps communities find energy savings, jobs, and new industries—with just a few clicks of a mouse. Find out (here and online) how energy efficiency can power small economies. (p. 4)

### Biophilia

**and the Built Environment.** We've told you about *biomimicry*; now read about RMI's Green Development Services' other area of important new research: *biophilia*. It's the reason we really like some buildings, and in this issue of *Solutions* we explain why it's a promising approach to building design. (p. 7)

**Mad as a Hatter.** Toxins and pollutants are common in many hospitals. Now RMI is working with the Washington DC-based Health Care Without Harm to rid health care facilities of many of them. Here we check up on the effort. (p. 12)

**Getting to the CORE of Local Energy Issues.** A decade ago it was just a modest idea. Today this little community energy office is on track to help Roaring Fork Valley residents keep nearly 1 billion pounds of carbon dioxide out of the atmosphere. (p. 18)

**Other Voices.** You know what's going on in the Middle East. Do you know what's going on at Fort Bragg, North Carolina? Well, everything from recycling to regional sustainability planning. (p. 20)

**“In today’s environment, innovation and technological breakthroughs more likely are driven by convergence—where disciplines intersect... once-singular fields now collaborate, with sometimes surprising, and always interesting, results.”**

Dr. Shirley Ann Jackson  
President, Rensselaer Polytechnic Institute

Engineering (a.k.a. “10XE”), a four-year program to develop and introduce pedagogic tools on whole-system design for both engineering students and practicing engineers. The focus is on case studies where whole-system design boosted resource productivity by at least tenfold, usually at lower initial cost than traditional engineering approaches.

Whole-system design optimizes an entire system to capture synergies. The concept is straightforward, but implementation is not trivial. It requires creativity, good communication, and a desire to look at causes of problems rather than adopting familiar solutions—and it requires getting to the root of the problem: education. Like the engineering profession itself, engineering education is often compartmentalized, with minimal consideration of systems, design, sustainability, and economics. It stresses analysis

over synthesis. The traditional design process focuses on optimizing components for single benefits rather than whole systems for multiple benefits—thereby “pessimizing” the system. This, plus schedule-driven repetitiveness (i.e., copy the previous drawings), perpetuates inferior design. Whole-system design, on the other hand, offers competitive advantage by revealing better, simpler solutions.

Whole-system design has already proved its value in industrial engineering. More than half the world’s electricity turns electric motors. The largest use of electric motors is pumping. In 1997, a major carpet manufacturer was building a factory in Shanghai. One heat-transfer loop was designed to use fourteen pumps totaling 95 horsepower. Using whole-system design that RMI’s Amory Lovins brought from Lee Eng Lock in Singapore, Dutch engineer Jan Schilham cut the power use by 92 percent to just 7

horsepower by using fat, short, straight pipes rather than skinny, long, crooked pipes. Thanks to smaller motors and pumps, total capital cost went down.

RMI isn’t the only organization concerned about the state of engineering education and practice. In an effort to improve the design abilities of engineers, the Board of Direction of the American Society for Engineering Education has recommended that “engineering faculty should use systems approaches, including interdisciplinary teams, to teach pollution prevention, life cycle analysis, industrial ecology, and other sustainable engineering concepts.” The Accreditation Board for Engineering and Technology requires a major design experience to include most of the following considerations: economic, environmental, sustainability, manufacturability, ethical, health and safety, social, and political. These organizations agree with Dr. Shirley Ann Jackson (the president of Rensselaer Polytechnic Institute) that “in today’s environment, innovation and technological breakthroughs more likely are driven by convergence—where disciplines intersect... once-singular fields now collaborate, with sometimes surprising, and always interesting, results.” Clearly,

## RMI *in the news*

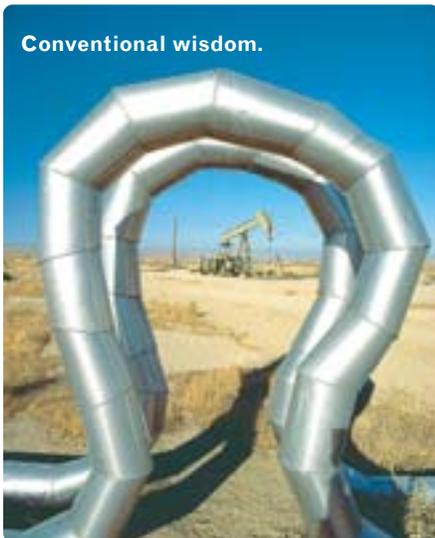


### RMI Kicks Off '04 Lecture Series

RMI’s popular series of Aspen-area lectures (“RMIQs”)\* will be returning this year with at least three events. The first lecture will take place 17 February at the Given Institute in Aspen, 5:30–7:00 p.m. Founder and principal of RMI’s Green Development Services

**Bill Browning, Hon. AIA**, will lecture on “Big and Green” architecture, and describe why big architecture is increasingly going “green.” **Dr. John Todd** will be the featured speaker at our second RMIQ lecture (also at the Given Institute, 5:30–7:00 p.m.) on 24 March. One of the pioneers of biological design, John is the inventor of the “EcoMachine,” a device that naturally removes pollutants from water. Finally, this summer, RMI CEO and Cofounder **Amory Lovins** will present RMI’s latest research on specific ways to end the United States’ addiction to oil. “Winning the Oil Endgame” will be presented at Paepcke Auditorium in Aspen; date and time to be announced. Watch RMI’s website ([www.rmi.org](http://www.rmi.org)) for more details on these and other upcoming events.

\*RMIQ is shorthand for RMI’s Quest for Solutions.



Conventional wisdom.



10XE wisdom.

demand for whole-system design and 10XE is high. And these educators aren't the only ones behind it. The William & Flora Hewlett Foundation has funded RMI's planning efforts thus far, and two private firms have already agreed to provide considerable support in the future.

While whole-system design can enrich far more engineering disciplines than it now does, getting 10XE principles widely adopted will require RMI to sustain a complex multi-year campaign. It starts by understanding the current state of engineering education and practice worldwide, defining case-study criteria, collecting initial cases, and recruiting expert practitioners. A charrette-format "summer study" will then collect, write up, and refine the most vivid, memorable, high-brain-Velcro case studies. A first draft of the casebook will next be developed and field-tested with both engineering educators and practitioners. Following revision, a second version will be developed and disseminated through a series of steps engaging both academic leaders and engineering firms. The ultimate "demand-pull" driving both engineering schools and firms will come from major cus-

tomers—like many of RMI's industrial clients—who need whole-system engineers for their business success.

Firms that apply 10XE will gain competitive advantage, hire more practitioners and recent graduates with 10XE experience, and increase those employees' market value. Progressive educators will adopt 10XE quickly because of the economic and environmental advantages, but less progressive educators are likely to change only when forced by their graduates' difficulty finding jobs. Thus, demand from industry for a different way of doing engineering will prompt change even by those satisfied with the status quo.

The success of this ambitious effort will require international collaboration, so the Institute has teamed up with The Natural Edge Project (see [www.naturaledgeproject.net](http://www.naturaledgeproject.net)). It helps to develop robust frameworks, operational methodologies, and best practices for sustainability, chiefly in the Asia-Pacific region.

Our several dozen Factor Ten Engineering case-studies, spanning the range of engineering disciplines and applications, will optimize whole systems, achieve ten times better

By the time most designs have been completed about 80 percent of their lifetime economic and ecological costs have already been determined.

resource productivity with no loss of service, have lower first and operating costs, tunnel through the cost barrier, and demonstrate simple, elegant solutions. Whole-system design principles used by RMI's Green Development Services already integrate building orientation, envelope, lighting, and equipment to use an order of magnitude less energy with short or negative payback times.

RMI's casebook will tell many such stories, contrasting their design logic and calculations with traditional ones, side-by-side in two columns. Our goal is to ensure that the reader will never do it the old way again (at least without wincing)—and will run out and tell every engineer within earshot about the great new way to do design.

By the time most designs have been completed, but before they're built, about 80 percent of their lifetime economic and ecological costs have already been determined. It is thus a wise investment in our future to help re-wire the mindsets of engineers worldwide to focus on resource efficiency up front (all the really important mistakes are made on the first day). Making whole-system design the new norm is challenging, but that's what the past twenty-two years have been preparing us for. Through Factor Ten Engineering, Rocky Mountain Institute expects to improve engineering education and practice in the service of a more secure, just, prosperous, and life-sustaining world.

*Dr. Andrew Kean, until recently a Berkeley-educated mechanical engineer with RMI's Education Team, has now migrated to our frequent partner Rumsey Engineers in Oakland, Calif.*

# Helping Communities Find the Benefits of Efficiency

RMI'S NEW WEBSITE CALCULATES ENERGY SAVINGS POTENTIAL

By Jeremy Heiman

When cities and towns lose jobs, community leaders are left wondering how to replace them. A common reaction is to hire economic development consultants who typically advise the town leaders to offer tax breaks or free infrastructure to new industries or retail developers. These then compete with existing businesses, and after paying the costs of growth, the community may be worse off than when it started.

But there's another alternative, according to Michael Kinsley, of RMI's Research & Consulting team.

"Economic development professionals tend to focus exclusively on recruiting new businesses," Kinsley said. "Most

"[Energy efficiency] also had this amazing unanticipated side effect: it created 880 new jobs and increased regional income by \$124 million."

Michael Kinsley  
Principal, RMI Research & Consulting

simply don't know that there are business development and job creation opportunities in energy efficiency and renewable energy." Kinsley and a team of RMI researchers have developed an interactive website called the *Community Energy Opportunity Finder* to help communities discover those opportunities.

"We know that efficiency and renewables work, both through logic and by the examples of such cities as Sacramento," Kinsley continued.

"Sacramento voters told the municipal

utility company to shut down a poorly performing nuclear electric generation plant after costly repairs failed. The utility responded by helping customers use energy more efficiently, which avoided the need for new power. It also had this amazing unanticipated side effect: it created 880 new jobs and increased regional income by \$124 million. And that's before counting the benefits of making power generation more diversified and renewable."

## RMI *in the news*

### Former Navy Secretary Richard Danzig Visits RMI



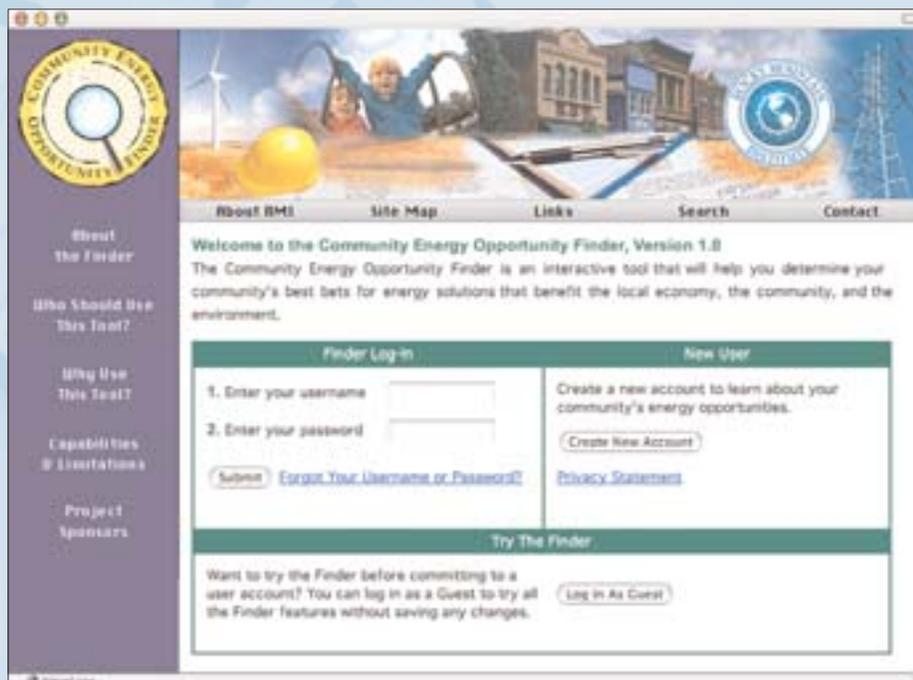
As *RMI Solutions* readers have likely noticed, the Institute's work on security, particularly energy security, has picked up in the past two years.

Last fall it got an even bigger boost when former Secretary of the Navy Richard Danzig, Ph.D. made a presentation to RMI's Board and staff about terrorism and some of its more malicious incarnations. Mr. Danzig (pictured here with RMI Board member **Adam Albright** and RMI researcher/consultant **Odd-Even**

**Bustnes**) has lately been working in both the private and public sectors, and commented on how he has benefited from the security thinking of several RMI scholars—including Senior Fellow **Dr. Eric Rasmussen** and RMI CEO Amory Lovins.

"We're lucky to have the benefit of Richard's visit," said Executive Director **Marty Pickett**. "He brings years of experience and international credibility, and reinforces the perspectives that we articulated in *Brittle Power*" ([www.rmi.org/sitepages/pid533.php](http://www.rmi.org/sitepages/pid533.php)).

As Secretary of the Navy, Mr. Danzig was known for promoting Sailors and Marines as trained professionals; directing new capital investments to support them better; achieving better synergy between the Navy and Marine Corps; and embracing Information Age and other new technologies that can better achieve these goals. One of the programs he championed during his tenure involved "Electric Drive and Integrated Power Systems" for the next class of ships—an area RMI is supporting in technical discussions with Naval leaders. Clearly, we're glad to have his energy.



The *Finder's* no-nonsense, user-friendly interface. Users are asked to enter basic physical and energy information about their community. The *Finder* then allows users to create and save multiple scenarios for their community based on different economic assumptions and performs a series of calculations to determine potential dollar savings, emissions reductions, and jobs gained.

But the people who understand energy efficiency and renewable energy sources and those who work in economic development and business improvement seldom come into contact with each other. That missed communication causes missed opportunities.

“I began to wonder if there were a way that community leaders could be made aware of these huge opportunities without hiring an expensive consultant,” Kinsley said. Hence, the idea of an interactive website that would calculate a community’s energy savings potential.

Kinsley and Kate Parrot, then an RMI researcher, met with RMI’s Energy & Resources team leader Joel Swisher and other RMI energy experts early in 2001. They asked whether it would be possible to use a website to calculate the local effects of improving energy efficiency. The answer was a resounding yes.

Parrot, named project manager and technical lead, set to work creating a mockup and developing criteria for a website that could help communities and would actually be used. The site she and Kinsley imagined would be accessible to both citizens and community officials, regardless of their technical knowledge, and users would have to spend no more than three or four days on the project, using easy-to-find local data.

“We decided what we wanted the outputs to be, then backed up from there to see what data we’d need,” Parrot said. They also reduced the complexity of the site so it wouldn’t need data that weren’t available at the community level.

They began to speak of the site using the analogy of an automobile. The part visible to the user was the “body,” and the unseen part that does the calculations would be the “engine.” The engine would

Energy efficiency works as an economic development engine in two ways:

1. It requires investment in energy-efficient devices and their installation—supporting local payrolls
2. Energy efficiency frees up money for local spending while improving quality of life

be a massive spreadsheet that calculated potential energy savings, dollar savings, air pollution emissions reductions, and job creation from energy efficiency programs.

The spreadsheet was sent to the **Land Information Access Association**, RMI’s partner in the project (along with the **Environmental Protection Agency**). LIAA, a nonprofit group that helps communities sustain their cultural and natural resources and cope with the impacts of changing land use, had the expertise in computer programming to make the *Finder's* engine work. LIAA staffers, long familiar with RMI’s work, were motivated to work on the project because they wanted to develop their own ability to make changes in communities, and saw the *Finder* project as a way to further that end, Parrot said.

While the engine was being built at LIAA’s Michigan headquarters, Parrot and Andy Smith, an RMI intern, were busy designing the appearance of the *Finder's* body and writing the website text. The team then connected the engine to the body. Jennifer Atlee, a former intern, was instrumental in the project’s conceptual development, while another former intern, graphic artist Michael Padget, translated drawings by Parrot and Smith into actual web pages. Rob Astor of LIAA tied the pages to the programming that activates the calculations. Parrot’s team leaned heavily on RMI’s 1994

For an example of a community-based energy efficiency effort, see “What Are You Doing?” on p. 18.

*Community Energy Workbook*, by Alice Hubbard and Clay Fong (see below), using some of its text verbatim.

The pages of the finished site have a simple, efficient appearance. Users are asked to enter basic physical and energy information about their community. The *Finder* lets users create and save multiple scenarios based on different economic assumptions. The *Finder* then performs a series of calculations and displays potential dollar savings, emissions reductions, and jobs gained.

RMI’s *Community Energy Opportunity Finder* website is intended to be the equivalent of an energy consultant’s preliminary analysis, Kinsley said, helping to frame energy efficiency and renewables for influential community leaders.

“We wanted to create an even playing field, so energy efficiency and renewables can compete with other opportunities for economic development,” he said. Community leaders need to be informed that energy efficiency works as an economic development engine in two ways:

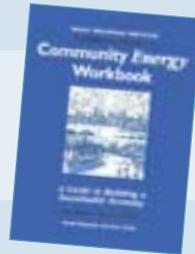
1. It requires investment in devices and equipment—efficient motors, efficient lights, and the labor required, for example, to insulate homes and businesses—supporting local payrolls.
2. Energy efficiency reduces utility bills for residences and businesses, freeing up money for local spending while improving quality of life. Most of this money stays in the community and may turn over several times.

Communities often try to solve economic problems with expansion, which doesn’t usually have widely distributed benefits: a new stadium or subdivision may benefit relatively few constituents, and seldom those truly in need. This type of development, too, may cause such secondary problems as increased traffic and infrastructure costs.

In contrast, Kinsley said, development via energy efficiency or renewable energy provides benefits distributed widely among the community’s citizens, especially those in need. And when cashflow is freed up for such basic necessities as heat and light, additional wealth is created community-wide.

The *Finder* ([www.finder.rmi.org](http://www.finder.rmi.org)) will go live this month.

To order a copy, visit [www.rmi.org/store/p12details2122.php](http://www.rmi.org/store/p12details2122.php) or call 970-927-3851



### RMI *in the news*

## “Mad Aussies” and Their “Eco Trekker” Visit RMI

RMI seems to be a magnet for a lot of interesting people. In early October, some of 2003’s most unusual visitors showed up in the form of the “Eco Trekker” (see [www.ecotrekker.com](http://www.ecotrekker.com)). It’s a project put together by a group of Australians to cross the United States (in a huge, meandering loop) while showing off and promoting alternative fuels and technologies. All told, the group aims to visit thirty U.S. states in eight months in and on a variety of vehicles, including a huge biodiesel-powered “Mothership” (a recreational vehicle boasting a 500-amp photovoltaic array on the roof powering other vehicles and an office), several electric scooters and motorcycles, and a grass car that also runs on biodiesel—not to mention a solar canoe (see [www.ecotrekker.com/technology.htm](http://www.ecotrekker.com/technology.htm)).

The leader of the effort, **Shaun Murphy**, a former television series host and self-described eco-enthusiast, gave RMI CEO Amory Lovins a quick tour of the Mothership and the various gadgets and machines located therein. Amory was impressed by both the half-ton hydraulic tailgate lift (solar-powered) and the fact that Shaun & Co. was able to get by on mostly biodiesel. Amory’s thoughts were recorded on the Ecotrekker website: “Trust a bunch of crazy Aussies to take on something like this.” Not surprisingly, over the years a lot of Aussies have worked at RMI.



# An Introduction to *Biophilia* and the Built Environment

By Corey Griffin

**“Why does a house designed by an architectural individualist for the purposes of a special client appeal so much to the public in general?”**

Edgar Kaufmann, Jr.  
commenting on Frank Lloyd Wright’s  
Fallingwater

**K**aufmann’s question is a good one as over 140,000 people visit Fallingwater in remote Western Pennsylvania every year. In a poll of its members in 2000, the American Institute of Architects named Fallingwater “Building of the Century.” Despite Fallingwater’s structural issues (which a multimillion-dollar renovation has recently fixed) and other problems, this unique building is still regarded by many as the single finest piece of American architecture.

The appeal of Fallingwater may lie in its multiple connections to the natural environment and, consequently, *biophilia*. First defined and described by Harvard biologist Prof. Edward O. Wilson in 1984, biophilia is the study of the human response to the natural environment and the relationship between humans and natural systems, which is, in its simplest form, a sense of place. While there has been a significant amount of study of biophilia and its implications for landscape design, little research or literature exists on biophilia and its connection to the rest of the built environment, particularly architectural design.

Today, the technology and knowledge exists to create a building that

touches the earth lightly during both construction and day-to-day operations. However, what has been often neglected by creators of low-impact “green” buildings is the need for spaces to be *habitable*. Occupants of built environments don’t want simply to work, play, eat, or sleep in a functional building. They want to be inspired, invigorated, comforted, and reassured by their surroundings. They want spaces that will make them more productive and healthy, and they want spaces in which they love to be—spaces that, as RMI’s Amory Lovins puts it, create “delight when entered, pleasure when occupied, and regret when departed.”

Over the past two years, RMI’s Green Development Services (GDS) has been examining the literature on biophilia and the built environment. In conjunction with Yale University, GDS is now seeking funding for a major multiyear initiative that will collect and disseminate defined and quantified information about “biophilic” design.

“Many of our most cherished buildings and landscapes contain prominent biophilic features only vaguely recognized by occupants and users, although they nonetheless exert powerful effects,” said Jenifer Seal of GDS. “What we will be doing is figuring out why these forces occur—both qualitatively *and* quantitatively—so they can then be better promoted, incorporated, and enjoyed in our manmade environments.”

“Also, much of the material that has been generated so far is very theoretical in nature and not directly tied

to today’s real estate development,” Seal said. “I hope RMI’s contribution will be to make this knowledge more accessible and attractive to the building industry—practical, profitable, and not just for high-end projects. Finding ways to incorporate these concepts into the existing fabric of our already-built environment is important as well.”

## Biophilia and Our Ancestors

Before discussing the potential connection between biophilia and architecture, the concept of biophilia deserves a deeper explanation. Wilson first described the concept as “the innately emotional affiliation of human beings to other living organisms. Innate means hereditary and hence part of ultimate human nature.”<sup>2</sup> The hypothesis is that this affiliation leads to positive responses in terms of human performance and health—even emotional states.

**Connecting to the natural environment.**



Photo: Huston Eubank

## Introduction to Biophilia

Roger S. Ulrich summarizes this idea best in his essay on biophilia and natural landscapes:

“The speculation that positive responses to natural landscapes might have a partly genetic basis implies that such responses had adaptive significance during evolution. In other words, if biophilia is represented in the gene pool it is because a predisposition in early humans for biophilic responses to certain natural elements and settings contributed to fitness or chances for survival.”<sup>3</sup>

Even before Wilson published *Biophilia* in 1984, British geographer Jay Appleton had applied this hypothesis to landscape design by suggesting that elements of *prospect* (an extensive view) and *refuge* (being protected from danger) that would have enabled our ancestors to survive can be found in preferred landscapes today. Since Appleton published *The Experience of Landscape* in 1975, many landscape architects and theorists have examined human responses and prefer-

ences for certain landscapes. Most notable are the psychologists Rachel and Stephen Kaplan who have written multiple articles on the subject and, in 1998, compiled a book of landscape design elements partially based on biophilic concepts entitled, *With People in Mind*.

Judith Heerwagen (a partner on this RMI research initiative) and Prof. Gordon Orians did some particularly interesting work on landscape prefer-

### RMI *in the news*



## RMI Helps Make Financial Case for Green Building

RMI has contributed to probably the most impeccable argument ever made for green real estate development. In late 2003, various Institute staffers helped former RMIte **Greg Kats** (see *RMI Solutions* Fall/Winter 2003) assemble a report to California's Sustainable Building Task Force on the costs and benefits of building green.

“This is one impressive report,” said RMI's **Jenifer Seal**. “Most people are skeptical about the financial component of green building. Many still carry the belief that green development has to cost significantly more. This report is the first to thoroughly assess and address this misconception.”

The report shows that major financial benefits of building green can flow from operational savings after construction—through saved energy costs, saved water costs, saved materials costs, saved waste disposal costs, and saved construction and demolition costs. The report also addresses gains in worker productivity via indoor air quality and natural ventilation and lighting. And it shows that capital cost, if any, is surprisingly modest.

“Integrating ‘sustainable’ or ‘green’ building practices into the construction of state buildings is a solid financial investment,” states the executive summary. “In the most comprehensive analysis of the financial costs and benefits of green building conducted to date, this report finds that an upfront investment of less than 2 percent of construction costs yields life-cycle savings of over ten times the initial investment. For example, an initial upfront investment of up to \$100,000 to incorporate green building features into a \$5 million project would result in a savings of at least \$1 million over the life of the building, assumed conservatively to be twenty years.”

Kats was the principal author for the report, prepared as a result of an August 2000 executive order by **California's then-Governor Gray Davis**, establishing sustainable building as a primary goal for state construction. The report was prepared for more than forty California agencies, including the state's department of finance, which endorsed its conclusions. Although it focuses on California buildings and operations, its data and conclusions are relevant nationally.

Kats is currently writing a chapter about the report for a new book to be published by the Urban Land Institute.

Based in part on the report, the **California Board of Regents** has decided that all future higher education construction in the state will be green—billions of dollars' worth of construction. Kats observes that “The report is already helping public agencies and private institutions make the choice to build green with the confidence that this is the most cost-effective and sensible option.”

Contributing authors included Leon Alevantis, Adam Berman, Evan Mills, and Jeff Perlman. Besides Jenifer Seal, RMI's **Bill Browning**, **Bob Wilkinson**, and **Amory Lovins** reviewed the report. It's available at [www.cap-e.com/spotlight/index.cfm?Page=1&NewsID=25770](http://www.cap-e.com/spotlight/index.cfm?Page=1&NewsID=25770), along with downloadable PowerPoint slides, assumptions, and some media coverage.

**Greater access to natural systems—such as diffuse sunlight and outdoor air through natural ventilation—has been linked to increased productivity in building occupants.**

ences. They surveyed people in a variety of cultures and locations around the world to see if there were a preferred image of landscape. What they and others found is that people prefer landscapes that have copses of trees with horizontal canopies, water, elevation changes, distant views, flowers, indications of other people or inhabited structures—all elements that indicate possible food, shelter, and places to explore (or, as Heerwagen and Gordon Orians describe it in *The Biophilia Hypothesis*, “habitability cues, resource availability, shelter and predator protection, hazard cues, wayfinding and movement”).<sup>4</sup>

These elements evoke the conditions of our ancestral habitat, the African savanna. Humans frequently replicate savannas in gardens, lawns, parks and other settings. Some argue that this is a purely cultural artifact—the English landscape architect’s vision spread by colonialism. On the other hand, we find appealing habitats like the oak savannas of the American Midwest,

**The natural in-vironment at RMI’s super-efficient HQ green-house.**



which came into being through the annual burning of trees by the Indians. In the Algonquian language these savannas are called the “teewahcah,” which translates as “the beautiful place.”<sup>5</sup>

### From Landscape to Architecture

While a lot has been written about landscape design and biophilia, Grant Hildebrand, a professor of architectural history at the University of Washington, was the first to make the leap of applying the concept of biophilia to the entire built environment. Using evolutionary theory, Hildebrand argues that in the span of *Homo sapiens’* existence, the era in which humans have constructed habitats for themselves is like a blink of an eye compared to the time spent building—less in the ancestral habitat of the African savanna. Consequently today, upon “reflecting on the various settings and experiences of our lives, we should be able to find some fairly close matches between characteristics we like and characteristics that would have improved our chances of survival.”<sup>6</sup>

Furthermore, these same qualities can and should translate into architecture built over the past few thousand years that humans “like.” While Hildebrand says these qualities create architectural pleasure, this study argues that humans find that spaces “that would have improved our chances of survival” make the built environment more habitable. That habitability is the

essence of their appeal and why *Homo sapiens* continues to seek these evolutionary design attributes today.

### Benefits of a Connection to the Natural Environment

A handful of scientific studies has shown major benefits of a connection to the natural environment—two of which are increased productivity and improved well-being—but the “natural environment” needs a proper explanation.

The natural environment includes the ancestral environment described above as well as such natural systems as the cyclical dynamics of daylight, weather, and temperature, and the annual changes of seasons and the movement of the sun. The natural environment also includes the more traditional definition of nature: ecosystems, trees, flowers, flora and fauna of all types, either inside or out.

Greater access to natural systems—such as diffuse sunlight and outdoor air through natural ventilation—has been linked to increased productivity of building occupants. In a 2001 study, the Heschong Mahone Group showed that “elementary school students in classrooms with the most [diffuse] daylight showed a 21 percent improvement in learning rates compared to students in classrooms with the least daylight.”<sup>7</sup> According to a study by Sterling and Sterling (1983), absenteeism rose from 1.3 percent to 4.5 percent when an organization moved from a building with operable windows and natural ventilation to a building with central air and sealed

## Introduction to Biophilia

windows, while the rest of the work environment, including management and furniture arrangements, remained relatively constant.

The clinical benefits of a greater connection to the natural environment include reduced stress, faster recovery time, and decreased use of strong painkillers. In a 1991 study by Terry Hartig and his associates (Mang, and Evans), stressed individuals who took a forty-minute walk in an urban nature area dominated by trees reported improved emotional states and performed better at a proofreading task than equivalently stressed individuals that took a walk in an urban setting without trees. Similarly, M.J. West (1985) discovered that prison inmates with views of nature had fewer health-related stress symp-

toms, such as digestive complaints and headaches, than prisoners with views of buildings or prison walls. Ulrich (1984) completed the best-known and most thorough study linking views of nature to/hospital recovery:

The patients were assigned essentially randomly to rooms that were identical except for window view: one member of each pair overlooked a small stand of deciduous trees; the other had a view of a brown brick wall. Patients with the natural window view had shorter postoperative hospital stays, had fewer negative comments in nurses' notes ("patient is upset," "needs much encouragement"), and tended to have lower scores for minor post-surgical complications such as persistent headache or nausea requiring medication. Moreover, the wall-view patients required many more injection[s] of potent painkillers, whereas the tree-view patients more frequently received weak oral analgesics such as acetaminophen.<sup>8</sup>

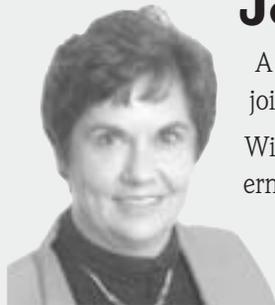
In 1990, Ulrich and Outi Lunde conducted research on the recovery of open-heart surgery patients in Sweden. Their findings suggest that patients with pictures of an open view with water had less postoperative anxiety than control groups or groups exposed to a picture with abstract geometric forms or an enclosed forest scene. While the evidence is still circumstantial, these studies show the possibility that a greater connection between interior spaces and the natural environment could improve health.

### Biophilic Design Attributes

Although RMI's work on biophilia is just beginning, a set of design attributes associated with these environments is becoming evident.

## RMI *in the news*

### Prominent Policy Expert Sue Woolsey Joins RMI Board



A nationally recognized policy expert and science advocate, Suzanne Woolsey, Ph.D., recently joined RMI's Board of Directors.

With an impressive public service record, Mrs. Woolsey has been active at the intersection of government, the private sector, and the science community for more than three decades. She began her professional career as a policy analyst in the office of Elliott Richardson, then Secretary of Health, Education, and Welfare. In 1977 she became the associate director of the Office of Management and Budget, overseeing 52 percent of the federal budget. In 1980 she joined the editorial board of the *Washington Post*, writing editorials and op-ed pieces on domestic policy issues. At the end of that year she joined Coopers and Lybrand as a consulting partner, managing strategic work with universities and research institutes.

In 1989 Mrs. Woolsey joined The National Academies of Science, Engineering, and Medicine to direct their work in behavioral and social sciences and education. After three years she became the Academies' first chief operating officer, a position she held until May 2000. She then served as the chief communications officer of The National Academies, spearheading a major initiative to improve engagement between the scientific community and the public.

She currently serves on a range of diverse boards, including the boards of the German Marshall Fund of the United States, Van Kampen Mutual Funds, Colorado College, Neurogen Corporation, Intelligent Medical Devices LLC, and the Institute for Defense Analyses. She is also a member of the Council on Foreign Relations. She holds a BA with honors from Stanford in history and psychology, and MA and Ph.D. degrees from Harvard in clinical and social psychology.

## Introduction to Biophilia

**The Way Station is a nonprofit mental health facility in Frederick, Maryland. Extensive daylighting and nontoxic materials and finishes ensure a healthy indoor environment for both patients and workers.**

Photo courtesy HarrietWise and ENSAR Group



Interestingly, some of these amenities provide building occupants with access to natural systems even though they don't have direct contact with them, visually or physically.

Along with a greater connection between the interior and surrounding natural environment, some "successful" projects we've examined so far boast attributes similar to those that would have enhanced our ancestors' chances for survival: access to water, complexity and order, enticement, peril, and the duality of prospect and refuge.

The ultimate goal of RMI's new research initiative is to outline biophilic design attributes and put them into a clear, sensible, organized format so developers, designers, planners, and architects can learn about the importance of a connection to the natural environment in all their building projects. In the near future, this could help more people enjoy the everyday places where they live and work—as much as they enjoy Fallingwater.

*Corey Griffin is a former RMI Konheim Fellow. He is currently working on a master's degree in architecture at the University of California at Berkeley.*

These biophilic design attributes include:

- the use of dynamic and diffuse daylight,
- the ability to have frequent, spontaneous and repeated contact with nature throughout and between buildings,
- the use of local, natural materials,
- a connection between interior and exterior surfaces,
- natural ventilation,
- a direct physical connection to nature from interior spaces, and
- direct visual access to nature from interior spaces.

<sup>1</sup> As quoted in Hildebrand, *The Wright Space*, p. 15.

<sup>2</sup> Edward O. Wilson, "Biophilia and the Conservation Ethic," p. 31.

<sup>3</sup> Roger Ulrich, "Biophilia, Biophobia, and Natural Landscapes," p. 75.

<sup>4</sup> Judith H. Heerwagen and Gordon H. Orians, "Humans Habitats and Aesthetics," *The Biophilia Hypothesis*, Island Press, Washington DC, pp. 142–146.

<sup>5</sup> Gerald Wilhelm, Conservation Design Forum.

<sup>6</sup> Grant Hildebrand, *The Origins of Architectural Pleasure*, p. 10.

<sup>7</sup> Lisa Hescong, "Daylighting in Schools," p. 2.

<sup>8</sup> Roger Ulrich, "Biophilia, Biophobia, and Natural Landscapes," pp. 106-107.

# Mad as a Hatter

GREENING UP BOSTON'S HEALTH CARE SYSTEMS AND FACILITIES



By Cameron M. Burns

**“The irony of people getting sick in health care facilities or in nearby or distant communities because of how we build our buildings and use and dispose of materials demands that we change our practices.”**

Dr. Ted Schettler  
Science Director, Science and  
Environmental Health Network

In Lewis Carroll's 1865 novel *Alice's Adventures in Wonderland*, the author chose a hat-maker as a main character in the story. The hat-maker was a memorable chap—somewhat demented, talking utter nonsense, and forever having tea. Many historians speculate the reason for his impressively odd behavior was mercury poisoning. Mercury destroys the nervous system, and the symptoms include tremors (“hatters’ shakes”), personality changes, irritability, and difficulty in speaking, seeing, hearing, and walking—leading oftentimes to death. During the mid-nineteenth

century, hat-makers used hot mercury nitrate solution to remove animal fur (a process called *secretage*) during the manufacture of felt hats.

While many cities and states have banned mercury for various uses, it can still be found in many products and, until about a decade ago or so, mercury was a common component of many health care devices—yet it's lethal stuff. A typical mercury thermometer, for example, contains about one gram of mercury. During 2000 the EPA estimated that 16.8 tons of mercury made their way each year

## RMI *in the news*

### **NatCap Enters the Curriculum at the University of Colorado**



Fans of RMI's book *Natural Capitalism* have long hoped that its concepts would be picked up by educational institutions. The book has appeared on many college course syllabi since it was published in 1999, and its influence continues to grow.

Last summer former RMIte **David Payne** and **Tom Dean**, associate professor of management at the **Leeds School of Business at the University of Colorado**, teamed up with RMI researcher/consultant **Chris Page** to develop course “modules” for teaching *Natural Capitalism* at the university level, targeting both undergraduate business majors and MBA students interested in sustainability. And last fall, the modules were incorporated into three of Professor Dean's classes—one for MBA students, two for undergraduates.

The modules are self-contained, modifiable teaching tools, complete with PowerPoint presentations, lecture notes, exercises, and readings from RMI and other sources. The development of the modules was funded by a grant from the Kettering Foundation.

Having piloted the modules in Professor Dean's classes on sustainable entrepreneurship and green business, the authors will soon make them available to other educators interested in natural capitalism.

The subject matter includes the four principles of natural capitalism: advanced resource productivity, biomimetic production (“make it like nature”), a “solutions economy” business model, and reinvesting in natural capital. Emphasis is placed upon concepts and challenges of particular interest to business school students.

This spring, Dave, a Ph.D. candidate at the school, began teaching natural capitalism as a full-blown topic in its own right as part of a senior undergraduate seminar he has established.

For more on Tom and Dave and their work, see <http://leeds.colorado.edu/faculty/deantj> and <http://leeds.colorado.edu/phd/payned>.

Health care facilities generate more than two million tons of regulated waste each year, and the fourth biggest source of airborne mercury emissions is medical waste incineration, according to the EPA.



Historically, about 85 percent of medical intravenous bags (IV bags) were manufactured from PVC, which contains the phthalate di-2-ethylhexyl (DEHP). Recently, the two largest manufacturers of these bags committed to phasing it out of their product.

into municipal solid waste from mercury thermometers alone. The dental sector alone uses about thirty-three tons per year of mercury and is the leading source of mercury in our effluent water, according to the Association of Metropolitan Sewerage Agencies. Mercury can also be found in non-medical items that are common in hospitals, from cleaning products and fluorescent and high-intensity lamps to non-electronic thermostats, switches, and pressure gauges.

“Over the last eight years mercury has been a major target of non-governmental agencies, the EPA through their Hospitals for a Healthy Environment program, and hundreds of forward-thinking hospitals,” said Bill Ravanese of Health Care Without

Harm (HCWH), a Washington DC-based nonprofit organization that works on “greening up” health care facilities. “The mantra now within the health care sector is the ‘virtual elimination’ of mercury. Leading health care facilities are now working to eliminate not only mercury but the generation and use of many toxic materials, including dioxins and other persistent bioaccumulative toxic chemicals, pesticides, phthalates, certain cleaning chemicals, solvents, and other things that can pose risks to workers, patients, the public, and the environment.”

If the stuff Bill mentions sounds scary, it should.

Dioxins are some of the most toxic chemicals known. The unintentional by-product of certain industrial processes involving chlorine, dioxins are released when polyvinyl chloride (PVC) plastic (used in many medical products) is manufactured or incinerated. Like many heavy metals, dioxins bioaccumulate in our food supply, and exposure to even tiny amounts can lead to birth defects, learning disabilities, infertility, immune system suppression, and hyperactivity in children.

Phthalates are also highly toxic; they’re added to plastics to soften them up (think of the clear flexible intravenous bags—IV bags—used in hospitals). Phthalates are prone to leaching out of PVC and other plastics. Laboratory animal studies that are believed relevant for predicting risks in humans show that di-2-ethylhexyl-phthalate (DEHP, the phthalate in some IV bags) can

interfere with normal development and function of the male reproductive tract at relatively low doses.

So why are dioxins and phthalates so common, especially when alternatives exist? And for that matter, why would we keep dangerous cleaning agents in health care facilities? And why would we ever build a hospital with toxic furnishings or materials? Or one that pollutes dramatically? Are we as mad as hatters?

The answers to these questions have as much to do with societal change as with anything, but the good news is that there are solutions. Many of the dangerous materials and devices found in health care systems and facilities can be replaced with benign, safe, cost-competitive alternatives—it’s just a matter of making it happen.

Rocky Mountain Institute’s work on green buildings, a mainstay of our research and practice for over a dozen years, is now taking a new direction: the health care industry. Recently, RMI joined forces with Health Care Without Harm, to green up health care facilities in the Boston area.

### Bad Buildings, Sick People

In recent decades, many studies have confirmed that buildings can be major contributors to human illness. Building-related activities are responsible for 35–45 percent of carbon dioxide releases and significant stratospheric ozone depletion (through the use of refrigerants and other ozone-depleting materials). Through buildings we use over 75 percent of PVC, about 40 percent of raw stone, gravel, sand and

## Mad as a Hatter

### Bad Buildings, Sick People (continued)

steel, and 25 percent of virgin wood. Buildings use about 40 percent of our total energy, 67 percent of our electricity, and 16 percent of our water, while building construction and demolition generate about 25 percent of municipal solid wastes.

Buildings operated specifically for health-related activities can be just as

destructive. Health care facilities generate more than two million tons of regulated waste each year, and the fourth biggest source of airborne mercury emissions is medical waste incineration, according to the EPA. Also, health care facilities use a surprising number of highly toxic chemicals as pesticides, cleaners, and disinfectants.

“These **volatile organic compounds** (VOCs) contribute to poor overall indoor air quality and are associated

with a host of health problems,” states HCWH’s website. “In fact, the EPA estimates that indoor air pollution is one of the top five environmental risks to public health, potentially causing eye, nose, and throat irritation, asthma, headaches, loss of coordination, nausea, cancer, and liver, kidney, and central nervous system damage.”

Added to all these issues is the simple fact that, on average, people in the United States spend 90 percent of

### RMI *in the news*

## Soft Paths Filmmaker Buck Robinson passes

The man behind the 1981 film *Lovins on the Soft Path: An Energy Future with a Future* and a close friend of RMI, Nelson “Buck” Robinson, died recently at his New Hampshire home after a courageous fight with Lou Gehrig’s Disease (ALS). He was 64.

Buck was smart, witty, and warm-hearted, and he cared deeply about environmental and sustainability issues before the term *sustainability* was commonplace.

A graduate of Williams College, the University of Michigan Law School, and Harvard Business School, Buck founded several community-oriented and earth-friendly businesses, including the **Essex Ecology Center** in Rockport, Mass., the **Cambridge Alternative Power Company** in Cambridge, Mass. (which sold and installed alternative energy products), and **Capco Energy Supply** in Burlington, Mass., a wholesale distributor of energy-conscious heating equipment. In 1993, Buck and his wife Caroline also founded an organic farm (**Berry Hill Farm**) in Stratham, N.H., which produces a variety of berries. One of his favorite photographs appears here and shows Buck perched atop a sun-drenched compost pile on the farm, sitting zazen, and sporting a beneficent smile.

In 1981, Buck volunteered to produce *Lovins on the Soft Path*. An ambitious effort that Buck took a substantial personal financial risk to make, the film was immediately applauded for its lucid explanation of energy economics and alternatives. It also reaped multiple awards, including the blue ribbon at the American Film Festival, “Best of Festival” at the National Association for Environmental Education Film Festival, “Best Science & Technology Film” at the San Francisco International Film Festival, and “Best Energy Film” at the Audubon International Environmental Film Festival. The film remains available for rent or purchase from **Bullfrog Films** ([www.bullfrogfilms.com](http://www.bullfrogfilms.com)), with royalties paid to benefit RMI.

Buck lived what he preached and was famous for his enthusiasm for fuel-efficient automobiles. “As an expression of his beliefs, Buck drove the hybrid *Prius* upon its release in 2000, carrying the license plate ‘48+ MPG,’” reported the *Chicago Tribune’s* obituary. “The car stimulated countless conversations and Buck’s enthusiasm sold many hybrid cars for Toyota. The family now drives the new 2004 *Prius*, and it carries the license plate ‘55+ MPG’.”

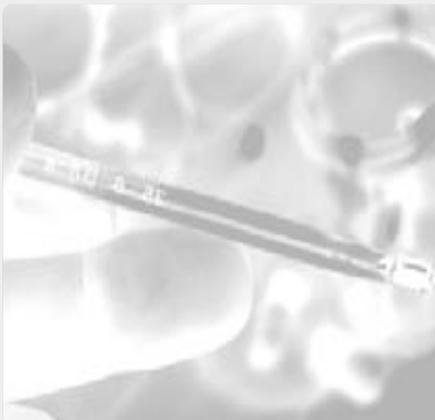
Shortly before his death, Buck proudly told RMI of the **Jordan Institute’s** intention to give the first Nelson B. Robinson memorial award for leadership in renewable energy to Amory Lovins. Amory was touched by this extraordinary gesture, and quickly called Buck and Caroline to accept the award, which will be formally granted in a ceremony later this year. For a lifetime of dedicated service and to a committed friend and colleague, we can only say thanks, Buck. We shall miss you.



their time indoors. For workers and sick people, particularly those with depressed immune systems or other chronic illnesses, the consequences of exposure to building health hazards are particularly unwelcome.

“The irony of people getting sick in health care facilities or in nearby or distant communities because of how we build our buildings and use and dispose of materials demands that we change our practices,” said Dr. Ted Schettler, science director of the Science and Environmental Health Network and a physician at Boston Medical Center.

“Available alternatives make it possible to substantially reduce risks and to provide healthier and more healing environments.”



### The Plan: Green Up Beantown Hospitals

Boston’s health care system is one of the world’s most prominent. The network of clinics, hospitals, and research facilities in the area is the third largest recipient of National Institutes of Health funding for both medical research and construction. At present, roughly \$300 million worth of health-care-related construction is scheduled to take place in the next few years. It’s a great opportunity to steer this wave of construction in a safe direction.

In summer 2003, RMI and HCWH signed an agreement to work together in the Boston area to reduce toxicity in health care facilities and influence green building design. With initial funding from the Merck Family Fund and the Barr Foundation, RMI and HCWH established a plan for greening up Boston’s health care facilities.

The RMI-HCWH plan is arguably modest, but the challenge in greening up hospitals is the same as introducing sustainability ideas anyplace—baby steps must come first. Specifically,

the first step will be a fact-finding mission led by HCWH, in which senior leaders in the Boston health care community will help outline the major issues in health care facilities and barriers to change.

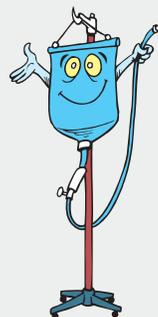
In the second phase of the project, RMI will develop an Innovation Workshop in integrated design. It’ll help participants create unique solutions that are cost effective, improve building performance, and promote human and environmental health.

HCWH will lead much of the third phase, in which participants will be aided by RMI and HCWH in implementing change within their facilities and systems, and disseminating the recommendations of the effort to the health care sector.

Both RMI and HCWH anticipate the project will generate policy directives and influence design in Boston-area health care facilities and, we hope, nationally.

Undoubtedly, much of the project will center on education. “Building support among key constituencies for sustainable design is paramount to our success, especially in accelerating the transition to healthier building materials,” said Gary Cohen, HCWH’s co-executive director.

CONTINUED ON PAGE 34



**The Plan: Reduce toxicity in health care facilities and influence green building design**

**Phase 1: Fact-finding mission led by HCWH, in which senior leaders in the Boston health care community will help outline the major issues in health care facilities and barriers to change**

**Phase 2: Develop an Innovation Workshop in integrated design**

**Phase 3: Implement change in facilities and disseminate recommendations**

## The Folks Who Make RMI Tick



**Marty Pickett,**  
Executive  
Director

RMI publica-  
tions—including  
this newsletter—are filled with the

excellent work of our Research & Consulting staff, but I want to take a moment and acknowledge the work of some terrific volunteers. These young people sought out RMI and are so passionate about being here that they are contributing their time.

At present, we have three volunteers: Ramola Yardi, Anna Jaffee, and Tomakin Archambault.

Ramola is from the subtropics of Brisbane, Australia. She has a master's degree in policy studies and recently worked for

the Brisbane City Council in strategic policy and economic development.

While there, she read *Natural Capitalism* and was inspired by the practical solutions it described. Then she was given the task of finding ways to integrate the council's Economic Development and Social Policy divisions. After more research, she came across Michael Kinsley's sustainable economic development work, which "really got the linkages" in an innovative and practical way.

A few phone calls, a handful of emails, and one long plane ride later, and Ramola now shares an office with Kinsley, where she does research for members of RMI's Commercial & Industrial Services Team. She will be here for six months to a year, soaking up knowledge, living off her savings, and enjoying her time in Colorado.

"I felt I had fallen prey to a sort of cultural isolation, and RMI seemed the perfect first antidote. There is very little talk here about ideas that cannot be realized."

Anna Jaffee

Tomakin Archambault grew up in Estes Park, Colorado, and earned a mechanical engineering degree at the University of Denver. After being introduced to RMI through a borrowed newsletter, he realized that the Institute was filled with "many interesting people working on many interesting projects." After college he did an engineering internship with the National Park Service, then decided volunteering at RMI would be his next career move. He is currently doing research for the Green Development Services team and is helping team leader Alexis Karolides, AIA, with a United Nations report on the global impacts of housing.

CONTINUED ON PAGE 23

### Editor's Notes

## The Good Fight



**Cam Burns,**  
Editor

A lot of *RMI Solutions* readers are undoubtedly anti-war, but that doesn't mean any

of us should be anti-military. After all, the U.S. military achieved some of the most important victories of the 20th century, and helped create some of the most important global institutions and cooperative programs in history.

America has changed a great deal since the days of the Marshall Plan, and our military is changing along with it. I encourage you to read Lynda Pfau's article "Sustainability and the U.S. Army: Fort Bragg's Remarkable Efforts" (p. 20) When that article was coming together,

Fort Bragg's KrisTina Wilson emailed me a selection of images. They showed soldiers attending sustainability-related meetings, soldiers at area schools on Earth Day, and soldiers doing recycling. Best of all, the images showed how proud the soldiers are of their efforts. If the military—with its traditionally rigid culture and strict chains of command—can fight for a better planet, we all can.

This brings me to another fight: the war on greenhouse gas emissions. In December, Reuters reported that damages caused by natural disasters rose 9 percent in 2003—to \$60 billion.

Indeed, the heat wave that struck Europe last summer caused an estimated \$13 billion worth of damage. Although most of the losses were uninsured crops, Gerhard Berz, head of Munich Re's

Geo Risks research department, noted that "extremely hot summers could become more or less [the norm] in Europe by the middle of the century."

When disasters become commonplace and insurance rates go up, doing business becomes expensive. A year ago, RMI created a tool to help trim greenhouse gas emissions and, ultimately, help prevent "natural" disasters—the *New Business Climate: A Guide to Lower Carbon Emissions and Better Business Performance*. The book looks beyond the political machinations of the Kyoto Protocol to analyze the enduring importance of businesses strategies as the world goes on a low-carb[on] diet—which it is doing. Check it out at [www.rmi.org/store/p12details2421.php](http://www.rmi.org/store/p12details2421.php) and join us in the good fight.

## Joanie Henderson, RMI Research & Consulting



Joanie Henderson, mild-mannered member of RMI's research and consulting practice, doubles as a local hero who responds to emergency calls

at any time. Like many RMI employees over the years, she carries on a proud tradition: she's a volunteer firefighter and Emergency Medical Technician with the Basalt and Rural Fire Protection District.

At RMI, Joanie works with all three of RMI's research and consulting teams, Managing Director Kyle Datta, and CEO Amory Lovins. She provides valuable background information and updates current innovations in specific fields, sectors, or firms.

"I collect copious data and evaluate them, condensing them into a smaller quantity of meaningful and relevant information for the project at hand," she said.

"I know where to look for data. That takes a breadth of knowledge not only of what's relevant to a particular project, but of what's meaningful in pursuing RMI's mission as well. It is a constant learning process."

Lately, Joanie has been working on a major RMI project aimed at creating a roadmap for ending the nation's dependence on petroleum. She's researched the use of early illumination fuels (whale oil, town gas, kerosene) to illustrate how quickly fuel sources in the past have successfully shifted; how to stretch the use and life of paving asphalts, substitutes for it, and methods for extending its life; and potential aircraft efficiency improvements.

She's also working with Green Development Services researcher Jenifer Seal

and other non-RMI researchers to create a **Smart Growth Indicator** for use in brownfield redevelopment.

Joanie started work at RMI in June 2000, right after graduation from Sonoma State University. She was hired then as research assistant to the Research & Consulting Team. After a few months, she was made research assistant to RMI Cofounder Hunter Lovins, a position she held for two years.

When Hunter Lovins left RMI in June 2002, Joanie began working exclusively with the Institute's Commercial & Industrial Services Team. In addition to doing research, she joined the CIS Team in presenting **Innovation Labs**—workshops that explore how natural capitalism can reduce a facility's waste and enhance overall resource efficiency and profitability.

Joanie became a firefighter right after she arrived in Snowmass. RMI is somewhat isolated, and she wanted to connect with a larger network of people serving the community. Soon she had a red beeper squawking at all hours of the day and night.

At 492 square miles, the Basalt Fire District is one of the largest in the United States. Eight paid staffers and fifty-seven volunteers cover the mountainous district from four fire stations that house seventeen firefighting and rescue vehicles. The department fights structure and wildland fires, but also responds to traffic accidents, household accidents, workplace accidents, swift-water and ice-related emergencies, hazardous materials emergencies, and all manner of medical emergencies. Confined space rescues—perhaps a construction worker who has fallen into a tight space—and high-angle rescues—

"I collect copious data and evaluate them, condensing them into a smaller quantity of meaningful and relevant information for the project at hand. I know where to look for data. That takes a breadth of knowledge not only of what's relevant to a particular project, but of what's meaningful in pursuing RMI's mission as well. It is a constant learning process."

often car accidents where vehicles have gone off the side of a mountain road—are not unusual. Medical calls and trauma calls are about equally common, Joanie estimates. Chest pain is the most common reason for medical calls, and automobile accidents are by far the biggest source of trauma calls.

Animal rescues, too, are part of the department's agenda. But it's not usually as easy as coaxing a housecat out of a tree. Once, Joanie said, she and a crew of volunteers had to rescue a huge draft horse that had fallen into an irrigation ditch flowing brim-full with freezing water.

Joanie said responding to emergencies is sometimes an eye-opening experience.

"We see car wrecks that make you question the sanity of the driver," she said. "It makes you want to ask, 'How the hell did you do this?'" She also marvels at "the different ways people can set things on fire. There are some pretty wild ones."

"It is truly a privilege to be part of an organization composed of volunteers who give up so much of their time to train for whatever emergency might come up and then to walk away from their jobs at a moment's notice to help someone in need," she said. "I am continuously overwhelmed at the level of compassion the volunteers display for members of the community they may have never met."

—Jeremy Heiman

## What Are You Doing?

# Getting to the CORE of Local Energy Issues

## Promoting CORE Values



Randy



Joani



Val

In Western Colorado's Roaring Fork Valley, the home of RMI's headquarters, there's a local agency called CORE.

The letters stand for **Community Office for Resource Efficiency**, but the word "office" doesn't refer to CORE's rented office in Aspen. CORE's staff often works at home or at one of many project sites.

The agency's office is more a state

of mind, a virtual space in which resource efficiency ideas are hatched and planned.

CORE, which has roots in RMI's tradition of innovation, has been the driving force behind tremendous gains in the use of wind energy in western Colorado. The organization has also completed many successful energy efficiency projects in the valley. CORE's success affirms that one of the best ways to reduce greenhouse gas emissions is through projects organized at the community level.

The CORE virtual office is occupied by three full-time employees: Director **Randy Udall**, Project Coordinator **Joani Matranga**, and Outreach Specialist **Val Douglass**. Udall has led CORE from the start, spearheading the push to bring renewable power to utilities statewide, to the local electric cooperative that serves RMI, and to municipal utilities in Aspen and Glenwood Springs.

He has also produced a good bit of intellectual capital in the form of oil and gas research that's available on CORE's website.

Matranga, an engineer, conducts analyses to check if a project will work and investigates new technologies.

She checked out the specifications of the Capstone MicroTurbine® that now generates both power and heat for the new Aspen Recreation Center building.

"I think I'm a bridge between technical and non-technical people," she said. Her job also includes developing and supporting new public policy with City of Aspen and Pitkin County staff.

Douglass created and maintains CORE's website ([www.aspencore.org](http://www.aspencore.org)), and develops publicity. She has created energy programs for local schools and is promoting installation of solar energy for homes and businesses.

CORE's most successful program to date is the **Renewable Energy Mitigation Program (REMP)**. Kicked off in 2000, REMP funds local energy efficiency and renewable energy projects in the 40-mile-long mountain valley dotted with small towns and rural homes and ranches. The concept was promoted to elected officials by CORE staff and Aspen building official Stephen Kanipe.

The REMP ordinance was added to the building code of the City of Aspen and Pitkin County. The code already had progressive energy language, which RMI helped tune-up in 1982. REMP now requires those who choose to install such energy-devouring features as outdoor hot tubs, heated pools, and heated driveways either to install renewable energy systems onsite or to pay a mitigation fee to compensate.

"The biggest barrier is people.

Basically, this is about substituting ingenuity for ignorance.

Sometimes people are actively ignorant, and sometimes they're just clueless.

Sometimes they are hostile.

Sometimes, to change the lights, you have to change attitudes first."

Randy Udall  
Director, CORE

REMP impact fees for excessive energy use proved an excellent way to fund CORE's energy efficiency and renewable energy projects.

"All of a sudden, we had an independent source of funding to help push this clean energy work along," said Matranga, who joined CORE seven years ago.

"We were surprised. We thought we'd raise \$100,000, maybe \$200,000 a year. It raised \$800,000 in the first year!" REMP has netted about \$2 million to date for many different projects.

REMP paid for solar hot water systems on a new affordable housing project and for the design of daylighting features in the new Aspen High School building. It pays for incentives to help local businesses retrofit with energy-efficient lighting, and for zero-interest loans to help residents and businesses convert to renewable energy. REMP has supported the installation of local microhydro systems. And REMP funds provide rebates to citizens who purchase efficient appliances.

The program also funds solar incentives. CORE pays the owners of home photovoltaic (solar electric) systems twenty-five cents per kilowatt-hour of electricity generated, and provides \$1,000 rebates to homeowners who install solar hot water systems. This has been extraordinarily successful, Udall said—CORE's geographic area is leading Colorado in solar installations.



### The Core of CORE: How it Started

A local agency to champion energy efficiency, Udall said, was originally the idea of RMI researcher **Alice Hubbard**. She took her idea to Bob Child, then a county commissioner in Pitkin County, where RMI's headquarters are located. Aspen City Councilman Terry Paulsen was a supporter from the start, as was Pitkin County Commissioner Mick Ireland. Bill Stirling, then mayor of Aspen, provided indispensable help and was "the political wizard who figured out how to get the funding together," Udall said.

Ads went out for a director. Udall applied and was hired, and CORE opened in August 1994. Prior to that, Udall had been writing articles on the environment, many published in prominent magazines. One of his efforts was a *Sierra* magazine profile of RMI CEO Amory Lovins. In the early 1990s, Udall edited *RMI Solutions*, and produced freelance articles for it. He also wrote a primer on green building that was RMI's first green building publication.

The original CORE partners were Aspen, Snowmass Village, and Pitkin County. Early on, local utilities provided funding, but with trepidation.

"There was some skepticism that we'd be able to do anything useful," Udall said. But the supporters of the idea had a plan.

"We knew we wanted to do some [lighting] retrofits and some education and some work on solar power and other renewables," Udall said. "As we went along, we found more opportunities." Wanting to tackle the issues that provide the best leverage, Udall immediately involved CORE in making renewable energy available.

"Buying green energy is the most significant environmental choice a business or a family can make," Udall said. Green energy purchases have a greater impact than recycling, for example. Each big utility wind turbine keeps about six million pounds of carbon dioxide out of the atmosphere each year.

CORE worked with an environmental law firm based in Boulder to push for a statewide green pricing program. Green pricing allows consumers to pay a premium for electricity generated by wind-farms and other renewable sources, thereby giving the utility additional impetus to develop its green power generation resources, along with additional capital to do so. Xcel Energy, the major electric utility in Colorado and the local utilities' supplier of power, soon began offering green pricing rates on wind power to its customers. (Unfortunately it hasn't yet followed the Austin municipal utility's model of selling windpower at a fixed price—without the fuel-adjustment clause, because there's no fuel. When gas prices spiked, Austin's green power customers found themselves paying less

per kilowatt-hour than their fossil-fuel-dependent neighbors.)

Due partly to CORE's work, the City of Aspen's electric utility now buys a bigger percentage of wind-generated electricity than any other municipal utility in the country and Holy Cross, the local electric coop, is now one of the largest purchasers per capita of wind energy among utility companies in the United States. Owing to exceptional hydroelectric resources, Aspen's power is now 65 percent renewable, Udall said.

CORE's successes are numerous, but sometimes things don't go as planned. "When we started CORE, we thought of everything we did as experiments," Udall said. Stumbling blocks can be lack of time, lack of money, competing egos, institutional barriers, or just plain ignorance.

"The biggest barrier is people," Udall observed. "Basically, this is about substituting ingenuity for ignorance. Sometimes people are actively ignorant, and sometimes they're just clueless. Sometimes they are hostile. Sometimes, to change the lights, you have to change attitudes first."

In retrospect, the attitude-changing has paid off. Over the next twenty years, CORE's projects will have prevented the release of nearly 1 billion pounds of carbon dioxide.

CORE was a genuine original when its doors opened in 1994, but groups with a similar mission are now active in other Colorado mountain towns and in communities across the country.

"People want renewable energy," Matranga said. "The surveys say it all the time. You just need to build political will and provide choices."

—Jeremy Heiman



# Sustainability and the U.S. Army: Fort Bragg's Remarkable Efforts



By Lynda S. Pfau

**A** little more than two years after its inception, *Sustainable Fort Bragg* continues to gain momentum.

"*Sustainable Fort Bragg* has proven sustainability principles can be successfully incorporated into a military installation mission of ensuring combat readiness of the Army's premier Power Projection Platform while ensuring regional communities have sustainable and productive futures as well," said Dr. Christine Hull, Fort Bragg's long term sustainability planner. "This is *Sustainable Fort Bragg's* legacy to the region and to the lives of the soldiers and their families who call Fort Bragg home."

Fort Bragg is one of the U.S. military's most important bases. Home of the Army's Airborne and Special Operations Forces, the installation's mission is to maintain the XVIII Airborne

Corps, a strategic crisis response force manned and trained to deploy rapidly by air, sea, and land anywhere in the world at a moment's notice. The installation's motto is "18-hours wheels-up"—that is, soldiers must be in the air, away from their families, and prepared to fight in a maximum time of 18 hours.

Fort Bragg is also big. The 160,770-acre installation includes a vast infrastructure of roads, buildings, parks, and training areas and boasts a daytime population of over 100,000 people—indeed, Fort Bragg is a city unto itself. The successful operation of Fort Bragg requires clean air and water, millions of kilowatt-hours of electricity, and spacious, undamaged training areas to train troops effectively.

In the late 1990s it became apparent that Fort Bragg's training areas may not be able to train troops to standard in the future. In fact, Fort Bragg faced a training-area shortfall of nearly

76,000 acres, as well as a decreasing likelihood of obtaining undeveloped land adjacent to existing training areas.

But upgrades and expansions at military installations aren't as straightforward as they were in past decades. Today, the communities that surround military bases are as interested in what goes on there as are commanders in Washington. In short, environmental and resource issues have the ability to hamper many activities (most notably training), so they are of the utmost importance to everyone at Fort Bragg.

In 1999, the installation broke with the traditional reactionary posture in terms of encroachment issues, regulatory constraints, and funding and land shortfalls, and crafted a proactive vision for what Fort Bragg needed to look like in twenty-five years: the *Sustainable Fort Bragg* initiative.

## Fort Bragg Sustainability Goals

- **Reduce amount of water taken** from Little River by 70 percent by 2025, from current withdrawals of 8.5 million gallons/day.
- All water discharged from Fort Bragg will meet or exceed North Carolina state **high quality water (HQW) standard** by 2025.
- Meet **minimum Platinum standard for all construction** by 2020 program, and renovate 25 percent of all existing structures to at least a Bronze standard by 2020 (using the Sustainable Project Rating Tool – SPiRiT).
- **Landfill waste to be aggressively reduced toward zero** by 2025.
- Develop an **integrated environmental education program** for Fort Bragg, its surrounding communities, and interested parties.
- Develop and implement an effective regional **commuting program** by 2015.
- **Reduce the use of both gasoline and diesel** in the non-tactical fleet by 70 percent by 2015 and 99 percent by 2025.
- **Reduce energy use** in accordance with Executive Order 13123.
- Work toward **100 percent Environmentally Preferred Purchasing** by 2025 for all purchases, including government purchase card, contract, and military requisition.
- Implement a **scientifically based conservation program** for natural and cultural resources compatible with military readiness and training.
- **Adopt compatible land use laws/regulations** with local communities by 2005.

**“Sustainable Fort Bragg has proven sustainability principles can be successfully incorporated into a military installation....”**

Dr. Christine Hull  
Long Term Sustainability Planner, Fort Bragg

Based on a sustainability framework developed by a group called The Natural Step, *Sustainable Fort Bragg* focuses on a handful of long-term bold and ambitious (“big, hairy, audacious”) goals (see sidebar: “Fort Bragg Sustainability Goals”) that rely on partnering between agencies both on and off the installation, eliminating duplication of effort, and moving toward a shared vision. Each goal has a team leader, each of whom has the ability to affect directly the installation’s efforts toward the ten goals.

“Achievement of Fort Bragg’s long-range (twenty-five-year) goals better enables Fort Bragg to support the Army’s mission today without compromising the ability to accomplish the mission in the future,” said Paul Wirt, chief of Fort Bragg’s Environmental Compliance Branch. “With an estimated input of nearly \$4 billion into the local economy, procurement of environmentally preferred products and services will assist in bringing new industries as well as advanced technology and services to the region, providing a higher quality of life for both the soldier and his or her family living on the installation, as well as for the surrounding communities.”

### Success So Far

Many sustainability “successes” have already been achieved. A strategic resource plan that details areas where integrated planning will merge with existing Army and Fort Bragg projects and programs has been adopted. The military’s Sustainable Project Rating Tool (SPiRiT) standards—a rating tool similar to the U.S. Green

Building Council’s LEED system—has been incorporated into requests for proposals (RFPs) for construction projects (Fort Bragg has one of the Department of Defense’s largest military construction programs). Sustainability has also been added to existing environmental education and training programs. And, a new shuttle bus system has been implemented on the installation, providing troops—especially mobilized units—with a way to get around the cantonment area.

With the large amount of construction, demolition, and renovation taking place at Fort Bragg, a tremendous amount of solid waste is generated.

“Green” thinking generated new uses for hundreds of tons of material that otherwise would have been buried in the landfill, and an astounding 56 percent of the solid waste produced on Fort Bragg was recycled in FY02.

Photos courtesy Fort bragg



For example, over 132,000 tons of concrete from demolition projects was ground up and found new life in roadbeds, trail bases, and range refurbishing projects. Approximately 140,000 tons of excavated earth was also diverted to range erosion projects. And trees removed because of construction were converted into more than 4,800 tons of mulch.

Future *Sustainable Fort Bragg* projects will likely include a compressed natural gas (vehicles and refueling appliances) demonstration project, and a mulching program to divert trees and limbs from the landfill—among other things.

Fort Bragg successfully leveraged funding for several other projects directly related to these strategic goals in the last two years. The *Installation Design Guide*—the guiding document for all Army construction—was updated to incorporate and reflect SPiRiT’s sustainable design standards for construction, renovation, and demolition.

An innovative stormwater management project is scheduled for design and construction, and a project to evaluate and monitor sedimentation in watersheds located in the training areas is planned. A feasibility study was also completed for reclaiming the more than two billion gallons of treated wastewater that is discharged annually so it can be used for irrigation. Several grant projects were accomplished in conjunction with local universities—one included identifying and categorizing local environmentally preferred products and materials, while another investigated local recycling efforts and regional recycling markets.

Permanent water conservation measures, based on the measures enacted during the severe drought of 2002, have reduced water consumption by

## Other Voices

With more than half of Fort Bragg's soldiers deployed, it would have been easy to place sustainability planning on the shelf, but the opposite has occurred.



30 percent. Conservation measures apply to all users and customers of water treated by the Fort Bragg Water Treatment Plant, including housing, units, directorates, contractors, golf courses, and the nearby Pope Air Force Base. Watering schedules are based on the odd/even system and are limited to no more than forty-five minutes either in the morning or early evening.

### Wide Recognition

Federal, national, and state agencies have recognized both *Sustainable Fort Bragg* and the outcomes of the program's objectives, confirming the validity of the initiative.

*Sustainable Fort Bragg* won in the government/nonprofit category in the first annual North Carolina Sustainable Business Awards for its leadership in efficient use of natural

resources. The awards were created to recognize North Carolina businesses, government agencies, and non-profit organizations that are leaders in both conserving natural resources and providing long-term economic growth.

*Sustainable Fort Bragg* has also received broad support within the installation and regionally, and has captured the attention of Pentagon leaders as well. More than ten Army installations have used *Sustainable Fort Bragg* as the blueprint for developing and implementing their own sustainable installation programs. An additional four installations are "in the chute" and ready to initiate sustainability programs.

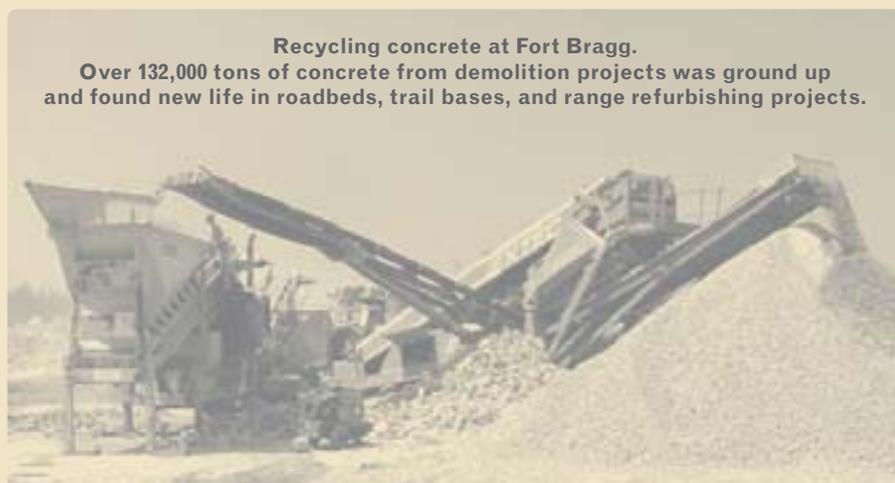
Perhaps the greatest measure of success is that *Sustainable Fort Bragg* has spawned a new regional effort, "Sustainable Sandhills." Cofounded by the North Carolina Department of Environment and Natural Resources (DENR) and Fort Bragg, the Sustainable Sandhills Initiative involves community leaders from the six counties surrounding the installation coming together to plan a sustainable region. Using principles from *Sustainable Fort Bragg*, the Sandhills group identified regional environ-

mental challenges as well as strategies to tackle them head-on. Several well-attended informational seminars and training workshops demonstrated widespread interest in a regional sustainability plan. Community Resource Teams have started writing plans similar to that developed by Fort Bragg to meet regional goals.

"This is probably the real measure of a sustainability effort—the fact that our work on the base has gained recognition, acceptance, support, and is now being replicated elsewhere," said Wirt.

The leadership at the installation is pleased by *Sustainable Fort Bragg's* exceptional results so far. With more than half of Fort Bragg's soldiers currently deployed, it would have been easy to place sustainability planning on the shelf, but the opposite has occurred. *Sustainable Fort Bragg* is now integrated across the installation's business centers and has been elevated by commanders to one of the installation's key processes and strategic goals.

"It has been an incredible two years," said Col. Gregory G. Bean, director of the Fort Bragg Public Works Center. "Developing goals, recruiting stakeholders for goal teams, sustainability training, and conferences—the amount of work accomplished is just incredible."



Recycling concrete at Fort Bragg.

Over 132,000 tons of concrete from demolition projects was ground up and found new life in roadbeds, trail bases, and range refurbishing projects.

### About the Author

Lynda S. Pfau is environmental resource coordinator at Fort Bragg. For more information, see [www.bragg.army.mil/sustainability](http://www.bragg.army.mil/sustainability), or contact Dr. Christine Hull, long-term sustainability planner, at 910-396-3341, ext 351.

## Elaine LeBuhn



Elaine LeBuhn always has to be busy. She works best under stress, and she says she's uncomfortable starting a day without having some work already planned.

Fortunately for RMI, a good bit of the work she does is very beneficial to the Institute. Elaine, who lives in nearby Snowmass Village, joined RMI's Board of Directors in October 2002.

Last year, before she was elected to the Board, Elaine and Development Director Dale Levy teamed up to brainstorm ways to make RMI better known and supported in its own back yard. Knowing it was the Institute's twentieth anniversary, Elaine came up with the idea of having an anniversary picnic for friends of RMI and potential donors from throughout the valley. Then she pitched in as an organizer and helped make the picnic an extremely successful and memorable event.

Her contributions as a Board member, Elaine said, are most likely to be in the area of development—thus her membership of the Board's Development Committee. She is also a member of the Nominating Committee

and cofounder of the National Solutions Council, a group dedicated to broadening RMI's base of support both locally and nationwide.

"I think that the growth of the National Solutions Council is an innovative way to share the message of RMI with the world," Elaine said. "I think through the Solutions Council, I can have a lot of impact."

Elaine said her immediate goals for RMI include increasing membership of the National Solutions Council and continuing to raise awareness of RMI locally.

Elaine was director of development for the Aspen Institute in 1995, when she married Robert LeBuhn. Her life changed. She left her job and, with her husband, focused on philanthropy and guiding nonprofit organizations. She feels strongly that this work is her duty.

"I don't like to waste time, and I've always felt a need to give to society," she said. Both she and her husband sit on the boards of various nonprofit organizations.

Elaine is a member of the Patrons' Council of Carnegie Hall and the boards of Rainforest Alliance, the National Public Radio Foundation, and the Maestro's Circle of the Aspen Music Festival and School. Rob is on the

"Rob and I practice philanthropy extensively because we believe that we have an obligation to give to society... and future generations should have the benefit of what we enjoy today."

boards of the Aspen Music Festival and School and All Kinds of Minds, an organization dedicated to recognizing the differences in how children learn. He's also chair of the Geraldine R. Dodge Foundation and recently joined the Board of RMI's for-profit spin-off Hypercar, Inc.

"Rob and I practice philanthropy extensively because we believe that we have an obligation to give to society," Elaine said, "because we've been so fortunate, and future generations should have the benefit of what we enjoy today."

Elaine has five children and six grandchildren, perhaps a source of her concern for future generations. In the free time that she does allow herself, she enjoys hiking, bicycling, skiing, and sailing. She and her husband have sailed in the Caribbean and among the Greek islands, and they love visiting such relatively unspoiled places under sail.

"I guess it's the freedom, when you're sailing," she said. "The wind just takes you where it wants to."

—Jeremy Heiman

### The Folks Who Make RMI Tick

CONTINUED FROM PAGE 16

Anna Jaffe came to RMI from Princeton, N.J., after deferring college.

Anna is working with intern Jeff Bannon on a project to retrieve and revive case studies and examples from *Natural Capitalism* that were cut from the book in late editing because it was too long.

Anna notes that she "tries to maintain faith in the goodness of all people, and RMI is an organization that operates under that assumption."

Anna's here through February, and thinks she'll do physics and architecture once she gets to MIT.

As you can see, these are dedicated young people who are helping make a

difference through their volunteer efforts at RMI. We are grateful to have this wonderful support. Of course, we have other volunteers from time to time on general RMI projects, from stuffing envelopes to moving furniture, and all of RMI's donors and supporters are, in many ways, volunteers too. We are thankful for all of these unique contributions.

## The Caulkinses: One Family, Many Ideas

One of the nice things about growing up in a big family is you get to see, hear, discuss—and, regularly debate—different ideas and myriad philosophies. Indeed, it's this kind of dynamic, ever-challenging upbringing that many psychologists believe produces open-minded, fast-thinking citizens.

Denver's Caulkins family is proof of this theory. A family of five grown children, they represent a broad political and social cross-section, from conservative military and business people to filmmakers and artisans. In many ways, this variety makes the Caulkinses representative of Colorado itself—a big state with a broad range of individuals. But despite all their differences, one of the things they have in common is that they all wholeheartedly support RMI's work.

The five grown Caulkinses are the children of **Eleanor** and **George P. Caulkins, Jr.**, the latter being one of the six original founders of the Vail ski resort.

George “lived in Aspen in the early 1960s,” recalled daughter Mary. “When he and his pals drove between Denver

and Aspen they noticed an area along Gore Creek east of Highway 6 that consistently held a lot of snow. They stopped one day and hiked up what is now Vail. At the top they discovered the vast open terrain of what is called the ‘back bowls.’ Dad’s role was to help raise the money for the development. They made a promotional movie and he drove it around the country begging his relatives and friends to invest. He had no luck for a long time. Then finally, he sold one lot and he went back to everyone and said, ‘They’re selling like hotcakes’...and then they did.”

That story is immortalized in a book called *The Inventors of Vail* by Dick Hauserman and on dozens of websites. Less known is what some of the founders did afterwards. One thing George, Jr. did was marry Eleanor Newman. They had five children (**George III, John, David, Mary, and Max**), each of whom is an individual in every way:

- Eldest son George III (39) is a Marine who flew Cobra helicopters in the Persian Gulf War. He now works in venture capital, and he and wife Christina Radichel have two boys: Will, 3, and Henry, 1. George likes golf and squash.

- Next son John (37) lives with wife Bara and son Jonathan, 5, in Prague (Czech Republic). John owns a bar in Prague called *Café Duende* and is producing a festival on “film about music and music about film.” John founded, edited, and published *The Prague Pill*, an English-language bimonthly newspaper, and is involved in venture capital.
- David (35) lives in Vail where he has a studio for fine furniture and wood-working. He studies furniture-making at both the Center for Furniture Craftsmanship in Maine and at Anderson Ranch in Colorado. He’s also an avid angler, skier, climber, cook, and gardener, and he plays golf and hockey.
- Daughter Mary (34) lives with husband Karl Kister. “I am trying to be a tile-maker,” she admits. “But I am spending a lot of my time working on my instrument pilot rating.” Karl is the president of the Museum of Contemporary Art in Denver, so the couple spends a lot of time around the museum. They enjoy movies, gardening, and traveling.
- Max (31) is married to Ramey Griffin and the couple shares a house with Abu, Max’s chocolate Labrador. Max works at a sports equipment company called Harrow Sports. He also enjoys golf. He coaches the Team Colorado lacrosse team and is an advocate for the Girls and Boys Clubs.

### RMI in the news

## Boulder Supporter Keeps Pushing NatCap



**Jack Twombly** of Boulder, Colo. has been an RMI supporter for a long time, and his enthusiasm for RMI's 1999 book *Natural Capitalism* has helped get the book noticed in the progressive Front Range city.

“**Boulder Bookstore** solicits brief recommendations from any customer on a book found meritorious,” Jack recently wrote in a letter to RMI. “If accepted for posting at a storefront display, it earns one a significant discount on his or her next purchase.” So on 7 February 2001 Jack “crammed as much of [his] boundless enthusiasm for *Natural Capitalism* as [he] could into about 100 words” and submitted the recommendation to the store. The recommendation was accepted, and Jack got his discount.

“Though I won’t flatter myself thinking the endorsement had that much to do with it, the fact is that from 7 February 2001 to date, Boulder Bookstore has sold 409 copies of *Natural Capitalism*,” Jack wrote. “The recommendation is still displayed and the man at the computer told me they continue to sell about ten copies a month.”

**"RMI is unique and serves the common good in an invigorating, challenging way."**

Mary Caulkins

The Caulkins kids all grew up skiing and hiking in Vail and sailing in Penobscot Bay in Maine in the summertime.

"There are a million good stories about growing up with four siblings," said Mary. "It was a never-ending circus while it lasted. We were a gang of goofs. We try to be a little more civilized now. There is almost nothing that we all agree on, so the idea of shared 'family values' is interesting in itself. Maybe that strong sense of individuality is our most defining characteristic as a family. People who meet us all often scratch their heads and wonder how it happened."

As several family members mentioned to *RMI Solutions*, there is a bit of a left-wing/right-wing split running through the family. "This split could also be described as the arts versus sports fans split, although skiing is popular with everyone," noted Mary.

There are, however, a few things that unite the Caulkinses.

These include frugality ("in the form of old clothes, cars, and finish your food—not necessarily a positive value," as Mary puts it), a sense of right and wrong, and

a strong commitment to the community. The family members are also united in their support of RMI.

"Our interests vary dramatically, as do the reasons for our support for RMI," noted George III. "My interest in RMI is practical only, as a businessman. I like that RMI looks for solutions to problems that enhance and improve productivity—that those solutions protect and improve our environment is a bonus. Protecting the environment is like eliminating poverty; everyone is for it (irrespective of how some quarters would like to paint the business community). The only question is, 'At what cost?' RMI's solutions can make that cost zero, or, hopefully, a benefit."

All the Caulkinses would probably agree that RMI's diverse projects and diverse approaches to changing the world are part of its broad appeal to a family of individuals.

"RMI manages to cover so much ground because it understands the connections and relationships between different issues such as energy-poverty-security," said Mary. "The ideas always

seem so elegant and perceptive. From the processes of charrettes and the solutions in green building designs to the public availability of all this information, RMI is unique and serves the common good in an invigorating, challenging way."

"I particularly like that RMI can see that progress will best be made by not antagonizing entrenched constituencies, but by cooperative opportunism," added George III. "Sustainability can be profitable, and RMI can provide the tools. Further, as RMI has shown, there is nothing inherently contrary to environmentalism in capitalism."

RMI relies heavily on an extended family to accomplish its mission—from subcontractors to consultants, from supporters to friends. We're just glad the Caulkinses are one branch of our large, strong, and colorful family tree.

As John said in an email from Prague, "I am very optimistic about the journey ahead, and I see RMI's role as leading the leaders."

—Cameron M. Burns



**(From left)  
Mary, Max,  
Dad (George Jr.),  
George III,  
Mom (Eleanor),  
and David.**

**(Background)  
John in Prague.**

## It's never too early to plan ahead



**Dale Levy,  
Development  
Director**

The death of my sister and her husband in a motorcycle-car accident

last October has caused me to think much more seriously about a will—and ensuring that it is legal and up-to-date. My sister and brother-in-law had a will. Unfortunately their will, leaving everything in a trust for their eighteen-year-old son and seventeen-year-old daughter and other beneficiaries, was declared invalid because it had not been signed by two witnesses. We learned they had not consulted an attorney in completing their will.

My wife and I have a will that was written with the help of an attorney. But it was done in 1992, and in Kansas. Circumstances have changed and we now live in Colorado. State laws differ, we know we need to update our will. We have vowed that before we take a vacation in mid-March we will re-do it—again with the help of an attorney. This is important because of provisions we have made for our children—and now need to make for our grandchildren—and because of bequests we've made to charitable organizations.

I would urge you to complete a will—with the help of an attorney. And if you want to consider making a bequest for one or more nonprofit organizations—such as RMI—you might find helpful a brochure entitled “What You've Always Wanted to Know About Wills.” We'd be glad to send you a copy.

A number of different options exist for making a contribution in your will. In each case, your attorney can help you with the wording.

Ways to leave a bequest to RMI include:

- 1) designating a specified percentage of your estate to the Institute;
- 2) naming a specific, fixed amount of money for your bequest;
- 3) leaving specific property to the Institute, such as real estate, stocks, or perhaps a collection of books;
- 4) including a residual bequest. In this instance, after all your specific bequests have been fulfilled and all heirs have been provided for, any remaining amount is left to RMI. Sample wording might read: “I hereby leave (a percentage, a specific amount, etc.) to Rocky Mountain Institute, a Colorado nonprofit corporation, whose purpose is to foster the efficient and restorative use of resources to make the world secure, just, prosperous, and life-sustaining.”

If you would like to receive a copy of the brochure “What You've Always Wanted to Know About Wills,” or if you have questions about how to include RMI in your will, please contact me at 970-927-7217 or email me at [dalelevy@rmi.org](mailto:dalelevy@rmi.org). Our address is 1739 Snowmass Creek Road, Snowmass, CO, 81654-9115. Thank you!

**“I give to RMI because it is an investment in the power of ideas; ideas that are critical to a better future.”**

Reuben S. Munger  
Boston, MA

**“The leaders of RMI understand that we live in a universe of abundance—not scarcity—and that by offering enlightened guidance to a system of free enterprise, as opposed to undermining those who are free to dream and create, humankind will rapidly evolve into a cleaner, renewable, more equitable society, free from hunger, disease, and pollution.”**

Lynda and Douglas Weiser

## National Solutions Council

**Co-Chair Kathy Finley**

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**Rita and Irwin Blitt**

**Kathryn Fleck**

**Neill Hirst and Greg Hughes**

**Gerald Hosier**

**Holly Hunt**

**Bruce Katz**

**Alex Kaufman**

**David Muckenhirn and**

**Karen Setterfield**

**Melinda and Norman Payson**

**June and Paul Schorr, III**

**Lynda and Douglas Weiser**

The National Solutions Council seeks to initiate relationships with individuals on a national and international level to represent the interests of RMI in his or her geographic region, to broaden the base of financial support for RMI, and to sponsor specific RMI projects from time to time.

*For more information about the NSC, contact Ginni Galicnao at [ginni@rmi.org](mailto:ginni@rmi.org) or 970-927-7201.*

**Our sincere appreciation is offered to these friends who have contributed to RMI between 1 September 2003 and 31 December 2003. 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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“RMI is at the forefront of putting forward thoughtful new solutions to major everyday problems. They tackle important micro issues ranging from data centers to refugee camps at the same time they lead the national debate on energy policy with tremendous insights into our electricity infrastructure and our hydrocarbon dependence.”

Reuben S. Munger  
 Boston, MA

### Our Partner: Health Care Without Harm

Health Care Without Harm ([www.noharm.org](http://www.noharm.org)) is a consortium of health-related organizations that work on specific issues. In fact, the organization calls itself a campaign. At present, HCWH boasts over 400 non-profit groups in fifty countries, ranging from medical professionals' groups to environmental groups, research institutions to health care systems and hospitals.

HCWH was formed in 1996 to tackle the issue of dioxin pollution (a 1994 EPA report identified medical waste incineration as the single largest source of dioxin air pollution). Since then it has expanded its mission to all aspects of health care and it aims, as its mission states, to “transform

the health care industry worldwide, without compromising patient safety or care, so that it is ecologically sustainable and no longer a source of harm to public health and the environment.”

Today, HCWH's targets include mercury, PVC, pesticides and cleaners, building materials and, of course, medical waste. While the list of places you can find mercury might be rapidly shrinking—thanks in large part to HCWH's work so far—some of the other dangerous items in HCWH's hit list are extraordinarily common.

HCWH isn't interested only in the list of nasty stuff found in health care facilities; rather, HCWH wants to get out in front of the health care industry entirely and influence building design, materials choices, and purchasing decisions. Arguably, that's what RMI brings to the table; the Institute has been influencing the “front end” of green building design since 1992.

The long-term goal of RMI and Health Care Without Harm is to improve the way hospitals are designed, built, and operated in order to promote better healing for patients, better productivity for hospital staff, better energy and resource efficiency, better public and environmental health (including disease and toxicity prevention), and better community interface.

Lewis Carroll might not have realized hat-makers of the mid-nineteenth century were deranged as a result of mercury poisoning, but today organizations like RMI and HCWH are very aware that mercury and pesticides and VOCs and other dangerous materials are commonplace in the health care industry. And to do nothing about it, we reckon you'd have to be mad as a hatter.

### RMI *in the news*

## RMite Joins Dana Meadows Leadership Fellow Program



**Donella (Dana) Meadows** was a brilliant educator, writer, and founder of the **Sustainability Institute**. After Dana passed away in the spring of 2001, her friends and colleagues created a fellowship for environmental professionals in her memory.

In June 2003, the first group of Dana Meadows Leadership Fellows gathered in Hartland, Vermont, for the first of four training retreats over a two-year period. **Chris Page**, of RMI's Research & Consulting group, was selected as one of the first fellows.

“During the course of the first two retreats, we stacked wood; participated in a systems thinking simulation exercise called the Beer Game, where we produced and sold beer and ‘crashed’ the distribution system; learned to map complex situations using a technique called ‘causal loop diagrams’; ate large amounts of whipped cream provided by the cows at Cobb Hill CoHousing, where the Sustainability Institute is located; were coached, guided and challenged by the staff at the Sustainability Institute to absorb and apply new skill sets; and assisted each other in developing focused individual projects to continue in between sessions,” Chris said.

The Fellowship is intended to give young leaders a solid grounding in skills and techniques around systems thinking and organizational learning, to help them become better practitioners in their respective fields. Dana herself was an expert in both areas, able to grasp complex systems and to explain them to people in simple, practical, clear terms.

“Having the luxury of spending four days twice a year with these remarkable people increases my energy and clarity for the work we do at RMI,” Chris said.

## RMI Solutions

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### LETTERS TO THE EDITOR

We want to hear your comments.  
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### ABOUT THE INSTITUTE

RMI is an entrepreneurial nonprofit organization that fosters the efficient and restorative use of natural, human and other capital to make the world secure, just, prosperous, and life-sustaining. We do this by inspiring business, civil society, and government to design integrative solutions that create true wealth.

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 50. 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.

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**RMI volunteers Anna Jaffe and  
Tomakin Archambault,  
and intern Morley McBride,  
reflect on another inspiring day of work at RMI.  
(Sorry, cardboard cutouts  
not available.)**





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# RMI Solutions

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