CHAPTER 13

Making Markets Work

Ceaseless market vigilance — How cheap a future — The myth of free markets — Skewed markets mean lost capital — Fiddling with the switches — An ordered arrangement of wastebaskets — "Satisficing" — When regulation fails — Golden carrots — Plain vanilla motors — Making a market in nega-resources — Alternative annual report

CHURCHILL ONCE REMARKED THAT DEMOCRACY IS THE WORST SYSTEM OF government — except for all the rest. The same might be said of the market economy. Markets are extremely good at what they do, harnessing such potent motives as greed and envy — indeed, Lewis Mumford said, all the Seven Deadly Sins except sloth. Markets are so successful that they are often the vehicle for runaway, indiscriminate growth, including the growth that degrades natural capital.

A common response to the misuse, abuse, or misdirection of market forces is to call for a retreat from capitalism and a return to heavy-handed regulation. But in addressing these problems, natural capitalism does not aim to discard market economics, nor reject its valid and important principles or its powerful mechanisms. It does suggest that we should vigorously employ markets for their proper purpose as a tool for solving the problems we face, while better understanding markets' boundaries and limitations.

Democracies require ceaseless political vigilance and informed citizenship to prevent them from being subverted or distorted by those who wish to turn them to other ends. Markets, too, demand a comparable degree of responsible citizenship to keep them functioning properly despite those who would benefit more from having them work improperly. But the success of markets when they do work well is worth the effort. Their ingenuity, their rapid feedback, and their diverse, dispersed, resourceful, highly motivated agents give markets unrivaled effectiveness. Many of the excesses of markets can be compensated for by steer-

ing their immense forces in more creative and constructive directions. What is required is diligence to understand when and where markets are dysfunctional or misapplied, and to choose the correct targeted actions to help them to operate better while retaining their vigor and vitality.

This book has often argued that most of the earth's capital, which makes life and economic activity possible, has not been accounted for by conventional economics. The goal of natural capitalism is to extend the sound principles of the market to all sources of material value, not just to those that by accidents of history were first appropriated into the market system. It also seeks to guarantee that all forms of capital are as prudently stewarded as money is by the trustees of financial capital.

The notion that much of the remedy for unsustainable market activities is the adoption of sustainable market activities may offend both those who deny that markets can be unsustainable and those who deny that markets and profits can be moral. Yet worldwide experience confirms an abundance of market-based tools whose outcomes can be environmentally, economically, and ethically superior. These tools include institutional innovations that can create new markets in avoided resource depletion and abated pollution, maximize competition in saving resources, and convert the cost of a sulfur tax or a carbon-trading price into profits realized from the sale and use of efficient technologies.

Ensuring that markets fulfill their promise also requires us to remember their true purpose. *They allocate scarce resources efficiently over the short term.* That is a critical task, especially as the logic of natural capitalism changes the list of which resources are genuinely scarce. But the continuity of the human experiment depends on more than just success in the short term, and efficiently allocating scarce resources does not embrace everything people want or need to do.

For all their power and vitality, markets are only tools. They make a good servant but a bad master and a worse religion. They can be used to accomplish many important tasks, but they can't do everything, and it's a dangerous delusion to begin to believe that they can — especially when they threaten to replace ethics or politics. America may now be discovering this, and has begun its retreat from the recent flirtation with economic fundamentalism. That theology treats living things as dead, nature as a nuisance, several billion years' design experience as casually discardable, and the future as worthless. (At a 10 percent real discount rate, nothing is worth much for long, and nobody should have children.)

The 1980s extolled a selfish attitude that counted only what was countable, not what really counted. It treated such values as life, liberty, and the pursuit of happiness as if they could be bought, sold, and banked at interest. Because neoclassical economics is concerned only with efficiency, not with equity, it fostered an attitude that treated social justice as a frill, fairness as passé, and the risks of creating a permanent underclass as a market opportunity for security guards and gated "communities." Its obsession with satisfying nonmaterial needs by material means revealed the basic differences, even contradictions, between the creation of wealth, the accumulation of money, and the improvement of human beings.

Economic efficiency is an admirable means only so long as one remembers it is not an end in itself. Markets are meant to be efficient, not sufficient; aggressively competitive, not fair. Markets were never meant to achieve community or integrity, beauty or justice, sustainability or sacredness — and, by themselves, they don't. To fulfill the wider purpose of being human, civilizations have invented politics, ethics, and religion. Only they can reveal worthy goals for the tools of the economic process.

Some market theologians promote a fashionable conceit that governments should have no responsibility for overseeing markets — for setting the basic rules by which market actors play. Their attitude is, let's cut budgets for meat inspection and get government off the backs of abattoirs, and anyone who loses loved ones to toxic food can simply sue the offenders. Let's deregulate financial markets, and self-interested firms will police themselves. Let straightforward telephone, cable TV, and airline competition replace obsolete regulatory commissions. Those seduced by the purity of such theories forget that the austere brand of market economics taught by academic theorists is only tenuously related to how markets actually work. The latest illustrations of that principle include the Wild West wreck now looming in Russia, mad-cow disease, savings and loan fraud, phone scams, and crash-by-night airlines. By the time textbook simplifications get filtered into political slogans, their relationship to actual market behavior becomes remote. A dose of empiricism is in order.

THE FREE MARKET AND OTHER FANTASIES

Remember the little section toward the beginning of your first-year economics textbook where the authors listed the assumptions on which

the theory of a perfect free market depends? Even as abstract theories go, those conditions are pretty unreasonable. The main ones are:

1. All participants have perfect information about the future.[1]
2. There is perfect competition.
3. Prices are absolutely accurate and up-to-date.
4. Price signals completely reflect every cost to society: There are no externalities.
5. There is no monopoly (sole seller).
6. There is no monopsony (sole buyer).
7. No individual transaction can move the market, affecting wider price patterns.
8. No resource is unemployed or underemployed.
9. There's absolutely nothing that can't be readily bought and sold (no unmarketed assets) — not even, as science-fiction author Robert Heinlein put it, "a Senator's robes with the Senator inside."
10. Any deal can be done without "friction" (no transaction costs).
11. All deals are instantaneous (no transaction lags).
12. No subsidies or other distortions exist.
13. No barriers to market entry or exit exist.
14. There is no regulation.
15. There is no taxation (or if there is, it does not distort resource allocations in any way).
16. All investments are completely divisible and fungible — they can be traded and exchanged in sufficiently uniform and standardized chunks.
17. At the appropriate risk-adjusted interest rate, unlimited capital is available to everyone.
18. Everyone is motivated solely by maximizing personal "utility," often measured by wealth or income.

Obviously the theoretical market of the textbooks is not the sort of market in which any of us does business. Actually, if there *were* such a place, it would be pretty dull. No one could make more than routine profits, because all the good ideas would already have been had, all the conceivable opportunities exploited, and all the possible profits extracted — or, as the economists put it, "arbitraged out." It's only because actual markets are so *im*perfect that there are exceptional business opportunities left.

Just how imperfect *are* the markets in which we all actually live? Let's run a quick check on that list of eighteen theoretical requirements:

1. Perfect information about the future? If anyone had it, he or she'd be barred from elections and stock markets — and probably not given any credence by the rest of us.
2. Competition is so imperfect that exceptional profits are commonly earned by exploiting either one's own oligopolistic power or others' oversights, omissions, and mistakes.
3. Markets know everything about prices and nothing about costs.
4. Most harm to natural capital isn't priced, and the best things in life are priceless.
5. No monopolies? Microsoft, airlines' fortress hubs, and your managed-health-care provider come close.
6. No monopsonies? Consider your utility, the Peanut Marketing Board, and the Federal Aviation Administration.
7. No market-movers? What about Warren Buffet and the Hunt Brothers?
8. Thirty percent of the world's people have no work or too little work. (Economists justify this by calling them "unemployable" — at least at the wages they seek.)
9. Most of the natural capital on which all life depends can be destroyed but neither bought nor sold; many drugs are bought and sold in a pretty effective free market, but doing either can jail you for life.
10. The hassle factor is the main reason that many things worth doing don't happen.
11. Does your insurance company always reimburse your medical bills promptly? Does your credit-card company credit your payments immediately?
12. Worldwide subsidies exceed $1.5 trillion annually — for example, America's 1872 Mining Act sells mineral-bearing public land for as little as $2.50 an acre and charges no royalties.
13. It's hard to start up the next Microsoft, Boeing, or GM — or to get out of the tobacco business.
14. The world's regulations, put on a bookshelf, would extend for miles.
15. The Internal Revenue Code exists.
16. You can't buy a single grape at the supermarket, nor an old-fashioned front porch in most housing developments.
17. Many people are redlined, must resort to loan sharks, or have no access to capital at any price.
18. So why does anyone fall in love, do good, or have kids, and why do three-fifths of Americans attend weekly worship services?

Actually, the market works even less perfectly than the above counterexamples suggest, for two reasons. First, corporations that benefit from subsidies, externalizing their costs, avoiding transparency, and monopolizing markets tend to ignore market realities and lobby for making new rules, or overlooking old ones, that will best achieve their private benefits. Second, people are far too complex to be perfectly rational benefit/cost maximizers. They are often irrational, sometimes devious, and clearly influenced by many things besides price.

For example, suppose you put a group of individuals in hot, muggy apartments with air conditioners and tell them that both the air conditioners and the electricity are free. What would you expect them to do? Won't they just turn it on when they feel hot and set it at a temperature at which they feel comfortable? That's what economic theory would predict; if cooling is a free good, people will use lots of it whenever they want. But only about 25 to 35 percent of individuals actually behave that way. Many others don't turn on the air conditioner at all. Most do run it occasionally, but in ways that are essentially unrelated to comfort. Instead, their usage depends largely on six other factors: household schedules; folk theories about how air conditioners work (many people think the thermostat is a valve that makes the cold come out faster); general strategies for dealing with machines; complex belief systems about health and physiology; noise aversion; and (conversely) wanting white noise to mask outside sounds that might wake the baby.[2]

Theoretical constructs are, after all, just models. The map is not the territory. The economy that can be described in equations is not the real economy. The world that conforms to eye-poppingly unreal assumptions about how every economic transaction works is not the real world. The sorts of economists who lie awake nights wondering whether what works in practice can possibly work in theory are not the sorts who should define your business opportunities.

Previous chapters have documented 100 to 200 percent annual returns on investment in energy efficiency that haven't yet been captured, as market theory presumes they must already have been. Previous chapters documented improvements in U.S. vehicles, buildings, factories, and uses of materials, fiber, and water that could probably save upward of a trillion dollars per year. These efficiency gains are available and highly profitable but haven't yet been captured. Chapter 3 even suggested that waste, in a more broadly defined sense, in the U.S.

economy could amount to at least one-fourth of the GDP. Such prominent examples of market failure suggest that the standard question of how to make markets more perfect should be turned around: Are there ways to address the *im*perfections in the marketplace that would enable people to capture the profit potential inherent in those flaws? It's time to identify the real-world obstacles to buying resource efficiency, and determine how to turn each obstacle into a new business opportunity. The attractive scope for doing this will be illustrated by examples about energy and occasionally water, but most of the implementation methods and opportunities described could be extended to saving any kind of resource.

CAPITAL MISALLOCATION

The lifeblood of textbook capitalism is the flow of capital.[3] In theory, capital flows to the best risk-adjusted returns just as automatically as water flows downhill. In theory, theory and practice are the same, but in practice they're not. In practice, even the major global institutions that handle most of the world's large capital flows have significant distortions and imperfections.[4] Realistically, most of us can't attempt to solve these problems on a global scale, but we can notice and address similar ones at the level of the firm or community.

Without managerial attention, not much happens. Most managers pay little attention to such seemingly small line-items as energy (one to two percent of most industries' costs). Similarly, most manufacturing firms choose investments that increase output or market share in preference to those that cut operating costs.[5] What both these habits overlook is that saved overheads drop from the top to the bottom line, where even small cost savings added back to profits can look a lot bigger. When the CEO of a Fortune 100 company heard that one of his sites had an outstanding energy manager who was saving $3.50 per square foot per year, he remarked, "That's nice — it's a million-square-foot facility, isn't it? So he must be adding $3.5 million a year to our bottom line." In the next breath, he added: "I can't really get excited about energy, though — it's only a few percent of my cost of doing business." He had to be shown the arithmetic to realize that achieving similar results in his 90-odd million square feet of facilities worldwide could boost that year's net earnings by 56 percent. The energy manager was promoted to spread his practice companywide.

Once managers do start paying attention, how do they determine how much energy efficiency is worth buying? Many supposedly sophisticated firms, it turns out, don't decide very carefully: They make all routine "small" purchases based on initial cost alone. Thus 90 percent of the 1.5 million electric distribution transformers bought every year, including the ones placed on utility poles, are bought on the basis of lowest first cost. Buying the less expensive and less efficient transformers passes up an opportunity to earn an after-tax return on investment of at least 14 percent a year plus many operational advantages. Nationwide, it also misallocates $1 billion a year.[6] Every first-year business student knows that the correct way to allocate capital is to compare investments' results over the long run, not choose the option that requires the least initial investment regardless of future return. Every computer spreadsheet contains net-present-value functions that perform this calculation automatically. Yet most companies don't buy energy efficiency using these principles.

Typically, energy-saving devices are chosen by engineers at the firm's operating level, using a rule-of-thumb procedure called "simple payback," which calculates how many years of savings it takes to repay the investment in better efficiency and start earning clear profits. Four-fifths of the American firms that even think about future savings (instead of just initial capital cost) use this method. Moreover, they do so with the expectation of extremely quick paybacks — a median of 1.9 years.[7] Most corporate officers are so immersed in discounted-cash-flow measures of profitability that they don't know how to translate between their own financial language and the engineers' language of simple payback.[8] They therefore may not realize that a 1.9-year simple payback is equivalent to a *71 percent* real after-tax rate of return per year, or around *six times* the cost of additional capital.

Most firms are therefore not purchasing nearly enough efficiency. They invest every day in ways to increase production or sales that don't return anywhere near 71 percent a year after tax; yet they continue to insist, often unknowingly, that energy efficiency leap this lofty hurdle. One remedy is to teach the energy engineers how to speak financial language. When the engineer goes to the comptroller and says, "Wow, have I got a deal for you — a risk-free return of 27 percent after tax!," he or she'll almost certainly get the capital that wouldn't have been obtained had the savings been expressed as a 3.4-year payback.

Many capital-constrained industries use hurdle rates even more absurd than two years: In some, the energy managers can't buy equipment that yields anything beyond a six-*month* payback. Yet at least in buildings, it's now possible to obtain capital for energy- or water-saving investments entirely from outside sources without committing any capital of one's own. In 1997, top finance firms joined the U.S. Department of Energy to create the International Performance Measurement and Verification Protocol,[9] which has since been adopted in more than 20 other countries, including Brazil, China, India, Mexico, Russia, and Ukraine. This voluntary industry-consensus approach standardizes streams of energy- and water-cost savings (in buildings and in most industrial processes) so they can be aggregated and securitized, just as FHA rules standardize home mortgages. The protocol is creating a market where loans to finance energy and water savings can be originated as quickly as they can be sold into the new secondary market. For an individual company, achieving energy savings can therefore be affordably financed and needn't compete with other internal investment needs. The protocol's metering and monitoring procedures will also help maximize savings and guarantee their longevity by providing more accurate feedback to building and factory operators.

But the misallocation of capital away from very attractive returns in energy efficiency has an even larger implication. While most business owners, just like most Americans in their own homes, typically want to get their money back from energy-saving investments within a few years, utilities and other large energy companies have traditionally been content to recover power-plant investments over the course of twenty to thirty years — about ten times as long. Our society, therefore, typically requires roughly tenfold higher returns for saving energy than for producing it.[10] Equivalent to a tenfold price distortion, this practice skews the economy by making us buy far too much energy and too little efficiency. Until the late eighties, the United States wasted on uneconomic power plants and their subsidies roughly $60 billion a year worth of capital investment, or about twice as much as it invested annually in all durable-goods manufacturing industries, thus badly crimping the nation's competitiveness.

However, in that distortion lurks another business opportunity. Arbitrageurs make fortunes from spreads of a tenth of a percentage point. The spread between the discount rates used in buying energy savings and supply are often hundreds of times larger than that —

enough to overcome the transaction costs of marketing and delivering large numbers of individually small savings. Scores of utilities proved this in well-designed eighties and early-nineties programs that delivered efficiency improvements at a total cost less than the *operating* costs of existing thermal power stations.[11] The spread in discount rate is also the basis of the Energy Service Company (ESCO) concept, where entrepreneurs are paid to cut energy bills. They charge nothing up front for their services but are paid by sharing the measured savings they achieve. Like the shared-savings landscape-retrofit and water-efficiency firms mentioned in chapter 11, skilled ESCOs are flourishing worldwide, although America's ESCO industry is still in its shakeout phase. Many federal agencies, though authorized to hire ESCOs, don't yet do so because of rigid procurement habits and procedures. This may change under President Clinton's July 25, 1998, order to remove those blockages, maximize ESCO deals, and — a major incentive — let agencies keep half of their resulting savings.

Individuals have an even harder time allocating capital to energy efficiency investments than firms do. Few people will pay fifteen to twenty dollars for an efficient lightbulb when an ordinary one sells for fifty cents, even though the efficient model, over its thirteenfold-longer lifetime, will save tens of dollars more in energy bills than its cost and will keep a ton of CO_2 out of the air. But there are ways to jump over that hurdle. Southern California Edison Company gave away more than a million compact fluorescent lamps, a measure that saved energy more cheaply than existing power stations could produce it. To broaden the market even further, SCE then cut the lamps' retail price via a temporary subsidy paid not to buyers but to lamp manufacturers, thus leveraging all the markups and lowering the retail price by more than threefold.[12] Some other utilities lease the lamps for, say, twenty cents per lamp per month, with free replacements; customers can thus pay for efficiency over time — just as they now pay for power stations — but the lamps are cheaper.

Similar workarounds are needed for larger investments. Few families can afford to buy photovoltaics, which are the equivalent of buying twenty-plus years' worth of electricity up front, any more than they could buy twenty years' worth of food in advance. Only 10 percent of American car buyers pay cash; all the rest finance or lease. When financing or leasing solar power becomes as cheap and easy a process as leasing a car, it will become as common and viable a commodity — as

is happening in Sacramento, where the municipal utility not only finances photovoltaics but even rolls them into the mortgage.[13]

Everything from vending machines to photocopiers, trucks to airplanes, office space to its furniture and equipment is now commonly leased. With more money chasing deals than good deals to chase, the almost riskless opportunities in financing energy and resource efficiency will inevitably become more attractive to investors, especially when offered as a kind of evolving service. Rapidly growing new investment funds, partly funded by the insurance industry to avert the possibility of climate change, are now investing directly in "leapfrog" efficiency-plus-solar power systems in developing countries. Those systems often cost less than villagers are already paying for lighting kerosene and radio batteries,[14] and represent a new market of 2 billion people.

Some of the biggest capital flows in the world — investments in energy supply and other primary resource acquisition or provision — beg for review. Those capital flows are largely misallocated today because most international opportunities to invest in, say, national or utility-level electric power systems consider only supply-side, not demand-side, options and have no meaningful way to compare the two.[15] The resulting misallocation sends far too much money to the supply side. It's a bit like the recipe for Elephant and Rabbit Stew — one elephant, one rabbit. The remedy, as explained below, is simply to reward the best buys, not the worst.[16]

ORGANIZATIONAL FAILURES

A famous company that hasn't needed steam for years still runs a big boiler plant, with round-the-clock licensed operators, simply to heat distribution pipes (many uninsulated and leaking) lest they fail from the stresses of heating up and cooling off; nobody has gotten around to shutting down the system. Why should one manager stick his neck out when the status quo seems to work and nobody's squawking? The litany of excuses for not attending to problems like these in a large organization is all too familiar and unproductive.

Billion-dollar fabrication plants ("fabs") speed the latest microchips to market by cramming design and construction into twelve to eighteen months — too fast for actual design. The chief engineer of a huge chip-plant design firm was once told by phone about such proven technologies as a cleanroom that uses manyfold less energy yet performs better, costs less, and builds faster. His rapid-fire reply: "Sounds great, but I pay

a $100,000-an-hour penalty if I don't have the drawings for our next plant done by Wednesday noon, so I can't talk to you. Sorry. Bye." The sad and ubiquitous result is "infectious repetitis" — the copying of old drawings — which leaves huge savings untapped.[17] The most painful but effective discipline for such sloppiness is bankruptcy: Once major improvements enter a cozily complacent market, laggards must improve or perish. In autumn 1997, an East Asian hard-disk-drive factory was using $7 worth of electricity per drive while a similar plant nearby used only 13.5 cents' worth.[18] Such a 54-fold energy cost disparity couldn't be sustained. The inefficient plant went broke two months later.

A safer remedy is to move early to substitute leadership for management. Leaders can arise at any level in an organization. Columbia University had its own entrenched practices until a tough new energy director, Lindsay Audin, was told to cut 10 percent off its $10 million-a-year energy bill, with uncompromised service and no capital budget. Authorizations were painfully slow until Audin showed that the delays were costing $3,000 a day in lost savings, more than the delayers' monthly paychecks. Five years later he was saving $2.8 million a year, 60 percent of it in lighting alone; had won 9 awards and $3 million in grants and rebates; and had brought 16 new efficiency products to market.[19]

The late economist Kenneth Boulding defined a hierarchy as "an ordered arrangement of wastebaskets, designed to prevent information from reaching the executive." But letting information flow to those who can best act upon it stimulates intelligence and curiosity — as in the factory where merely labeling the light switches, so that everyone could see which switches controlled which lights, saved $30,000 in the first year. No one had wanted to fiddle with the switches, lest they inadvertently cause interruptions, but labels proved to be both cheap and effective.

Another part of the reform package in any organization should be to encourage individual risk-taking. In 1994, Mitsubishi Electric tackled this problem head-on by changing how it evaluates employees' performance. Mistakes were explicitly offset by successes, so risk-takers whose boldness paid off would be rewarded. The resulting speed-up in organizational learning enabled the firm to achieve its five-year strategic goals a year early.[20] Rewards can also be institutional: Washington State routinely shares savings among their achievers, the General Fund, and an account reserved for reinvestment in more savings. This allows innovators to save even more without having to go back to the capital budgeting process.

The ultimate form of risk-taking is research: As Einstein remarked, "If we knew what it was we were doing, it wouldn't be called 'research,' would it?" A peculiar blind spot in many organizations leads to abysmally low R&D investments that lock in stagnation. The U.S. building and construction-materials industries, for example, reinvest only about one percent of their revenue in R&D, compared with ten to twenty times that for cutting-edge industries like electronics and pharmaceuticals. No wonder their techniques and materials are so antediluvian. Recent U.S. Congresses share this shortcoming, regularly slashing energy-efficiency R&D budgets that have historically yielded taxpayer returns of thousands of percent per year: Just a handful of the technologies developed at the Center for Building Science at Lawrence Berkeley National Laboratory have already ensured energy savings worth hundreds of times the center's total cost.[21]

A common problem in introducing innovation is determining who's actually going to do the work. How many economists does it take to screw in a compact fluorescent lamp? None, goes the joke — the free market will do it. But we all know that somebody actually has to get the lamp from shelf to socket; otherwise the wealth isn't created. In the 1990s many firms, assuming they'd already carried out all their worthwhile energy savings and noticing that energy prices were continuing to fall, downsized their energy managers right out of their jobs. Their responsibilities were shifted onto other overloaded agendas, and predictably ceased to be a priority. Often the loss isn't simply of a warm body; it's of a devoted champion of efficiency without whom little will happen.

Individual initiative can still be defeated by bureaucracies. Many who propose changes discover that, because resource-saving equipment must be purchased from one budget, while its savings will benefit another budget, they can't get approval. Federal buildings similarly separate their construction from their operating budgets, and managers may be forbidden to share investments that reduce taxpayers' total costs. More generally, large organizations often behave in ways individuals would never dream of. A multinational company benchmarked its plants worldwide, for example, and discovered that one of them was five times as efficient as most others. It soon found itself under internal pressure to "dumb down" its planned new plants toward the poorer ones' levels of performance so that their managers wouldn't look as bad.

Organizational economists have classified and explained such seemingly bizarre behaviors.[22] As Nobel economist Herbert Simon learned, many firms do not fully maximize earnings but rather resort to "satisficing" — doing just well enough to get by and to satisfy all the parties they need to. The inherent complexities of their environment and the limits of their authority to make and execute decisions make this timidity inevitable. Shareholders, for example, hold diversified asset portfolios, but managers whose careers ride on the success of *specific* projects are far more risk-averse, so they select only extremely high-return investments — and so on down the hierarchical chain of control. Subordinates bear the personal risks of failure, while superiors see just the results and know which projects were chosen but not why. This sort of hierarchy leads to systematic suboptimization — to second-best solutions that are less profitable overall than they should be but are also less risky individually. Rewarding individuals' net success, as Mitsubishi Electric did, is one answer. Another is to create a broader alignment between corporate and personal objectives. One utility that started paying its efficiency marketing staff a dollar for every measured kilowatt saved quickly found that verified savings got bigger and cheaper — both by an order of magnitude.

REGULATORY FAILURES

Another portion of the seemingly irrational behavior that takes place in the business world occurs because companies are forced to obey not just the invisible hand of the market but also the all-too-visible hand of the regulator, and some regulation inadvertently produces the opposite of the intended results.

All but a handful of states and nations, for example, reward regulated energy utilities for selling more energy[23] and penalize them for cutting bills. This gives shareholders and customers the opposite goals, with predictable results. Many proposed utility restructuring efforts (often misnamed "deregulation" or "competition," though most would actually inhibit those goals)[24] are missing a unique opportunity to mend this flaw. Instead they would enshrine the same perverse incentive in commodity-based market rules, rewarding the sale of as many kilowatt-hours as possible at the lowest possible price, rather than rewarding better service at lower cost.[25] But a straightforward and proven remedy does exist. Where retail price remains regulated, simple

accounting innovations in a few states have decoupled retail electricity distributors' earnings from their sales volumes, so those utilities are no longer rewarded for selling more energy or penalized for selling less. The utilities keep part of whatever they save off their customers' bills. Through this plan, the nation's largest investor-owned utility, Pacific Gas and Electric Company, added over $40 million of riskless return to its 1992 bottom line while saving customers nine times that much. In California alone, the Public Utilities Commission found that, during the period 1990–93, efficiency investments rewarded and motivated by this incentive system's emulation of efficient market outcomes had saved customers a net present value of nearly $2 billion. Thoughtful utility restructuring can accomplish the same everywhere. Even without retail price regulation, it can create truly competitive conditions of diverse sellers, easy entry and exit, fair access to monopoly bottleneck facilities and to market information, effective antitrust enforcement, and continuing scrutiny to prevent abuses of market and political power.[26]

Another problem with regulations is that they are often obsolete[27] and even more often misinterpreted. Standards meant to establish a "floor" have with time come to be interpreted as a ceiling or as an economic optimum. For example, almost all U.S. buildings use wire sizes that conform to National Electrical Code (NEC) minimum requirements, because the wire size is selected and its cost passed through by the low-bid electrician. But the NEC minimum standard was chosen to prevent fires; to save money over time, wire one or two sizes fatter should be selected to reduce electrical resistance. The fatter wire costs more to buy but less to operate. In a typical office lighting circuit, the next larger wire size yields about a 193 percent-per-year after-tax return on its additional cost.[28] Few electricians know this and fewer care, since their reward for proposing higher-efficiency wires is typically a lost engagement: General contractors hire the low bidder. This situation is just another example of ubiquitous "split incentives," where people who choose technologies often aren't the same people who will pay the bills.

This problem can be solved by better regulation, such as rewriting the NEC — a slow and difficult process — or by introducing the feebates described in chapter 5, which focus the developer's attention up front on designing the building for maximum efficiency. A solution could also be found without regulation, in at least two ways. The project's

manager could instruct the general contractor to calculate bids on minimum life-cycle cost, so more copper up front gets offset by electrical savings later — or, better still, could include properly sized wire in the specifications to which all bidders must adhere. There are also intermediate levels of solutions: Financiers or their lawyers could put optimally sized wire on their due-diligence checklist, or the local utility could provide attractive energy-efficiency incentives only for projects that are wired using a socially optimized wire-size table instead of the NEC table. Where can the developer or contractor get such a revised wire-size table? From the organization with a direct interest in turning optimal wire size into its member companies' profits — the Copper Development Association.[29]

Minimum acceptable conditions, like "meets code" (euphemism for "the worst building you can put up without being sent to jail"), or the British expression "CATNAP" (Cheapest Available Technology Narrowly Avoiding Prosecution), should have provisions to reward even better performance. Regulators often have indirect ways to address such minimal-compliance issues. To encourage developers to exceed the minimal energy-saving requirements of building codes, Santa Barbara County entitled those overcomplying by 15–45-plus percent to jump ahead in the queue for approvals, saving them a lot of time. This is a valuable reward for the builders, but it cost the county nothing.

INFORMATIONAL FAILURES

Another reason for the reluctance of business to invest in resource efficiency may be a lack of accurate and up-to-date information. Do you know where to get everything you would need to optimize your own energy use, how to shop for it, how to get it properly installed, who would stand behind it? If any of this book's examples of large, inexpensive savings surprised you, you've just witnessed a considerable market barrier: If you don't know something is possible, you can't choose to do it.

Labeling helps to address the information problem by telling buyers how competing models compare. In the United States, major appliances carry mandatory efficiency labels (though often with outdated information). A number of voluntary labeling systems, such as were used for measuring the efficiency of a quarter million San Francisco houses in 1978–80, have also found their way to the market as buyers started questioning the value of any houses that *weren't* labeled. EPA's

voluntary Energy Star standard for office equipment is now embraced by over 2,000 products from more than 400 manufacturers. The efficient machines work better, yet cost the same or less, and are therefore mandated for federal purchasing. They're saving a half billion dollars a year, could nearly double that amount by 2000, and promise a ten-million-ton-a-year carbon savings by 2005.

Other voluntary programs that provide a more comprehensive system of informational, technical, and trade-ally support, like EPA's Green Lights,[30] are succeeding because they create competitive advantage. Involving more than 2,300 organizations and 7 percent of U.S. buildings, Green Lights' retrofits typically save over half of a company's lighting energy with 30 percent ROI and unchanged or improved lighting quality. Green Lights firms also show stronger earnings growth than nonparticipants.[31] The national potential for this effort is a $16 billion annual savings, plus a 12 percent reduction in utilities' carbon and other emissions.[32] In 1998 alone, Green Lights and Energy Star Buildings participants were expected to cut their energy cost by more than $280 million, and reduce air-polluting emissions by over 5 billion pounds.[33]

How much do you pay at home for a kilowatt-hour of electricity, and how many kilowatt-hours does your refrigerator — typically the biggest single user in the household — consume each year? If you don't know, because you're too busy living to delve into such minutiae, then you're part of another market barrier. To make such decisions more efficient — and because most appliances are bought not by billpayers but by landlords, homebuilders, and public housing authorities — Congress, by a near-unanimous vote, approved mandatory efficiency standards for household appliances. For the same reason, these are starting to be extended to some commercial and industrial devices, too. Utilities can also reinforce standards by rewarding customers for beating them.

VALUE-CHAIN RISKS

Manufacturers often hesitate to take the risk of developing and producing new energy-saving products because of their uncertainty that customers will buy them in the face of many of the obstacles listed in this chapter. To overcome this reluctance, Hans Nilsson, then an official of the Swedish energy-efficiency agency NUTEK, pioneered contests for bringing efficient devices into the mass market. Under his terms, a major public-sector purchasing office, Statskontoret, would issue a

request for proposal, which committed to buy a large number of devices, bid at certain prices, if they met certain technical specifications, including energy savings that would be highly cost-effective to the user. This explicit expression of market demand elicited many innovations, giving a strong advantage to Swedish industry in both home and export markets. Following the Swedish example, the "golden carrot" program, devised by Dr. David Goldstein of the Natural Resources Defense Council, improved U.S. refrigerator design.[34]

Another way to encourage cities to try pioneering technologies could be an analogue of a public-guarantee system the EPA has used. This assured the first adopters of an innovative wastewater treatment system that they would receive a free replacement with a conventional alternative if the novel one didn't work. Such risk management is often the key stimulus needed to start a rising spiral of demand and production.

Efficient equipment often isn't available when and where customers need it — as anyone knows who's tried to get an efficient replacement for a burned-out water heater, furnace, air conditioner, or refrigerator on short notice. Distributors frequently reject the risk of carrying non–"plain vanilla" inventory that may sell slowly or not at all. Thus British Columbia Hydro found that the huge motors in that province' s mining and pulp-and-paper mills were virtually all inefficient, simply because they were the only product that local vendors stocked. More efficient motors had to be special-ordered, which took much longer than the mills could afford to wait. In 1988, though, B.C. Hydro started paying distributors a small, temporary subsidy to stock only efficient models, covering their extra carrying cost. In three years, premium-efficiency motors' market share soared from 3 percent to 60 percent. The subsidy was then phased out, supported by a modest backup standard. Similarly, PG&E found in the eighties that rather than paying customers a rebate for buying efficient refrigerators, it could improve the rate of adoption of efficient refrigerators, at less than a third the cost, by paying retailers a fifty-dollar bonus for each efficient model stocked but nothing for stocking inefficient ones.

FALSE OR ABSENT PRICE SIGNALS

One of the best methods to start reducing the self-deception that accompanies subsidies and other distortions is to account scrupulously for the factors that economists call externalities. Nobody knows exactly

how much value to place, say, on the effects of air pollution on human health or on ecosystems. But recognizing that zero is not the right number, utility regulators in about 30 states now take some externalities into consideration in assessing utilities' proposed resource acquisitions, since most utilities don't. Until the "polluter pays" principle, accepted in principle by all industrialized countries since the 1970s, is actually implemented in energy pricing, however, prices will continue to reflect the tacit assumption that, as local energy official Randy Udall puts it, "the future is worthless and the environment doesn't matter." Calculations of cost-effectiveness based solely on private internal cost will continue to be "a value system masquerading as mathematics."[35]

Price signals are inadequate in many more immediately practical ways, too. Utility bills are seldom itemized: You can no more determine the running cost of each piece of equipment, in total or at different times of day, than you could shop sensibly if your supermarket bill showed only a grand total but no details of what you'd bought. Few firms track energy costs as a line item for which profit centers are held accountable. Firms in rented space may have energy bills prorated rather than submetered. Many companies, especially chains and franchises, never see their energy bills, which are sent directly to a remote accounting department for automatic payment. Some large firms even assume that utility bills are a fixed cost, not worth examining. But new bill-paying and bill-minimizing service companies have recently been springing up, many of which provide submetering of specific machines, times, and sites, and two-way, real-time communications to help managers pinpoint opportunities for improvement. Just ensuring that each meter generating a bill is actually in use and on the customer's premises often yields substantial savings.

Price *levels* make a difference, but so do price *structures.* Utilities often manipulate tariff structures to discount higher use or to penalize efficiency. Many did so for decades, even when their own costs increased with greater sales, believing this strategy would increase their profits, which traditional rate-of-return regulation tied to greater energy sales. Getting the incentives right so that rewards are granted for what we want — lower *bills* — and not the opposite — higher *sales* — will make such distortions counterproductive and rare.

One final class of distortions to energy choices comes from lopsided tax policy. For example, energy purchases are treated as deductible business expenses, while investments to save energy get capitalized.

However, such rules, with some effort, can be changed. When the Japanese government wanted to clean up sulfur emissions from power plants, it reportedly allowed scrubbers to be expensed in a single year. Analogous U.S. initiatives to speed the installation of efficient and environmentally sound devices and the retirement of inefficient or polluting ones are already under consideration.[36]

INCOMPLETE MARKETS AND PROPERTY RIGHTS

Even perfectly accurate prices are useless without markets in which buyers and sellers of resource efficiency can meet and do business — markets that offer a level playing field where all options can contend fairly at honest prices. As of now, such arenas don't exist. There's not yet any significant market in saved energy: "Negawatts" — electricity saved by reducing inefficiencies in its use — aren't yet a fungible commodity subject to competitive bidding, arbitrage, secondary markets, derivatives, and all the other mechanisms that make for relatively efficient markets in copper, wheat, and sowbellies. Although tradable emission rights and credits are starting to emerge, as noted in the previous chapter, you can't yet go bounty-hunting for wasted energy, nor bid negawatts (or their futures and options) against expansions of energy supply.

The existence of such markets could be a business bonanza, if the parties whose joint transactions could create the savings were introduced to each other. Thus when Morro Bay, California, ran short of water in the late 1980s, it simply required any developer wanting a building permit to save, at some other site in town, twice as much water as the new building would use. Developers then discovered what saved water is worth, because the town had established a market in it. One-third of the houses in Morro Bay got retrofitted with efficient plumbing fixtures in the first two years and two-fifths in the first four years. This plan could as well have been implemented in a larger area, via water-savings brokers. Fantasy? It's already happening. A few states — notably California, Oregon, and Montana — have reformed their "use-it-or-lose-it" water laws to allow saved water to be sold or leased without penalty. Brokers are now emerging to handle those save-and-resell deals.

Instead of just marketing negawatts (saved electricity) — a business now worth some $5 billion per year in the United States — utilities should begin to make markets *in* negawatts. This would not only maximize the number of customers saving but would also maximize *competition* in who saves and how, driving cost down and quality up. In the

1980s, Central Maine Power Company started the trend by offering cash grants to those industrial customers that pledged to save the most electricity per dollar of grant. This auction grew into one featuring "all-source bidding," later practiced in some eight states, where all ways to make or save electricity could compete. A utility that wanted more power would ask, "Who out there wants to make or save electricity at what price?" — and take the low bids until its needs were met. Around 30 states also ran auctions just for supply. They were typically offered, at attractive prices, many times as much as they wanted. Where efficiency was allowed to bid against new supply, it almost always won, permitting valuable "decongestion" of crowded grid capacity.[37]

Every form of avoided resource depletion and prevented pollution is a potential candidate for an entrepreneur to find and exploit inefficiencies. Establishing markets in saved oil could induce arbitrageurs to exploit the spread between the cost of lifted barrels and saved barrels. Dams could bid against showerheads, clear-cuts against duplex copiers. Carbon and cobalt, tungsten and trees, reefs and rainforests, are all ripe for trading savings. Just as with subatomic particles, for every resource there is an equal and opposite "antiresource": For every activity there is an abatement, arguably meriting a value and a market in which to express it. Few of those markets yet exist, but creating them can make traders prosper and all of us better off. Making markets in saved resources and avoided pollution can support powerful entrepreneurial innovations that turn each obstacle to resource productivity and loop-closing into an opportunity.[38] The bigger the problem, the bigger the potential gain, whether in energy and water, fibers and minerals, or land and mobility.

CREATIVE POLICY FRAMEWORKS

In 1991, President Bush signed into law the Intermodal Surface Transportation Efficiency Act, which mandates least-cost choices for solving local transportation needs, thus allowing federal transport dollars to flow to the best buys, not only to highways. In about thirty states, this legislation is effectively not in force because the federal funds must usually match state funds that are legally restricted to road building. It may take decades of bruising fights with highway lobbies to bring about compliance in every state.

Even better than such specific, necessary, but tedious state-by-state reforms are initiatives that can solve many other problems simultaneously. For example, resource policy consultant Dr. Mohamed El-

Gasseir has devised, and financial adviser Andrew Tobias has promoted in California, an innovative way to signal American gasoline's true social cost while reducing everyone's bills.[39] Their proposal is called "pay-at-the-pump" car insurance. Most Americans currently pay more per mile for car insurance than for gasoline, and most of that insurance is related to collisions, whose risk increases with miles driven. In Dr. El-Gasseir's plan, states can distinguish between two parts of the insurance premium. The collision-related part is charged at the gas pump, then forwarded to the private insurance companies in proportion to their market share. The remaining premium, for theft and casualty risks, would be paid through the mail to each consumer's chosen company in the usual way. A truing-up term on each bill would reflect differences in what coverage a customer wanted, how competitive the issuing insurance company's pricing was, and how good a driving record the insured had. Such insurance could also be made no-fault, paying the injured rather than the lawyers. Under the proposal, the apparent price of gasoline would rise by perhaps thirty to eighty cents a gallon — to a level still about the lowest in the industrial world but a more accurate price signal than now. Yet the increase is *not* a gasoline tax; on the contrary, the total cost of driving would go *down,* because there would no longer be any need to socialize the cost of accidents by uninsured motorists, who now constitute perhaps a fourth to a third of all U.S. drivers. Under pay-at-the-pump, everyone who buys fuel automatically buys collision and liability insurance. This is simply a smarter way to pay for automobile insurance — and it reminds us, whenever we fill up, that insurance is a part of the cost of driving.

By creating markets in negamiles and negatrips, society could discover what it's worth to pay people to stay off the roads so we needn't build and mend them so much. For that matter, as suggested by Douglas Foy, who directs the Conservation Law Foundation of New England, why not privatize each transit mode into one or more regulated public utilities that are rewarded, like Oregon's electric utilities, not for providing a bigger volume of service but for minimizing social cost? Automatic electronic billing could easily charge drivers for these social costs. This system could eliminate all transport-related subsidies and make each mode pay its own way. It contains the further possibility of converting all modes of mechanized travel from a burden on taxpayers into a stream of payments or royalties from the privatized utilities back to the public sector that built the infrastructure.

FAIR RULES MAKE MARKETS WORK

As the mafia-and-robber-barons era being reenacted in contemporary Russia should remind anyone who has forgotten a similar period of American history, market competition, like any sport, works only if there is a rulebook adhered to by all the players and enforced by honest umpires. Flagrant American abuses of market power in the early part of the century — Rockefeller in oil and Insull in electricity, among many others — led the United States to enact a series of antitrust rules and utility regulations. Devastating frauds and deceptions that fleeced millions of their life's savings led to the establishment of the Securities and Exchange Commission, the Federal Trade Commission, and other watchdogs of the public interest. Tragedies in public health and safety regularly confirm the need for a Food and Drug Administration and a Federal Aviation Administration. The market relies on these and other regulatory institutions for overseeing fair dealing, providing trustworthy information, and dedication to issues of the public good that private markets were never designed to protect. Otherwise, in a worst-case scenario, unchecked avarice can all too easily exploit and destroy a people's willingness to let markets work. Without care, this could be the fate of the Russian experiment with capitalism.

Of course, these institutions, like all others, need constant renewal. Recent trends toward forming rules and regulatory bodies that are supranational, secretive, and unaccountable threaten the basic principles of open markets that they are supposed to support. When the world's traders make rules for their own conduct in closed hearings before the World Trade Organization, the rule of law suffers. When the financiers prohibit any government interference with capital flows on grounds of mere national social interest (as the proposed Multilateral Investment Agreement would mandate), they are creating conditions that will allow them to go about their business more conveniently. But these are, in fact, the very practices — opacity and elimination of public scrutiny — that will destroy their own legitimacy, and even their ability to harness the marketplace of ideas to devise sound and farsighted decisions. Elevating the objectives of trade above the transparency and accountability that democracy requires will ultimately destroy at least one of these institutions, if not both.

Markets are, in the most basic sense, little more than a way of exchanging information about what people have and what they want. Markets are a system of rules and mechanisms for comparing prefer-

ences and opportunities to see if they can be rearranged in a better way that makes somebody better off and nobody worse off — a condition that economists call a "Pareto improvement." But there are also other means to achieve improvements without fancy arrangements using price signals: The objective can instead be signaled more directly, without the mediation of prices.

Systems without feedback are, by definition, stupid. But systems with feedback of even the most rudimentary sort can grow smarter in a hurry. How clean a car would you buy if its exhaust pipe, instead of being aimed at pedestrians, fed directly into the passenger compartment?

A factory that discharges pollution into a river is more likely to clean up if its water intake is downstream of its outfall. In fact, why not just hook the two pipes together? If it's clean enough for the public to use, why isn't it also clean enough for the factory to use? Some major chemical firms have even considered requiring their plant managers to reside at the downwind site boundary, exposing them to the same risks to which the plant exposes the public — much as Mr. DuPont built his house near his original explosives factories. This way lies the logic of the second principle of natural capitalism — eliminating the *concept* of waste and toxicity. Simple ways to use feedback to minimize risk and cost are almost unlimited. The U.S. Navy's early nuclear submarines had problems with the quality of their hull welds — until Admiral Rickover announced that the welders would be aboard the maiden dives. Swedish publisher Mariefriske's office workers avoid occupational maladies because the same department budget that includes ergonomic investments also includes workplace health services.[40]

Another effective example of creating informative feedback loops was the work of Greenpeace International scientist Dr. Jeremy Leggett, who introduced senior climate scientists to leaders of the European insurance and reinsurance industry. The information given them helped insurers to understand the connection between two things: their rapidly rising casualty claims from major storms, floods, and other instances of climatic volatility, and the prediction of all reputable climate simulation models of the effects of adding more greenhouse gases to the atmosphere. Those European reinsurers have become among the strongest private-sector forces lobbying for strong climate-protection policies. The insurance and reinsurance industry worldwide is larger financially than the oil and coal industries put together. Now it is starting

to make a third linkage: investing some of its huge financial flows in the advancement of climate protection[41] — including the developing-country solar-power initiatives mentioned earlier, energy efficiency (not least for the industry's vast portfolio of commercial properties), and renewable energy. As such green investment expands because of its double dividend — high returns *and* reduced insurance risks — those who lose in capital competition will be compelled to take notice.

Cybernetics — the science of communications and control in machines and living things — studies not only feedback but also goals. A feedback system defines a "reference state" to which an operation is to aspire, and measures the difference between what is and what should be. It then generates from that difference an "error signal" that, fed back, tells the system how to change in order to get closer to the goal. People function this way. Companies do also; that's why they prepare strategic and business plans. There are ways to help them do it better.[42] Suppose, for example, that a business were to prepare — initially for internal use, since it would contain proprietary material — an *Alternative Annual Report.* The traditional annual report describes, in a widely accepted narrative and financial format, what the firm accomplished during the previous year. The alternative version would describe, in the same format, what the company would *like* to have been able to report it had accomplished, had all the internal and external obstacles been removed that make what's good for the shareholders in the short run diverge from what's good for future generations worldwide. If that gulf between reality and intention could be bridged, if the company could be run entirely with heart and without compromise, what outcomes would emerge? Since the *Alternative Annual Report* covers the past, it doesn't require any wild projections about future developments; it's just an as-if look back at what could have been done differently and better. It focuses attention on what's getting in the way of making dreams come true. Leaders may discover, for example, that they would have been able to run the company much more sustainably and honorably under different rules, such as ecological accounting and tax-shifting. If a number of companies tried this exercise, such common experiences and observations could emerge — and perhaps even the nucleus of a constituency for mending what's broken.

If we don't change where we're going, we may get there. If we want to go somewhere else, we need stars to steer by. Perhaps the first step is to describe the sort of destination we want to reach.