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RMI Solutions NEWSLETTER

Brittle Times, RMI's Response

By Amory B. Lovins and L. Hunter Lovins

The events of 11 September might have permanently altered our understanding of what is required to maintain a free and open society.

From its inception, Rocky Mountain Institute has worked to promote a secure, prosperous, and life-sustaining world. On 11 September, those goals came under attack—magnifying their importance and urgency. We can best honor the thousands of victims, citizens of over 80 nations throughout the world, by recommitting to create such a future.

A handful of people with plastic knives and box-cutters seized four airplanes and wreaked havoc. A week later, their violence was threatening to hijack much of U.S. policy. Their attack so outrages common decency as to tempt reactions that Americans would abhor in normal times—bombing civilians ruled by despots considered complicit, eroding civil liberties, blaming anyone who looks or thinks differently, rushing to military and energy choices that would be repented at leisure. But if policy simply reacts to the terrorists, they win. America and the world need rather to address root causes: to reassume global leadership in helping all people to fulfill their legitimate aspirations for a safe and decent life.

The terrorist attack elicited wide agreement on some obvious but sometimes overlooked points:

• Murdering innocent people is a supreme evil in the eyes of every religion, emphatically including Islam. This applies to terrorism—and to America's response to it.

• The perpetrators must be brought to justice under the rule of law, and with great care not to harm the innocent. Indiscriminately violent retaliation would undermine all we're fighting for. A world of justice and compassion is morally, as well as practically, better than a world of revenge. Amidst talk of technology and retribution, we need understanding and transformation.

• America's distinctive strengths flow from her diversity, freedom, and tolerance—precisely the qualities that are most under attack, most precious, and most vital not to impair. Terrorists succeed if they drive us to deny our values and diminish our freedoms.

• The attackers hope to provoke a jihad/crusade confrontation between America and Islam, and more broadly to inflame tensions between the powerful and the dispossessed. We defeat this goal if we

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New York as we all remember it. The 11 September attacks will have implications for us all.

instead build a new solidarity between those working to achieve a just and sustainable society and those for whom it is a distant abstraction. Terrorists are bred amid social and economic conditions that create despair and fury. To the extent that enhancing sustainability can relieve those conditions, we both do right and increase everyone's security.

• Many people in the world are profoundly angry at America, and it would be wise to understand why. *Wall Street Journal* correspondent Jonathan Kwitney, in his disquieting book *Endless Enemies: The Making of an Unfriendly World*, chronicles scores of countries where venal, stupid, or insensitive U.S. behavior, over decades, turned potential friends into foes. If we want other countries to think well of us, he concludes, we should be the kind of people one would like to do business with, and should ensure that whoever comes to power in other countries has never been shot at by an American gun. That seems simple and effective, pragmatic and principled. As we seek to understand other cultures, honor their differences, and respect social goals that may diverge widely from our own, we need to hear the reasons for the anger of those who do not feel heard. As a Muslim prayer reminds us, "Praise be to the Lord of the Universe who has created us and made us into tribes and nations / That we may know each other, not that we may despise each other … And the servants of God, most gracious are those who walk on the Earth in humility, and when we address them, we say 'Peace.'"

• The United States is extremely vulnerable, not just because it's a free and open society, but also because of the fragile architecture of its complex, centralized, interdependent technical systems—gigantic pipelines, powerlines, dams, refineries, chemical and nuclear complexes. This vulnerable design makes future attacks both more probable and potentially far worse. We've long been surprised these weaknesses weren't exploited sooner and more fully. A great deal more work is needed to identify these vulnerabilities and design them out.

Consider, for example, the opportunistically renewed push for uneconomic and extraordinarily vulnerable energy technologies, such as expanded dependence on the Trans-Alaska Pipeline (*RMI Solutions*, Vol. 17, No. 1, spring '01) and on nuclear power, which holds billions of curies of releasable radioactivity—rivaling the fallout from a megaton-range groundburst—upwind of many American cities. For example, *The Nation* (16 September) and *U.S. News and World Report* (17 September) report that over half of U.S. nuclear plants routinely fail basic site-security tests even when given advance notice. (They just went on maximum alert, but that doesn't mean they could repel a competent attack.) It doesn't take a crashing widebody jet to unleash their lethal inventories (though that would); a few people could do it on the ground, in some cases without entering the plant's site. Despite this threat and nuclear power's disastrous economics (see "Gone Fission," p. 11), its proponents nonetheless want, and have so far gotten, even bigger subsidies to support expansion, and seem about to win renewal of their liability exemption. In contrast, as David Lochbaum of the Union of Concerned Scientists noted, nobody is asking about terrorist threats to windmills—which also produce power sooner and cheaper.

Our 1982 Pentagon study *Brittle Power: Energy Strategy for National Security*, still the definitive unclassified work, showed how accepting market verdicts could gradually, steadily, turn vulnerability into resilience. The foundation of a secure energy system is to need less energy in the first place, then to get it from sources that are inherently invulnerable because they're diverse, dispersed, renewable, and mainly local. They're secure not because they're American but because of their design. Any highly centralized energy system—pipelines, nuclear plants, refineries—invites devastating attack. But invulnerable alternatives don't, and can't fail on a large scale. Ignored in the current debate but available in the marketplace, they're also cheaper and more reliable. In time, they can make major energy interruptions impossible. Thus real energy security comes from choosing the best buys first; not bailing out market failures; building a balanced portfolio of competitive demand- and supply-side investments;

and preferring energy options invulnerable to cutoff by accident or malice. Happily, all these virtues coincide in the same technologies—the ones current policy disfavors. Why should some of the gravest threats to national energy security come from the energy policy of our own government?

To some extent, RMI can offer these answers. In other realms, we have only just begun to pose the questions. For example, the work that Hunter Lovins and Walter Link of the Global Academy have been doing on globalization raises some intriguing issues. As their recent paper for the United Nations pointed out, the world is profoundly different from the mental model most of us carry of an effective community of national governments. In fact, power now resides in three sectors: governments, corporations and civil society. As newspapers blare that we are at war, it is worth asking, "With whom?" Is this the first major conflict between a globalized network and a national government? In the new tri-polar world, where power resides in governments, corporations, and civil society, this network of self-organized individuals empowered by satellite phones, email, and FedEx to pursue their agenda aren't playing by governments' rules, but they're highly effective. Similarly, solutions to the many global challenges will only arise if collaboration between the three sectors creates new networks dedicated to finding and implementing solutions.

The question that has guided RMI's work from its inception is how can Americans, and all people, be safe and feel safe in ways that work better and cost less than present arrangements? Recent events have been called the first war of the 21st Century. Unfortunately, that "honor" goes to the many conflicts that continue to take lives around the world. Security—freedom from fear of attack or privation—is best achieved from the bottom up, not from the top down; by means that are the province of every citizen, not the monopoly of national governments; and without needing to use or threaten violence. It comes from making others more secure, not less, whether on the scale of the village or the globe. It is rooted in conflict avoidance or prevention; bolstered by conflict resolution; and backstopped by non-provocative defense, which can reliably defeat aggression without threatening others. This new security triad from *Security Without War*—a prescient 1993 RMI book by Hal Harvey and Mike Shuman—suggests that though there is a vital role for the military professionals with whom RMI has long worked (see "Battling Fuel Waste in the Military," p. 6), that role is poised for profound change in an increasingly dangerous, multi-polar, and polarized world.

The foundation of real security is global good-citizenship, fully engaged within an interdependent world of mutual interests. World War II arose from a resentful Germany punished for World War I. George Marshall didn't repeat that error; he strengthened and rebuilt Germany as a bulwark of democracy. We have vast rebuilding to do to reverse the poverty, inequity, and injustice that make people feel angry, powerless, and resentful. As Jeff Raskin remarks, "Putting the billions recently allocated [for military strikes] into feeding the hungry, teaching the undereducated, and healing the sick around the world would go further toward minimizing terrorism than anything else we could do with the money."

John Wimberly, of Western Presbyterian Church in Washington, D.C., writes of the spiritual dimensions of this challenge:

"Regardless of where one stands in the debate about the causes of wealth and poverty, Tuesday's terrorism leaves us no choice but to admit that fear, hatred, and violence increasingly define the relations between the rich and poor.

"Those who don't have wealth fear that their children's lives will be worse than their own. Anger grows as they watch their loved ones die of diseases that disappeared years ago in developed nations. Leaders who foster hatred of the developed nations suddenly sound reasonable.

"Those who have wealth grow increasingly fearful of the masses of poor people. They become resentful that their wealth does not give them the freedom and safety they once assumed it would create. Leaders who tell them that the poor are a threat to their well-being suddenly sound reasonable.

"It is a recipe for madness. A blueprint for mutual self-destruction. Where does it end? The world's major religions all agree that it is the responsibility of those who have to help those who do not ... What we do or don't do with our money is an issue of profound spiritual significance. The strong are supposed to help the weak.

"And isn't the well-being of others an important aspect of good economic policy as well? Impoverished people don't buy products. Uneducated people don't constitute a good workforce. Strong economies produce jobs that can enable the poor to build a better future ... Long-term economic self-interest requires attention to the needs of others.

"If both economists and the world's religions agree that self-interest and the interest of all are inseparably intertwined, what is the problem? The problem is fear, fear that morphs into hostility ...

"The opposite of fear is faith. Our daily lives are built on hundreds of large and small acts of faith. We have faith that when we get on a plane, it will take us to the scheduled destination; that when we sit in an office, we are safe; that the sun will set tonight and rise tomorrow.

"What is at stake today is whether we will live lives of fear or lives of faith. We live in a national and personal moment of truth."

We all have much work to do.

Shaping Our Response

Refugee Camps as a Model for Sustainable Settlement

by Eric Rasmussen, MD, FACP

In February 1994, Robert Kaplan wrote an article for the *Atlantic Monthly* entitled "The Coming Anarchy." That essay presented a clear and telling depiction of how scarcity, crime, overpopulation, tribalism, and disease were affecting the world's social fabric. The article impressed President Clinton, and the general acclaim helped propel Kaplan into a book-length expansion entitled *The Ends of the Earth: A Journey to the Frontiers of Anarchy* (Atlantic Press, 1996).

That book remains very useful reading. It is a bleak story, in the main, but it contains knowledge we need to acquire if we're to understand the world formed since the loss of the other superpower. Fortunately, as a fleck of copper within the gray sand of the tale, there is a story late in the book that helps relieve the despair. It tells of the Rishi Valley, near Bangalore in India. The valley's common cycle of poverty, degradation, and decline was arrested through unusual attention to husbanding local resources, restoring local hydrology, and educating the local community on the strengths and possibilities of their environment. The consequent transformation was remarkable and is serving as a model for restoration throughout southern India.

There are many places in the world where such a transformation would be welcome.

Eric Rasmussen

My wife and I lived in Haiti in 1985–1986, while I was on loan from Los Alamos National Laboratory. In Haiti I was struck by the poverty—although poverty is not unique anywhere—and by the ignorance, and still more by the bleak future of an agrarian society where there is no soil. I also became interested in the unintentional effects the United States can have on countries only briefly useful to us.

During those months in a remote corner of Haiti, I learned a little about the environmental damage wrought by the United States in pursuit of natural rubber near the outset of WWII. Then, as now, we were securing the materials required to sustain our national economy. But the native trees we cleared for the cultivation of new rubber plantations were not replaced when the rubber trees we planted failed to grow. The subsequent decades of tropical rainfall onto dead stalks and rootless dirt took the topsoil with the runoff. Haiti was then, and remains, an environmental and social disaster; a country mired in misery and unlikely to improve within our lifetimes.

With the history of U.S. intervention, and then our departure with nary a backward glance, Haiti resembles Afghanistan. We once supported both the people of Afghanistan and those from elsewhere who rose in support of the Afghan opposition to the Soviets. We armed and trained those we thought might serve as a bulwark for us in Central Asia, then we left them behind once our own ends had been met. We're now facing opponents in Afghanistan who once worked for us in that war, and the training we gave them created a formidable foe.

Afghanistan echoes that spiral of poverty and decline I found in Haiti, but with the added burdens of both war and civil strife. Understandably, many within Afghanistan are now worried about our response to the U.S. attacks. Tonight they are moving as quickly as possible out of our way, crossing borders in every direction. The UN High Commissioner for Refugees estimates up to a million will flee into Pakistan, 400,000 into Iran, and thousands more across the northern borders into Uzbekistan and Tajikistan, all arriving before Thanksgiving. The needs of that mass of humanity pose a genuine threat to the security and stability of the surrounding nations, each of which was only marginally able to manage the basics for it's own citizens before this onslaught. Wouldn't it be useful to find ourselves able to ease that refugee burden and perhaps establish a foothold for a more sustainable society in those new camps?

However, before we make any decisions on that sustainable society we need to know more about the young and the poor in the wastelands of that region. We need this knowledge because violent young men have come from there to us and expressed their views about our society. They have done it with calculated and deliberate malice against the innocent and unsus-

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pecting. Almost 6000 died in a few hours, roughly equaling our Vietnam dead in all of 1966. Nothing even remotely like this has ever happened in the West.

It now seems likely that Afghanistan is the geographical source of the violence visited upon us, although Al Qaeda cells in many countries may share in the guilt. Afghanistan is a very unfortunate, though hardly surprising, location. Should the United States choose to take an equally violent retribution there, it will be visited upon a nation and a people already on the edge of the abyss.

Few of us know much about Afghanistan. Brief perspectives from the news fail to recognize the depth, complexity, intensity, and sophistication of a culture so completely outside our ken. We may feel anger at the events of 11 September, but for many of us it is tinged with a dispassionate respect for an enemy who can live unnoticed within a despised society for years while preparing for a complex suicide. These men attacked the most powerful nation in the world using blades designed to open cardboard boxes, succeeded in their attack to a degree almost beyond imagining, shook social and economic foundations globally, and may well have tipped the United States into a financial recession. Current figures show that in the week after the attack, more than $1.4 trillion was lost from the world's financial markets. This from a combination of cardboard box-cutters and an unshakable will.

That "will" is a critical component in their success, and much of it is developed within a very limited educational system in the worst of circumstances. We in the West are only vaguely aware of Islamic schools. For many men in Afghanistan (women are excluded) those schools are now the only source of learning and advancement. Although the Taliban are not Afghan (and are viewed by many Afghans as unwelcome outsiders), they have forced on the native Afghans conformation to an extremist Islamic doctrine called *Wahhabism*. In the newly-established Islamic schools they teach the Wahhabi version of their faith, facets of which include the demonizing of us and of Israel, and the advocating of a self-sacrificing violence. Their doctrine and their opinions, in no sense excused, are shaped by the atrocities exchanged during the Soviet invasion of Afghanistan, by the brutality of the subsequent civil war, by the deaths of Palestinians in Israel, and by their daily life of violence, illiteracy, isolation, deprivation, and insecurity bred by poverty. They have continued to struggle in the face of environmental devastation and ever-dwindling resources having little but their faith to hold on to, and their belief system is deeper and more pervasive than almost anything we can understand.

To get a glimpse of the unfamiliar intensity and single-mindedness of fundamentalist Islam, remember the perhaps apocryphal story concerning the burning of the Library at Alexandria in Egypt. Alexandria was then (around 640 AD) the largest repository of papyrus books and Classical learning the world had ever known. Reportedly, the besieging Caliph Umar said, "If the books agree with the Koran they are superfluous. If they disagree, they are blasphemy. Burn it." And 550,000 irreplaceable manuscripts went up in smoke.

More than 1300 years later the Taliban decided that the very presence of ancient Buddhist sculpture within their sight was an insult to Islam. The sculptures were destroyed.

Such anecdotes may enlarge the separation we draw between "us" and "them," but that is not my intent. We in the United States recently appeared to be embarked on a somewhat isolationist voyage ourselves, taking our own measure of global agreements that we thought might not be in the best interests of the United States, and accepting participation with the world only if we thought it to our purpose. That is now altered significantly, and the Grand Coalition developing will probably force our cooperation globally in ways not envisaged on Inauguration Day 2001.

That change may be an opportunity. If we're now intending to cooperate with international partners toward common goals, a few rational humanitarians working in sustainable development could help that new cooperation move forward more effectively. And we would start with refugee camps. Thoughtful people with some experience in sustainable development can now describe better ways to develop a society, its communities, and its tools than we could ten years ago.

For transforming established communities we can learn from the successes in Curitiba, Brazil, detailed in *Natural Capitalism*. For the development of a community within challenging regions we have the examples of Gaviotas and the Rishi Valley. In describing ZERI (Zero Emissions Research and Initiatives) we can demonstrate a superior method for efficient, sustainable, and profitable business practices in a dozen places around the world. Within the projects coordinated through Rocky Mountain Institute we can show thirty successes that optimized each location for the people it contained. Michael Hawley at MIT established schools in Cambodia that have stimulated even the youngest pupils to learn. John Todd's Living Machines produce fresh water from sewage. And, to help us understand what it takes to succeed in a harsh and unforgiving environment, we have Janine Benyus, unfolding the elegant and appropriate engineering used by nature in *Biomimicry* (William Morrow & Co, 1997).

There are other valuable people, many of them friends and colleagues, all willing and able to create something helpful out of utter waste. We should recognize, though,

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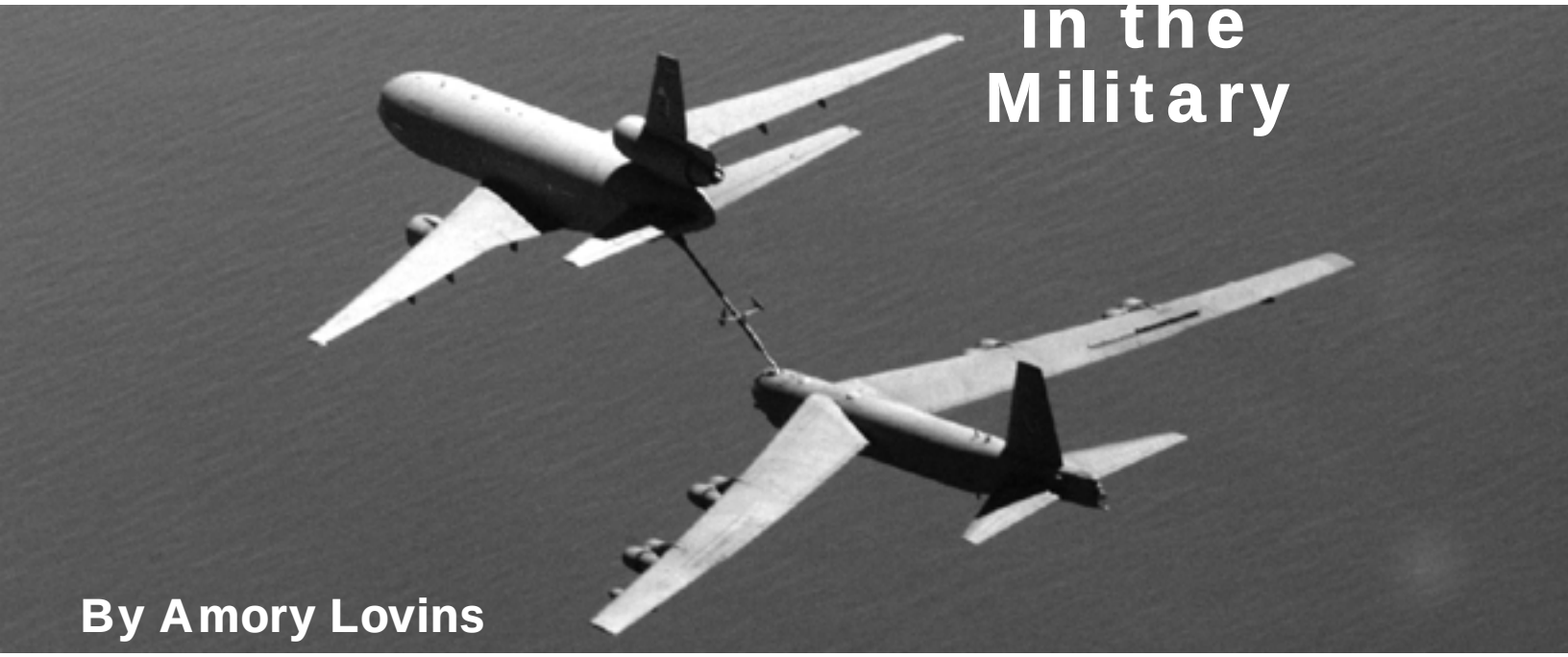
Battling Fuel Waste in the Military



By Amory Lovins

Aerial refueling of a B-52 bomber by a KC-10A.
Photo: U.S. Air Force

Most Americans are only too aware that their tax dollars support a massive military machine. The Department of Defense's annual budget is over $291 billion and rising. DOD has three million people, 36 million acres, over 250 major installations, 40,000 additional properties, 550 public utility systems, over 150,000 land vehicles, 22,000 aircraft, and over 300 ocean-going vessels.

But most of us don't realize that despite a 36 percent drop in total DOD energy use during 1990–99, chiefly due to force reduction, around $5+ billion of the military budget buys energy. Most of DOD's five billion gallons of annual petroleum use fuels weapons platforms—land, sea, and air—that are manifestly inefficient. To add a little irony, much of the fuel used by the military is exhausted moving fuel around. Of the gross tonnage moved when the Army deploys, 70 percent is fuel.

Since it was founded, RMI has welcomed opportunities to work with and learn from military professionals who pursue security goals by different means. RMI's pioneering work in the 1980s on nuclear nonproliferation, domestic energy vulnerability, and "least-cost security," attracted much attention in military circles.

In recent years, RMI's involvement with the military has expanded. In 1995, my brief to Naval leadership launched a series of collaborations, which between 1995 and 1998 saw RMI's Green Development Services helping the Naval Facilities Engineering Command (NAVFAC) overhaul how the Navy designs buildings. Nowadays, all bidders for NAVFAC contracts must be good at integrative design. RMI has also supported similar efforts for the Army in Texas and Illinois, the Marine Corps in North Carolina, and the Air Force in Colorado.

All of the Armed Services are variously adopting green design—not just to save money, but also to improve the quality of service life, which is critical to recruitment, retention, and operational effectiveness. And efficient buildings slow the conversion of tax dollars into climate change—perhaps the gravest threat to global security.

In 1999, our technical work with the military moved beyond buildings when I was invited to serve on an unclassified Defense Science Board Task Force. It sought to ascertain why the Defense Department is the nation's largest energy user (using one percent of all energy in the United States) and probably the world's largest oil buyer. Clearly, the Task Force would like to change that ranking.

Most of the things we looked at were not, as the saying goes, rocket science. It wasn't hard to decide that 0.56-mpg tanks and 17-feet-per-gallon aircraft carriers are just as unnecessarily wasteful as civilian gas-guzzlers. Through a hundred-odd briefings in a year and a half, the Task Force found more than a hundred effective fuel-saving technologies. None would impair and most would improve what the Defense Department is there for—warfighting capability. Much, perhaps most, of DOD's fuel could be cost-effectively saved. That tech-

nology assessment was the easy part. The harder question was why a capable meritocracy with more wants than funds hadn't achieved all the savings already.

The institutional reasons that trapped good people inside a dysfunctional system were complex, but they were rooted in false price signals due to a lack of activity-based costing. When weapons platforms are designed and bought, their fuel is assumed to cost what the DOD-wide supplier, the Defense Energy Supply Center, charges as its average wholesale price, fluctuating around a dollar per gallon (currently $1.34).

Further Reading:

- Lovins, Amory B. and L. Hunter. *Brittle Power: Energy Strategy for National Security*. Includes a foreword by President Reagan's Chairman of the Joint Chiefs of Staff and President Carter's Undersecretary of the Navy. Andover, Mass.: Brick House, 1982. Out of print; to be reposted at www.rmi.org. Summarized in "The Fragility of Domestic Energy," *Atlantic*, November 1983.
- "Nuclear Power and Nuclear Bombs," *Foreign Affairs*, 58:1136 (summer 1980), 59:172 (Fall 1980).
- Shuman, Mike, and Hal Harvey. *Security Without War.* Boulder, Colo.: Westview, 1993. A book credited with contributing to Gorbachev's revolution in Soviet policy.
- *The Defense Science Board's report More Capable Warfighting Through Reduced Fuel Burden* was released in May 2001 by the Office of the Undersecretary of Defense for Acquisition and Technology, Washington, D.C. 20301-3140. It was summarized in *Business Week*, 3 September 2001.

However, the cost of delivering that fuel to the platform is assumed to be zero. Logistics—moving stuff around—takes roughly a third of DOD's budget and half its personnel. But when designing and buying platforms, logistics is considered free to the platform that consumes the fuel. This practice understates delivered fuel cost by a factor that I estimate to average at least three for DOD as a whole, and tens or hundreds in some particular cases.

The venerable B-52 bombers now being flown by the children of their original pilots have inefficient, low-bypass engines from the 1960s. Those could be refitted to modern ones using a third less fuel to achieve up to half again as much range. But they haven't been, because the fuel is thought to be cheap. And so it is, when delivered in peacetime to a U.S. airbase, where delivery to the plane adds only about 20 cents a gallon. But when the plane is on the long-distance mission for which it was built, it typically needs midair refueling. That adds $17.50 a gallon, not counting the $9-billion cost of at least 55 tankers the Air Force would need to replace. Thus the Air Force in FY1999 paid $1.8 billion for two billion gallons of fuel, but delivering that fuel into the aircraft added another $2.6 billion, so the actual delivered fuel bill was $4.4 billion: the Air Force spent 84 percent of its fuel-delivery cost on the 6 percent of its gallons that were delivered in midair. If you count that delivery cost, re-engining the B-52s has a quick payback—all the more so because it typically makes midair refueling unnecessary!

The Army's formidable half-mile-a-gallon M1A2 tanks are powered by inefficient 1960s-design gas turbines that yield 1500 horsepower to make 68 tons dash around a battlefield at 30 mph (42 on the road). They do that pretty well. But 60- to 80-odd percent of the time, that huge turbine is idling at one percent efficiency to run a 5-kilowatt "hotel load," mostly air conditioning and electronics. Most civilian vehicles would use a small auxiliary power unit to serve such tiny, steady loads efficiently. Tanks don't, because their fuel was assumed to cost about a buck a gallon. But to keep up with a rapidly advancing armored unit on the battlefield, cargo helicopters may have to leapfrog big bladders of fuel hundreds of kilometers into theater, using much of the fuel to do so. The delivery cost can then rise to $400–600 a gallon—yet it was assumed to be zero. If the designers had known the real delivery cost, they'd have designed the tanks very differently.

Fuel-wasting design doesn't just cost money; it inhibits warfighting. Each tank is trailed by lumbering fuel tankers. An armored division may use as much as 20, perhaps even 40, times as many daily tons of fuel as it does of munitions—around 600,000 gallons a day. Of the unit's top ten battlefield fuel guzzlers, only Abrams tanks (#5) and Apache helicopters (#10) are combat vehicles. Several of the rest carry fuel. This takes a lot of equipment and people. The Army directly uses about $0.2 billion dollars' worth of fuel a year, but pays about 16 times as much, $3.2 billion a year, just to maintain 20,000 active and 40,000 reserve personnel to move that fuel. And unarmored fuel carriers are vulnerable. Attacks on rear logistics assets can make a fuel-hungry combat system grind to a halt. Yet the warfighting benefits of fuel economy—in deployability, agility, range, speed, reliability, and maneuverability—are as invisible as the fuel delivery cost.

Today's armored forces were designed to face Russian T-72s across the North German plain. Nowadays, however, their missions demand mobility. Only one 68-ton tank fits into the heaviest U.S. lift aircraft, so deployment is painfully slow, and when the tank arrives in, say, the Balkans, it breaks bridges and gets stuck in the mud. Army Research has a better idea—an innovative 7–10-ton version that uses about 87 percent less fuel, yet is said to be as lethal as current models and no more vulnerable. (The Army figures such redesign could save about 20,000 personnel—plus their equipment and their own

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All Energy Experts on Deck!

BY AMORY B. LOVINS

USS Princeton

Wandering around some Navy ships, I noticed that many design details were as inefficient as those in civilian buildings and equipment. Inefficient pumps fought against throttling valves; oversized motors and chillers ran suboptimally; operators lacked proper readouts and controls. How much energy, I wondered, is thereby wasted? Might the Navy unknowingly have energy-saving opportunities at least as big in its ships as RMI was finding in Navy buildings?

Calculations in the Defense Science Board Task Force confirmed that nearly a third of the Navy's nonaviation fuel goes to "hotel loads"—not to propulsion, radars, weapons systems, or aircraft-launching catapults, but to mundane pumps, fans, chillers, and lights. And based on some casual observations, much, perhaps most, of their energy seemed to be wasted.

To be sure, the Navy has different design imperatives than civilian architects: ships must go far and fast through all the world's climates, project power, protect crews, and fight through gales and missile strikes. Being shot at demands serious redundancy and special operational methods. Cramped space often makes pipes and ducts small and twisting, especially when whichever get installed second must snake around whichever got installed first. Nonetheless, there seemed much room for improvement, even though the Navy had already led all the Services in energy savings—partly by letting skippers keep for their own ships' needs half the fuel dollars they saved.

I discussed this hypothesis with Vice Admiral Denny McGinn, the dynamic Commander of Third Fleet (now Deputy Chief of Naval Operations) whom I had met a decade earlier while lecturing at the Naval War College. We liked the idea of an experiment: let's just go measure how a ship works and see how much energy we can save. The Admiral nominated as a testbed his own command ship, *USS Coronado*, but that converted amphibious support vessel was too atypical. A typical surface combatant was soon chosen instead—*USS Princeton*, a 9,600-ton, 567-foot, billion-dollar Aegis cruiser homeported in San Diego. With support from Navy Secretary Richard Danzig, the Office of Naval Research gave RMI a $50,000 grant to go see what energy-saving potential we could find. The Naval Sea Systems Command's able engineers had estimated that 19 percent could be saved on ships of this class, of which *Princeton* was in the top one fourth for efficiency.

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MILITARY ENERGY ▼

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in sum, billions of dollars a year.)

A little-known 1982 Army experiment suggests the potential value of even more radical lightweighting, possibly to a 0.7-ton version. When 30 tanks were set against 30 Baja dunebuggies armed with precision-guided munitions, the prompt result was 27 dead tanks (21 completely immobilized) and three dead dunebuggies. That exercise was done in desert, not forest or city, and not under chemical warfare conditions, but it's still enlightening. With different tactics, light and even ultralight forces may be more militarily effective than familiar heavy ones.

Recent tactical experience, from Iraq to Somalia, suggests that the Joint Chiefs' new doctrine emphasizing light, mobile, agile, flexible, and easily-sustained forces is vital to modern warfighting. Yet it's very far from most of the forces now fielded. Heavy-metal tradition dies hard, and porkbarrel politics impedes fundamental military reform.

Other policies inhibit capability as well. When I visited the Navy's newest nuclear aircraft carrier, I was startled to find that its design had been frozen 23 years earlier due to the cumbersome procurement process. That's a disadvantage of over 40,000-fold against electronic equipment that's subject to Moore's Law and bought at Radio Shack. Wargames suggest that an adversary with a few billion dollars' worth of up-to-date over-the-counter hardware could even beat the United States, which has excellent warriors but often outmoded equipment.

A sweeping revolution in military affairs is underway. The Defense Department is trying to jettison or bypass its antiquated procurement methods and buy commercial off-the-shelf equipment wherever possible—it's usually far more modern and capable, but much cheaper and often durable enough. Similarly, DOD is asking why it takes six months to plan a divisional deployment

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All Energy Experts on Deck!

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Above: The view from *USS Princeton* as she pulls over a fuel line to take on hundreds of thousands of dollars' worth of fuel from an oiler. On the far side of the oiler, another cruiser is fueled simultaneously. Photo: Chris Lotspeich.

RMI's Chris Lotspeich and three of RMI's consulting engineers—Ron Perkins and Ned Orrett (both ex-Navy men) and Jim Rogers—did two "floats" aboard *Princeton* to observe, study, measure, and learn about hotel loads from the officers and crew. Our preliminary survey found gratifyingly large potential savings: perhaps, if found feasible, as much as several times NAVSEA's expectations.

Princeton uses nearly $6 million worth of diesel-like turbine fuel each year. Her gas turbines, akin to those on an older passenger jet aircraft, use about $2–3 million worth of oil to make up to 2.5 megawatts of electricity, the rest for 80,000 horsepower of propulsion. The RMI team found that retrofitting motors, pumps, fans, chillers, lights, and potable water systems could save an estimated 20–50 percent of the ship's electricity. That could cut total fuel use by an estimated 10–25 percent—perhaps even 50–75 percent if combined with other potential improvements we sketched for propulsion and electric generation. (However, if the electricity-generating gas turbines weren't run differently, even heroic electricity savings would save little fuel, because they'd be offset by even less efficient operation of the underloaded turbines.)

Just as in civilian facilities ashore, the RMI team started by calculating what it's worth to save a kilowatt-hour. Since the electricity is being made inefficiently from fuel that's mainly delivered by "oiler" ships, the answer is an eye-popping 27 cents, six times a typical industrial tariff ashore. This high cost makes "negawatts" really juicy. For example, each percentage point of improved efficiency in a single 100-horsepower always-on motor is worth $1,000 a year. Each chiller could be improved to save its own capital cost's worth of electricity (about $120,000) every eight months. About $400,000 a year could be saved if—under noncritical, low-threat conditions—certain backup systems were set to come on automatically when needed rather than running all the time. Half that saving could come just from two 125-horsepower firepumps that currently pump seawater continuously aboard, around the ship, and back overboard. In a critical civilian facility like a refinery, where one wanted to be equally certain the firefighting water was always ready, one would instead pressurize the pipes (usually with freshwater) with a 2-hp pump, and rig the main pumps to spring into action the instant the pressure dropped.

Princeton's total electricity-saving potential could probably cut her energy costs by nearly $1 million a year, or about $10 million in present value, while improving her warfighting capability. (A ship that burns less fuel can go farther and faster between refuelings, and emits less conspicuous signatures to announce her presence.) The Navy has 27 ships of this class, 317 in total (surface and submarines, fossil- and nuclear-fueled), most with analogous designs and operations. RMI has invited the Navy to tear our conclusions apart, and, if they find them useful, consider implementing them just as aggressively as, in the second half of the '90s, they adopted RMI's recommendations for green building design.

Maybe those who seek offshore oil resources beneath fragile seabeds are drilling in the wrong place—under the ocean rather than atop it. Aboard the U.S. Navy's ships, it seems, are rich reserves of "negabarrels." Exploiting them will save hard-earned tax dollars, reduce pollution, and improve our nation's security and prosperity. You might call this approach applied patriotism.

Cleaner Energy, Greener Profits

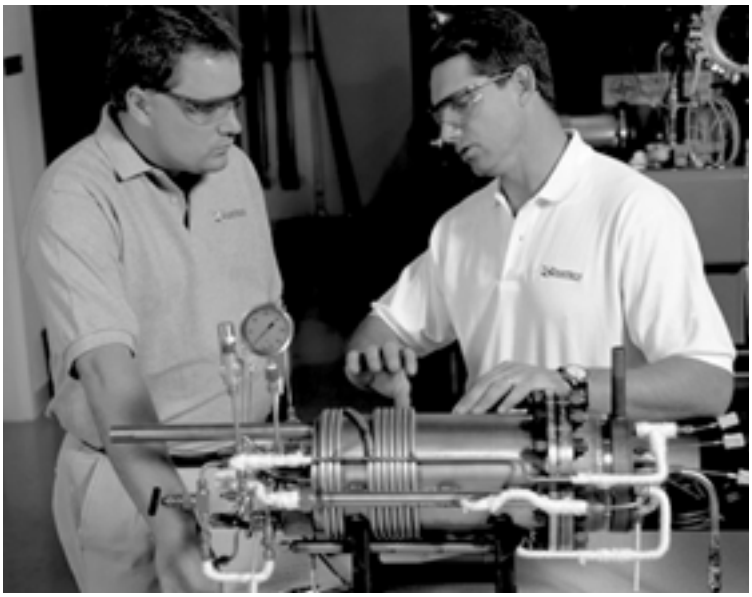
Fuel Cells as Cost-Effective Distributed Energy Resources

By Joel Swisher

The recent electricity crisis in California has focused attention on the option of generating electricity from small, decentralized sources, collectively known as distributed generation (DG). The changing structure of the electric industry and the continuing development of new technology have also made DG options more attractive. One promising DG option is the fuel cell, which converts fuel to electricity at high efficiency without combustion and with negligible emissions. Several different fuel cell technologies are under development and commercialization for various stationary and vehicular applications.

Market conditions in the electricity industry are changing in favor of DG technologies such as fuel cells. Strict environmental constraints on power production are inevitable, as electric generation produces a large share of local and global pollution. The restructuring of the industry is causing power markets to diverge into two groups of customers, those who demand a low-cost commodity and those who demand electric service with a high level of reliability. The emergence of the digital economy is driving the demand for premium-reliability power, and many customers are willing to pay for it. But they can't get premium power from a central power plant because the grid in between is too unreliable.

New DG technology is making it more feasible and less expensive to produce power near the customer. Also, new technologies for controlling, switching, and storing energy are enabling the transition to DG by improving efficiency and reliability. Falling costs of fuel cells will make them increasingly competitive with conventional power sources. In fact, careful study of the economics of power delivery suggests that cost-effective applications already exist. These early markets can lead to commercialization paths that will bring fuel cells into mainstream use in buildings and vehicles.



Idatech employees discuss design of a methanol fuel processor developed for a residential-sized fuel cell system. The final product, a washing-machine-sized unit, will produce three to four kilowatts of clean energy. Photo: courtesy of IdaTech

The main benefits of such DG technologies as fuel cells can be divided into five categories.

First, small scale and modularity provide added value by offering the ability to put in place as little or as much generating capacity as needed, but no more. The value derived from this increased flexibility, called option value, is based on shorter lead time and decreased risk of overbuilding, which reduce financial cost and risk.

Second, DG sources can provide substantial cost savings if they are sited where (and when) they can prevent or defer pending investments in utility distribution capacity.

The third, and related, benefit is engineering cost savings from reduced losses, improved voltage stability and power factors, and longer equipment life.

Fourth, by providing an independent power source near the customer, DG can improve the reliability of electric service to customers where the reliability of power is critical. Premium reliability can have a very high value in such sensitive industries as data storage, semiconductor manufacturing, and many conventional industries as well. (Although the digital economy is driving demand for increased power reliability, this growth does not translate into increases in the *amount* of electricity needed, as a coal-industry disinformation campaign had led many to believe.)

Finally, fuel cells are among the cleanest DG technologies, and their environmental benefits allow them to be sited very flexibly. This siting flexibility makes it more feasible to capture other DG benefits, such as premium reliability and distribution cost savings, which depend on the proper siting of DG sources in relation to customer demand. Thus, promising near-term applications are in emission-limited areas where there are

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GONE FISSION?

By L. Hunter Lovins and Amory B. Lovins

Buoyed by a supportive White House, growing climate concerns, temporarily high gas prices, and California's electricity mess, the nuclear industry is running an all-out public relations campaign to resuscitate its product. It ignores one crucial fact: nuclear power already died of an incurable attack of market forces. As *The Economist* recently concluded, once touted as "too cheap to meter," nuclear now looks "too costly to matter."

Overwhelmed by huge construction and repair costs around the world, nuclear plants ended up achieving less than 10 percent of the capacity and one percent of the new orders (all from countries with centrally planned energy systems) officially forecast a quarter-century ago. The industry has suffered the greatest collapse of any enterprise in industrial history.

RMI's primary objection to nuclear is its failure to pass the market test. But it is troubling that the nuclear industry is still dismissing legitimate public concerns about the risks of a technology so unforgiving that, as Nobel physicist Hannes Alfvén wrote, "No acts of God can be permitted." Each nuclear plant, through accident or malice, could release enough radioactivity to threaten a continent. The industry correctly claims that this is extremely unlikely, while many citizens equally correctly point out that it has happened, and that it can happen again. But let's take the industry at its word. If nuclear power plants are so safe, then why would the industry build and run them only if the federal government passed a law (the Price-Anderson Act) limiting liability in major accidents? Why should the nuclear industry enjoy a liability cap that reduces its incentive for safety, distorts choices with a vast subsidy, and is unavailable to any other industry? Shouldn't nuclear operators self-insure and put their money where their mouths are, or buy insurance at market prices like everyone else? The exemption law's expiration in 2002 presents an awkward dilemma for advocates of both nuclear power and free markets.

Citizen opponents are also correct that scientists still haven't developed reliable ways to isolate nuclear wastes and decommission plants, which remain dangerously radioactive for far longer than societies last or geological foresight extends.

And as we wrote in the summer 1980 *Foreign Affairs* ("Nuclear Power and Nuclear Bombs"), nuclear power's gravest risk is that power plants provide ingredients and innocent-seeming civilian cover for the development of nuclear bombs, as was the case in India and elsewhere. However, after decades' proof that reprocessing nuclear fuel — which separates out vast amounts of pure bomb materials — is also unprofitable, unnecessary, and a complication to nuclear waste management, the White House has recently proposed to revive it.

But RMI's approach has always been that if nuclear power is uneconomic, we need not argue about whether it is safe. "If a thing is not worth doing," said economist John Maynard Keynes, "it is not worth doing well." Leaving aside bomb-spreading, wastes, sabotage, and uninsurable accidents, nuclear power is simply uncompetitive and unnecessary. After a trillion-dollar taxpayer investment, it delivers little more U.S. energy than wood. Globally, it produces severalfold less energy than renewable sources. The market prefers other options. In the 1990s, global nuclear capacity rose by one percent a year, versus 17 percent for solar cells (24 percent last year) and 24 percent for windpower. Indeed, worldwide, windpower has lately added about 5,000 megawatts a year, as compared with the 3,100 new megawatts nuclear power averaged annually in the 1990s. The decentralized generators California added in the 1990s have more capacity than its two giant nuclear plants—whose debts triggered the restructuring that created that state's current utility mess.

Enthusiasts claim new-style reactors might deliver a kilowatt-hour to your meter for five cents, vs. 10–15 cents for post-1980 nuclear plants worldwide. (Of that 10–15 cents, nearly three cents pays for delivery, about two cents for running the plant, and the rest for its construction and for occasional major repairs.) But on the same accounting basis, superefficient gas plants or windfarms cost only 5–6 cents per kilowatt-hour, cogeneration of heat and power often 1–5 cents, and efficient lights, motors, and other electricity-saving devices under two cents, often under a penny. Cogeneration and efficiency are

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Insurmountable Opportunities?

STEPS AND BARRIERS TO IMPLEMENTING SUSTAINABLE DEVELOPMENT

By L. Hunter Lovins and Walter Link

The world has experienced significant developments since its leaders last gathered for an Earth Summit in Rio. There has been progress towards the goals, and yet in many ways the situation has become worse rather than better. More than ever, an urgent need remains for both comprehension and action.

The Biggest Challenge: Loss of Ecosystem Services

Perhaps foremost, there is no longer any serious scientific disagreement that every known ecosystem on the planet is in trouble. "There are considerable signs that the capacity of ecosystems, the biological engines of the planet, to produce many of the goods and services we depend on is rapidly declining," states a report prepared by the UN, the World Bank, and the World Resources Institute. According to the report, half the world's wetlands have been lost in the past century, half of the world's forests have been cut down, 70 percent of the world's major marine fisheries have been depleted, and all of the world's coral reefs are at risk.

There is a growing realization that the environmental problem is not so much a polluted river here or a release of a particular toxin there, but the worldwide loss of ecosystem services, the natural capital that enables the planet to sustain life. The processes that cycle nutrients and water, regulate the atmosphere and climate, provide pollination and biodiversity, rebuild topsoil and biological productivity, control pests and diseases, and assimilate and detoxify society's wastes are supplied by such ecosystems as estuaries, coral reefs, forests, grasslands, oceans, etc. The free and automatic services from these ecosystems provide tens of trillions of dollars of worth each year—more than the global economy. But their value is nowhere reflected on anyone's balance sheets. Their loss is dooming many species, but is ignored in reports from Wall Street.

The cost of destroying ecosystem services can be staggering. In China's Yangtze basin in 1998, for example, upstream deforestation triggered flooding that killed 3,700 people, dislocated 223 million, and inundated 60 million acres of cropland. That $30 billion disaster forced a logging moratorium and a $12 billion crash program of reforestation.

The Next Industrial Revolution

At the same time, we stand on the threshold of changes almost unimaginable to us, a historic shift between all that has happened since the first industrial revolution and the next industrial revolution. Why now? Perhaps because of the gravity of the situation. Abba Eban once said, "People and nations behave wisely—once they have exhausted all other alternatives." But fundamental economic shifts are also underway. The first industrial revolution grew out of conditions in which the scarcity of skilled labor was limiting material progress. All of our institutions today, from tax codes to mental models, derive from an attempt to penalize the use of people and encourage and even subsidize the use of natural resources to increase labor productivity. Businesspeople responded to the incentives in front of them and helped to create the present economic and environmental conditions.

Now, when 10,000 more people arrive on earth every hour, what is scarce is not people. Today more people are chasing after fewer jobs and natural resources. The limits to economic growth are coming to be set by scarcities of natural capital, not by the scarcity of human labor that characterized the first industrial revolution.

Business is the cause of most environmental challenges, but it is also the only institution left on the planet large enough, well managed enough, and resourceful enough to solve the problems facing us. Increasing resource productivity, at the same time, has the potential to solve most of the environmental challenges that the world's nations must address. Companies like Interface—which has made a fundamental commitment to sustainability and now makes 27 percent of its operating profits from eliminating waste—have demonstrated the success of these concepts. There are other corporate leaders, too, and their exemplary roles are encouraging.

Five Achievements Since Rio

1. The Rise of Corporate Social Responsibility

Increasingly, major corporations are realizing that to retain credibility they must make clear to their customers that they have made a commitment to environmental responsibility and that they intend to live by this commitment. This is a significant enough trend that the Dow Jones Sustainability Group Index now tracks the performance of the top 10 percent of the leading sustainability-driven companies in the 2,000-company Global Index.

2. The Rise of Civil Society

At the same time that corporate efforts to promote sustainability are increasing, civil society is gaining in strength and capability. North America and Europe have long had a

vibrant civil society, but the past decade has seen a dramatic increase around the world in the number of groups addressing the challenges of sustainability. Also, consumers are increasingly voting with their dollars, favoring companies that they perceive are socially and environmentally responsible.

3. The Advent of Socially Responsible Investing

Socially Responsible Investing (SRI) predates Rio, but since Rio, the SRI movement has matured to the extent that a 1999 study by the Social Investment Forum estimated that well over two trillion dollars is invested in the United States alone using some social criteria. A 1999 report on responsible investing in the United States reported that one out of every eight dollars under professional management was part of a socially responsible portfolio.

4. The Creation of Standards and New Forms of Measurement

The gross domestic product, or GDP, the traditional measure of financial activity, is widely acknowledged to be useless for measuring whether society is better off. The GDP operates like a business income statement that adds expenses to income instead of subtracting them.

Several new indices are now used to measure the quantity of products and services consumed and assess progress toward sustainability.

5. NGO, Business, and Government Coalitions

The complex nature of the issues of sustainability means that no one set of experts has a monopoly on solutions, or the ability to impose them. Coalitions of government, businesses and non-governmental organizations (NGOs) are arising to work together to design and implement solutions that are more sustainable and more appropriate to their circumstances.

Editor's note: This article is a condensed excerpt from Hunter Lovins's and Walter Link's recent paper "Insurmountable Opportunities." The paper was written at the invitation of the United Nations in preparation for 2002's Rio+10 Global Summit on sustainable development in Johannesburg, South Africa. Lovins and Link were part of a 25-person expert group to contribute to the agenda-building process. The full text is available at www.rmi.org/sitepages/pid178.php.

Five Challenges and Solutions

1. Restructure the World's Economies from Devastating to Sustainable

The accomplishments listed above are sources of hope, but are only tentative steps towards creating a sustainable world. The hard truth is that even companies most dedicated to the ideals of sustainability are still polluting, and struggle to make a profit in an economic system that is predicated on logic that makes the present system unsustainable.

At the most fundamental level, the whole system within which decisions are made needs to be restructured so that the inevitable logic of the system leads to sustainability, not away from it.

Overcoming these formidable challenges will require the following actions:

a. Clear statements by world leaders recognizing we are in a crisis;

b. A restructuring of regulations at all levels of government to help reorient the natural flow of economies in such a way that sustainability becomes the outcome inherent to the new system;

c. A new approach to problems and solutions from a whole systems perspective; and

d. A serious commitment by governments to identify and overcome barriers and resistance to change.

2. Near Certainty of Climate Problems and Water Shortages

There is now indisputable evidence of global warming, but there seems to be a paralysis among some nations preventing them from adopting meaningful solutions. Climate will become less stable for at least the next few decades, probably at an increasing rate. This will mean unprecedented floods, droughts, more frequent and severe storms, major insurance losses, local and regional famines, the spread of serious diseases to new areas, and more political instability and refugees.

Climate change has resulted largely from using energy in ways that are economically inefficient. It is a problem that we needn't have and that it's cheaper not to have, because saving fuel costs less than buying it. As a result, the private sector is contributing the most to reversing the problem. Private-sector leadership is driven as much by direct profitability as by climate concerns. By 2010, the world's sixth-biggest chipmaker (STMicroelectronics) aims to emit zero net carbon dioxide and equivalent gases, while DuPont intends to emit 65 percent less than it did in 1990—all in the name of increasing shareholder value.

3. Environmentally Caused Spread of Disease, Human and Animal Epidemics, and Other Health problems

A combination of factors—from climate change and increased globalization to modern agricultural and industrial practices—has made it essentially inevitable that there will be a continuing series of epidemics and affronts to health. For example, climate change is allowing diseases and parasites long thought confined to the South, such as the West Nile Virus, to migrate north.

Synthetic substances and diseases that degrade the fertility and immune competence of the population are of special concern, as pathogens, co-evolving under the selective pressure of ubiquitous antibiotics, increase their predation on dense human monocultures.

Chemists and designers have plenty of talent to invent these improvements if

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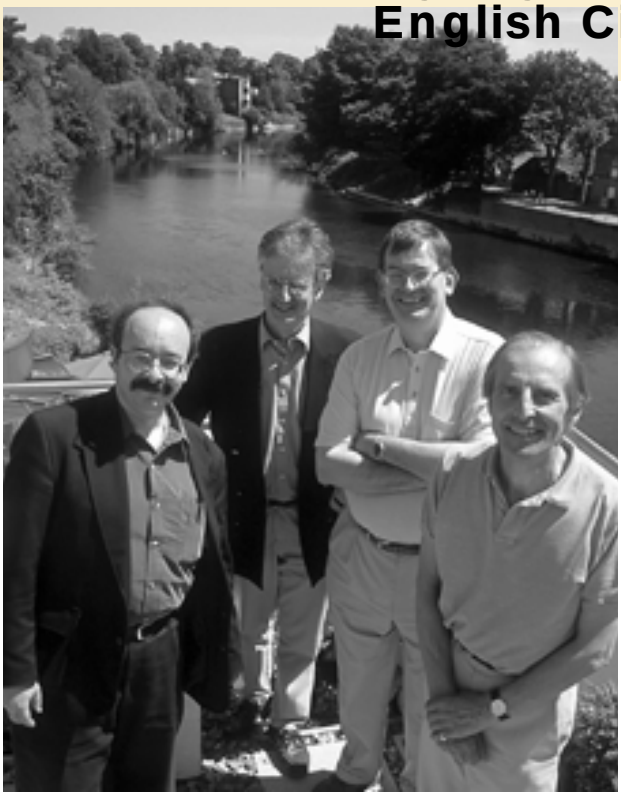
by Cameron M. Burns

Changing the World—an Apple a Day

English Cidermaker Aims for Lofty Ideal



Left to right: RMI's Amory Lovins with Peter Savidge, Director of Holme Lacy College; Ian Kirkhope, Bulmers's Group Operations Director; Esmond Bulmer, a Founder and Trustee of the Bulmer Foundation and former Chairman of Bulmers. The River Wye, one of Bulmers' many community concerns, is behind. Photo: Cameron M. Burns

Duncan Green doesn't have epiphanies every day. In his position overseeing much of the processing operations for HP Bulmer Ltd. (aka Bulmers), the top English hard cidermaker, he sees a lot of things that he might do differently. But during a late-May sustainability charrette (an intense design and strategic planning workshop) in which the entire firm re-examined its operations, he had a major revelation.

Duncan's epiphany came after he learned about agricultural symbiosis. More specifically, Duncan, an apple man, learned that certain crops grow well on the waste from other crops. Bulmers produces some 10,000 tonnes of apple tree prunings each year, which are currently burned as waste. Gunter Pauli, a Belgian entrepreneur, Director of ZERI (Zero Emissions Research and Initiatives) and RMI network member, explained to Duncan and his colleagues that these prunings can be used as an agricultural substrate, and could, depending on the crop, yield (out came the calculator and pencil—click-click, scratch-scratch) … £10 to £20 million (wholesale) worth of other agricultural products.

"That wholesale value is actually larger than the value of the apples we grew on the trees in the first place," Duncan said during the charrette, which was held in a Hereford restaurant/conference center on the banks of the River Wye. Duncan liked these numbers. Everyone liked these numbers. And nearly everyone at the event sank into deep thought about agricultural products that didn't look anything like your typical apple. In their visions fruits, vegetables, nuts and grains began growing under apple trees along Herefordshire's backroads; tubers, legumes, fibers and fungi were being sold in the town market through a Hereford Farmers' Cooperative; and "Hereford's Best" became a world-recognized agricultural brand. By the end of the charrette, Bulmers' Marketing Department even planned the appointment of a Marketing Manager for non-apple products.

The concept of converting apple tree clippings from a costly waste—collected, burned, and sent into the atmosphere as a pollutant—into a revenue generator (other foodstuffs) that would likely outpace the original product was just one of many realizations that Bulmers employees and managers had during a four-day sustainability charrette convened by RMI.

RMI leads several major charrettes annually, but the Bulmers charrette (titled "Building a Sustainable Herefordshire") was one of the Institute's most important jobs to date. Most companies that host charrettes target specific aspects of the company: individual buildings or products or equipment or process areas. For Bulmers, RMI was looking at sustainability throughout the entire firm. It was a top-down rethinking of the entire corporate culture—a watershed moment for Bulmers and for the community of Hereford, England. This charrette was also something of a watershed event for RMI, as it was our first whole-systems-oriented charrette.

RMI's role with Bulmers was one of supporting and steering an obviously deep-seated company desire to become "sustainable." Bulmers' Charlie Bower, whom RMI's Amory Lovins calls "the most effective corporate change agent I know anywhere" had somehow gotten it into his head that Bulmers should become a corporate name indelibly linked to the goals and qualities of sustainable business.

More specifically, Charlie's goal is to make Bulmers the leading sustainable producer of beverage raw materials in Europe, and the catalyzing agent in Herefordshire's emer-

gence as a model sustainable, rural-based community.

All these goals had been previewed at the company's last annual general meeting. As the now-famous story goes, Bulmers' CEO was waxing poetic how the firm aimed to keep on earning big returns for shareholders, but surely there was more to it than that. *Why*, he asked, *are we in business?* Whereupon a cheeky entertainer got up and amplified the message: "Saying the purpose of a business is to earn returns for shareholders is like saying the purpose of life is breathing." He then breathed at the audience for a minute or two—and added, "A bit boring, isn't it?" Whereupon the CEO announced that as Bulmers strove to become a leader in sustainable business for fun and profit, everyone would be offered expanding opportunities to make their lives, their communities, and the world better. The response at all levels has been enthusiastic.

The company has established objectives of a 75 percent reduction in the environmental impact of transport by 2002; zero waste emissions from Bulmers, Hereford by 2003; and a 75 percent reduction in energy consumption by 2005. In late May 2001, Bulmers, RMI and our project partners rolled up our collective sleeves and got down to work.

Starting Out Right

HP Bulmer & Co. was founded in 1889 by brothers Percy and Fred Bulmer, who were geniuses in their respective areas: Percy in perry (from pears) and cider production and factory organization, and Fred (whether he liked it or not) in selling.

Percy and Fred weren't just good at making cider and perry. They were experimenters. They tried various machines in their plants. They examined every known and imaginable method for producing drinks. Percy sailed to the Continent regularly to examine things as diverse as champagne manufacturing techniques, bottling techniques, and sugar beet processing—all of which would become "the foundation of the firm's ultimate supremacy," as L.P. Wilkinson wrote in *Bulmers of Hereford*.

They were also socially conscious men, with a keen awareness of the community and their place in it. Fred was instrumental in the creation of the National Association of English Cidermakers and was heavily involved in education, healthcare, women's rights issues, housing, and law and order. He helped start programs for affordable worker housing; he helped found several schools; he fought to raise the minimum wage; he was even known to visit sick employees while strolling around town.

Charlie Bower

Innovative, daring, willing to experiment and fail, willing to apply new techniques, and ultimately willing to offer help to those around them, from other cider manufacturers to employees and neighbors—the company was *different* because Percy and Fred were *different*. Cidermaking might've have been their business, but that was just the economic engine that powered a raft of other activities.

More than a century later, the world is a very different place. Certainly the social ills that were Fred's great concerns still exist, but they are just one of many problems humans on an overused planet are facing. Worldwide, natural capital is now in decline and international solutions are critical. In rural Hereford, they include the loss of agricultural land for family farming, increased presence of pesticides in natural ecosystems, a community that is increasingly moving away from family farming (largely because the rising generation has little interest in agriculture), increasingly congested highways, a declining river ecosystem, and to add insult to injury this year, millions of animals slaughtered to stop Foot-and-Mouth disease.

Charlie Bower isn't the only one aware that the great heyday of Percy and Fred is gone. Esmond Bulmer, Percy's grandson, and Hugo Bulmer, Percy's great-grandson, agree. They know Bulmers can and probably should try to regain that high community mantel on which their ancestors sat. They also know that such community nurturing is just one facet of a responsible 21st century corporation, and have been exploring ideas and strategies with Forum for the Future (a U.K.-based nonprofit consultancy similar to RMI), Breakthrough Technologies, and the Bulmer Foundation.

Bulmers' sustainability charrette, facilitated by Rocky Mountain Institute, was designed to draw out ideas for sustainability activities in eight areas of the company's operations and to assess which measures offered the most significant advantages in social, environmental, and economic terms.

Riding the Plumbing Range

In one of his previous incarnations, RMI's Amory Lovins was probably a plumber, a cowboy of pipes, pumps and valves. Although today he might be an internationally recognized energy expert and leader of an efficiency revolution, he's still a plumber at heart. And when he rides into town, poorly-designed and badly-sited pipes, pumps, valves and processing machinery of all shapes and sizes had better look out.

Amory was at his plunger-slinging best at Bulmers' processing plant, during a tour the day before the charrette. In its most basic essence, cidermaking really is about the ebb and flow of liquids and semi-solids. After apples are grown, they are milled and pressed for juice. This used to be done with flat, round millstones, but today is performed by large metal machines that look remarkably like oversized washing

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ASK ROCKY

by
Rick Heede

Of Chickens and Kings

Dear (All) Rockies,

Natural capitalism and the "Soft Path" approach to energy provide a realistic way of combining our natural desire to enjoy life with maintaining the resources on our habitat. This approach was sternly endorsed in your article on Kyoto in the summer newsletter.

But there was a strong hint, also, that Chicken Licken is alive and well when it comes to the sky falling over climate change and greenhouse gases. Is the climate changing? Is CO_2 damaging? I doubt both. I suspect that when Chicken Licken gets to the king, she will find he has no clothes!

Global warming hasn't settled in Down Under yet. We are suffering a near record cold winter—made worse by the effects of some lunatic changes on power generation and sale as in California. Not so the New York summer—no doubt it is reminiscent of the "good old days."

Greetings from the land of the kiwi.

Ken Nichol

Christchurch, New Zealand

Dear Ken:

Thanks for your response to our article and your support of our work.

I cannot say with certainty, even to myself, that the climate is changing. All I can rely on is (a) anecdotal information about weather (most folks I ask believe the weather is changing, based on where they have lived for decades), (b) personal observation over 40+ years (I concur), and (c) the assessments of a bunch of smart folks (the vast majority of whom have scientifically concluded that the climate is already changing and this change is likely to accelerate). Clearly, there is a difference between changing weather and changing climate, but at some point there is a convergence. Mistrust of experts is often justified, and you may trust whom you please. I choose to trust the experts I have read, spoken to, and worked with for years, all of whom can tell me volumes about how the climate has changed and who are convinced that great changes are afoot, even if we start to reduce emissions immediately. The 2,000 or so scientists of the International Panel of Climate Change and the U.S. National Academy of Sciences also agree (see reference to the recent NAS report below). There are so many convincing metrics: increased frequency and severity of storms (even if you ignore their rising economic damages), the global temperature record, the ice-shelf response, the arctic polynyas and ice sheet thickness, the earlier springs, migrating cloud forests and disease vectors, the ecosystem and biological responses (migrations, feeding, and mating behaviors), the decreased transport of warm waters in the Gulf Stream, the warming of the world's oceans from the surface to 3,000 meters, and so on. None of these changes, in isolation, prove that climate change is occurring. Yet in aggregate, these and hundreds of other changes come increasingly close to proof. Not absolute proof, whatever that is, but proof beyond a reasonable doubt.

But let's assume that our concern is misplaced: the climate is not changing. RMI therefore focuses on the profitable, "no-regrets" measures and hews close to the Precautionary Principal. We can accomplish much as citizens, communities, and companies that benefit the public weal and private interests whilst reducing greenhouse gas emissions, regardless of whether climate change is real or chimeric. Multiple benefits can be reaped from the same investments: lower SO_2, less crop and fisheries damage, reduced mortality from particulates, greater economic efficiency, more money kept in your own community, lower interest rates, a cleaner city (Christchurch could use cleaner air), corporate profits, lower bills, a better chance to distribute the benefits of clean technology to the three billion of us without access to power and potable water, reduced need for nuclear power (as if there's a need for it anyway), etc.

The radiative changes we have added and will continue to add to the atmosphere appear indisputable to me. I would be very surprised indeed if stirring such a complex pot would not yield, as Paul Hawken puts it, "global weirding." A record cold winter in New Zealand seems perfectly in line with expecting change to be all over the map. It is, after all, the surprising surprises for which we cannot prepare that will be the most interesting, not to say damaging.

Thanks again, Ken.

Cheers, Rick

P.S. Let me know if you spot any nude kings.

P.P.S. You can download NAS/NRC's "Climate Change Science: An Analysis of Some Key Questions" (the report requested by the White House in May 2001) at http://www.nap.edu/catalog/10139.html.

Visitors Extraordinaire

By Marty Pickett, Executive Director

Long before I became executive director, I often heard or read of important visitors to RMI or world leaders who were interested in RMI's work—legendary scholars, innovative scientists, famous writers and thinkers, and a cross section of politicians the likes of whom the U.S. Capitol seldom sees. Now, I know firsthand how fascinating RMI's work is to many people, as demonstrated by the number and caliber of visitors to our offices in Old Snowmass.

First, it's not just a coincidence that many important people are able to stop by RMI while visiting the Roaring Fork Valley. Amory and Hunter intentionally set up shop in Old Snowmass almost 20 years ago partly because it's near Aspen. With the Aspen Institute, the Aspen Center for Physics, the Given Institute, and dozens of high-quality seminars, meetings and conferences each year, many of the world's great minds congregate there.

Many come out to RMI, too, or learn more about us because of our presence in the Valley. Over a cup of coffee or during a tour of our energy-efficient facility, a casual conversation about a global issue might lead to a cutting-edge paper, lecture, book, or demonstration project on a specific topic. While you might hear more and more about RMI's research and consulting work, in this newsletter and, various media including journals and corporate literature, our strategic influence is as great as ever. That's because we agree with the late Dana Meadows who said the most effective intervention in a complex system is to change the mindset of the people who make the rules!

Who might a typical RMI visitor be, you ask? I'll try and describe a few, since they are anything but typical. During a roughly two-week period in late July and early August, we hosted Peter Senge, author of *The Fifth Discipline* and a founder of the Society for Organizational Learning, as well as Gunter Pauli, a Belgian entrepreneur, author, and founder of Zero Emissions Research and Initiatives. A group of editors from *Fortune* magazine hosted an event in Aspen with the "100 Smartest People We Know," including our own Amory Lovins. Then Amory hosted a half-dozen of those smart folks at RMI. Sir Mark Moody-Stuart, just-retired Chairman of the Committee of Managing Directors of the Royal Dutch/Shell Group, came to talk to Amory and Hunter. Amory and Hunter also spent time with their friend Bill Joy, chief scientist at Sun Microsystems. Dan Durett, Director of Minority Programs for the National Council for Science and the Environment, came by to talk about how we can collaborate to get RMI's messages into programs at minority colleges and universities.

President Clinton scheduled time at RMI when he recently visited Aspen, and spent well over an hour chatting with several RMItes, learning more about our work. As a great supporter of the book *Natural Capitalism* while in office, he asked his staff to read the first galley proofs, and continues to recommend it in his speeches.

Although these great meetings of minds (and meetings of great minds) are day-in, day-out activities for RMI, I'm not listing them here to impress you. Rather, I hope you're encouraged by some of the "behind the scenes" discussions that RMI is regularly involved in about various global concerns. Unfortunately, the planet's problems are so big and growing so quickly, that if leaders—at all levels—don't address these issues now, we face a bleak future. If RMI's work and thinking helps motivate or facilitate these discussions, we're a step closer to satisfying our mission. I hope we can use our influence, at all levels, to help find the absolute best solutions to some of earth's great challenges.

P.S. As RMI faces its greatest strategic influence challenge ever, after the events of 11 September, our management, staff, and Board of Directors are examining ways in which RMI can be involved in demonstration projects that can directly benefit those areas affected—from working to make refugee settlements more sustainable to being part of a team to design efficient, secure, and sustainable structures to replace the devastation in lower Manhattan. Meanwhile, we all suffer as you do from our desire to "do more." Albert Schweitzer said it best: "Just as the wave cannot exist for itself, but must always participate in the swell of the ocean, so we can never experience life by ourselves, but must always share the experience of life that takes place all around us."

WHAT ARE YOU DOING?

Editor's note: Our first installment of "What Are You Doing?" features our summer 2001 interns, some of whom filled internship positions made possible by contributions from generous donors. If you are interested in supporting one of these funds, or creating a new one, please contact Development Director Dale Levy at 970-927-3851 or dalelevy@rmi.org

Jennifer Atlee

(Phillip Austin Semmer Memorial Internship)

Jennifer Atlee

Is your community wary of investing in innovative projects without proof of success? Several of us at RMI are currently working on a "Community Opportunity Finder," which will provide communities with evidence that sustainable development projects will work for them. This new web tool is designed to mimic an expert consultant's preliminary analysis, without the consultant's expense. Kate Parrot and I are developing the prototype module about energy, which will provide the user with hard numbers for the jobs created, and the dollars and pollution saved, by implementing the recommended programs.

Ryan Bennett

(Neal McBurnett and Holly Lewis Internship)

Ryan Bennett

My work at RMI focuses on integrating natural capitalism into business. More specifically, I'm working on a project that focuses natural capitalism principles on Chicago-area businesses. Chicago is ideal because of a plethora of manufacturing and industrial facilities. My work includes creating a "checklist" that an RMI auditor can use during a facility walkthrough to ask targeted questions and suggest cost-saving and environmentally superior solutions. This tool can be continuously refined and tailored to different types of facilities—everything from machinery manufacturers to breweries.

Eliza Eubank and Sarah Stokes

(David Tice Memorial Internship)

Eliza Eubank & Sarah Stokes

Current agricultural practices are often in conflict with maintaining a healthy ecosystem. Our main goal as interns with RMI this summer is to create a model where the two work together. We have developed an intensive grazing program with a herd of 35 cows on the 957-acre Windstar Land Conservancy. Each paddock is grazed heavily for a short period (usually 2–3 days) then allowed a 45-day rest period. This method of management mirrors the natural "herd effect" of elk, bison, deer, and antelope, and provides the cattle with high-quality grazing while preserving and improving the pastureland.

Peter Gage

Peter Gage

I've been working on an inventory and analysis of Oberlin College's greenhouse gas emissions. The long-term goal is for Oberlin to become climate neutral by 2020. In other words, this means that all the school's emissions of any greenhouse gas will be accounted for and offset by various methods of carbon sequestration. The first step, though, is to greatly increase the campus's energy efficiency and replace carbon-intensive energy sources like coal with more climate-friendly sources.

Peter Light

(John and Mary Frantz Internship)

Peter Light

So you're planning to get one of the first Hypercars to hit the showroom floor, or maybe you're just interested in the progress of fuel-cell-powered vehicles. But how will you drive more than 300 miles from the dealership—how will you refuel your Hypercar with hydrogen gas? That's the question I'm currently researching at RMI. The halftime report: scores of ideas from many different industrial and academic arenas have sprung up to meet this challenge, and will elegantly cross-pollinate with the concurrent developments of stationary fuel cells and distributed generation technologies. These are exciting times!

Lauren Yarmuth

(Eric Konheim Memorial Internship)

Lauren Yarmuth

As this year's Konheim Fellow, I have been involved in compiling and editing case studies for the upcoming GDS Second Edition CD-ROM. The success of the 1997 GDS publication *Green Development: Integrating Ecology and Real Estate*, and accompanying "Green Developments" CD-ROM—as well as increased interest and demand in the field of green development—have warranted an up-to-date version. The new edition will feature about 200 case studies, including updates from the first CD and many important new developments.

Charming Business with the Prince

In August, Hunter Lovins, RMI co-CEO (Strategy), met with a group of world business leaders at the annual reunion of HRH Prince Charles's "Business Leaders on Environment Program" at the Prince's estate, Highgrove, England.

Along with such business leaders as just-retired Royal Dutch/Shell Chairman Mark Moody-Stuart, Lovins spoke on "Climate Futures and Business Opportunities."

The Business Leaders on Environment Program was created by Prince Charles to enable business leaders and "opinion-formers" to debate "the business case for sustainable development, in consultation with leading international figures in their fields."

The Program offers a weeklong seminar at Cambridge University where business professionals are immersed in sustainability issues as they relate to business. Those who attend then become part of an ongoing network from which new recruits can draw inspiration, expertise and advice. Some 350 representatives from 300 of the world's biggest companies are network members.

This fall, the Program will expand to the United States. Executives interested in participating can get more information at www.cpi.cam.ac.uk/bep/.

Lovins was asked to join the discussion because she is both a leading world expert on sustainable business practices and whole systems thinking, and because she is American and was thus able to offer valuable insight into the American approach to sustainability.

"It was great honor for RMI to be invited to share ideas with the Prince, Sir Mark and the business leaders." Lovins said. "These people are serious about finding solutions and it is exciting to be able to contribute to such discussions."

RMI Wins 3rd Award (of 2001)

Recently, RMI picked up its third prestigious award of 2001, the Building Economic Alternatives Award presented by Co-op America.

Every year, Co-op America presents the award to the person or group that the organization believes has done outstanding work in one of the "issue areas" covered in Co-op America Quarterly during the previous year. (Year 2000 issue areas included "The Good Life: Redefining Success in the 21st Century," "Changing the Climate," and "Wood Wise.") The award is given "to recognize and congratulate people or organizations that are on the forefront of creating positive change toward a sustainable future," according to Nate Albee of Co-op America.

"We are especially impressed by Rocky Mountain Institute's work in defining the problems related to climate change and presenting viable solutions to those problems," Albee wrote in a letter to RMI. "The only hesitation occurred when someone suggested that RMI receives so many awards that this one might get lost in a heap with all the others! While we hope this is not the case, we would like to take the opportunity to congratulate you officially. Keep up the great work!"

President Clinton visited RMI in late August and spent time with many staff members. They included (from left to right): Dale Levy, Marilyn Wien, Steve Swanson, Marty Pickett, Tom Feiler, Nancy Johnston, Bill Clinton, Charmaine Boudreaux, Amory Lovins, Missy Morgan. Photo: Norm Clasen.

New GDS CD-ROM Out in Early 2002

RMI's Green Development Services' new CD-ROM *Green Developments 2.0* is slated to be released in early 2002. The new CD, a follow-up to 1997's highly successful book and companion CD-ROM *Green Developments*, will include updates of some of the original case studies, plus over 120 new ones.

"It describes the principles of building green, but also gives a detailed look at the technologies used and how they apply to each other within a system," said Ben Shepherd, a GDS research consultant, who is worked on the project. "We are also including over 20 European case studies. Europeans are well known for their innovative uses of natural ventilation and daylighting, so it's great to have some good examples included."

The CD boasts thousands of high-quality images (interior, exterior, location, site, architectural context, etc.).

Importantly, the disk will include financial information about green building and green development (cost per square foot, pricing of building materials, HVAC systems, etc.) so developers, contractors, and homeowners can understand the financial implications of green building.

The project has been funded with the help of the Department of Energy and the Kettering Foundation.

RMI Charts the Course of Wastewater Treatment

Braving airport closures and icy roads from a spring blizzard, eight top experts in on-site and small-scale wastewater systems gathered with RMI staff in Snowmass 2–3 May to outline the future of wastewater management. Led by Adjunct Research Scholar Richard Pinkham and funded by the U.S. Environmental Protection Agency, RMI is documenting the economic benefits of decentralized wastewater technologies. These include reduced financial risk through incremental implementation (versus large, lumpy investments in centralized sewers and

Richard Pinkham

treatment plants), lower-cost local reuse, distributed groundwater recharge, reduced pressure for growth when sewers are extended, and a host of other advantages. The technologies are many and generally simple, though innovations are constantly occurring and unit costs are likely to decrease as volumes go up. (Sound familiar? Think photovoltaics. Think fuel cells.)

And small-scale wastewater systems aren't just for rural areas anymore. RMI anticipates that as the benefits become known and efficient management institutions continue to develop, advanced small-scale wastewater technologies will increasingly be integrated into urban and suburban wastewater systems. Modeled on RMI's forthcoming book, *Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size*, the wastewater study will be available in mid-2002.

RMI Senior [Staff] Moment

It was 1984 or '85, no one can remember exactly. RMI's Amory and Hunter Lovins and Michael Kinsley were attending a meeting in the cramped offices of the Colorado Public Utilities Commission. A pile of documents was handed out to attendees. As Hunter recalls it, Michael looked up from a document he was reading and said to the host that one document appeared to include a typo: it was supposed to say "megawatts," but in fact read "negawatts."

In any event, from then on Amory spread "negawatt" all over the industry and it soon became standard parlance for "saved watt." Trying to nail down a specific date, Amory recently noticed that he used the term in the title of a November 1985 speech to the National Association of Regulatory Utility Commissioners, which was reprinted in *Public Power* in March 1986. Thus, he speculates, "negawatts" came into being during or before 1985.

"Where I saw an amusing typo," Kinsley recalled, "Amory saw an entirely new term. And now it's a common term in energy circles the world over."

RMI's Main Building Cool

In mid-July, RMI got a strange phone call from our local electric coop, Holy Cross. It seems utility officials wanted to make sure things were okay at RMI's efficient headquarters. That's because, as of Monday, 16 July 2001, there had been a zero net use of electricity in the building for the first two months of summer. RMI co-founders Amory and Hunter Lovins were, of course, delighted. "Our solar capacity normally meets about half the annual needs of my household and a 12-person office," said Amory, "but as the office equipment becomes more efficient, we can reach 100 percent solar in sunny summer months. That's less coal burned—and more money to do RMI's work."

RMI Board Gets New Members

RMI welcomes three new members to our board of directors. All three candidates recommended by the nominating committee this year were elected unanimously by the board. Brian Rosborough joined the board in March and Janine Benyus and David Orr in September. RMI's bylaws allow for a board of up to 17 members, and these new additions bring the current number to 14.

Janine Benyus, of Stevensville, Mont., is author of six books on life sciences subjects.

A graduate of Rutgers University, Benyus holds degrees in forestry and writing. In addition to her writing, she teaches interpretive writing, lectures at the University of Montana, and works towards restoring and protecting wildlands.

Her 1997 book, *Biomimicry: Innovation Inspired by Nature*, influenced the creation of natural capitalism by Hunter Lovins, Amory Lovins and Paul Hawken. Biomimicry, seeking sustainable solutions by mimicking nature's designs and processes, is the second principle of natural capitalism.

Other books by Benyus include *Beastly Behaviors*, a guide to animal behavior, and three field guides to wildlife habitats.

"Janine knows RMI's work really well," said RMI Executive Director Marty Pickett. "One of RMI's intentions was to place someone with expertise in biology on the board, and Janine fills that spot."

David Orr, of Oberlin, Ohio, is Professor of Environmental Studies and Politics at Oberlin College and Chairman of Oberlin's Environmental Studies Program. Orr holds a PhD in International Relations from the University of Pennsylvania.

He is currently a trustee of the Educational Foundation of America, the Compton Foundation and the JED Fund, and is a past trustee of other such organizations. He is a member of the Editorial Advisory Board of the *Orion Nature Quarterly* and the *Bulletin of Science, Technology, and Society.*

Books Orr has written include *Earth in Mind: Essays on Environment, Education and the Human Prospect* (1994) and *Ecological Literacy and the Transition to a Postmodern World* (1992). He has published dozens of papers and been invited to present guest lectures at scores of colleges, universities, and other institutions in North America and Europe.

"David Orr is one of the leading environmental educators in the country," Pickett said. "He brings extensive nonprofit experience to the board, too."

Brian Rosborough is founder, current chairman and past president of Earthwatch Institute. He established two international nonprofits, Earthwatch Institute and the Earthwatch Institute Center for Field Research, to underwrite science, conservation and education projects that support sustainable use of cultural and biological resources.

Rosborough's current board memberships include EarthCare Company, Inc. and Uniform Digital Mapping and the boards of trustees of Mount Holyoke College and Princeton University.

"Brian also brings substantive knowledge of RMI's work," Pickett said. "With his long career as founder and president of Earthwatch, he brings a lot of experience in nonprofit governance."

Moving On

Longtime RMItes Jennifer Cairns, Mark Scott, and JoAnn Glassier have decided to move on. Mark is headed to China, where he will be teaching Elizabethan prose and Modern American Poetry at Shanghai University. JoAnn is going into a semi-retirement so she can spend more time with her grandchildren. Likewise, longtime RMIte Jennifer Cairns recently moved on to retirement in Hotchkiss. Good luck all!

Dear RMI Readers and Supporters,

As you've probably read, we are now asking for a $20 donation in return for an annual subscription to our newsletter (three issues). You can read the newsletter online anytime at www.rmi.org without a subscription. However, if you enjoy it, we hope you'll contribute anyway.

Also, we apologize if you received your copy of *RMI Solutions* at the wrong address, or if you requested an email notification and instead received a hard copy in the mail. Please, if you would like changes made in your mailing address or in how you receive RMI information, contact Jessica Hood at 970-927-3851, or email her at jessica@rmi.org.

Gone Fission ▼

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especially cheap because they occur at the site where the energy is consumed and thus require no delivery.

All these non-nuclear options continue to get cheaper, as do fuel cells and solar cells—where a pound of silicon can produce more electricity than a pound of nuclear fuel. Already, Sacramento's municipal utility, which has successfully replaced power from its ailing nuclear plant (shut down by voters) with a portfolio emphasizing efficiency and renewables, has brought the heretofore costliest option, solar cells, down to costs competitive with a new nuclear plant.

The PR spinners trumpet that nuclear power costs less than power from gas plants. Perhaps, if you look only at the running cost of an average nuclear plant that is already built, compared with the running cost of an old, inefficient gas-fired plant. But this does not include delivery of nuclear electricity to customers, nor the prohibitive construction costs of a new nuclear plant. Notice, too, the ads don't compare new nuclear plants with the new, doubled-efficiency gas plants that are now beating the pants off nuclear and coal worldwide. Under realistic cost comparisons, nuclear power plummets to its actual status as the worst buy available.

Lost in the debate over what kind of new plant to build is the best option of all: more efficient use of the electricity we already have. The U.S. has been reducing electric use per dollar of gross domestic product by 1.6 percent a year. In California between 1997 and 2000, it fell by 4.4 percent a year. California has held its per-capita electricity use essentially flat since the mid-1970s. Far greater savings remain untapped—enough nationally to save four times nuclear power's output, at 1/6th its operating cost. An estimated three-fourths of U.S. electricity could now be saved through efficiency techniques that cost less than generating that power even in existing plants.

Nor, finally, do shortages of electricity in California justify more nuclear plants anywhere. California did not have soaring electricity demand during the 1990s, did not stop building power plants, and is probably not even short of generating capacity. The system that had rolling blackouts at a 29-gigawatt load last winter is the same one that comfortably delivered 53 gigawatts two summers ago. Half its power plants didn't suddenly evaporate. Rather, there was adequate generating capacity—if power plants ran as reliably as they did before utilities sold them. But since utility maintenance contracts expired last fall, many of the sold plants have been calling in sick—often, some evidence suggests, because their new owners earned far more profit by selling less electricity at a higher price rather than more at a lower price.

If California did have a serious supply-demand imbalance, it should be resolved in the cheapest, fastest, surest, and safest ways. Buying more nuclear plants violates all these criteria. It would buy less solution per dollar, making the problem worse. That's also true of nuclear solutions to climate change.

Anyone who doubts the effectiveness of demand-side solutions need only look to California, where in the first half of this year, with limited formal programs, Californians have decreased their peak demand for electricity by more than 12 percent, reversing the past 5–10 years' demand growth.

After a half-century of nuclear power, the verdict of the marketplace is in. Nuclear power has flunked the market test. Nuclear salesmen scour the world for a single order, while makers of alternatives enjoy brisk business. Let's profit from their experience. Taking markets seriously, not propping up failed technologies at public expense, offers a stable climate, a prosperous economy, and a cleaner and more peaceful world.

(For more information, please visit www.nci.org/conf/lovins/001.gif)

Fuel Cells ▼

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premium reliability needs, costly distribution constraints, or both.

Fuel cells can be cost-effective in these applications even at their present costs, if the DG benefits can be captured. Thus, the near-term commercialization path for fuel cells appears to be grid-connected fuel cell systems in commercial buildings, communication providers' hubs, and other facilities that need high reliability and low emissions (especially if they can use the fuel cell's waste heat). The most cost-effective applications will be in locations with distribution constraints.

A longer-term commercialization path for fuel cell technology will integrate these stationary applications with the generating potential for fuel cells in cars, trucks, and buses. Vehicles parked at these facilities during the day could be plugged into the building, generating large amounts of electricity during peak demand hours. This would take fuller advantage of the vehicles' fuel cells, which would otherwise stand idle in the parking lot.

Ultimately, such plug-in-power-plants-on-wheels could have 5–10 times as much generating capacity as all the power companies now own.

Editor's note: Dr. Joel Swisher, PE, an internationally-recognized energy expert, recently joined RMI's Research and Consulting team. His recent work on fuel cells was supported by the W. Alton Jones Foundation. This report will soon be available on our website, www.rmi.org.

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asked to do so; they simply haven't been asked because, in violation of the Precautionary Principle,* new synthetic chemicals have generally been assumed safe until proven dangerous rather than potentially dangerous until proven safe. Wise governments will therefore err visibly on the side of caution, and encourage innovation in developing and deploying non-toxic substitutes.

The industrialization of agriculture will yield ever worse problems of pathogens, contamination, pests, ecosystem breakdown, and declining fertility. Ultimately, the habits and institutions that encourage and condone such outcomes will be rejected. Europe's rapid market swing towards organic agriculture reflects a growing suspicion that industrially produced food may be unsafe in ways that are not officially acknowledged and may not yet be known to science.

4. Genetic Technology

As we noted in the previous issue of RMI *Solutions* (Vol. XVII, #1), humankind's newfound ability to map and manipulate the genome has brought us a new era of great promise and challenge. Like nuclear technology, the manipulation of the genome has the potential to alter life as we know it, and is shifting the pace of evolution.

5. Population

Ever-increasing population means that to achieve sustainability—roughly defined from a human perspective as "natural capital per capita"—natural capital must increase with population. At present, this is not happening.

It is important, however, to remember that population is only one term in the generally ignored Holdren and Ehrlich formula. That dictum tells us that the impact of a growing population can be offset by a reduction in the amount of resources that this population demands, and by better technology that allows more people to enjoy a higher standard of living using fewer resources.

**The Precautionary Principle as defined in the 1998 Wingspread Statement on the Precautionary Principle, has the following components: 1) action to prevent harm when science is uncertain; 2) shifting the burden of proof toward proponents; 3) assessing alternatives; 4) transparency and democratic participation in decision-making.*

FIVE STEPS TO SUSTAINABILITY

1. Implement Natural Capitalism.

The concepts of natural capitalism should be integrated throughout the UN system, the various multilateral organizations, and the world's governments, as stewards for all life on earth. Failing that, these institutions will lose first their credibility and then their legitimacy.

2. Reinvent Governance.

Develop a system of governance that acknowledges and builds on what is working now: coalitions of non-governmental organizations (NGOs), companies, and governments. Strengthen the role of the many NGOs now active on the world stage.

3. Support Micro-lending.

Far too little of the world's enormous flow of capital reaches those who most need it. The various systems of charity and development aid, while noble, have not addressed the structure of poverty, and in many cases worsen it, creating a culture of dependence. Banks and financial organizations that have created micro-credit programs have demonstrated how the innovative force of entrepreneurship can be used to create genuine economic development at a fraction of the cost.

4. Change Education and Communication.

Education must address all aspects of being human rather than only providing job training. Such education would enable people to learn how to value and respect each other and the environment that sustains them and life, now and in the future. It would allow children to grow into practical stewards of creation rather than exploiters who try to fill their empty hearts with more and more consumption. Dana Meadows called this "Seeking to meet non-material needs with material acquisitions," and points out that it is at the heart of the consumption-driven lifestyles that now predominate in much of the world.

5. Adopt the Precautionary Principle.*

This is simply sane policy for any species desiring a lengthy tenure on the planet. Already embodied in the Montréal Protocol, it should be national policy around the world, and the basis of all sustainability statements.

CONCLUSION

Implementing the measures that have been outlined above would herald in a huge new industrial revolution. It would revolutionize our systems and our thinking. It would also provide a boost to industries and societies around the world, offering an enormous opportunity to deliver the products and services needed to achieve sustainability. Providing these would not only solve the sustainability crisis, but would also solve the unemployment plaguing most countries. It would demonstrate once again that the supposed dichotomy between environmental protection and employment resides in an unsustainable system, and can be resolved by turning towards sustainability.

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that while elegant solutions are often simple, they cannot be piecemeal. They should instead be complex, resilient, and integrated. The key, as described by Amory Lovins and Gunter Pauli, is a "whole-systems" approach to development, including something as austere and forbidding as a refugee settlement. ZERI's concept of "concentric rings of utility," each using the waste products of a previous industry until there is no final waste at all, may be exactly the solution required when resources are scarce, the population is fragile, and the initial environment is unforgiving.

Now, more acutely than we had wanted, we find an opportunity to look carefully and well at the plight of a newly-displaced population. The Afghan refugee camps now needed on the Pakistani, Iranian, Tajik, and Turkmen borders are an ideal opportunity to establish sustainable settlements, providing tools and techniques that encourage the willing return of a refugee population. In addition, if we can design a sustainable and reproducible way to meet the human needs of both the new arrivals and the prior occupants in the austere conditions of an ad-hoc refugee camp, the way that's done should also help billions of other people trying to create sustainable settlements where they already live. The discussion of how that might occur is already underway.

In late August RMI hosted a very timely seminar. The topic was the use of information technology for sustainable development. We wanted to look at how information collection and flow might lead to a greater understanding of the dynamics of dislocation and resettlement, and how that might give opportunities for shaping a proactive response as any crisis unfolds. We wanted to see if it was possible to thrive in dislocation.

The participants were bright and experienced people working to intelligently assist three groups:

1. Agencies involved in both sustainable development and emergency response, particularly within global disaster relief;

2. The National Science Foundation, with special attention to their submission for the UN Earth Summit 2002 in Johannesburg next September, and

3. Contributors to a subsequent seminar to be held in February 2002 on the specific subject of sustainable settlement for displaced populations.

We set as ground truth a few items about which we were fairly confident. Based on both ZERI's analysis and our own experiences, dislocated populations in both natural and man-made disasters first need water, food, security, shelter, and healthcare. If we are successful in providing those bare essentials, we will be able to progress to the provisioning of energy, education, jobs, and access to capital. This sequence is neither inviolate nor independent. Everything required depends a little on everything else.

Once that perspective was clear, the participants agreed on a second issue: before we can supply provisions effectively, some cultural groundwork needs to be laid. One term we used was "cultural intelligence," and we used an example.

In October 1993, ninety-nine soldiers of Task Force Ranger were pinned down in a firefight in Mogadishu, Somalia. Eighteen Americans eventually died. In the later interviews it was found that among the innumerable reasons that the crowds in Mogadishu responded with glee to the sight of Americans in trouble was reportedly that we had been insulting them daily. In Somali culture it is apparently considered very offensive to show the soles of your feet to anyone. We, the U.S. military, had spent many days flying low over the city, soldiers sitting in the open doors of the helo, with feet hanging out. There was no intent to offend—we just didn't know.

Global relief organizations have now acquired enough experience with refugee camps to discuss problems like cultural intelligence in detail. Those of us not directly involved in relief work, yet with a set of tools that might be useful to those agencies, need to learn how to integrate our assistance to them effectively. We can see, for example, methods by which ZERI and natural capitalism might form educational crucibles, introducing knowledge about sustainable self-sufficiency to those who need to start over. As the crisis eases and repatriation becomes possible, we would be able to help them return to their original homeland smarter than they left.

Should we succeed in developing such an international model, host nations may be less reluctant to offer refuge, and the pain suffered by all participants could be reduced. It would also ease the ongoing burden and expense on those countries and agencies taking responsibility for the displaced.

As the participants in the August seminar broke from the plenary session into the working groups, I was asked what perspective I wanted them to take during their discussions. I quoted from Amulya KN Reddy, a colleague from the Indian Institute of Science in Bangalore. When approaching community problems he said, "Take care of the poorest. The rest will then take care of itself." That advice was not intended as saintly sentiment. It was, rather, my recognition that optimal efficiencies can be best found among those who have the least, and so we should consider whole-system solutions from the bottom up.

That view was apparently successful,

because the ideas that streamed back from the working groups were intelligent, creative, compassionate, and achievable. Although the topic was supposed to be "informational technology in sustainable settlement," a very broad topic, the groups chose to focus on displaced populations and on using information to achieve sustainable, ZERI-based transitional camps along natural capitalism principles.

So we will have a report on "information technology in sustainable settlement" from this symposium. We will distribute it appropriately and someone may notice and choose to implement something we've mentioned. If we have been careful, the implementation will be useful and we may establish a groundswell of sustainable development that will echo the early achievements of the Rishi Valley and Gaviotas, spanning boundaries that may then begin to diminish resource-based conflict.

But once the report is released, it is out of our hands. Surely there is a more effective response to the twin tragedies of violent deaths in the United States and slower deaths in Afghanistan than the release of another report and the hope that someone listens and acts?

Let me suggest that we listen ourselves to the ideas we shared, synthesize them, then carry that intelligent, thoughtful, productive, and energetic insight into the next seminar, the next "charrette," earlier than we had planned. We had intended to hold a charrette on the topic of Sustainable Settlement in February 2002. I think that is too distant, and that the ideas and implementation paths are needed now, even as the bitter Central Asian winter begins to descend on the airstrips and roads available for the relief effort.

The sustainable settlement meeting was explicitly designed to address problems inherent in the very type of crisis unfolding now. The resources that will be expended by relief agencies to establish the new camps will vanish, with more loss to follow, if there is no effort to design a "whole-system" community within the morass. Stopgap measures don't incorporate a future, though they may save those closest to the brink. Knowing what is at stake, we should be working closely with current experts in disaster relief to incorporate sustainable design concepts from the very beginning.

We should act now—within weeks. The sooner we can intelligently contribute to an integrated relief response, the better we will lay foundations for success. From there, as Janine Benyus describes, the successive stages of rebirth can begin.

To my knowledge, no attempt has been made to implement this degree of sustainable development within refugee camps forming in a crisis setting.

The relief agencies have done extremely well in relieving urgent needs in the face of dwindling donor support, but their time and resources are limited. We can, I think, bring to those agencies and the donor governments some hope for a system that will become self-sustaining, providing the tools for creative growth needed by any community. We can help them with water provisioning and purification, novel and nutritious food crops, power production, cooking fuel, disease surveillance and response, effective sanitation from biological systems, educational models that work in remote environments, employment within the camps, food production, the development of non-violent communication skills, and longer-term job opportunities. And much of the effort can be designed using the people in the camp and the environment that surrounds them, decreasing their helplessness, frustration, and rage. As was pointed out to me by a senior Navy officer recently, "It doesn't matter whether you've killed the mosquitoes if you haven't drained the swamp," and this does appear to be an opportunity to shift the world perspective held by those refugees recently under the influence of a violent and cruel pseudo-theocracy.

Current events have been disheartening. But we can harness that sorrow and frustration to stimulate a diverse assortment of intellects. Pushed by the images of brutality, waste and loss, we can turn our energy toward the development of a more just and equitable and sustainable society in a corner of the world that badly needs that opportunity. Martin Luther King said, "If you want peace, work for justice," and there are few more stark examples of unjust inequality than the need for a refugee camp. Let us use our intelligence, our energy, our sense of fairness, and our newly-forming coalition to achieve a more worthy goal than simply using our military capability for retribution. I think a refugee camp designed and built as a sustainable system from the ground up might be a decent start, and the ripples would be beneficial across a large pool of the dispossessed throughout the world. If we are smart, and just a little compassionate, we will take this rare opportunity to quietly start another Renaissance.

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machines. Then there's fermentation, maturation, filtration, blending, pasteurization, and carbonation. Finally, the drink is packaged and shipped. More than anything else, Bulmers' processing plant exists to push fluids around through pipes.

In FY2000, Bulmers spent an estimated £1.6 million on energy—a seemingly large number, yet no surprise considering motors use three-fifths of the world's electricity, and that most motors are used for pumping. A large motor (tens of kilowatts) uses its capital cost in energy every few weeks. Replacing old pumps and pipes with more efficient models produces savings that go directly to a company's bottom line, are immediate, and have triple-bottom-line benefits. Surrounded by hundreds of pipes connected with thousands of 90-degree elbows, Amory could see potential savings in every direction. One pipe in the fermentation plant really caught Amory's eye. It snaked across a large section of the factory with 16 right-angle elbows that were visible—and even a few more Amory couldn't see. "That pipe had 11 elbows that could be eliminated just by rotating the tank about 60 degrees around its vertical axis before hooking it up," Amory noted. Most of the time, pipefitters are told to dress pipes in neat right angles and get paid more for installing more elbows—not exactly the best way to design for efficiency.

Amory's friend Eng Lock Lee, on of RMI's favorite efficiency engineers, came over from Singapore to ride shotgun. He pointed out that when manufacturing processes are optimized, generally many other things are optimized as well. For example, using large, straight pipes, optimally laid out to connect equipment, leads to smaller (and cheaper) pumps and motors. But it also uses less overall space, saves noise, yields greater productivity, and requires less maintenance. Often these non-energy benefits

Bulmers' Duncan Green shows John Todd and RMI's Amory Lovins around the processing plant. Photo: Cameron M. Burns.

are of far greater value than the energy savings, yet are rarely calculated. ("I'm beginning to learn it's really all about plumbing," noted Duncan, as he led Amory and Eng Lock around the factory.)

Down to Business

Amory and Eng Lock brought their keen observations—as did another roughly 100 charrette participants—to the table when everyone sat down to talk about how to make Bulmers more competitive while becoming a sustainability leader. While manufacturing processes would seem the obvious target for the bulk of the discussions, Charlie Bower's vision for Bulmers goes far beyond pipes and pumps—and the organization of the charrette reflected this. Eight working groups brainstorming innovation in the areas of sustainable agriculture, community, management strategy, marketing, packaging and transportation, stakeholders, and manufacturing processes came up with dozens of ideas and specific actions. Pipes and pumps were but two small actors in a cast of thousands.

If you were to divide a company into eight functions, separate them into groups, and have group members talk about sustainability activities, you might think you'd end up with eight completely different conversations—not so at Bulmers. Even Bulmers charrette groups as divergent as Transportation and Packaging and Marketing came up with remarkably similar ideas and parameters for immersing Bulmers in sustainability. This synergy between the groups is precisely the type of whole-system or integrated thinking that RMI fosters.

Ideas included the creation of a model sustainable Herefordshire farm, creative partnerships with competitors, encouraging entrepreneurship within the community, sustainable packaging (yes, biodegradable drink containers), preserving agricultural Herefordshire through a yet-to-be-developed "community investment instrument," top-down sustainability training led by managers, and a totally new product—a naturally fermenting cider packaged in natural, sustainable packaging. The ideas came fast and furious, and ranged from economic "plumbing" (stopping leaks and retaining value) to entirely new business concepts.

The most noticeable thing about the charrette was that sustainability became an over-arching theme for the entire corporation. Company officials announced a management policy that would incorporate sustainability. But going deeper, Bulmers' management is set on finding the time and financial resources to allow sustainability activities to happen.

"This was a truly remarkable event," noted Huston Eubank, RMI's project manager for the Bulmers charrette. "It was what I imagined it might be like to have been in Ray C. Anderson's office at Interface when he began implementing his "midcourse correction" (see his book *Mid-Course Correction* by Ray C. Anderson,

www.chelseagreen.com/Midcourse/index.html). Often the most difficult thing is to design something simple. Bulmers is well on its way with the ideas developed and shared at this charrette."

Meanwhile, back at the farm

The beauty of unlocking creativity in an event such as the Bulmers charrette shows that innovation doesn't stop once you learn about growing other products on supposed wastes. Impressed with the potential of symbiosis, Bulmers' folks are no longer sure whether Bulmers of the 21st Century will be a cidermaker, a vegetable grower, a community vehicle for a local agricultural-growers' cooperative—or all of the above plus several others.

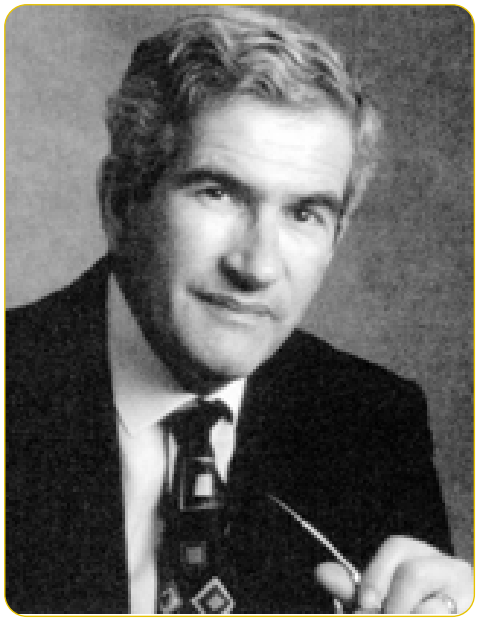
Pushing their creativity a step further—which is probably what all Bulmers employees will be doing in the future—does Bulmers begin offering an agricultural waste-removal service, and go around collecting and disposing of farmers' wastes? A small fee for removing wastes might offset the cost of starting the new business venture. And finally, maybe Bulmers won't grow symbiotic products at all, but instead provide support for local farmers to augment their current operations and incomes by starting their own symbiotic products-growing operations.

Duncan Green isn't quite certain, but one thing he now clearly understands is that creativity, discussion, and motivation can open up ways of seeing that most people would not, could not ever understand—not only for a company, but for the company's friends, neighbors, employees and business partners ... and even the competition.

BOARD SPOTLIGHT

Mike Curzan

RMI Board Member



With a distinguished career in finance and affordable real estate development, Myron (Mike) P. Curzan, Esq. fits comfortably into the RMI Board of Directors, where he chairs the Finance Committee.

"I joined the RMI board because I wanted to be connected with a cutting-edge organization," Curzan said. "I've been promoting use of the green development concepts pioneered by Amory and RMI to my real estate clients."

Most of Curzan's career has focused on developing affordable housing for universities, governmental organizations, and non-profit corporations.

He was a senior partner specializing in real estate in the 1970s and '80s for the Washington law firm of Arnold & Porter. In 1990, Curzan took a two-year leave to become Vice Chairman of the Board of Connecticut Mutual Life Insurance Company for investments. In 1996, he formed his own real estate development company UniDev, LLC, which specializes in university housing.

The latest UniDev project involves creating 900 units of faculty housing at the California State University campus in Ventura County. The residences are designed to be affordable to faculty and staff making as little as $30,000 a year.

"We're using an RMI-recommended 'green consultant' for the development," Curzan said.

As far as current RMI-related projects go, Curzan said he finds the Hypercar℠ vehicle research the most exciting, as well as systems for distributed generation.

"Efficient fuel cells have the potential not just for powering vehicles, but for heating and air-conditioning buildings as well," he said. "There are tremendous spin-off possibilities."

As a member of the RMI investment committee, Curzan said he would like to maximize the Institute's endowment. "Amory and Hunter [Lovins] never have a shortage of interesting projects to pursue. I'd like to see more funds for those activities."

—Bernie Grauer

DONOR SPOTLIGHT

'Cookies & Cream'

To help an organization like RMI do its groundbreaking work worldwide takes all types of people, of all sizes and shapes, beliefs, and levels of public prominence. One thing they all share, however, is devotion to the Institute.

Gracie Bailey

Grace ("Gracie") Bailey and Jerry Greenfield are two such donors.

Gracie lives in Franklin, Ohio, with husband Bryan and sons Zachary and Aaron. Gracie became aware of the Windstar Foundation in the mid-1990s after reading John Denver's autobiography *Take Me Home*. Gracie joined the Windstar Foundation, and eventually ended up going to Africa to work on a village water system with a Windstar group.

Gracie began donating to the Windstar Foundation, and later began giving to the Windstar Land Conservancy—$10 every pay period (twice a month). All of Gracie's gifts are given in memory of John Denver, which is how she found out about RMI.

In October 1998, Gracie sent RMI a cross-stitched poem "Do not stand at my grave..." and she's been donating, and sending letters telling us about Franklin and the folks at her post office ever since. She also sends a batch of delicious cookies once a month.

"I have a list of people and groups I believe in," she says. "Baking them some cookies is the least I can do. I don't want to just send a check—it's so impersonal."

Gracie recently lost her sister-in-law to cancer, and adopted one of RMI's goats in her memory. Gracie and her family will visit RMI and Windstar in October for the first time.

Jerry Greenfield is the Jerry in "Ben & Jerry's" ice cream, which he co-founded in 1978 with childhood friend Ben Cohen. Jerry has been giving to RMI since 1994, either through the Ben & Jerry Foundation or personally. He got started in his support of the institute after running into RMI co-founder Amory Lovins at a Social Venture conference in Gold Lake, Colorado. "I heard him talk about energy and efficiency and compact fluorescent lightbulbs and he was going around giving these back massages," Jerry recently recalled. "He gave me a back massage that was incredible. It was just unbelievable." (Amory calls it "alternative energy.")

Jerry Greenfield

Jerry believes the practical aspects of energy and resource efficiency are so compelling that every business should be examining ways to become more efficient.

Although Jerry knows that the company he co-founded is in step with most of the principles RMI preaches, he became a supporter regardless, and has been donating ever since. With Jerry's latest contribution, he included a handful of coupons for Ben & Jerry's ice cream (which should go nicely with Gracie's cookies.)

(Somehow, neither Gracie's cookies nor Jerry's coupons seem to make it over to RMI's Southeast Annex building, where most RMItes work; however, Development Director Dale Levy promises changes are in the works.)

Military Energy ▼

continued from page 8

when global companies can deliver a spare part pretty much anywhere on earth in 24 hours. The result: a commendable effort to redesign a creaky old logistics system from scratch.

These innovations will all save prodigious amounts of energy, pollution, and money. From data in the DSB report, I estimate that comprehensive military fuel efficiency could probably save upwards of ten billion dollars a year, because the few billion dollars of direct annual fuel savings can trigger far larger avoided fuel delivery costs. Fuel efficiency could displace—or redeploy from tail to tooth—at least a division's worth of fuel-delivery personnel and their equipment and support pyramids.

As for whether such innovations also make the world more secure, that depends on how well citizens exercise their responsibility to use military power wisely—and to create the sort of world in which its use or threatened use becomes less necessary.

If we get that right, we can all be safe and feel safe in ways that work better and cost less than present arrangements, and fewer of the men and women in the Armed Forces need go in harm's way.

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Our staff shows 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.

Our sincere appreciation is offered to these friends who contributed to RMI between 1 May and 31 August 2001. Numbers in parentheses indicate multiple donations by our frequent givers. 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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**Many recent gifts to the Semmer Memorial Internship Fund were given in memory of Phillip's grandmother, Eleanor Velie, who passed away in May. RMItes join in expressing our sympathy to the extended Semmer family.*

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Hearty Thanks To All

Dale Levy, Development Director

Several days ago I shared an idea with my colleagues at RMI about sending holiday cards (including a reply envelope) in early December to RMI donors and friends. Such mailings had been successful in raising funds for other organizations where I had worked.

Most looked at me as if I'd lost my marbles. Or at least thought I was very crass.

As we talked, however, the idea of encouraging alternative holiday gift giving became attractive. We all know how tough it is to come up with gift ideas for our friends and relatives.

Like us, you have probably found yourself trying to remember whether you gave your father a shirt or a tie last Christmas. Or what color blouse or towels your sister likes.

We think we have an answer that could help you, your friends, your relatives, and our earth. Consider giving gifts to Rocky Mountain Institute. Your gifts to RMI would honor your friends and relatives by providing continuing financial assistance for research, strategic influence, and outreach and education about sustainable solutions to energy, water, transportation, climate, security, and green building development.

We'll send you a packet in early December that will include everything for easy gift giving to RMI. We'll also send a card to the person(s) in whose name you are donating.

In other news, to encourage visits to our website, we're offering prizes to a few lucky clickers. Recently, we began printing numbers on the upper right hand corner of the mailing label on this newsletter. Find the number, then go to our website at www.rmi.org and click under the announcement for the fall newsletter (you'll see it). Look at the list of numbers there. If your number matches any of those listed on the website, you are a winner!

To claim your prize (which could be RMI merchandise or publications), please call Charmaine Boudreaux at 970-927-3851, email her at charmain@rmi.org, or write her at 1739 Snowmass Creek Road, Snowmass, CO 81654.

staff spotlight: Alexis Karolides

Alexis Karolides, a senior consultant for RMI's Green Development Services, is getting her chance to walk the walk and talk the talk. Alexis and her husband, artist and builder Douglas Hill, are setting out to build their own home. Alexis, an architect, is designing the house partly around materials they have salvaged from demolished buildings.

Alexis can trace both her inclination to be an architect and her affinity for conservation to her background. She grew up in River Falls, Wisconsin, on the Minnesota border. Her mother was an artist; her father, an English professor at the University of Wisconsin's River Falls campus. Both were born into immigrant families around the time of the Great Depression; they knew the value of saving resources. They also passed on a penchant for creativity that showed up later in life.

Though Alexis grew up with a wide spectrum of interests, she loved physics, and that became her major. Her undergraduate thesis was on solar and alternative energy, where she ran across the writings of one Amory Lovins, about something called the "Soft Path."

Physics satisfied her analytical side, but she wanted to go beyond the theoretical world of the physics lab. Exploring further, she decided to study architecture, because it would allow her to continue to be analytical while also drawing on her creativity.

"I thought I'd be able to affect the world in a more visible, immediate way," she says.

Alexis and Doug quickly discovered that building a house near Aspen has a unique aspect. Because large luxury houses are being torn down to make room for even larger luxury houses, a huge amount of demolition debris ends up at the Pitkin County Landfill. A good share of it is reusable. To someone with Alexis's sensibilities, these materials are begging to be reincarnated.

"When I see Douglas fir beams being ground up for compost and marble slabs going into the landfill, it violates my sense of ethics," she says. Doug has salvaged 180 such beams that would otherwise have gone to the landfill, as well as solid wood cabinets and doors, wood and tile flooring, and countless other items.

Alexis and Doug's house will feature straw-bale walls, solar-heated radiant floors, and some of those Douglas fir beams overhead. Alexis drafted the first plan for the house some time ago, but the design keeps evolving.

"They say the hardest thing for an architect to do is to design her own house," she says. "And it's true. Just when you think you have it designed, you find some more materials."

—Jeremy Heiman

Ten Small Business Keys to Natural Capitalism

By Byron Kennard

Defenders of polluting industries continue to score politically by portraying environmental protection as harmful to economic growth and jobs. Environmental stewardship and a robust economy go together more often than not, and are in fact, virtually symbiotic. In recent years, however, advocates of environmental protection have begun to realize they have a golden opportunity to turn the tables on their opponents by allying themselves with the principal source of economic growth and jobs in the United States: small businesses.

The nation's booming small business sector now generates half of the private gross domestic product, half of all U.S. sales activity, and half of all private sector output. In 1999, Americans started 900,000 new small businesses. Today, amazingly, one in twelve Americans is trying to start a new business.

Just as *RMI Solutions* regularly tells the stories of those really big firms shifting the business paradigm, there are dozens of examples of small businesses working for a better economy while changing industry. T/J Technologies of Ann Arbor, Michigan, for example, is a small research company that develops environment-friendly materials for electrochemical storage devices such as ultracapacitors, lithium-ion batteries, and fuel cells. The firm's devices deliver more energy with less weight in smaller packages. In each of the past four years, the company's revenues have doubled.

GreenDisk is a small business in Redmond, Washington, founded by Center for Small Business and the Environment (CSBE) member David Beschen. David saw that the top-quality diskettes in boxes of unsold, unused software could be salvaged and reused. GreenDisk now offers renewed and reused disks through major office supply catalogs.

The nation's first (and still only) environmental management system integrated with sustainability concepts was developed by Rejuvenation, Inc. (www.rejuvenation.-com), a lamp and fixture company based in Portland, Ore. now employing over 200 in manufacturing and retail operations. RMI's Christopher Juniper was the project's lead consultant, supported by funding from the Oregon Department of Environmental Quality—a good model for public/private collaboration that breaks new ground for all businesses, large and small.

Small businesses provide about 75 percent of the net new jobs and more than half of all private-sector jobs in America. Many of the nation's leading small businesses are profiting and growing through dramatic gains in resource productivity achieved by innovative technologies—both their own inventions and the rapid deployment of green technologies developed by others.

Because they are small and frequently new, these entrepreneurs are not captives of the old industrial order; they are its "marketplace critics." Like environmental advocates, they object to public policies and regulations that unfairly favor (and subsidize) older, bigger and dirtier businesses and that consequently act as barriers to innovation. Herein lies the basis of collaboration.

Environmental advocates, with their formidable political skills, can help small businesses overcome these barriers. For their part, small businesses can help environmental advocates win the "economics versus the environment" debate. Working in alliance, they will be able to:

Reframe the question. The debate that's needed is about the best interests of business. Is it defending old inefficient industries that are in decline? Or is it championing new efficient industries that are rising?

Change the cast of characters. This new debate is not between businesspeople and environmentalists. It's between two com-

peting groups of business advocates, one representing the past and one representing the future.

Control the rhetoric. The "spotted owls versus jobs" formulation puts environmentalists at a disadvantage. The "efficiency versus inefficiency" formulation turns the tables, putting polluters at a rhetorical disadvantage.

Maximize credibility. It's tough to succeed in small business and tougher still to launch an innovation, but these small businesspeople are profiting and growing while doing the right thing environmentally. They speak with a credibility few can match.

Introduce "real world" proof. Evidence brought to the table by small business is neither theoretical nor academic nor futuristic. These firms are making and selling real products and, in the process, creating real jobs and greener products.

Politicize the message from the bottom up. While there's not a power plant or oil refinery in every nook and cranny of America, there are small businesses. When they speak out, their voices are heard in city councils, county commissions, and state legislatures—and in Congress.

Broaden and strengthen the movement. As clean new industries grow, it will be in their self-interest to support organizations working for similar objectives. Environmental groups should welcome them to become members, sponsors and donors, and to look for how they can help businesses with ideas and political support.

Ride the wave of new technology. Since the pace of technological innovation continues to quicken, there's pressure (and opportunity) to become greener and greener (i.e. more and more profitable). The public sector should be harnessed to provide all the help possible for small businesses to survive on the "bleeding" edge.

Fuse two great sources of political activism. Like environmentalists, small businesspeople constitute a large, active and influential voting bloc. Nearly a third of all small business owners and employees who voted in 1998 reported they volunteered on behalf of a political candidate, and 36 percent said they contributed financially to a candidate.

Combine two powerful mystiques. Americans revere small business because it embodies such admired values as hard work, thrift, pluck, and ingenuity. Americans venerate the natural environment. Combine the mystique of small business with that of the environment and the result is a 21st Century alchemy: countless new green companies with technologies that create jobs, build a sustainable prosperity, and protect the planet.

Both small businesses and the environment would benefit tremendously if government and society recognized and appreciated the symbiosis between the two. Small business operators just want to make a living, and onerous government regulations can be an impediment to this goal. Time spent monitoring and record-keeping, obtaining permits and completing reports, etc., is time taken away from the business. Often, regulations are difficult to find, understand, and stay on top of, which exacerbates the problem. Incentives and education are a better policy choice; many local economies have, like Pittsburgh PA, implemented programs to link small businesses with advanced technologies.

CSBE is working to induce political collaboration between the small business community and environmentalists in support of public policy goals that profit small businesses and help protect the environment. The Center's present agenda includes:

• **Small Businesses in California.** To help small businesses in California surmount the state's energy crisis, this summer we established a CSBE California Energy Project, based in Los Angeles. The project strives to add a strong small business component to the wide variety of remedial efforts now underway or proposed.

• **U.S. National Energy Plan (NEP).** The administration's proposed NEP advocates strengthening the EPA's Energy Star program overall, but does not highlight the needs of small business. We recommend that the NEP include an assessment of commercial products/equipment targeted to small business needs and not yet labeled by Energy Star.

• In addition, a one-time-only federal tax credit for small business purchases of energy efficient equipment is needed. Such a tax credit could be based upon purchases of Energy Star-labeled products. (Energy Star identifies hundreds of energy efficient office and consumer products.)

• We also recommend that SBA loan programs be modified to provide both new loans and refinancing options for small businesses that purchase or lease Energy Star related products, as well as requiring new construction and remodeling financed by SBA to specify or require Energy Star's new construction standards.

Byron Kennard is the Executive Director of The Center for Small Business and the Environment (CSBE). CSBE helps small businesses be more environmentally responsible (see www. aboutcsbe.org). Also see "In Business—Creating Sustainable Enterprises and Communities" (www.inbusiness.org).

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