HOW NOT TO PARACHUTE MORE CATS

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Hunter and Amory Lovins are the principals of Rocky Mountain Institute. RMI is a 40-person nonprofit resource policy center which the Lovinses cofounded in 1982 to foster the efficient and sustainable use of resources as a path to global security. Hunter, RMI's President is a lawyer, sociologist, political scientist, firefighter and rodeo rider. Amory, originally an experimental physicist, has been called by Newsweek "among the Western world's most influential energy thinkers." Together they have taught at many universities, authored some 20 books and hundreds of papers, and consulted extensively for governments and private industry. In 1984 they received the Right Livelihood Award (the "alternative Nobel Prize"), and in 1989 their energy work was honored by the Onassis Foundation's first Delphi Prize, one of the world's top two environmental awards. In 1993, Amory received a MacArthur Fellowship.

For more documentation, see:

- Hunter and Amory Lovins and Seth Zuckerman, *Energy Unbound: A Fable for America' Future*, Sierra Club, 1986—a popular novel exploring what the energy problem is and what you can do about it, and emphasizing the kinds of interconnections described here. This book is now out of print, please check your local library or contact RMI for related publications.
- The many other publications of Rocky Mountain Institute; a list is free upon request, and new releases are announced in a quarterly *Newsletter*.
- Publications ranging from popular to extremely technical are available to document and amplify the factual statements made in this paper.
- The Institute welcomes tax-deductible contributions to support its work on these issues.

The environmental consciousness of recent years taught us many things, but one of the lessons we have yet to take to heart is that many of the challenges facing us are connected. Most of us live our lives as though this were not true. Governments and corporations, in particular, often manage their resources as if interconnections didn't exist. A parable from Borneo illustrates why little understood connections are important.

In the early 1950s, the Dayak people in Borneo suffered from malaria. The World Health Organization had a solution: they sprayed large amounts of DDT to kill the mosquitoes that carried the malaria. The mosquitoes died, the malaria declined; so far, so good. But there were side-effects. Among the first was that the roofs of people's houses began to fall down on their heads. It seemed that the DDT was killing a parasitic wasp that had previously controlled thatch-eating caterpillars. Worse, the DDT-poisoned insects were eaten by geckoes, which were eaten by cats. The cats died, the rats flourished, and people were threatened by outbreaks of sylvatic plague and typhus. To cope with these problems, which it had itself created, the World Health Organization was obliged *to parachute 14,000 live cats into Borneo.*

The Challenges Facing Us

If we do not understand interconnections, often the cause of problems is solutions. However, understanding subtle connections can enable us to "solve for pattern", so that one solution can be leveraged to create many others. This is especially true in the management of such global resources as sea, air, climate, and the genepool, and more localized resources as soil, food, minerals, groundwater, and energy.

Humankind faces many serious problems, ranging from the threat of nuclear proliferation in developing countries, unchecked population growth, falling stocks of groundwater, forests, fish and soils, rising accumulations of wastes and pollutants, global warming, the rapid spread of deserts into once fertile farmland, and destruction of the rain forests, to such regional problems as hunger, the energy crisis, shortages of water and strategic materials, and the extinction of species. Together, these problems seem to be a far graver security threat than, say, a Russian attack.

The best presentation of the problems we face is the recent book, *Beyond the Limits* by Dana Meadows, Dennis Meadows and Jorgen Randers. This must-read book details the characteristics of a human society that has grown beyond its limits. These include:

- The use of money, energy, and labor to defend or exploit more distant, deeper, or dilute resources.
- The use of money, energy, and labor to compensate for what were once free natural services (sewage treatment, flood control, air purification, pest control, restoring soil nutrients, preserving species).
- Deterioration of physical and social infrastructure.
- Reduced investment in education, health care, and shelter in order to meet consumption needs or pay debts.
- Increasing conflict over resources. Because of this there is less social solidarity, more hoarding, greater gaps between haves and have-nots.

Sound familiar? It is pretty good description of our society It is also a description of *overshoot*, of growing so large so quickly that limits are exceeded. When an overshoot occurs, it introduces stresses—in both natural and social systems—that slow growth. If humanity does not change course, the problems listed above will worsen. Overshoot will turn into collapse.

Beyond the Limits describes four broad measures we must take.

1) GET BELOW THE LIMITS. This will require implementing least cost, end use policies for materials and energy, materials recycling and energy efficiency, proper resource pricing such as elimination of subsidies, and pollution prevention.

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There are powerful new technologies that enhance resource efficiency and substitute plentiful for scarce resources. These new technologies, if carefully chosen to contribute to sustainability, can overcome, or at least long defer, many of the problems that at times look hopeless.

2) PROTECT, RESTORE, AND ENHANCE THE RESOURCE BASE. This would involve creating biodiversity reserves, promoting organic agriculture, reforestation, managing watersheds and fisheries better, establishing greenhouse gas emission agreements, and setting up just ownership and democratic control of resources. Fossil fuels, groundwaters, and minerals should be used with the greatest possible efficiency, recycled when possible, and consumed only as part of a deliberate transition to renewable resources.
3) IMPROVE THE SIGNALS, so we know when we are in overshoot and approaching collapse. This would include such measures as better indices, perhaps a green GNP; earth monitoring; computer modeling; sustainable economics, media improvements, governance improvements. Look for signals that indicate when the environment is stressed. Decide in advance what to do if problems appear and have in place the institutional and technical arrangements necessary to act effectively. Educate for flexibility, creativity, critical thinking, ecological literacy, and systems understanding.
4) SLOW AND EVENTUALLY STOP EXPONENTIAL GROWTH OF POPULATION AND PHYSICAL CAPITAL. This involves institutional and philosophical change and social innovation. It requires defining desirable, sustainable levels of population and industrial output, setting goals that seek to supply "enough" rather than "more", and finding ways to provide nonmaterial satisfaction of nonmaterial needs. It also calls for a politics of hope, of doing more than just avoiding the negative, of actually seeking out the positive, and the successful.

Many people, overwhelmed by the vastness of these challenges call for stern regulations on both a global and local scale, deep sacrifices by all people, and acceptance of a grim future of limits.

It may come to this. Ours is only a little planet, and the only place in all the universe that we know can sustain life. It would behoove us, who only borrow the planet from our children, to treat it with wisdom, care, and love. Yet draconian limits may not be the only approach.

Beyond the Limits argues that if we take these warnings seriously, we do have time to meet all the challenges facing us. Collapse is not the only possible outcome. We can ease down from beyond the limits. That need not mean reducing population or capital or living standards, though it certainly means reducing their growth. What must go down, and quickly, are *throughputs*—flows of material and energy from the supporting environment and the flows of wastes back into it. Fortunately, in a perverse way, the current global economy is so wasteful that there is tremendous potential for reducing throughputs while raising the quality of life for everyone.

For example: Of the 5.4 billion people on earth, over 1 billion have less food then their bodies require. Every day an average of 35,000 people die of hunger-related causes, most of them children. However, if food were equitably distributed and less lost to spoilage and waste, there would easily be enough to give all people an adequate, varied diet.

China has lost three-fourths of its forests. Europe has no undisturbed, primary forests left. The U.S. has lost 85% of its primary forest. Half of the tropical forest is gone. At current logging rates, the rest will be gone within 50 years and with it perhaps half the species of life on earth. Again, though, there are answers: Half of U.S. wood consumption could be saved by increasing the efficiency of sawmills and construction, doubling the rate of paper recycling, and reducing the use of disposable paper products. In the developing world, sustainable, high-yield agriculture could reduce the need to clear forests for food, and more efficient stoves could reduce

the need for firewood

These are examples of ways to avoid collapse. Solutions can be worked out in hundreds of ways at all levels, from households to communities to nations to the world as a whole.

If we are both clever and a bit lucky, clear understanding of interconnections can enable locally based resource management decisions to work together to create sound decisions for the globe.

Over the past decade, a great deal has been learned from practical efforts to cope with various resource shortages. In particular, there are powerful new technologies that enhance resource efficiency and substitute plentiful for scarce resources. These new technologies, if carefully chosen to contribute to sustainability, can overcome, or at least long defer, many of the problems that at times look hopeless. They can not only solve the problem at hand, but also promote equity, global security, and a healthy environment.

Energy: New Technologies

This potential of new technologies to stretch resources and help us live more lightly on the earth—rather than, as Herman Daly puts it, treating the earth as a business in liquidation—is perhaps easiest to see in energy. The following examples should be viewed not only as solutions in their own right but metaphorically, as a way to approach resource issues.

In energy policy the conceptual solutions are now clear. More efficient use of energy and the harnessing of cost-effective renewable resources—such sources as sun, wind, flowing water, and biomass, which don't run out—can together provide affordable and sustainable energy options that outcompete and outpace both fossil and nuclear fuels, despite many official efforts to force the opposite result.

The transition is happening much faster than was thought possible ten years ago. For example, in the past fifteen years, the U.S. got more than four times as much new energy from energy savings as from all net expansions of energy supplies put together. The millions of little things people did to weatherize houses, get more efficient cars, plug up steam leaks, etc., yielded four times as many additional BTUS as did the net increase in supply from the new oil and gas wells, coal mines, and power plants built in the same period. Of all the new supplies, renewable sources provided a third.

Savings of this sort do not mean freezing in the dark, doing less, doing worse, or doing without. It is not conservation by curtailment. It means doing more, enjoying more comfort, providing the same or better services, but doing it a little smarter.

Impressive though these savings are, they are only the beginning. The U.S. can still cost-effectively save half of the electricity we use—even the Electric Power Research Institute (EPRI), the utilities' own think-tank says so—and at least that much of the oil and gas. Achieving these technical potentials, or the even larger ones researchers at Rocky Mountain Institute have identified, would take several decades, but pursuing them is clearly worthwhile. Just the energy savings the U.S. has already implemented are saving $160 billion a year, compared to what we would be spending if we used energy as inefficiently as we did in 1973. Yet if America were as energy-efficient as some of our Asian and European competitors are, we would save an *additional* $200 billion a year.

We also have the capability to make bad decisions. During the '70s and '80s, the energy supply options got about six times as much investment and at least 20 times as much government subsidy as the more cost-effective efficiency improvements. By 1984, American taxpayers spent over $40 billion each year on energy subsidies. Over $12 billion of that went for nuclear power, plus another $16 billion for other forms of electrification. All forms of efficiency and renewables got under $4 billion; during the Reagan Administration efficiency and renewables subsidies were reduced almost to nothing. The 1986 Tax

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Increasing R&D budgets by just the cost of building one nuclear power plant ($160 million a year for 20 years) could, by the year 2030, enable renewable energy to provide about half the total energy and all the electricity used in the United States in 1989.

Reform Act reduced total energy subsidies to $18 to 32 billion by 1989, but kept them still badly skewed in favor of fossil fuels, nuclear, and electrification.

Similarly, EPRI estimates that of all the baseload electrical savings expected to be achieved by the turn of the century through utilities' efficiency programs, about two-thirds will be undone by utilities' efforts to sell more electricity (still the predominant fashion in the industry, and hardly surprising, since in 46 states, utilities earn more profit by selling you more electricity, than by helping you to cut your bill). Such misguided policies were probably the main reason that the previously steady reductions of national energy intensity by several percent a year stalled in 1988 and stayed stalled for five years. How much better would the nation have done, and could it still do, with a level playing field where all options could compete fairly on their merits?

Despite such barriers, the sustainable technologies have done remarkably well. From 1979 to 1986 there was more net increase in U.S. energy supplies from sun, wind, water and wood than from oil, gas, coal, and uranium. Americans ordered more new generating capacity from small hydro and windpower than from coal and nuclear plants, without even counting the many cancellations of big power plants. Renewable sources, which those glossy magazine ads from the nuclear industry say cannot contribute much until the next century, now supply 11-12% of the nation's total energy, and the fastest-growing part. Besides the main contributions, which come from biomass and older hydroelectric dams, between one and two million solar buildings are now operating; upwards of 6% of our gasoline is blended with biomass-derived alcohol; and there are tens of thousands of stand-alone solar-electric buildings in the country. Renewable energy sources that are already cheaper than fossil fuels include passive solar space and water heating, much solar process heat for industry, some biofuels, small hydropower, wind machines in good sites, and at least two kinds of solar-thermal-electric generation. Windpower has recently beaten the cost of new coal plants, even ignoring coal's greater subsidies and pollution, and is officially recognized as the cheapest generating technology in good sites.

A study by five National Laboratories recently concluded that increasing R&D budgets by just the cost of building one nuclear power plant ($160 million a year for 20 years) could, by the year 2030, enable renewable energy to provide about half the total energy and all the electricity used in the United States in 1989, including the equivalent of nine million barrels of oil per day directly replacing oil and natural gas.

Nuclear power, in contrast, cannot compete with either efficiency or renewables. It cost the United States about $200 billion in public and private investment—by one government estimate over a *trillion* dollars if all the taxpayer-provided R & D is included. That is more than the Vietnam War and the Space Program combined, to deliver to the U.S. substantially less energy than *wood*. Because devices now on the market can save four times as much electricity as all U.S. nuclear plants make, at just five percent of the cost of building and running them, it's cheaper to write off any nuclear plant and provide customers with efficiency. So recently, the city of Sacramento, California, did just that. They closed the Rancho Seco Nuclear plant, and are building a utility based on photovoltaics and energy efficiency. As a result, they're making more jobs, less pollution, stable electric rates, and a more sustainable and prosperous community.

It has been said, the devil is in the details, where would all these energy savings come from? Let's look at fuel savings and electric savings in turn.

Fuel Savings

During 1973-86, the U.S. cut the energy intensity of the economy by a fourth, its oil and gas intensity by a third, and OPEC's market share by half. Oil imports fell from 46

percent of consumption in 1977 to 28 percent five years later. By 1985, Persian oil imports were only one-tenth their 1979 peak. By 1986, U.S. energy savings, chiefly in oil and gas, had become a national energy source two-fifths larger than the entire domestic oil industry.

Transportation, burns nearly two-thirds of U.S. oil, and is the key to cutting oil dependence. The U.S. household vehicle fleet now averages 19 miles per gallon (mpg). Improving that to an average of 22 mpg could displace all of the oil the U.S. imported from Iraq and Kuwait before the hostilities of July 1990. Increasing the vehicle fleet average by another 10 mpg would displace all of the oil we import from the Persian Gulf. (Did we put our kids in 0.5 mpg tanks and 17-feet-per-gallon aircraft carriers because we failed to put them in 32 mpg cars? That's all it would have taken, had we done nothing else, to eliminate the need for any Persian Gulf oil.)

We almost displaced Gulf oil imports anyway. From 1977 to 1986 the rise in U.S. oil productivity averaged five percent per year, four-fifths faster than needed to keep up with both economic growth and the decline in domestic oil extraction (oil imports fell by half). Had the U.S. just maintained that pace, it would have needed no Persian Gulf oil from then on.

However in 1986 Reagan administration rolled back of Congressionally mandated light-vehicle efficiency standards immediately doubled oil imports from the Persian Gulf. It wasted oil at the same rate at which the government hoped oil could be extracted from beneath the Arctic National Wildlife Refuge. It also contributed to Japan's growing share of the U.S. car market. Imports of Persian Gulf oil surged more than 500 percent from 1985 to 1989, to over 600 million barrels of oil each year. Now, although America is fairly self-sufficient in most forms of energy, with five percent of the world's population we use about 25% of the world's oil.

This has economic consequences. The trade deficit in oil is roughly $50 billion each year. Since 1970, oil imports have been responsible for nearly 75% of the trade deficit and have resulted in a net outflow of money to the OPEC nations of $1 trillion. Thus overuse of oil is a major threat to economic security.

Had we instead raised light vehicles' efficiency 50 percent, it would have saved two million barrels of oil per day, more oil than we import from the Persian Gulf. And we can do that and better. A dozen automakers worldwide have demonstrated comfortable, fast cars two to four times as efficient as today's new U.S. models, with improved safety and competitive manufacturing cost. Prototypes range from 63 to 138 MPG. Recent advances in aerodynamics, new materials, ultra-lightweight construction, new engine and energy-storage technologies, microelectronics, and computer-aided design and manufacturing can yield a 150-mpg, safe, peppy, comfortable, and affordable station wagon.

Severalfold lighter, these cars can also be safer because materials and design are more important to safety than mass, and what it takes to protect people doesn't weigh much. Designing the car to be very light and slippery—more like an airplane than like a tank—makes it two to two-and-a-half times as efficient. The car should also have hybrid-electric drive: wheels driven by electric motors, but the electricity would be made onboard by burning fuel in a tiny engine or other powerplant, rather than hauled around in a half-ton of batteries. By itself, hybrid drive makes an ordinary, heavy car about 30-50% more efficient. But at Rocky Mountain Institute, we've found that making a family car ultralight *and* hybrid makes it 5-20 times as efficient. Available, state-of-the-shelf technology can achieve several hundred miles per gallon, enabling a family car to go coast-to-coast on one tank of any liquid or gaseous fuel. It could also be sportier, far cleaner, more comfortable, more spacious, more durable, and probably cheaper than today's cars.

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Many existing and wanna-be automakers, big and small, are eager to bring such "hypercars" to market. Of course, when that happens, the world oil price will crash more or less permanently, because hypercars and their heavy-vehicle analogues will save about as much oil as OPEC now extracts. They'll also eliminate oil imports, urban smog, and a host of other problems. Since the U.S. remains competitive in all the key technologies needed to make hypercars, the transition to hybrid ultralights could restore the United States to world automobile leadership. By transforming America's largest industry, amounting directly and indirectly to a seventh of the GNP, this could even form the nucleus of a green industrial renaissance.

Large oil savings are also available in heavy transport. Ultralight-hybrid buses, vans, trucks, and trains can be severalfold as efficient as now. Boeing's new 777 jetliner is twice as fuel-efficient per seat-mile as the 727. Much of the non-transportation uses of oil can also be saved. For example, the wasted energy leaking through U.S. windows totals twice the output of the Trans-Alaska Pipeline. "Superwindows" can stop that loss while making buildings cheaper to construct (because heating and cooling equipment becomes smaller or unnecessary). Overall, the United States could save most of its oil more cheaply than drilling for more. In the longer term, biofuels from farm and forestry wastes, and efficient land-use (building communities around people, not cars), can, if we wish, virtually eliminate oil use while making us all better off and improving our quality of life.

Electric Efficiency

The savings potential is even larger in electricity. Electricity costs Americans $180 billion and the world over half a trillion dollars per year. Expanding its supply has lately consumed as much U.S. capital (directly and in Federal subsidies) as all investment in durable-goods manufacturing. In the developing world, at least one-fourth of all capital goes to electrification.

Electricity saving technologies aren't glamorous. Motor controls, more efficient refrigerators, and modernized light bulbs seem insignificant compared to a shiny, new nuclear plant. However, the thousand or so best electricity-saving innovations now on the market, fully used throughout the U.S., would displace over half of all the electricity the country now uses. Our best estimate is that they'd save at least 75% of all electricity, cheaper than just operating existing thermal power stations.

For example, lighting uses roughly 20% of U.S. electricity. Just the lighting improvements now commercially available can, if fully used, cost-effectively save enough electricity to displace 120 Chernobyl-sized power plants. A compact fluorescent lamp uses 18 watts to deliver the same illumination as a 75-watt incandescent bulb. It also lasts about a dozen times as long (saving enough installation labor and replacement bulbs to more than pay for the lamp.) A utility can give away a compact fluorescent lamp more cheaply than it can fuel its existing power plants. Southern California Edison Company, for example, has already given away more than a million such lamps.

Similarly, better electric motors could displace roughly 160 power plants; improved appliances and water heating, another 120; air conditioning and ventilating improvements, around 100. Even EPRI estimates that 24 to 44 percent of U.S. electricity use can be saved in the last eight years of the 1990s, not counting the 8.5% they expect to be saved anyway. Such savings could eliminate the country's need to invest tens or hundreds of billions of dollars in new generating capacity.

Utilities and customers have lately split investments totalling about $5 billion per year in wringing more work out of the electricity we already have. They report that the average cost of implementing electricity savings of all kinds has been a couple of cents per kilowatt-hour (kW-h). The best-designed programs are severalfold cheaper than that. In contrast, each kW-h generated by an existing

power plant costs upwards of five cents. Delivered power from a new nuclear plant can cost as much as 20 cents per kW-h.

Saving The Utilities

These opportunities can return utility companies to financial health. Many utilities, once America's blue-chip investment, have ignored Miss Piggy's Fourth Law: "Never try to eat more than you can lift." Some went bankrupt trying to finish power plants they didn't need, couldn't afford, and wouldn't be able to pay for. Least-cost energy policy, however, offers such companies, their consumers, and their bankers a way out.

In many parts of the country, arguments are now raging over who should pay for various power plants. If the company pays, the investors lose value on their stock. If the customers pay, their electric rates soar. If, however, the utility helps its customers to use energy more efficiently, the utility will make more money. It may sell less electricity, but because it is cheaper to provide the energy services people want through greater efficiency than through running power plants, the utility's costs will go down more than its revenues; therefore its earnings can go up. (New regulatory concepts allow the utility to keep, as extra profit, part of what it saves its customers.) The utility can use the savings partly to pay off the plant it built and partly to lower the rates.

If all Americans saved electricity at the same speed and cost at which the roughly ten million people served by Southern California Edison Company actually *did* save electricity during 1983-85, then national forecast needs for long-run power supplies would decrease by about forty Chernobyl-sized power plants (of 1,000 megawatts each) *per year*—equivalent to an avoided capital cost, including its federal subsidy, of about $80 billion per year. Thus if the economy grew by several percent per year, total electrical usage could still decline. The total cost for utilities to achieve those savings would average two cents per kilowatt-hour, or less than *ten percent* of the cost of new power stations.

There is also a similar revolution underway in ways to implement the new technologies. Many utilities are offering loans, rebates, leases, and even gifts of energy-saving equipment.

Some State Governments are harnessing utilities' market motivations to encourage efficiency, by decoupling utilities' profits from sales. Such regulatory reform lets the utilities keep as extra profit part of any savings created for their customers. Keeping 15 percent of the savings, for example, spurred Pacific Gas and Electric, the nation's largest private utility, to stop building or planning conventional power plants. A decade ago, PG&E projected 20 new power plants. Today it plans none. In 1993, it *dissolved* its engineering and construction division because it never again expects to build a power plant. Instead, it will get at least three-fourths of its power needs in the 1990s from efficiency and the rest from renewables. (Four other western utilities now believe they can cost-effectively *get* all of their new power in the '90s from efficiency alone.)

A main reason for PG&E's change of heart is that its regulators gave its shareholders and customers the same rather than opposite goals: whatever would save the customers the most money would be the most profitable investment for the shareholders, while the most-cost investments would be the least profitable. Thus in 1992, PG&E invested over $170 million to help customers save electricity more cheaply than the utility could make it. That investment created $300-400 million worth of savings. Customers got 85% of those savings as lower bills, while the utility's shareholders got the rest—over $40 million—as extra profits. Everybody won.

Some utilities are even moving quickly to make saved electricity into a commodity, just like copper, wheat, and sowbellies. In at least eight states, a utility that wants more generating capacity runs an auction for all ways to make *or save* electricity, then accepts the low bids. (In practice, they're virtually always savings, not new supply.)

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The Davis House, Pacific Gas and Electric's demonstration house in California's Central Valley uses 75% less energy than a typical house built under the state's already strict standards. The 1600 square foot house has no air conditioner or furnace in a climate that ranges from below freezing to 110 degrees, and cost $1,800 less to build than a conventional home.

Saved electricity can increasingly be traded between customers, utilities, even countries. Contracts have already been signed in which utility A pays utility B to save electricity in B's territory and sell it back to A.

About a dozen utilities now sell efficiency, for fun and profit, in the territories of *other* utilities. (Electricity is usually a monopoly, but efficiency isn't; you can sell it anywhere you want to. A Northwest utility sold electricity in one state but efficiency in *nine* states.) Gas utilities can even sell electric efficiency, in ways that change the behavior of buildings so it becomes more economical to switch to gas.

Some states and towns have been considering a law that would charge a positive, or rebate a negative, hookup fee for new buildings, depending on how efficient they are. (This same type of law could vary the normal 5% sales tax on new cars over a range of 0-10% depending on their efficiency. Even better would be rebates for very efficient new cars, provided you scrap your old Brontomobile to get it forever off the road. Produce a death certificate, showing that your old car has been duly recycled, and get your rebate. Or scrap your old car, and *don't* replace it; bring in two bumpers and a fender, and get a bounty.)

These and other innovative implementation methods, developed at RMI and now rapidly entering successful practice around the country, are part of a larger trend towards *making markets in resource efficiency*. If depletion and pollution are made costlier, for example by carbon and sulfur taxes, people won't be able to respond very imaginatively to that price signal unless there's also a marketplace where their potential losses from the taxes can be turned into someone else's profit.

Energy For Economic Health

Energy efficiency also adds up to economic development. In the early 1980s, the Southwire Corporation, an energy-intensive heavy industry, dealt with falling prices and rising costs by cutting in half its energy use over eight years. This 60% cut in gas and 40% drop in electric use per pound of product equaled the company's profits. Without its energy-saving program, Southwire would have operated at a loss, and might have followed other such companies into bankruptcy. The energy program may have saved 4,000 jobs at 10 plants in six states.

In Osage, Iowa, the municipal utility helped its customers get more efficient, rather than pay to build a new power plant. Over nine years this program to weatherize homes and control electric loads saved the utility enough money to prepay all its debt, build up a nice cash surplus, and cut customers' real rates by a third. These lower rates attracted two new factories to town. The program saved the equivalent of $1,000 per household per year. The extra money helped local businesses and created jobs, making Main Street noticeably more prosperous than comparable towns nearby.

Resource efficient real estate development can significantly improve comfort, aesthetics, affordability and value of properties while reducing pollution and saving money. Over 30% of America's total energy usage, 60% of its electricity and its financial resources and 26% of the contents of its landfills are linked to buildings. Over 80% of the average American's time is spent inside. Enhancing the energy efficiency and livability of buildings through better design is a powerful way to save money, clean up the environment and improve quality of life. For example, the Davis House, Pacific Gas and Electric's demonstration house in California's Central Valley uses 75% less energy than a typical house built under the state's already strict standards. The 1600 square foot house has no air conditioner or furnace in a climate that ranges from below freezing to 110 degrees, and cost $1,800 less to build than a conventional home. Similar houses in nearby Village Homes, a planned solar community, are selling for a premium of $11 a square foot. Village Homes also enjoys a 90% lower crime rate than neighboring subdivisions, in large

measure because of the various "green design" features that have contributed to a real sense of community.

Resource efficient building design can also improve the bottom line by significantly improving worker productivity. Improving lighting, cooling and heating, often best achieved by measures to save energy, makes workers more comfortable and productive. A one percent increase in worker productivity can give a company savings that exceed its entire energy bill. A study conducted by Rocky Mountain Institute in 1994, found numerous examples of companies that, while seeking to save money by saving energy, ended up improving productivity by 6 to 16 %.

Power For Development

Energy-saving technologies also have important implications for developing countries. Most official programs call for centralized, capital-intensive megaprojects, whether in energy, agriculture, or industrial production. Unfortunately, the history of such projects as dam-building, nuclear programs, green revolutions, and heavy-industrial economic development has shown some successes but more large failures. Development policy has viewed modern technology as a panacea, without regard to whether a given technology is appropriate to the local culture or to whether it promotes sustainability and equity.

For example, a large dam or nuclear plant will indeed produce electricity. But, the high cost of such projects drains scarce development money from the country. In recent years, a fourth of all development capital in the world has gone to electrification. The cost of running wires to serve remote villages is so high that the electricity usually ends up going to the urban elite. The country falls further in debt paying both the capital and operating costs, while the villagers, in whose name the project was begun, rarely see any benefits. On official projections, more money will be needed to build the power plants the experts say are necessary to industrialize developing countries than will result from the economic growth these countries are projected to have. This leaves little money to buy all the things that were supposed to use all that electricity. On the other hand, modern technologies that are sophisticated in their simplicity not their enormity, when carefully matched to the local needs, can do a lot to promote real development. It is hard to imagine how much development can occur without building efficiency into new infrastructure from scratch.

Many efficiency technologies can be carried into the village on peoples' backs. In a village in, say, China or India, electricity is used for such tasks as water-pumping, grain-grinding, refrigeration, running sewing machines, radios, TVs, and lights. More efficient lighting and motor technologies can roughly treble the amount of human welfare that each kilowatt-hour will yield in that village. It means that in a Chinese village, where people typically get a third of their power from very small hydro dams, all the present electricity needs could be met with just dams. The costly, balky diesels that keep breaking down would no longer be needed. Similarly, quadrupled-efficiency light bulbs would cut by nearly a third the evening peak load that crashes the Bombay grid; given away in Haiti, they could increase average disposable income by perhaps as much as a fifth; and installed in a typical North Carolina chicken barn, they increase profits by a fourth.

Since the average poor country uses energy almost three times less efficiently than the average rich country, which in turn can improve its efficiency a least fourfold without coming anywhere near the present limits of cost-effectiveness, there's room—if poor countries directly became as efficient as rich countries now *should* be—to support a roughly tenfold increase in developing countries' economic activity without increasing their energy use at all. This approach would free up precisely the capital needed to pay for necessary development.

It is important, however, to buy efficiency *instead* of costly supply investments, not in

A study conducted by Rocky Mountain Institute in 1994, found numerous examples of companies that, while seeking to save money by saving energy, ended up improving productivity by 6 to 16 %.

addition to them. China, for example, recently mass-produced huge numbers of refrigerators, raising the fraction of Beijing households owning one from 2% to over 60% in six years. But by inattentively choosing an inefficient refrigerator design, the Chinese government committed itself to spend billions of dollars it doesn't have on new power plants to run those inefficient refrigerators. This sort of decision is repeated daily throughout the world.

Renewable supply technologies can also help and are natural partners with efficiency. For example, photovoltaic cells can provide electricity even in remote villages to power efficient community refrigerators and household lights. Like the motor controllers, the cells can be hand-carried into the village. In combination with efficiency, well-designed renewable supply technologies cost far less per unit of power delivered, and can be built far faster and at lower risk, than the megaprojects. The impacts are low, the benefits direct, and the gains in equity striking.

A good place to show this would be the electrification of rural South Africa, which would take at least 50 years by conventionally running wires all over from the central coal-fired stations, but as little as 5 years by leapfrogging over that old-fashioned concept and instead giving each village efficiency and solar cells. Furthermore, numerous national and global studies suggest that presently available and cost-effective renewable sources are probably sufficient to meet the world's energy needs—given efficient use—on even a very affluent planet.

Though seldom cheap, renewable energy is cheaper than its long-run (and, increasingly often, also its short-run) nonrenewable alternatives. Costs are continuing to fall: in Colorado, if you're more than about a quarter-mile from the nearest power line, it's usually cheaper to buy superefficient appliances and solar cells than to hook up to the grid. Most developing-country villages are even farther away from the grid, and their electricity costs are even higher. In fact, when efficiency and solar cells were recently installed in an Indonesian village at lower cost than hooking onto an adjacent transmission line, the people started saving money immediately—because financing the efficiency and solar energy, on the same terms used for power plants, cost less debt service than the people *were already paying* for lighting kerosene and radio batteries.

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Similarly, rolls of high-tech plastic sheeting, combined with local building materials, can enable people to put simple but very effective solar greenhouses on their homes. Imagine a village in upland Nepal. The greenhouse can keep the home warm in the winter, reducing the need for firewood and thus reducing deforestation. This, in turn, reduces soil erosion, which helps alleviate flooding downstream in India.

Ultimately, avoiding the flooding may prevent a famine that could otherwise kill several hundred million people. The greenhouse also allows its owners to grow fresh vegetables more of the year, improving nutrition, and to have a warm space for older people to enjoy. This may seem like a lot to expect of a simple roll of plastic, but it is representative of the benefits that carefully chosen, appropriate technologies can provide. It will be critical, though, especially if supercars crash the oil price, that developing countries are provided with the information and financing to make the transition to sustainability, and are not just used as a market to soak up our cast-off, inefficient technologies.

Energy And Environment

Energy savings can also solve the problem of acid rain, to the extent it comes from coal-fired power plants, *at a profit*. This profit and the environmental benefit is biggest when the form of energy saved is electricity. Each unit of electricity saved avoids burning three or four units of fuel (in developing and formerly socialist countries, more like five or six units), and that fuel is mainly coal. Power plants burn a third of all fuel, release a third of all the resulting carbon dioxide, and emit a

third of the nitrogen oxides and two-thirds of the sulfur oxides.

Rather than raising your electric rates to put diapers on dirty coal plants, it is a lot smarter for your utility to help you use electricity more efficiently. For example, many utilities give rebates for compact florescent light bulbs. Each bulb, over its lifetime, saves enough electricity to displace 662 pounds of coal (if your utility runs coal plants) or 62 gallons of oil. Roughly 1,600 pounds of carbon dioxide and 18 pounds of sulfur dioxide don't get released into the air. Remember, the bulb more than pays for itself out of its energy savings, so the environmental dividends are free.

The utility sells less electricity, burns less coal, and emits less sulfur, but mainly it saves a great deal of money, because efficiency is cheaper than coal. The utility can then use some of the saved money to clean up the remaining plants, most of the rest of the money to lower its customers' electric rates, and a bit to reward its investors for having hired such smart managers.

While this may seem to be too good to be true, a number of utilities and commissions around the country have already reviewed this approach and are acting on it. In one analysis, which conservatively assumed potential electrical savings only a third as big and several times as costly as Rocky Mountain Institute's more detailed assessments have shown, the Midwest region whose power plants emit a third of U.S. utilities' sulfur could cut those emissions by more than half. This could be achieved not at a cost of $4-7 billion as the utilities have been claiming but at a net *saving* of $4-7 billion—a swing of roughly $11 billion from net cost to net profit.

Profitable Climate Protection

Energy inefficiency is also endangering the earth's climate, which underpins food-growing and many other vital elements of security. Most people now realize that the burning of fossil fuel, in effect, reverses photosynthesis. It puts carbon dioxide back in the air instead of taking it out. Carbon dioxide, as it accumulates in the atmosphere, acts as a transparent blanket for the earth, and may cause a dramatic warming of the planet. This would change the world's climate, flooding coastal cities, changing weather and rainfall patterns, and radically shifting present farming regions. Studies for Canada show that if nothing is done about the problem, 40-70% of days suitable for skiing would be eliminated. The problem is now projected to become severe by midway through the next century, and, as recent fire and hurricane seasons have demonstrated, may well be starting already to emerge from the "noise" of normal weather fluctuations. With 5% of the world's population, the U.S. is responsible for 25% of the world's greenhouse gas release. This is, in part, because the average North American uses 40 times as much energy as the average person in a developing country.

As should be clear from the previous discussion of energy efficiency and renewable energy, the CO_2 problem, to the extent that it is energy related, is an artifact of an economically inefficient energy policy. Because it is uneconomic to burn fossil fuels in the first place and cheaper to buy energy efficiency and renewable resources that don't affect the climate, we know how to abate at least half of the global change problem at a profit. The rest can be abated, generally at no cost or at a profit, by replacing chlorofluorocarbons (which we must do anyway to protect the ozone layer) and by adopting sustainable farming and forestry practices. (Fossil-fuel CO_2 causes only about two-fifths of all global warming.)

Slowing Nuclear Proliferation

Energy efficiency can improve national and global security in more direct ways. For example, using energy in a way that saves money—that is, using energy more efficiently and using renewable sources—can go a long way toward slowing the spread of nuclear bombs.

For many years the driving force behind

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nuclear proliferation has been the spread of supposedly peaceful nuclear power. Nuclear power programs have provided the material, equipment, skills, and above all the innocent civilian "cover" for bomb programs. Such countries as Iraq, Pakistan, and North Korea can pursue nuclear bomb programs while saying, "We're not making bombs; we're making electricity vital to our development." Other countries which, for commercial reasons, want to sell bomb kits to them can say, "These countries say they're just making electricity; why should we question their assurances?"

We can expect no real progress on limiting the threat of nuclear war as long as we have an energy policy that insists on donating bomb kits to developing countries. This constraint would seem to commit us to a grim future, since nuclear power, according to many of the world's energy officials, is essential.

However, imagine for a moment that there is no longer an international commerce in nuclear technology. In that case, the ingredients needed to make bombs by any of the twenty or so known methods would no longer be casual items of trade. A country or subnational group might still be able to get the ingredients on the black market, but necessary components would be much harder to get, more conspicuous to try to get, and politically much more costly to be caught trying to get, because for the first time, the reason for wanting the items would be *unambiguously* military. There would be no doubt about what that country was up to. Such "unmasking" wouldn't make the spread of bombs impossible, but it would make it far more difficult, if not impossible, for the most worrisome countries to continue their slide into the Nuclear Club.

Such a seemingly utopian world in which there is no nuclear commerce isn't utopian at all. It's what the market is already doing. For example, it is now economic, with today's technologies, to save at least four times as much electricity as nuclear plants make; and saving that electricity would cost about one-seventh as much as just *operating* the nuclear plants, even if building them were free. Because of that kind of competition (plus such supply developments as very cheap and efficient steam-injected gas turbines and packaged gas-fired combined-cycle plants), nuclear power, and, for that matter, the previously projected expansion of coalpower, are dying of an incurable attack of market forces throughout the world's market economies.

To slow the spread of bombs, therefore, it is not necessary to be antinuclear, nor to sacrifice a vital source of power for the future. If American energy policy were just to acknowledge and ratify what the market has already done, we would be most of the way toward stopping the development of nuclear weapons programs. Then we can get on with what we should have been doing instead: helping all countries to use not just the cheapest but also the most inherently nonviolent technologies to meet their energy needs.

There is, of course, one more driving force behind the spread of bombs. The prestige attached by countries like ours to having bombs for international bullying, is a powerful inducement for smaller countries to seek bombs—to "succeed" in the way we have defined. The United States has made, on average, one threat of nuclear violence a year since World War II. While even the Soviets offered to agree to a mutual pledge of no testing and "no first use" of nuclear bombs, America continued to refuse. The solution to this challenge is not to be found so directly in resource policy. Limiting the number of countries possessing nuclear bombs will certainly help. However, reversing the arms race depends, among other things, on rethinking what we mean by security.

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Global Security

The end-use/least-cost methodology developed in energy policy can help us redefine and resolve what security is, where to get it, and who is responsible for it. In recent times, American security has been seen as a commodity, dispensed by a monopoly vendor called the Pentagon in the form of weapons

systems, costing upwards of $10,000 per second. At Rocky Mountain Institute we have been rethinking that assumption, again from the standpoint of advanced techniques for resource efficiency.

Security is commonly thought of as resulting from armies and missiles. The dictionary, however, more usefully defines security as "freedom from fear of privation or attack." A vital element of our security, but one usually overlooked in debates on bloated military budgets, is ensuring secure and affordable supplies of energy, water, food, and shelter. Security also derives from a society in which people are healthy and have a healthful environment, a sustainable economy, a legitimate system of government, and abundant cultural and spiritual assets. Many of these elements of security can be provided more efficiently and cheaply than they now are—and so can the ingredients of security traditionally thought of as primarily military.

For the past decade, for example, one of this nation's major military objectives has been protecting access to Mideast oil. Yet *one year's* worth of the roughly $50 billion per year which we are spending on forces whose mission is to protect or seize Mideast oil fields, if spent to make American buildings more heat-tight, would *eliminate* imports of Mideast oil.

We have in this country two supergiant oil fields that are still largely untapped. They are the "weatherization and the accelerated scrappage of gas-guzzlers oil fields". Each of these sources of saved oil is bigger than the biggest oil field in Saudi Arabia. Saving this energy would eliminate U.S. oil imports from all sources, and could do so before a new nuclear power plant or synfuel facility could deliver any energy at all, and at a tenth of the cost. As a result of what has already been done to save energy over the last decade, and all that remains to be done, those vast pools of cheap oil in the Mideast are no longer an indispensable centerpiece of global security.

The other half of the dictionary definition of security—freedom from fear of attack—can also be achieved more cost-effectively. Analysts around the world, and in every major government, recently including our own, are doing some exciting thinking about non-military approaches to defense. One can, for example, organize a country in such a way that an occupying army would find life impossibly disagreeable. Such sanctions may enable a nation to increase its security more cost-effectively through nonviolence than through increasing its military budget. Further, such analysts as the Boston Study Group have shown how to cut military budgets significantly while increasing the effectiveness of traditional military forces. They have shown how to redesign force structures so that each side's defenses are stronger than the other's offenses no matter what the actual levels of offensive capability.

These approaches, coupled with what we know about resource efficiency, offer hopeful new ways to start building a truly secure society—not by buying new and more terrible weapons from the Pentagon but rather by taking personal responsibility for making our lives and our communities more secure. Happily, this sort of security is contagious. To be truly secure, you must see to it that your neighbors are also secure. If each of us is to remain secure, we must ensure that the region and ultimately the globe is secure. Otherwise, people from other lands might envy or even try to take what we have. In this sense, we can increase our security only by making others more secure, not less.

Of course, resource efficiency alone cannot prevent all conflicts. "Leader control" is needed too, to deter political conflicts by publicizing leaders' planned adventures and making leaders politically accountable for them—in advance. (It's a telling lesson of history that there are almost no examples of wars between two democracies.) Even then, some conflicts will still arise, and will need to be peacefully resolved through improved international laws, norms, and institutions. And if all else fails, non-provocative defense (through defensive weapons, civilian-based defense,

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and the like) can ensure the predictable defeat of aggressive warfare. But combining three elements—conflict *prevention*, conflict *resolution*, and nonprovocative *defense*—yields a new approach to security that works better and costs less than present arrangements; that enhances everyone's security; that does not rely on the use or threat of violence; and that can be built from the bottom up, because it is not the monopoly of national governments but the province of every citizen.

One RMI study showed that imple water-sav- ng fixtures, used throughout Denver house- holds and their lawn-watering quipment, could save more water than the pro- posed $1 billion Two Forks dam would provide.

Water and Agriculture

The lessons learned from energy are also helping to solve some other looming resource crises, such as the linked issues of water and agriculture. Present policies in both these areas have created expensive, unsustainable systems. For example, roughly 85% of our nation's water consumption is in agriculture.

As water tables in many areas retreat toward the People's Republic, the cost of energy for irrigation pumps is a major expense for many farmers. Chemical runoff from farms, in turn, is polluting many water supplies. Agribusiness-style farming has led many farmers to buy more land, use larger machines, and apply more chemicals than they can afford. This style of farming has bankrupted many farmers, hurt rural culture, depleted the land, impoverished genetic diversity, and subjected consumers to food of questionable purity.

Contributing to the unsustainability of the food system is an array of federal subsidies for water development and agricultural production. Farmers seldom pay the full cost of water provided by federal irrigation projects, so their incentive to conserve water is reduced. Commodity price supports and the tax code reward capital-intensive methods of farming, favoring corporate farms at the expense of more labor intensive, family farms and the stewardship ethic and rural economies that they support.

In urban areas the fragile nature of these systems becomes clearer. The average molecule of food travels 1,300 miles before someone eats it. Many cities depend on water pumped hundreds of miles through vulnerable supply systems. Much urban water contains an array of worrisome toxics (many the byproducts of making agrichemicals), and a growing number of regions are experiencing water shortages.

Wrapped together, these problems seem overwhelming. Yet again, by basing a search for solutions on the principles of efficiency and sustainability and by developing programs that solve more than one problem at a time, the situation comes to look less daunting. For example, such organizations as Rocky Mountain Institute, the Land Institute, John Jeavons's gardening center in Willets, California, and the Rodale Research Center are developing new approaches to sustainable agriculture that emphasize reduced costs and lowered impacts from chemicals and machines.

Rocky Mountain Institute also couples its agricultural work with studies of increased water efficiency. For example, one RMI study showed that simple water-saving fixtures, used throughout Denver households and their lawn-watering equipment, could save more water than the proposed $1 billion Two Forks dam would provide. The cost per acre-foot would be a fifth that of the dam—or an eighth if energy savings in the hot water were counted. Partly in response to these figures, the then EPA Administrator, William Reilly, vetoed the dam proposal.

Water-efficiency programs can also link farmers with cities. Since so much more water is used for irrigation than in cities, even small savings on farms can free up relatively large amounts of water for cities. But this need not put farmers out of business. Farmers can be helped to improve the technical efficiency of irrigation so that they can grow as big a crop but use less water. Water saved on farms can even be used by a partner city, which then treats the water and returns it (enriched by nutrients) to the farmers along with a payment to help farmers' cash flow. Conversely, New York City recently undertook an effort

to encourage farmers in the Catskills to adopt organic farming techniques, not only to gain access to more healthful food, but to clean up the most serious non-source-point pollution affecting New York's water supply.

Rocky Mountain Institute has found enormous potential for improvement, not just in showerheads, toilets, faucet flow controls and irrigation equipment, but in the decision frameworks facing water users. For instance, farmers will use water more efficiently if provided accurate and timely information about water demands of their crops. Water prices that reflect more fully the direct and indirect costs of water use also provide information that leads to greater efficiency, as do financial incentives offered by water utilities and irrigation districts to farmers who change equipment and practices.

All the new methods of financing and delivering *electric* efficiency can also apply to water. Sliding-scale hookup fees, giveaways, mass retrofits, rebates, arbitrage, inter-utility or inter-customer trades of saved water—all are rapidly entering the water field. Indeed, one California town simply told contractors that before building a new house, they must first save that much water somewhere else in town. The result: the installation of water-saving fixtures in a third of all the houses in the first two years of the program.

Towards a Theory of Community

The approach presented here stems from our belief that individuals, acting in their own self-interest within the system of economics that Adam Smith called the "free market," can also act wisely for the good of the planet.

Most people are only going to take an action if they believe it to be in their interest. On occasion, people might be inspired to change their lifestyles for the common good. But if the change is a sacrifice, it is unlikely to last very long. The lesson we learned from the energy crisis, however, is that wise resource management need not necessarily involve government regulations forcing hardship and sacrifice. The millions of "avaricious," "short-sighted," "self-interested" people who only wanted to save money and provide themselves with an energy supply that couldn't be cut off actually did more to solve the energy crisis than the "expert" planners in Washington, DC. The energy crisis demonstrated the wisdom of individual decision-making and community problem-solving, and of community activism to ask and answer such questions as 'what kind of a future do we want?'

The experience of the energy crisis showed that, given incentive and opportunity, ordinary people can implement sophisticated, sustainable resource policies through free-market mechanisms far faster than through government exhortation. This experience should serve not only as a model for crafting solutions to the many other resource problems facing us, but also as a source of hope that these challenges can actually help us build a more comfortable, abundant life for all the crew of Spaceship Earth.

It is important to remember, however, that there is no free market. The Western economic system, however fine it is, remains imperfect. There are many conditions called for by free-market theory that today's system does not have. For example, a free market presupposes that everyone has perfect information about the future, that we have complete knowledge of all the new technologies and possibilities emerging every day. The theory assumes perfect competition, no barriers to market entry or exit, no underuse of any resource, no monopoly, and no monopsony. These are obviously unrealistic conditions. The market is also flawed by the massive subsidies that distort the economic decisions people make.

Even more important, there are many things that the market was never intended to do. Markets allocate resources without asking or telling us how much is enough: markets are meant to be *ef*ficient, not *suf*ficient. (As Herman Daly points out, a boat loaded with too much weight will sink even if the weight is optimally allocated.) Markets do not signal

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when the National Product becomes too gross or when basic needs are being sacrificed to prodigal wants. Furthermore, markets are meant to be greedy, not fair. Under Adam Smith's theory, even a perfect market was never designed to guarantee such values as sustainability, resilience, beauty, justice, or community. A market can not tell us when we are "beyond the limits".

These non-economic values may ultimately mean more to us than money. Yet if a free market protects the ozone layer of the atmosphere or the accumulated wisdom of past generations—if it does something good for grandchildren, for wilderness or whales—that is purely coincidental. These key issues were never intended to be addressed by the market at all. The market is remarkably good at allocating scarce resources over the short term. It will go a long way toward solving the resource issues that confront us. But, such broader questions as "What sort of a future do we wish to live in?" are the realms of the spiritual and political activist. It is the responsibility of us all to seek a balance between the disciplines of economics, politics and spirit.

So far, however, no one has brought forth a political theory that addresses this need. For example, in energy policy we learned that the practical answers, the approaches that have begun to solve the energy crisis, came primarily from the level of the community, from the voluntary groups that came together to decide what their problems were and how to solve them.

If you look at the theories on which America was founded, you will find in them no mention of community. The political theories that guided such thinkers as Thomas Jefferson and the founders of the American Republic spoke of the role of the individual, the role of the State-as-nation, and the social contract between them. It was on these theories that our Constitution was built. These underpinnings of democracy, and the varied forms of constitutional government to which they have given rise, stand as some of the finest works of humankind. Yet for today's problems, neither the isolated individual nor the cumbersome nation seems best suited to take effective action. Such forms as networks for citizen diplomacy, bioregional alliances, religious groups, farmers' associations, community development corporations, and many others are emerging as new forms of government and leadership. As a nation, and as a world community, we need to evolve a more inclusive political theory—one that recognizes that the effective level of decision making is sometimes the Federal government, sometimes the individual, but often somewhere inbetween. It needs to address the competing worlds of economics, politics, and values, and include a declaration of what it is we are seeking, of the values we hold dear and of the spirit that guides us.

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Conclusion

Resources, traditionally, have been seen as the property of the few and the driving forces behind economic development. This view of resource management has led to an unprecedented plunder of the world's treasures. It has taken humankind from remarkable wealth to within sight of disaster. It is critical that we remember that economic development and resource use that are based on unsustainability will lead only to a devastated planet of bankrupt countries, stagnant economies, and impoverished people. Mines grow no second crop. However, if we learn the lessons of resource efficiency, we are confronted, as Pogo said, by insurmountable opportunities. The many crises facing us should be seen not as threats, but as chances to remake the future so that it serves all beings.