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RMI Solutions NEWSLETTER

CALIFORNIA'S ELECTRICITY SUPPLY 5 MYTHS

by Thomas Feiler

IT'S RARE WHEN DISCUSSIONS OF A commodity dominate dinner-party chat, but that was the case on many California patios this summer. And everyone seems to have an opinion about why the lights went out in San Francisco for several hours one day in June, why residents in San Diego saw their summer electric bills double, and why dire public warnings to reduce electricity use or risk blackouts have become commonplace throughout the Golden State.

Once heralded as the nation's leader in restructuring its electric utilities and creating competitive markets for electricity, California is rethinking the wisdom of its actions. And the rest of the country is watching. All 49 other states and the federal government are considering restructuring the electricity industry in their jurisdictions. They can learn from California's mistakes—or repeat them.

When it comes to essentials like electricity, the public is of two minds about markets and competition. Enthusiasm is strong when markets deliver lower costs or

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A wind farm in southern California: the electricity supply *is* increasing, just not in the way most people expect.

photo: Norm Clasen

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greater value, but ebbs quickly when markets produce pain.

This past summer's market volatility offered a vivid reminder of the fundamental dependence of the economy and society on reliable electric power. For a growing number of high-tech companies, the cost of even tiny outages can be spectacularly high. Increasing demand for reliable power has heightened political reactions and the search for quick fixes. In one of the bigger ironies of the electric industry restructuring debate, former free-market proponents are proposing increased government regulation, mandatory membership in industry organizations, centralized governance of grid operations, and government price controls.

California's power problems are not the direct result of competitive markets, but rather of a *lack* of robust competition.

In thinking about appropriate responses, it is helpful to look past five troubling myths now circulating about the cause of the recent problems and the role of competition in the electric power industry.

Myth #1: The electricity supply system is failing

California's power supply crisis has come even though none of the state's power plants or transmission lines has failed. In fact, many parts of the system that were supposed to be taken off-line for regular maintenance and repair continued to operate throughout the summer, proving that the electricity supply infrastructure is in fine shape.

However, the entire electrical system—the grid—is vulnerable. Four summers ago, a series of technical and human failures on a hot August day knocked out power to about 7.5 million customers in eight western states and British Columbia. That disruption, the second worst ever experienced in the United States and the worst to hit this region, can be traced to the inherent instability of a system that is designed around a small number of large, centrally controlled facilities.

Simple and cost-effective ways to increase the reliability, resilience, and stability of the system, such as using small-scale, distributed generation technologies and end-use efficiency, are well known within the industry, but have not been pursued with any discipline or enthusiasm by the traditional utilities. The utilities are used to doing business the old way, delivering electricity created by central power plants—a system that is easily controlled and monopolized, but vulnerable to large-scale disruption.

Myth #2: Competitive power markets are to blame

California's power problems are not the direct result of competitive markets, but rather of a *lack* of robust competition in the markets. The structure of the new power markets, after all, was designed to serve not only economic efficiency but also political objectives. As a result, the type of competition that the new market has delivered is imperfect and immature in some very important ways that cannot be explained by either classical economics or conspiracy theories. Most notably, the architects of the market focused almost entirely on the supply side of the business (and the political deals necessary to get the buy-in of the three large California utilities) but neglected, and in some cases obstructed, the ability of consumers to obtain energy services in more rational and cost-effective ways.

In this half-baked competitive environment, the wholesale power markets are behaving rationally, although quite erratically, to supply and demand signals. San Diegans' electricity bills doubled because San Diego Gas & Electric executives gambled in the marketplace and lost. Rather than secure supplies in advance to meet their customers' summer needs, they gambled that they could buy cheap electricity in the spot market, and that rising summer demand wouldn't drive prices up. Both bets were terribly wrong, and now their customers are left holding the bag.

The good news is that because of restructuring, Californians can now choose from a rapidly growing number of alternative electricity suppliers (with several offering environmentally friendly renewable electricity) that might take a more measured and cautious approach to purchasing electricity for their customers. Consumers were initially slow to realize they could switch electricity companies, but a growing number of San Diegans are now voting with their feet. Such signals should motivate utilities to improve their practices.

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EDITOR'S NOTE

by Brent Gardner-Smith

As this issue of *RMI Solutions* came together, it took on a geographic perspective.

You'll find insight into the causes of California's spike in electricity prices, why China's consumption of coal is down, how the fight to limit greenhouse gases in Australia is going, why the Canadian finance minister sounds more like an environment minister, and what manufacturers in Cleveland are doing to put into practice the principles of Natural Capitalism.

RMI staffers fanned out across the globe this year to work on different projects, and it spurred our reporting on topics as diverse as the green Olympic village in Sydney and why Taiwan shouldn't complete its fourth nuclear power plant.

Also in this edition, you'll find some new features. We've added "Hot Seat," a forum in which readers are invited to pose questions to RMI about the contents of the newsletter.

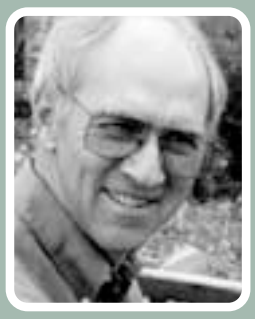
We've created a guest column slot, called "Other Voices," to showcase complementary ideas and insights from colleagues outside RMI. We found the inaugural column by Harlan Cleveland to be a thought-provoking piece on how the world is changing, and will continue to change.

Making a return appearance in this issue is "Dear Rocky," a feature where we share a few of the hundreds of questions posed to our outreach specialists each year. Answering these questions is a big part of RMI's mission, and we devote a considerable amount of our time and energy to being a clearinghouse of information for people trying to make a difference.

Finally, "Board Spotlight" introduces the vital, interesting, and exceptional people who serve on RMI's Board of Directors. The first spotlight is shining on Christine Loh, who has made waves as a member of Hong Kong's legislature and now as a citizen activist trying to improve the city's environment.

I hope you enjoy this issue.

Don't Drop Off Our List—Donate and Keep RMI*Solutions* Coming!



by Dale Levy, Development Director

As RMI's new development director, I've challenged almost every assumption about fund-raising here. As you can imagine, this has led to many interesting and stimulating conversations!

Of course, vibrant debate is not uncommon at RMI, especially when working on something as important to the Institute as our newsletter.

We've recently redesigned *Solutions*, added columns from RMI staff and outside colleagues, and developed more features—including a reader feedback section. We think the newsletter is significantly better than it was last year.

We've also looked at the size of our mailing list, which through the years has grown to include 20,000 names.

As we made changes to the newsletter and reflected on the costs of production, paper, and postage, we began wondering: how many people on this list are still interested in receiving this newsletter and are current RMI supporters?

Well, this question led to another of those lively discussions. In the end, we decided that beginning with the next issue, *Solutions* will be sent only to those who make a $20 or greater donation to RMI on an annual basis.

If you are already a donor of $20 or more, you don't need to do anything except sit back and enjoy the newsletter. (Thank you for your support!)

If you are not currently a supporter of RMI, but enjoy reading the newsletter, either in print or online at www.rmi.org, we encourage you to send a donation of at least $20. This will ensure that you continue receiving *Solutions* three times a year. Please use the enclosed envelope to send your contribution.

If you can't afford a minimum contribution, please let us know of your unique situation and we will send you the newsletter as a gift.

We are working hard to make *Solutions* a source of news and insight on the issues on which RMI focuses. And we think it is an excellent way to stay connected with what is happening at RMI. We hope you agree.

Your participation and ongoing feedback are valued, so please don't hesitate to drop us a line and tell us how we're doing.

the IMPACT of globalization

by L. Hunter Lovins

Many people watched the recent protests against globalization in Prague, Melbourne, Washington, and Seattle, and wondered what all the fuss was about. Few would dispute that globalization has become a source of dissension, but fewer can describe the issues, and fewer still know what to do about them. Once an academic topic for policy analysts, globalization is now inciting demonstrations on a scale unseen since the Vietnam War.

Part of the problem is that the world as we know it is changing rapidly, and increasingly no one is in charge. The fall of the Berlin Wall and the apparent triumph of capitalism worldwide, and the spread of communications and information technology bringing the ability to move capital around the world at the stroke of a computer key, have fundamentally changed the way the world works. Increasingly such changes are affecting not only Wall Street and Main Street, but even rural villages in the developing world.

WHAT'S THE FIGHT ABOUT?

Advocates of globalization argue that trade must be the preeminent objective of international agreements, and that other concerns are legitimate only to the extent that they don't inhibit the free movement of goods and financial capital. This view holds that free trade will expand economic opportunities and "lift all boats." Opponents, they argue, are protectionists or Marxists.

Nations that trade, advocates claim, will not go to war with each other. Globalization will spread the Western liberal values of democracy and human rights, and unleash competition that favors excellence. Trade will empower a middle class that will demand greater democracy and ultimately greater protection for the environment. The World Bank, the International Monetary Fund, and (much more recently) the World Trade Organization were founded to advance this agenda. The protesters may not like it, but nearly every country in the world is a WTO member, and none has resigned. Even China now seeks membership.

Opponents of globalization include people and organizations with very diverse concerns, cultures, and goals. They tend to agree, however, that the benefits claimed for globalization are illusory, or accrue only to elites. The WTO, whose meeting in Seattle the protesters disrupted, is seen as threatening hard-won treaties and local laws that protect the environment and human rights.

The existing trade regime, opponents say, is worsening the disparities of wealth between haves and have-nots in the global economy. They challenge not only the multilateral institutions but also the very merits of free trade, calling for a relocalization of finance and of decision-making. Preferring local and national self-determination, some demand the outright elimination of the WTO and a rolling back of globalization.

Some critics also decry, with farmer/poet Wendell Berry, the homogenization and commoditization of all goods, so that their story is lost and customers can't make responsible decisions about whether to buy them. The meat in Swiss village butchershops is labeled with the name of the farm it came from, so good farmers can be rewarded and bad ones penalized in the

Join discussions on globalization and Natural Capitalism at www.rmi.org and www.naturalcapitalism.org.

local marketplace, but this is lost when meat becomes anonymous on a supermarket shelf. Wrapped in this concern are profound questions about social fabric, appropriate scale, and human purpose.

The WTO has critics within itself, with developing countries claiming that the rich have set the rules to their unfair advantage. Many observers of the Seattle meeting predicted that a stalemate would have occurred even if no protestors had shown up. They point out that WTO member nations do not even accede to the organization's rulings. The protests in Seattle—and the resistance to WTO decisions that compromise member countries' standards of health, safety, and the environment—are evidence that the WTO is failing in its role as a negotiating forum. Its legitimacy is compromised by decisions that coerce member countries into relaxing their domestic standards to a lowest common denominator.

SO WHAT'S TO BE DONE?

The changes that the protesters are demanding would have significant consequences, but may not be achievable. It's not clear that anyone, even national governments, could slow globalization if they wanted to. Of the world's 100 largest economic entities, more than half are no longer countries but companies. While many rightly criticize the effects of this trend, it is folly to deny that financial capital is now instantly transferable around the globe, or that communications technology and the Internet have forever changed the way business is done and decisions are made. It is even questionable whether the nation-state as such will endure in a world in which the market is breaking down political and economic borders.

Ironies abound in this situation. The governments encouraging globalization are themselves being weakened if not supplanted by it, their sovereignty under attack. The protesters decrying globalization are able to gather and organize only because of the technologies (and in no small measure the social sense of global interconnectedness) that enable it. The corporations that the protesters accuse of being both the drivers of globalization and its primary beneficiaries are themselves at risk from it: 40 percent of the *Fortune* 500 firms listed in 1985 no longer exist.

The debate over globalization seems intractable. However, three aspects of RMI's work in Natural Capitalism and Economic Renewal can enlarge the terms of the debate, and may make it less thorny.

AN INADEQUATE IDEOLOGY

Much of the failure of the multilateral organizations to gain acceptance and resolve disputes stems from the fact that their underlying ideology is incomplete.

Like GNP statistics and most ways of accounting for economic activity, the ideology of globalization ignores the value of human and natural capital. It assumes that increasing trade in the two forms of capital that are mobile—manufactured and financial capital—will, by itself, increase human wellbeing. That might be true if the sole basis for prosperity were the exchange of those two forms of capital. But ignoring the critical role of the other two forms of capital and engines of wealth creation, and behaving as if human and natural capital had no value, will result only in the increased impoverishment of almost everyone. These forms of capital are place-based, being rooted in an environment or a culture, are therefore not enhanced by the physical mobility of trade, and may be harmed by it.

However, as our book *Natural Capitalism* describes, companies can begin to behave in ways that enable them to profit and outcompete their rivals even as they reduce their resource use, eliminate waste, and restore natural capital. This means that it is now strongly in the economic interest of corporations to begin behaving in ways that protect the environment. Over the past decade, many farsighted companies have already discovered remarkable opportunities through adopting the principles of Natural Capitalism (see page 6). This has profound but previously ignored consequences for the debate over globalization.

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Together, the four principles of Natural Capitalism form a business strategy that is both essential and profitable. The companies that are furthest down the road in adopting it are finding not only astonishing competitive advantage and profitability, but also ways to eliminate (not just reduce) waste and pollution. They can often employ more people, and improve innovation and morale.

Such companies are taking a leading role in addressing some of society's most profound economic and social problems. They may not think of themselves as environmentalists, only as profit-maximizers. Yet

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TRUE TALES OF NATURAL CAPITALISM

by Holly Harlan

SOME BUSINESSES WORRY THAT implementing Natural Capitalism will require too much time and staff energy. However, two Cleveland, Ohio manufacturers have found that even small steps can lead to higher resource productivity and greater profitability.

Mike Wochna, president of Melin Tool, a family-owned machine shop with 50 employees, began by eliminating solvents from his processes—an application of the second principle of Natural Capitalism, which aims to close materials loops and eliminate waste and toxicity.

The solvents the company was using had special handling and disposal needs, and presented air-quality issues on the shop floor. Wochna collaborated with Better Engineering Manufacturing of Baltimore to develop a water-based cleaning system that was strong enough to clean off oil residue without a chemical solvent.

The new system, which cost $35,000, not only eliminated the use of solvents, it also doubled capacity, reduced labor costs, improved air quality, and reduced noise.

"I didn't make this investment based on cost savings," Wochna said. "I wanted to improve the air quality in my shop. However, because the new cleaning system runs unattended, I found that I save $55,000 a year in labor costs and could move a worker to an opening in another part of the operation."

A resource-flow analysis of a product, process, or company can help both to eliminate waste (principle two) and to increase resource productivity (principle one). The analysis can be a simple input/output diagram or a more in-depth lifecycle analysis that considers all the inputs needed to produce a product and all the outputs created by the process, including waste (which we prefer to call "unsaleable production").

After conducting such an analysis this past summer, Pete Accorti, co-owner of Talan Products, a Cleveland-based stamping company with 45 employees and over $9 million in sales, decided to start by looking at a primary input—energy.

Talan was spending about $12,000 a month on electricity, but the company had not seriously tried to control this cost; its focus had been on labor productivity and sales growth.

The first thing Accorti did was create an energy management committee. The committee contacted Talan's main vendors, starting with the company that provided and serviced the air compressors used in the manufacturing process.

"We discovered that it was costing our company $6,000 a month—half of our electricity bill—just to run two compressors," Accorti said.

Now Talan is working with the compressor vendor to do a seven-day analysis of air usage and peak demand. Based on the outcome, the company expects to install one high-efficiency compressor instead of two older ones.

The vendor took the older compressors back and credited them against the lease of the new compressor. Net savings are expected to be $3,000 per month. Talan may also contract with an air-services supply company to eliminate buying or leasing compressors altogether. This is an example of principle three, which entails shifting from selling (or buying) products to leasing services.

What these examples show is that putting Natural Capitalism into practice need not take on overwhelming proportions. Dramatic gains toward running an operation with greater resource efficiency can be made by taking simple and direct actions. What's more, the cost savings that are usually a byproduct of this more efficient approach can help companies implement the fourth principle of Natural Capitalism—reinvesting in natural capital, which is the basis of future prosperity yet is in increasingly short supply.

Holly Harlan is the manufacturing assistance program leader at the Westside Industrial Retention and Expansion Network (www.wire-net.org) in Cleveland. WIRE-Net's mission is to retain, grow, and attract industrial and related employers and to engage them as stakeholders in the community.

THE FOUR PRINCIPLES OF NATURAL CAPITALISM

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

- **Radically increase the productivity of natural resources**
- **Shift to biologically inspired production models**
- **Move to a solutions-based business model**
- **Reinvest in natural capital**

WHAT'S POSSIBLE MAY NOT BE WISE

by Amory B. Lovins with L. Hunter Lovins

IN SCARCELY MORE THAN A HALF-CENTURY, our species has developed at least four technologies that pose a danger to its own future.

The first, nuclear fission, retains the potential to annihilate humanity. Cold War terror is now history, but in its place have come other dangers. Fifty-five years after Hiroshima and Nagasaki, few people remember what it means to kindle a small star over a city. Vigilance has relaxed, while bomb-making technology and know-how has spread widely in simplified forms. The missing ingredient—fissionable material—is falling into numerous and irresponsible hands. Saddam Hussein nearly made bombs and is still trying; if he doesn't succeed, someone else will, or will simply buy military bombs gone astray.

Having worked for decades on nuclear nonproliferation, I wouldn't be surprised to wake up tomorrow morning and discover that nuclear terrorism, or even nuclear war, was under way. There have been near-misses.

Once made, bomb materials last nearly forever. Human institutions and attention don't. Will we go on being lucky—nearly forever?

DESCARTES MEETS DARWIN

Then there's the manipulation of genes. The euphemism "genetic engineering" is inaccurate. Genetic manipulation moves genes, but is not really about genetics (which is a finely tuned evolutionary process for selecting and transmitting heritable information so as to improve biological fitness). "Engineering" implies an understanding of how causal mechanisms translate action into effect, but we are far from understanding how genetic patterns turn into organisms.

But we are well along in changing those patterns anyhow—and thereby transforming science from a way of *understanding how nature works* into a tool for *changing what nature is.*

Biotechnology not only speeds up genetic changes by about a billionfold—far too fast to ensure safety before release—but also changes their goal from evolutionary success to economic profit. This industrialization of life, fundamentally changing the nature of the 3.8-billion-year-old life process, is carried out by people skilled in gene-splicing technique and biochemistry, but generally ignorant of key biological fundamentals—ecology and evolutionary biology. It's very clever kids with PhDs in "molecular biology," playing with dangerous stuff they don't understand.

Some theologians suggest—not from ignorance or superstition but out of deep biological wisdom—that it was not through mere carelessness that the Creator failed to put genes from an arctic fish into a strawberry to boost its cold tolerance. They question the belief that biodiversity is so inadequate that we must create novel life forms, unneeded for nutrition and unwelcome in the marketplace, to correct God's lamentable oversights.

And like nuclear power, biotechnology can be abused. High-school kids can buy gene-splicing kits for basement experiments with recombinant DNA, and find it not unduly difficult to splice deadly toxins into common bacteria. Amateurs have already been caught doing so. Some countries (and perhaps non-national terrorist groups) employ teams of amoral but skilled scientists to create dreadful new plagues. That's so much easier, cheaper, and more concealable than developing nuclear bombs. It will be a pleasant surprise if no designer epidemics are unleashed on the world, accidentally or deliberately.

Genetic manipulation, far from being the pinnacle of industrial modernity, is actually the last gasp of industrial primitivism,

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applying a reductionist and mechanistic mindset to living systems that don't work that way. It's the biggest intellectual collision since the Reformation: Descartes meets Darwin. Yet it's astonishingly devoid of compelling social or economic rationale.

Perhaps its most striking feature (just like nuclear power) is the insubstantiality of its actual benefits. We are assured that biotech is the only way to feed the world, just as we were told that nuclear power is the only way to keep the lights on. The reality is just the opposite. Both technologies cost more and work worse than well-established alternatives outside the commercial orthodoxy—alternatives that are better buys for customers but less profitable for input suppliers.

SCIENTIFIC HUBRIS

The potential dangers of two other emerging technologies—nanotechnology and robotics—have been eloquently discussed in an article in the April 2000 issue of *Wired* by Bill Joy, cofounder of Sun Microsystems and the father of Unix and Java.

Nanotechnology—the technique of making self-replicating machines on a molecular scale—offers the promise of "desktop manufacturing" that could assemble anything, one atom at a time, very cheaply, with no waste. Yet, as Joy points out, nanotech can exhibit the same amoral, scientific hubris as transgenics, and holds the same apocalyptic possibilities as nuclear technology. It could be used by rogue states or terrorists to create microbe-sized, self-replicating antipersonnel weapons designed to attack all life within a target geographic area or genetic group. Worse, a simple but genetically superior lifeform created by nanotechnology and released without effective controls could conceivably transform all organic matter on earth into "gray goo."

There is no need for humanity to take such risks. Roughly comparable materials and energy efficiency is already available, without nanotechnology's scary downside, from other techniques described in my recent book with Hunter Lovins and Paul Hawken, *Natural Capitalism*, and in Janine Benyus's book *Biomimicry*.

I'm far less qualified than Bill Joy to comment on where robotics and artificial intelligence are taking us. But as one of the world's most capable computer scientists, he deserves to be taken seriously when he asks whether this art, too, may change for the worse not only what we can do but also who we are. A robotic device that can design and build another robotic device has already been demonstrated. In the fast-forward world of Moore's Law and Internet Time (like dog years—they go by about seven times faster), it may not be long before computers and robots are so much better that we are at so many things that they start feeling they don't need us.

DOUBLE-EDGED TOOLS

My purpose in summarizing these concerns is not to scorn my colleagues in technological innovation, nor to sow panic, nor to gripe about the general goal of progress. As a technologist whose life's work is innovation to create a more secure, prosperous, and life-sustaining world, my questions are about means, not ends.

My purpose here is rather to invite us all to use our critical faculties and our market and political responsibilities to create the sort of world we want. When the most powerful force we know in the universe—six billion human minds wrapping around a problem—is harnessed, it should create happiness and satisfaction rather than suffering and injustice.

Our new tools are so sharp, double-edged, even deadly, that we need to be sure they won't injure us. If we can't be confident about that, then we should lay them down and choose safer ones.

The coming decades will be our species' graduation test, when we discover whether this opposable-thumbs-and-large-forebrain experiment was a good idea. The search for intelligent life on earth shows promise, but is now entering its most critical stage. Let's not mess it up now by blandly assuming that whatever is possible is also wise.

Amory Lovins co-founded RMI and is its co-CEO (Research). This article was adapted from a column distributed by the Los Angeles Times Syndicate.

DEAR ROCKY

by Jason Denner, RMI Outreach Coordinator

Alcoholic Cars

Dear Rocky,

I have visited Brazil several times in the past 40 years. Each time I have been impressed that their autos were being fueled by alcohol—the number of alcohol-powered cars has increased dramatically and they all seem to be American made. Why can't we use alcohol until a better "car" is perfected?

—Dr. Morris J. Nicholson, Sun City, Arizona

Dear Dr. Nicholson,

The question of alcohol fuel is a complex one. Alcohol fuels come in two flavors, ethanol and methanol. Either can be combined with a small amount of gasoline for use in normal vehicles, with minor modifications to fuel system and engine tuning. In fact, versions of Dodge's Grand Caravan, Ford's Taurus, and Chevy's S-10 pickup are available that run equally well on either E85 (85 percent ethanol, 15 percent gasoline) or straight gasoline. Brazil uses ethanol-rich blends, though their market share is declining.

In the United States, most ethanol is derived from corn. As corn grows it absorbs carbon dioxide from the air, effectively sequestering the amount released from burning ethanol in an internal combustion engine. Thus ethanol could be a "climate-neutral" fuel—if the corn is sustainably grown.

Unfortunately, in the United States most corn is grown using a great deal of fossil fuel—for farm equipment and chemicals—and in ways that deplete topsoil, negating much of the gain from corn's being a renewable resource. Brazil's ethanol—from sugar cane, grown mainly to support jobs in the impoverished northeast—raises similar issues.

Ethanol can also be produced from agricultural waste products, such as switchgrass and corn chaff. However, most ethanol-producing companies—many of which have interests in corn production—have not developed their plants for these feedstocks. The economics and net energy yield of ethanol can be favorable with the best techniques, though they're not always used. Similarly, most methanol is produced from natural gas, although production from renewable biomass is possible.

We believe that hydrogen will ultimately replace all other fuels for most vehicles and many other energy applications. But since direct-hydrogen fueling stations are not yet widespread (though they could be soon), your question about alcohol-fueled vehicles as an interim step is appropriate.

As long as we're considering clean interim fuels, though, we must compare alcohol with another immediately practical choice: compressed natural gas (CNG). Natural gas—methane—is the simplest hydrocarbon, having only one carbon atom surrounded by four hydrogen atoms. Alcohols have higher carbon/hydrogen ratios than methane, and thus emit more carbon dioxide when burned.

Also, alcohol-burning internal combustion engines can emit more phenols—a potential health hazard in urban areas—than gasoline engines do. That's why many urban transit systems now favor CNG-fueled buses over those that burn alcohol.

At RMI we believe CNG represents an attractive interim step to hydrogen for these reasons and also for one other: it's a gaseous fuel. The infrastructure needed for transporting and dispensing CNG is partly similar to that for hydrogen, so switching to CNG could help pave the way for hydrogen.

Houseboat Power

Dear Rocky,

I am currently designing a houseboat for personal use and am wondering what might be the best propulsion system. I am considering using a lead-acid battery with photovoltaic (PV) recharge. I envision something simple like two 120-volt DC motors for standard propulsion and two battery banks having ten batteries apiece. Of course an inexpensive fuel cell would be nice! But where would I get hydrogen in the middle of a lake like Powell?

—Robert Y. Jones, Aurora, Colorado

Dear Robert,

RMI hasn't gotten to the subject of marine applications of fuel cells, yet. The U.S. Navy has been using fuel cells in submarines for some time, though, so the idea is not without precedent.

Interestingly, the middle of Lake Powell could be one of the best places to get hydrogen. One way to produce hydrogen is through electrolysis: using an electric current to split water into its constituents, hydrogen (H_2) and oxygen (O). This could be accomplished with PV-supplied electricity.

Because it *can* be done, of course, does not necessarily simplify your task of finding appropriate components with which to build your system. If you do decide to create the world's first fuel-cell-powered houseboat, you'll find some useful resources at our Hypercar Center® website (specifically http://www.hypercar-center.org/dox/what_a9a.html).

THE CHALLENGE

Of Reducing Greenhouse Gases Down Under

Australians, as was evident during the summer Olympics, are generally a sunny and optimistic people. But when it comes to reducing the country's greenhouse-gas emissions, there's little to smile about, mate.

RMI staffers began working in earnest this summer on climate issues in Australia. They found that while there's a high level of concern about the problem among government, community, and environmental activists, the reality is that emissions are still climbing rapidly.

Australia's greenhouse-gas emissions grew by 16.9 percent from 1990 to 1998—hardly an auspicious start to meeting the country's commitment under the Kyoto Protocol to limit its emissions by 2010 to just 8 percent over the 1990 level.

Does that remind you of something closer to home? It should. The United States is similarly delinquent in meeting its Kyoto pledge to reduce emissions to 7 percent below 1990 levels by 2012. The latest figures show U.S. emissions running 9.9 percent above.

If those patterns continue, both Australia and the United States will miss their targets. Their lack of progress to date is expected to come to light at the Sixth Conference of the Parties (COP-6) to the Kyoto Protocol, to be held November 13–24 at The Hague.

Both countries are lagging in part because they're enjoying unprecedented economic booms. The United States is also suffering from a lack of political will to address the problem: the Senate has yet to ratify the Kyoto Protocol, and President Clinton's proposed Climate Change Technology Initiative has been stalled in Congress.

The folks Down Under face some different hurdles, including a coal-mining industry resistant to any threat to its livelihood, and a preponderance of older, energy-inefficient housing. (Hence the importance of model projects like the Sydney Olympic Village—see sidebar.)

KING COAL

Although Australia is responsible for only 1.4 percent of global greenhouse gas emissions, it's among the highest carbon emitters in the world on a per-capita basis.

A major contributing factor is that 80 percent of its electricity is coal-fired (natural gas and hydro account for the rest). Coal is the country's main commodity export. A reduction in the amount of coal burned domestically could hurt the coal-mining industry, which has been weakened over the past few years by low global prices, poor profitability, and long-running industrial disputes.

"While there are active programs and obvious concerns over climate change in Australia, there also seems to be an unspoken consensus that anything that threatens economic growth or the coal industry is just a no go," said senior RMI climate researcher Rick Heede, who traveled to Australia in July with CEO Amory Lovins for a series of energy-related meetings and presentations.

Since 1997, Australia has spent A$400 million on renewable-energy programs. Another $400 million is earmarked for a Greenhouse Gas Abatement Program. But emissions keep rising.

"We got the feeling that many Australians, like many Americans, are happy going on the current course," said Heede. "There is a lack of understanding, in both countries, about how corporations can profitably reduce their emissions."

To that end, RMI is now actively engaged in helping Australian communities and companies do just that.

RMI and the city of Newcastle (pop. 250,000) are now working together to develop a plan for the city to meet more than its share of Australia's Kyoto commitment. RMI signed a memorandum of understanding with the city and the University of Newcastle to work on the project.

"The city is considering a commitment to reducing emissions by 20 percent from 1995 levels," said Heede. "Newcastle has a good opportunity to be a model for other cities. It was the most advanced of the cities we visited in regard to reducing greenhouse gases."

WHIZZING ROUND OZ

And interest in energy issues is high in Newcastle.

"Amory gave the keynote address at a Newcastle energy town meeting," said Heede. "It was amazingly well-attended for a rainy night. Nearly 1,000 people came. There was very strong participation and commitment in evidence by city officials, the local utilities, and the newly established Sustainable Energy Technology division of the country's main energy R&D agency."

Heede and Lovins held more than 30 meetings in Australia during their July visit. While most of their agenda was devoted to climate issues, they also discussed sustainable tourism with grassroots activists in Tasmania, briefed British Petroleum on electric-utility and HYPERCAR℠ developments, consulted with Melbourne University Private on starting a green business school, discussed HYPERCAR technology with automakers, and gave numerous presentations and interviews on Natural Capitalism.

They also met with the environment minister and other federal officials in Canberra, state ministers and officials in Queensland and New South Wales, and municipal officials in a variety of cities, including Melbourne, where they helped launch that city's Climate Action Plan which seeks to reduce emissions by 10 percent from 1990 levels by 2010.

"I feel we were able to give Australian companies, communities, and government officials a real sense of the opportunities to reduce their greenhouse-gas emissions," said Heede. "We were giving activists a springboard for further action on both climate abatement and corporate sustainability."

—Brent Gardner-Smith

Sydney 2000: A Green Olympic Legacy

RMI's GREEN DEVELOPMENT Services played a role in developing the athletes' village of Newington for the Sydney 2000 Olympic Games…and beyond.

The project was designed to provide housing for 15,300 athletes during the Games, and then to be reused as an environmentally responsive new town with 4,500 permanent inhabitants. The project was privately developed by Mirvac/Lend Lease, one of the largest developers in the world.

Of the three neighborhoods, one was built with temporary structures for the Games, which are now being sold and moved to other sites in Australia. The other two neighborhoods are being converted from dormitories to completed single- and multi-family homes.

Green Development Services founder and lead consultant Bill Browning was part of the team that won the design-build contest for the village. His role was essentially that of an in-house benchmarker: he helped the group make sure the concepts it was using for Sydney were of gold-medal quality.

"I was consistently asked 'Is this the best we can do?' and 'Who is doing something similar?'" said Browning. "In return, I was able to ask 'Have you thought of this?'"

In addition, Browning helped link the Australian members of the team with American and European product manufacturers.

The team of designers, builders, and consultants thought of myriad ways to "green" the new village, including:

- cleaning up an abandoned naval munitions depot at the site;
- locating Newington near the Olympic venues and along new mass-transit lines to minimize auto dependence;
- creating three pedestrian-focused neighborhoods and a commercial center that will now connect with surrounding older neighborhoods;
- installing solar water heaters and grid-connected, one-kilowatt photovoltaic arrays on the roofs of 665 of the homes;
- eliminating the need for air conditioning through the use of energy-efficient design and passive ventilation;
- undertaking extensive environmental analysis and screening of building material choices; and
- restoring eucalyptus-tree savannas and creating a channelized stream for the open-space area.

Thanks to the highly efficient house designs and the roof-mounted solar panels, the neighborhood will actually be able to sell power back to the grid at peak hours.

"It is one of the more intensive distributed-power experiments going on anywhere," said Browning.

Allsport Australia,
38 Atchison St. St. Leonards NSW 2065
POB# 215, St. Leonards NSW 2065
Part of Getty Images Group

Photo: Mike Hewitt, Olympic Stadium, Sydney

CHINA: REACHING FOR GREEN GOLD

A coal-fired power plant looms over Shanghai's harbor. Photo: Jeffrey Aaronson/Network Aspen

IT HAS 1.25 BILLION PEOPLE and an energy mix that depends heavily on coal. Already a major polluter, it's expected by many climate experts to become the world's biggest emitter of greenhouse gases. Yet it wants to host the 2008 Olympics—and to do so under smog-free skies.

Will China change? *Can* China change?

It's possible. And signs of swift change are increasingly evident.

While coal still accounts for a whopping 70 percent of China's energy mix, the country has made significant strides recently in reducing consumption: between 1997 and 2000, the country's coal output dropped from 1.4 to 0.9 billion tons. That decline has resulted from a combination of increased efficiency and a shift from coal to natural gas, oil, and renewables.

THE BLUE-SKY FACTOR

The Chinese are embracing alternatives to coal for several reasons, according to RMI's Amory Lovins, who with Hunter Lovins participated in a three-day symposium on environmental protection in Shanghai in July.

The first is rail capacity. The sheer volume of coal needed to keep generators generating and boilers boiling is severely hampering the country's ability to move other goods on its rail infrastructure.

Second, economics: new natural-gas-fired power plants typically outcompete traditional coal-fired ones, even in a country where coal is plentiful. (The same is true in the United States.) That gas-fired power plants are much cheaper and quicker to build than coal-fired ones is also a great advantage.

A third factor is the growing public-health emergency caused by chronic air pollution from coal-burning. In that regard, the Beijing authorities learned a lesson last year when the Communist Party decided to celebrate its 50th anniversary with a "blue sky day," a rare event in the polluted city. So the government shut down polluting industries and prohibited the burning of high-sulfur coal.

"They found they rather liked the blue sky and decided to get serious about air pollution," said Lovins.

Yet a fourth factor motivating China to use less coal is its bid for the 2008 Olympic Games in Beijing. China views the Games as a unifying project and knows that it stands a much better chance of winning them if it cleans up its air.

"They have very little time to show an improvement in clean air and they are moving rapidly," said Lovins. "Our Chinese friends say they have never seen anything happening so fast."

WARTIME URGENCY

In the past year, China has moved with "wartime urgency" to install a natural-gas infrastructure in five major cities, construct six 320-megawatt gas-fired power plants in Guangdong Province, and create a nationwide natural-gas network.

In Beijing, in an effort to promote natural-gas power, the city is preparing a slew of measures to phase out local coal consumption. Bejing plans to stop building coal-burning power plants and coal-to-gas generators, reduce the use of coal-burning equipment, speed up construction of natural-gas power plants, establish no-coal-use areas, and increase the number of households using natural gas.

The change in energy policy in China the last two years represents "a sudden generational and bureaucratic revolution," Lovins said, noting that "people who understand gas" have at last started to gain clout competitive with that of the coal-favoring technocrats who've held sway for decades. According to the U.S. Energy Information Administration, natural gas is expected to

provide 8–10 percent of China's energy by 2020, up from just 3 percent now.

The move to natural gas offers a significant climatic improvement over coal. While gas is also a fossil fuel, it contains half as much carbon as coal and, in a combined-cycle power plant, can burn twice as efficiently, yielding a roughly fourfold reduction in carbon-dioxide emissions per unit of electricity output.

During 1997–99, the Chinese economy grew by about 8–9 percent per year, but total primary energy use fell by about 4 percent, accelerating a trend that cut national energy intensity in half during the 1980s (by the late '90s, even electric intensity was decreasing). Since 1980, China has cut its energy intensity at least as fast as the United States has—nearly twice as fast if you accept the rather high official estimates of China's GDP growth.

Renewable energy is also catching on. In 1993, China had 15 gigawatts (GW) of renewable electric-generating capacity, almost all of it small hydroelectric projects. By this year, the planned total is 20 GW; for 2010, it's 32 GW, including 28 GW of small hydro and 3 GW of wind; and for 2020, it's 49 GW, including 39 GW of small hydro and 8.5 GW of wind. (These figures deliberately exclude large hydro projects, which typically do more environmental harm than good.)

"China is making a large, unheralded conversion toward sustainability by virtue of its energy policy reversal," said Lovins. "They deserve a lot of credit."

PLAYING LEAPFROG

The country, however, is still in an ecological crisis. As the population gets richer, it's eating higher on the food chain, causing more land to be committed to growing grain for livestock to produce meat. Nearly 2 million new vehicles take to the roads each year, and analysts expect that number to reach 3 million or more by 2010. Factories catering to the growing purchasing power of 1.25 billion domestic consumers—not to mention the ever-burgeoning export market—add to the air and water pollution. Forests are being felled, wetlands filled, groundwater mined, and biodiversity lost at an alarming rate.

"It's an ecological disaster zone," Lovins

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TAIWAN | NO MORE NUKES

Should Taiwan's monopolistic utility, Taipower, complete the island nation's fourth nuclear power plant?

A team of four U.S. energy experts, including RMI's Amory and Hunter Lovins, this summer recommended abandoning the project—and the Taiwanese government appears poised to follow that advice.

The team met in August with Minister of Economic Affairs Lin Hsin-yi (whose ministry oversees electricity), members of the Fourth Nuclear Power Plant Reassessment Committee (which was convened by the Ministry of Economic Affairs), the country's top two EPA officials, legislators, technical experts, and journalists. Their trip was sponsored by the W. Alton Jones Foundation.

The Taiwanese government was trying to decide whether to complete the $5.4-billion, 2.7-gigawatt plant, which is already one-third built. The team's advice was to invest instead in efficient use of electricity, industrial cogeneration, independent power production, fuel cells, and renewable energy.

"Taiwan has a lot of other options than completing the plant," said Amory Lovins, "and they're all cheaper and more reliable."

The team also suggested that Taiwan enhance its policy to open electricity and natural-gas markets to competition. Indeed, they felt that the combination of these two separate initiatives, properly understood and harnessed, would produce a gusher of faster, safer, cheaper, and more secure options.

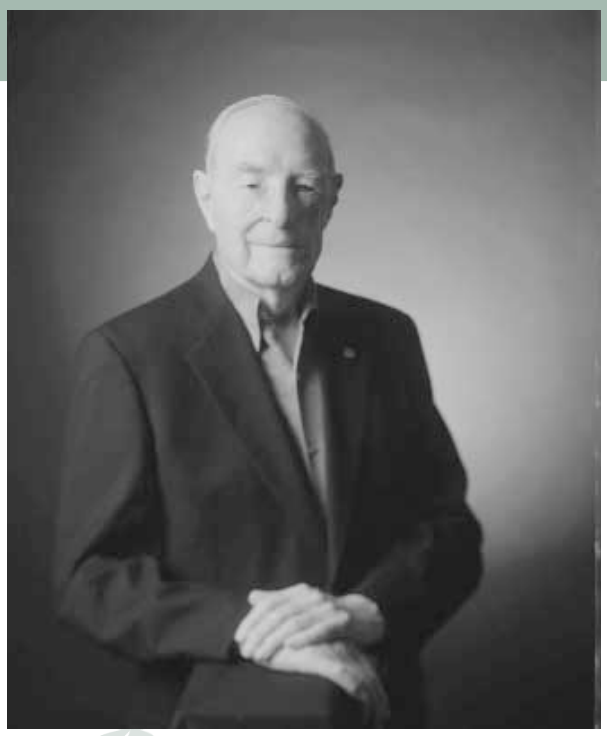
"Under competitive conditions, you'll get more electrical services than you need and they would be cheaper than building the rest of this nuclear plant," Amory Lovins told the Taiwanese media at a press conference on August 4.

Fellow team member Ed Smeloff, executive director of the Pace Energy Center at Pace University and a former board president of the Sacramento Municipal Utility District (SMUD), agreed, noting that 47 nuclear plants already under construction have been canceled worldwide since 1978. Smeloff also described the closing of the operating Rancho Seco nuclear power plant near Sacramento; SMUD's investments in efficiency and renewables met demand, cut debt and user rates, and created good jobs to boot.

As this newsletter went to press, Economic Affairs Minister Lin issued a recommendation to cancel the plant. The legislature may yet intervene in the final decision, due in November, but the plant's supporters concede that Lin's decision may have doomed the project.

LEADERSHIP FOR THE GLOBAL CENTURY

by Harlan Cleveland



MY SWEEP OF THE HORIZON SHOWS ten worldwide revolutions transforming our world. They are concurrent, but not parallel—rather, they are intermixed, interwoven, interactive.

FIVE TECHNOLOGICAL REVOLUTIONS

First, the sudden increase in explosive power has clamped a lid on the scale of warfare. That's a first in human history. The invention of weapons too big to use turned much of big-power military strategy into an expensive information game.

Second, biotechnology, including the deciphering of information in living genes, presents humankind with a vast range of new ethical choices and political puzzles. In this and other ways, we—*homo* we hope *sapiens*—are becoming increasingly responsible for our own evolution.

Third, computers, serving as prosthetic extensions of our brainpower, are replacing much of the repetitious drudgery people have always had to endure. They have certainly brought in their train new puzzles about the future of "work." But I can't believe that eliminating drudgery will be bad news for the generations to come.

Fourth, linking faster computers with more reliable telecommunications enables us to model and simulate vast systems such as the global atmosphere, the human genome—and fallout from nuclear explosions. This new analytical power is sensitizing us to the consequences of what we the people are doing to our natural environment—and what we might inadvertently do to ourselves.

Fifth, the widening spread of knowledge is creating a "skill revolution" that provides so many more people with the attributes and ambitions of leadership as to create a fundamental change in the technology of organization. Administrative pyramids and command-and-control systems are on their way out, consultation and consensus are increasingly "in."

FIVE ASPIRATIONAL REVOLUTIONS

The above five transformations are driven quite directly by scientific discovery and technological innovation. The other five are facilitated, even intensified, by science and technology. But they are driven by universal aspirations of the human spirit—by a widespread sense of entitlement to "enough" (the fulfillment of basic human needs), and beyond that by equally basic human desires for a sense of achievement, justice, solidarity, and participation.

So, sixth, the idea of human rights for everyone has become the world's first truly universal idea-system, the first superstar in the history of political philosophy. It has come to mean rights not only for women, captured soldiers, and political prisoners, but also for children and the aging, for racial and ethnic minorities, for immigrants and refugees, and for all manner of people once considered "untouchables."

Matching universal human rights with universal human responsibilities, however, has been left to be worked out in the 21st century.

Seventh, a global fairness revolution is widening as the spread of knowledge shows the disadvantaged in every society what they are missing—and is providing them with new means of communication to express their rising resentments and help them "overcome."

Eighth, fierce loyalties to cultural identity with less-than-global communities—

bonded by nationhood, ethnicity, race, religion, ideology, and even occupation—are colliding everywhere with the homogenizing cultures of "modernization."

Ninth, an emerging ethic of ecology is producing a revolution in human self-control—based not on "limits to growth" but on limits to thoughtlessness, unfairness, and conflict. The result, in many domains, is actually a "growth of limits."

Tenth, openness, market incentives, and the practice of pluralism are currently on display in some of the unlikeliest places. Authoritarian and totalitarian systems are simply unable to compete with looser systems that "go with the flow" in the global flood of knowledge.

THE INFORMATION AGE

These global tides and currents are all related to each other. Indeed, modern biologists and have joined a long list of spiritual prophets, inspired poets, and secular philosophers in insisting that everything is related to everything else—and that, in consequence, each of us has to try and think hard about "the situation as a whole."

The striking thing about these global windshifts is the extent to which they all are rooted in the historically sudden spread of knowledge—which in turn is the consequence of upheavals and opportunities created by the marriage of computers and telecommunications during the last quarter of the 20th century.

Peering now into the 21st century, we can't know just what will happen, or when. But we already know something more important: why it will happen.

Information—symbols, not things—will be playing the lead role in world history that physical labor, stone, bronze, land, minerals, metals, and energy once played. We'll have to burn into our consciousness how very different information is from all its predecessors as civilization's dominant resource.

Information expands as it's used—no "limits to growth" here. It is readily transportable at close to the speed of light. Information leaks so easily that it's much harder to hide and to hoard than tangible resources were. Information cannot be owned, only its delivery service can.

The striking thing about these windshifts is the extent to which they are all rooted in the historically sudden spread of knowledge.

The spread of information empowers the many, by eroding the influence that once empowered the few who were "in the know." And giving or selling information doesn't give rise to "exchange" transactions; these are acts of sharing.

These simple, pregnant propositions about the nature of information, as they sink in around the world and down the generations, should help us sort out some of the big conundrums that still puzzle us in the new millennium.

REDEFINING INTELLECTUAL PROPERTY

Let's take three examples.

First, if information cannot really be "owned," then the whole idea of "intellectual property" is clearly an oxymoron, a contradiction in terms.

It is, of course, quite possible to encourage and reward creativity—it happens all the time in universities and elsewhere. But it isn't necessary to glue future creativity to the antique notion of personal property rights. Rather than digging in now to defend patent and copyright law, those crumbling ramparts of information-as-property, we will be wise, early in the 21st century, to invent, elaborate, and project a more viable concept that leaves plenty of room for incentives for creativity, yet doesn't rest on "ownership of information" as its moral, legal, economic, and philosophical basis.

Moreover, the footings on which "trade secrecy" and government classification systems rest are just as vulnerable as patent and copyright law to the predictable tornadoes of change. They also deserve a skeptical new look early in the Global Century.

DWINDLING DISTANCES

A second example starts with the dwindling relevance of distance, which widens the definition of "community."

Down through history community has mostly meant the ties among people who lived or worked nearby. Community can now, much more readily, mean people with similar interests and motivations working together in "virtual teams" wherever they are living, working—or even traveling.

It is still premature, but it's no longer laughable, to speak of "the end of geography." Much of my life has been focused on international affairs, and I would have to be blind not to have noticed that geographically "regional" bodies have turned out to be the least effective and most underemployed of the many kinds of international organizations invented during the past 55 years.

The European Union may yet prove to be an exception to this broad-brush generalization; but even "Europe" hasn't yet come together enough to project its values worldwide in the 21st century.

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HOT SEAT

We received several challenging questions to facts and figures given in the last newsletter. The following point-counterpoint between a critical reader and Amory Lovins was particularly interesting. The exchange occurred via e-mail.

Stephen B. Andrews:

On page 2 [in an article on global warming, you state:] "Coal is already defunct or on the way out in most of the world. Its use is now falling even in the United States, China, Russia, and Eastern and Western Europe."

Then how do you square your statement with [June 1999 figures showing that world] consumption is stable over the period 1988–98?… While your other figures are correct, consumption is up in Japan, India, South Korea, and South Africa, hence the leveling. How can you call this "defunct" or "on the way out in most of the world"?

Amory Lovins:

You were right up to 1998. We're right starting in 1998. Chris Flavin [of the Worldwatch Institute] wrote…on 15 March 2000 that "…the good news in world energy markets the past two years is almost entirely in the coal sector.

"For the first time, we can say that world coal demand is on an unambiguous downward track—in Eastern and Western Europe, Russia, China, and even (finally) North America.

"These declines have been so sharp in 1998 and 1999 that Worldwatch is now estimating that global carbon emissions have fallen for two consecutive years. As a result, carbon emissions in 1999 were actually slightly below the 1996 level. The last time the world had this much 'good news' on the carbon front was during the last oil crisis 20 years ago.…"

China, by the way, officially projects a 2000 coal burn that's back to the 1986 level!

Andrews:

On page 25 [you state that:] "…American dependence on imported oil [is] now back to early 1970s levels." [Here Andrews cites official figures showing that U.S. petroleum imports went from 6,025 to 9,612 million barrels per day during 1973–99.]

Hello!? What's wrong with the above picture? Imports are up 60 percent!! More importantly, imports are up 3.5 mb/day. I don't think the Saudis give a rip what the "percentages" of imports are at this point. They sell millions of barrels of oil, not percentages of barrels of oil. In the year 2010, are we more likely to have a conflict with the Chinese over millions of barrels of oil which they AND we want to import, or over the percentages which we want to import?

Lovins:

What matters to "dependence" is not the absolute level of crude imports…but net imports as a share of products supplied.

This share is graphed for 1973-99 at www.eia.doe.gov/pub/energy.overview/monthly.energy/graph/mer1_7.pdf. You're right that the statement could have been clearer if *RMI Solutions* had published more information. But the graph shows that the relevant fraction was 49.6 percent in 1999, very similar to, but having surpassed, the 46.5 percent in 1977 (the previous peak).

I take [the article writer's] statement to mean, correctly, that import dependence, conventionally measured in share of consumption, has already regained and passed its earlier crisis-period levels. He's right. I believe what matters to dependence and to its domestic perception is share of consumption. You're correct that exporters may have a different perspective, but that wasn't [the writer's] point. The scope for international conflicts depends on (among other things) still a third perspective—market flexibility and share.

Andrews:

Lastly, apart from errors, I want to continue challenging the RMI company line on the world's future oil consumption.... Please consider these facts, then respond to the question below if you have a moment:

A. There are some 700,000,000 mostly inefficient gasoline and diesel vehicles in the world today—inefficient, at least, compared to both hybrids and your pet fuel-cell-powered vehicles. While cars in the U.S. last an average of 16 years, those very same vehicles are often spirited out of the country to be maintained for many more years. While no reliable figure is available, an estimated life expectancy of 20-plus years for the world mechanized fleet is probably not unrealistic.

B. There are some six billion people in the world (a few handfuls more than when "…Stone Age man ran out of stones...").

C. The appetite for cars worldwide is powerful; fortunately, economics in the developing world limit the purchasing power there to some degree.

D. The appetite for gas-guzzling SUVs is mind-numbing in this country. Light-truck-category sales are over 50 percent.

E. The unwillingness of the U.S. driving public to tolerate rises in gasoline prices, from either taxes or short-term supply issues, is almost frightening. As per 1996, politicians are pandering to see what they can do to "ease the driving public's pain" until supply/demand [makes] the gasoline price issue fade away….

F. Two of the world's three largest oil producers (the U.S. and the former Soviet Union) reached their peaks in oil production a while back (1970 and 1988, respectively).

G. World oil discoveries peaked during 1962 (USGS figures). Today, we discover one new barrel of oil for every four barrels we produce.

H. Several oil industry retirees and current oil company officials have attested to the fact that world oil production will peak, hit a high point in daily production and then slowly decline, between 2005 and 2010. (Shell is more optimistic, using perhaps 2025 or 2030; BP has previously acknowledged 2010 or so.)

Lovins:

About right until G; remember that there's no point spending money now to prove up reserves when you have ample ones to extract within your E&P [exploration and production] time horizon to meet your demand and market-share expectations. H depends on tacit assumptions about demand growth; you need to consider not only geological and economic/technological supply but also efficiency and substitution if you're to have any insight into future supply/demand balance. This is probably where we most differ.

Andrews:

Given the above, I have a serious question for the RMI Hypercar Brain Trust: How many hybrids and fuel-cell vehicles do you anticipate in 2010? (Round numbers of millions will do)….

Lovins:

Collectively these could well have a market share around half—more like two-thirds if one is optimistic.… You can run the [fleet] numbers yourself. Just remember that improvement in the marginal vehicles' fuel economy by then should be roughly four to eight times [that of] the same-class new vehicles today, because platform physics, not just driveline, will be improving markedly; that a rapidly increasing fraction of the fuel burned will not be petroleum-based (initially mainly natural gas reformed to hydrogen, first downstream and later at the wellhead, and later mainly renewable electricity); and that accelerated-scrappage policies to hasten the stock turnover will be very attractive. All three of these effects multiply.

Andrews:

Given the above facts…unless you foresee a very high level of efficient vehicles flooding the market virtually overnight and worldwide—at nearly 100 percent of annual production by 2010—I question how you can make the statement "That's why oil prices and shortages are ultimately beside the point." I hope you are right because if you aren't, then in my opinion the above is a very irresponsible statement, *leading one to believe that all by itself "evolution will take care of everything" in a timely "technology* über alles *" fashion, without any economic hardship, let alone social upheaval.*

Lovins:

I've been assessing detailed options for efficiency and substitution in this industry for nearly 30 years. For what it's worth, total U.S. primary energy consumption is now within 2 percent of the "soft energy path" I published in *Foreign Affairs* in 1976. That's not entirely coincidental.

Andrews:

…And please don't tell me that we're going to elect Al Gore plus a Congress that will favor his enviro strategies, which will give us the leadership to move Detroit along faster and make the country wake up to the climate change problem. I saw how effective Clinton was in 1993 when he tried to pass the BTU tax.… I saw how [Energy Secretary Bill] Richardson wore holes in his knees trying to get OPEC to open the oil spigot well in advance of [this year's] elections.

Lovins:

I think you're unnecessarily fixated on the necessity to change federal policy. Our strategy is to make policy irrelevant to the transformation of the car industry, because it's just as random a variable as world oil price, and we don't want success to depend on a random variable.

CLARIFICATION

In "Return of the Nuclear Salesmen" (*RMI Solutions*, Spring 2000), we stated that 95 percent of all new U.S. energy "supply" during 1996–98 came from efficiency improvements.

This statement was based on an analysis of the economy's "energy intensity"—the amount of energy required per dollar of GDP. The economy grew faster than energy consumption during 1996–98, so energy intensity declined. Had energy intensity remained constant at 1996 levels, we calculate that the increase in energy consumption would have been 20 times greater than it actually was in 1998. Thus energy use increased by only 5 percent (1/20th) of the amount by which it would have otherwise risen.

We attributed the other 95 percent to energy efficiency. However, some of this reduction is arguably due to structural changes in the economy, such as the increasing proportion of GDP due to information techology industries.

Natural Capitalism Goes Global

Natural Capitalism: *Creating The Next Industrial Revolution* continues to be sought after by readers around the world.

***Natural Capitalism* is now available in softcover.**

The hardcover edition is now in its sixth printing (with 42,500 copies sold at last count), and the softcover edition was released in October. Both are published by Little, Brown in North America.

The book is also doing well in the UK (where it's published by Earthscan), Germany (Riemann/Bertelsmann), and Brazil (Cultrix).

In China, the simplified-characters Chinese edition by Shanghai Popular Science Press sold out on the second day of availability. The mayor of Shanghai read it on the first night of publication and the next day ordered 700 copies for all his top officials to read.

Chinese publishers are now reviewing proposals for a complex-character edition, which will better reach the primary business audience in China.

The book is due out in Japanese in late November from Nihon Keizai Shimbun, is being translated into Russian by the Russian Academy of Sciences, and is being translated by commercial publishers into Danish, Italian, Korean, and Estonian.

On to Greener Pastures

When RMItes move on to greener pastures, it's a good thing.

That's what RMI alum Auden Schendler has done, and he's gone from strength to strength. A former RMI research associate and newsletter editor, Auden left last spring to become the Aspen Skiing Company's environmental affairs manager. This September, he was named the company's director of environmental affairs.

"What I learned at RMI was absolutely critical to what I'm doing here, and I use many of the same principles and ideas," Schendler said. "In fact, I've described my department as a small version of RMI built into the corporation."

The Aspen Skiing Company has been recognized in the ski industry for its environmental programs. It is a two-time winner, in 1998 and 1999, of the Times Mirror Golden Eagle Award for Overall Environmental Excellence in the ski industry.

The company's environmental program includes a nonprofit, employee-funded and employee-directed Environment Foundation, which awards funds to local environmental organizations. It was also one of the first ski-resort operators to create a full-time environmental director position.

Adopt a Goat—Yes, a Goat

Last summer 600 cashmere goats spent nine days happily munching on Canada thistle and houndstongue—noxious weeds served up compliments of RMI on the 1,000-acre Windstar Land Conservancy property in Old Snowmass, Colorado, home to RMI's research center.

The goats, brought in from Wyoming, eat 90 percent weeds and 10 percent grass, leaving more food for wildlife and allowing the native grasses once again to dominate the pasture. Goats naturally prefer weeds such as thistle and houndstongue, which are invading pastures across the West, and they have voracious appetites.

The only down side to using the "transient" goats at RMI was the timing of the grazing.

"Nature dictates when the plant blooms and with the drought that we had this year everything was a month later than we expected," said RMI land manager Paul Buch. "The goats had to be scheduled months in advance and the timing of the grazing was not optimal. With our own small herd on site we could hit each area as it blooms and then repeat the grazing again during the summer."

And so, with that realization, Buch has launched an adopt-a-goat program so that

RMI can have its own herd to help manage the land.

"We need 50 to 100 goats," said Buch. "The program will be set up so that $100 'buys' you a happy and productive goat here on our property. It costs $50 for us to buy a goat and then another $50 on average to cover transportation and veterinary costs."

Cashmere goats have proven to be effective weed-eaters. They're smart, easy to handle with a trained dog, and look great in sweaters of their own making. The goats

will be deployed on different portions of the land where weeds are a problem, including wetlands and steep areas where access is difficult. In the winter, the herd will be contracted out to properties in warmer regions.

So don't delay. Contact Paul Buch at pbuch@rmi.org to begin the adoption procedure for your very own cashmere RMI goat.

RMI For Kids

The newest addition to the RMI website, RMI for Kids, is going live this fall. This is the Institute's first non-local program to bring its unique approach to resource efficiency and whole-systems thinking to younger audiences.

A startup grant from the Nathan Ohrbach Foundation has enabled us to create a rudimentary RMI for Kids section consisting of energy information and links for kids and teachers. To reach it, visit www.rmi.org and click on the "RMI for Kids" button on the left.

Further funding is needed to realize our extensive long-term plans for the program. We hope to grow it to include information on all of RMI's activity areas, including "Natural Capitalism for Kids."

The idea for RMI for Kids grew out of the many requests for information about our work that we've received in recent years from children, mostly fourth through sixth graders. Outreach coordinator Jenny Constable realized that none of our materials were designed to speak to anyone younger than high school students.

If you have any content suggestions for RMI for Kids, or any ideas on obtaining further funding for it, please contact Jenny Constable at jenny@rmi.org.

New Challenge Grant

RMI is pleased to announce that the Sandler Family Supporting Foundation has made a challenge grant to RMI of $100,000, provided that RMI raises another $200,000 from new individual, foundation, or corporate donors who give $10,000 or more by December 31, 2000.

"This challenge is a great way for a prospective donor to get additional leverage for their gift," said RMI Director of Development Dale Levy.

"We've already had several people and foundations respond to this challenge, and have secured nearly $100,000 toward the goal," he added.

Stock Gifts: Least-Cost Giving

A growing number of RMI supporters are discovering the benefits of donating stock.

By giving appreciated securities to RMI, you are entitled to a federal income tax deduction based on the current fair market value of the security. You will also avoid paying capital-gains tax on any increase in the value of the stock given. That's two ways to save, potentially enabling you to make your usual gift at lower cost, or to make a larger gift at no increased after-tax cost.

This program isn't just for the well-endowed. RMI has received stock gifts ranging from $150 to more than $30,000. And just in case you were wondering, RMI immediately liquidates donated stock—we're not in the business of speculating on the stock market—and doesn't have to pay tax on the cash raised from its sale.

Think of your gift to Rocky Mountain Institute as another savvy investment opportunity—an investment in natural capital, which yields dividends on a global scale.

If you have questions about giving appreciated securities to RMI, please contact Development Director Dale Levy or Comptroller Christy Hamrick at 970-927-3851.

WHAT ARE YOU READING?

Ben Shepherd, Intern, Green Development Services

Todd Buchholz's newly revised book, *New Ideas From Dead Economists* (Plume, 1999), explores "classical" economics and its application to today's world.

Buchholz lightens the load of the dismal science with commentary and humorous asides on traditional economic theory and even on the lives of the economists themselves. For instance, did you know that Adam Smith never taught (or even took) an economics course?

Re-examining the dead economists' ideas in light of current events, Buchholz asks questions like: Would Karl Marx have to revise his theories in light of the fall of the Soviet Union? What would Thomas Malthus say about the current state of immigration? What would they all think of the rise of a global economy? Good questions. Good reading.

Tom Feiler, Managing Director, RMI

The central theme of Enrico Cohen's *The Art of Genes: How Organisms Make Themselves* (Oxford University Press, 1999) is that metaphors matter—that the way we picture things shapes our understanding of concepts. Cohen argues that the mental models that currently guide the science of biogenetics are misleading.

He starts with a critique of traditional metaphors for developmental biology and genetics: namely manufacturing and computers. The problem with the manufacturing metaphor is that goods are made by humans or machines—that is, the making is done by an outside agent—whereas organisms make themselves. Likewise, developmental processes are fundamentally unlike the way a computer works because the computer's hardware is separate from, and external to, the program's execution, whereas the organism builds itself as it progresses through its stages of development.

Cohen's metaphor of artistic and serendipitous creativity challenges the conventional notion of genes as the "master control" mechanism, and presents a view in which genes have a more modest role within a system of other cellular components and within the context of the whole organism.

Kate Parrot, Research Associate, Economic Renewal

I kept pushing Peter Senge's *The Fifth Discipline: The Art & Practice of the Learning Organization* (Doubleday, 1990) around on my plate of bedside reading material like a child working dinnertime peas.

When I finally did pick it up, I was enthralled. This book teaches about learning in the experience of an individual, a group, an organization, or a nation.

Senge writes engagingly about how systems cause their own behavior. He also enumerates the five disciplines of the "learning organization": personal mastery and growth; working with mental models; building shared vision; team learning; and systems thinking (the last, Fifth Discipline, being the one that integrates the others). His compelling and beautifully articulated examples breathe life and bring context to abstract concepts.

Dhara Vala, Intern, Natural Capitalism Practice

Upsizing: The Road to Zero Emissions—More Jobs, More Income and No Pollution, by Gunter Pauli (Greenleaf, 1998), is a small book with a profound assertion: "Every politician and corporate executive should know that it is possible to improve the productivity of an enterprise, while generating more jobs and dramatically reducing pollution."

Pauli shows how "byproducts" and "waste" can be used in ways that are more profitable than the primary products of an operation. Considering tropical fruit plantations, for example, he notes that most waste huge volumes of biomass. But by applying techniques to close the loops, such as biorefining ethanol and extracting valuable chemicals, the value of the "waste" increases dramatically, and can help transform local economies.

The book's value lies in its in-depth case studies, ranging from a brewery in Fiji that uses wastes to help grow mushrooms to a Swedish island dedicated to the principles of "zero emissions."

This is not light reading, but Pauli offers up both hope and pragmatic solutions for redressing the sad fact that "humankind is the only species on the planet capable of generating waste no one wants."

INTERN | INVASION

RMI HAS ALWAYS WELCOMED an intern or two, or a few at a time, particularly in the summer. College students who've heard RMI staff speak, or who've read our publications or learned about the Institute through a professor, are often anxious to come and be a part of RMI. They learn a lot and the experience serves them well on their résumés. In return, RMI gets much-needed assistance and benefits from the interns' fresh perspectives on the world.

by Marty Pickett, Executive Director

Well, the summer of 2000 was one for the record books—we had a bumper crop of 13 interns! The decision was made to increase the number of internships partly because we had so many projects we needed help with, and partly because we had hundreds of applicants to choose from. The selection process wasn't easy; we had some extremely qualified and experienced applicants. I think we did well to whittle them down to just 13.

The camaraderie among the group this summer was strong, aided by hiking and camping trips in the surrounding mountains, and volleyball in the meadow in front of our building. The interns also came up with a unique way to introduce themselves: each one wrote a bio of him- or herself, and each bio was supposed to contain one lie. Spot the lies, they said, and we'll cook you all a gourmet dinner. It was hard to find the fibs, as so many of the interns had already done so much in their careers.

Our summer interns brought fresh insights and challenging questions. They researched globalization issues, rethought the approach we've taken on getting businesses and communities to work together, helped develop a "toolkit" that companies can use to put the principles of Natural Capitalism to work, and researched case studies in green development, distributed electricity, and other RMI-related disciplines.

The internship program offers yet another advantage to RMI—we get a good look at potential employee candidates! This year, the crop yield was high. We hired four of the interns to stay on staff. The others have gone back to school or the marketplace, brimming with fresh ideas, newly gained knowledge, and, hopefully, fond memories of a summer at RMI. But we expect to see them again—as leaders in their fields, or as corporate executives, perhaps, making decisions that will benefit both their firms and the world in which they do business.

***

As this year's Konheim Fellow, C.C. Gill continued a long and honorable tradition here at RMI. The Konheim Fellowship, which supports an annual internship with Green Development Services, was established by Bud and Carolyn Konheim in memory of their son Eric, who died in a 1991 sea kayaking accident.

Another family is currently raising money to endow a summer internship in memory of their late son, whose "dream" had been to work at RMI. Similarly, the families and friends of longtime RMI supporter Margaret Frantz and RMI's late land manager David Tice make donations to "sponsor" interns.

These internships are fitting, living memorials to individuals who supported the Institute's work and ideas.

Top Row: Chad Laurent, Kate Parrot, Amanda Ayres, Ben Shepherd.
Bottom Row: Adam Berman, CC Gil, David Payne, Alice Hartley.
Not Pictured: Holly Harlan, Dhara Vala, Ken Wicker, Lewis Cassidy, David Kaplan.

CONTINUED FROM PAGE 2

Myth #3: High temperatures are to blame

Temperatures this summer were high, but hardly extraordinary.

Utility executives are well aware of the simple relationship between hot summer weather and increased air-conditioner use, the largest driver of summer electricity demand. But inadequate planning by utilities and their government regulators to respond effectively to rising electricity use has exacerbated the problem and precluded more proactive and cost-effective responses.

For instance, investments in energy efficiency by California utilities in the early 1990s reduced statewide electricity needs by 10,000 megawatts (MW) compared to what they would have been, and delivered tens of billions of dollars of economic benefits to Californians. If these cost-effective programs had been continued, the state would have sailed through this past summer without a supply problem. And if neighboring states had captured their efficiency opportunities too, they wouldn't have depleted the regional power pool's reserves, thus causing the price volatility to which California, as the pool's biggest net importer, was most exposed.

Myth #4: New power plant construction has stalled because of restructuring

Power plant construction in California and the interconnected western power grid has been continuing at a brisk pace despite electric industry restructuring. During the 1990s, California added 6,048 MW of supply—roughly the equivalent of six large nuclear power plants. These "invisible" additions are what's been keeping the lights on.

But the reason for the perception that supply expansion has stalled is that California utilities *aren't* building large, high-profile power plants. Indeed, in the last decade about three-quarters of California's new plants were built by non-utility generation companies—a new breed of entrepreneurs that compete in the power markets with the traditional monopoly utilities. The average size of their plants is just 20 MW, compared to 300-500 MW for typical utility coal-fired plants and 1,000 MW for nuclear plants. In contrast with large, centralized utility plants, the small plants are distributed throughout the grid, thus boosting the reliability of the entire system. In addition, because most use cleaner-burning natural gas or renewable energy sources, they significantly reduce the air and water pollution associated with electricity production. And once built, the renewable sources lock in a fixed price because they use no fuel.

Myth #5: More power plants are the answer

Large, centralized power plants might be part of the short-term solution, but are likely to be poor investments in light of the rapid technological transformation taking place in the industry. Decentralized ways to make, save, and store electricity—microturbines, fuel cells, renewables—are rapidly shifting the electricity industry toward small-scale generating systems, dispersed siting, and high-efficiency end use.

The magnitude of the transformation of scale currently envisioned by many industry leaders and made possible by new technologies is hard to overstate. Such changes will save customers tens of billions of dollars in annual electricity costs, significantly reduce pollution, and usher in tremendous business opportunities for companies at the forefront.

WHERE DO WE GO FROM HERE?

If lawmakers, regulators, and consumers are looking for someone to blame for California's power shortages, the most obvious place to start is the combination of laws and regulations that have lately stalled California's cost-effective investments in using electricity more efficiently, and that have resumed the old, bad system of rewarding utilities for selling more electricity rather than cutting customers' bills.

ENERGY

Optimal industry restructuring would reward the best buys most and the worst buys least. The best buys—efficient use, then distributed generation—are plenty big to do the job.

Happily, the six bills signed into law in September by Governor Davis renew these historic priorities. Supported by a broad industry-utility-labor-environmental coalition mobilized by the Natural Resources Defense Council and its friends, the pioneering legislative package adds, among many other benefits, over $5 billion for efficiency and clean-energy investments during 2002–12.

The solution to California's electricity supply problems cannot be found either in simple-minded, muscle-bound approaches, or in government control of supply and demand in the marketplace. They lie in the proper application of market principles that reward economic efficiency and innovation, while disposing of old, inefficient, and misguided notions about markets and consumer behavior. In the meantime, we need to resist the temptation to latch onto quick fixes that are out of step with market dynamics, today's technology, and consumer needs.

Thomas Feiler is the managing director of RMI's Natural Capitalism Practice and a leading authority on the electric power industry.

China

CONTINUED FROM PAGE 13

said. "However, they are mobilizing to start creating system solutions by addressing root causes."

One sign of a growing environmental awareness is that Chinese newspapers are devoting more space to environmental problems. Another is that China has been shutting down polluting small coal mines, cement works, oil refineries, steel factories, and thermal power plants, despite increasing demand for such products in the country.

In light of all this, RMI has an opportunity to make a difference in China, and this past summer four staff members carried out exploratory work there. While the Lovinses participated as "internationally respected scholars" in the Shanghai symposium, Alexis Karolides presented a workshop on Natural Capitalism and green development in the northeastern city of Tianjin, and Huston Eubank served as the green-development representative on a team of American planners helping develop a model rural sustainable village in central China.

Amory Lovins returned with a sense that RMI will become increasingly active in China. RMI's work is considered transideological, welcomed equally by the ruling Communist Party and the burgeoning capitalist ("market socialist") sector.

"We're not viewed as a political troublemaker, we're offering them solutions to problems," he noted. "They are above all pragmatic. They want to know what works, and they want to implement it quickly. They are playing not just catch-up but leapfrog."

—Brent Gardner-Smith

Leadership

CONTINUED FROM PAGE 15

With electronics, satellites, and fast computers at our command, we have all watched the dwindling relevance of distance in our intellectual pursuits. But we've also noticed that delivering facts and ideas—which can be done so efficiently from a distance—is only half of teaching-learning dynamics. The other half is "getting to know you, getting to know all about you"—the magical, social, human part of education.

Computer-assisted communication is not a substitute for face-to-face contact. But the converse is equally true. Once I get to know you pretty well, up close and personal, I really don't need to see your face every time we talk on the phone or exchange messages by email.

What's clear is that combining up-close and distance learning enhances the educational experience, beyond what's possible with either mode alone.

TWILIGHT OF HIERARCHY

A third example of the impact of the informatization of society is the changing seismology of organization and leadership.

The direction of change is now more than obvious: everywhere, a shift from top-down "vertical" relationships toward "horizontal," consensual, collaborative modes of bringing people together to make something different happen.

This major historical fault-line is also, very clearly, a consequence of the spread of information—symbols, not things—as the newly dominant resource. The more people are "in the know," empowered by ready access to the enormous pool of knowledge available through the Internet and global media, the more likely they are to think they have something relevant to say—and insist on being heard.

It was in the nature of things that the few had access to key resources and the many did not: there never seemed to be enough to go around. The inherent characteristics of physical resources made possible—perhaps even necessary—the development of hierarchies of power based on control (of new weapons, transport, trade, markets, and even of knowledge back when secrets were sometimes secure), hierarchies of influence based on secrecy, hierarchies of class based on ownership, hierarchies of privilege based on early access to particular pieces of land or especially valuable resources, and hierarchies of politics based on geography.

Each of these five bases for hierarchy and discrimination has been crumbling in the waning years of the 20th century. The old means of control are of dwindling efficacy. Secrets are harder and harder to keep (as the CIA and the White House seem to relearn every month or two). And ownership, early arrival, and geography are of declining importance in accessing, remembering, analyzing, and using the knowledge and wisdom that are the really valuable legal tender of our time.

The twilight of hierarchy opens up a fast-growing need for people who can and will take the lead—and requires very different attitudes and strategies for those who opt to point the way.

Harlan Cleveland is President Emeritus of the World Academy of Art and Science. He has served as a Marshall Plan executive, a magazine editor and publisher, Assistant Secretary of State, U.S. Ambassador to NATO, and a university president. This article was adapted from a speech delivered to the Conference on Applied Brilliance in Dana Point, California on June 9, 2000.

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those that practice Natural Capitalism are in the vanguard of environmental restoration, because they are be behaving as if natural capital were properly valued. Some are even restoring human community and culture as well by similarly respecting and reinvesting in human capital.

It will be interesting to observe the reaction of the opponents of globalization to such companies. At present, protesters challenge the right of businesses to amass undemocratic power, and are questioning generically the legitimacy of any large company. If the Natural Capitalist thesis is correct, however, we are in the early stages of a new industrial revolution in which competitive advantage will flow to those companies that behave responsibly, not just because they gain legitimacy and brand equity, but because of the fundamental superiority of a business model based on radically higher resource productivity, closed loop and non-toxic production, the "Solutions Economy," and reinvestment in natural capital.

Investors and consumers are beginning to scrutinize companies from this perspective, and to reward the transformational ones that are, in the true spirit of capitalism, productively using and reinvesting in all four forms of capital. Those that practice the old industrial model—recognizing only financial and physical capital while ignoring natural and human capital—will suffer and may fail.

THE ROLE OF THE PRIVATE SECTOR

The second major gap in the current debate over globalization is that neither the protesters nor the parties to the global institutions are paying any attention to the positive, problem-solving role corporations can play.

The protesters believe that the corporate sector is the problem, not the solution, and must be regulated by government into behavior that does not destroy the environment. This prejudice is a hallmark of the efforts to counter the negative effects of globalization. It also limits the possibility of dialogue, and leads many businesspeople to suppose that the environment is a fringe activity of enthusiasts who want to regulate their activities and drive up their costs. This erroneous view is reinforced by a certain type of economic theorist (or environmental activist) who thinks that environmental protection must be costly and painful, on the theory that if it were easy it would already have been done by now.

If, however, it is true that adherence to the principles of Natural Capitalism will be the basis of profitability in the coming decades, then it is in businesses' own interest not to deplete their natural or human capital. Global corporate power has some serious downsides, no doubt, but the best leaders of the transformative corporate sector are inviting debate over what their role should be and how to make their companies restorative of human and natural capital. They are realizing that corporations that do not steward and reinvest in their most valuable resources will face a grim future.

It may well turn out that the institutions with the greatest interest in promoting environmental or labor agendas are the very companies that the demonstrators are vilifying. If Natural Capitalism drives a re-evaluation of business as we know it, then the current conflict over trade, labor, and the environment may become moot, as the economic interests of the corporations begin to converge with the values of citizens. Already a growing number of businesses are declaring a commitment to operate sustainably—because it's the right thing to do, or will buy them goodwill, or bring competitive advantage and profit, or some combination of these reasons.

In a perfect world, all corporate executives would follow the lead of Ray Anderson of Interface, Pasquale Pistorio of STMicroelectronics, and Mark Moody-Stuart of Royal Dutch/Shell. These leaders are redefining their responsibilities to extend far beyond enhancing shareholder value and the next quarter's profits, to embrace stewardship for the world. Such companies are embodying, clarifying, and extending the principles of Natural Capitalism as the new basis of profitability in the decades to come.

Until all companies follow their lead, however, citizens will demand that "government" institutions ensure a level playing field, with fair market mechanisms and basic protections of human rights and the environment, so that all people can increase their prosperity.

What institutions can meet this demand? What form of government can emerge to rival the strength of the market? This is at core the debate about globalization—not the details of trade, nor even the loss of local institutions and values, but how decisions will be made that affect what people truly value.

Clearly no one knows whether the nation-state will rise to this challenge, or some new form of governance will evolve.

Regardless, the influence of the business community should be brought to bear to hasten the transition to commerce based on the principles of Natural Capitalism at every level, from local to national to global.

THE ROLE OF GOVERNMENT

There remains a vital role for governments and for civil society. It is important to remember that markets have purposes. They also have limitations. Markets make a splendid servant but a bad master and a worse religion. A society that substitutes markets for politics, ethics, or faith is dangerously adrift. Not all value can be monetized; not every priceless thing is priced. Nor is accumulating money the same thing as creating wealth or improving people. Many of the best things in life are not the business of business. And as the Russians are finding under "gangster capitalism," unless there are democratic ways to establish and maintain a level playing field, only the most ruthless can conduct business.

It is imperative, therefore, that we all take greater responsibility in this debate. My guess is that government will and should trend toward stronger local control, where agencies can understand and deal effectively with most of the problems that face us. For the increasing number of problems that can be dealt with effectively only at the global level, new forms of governance need to arise, including coalitions of companies, governments, and civil society, that craft responses to such challenges as climate change or hunger.

However, any institutions that seek to satisfy this public demand must ensure that *all four* of the engines of wealth creation are enhanced: they must promote productive use of and reinvestment in human and natural capital as well as in financial and manufactured capital.

Businesses are starting to implement Natural Capitalism because it is profitable. The international agencies that seek to enhance the ability of business to trade should not ignore this trend. Unless they expand their underlying ideology to give due weight to the values of human and natural capital, they will weigh businesses down with the ideology of the first industrial revolution, which sought to substitute plentiful, cheap natural resources for scarce people. That made sense in the 1700s, but at the turn of the new millennium, continued reliance on it will only trap society in wasteful and economically inefficient behavior. Even such powerful institutions as the multilaterals must learn this if they are to endure.

The WTO and the other boosters of globalization must promote trade only to the extent that it embodies the principles of Natural Capitalism.

One of the easiest ways to begin this is for nations and the global institutions to place the various multilateral agreements regarding human rights and the environment on an equal footing with trade priorities. In effect, the WTO and the other boosters of globalization must promote trade only to the extent that it embodies the principles of Natural Capitalism; otherwise they will continue to undermine the very basis of prosperity and of life itself.

Governments, multilaterals, and companies should also embed the Precautionary Principle in every decision-making framework. This principle, already supposedly adopted by the Organization for Economic Cooperation and Development and the European Union, has at its core the idea that action should be taken to prevent harm to the environment and human health, even if scientific evidence is inconclusive. It is already an element in many international treaties, and has its roots in the basic legal doctrine of negligence. It is also sane behavior for any species desiring a lengthy tenure on this planet.

Finally, the multinational organizations must implement transparent and democratic decision-making procedures. Any unaccountable institution is by definition stupid, lacking feedback. Organizations with great influence will receive feedback. It is up to them to choose if they wish this process to be orderly and informative or disorderly and destructive. Any institution with great power will gain and retain legitimacy only if it is fair and accountable. The greater the power, the more the citizenry will insist on accountability. In the Internet Age, that insistence is no longer confined to traditional parliamentary democracies.

While some commentators say that globalization is not a new phenomenon, but dates back to the advent of ocean steamers and the early trading companies, what is sweeping the globe now is bringing both opportunity and threat on an unprecedented scale. That much is inevitable. What remains within our choice is whether we as citizens decide to manage these changes, and use them to enhance life, or whether we will leave those decisions for others.

Hunter Lovins is a co-founder of RMI and serves as its co-CEO (Strategy).

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Board Spotlight: Christine Loh

Four RMI staff members traveled through Hong Kong recently to consult on a variety of projects. Each came back with at least one common perception—that RMI Board member Christine Loh is a popular and influential figure in Hong Kong and that people there are buzzing about her effort to start a new organization called Civic Exchange. The buzz has reached *Business Week* as well, which profiled Loh in its July 24 issue and noted that "hers is the voice of a new generation in Hong Kong."

Loh recently stepped down from her position in the Legislative Council, which helps govern Hong Kong. To many citizens there, it was a shocking announcement as Loh was the founder and leader of the Citizens' Party.

"I am frustrated because the executive branch sees the legislature as an inconvenience that has to be overcome, rather than as an active partner to build participatory governance," she said when announcing her decision.

Loh, 44, is active in environmental affairs in Hong Kong, having worked to protect Victoria Harbour and to call the attention of policymakers to the area's air pollution.

Loh says her new effort will conduct policy research and push for changes by influencing lawmakers and other government officials.

RMI*Solutions*

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We want to hear your comments, criticism, or praise. Please address all correspondence to:

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Rocky Mountain Institute is an entrepreneurial nonprofit organization that fosters the efficient and restorative use of resources to create a more secure, prosperous, and life-sustaining world.

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

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

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Windstar's New Whale

One of the Windstar Land Conservancy's trademark images is a whale sculpture encircled by an open geodesic dome erected in the early 1980s by the Windstar Foundation.

This year, Windstar members Greg and Susan Gilles of Whidby Island, Washington spearheaded a project to replace both the dome and the sculpture. With Dexter Lewis and Scott Bergman, they cut structural members for a new dome based on the original Buckminster Fuller design and Lewis carved a new whale sculpture from a massive piece of driftwood found on a nearby beach.

On Memorial Day weekend, 30 volunteers helped assemble the new dome, dedicate the new whale carving, and place a time capsule to be opened in 50 years.

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CANADIAN | STRATEGIC | INFLUENCE

Changing the Rules By Changing Minds

Dana Meadows, co-author of *Beyond the Limits* and a long-time friend of RMI, likes to hand out a one-page sheet titled "Places to Intervene in a System." Based on her many years' studying the behavior of complex systems, it's a list of eight approaches to creating societal change, ranked in order of influence.

Interestingly, the techniques many activists emphasize—government regulations, tax rates, and so on—rank near the bottom. Tops on the list? Changing "the paradigm of the people who have power over the rules." Change the way those key decision-makers think, and they'll change everything else. That's where the greatest leverage lies.

To that end, RMI staffers spend a great deal of time focusing on what we call strategic influence—"influencing the influential" by creating and exploiting "teachable moments."

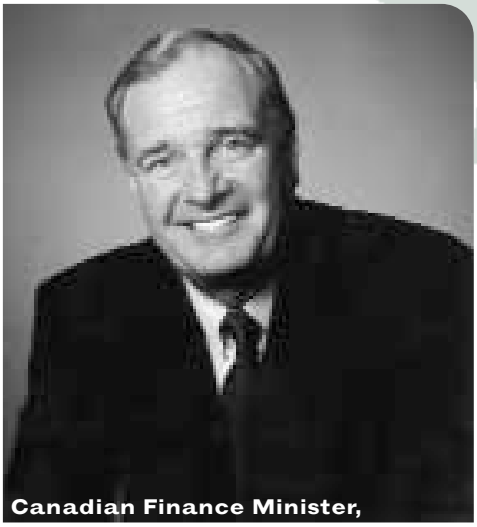
What are the keys to a successful effort? "Access, message, and delivery," says RMI's Amory Lovins. "First of all, you've got to get their attention. Almost always, that means going to them—preferably at their invitation—and working with them in their office, on their turf."

Ironically, sometimes the higher up the organization, the more eager the set of ears. "Heads of state seem starved for information," says Lovins. "They are often held in an inner ring by senior advisors."

But what happens once you're in the door?

"You have to address their problems," notes Lovins. Rather than lecturing, he recommends respectfully suggesting solutions that the decision-maker can use to shape to his or her political and economic situation.

Lovins and other RMItes are finding that the concept of Natural Capitalism is politically effective because it speaks to a wide range of conditions and experiences.



Canadian Finance Minister, Paul Martin

Here's an example from Canada, where Lovins has been working on energy issues for three decades.

On a recent visit, Lovins dined with Finance Minister Paul Martin and Environment Minister David Anderson. "They seemed taken with the ideas of Natural Capitalism," he says. "They understood the benefits of advanced resource efficiency and they could easily see principle three—selling services as opposed to producing goods—being applied to a primary resource economy like Canada's. I asked, 'Do you want to sell tons of stuff, so efficiency cuts your revenues, or services, so it cuts your costs?' There are examples of how they could sell services in both the forestry and mining sectors."

The next day, Martin gave a speech that caught the attention of many for its emphasis on environmental themes.

A newspaper story in the June 19 *Ottawa Citizen* on Anderson's policies reported that Anderson "has a powerful ally in Finance Minister Paul Martin, the one-time opposition environment critic.

"Mr. Anderson and Mr. Martin recently had dinner with Amory Lovins, co-author of *Natural Capitalism*, a book that describes the 'new industrialism' that is more efficient, profitable and environmentally friendly.

"Mr. Martin, in a recent speech, picked up on the book's theme: 'If we are to move forward toward our goal of sustainable communities, we must be willing to accept a new approach, one in which economic and environmental considerations are no longer viewed as separate entities.'

"Mr. Martin says Canada needs to use renewable energy like biomass fuels, solar and wind power on an industrial scale while abandoning 'the very concept of waste. The traditional model takes in virgin materials at one end, creates waste and emissions during production, and throws away potentially valuable materials after consumer use,' he says, sounding more like an environmentalist than a finance minister."

That last phrase is music to Lovins's ears. "A message like that always carries more weight when it comes from the finance minister, especially to the business community," he says. "It can lead to a change in tax and fiscal policy, which can influence business. It can create a level playing field for investment in resource efficiency."

—Brent Gardner-Smith

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RMI Solutions

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