Building a Sustainable Society

Lester R. Brown

The transition to a sustainable society will challenge the capacity of countries everywhere to change and adapt. Some adjustments will occur in response to economic forces, some in response to public policy changes, and still others as a result of voluntary changes in life styles. Market forces will also play a central role in the adjustment process, but in many situations they will be more effective if augmented by public policy. To exploit fully the market’s role in the transition, political leaders will have to learn its strengths and limitations.

These same leaders will also have to learn how better to manipulate tax policy, sometimes using it as an incentive, sometimes as a disincentive—sometimes both. Other institutional keys to the shift to a sustainable society are the more creative and responsible regulation of economic activity, and the reordering of budgetary and R&D priorities. In all, some policy instruments will have to be sharpened, some retired, and some created to fit the changing contours of circumstance and social will.

The scale of the transition to a sustainable society is matched by the urgency with which it must occur if major economic disruptions are to be avoided. That urgency notwithstanding, the shift to a sustainable society takes place in two stages. First, trends that the environment and the economy cannot withstand must be arrested; then they must be reversed. For example, the historical growth in dependence on oil has apparently ended; it will have been reversed if the fall in consumption that occurred between 1979 and 1980 continues. By contrast, soil erosion is worsening, and its reversal is as yet impossible to foresee. Similarly, while awareness of deforestation is spreading, concern has not yet been translated into sufficient programs and resource commitments.

The urgency of arresting and reversing unsustainable trends derives in part from the tendency of the negative trends to reinforce themselves. For instance, once forests begin to shrink under pressure of excessive demand, the process feeds on itself. When the sustainable-yield threshold is crossed, ever increasing claims are made on an ever smaller resource base, which helps explain why some countries have been largely deforested within a few generations. The same negative syndrome applies to soil erosion, overgrazing, and overfishing.

Efforts to arrest and reverse ecological and economic deterioration are proceeding unevenly. Population is a case in point. While a few West European countries have already stabilized their populations, others have yet to recognize even the need for slowing population growth, much less stabilizing it. Between these extremes are those countries that have introduced family-planning services, and those countries that have adopted population stabilization as a goal but have some distance to go before achieving it.

An examination of the principal components of the transition shows that it has just begun. With respect to each of its facets, a few countries have reached the advanced stage but most are only beginning the process. Basic changes in values usually occur only incrementally, and institutions do not learn as fast as individuals. As a result, years often elapse before changes in personal values are reflected in public policies and programs.

Role of the Market

As a transitional force, the market has both strengths and weaknesses. One of its strengths is its capacity to allocate resources among various uses. In a complex, modern economic system, central planners are hard-pressed to allocate resources more efficiently or intelligently than the market does. As economist Lester Thurow points out, “Economic markets make better decisions than those made by the political process because they economize on the knowledge needed by any one individual to make good decisions.” Moreover, when market discipline is not imposed on production, waste
occurs: resources get plowed into products that no one wants.

The functioning of a market economy rests heavily on a complex information system, one that tells the producer what consumers want. Not only can the market perform this function more precisely than a centrally planned economy, but it can also do so faster. In a perfectly competitive market economy, the failure to satisfy consumer demands shows up immediately, whereas in a centrally planned economy it may take years to adjust to consumer demand. Meanwhile, vast quantities of productive capacity and of manufacturing materials go to waste. For example, a women's shoe factory in the Soviet Union may perform quite satisfactorily according to socialist standards, meeting its production quotas year after year. But the shoes can simply pile up in a warehouse if Soviet women do not consider them stylish. Such gaps between producers and consumers in the Soviet Union contribute to a continuing inventory of unmarketable goods with a value that has been estimated at three to four billion rubles.

Yet another strength of the market is its ability to substitute one commodity for another as relative abundances and scarcities shift. Concisely and unambiguously, prices tell buyers which commodities are scarce and which plentiful.

Its many “selling points” notwithstanding, however, an unregulated market economy functions better in a frontier society than it does in one that is pressing against resource limits. Where virgin resources are abundant, their use or the conditions under which they are used need not be restricted. However, when the demands of the economy begin to press against the available supplies of land, minerals, water, and waste-absorptive capacity, the market economy needs to be modified in the public’s interest.

Concisely and unambiguously, prices tell buyers which commodities are scarce and which plentiful.

One problem with the free market is that it is no respecter of carrying capacity. Market forces can destroy fisheries, forests, grasslands, and croplands. The market has no alarm that sounds when the carrying capacity of a biological system is transgressed. Only when the system collapses and prices soar does the market “know” that anything has gone wrong. By this time, of course, the threatened resource may be irreparably damaged.

Another weakness of markets is their inability to take into account the external costs associated with various economic activities. The classic case is industrial air pollution. The polluted air emerging from the smoke-stacks of a steel smelter may destroy fresh water fisheries or agricultural crops for miles around. But what does the producer or the consumer care? The costs of pollution are borne by neither. They are paid instead by those who live on the leeward side of the steel plant.

In general, modern markets function far less effectively than economic textbooks suggest. Corporate concentration in key production sectors such as computer, automobile, and aerospace manufacturing reduces competition. Then, too, the manipulation of public tastes and appetites through advertising distorts the market in ways that may not serve the public interest, and that sorely impede the transition to a sustainable society.

Another market pitfall is short-sightedness. In the market, day-to-day decision making takes place with little concern for long-term perspectives. For example, even if existing farming practices contribute to excessive soil erosion and to a gradual long-term decline in the soil’s inherent productivity, measures to arrest soil erosion will not be sanctioned by the market unless they pay off quickly. In a highly competitive market with narrow profit margins, adopting soil-conserving practices could lead to bankruptcy. In such a situation, only public subsidies of the needed conservation practices or regulations requiring farmers to adopt practices can serve the long-term public interest. The market cannot.

Similarly, the world oil market until recently lacked both a long-term perspective and any responsiveness to the public interest, which is best served by a rate of depletion that allows a successful transition to alternative energy sources. From this perspective, OPEC was a godsend. For more than twenty years prior to the dramatic increase in oil prices in late 1973, the world’s oil consumption had been expanding at some 7 percent per year. Had the increase continued at this rate, it eventually would have culminated in an abrupt, traumatic transition to the post-petroleum era.

As a general matter, markets serve private not public interests. But this is particularly so with respect to land use. In American suburban communities where little land-use planning or zoning has taken place, unsightly and inefficient urban sprawl has resulted. While the land speculators have profited, often handsomely, from this lack of regulation, the community at large has been stuck with both an unwieldy system and with the higher costs
of providing social services and utilities, a burden it bears in the form of higher taxes and utility rates.

Some market proponents argue that market forces can always be counted upon to bring supply and demand into balance. This point is well taken, but this alleged market strength is not an undiluted blessing. The more important question may be at what price demand and supply are brought into balance. If wheat is in short supply in the world market, the price rises, signaling to farmers the need to produce more wheat. At the same time, the rising price shrinks effective demand (that is, demand backed up by purchasing power). As the price rises and thus trims effective demand, consumption may be driven below subsistence levels. Untrammeled, market forces can lead to hunger, even famine.

While most governmental intervention in the market is in the public interest, many ill-conceived interventions have done more harm than good. For example, oil-price controls in the United States during the seventies prolonged excessive dependence on oil. Indeed, artificially low oil prices have distorted the economic system to such an extent that belated decontrol is requiring some painful adjustments. In effect, oil-price controls encouraged consumption and delayed development of the alternatives.

As worldwide pressures on natural resources and ecosystems intensify, the resulting ecological and economic stresses are likely to lead governments to intervene more in the marketplace. The worse an economy appears to perform, the greater the pressures to intervene. Here, the risk is that government will address the symptoms of the malady rather than the causes, thus aggravating the problem. For example, as growing demand forces food costs up, governments will be tempted to impose food-price controls. But such controls discourage production and further escalate food-price inflation. Needed in this case instead is a greater commitment to agricultural development and more effective family-planning programs.

As a transitional force, the market system will no doubt need the reins of public policy. Financial incentives and disincentives, regulatory measures, and shifts in budgetary priorities—these and other policy instruments will be needed if the disruptions associated with the transition are to be minimized.

Financial Carrots and Sticks

When market adjustments are not fast enough, governments can use financial incentives and disincentives to bring about the needed changes. These include tax deductions, subsidies, outright grants, low-interest loans, and accelerated equipment-depreciation schedules. In centrally planned economies, they may also take the form of wage increases, performance bonuses, and preferred access to housing, education, or medical care.

Financial incentives and disincentives are now being widely employed in the effort to conserve energy, speed the shift to renewable energy resources, and slow population growth. Tax deductions, one of the most widely used financial incentives, are being offered by many national governments to individuals and businesses that invest in energy conservation or install solar equipment. In the United States, where there are some 38,000 tax-levying authorities, many local governments are joining Washington in offering tax relief to those who participate actively in the energy transition. For example, Vermont has waived property taxes on residential solar installations.

Some governments use outright grants to help underwrite the cost of transition-facilitating investments. In the United Kingdom, for instance, the government provides fifty-pound grants to all homeowners who insulate their residences. Subsidies for adopting soil-conservation activities are used in some countries. Following the Dust Bowl era of the thirties, the U.S. Department of Agriculture made direct payments to farmers who planted winter cover crops, set up windbreaks to reduce soil erosion, or took other soil-conservation measures.

Governments can also use low-interest or interest-free loans to encourage investments in activities that will help create a sustainable society. In Brazil, which imports nearly all of its oil, the government is providing low-interest loans for the construction of distilleries. This program is designed to accelerate production of alcohol as an automotive fuel and, to a lesser degree, as a feedstock for the chemical industry.

Those centrally planned economies that use wage increases or bonuses to affect production can help the transition along in various ways. They may, for example, give bonuses to factory managers who reduce energy use while maintaining production or to managers of state farms who reduce soil erosion to the tolerance level. In China, couples with one child who sign a pledge not to have any more children receive an immediate wage increase of some 12 percent.

In societies with a large public sector, giving preferred access to housing, education, medical care, and jobs can further social objectives. The government of Singapore, which administers much of the new housing in this South Asian city-state, rewards small families with preferred access to housing. In China, if a student is an only child and if the student’s parents sign a pledge not to have any more children, he or she gets preferential consideration for admission to the better schools.

On the other side of the tax coin are tax penalties. In densely populated Nepal, no income tax deductions for...
children are permitted for more than two children. While the tax-paying segment of the population is small, this measure does nonetheless signal official support for small families. In Germany, a stiff tax on gasoline, originally designed to raise revenue, has recently been increased to encourage gasoline conservation. Singapore has recently enacted steep auto-registration fees, up to $2,320 per vehicle, to discourage any further growth in the automobile fleet. The import tax the Kenyan government imposed on automobiles imported for private use may exceed the cost of the vehicle itself.

Another financial tool that can be either a penalty or a reward, depending on how it is used, is the deposit on purchased goods that can be recycled. In the United States, for example, some states require high deposits on beverage containers to ensure that bottles and cans (or at least the materials from which they are made) are reused or recycled. Norway uses a similar approach for automobiles. In both cases the purposes are the same—to reduce the use of raw materials, to conserve energy, and to reduce litter.

**Change through Regulation**

While market forces and financial incentives and disincentives can speed the transition to a sustainable society, regulation is the best means of making some adjustments. Where feasible, regulation may be simpler, more direct, and more easily administered than other market interventions. But while it can be a powerful tool of public policy, it requires an enforcement mechanism to be effective.

Regulation is well-suited for and widely used to increase energy efficiency, protect life-support systems, and control pollution. It is poorly adapted to the development of renewable energy sources (though here market forces and incentives are effective) and even less so to the stabilization of world population size. (For halting population growth, public education and incentives have been the most effective techniques.)

For protecting the basic biological systems, regulation is indispensable. Limiting the fish catch is an effective and widely used means of managing oceanic fisheries. If deforestation is to be arrested, tree cutting will have to be regulated and limited to a level no greater than the sustainable yields of forests allow. Where grazing areas are held in common, similar measures will have to be adopted if the grasslands are to be preserved. Saving threatened species from extinction often requires nothing short of regulation, international regulation in some cases.

Pollution control has been achieved almost exclusively through regulating the type and volume of waste discharge. All industrial countries and most non-industrial countries now regulate industrial-waste discharge.

In many parts of the world, greater energy efficiency is being achieved through the adoption of mandatory fuel-efficiency standards. The United States, for example, relies heavily on such standards to increase the energy efficiency of its automobiles, appliances, and, potentially, buildings. If market forces alone are trusted to increase the energy efficiency of buildings, progress is likely to be limited since energy efficiency has a long-term payoff and is not a highly visible characteristic of a building, and its investment cost puts off landlords who can easily pass along higher fuel costs to tenants. Indeed, even architects and builders have little incentive to devote much effort to constructing energy-efficient buildings unless governments mandate building energy-performance standards.

In the United States, regulations requiring automobile manufacturers to raise vehicle fuel efficiency have helped boost the national auto fleet’s overall efficiency. Since 1979, these have been vigorously reinforced by consumers’ responses to rising gasoline prices. While the legislation got manufacturers headed in the right direction, the combination of legislation and market forces is raising fuel efficiency even faster than originally planned.

Speed limits are another type of regulation designed to increase automotive fuel efficiency. Posted speed limits in most countries have traditionally been substantially above the fuel-efficiency optimum. But with the supply of oil tightening, most Western industrial countries have lowered speed limits. Within Western Europe the only major holdout is West Germany, where public resistance has cowed political leaders.

The shift from oil to renewable (or at least more plentiful) energy sources in the generation of electricity is being achieved through a combination of market forces and regulation. In the United States, market forces are spurring the shift from oil to alternative fuels—most commonly, coal—at a far faster pace than regulation alone would prompt. In Japan, the construction of any new oil-fired electrical generators has been prohibited. The United States and many other countries are not only banning the construction of new oil-fired plants; they are also requiring that existing plants be systematically retrofitted to use coal or some fuel other than oil.

On a much smaller scale, San Diego is one of several counties in California that have passed ordinances requiring builders to install solar hot water heaters in new houses and new swimming pools. The upshot was a great increase in the market for solar heating equipment. While regulations affecting swimming pools would not...
much affect fossil fuel consumption in many places, they will in California where there are many swimming pools and much sunshine. They also illustrate the advantages of using local regulations to facilitate the energy transition.

Setting either mandatory or voluntary regulations for controlling the temperature in buildings is already common in industrial societies. For example, France and Japan have established maximum wintertime temperatures. In some countries, compliance is largely voluntary, but in France energy monitors periodically check building temperatures and issue citations to violators.

Reliance on regulation has obvious limitations. Where regulations are politically unacceptable or enforceable, they may not work at all. Prohibiting the cultivation of land that is too steeply sloping to sustain agriculture over the long-term, for instance, may not be enforceable in countries with acute land hunger. Likewise, setting aside national parks to preserve wildlife in East Africa may not be a viable option if population growth is not slowed.

Not all societies will choose the same combination of policies to curb unsustainable trends. For example, the United States is relying heavily on fuel efficiency standards to reduce gasoline consumption, while Western Europe is using a stiff gasoline tax. Eastern European countries meanwhile use their governmental price-fixing authority to set high prices that achieve the same end. There is nothing sacred about any particular approach. Each society must select those approaches that are best suited to its own situation and needs.

**Financing the Transition**

Financing the transition to a sustainable society will require vast sums of investment capital, public and private. The demand for these unprecedented sums is coming at a time when capital formation is becoming more difficult, when growth is slowing and profit margins are narrowing. The hefty expenditures needed to sustain the housing stocks and transportation systems that evolved when energy was abundant and cheap, such as those in North America, will restrict savings. During this decade and the next, the capital needs of the transition will strain the capacity of governments and financial institutions.

Competition for investment funds will be keen and interest rates promise to remain high.

The economic transformation required to put society on a sustainable footing will involve making heavy investments simultaneously in several sectors. Capital will be needed for building fuel-efficient mass transit systems, constructing soil-conserving terraces, installing rooftop solar collectors, and taking thousands of other steps. Once the transition is largely complete, investment requirements will fall sharply. But until then, capital will be scarce and costly.

While global expenditures on soil conservation, reforestation, and population stabilization need to be doubled, tripled, or even quadrupled in the years immediately ahead, they will be dwarfed by the massive energy-related investments. With energy, all societies will have to find a balance between investing in energy production and energy efficiency. For Third-World countries, the balance must be between expenditures to produce more firewood and those to produce more fuel-efficient wood stoves. In industrial societies, the trade-off will be between producing synthetic fuels and manufacturing more fuel-efficient automobiles.

The cost-effectiveness of investing in production versus efficiency has been studied in more detail for the United States than for any other country. Independent studies by the Energy Productivity Center of the Mellon Institute, the Center for Energy and Environmental Studies at Princeton, the Harvard Business School, and the Solar Energy Research Institute all conclude that investments in energy efficiency are far more profitable than those in producing more energy. Indeed, all seem to agree that it would be economically profitable to reduce U.S. oil consumption so that oil imports could be phased out by 1990. As Roger Sant of the Mellon Institute notes, "All of the oil that we import is more expensive than our other energy services options. This means that if everyone’s economic self-interest were fully accommodated, we would not be purchasing any foreign oil."

The Mellon Institute projects that if every economically sensible action were taken between now and the end of the century vis-à-vis energy use, the typical American’s needs could be satisfied at costs well below those of 1980—even though energy prices will increase dramatically. Sant notes that the most attractive investments in the energy field are the "thousands of devices that improve the amount of service consumers get for each unit of fuel or electricity used." Among these are double-paned windows, automatic fuel dampers, electronic pilot lights, sophisticated thermostats, small units that cogenerate electricity and usable heat, and diesel engines in automobiles.

Study after study claims we should de-emphasize investment in synthetic fuels, noting that they cannot compete with the various investments in increased efficiency now and may not be able to for years. Indeed, the cheapest energy available is that now being wasted. An analysis by Robert H. Williams, of the Princeton Center for Energy and Environmental Studies, using life cycle costing techniques, shows that a house retrofitted by the National Bureau of Standards in Maryland for $2,840 in

By any reckoning, the transition to a sustainable society will require all the investment capital that can be mustered.
1978 saved 580 gallons of oil per year at a cost of only 60 cents a gallon, roughly half of the 1981 price of heating oil. According to Williams, investing $1,300 in a typical new house in the United States to make it conform to the proposed Building Energy Performance Standards would save 260 gallons of oil equivalent per year at a cost of 34 cents per gallon saved.

Equally attractive returns on investments are available with home appliances. For example, modest design improvements adding $100 to the purchase price of a frost-free refrigerator would save electricity at a cost of 1.6 cents per kilowatt hour, compared to current costs of about 5 cents per kilowatt hour. On average, notes Williams, it would be profitable to continue investing in technologies to raise auto-fuel efficiency over the next 15 years until on-the-road fuel economy reached 60 miles per gallon, even assuming the price of gasoline was only $1 per gallon.

Market behavior is beginning to reflect the result of the various energy analyses cited above. U.S. businesses, home-owners, and government spent $8.7 billion in 1980 on energy-efficiency improvements, more than in the preceding five years combined. Energy analysts project that such expenditures could easily increase to $30 billion per year in the United States by 1985. In industry, most expenditures have been for cogenerators, fluidized-bed combustion technologies for coal, waste-heat recuperators and heat pumps, more efficient heat exchangers, more efficient industrial processes, and computer-controlled energy-management systems for commercial buildings. Homeowners are investing in additional electrical generating capacity. Indeed, many utilities have begun to look carefully at the alternative ways of balancing supply and demand. What they are discovering is that it is far cheaper, less risky, and more profitable to invest in programs to conserve—and particularly to reduce peak requirements—that it is to build new capacity. For example, Pacific Gas and Electric, a large utility based in San Francisco, is planning to invest $164 million in the next decade in dozens of programs designed to cut peak demand by 25 percent by the year 2000. The object is to avoid having to invest several times this amount in additional generating capacity.

In Third-World countries, where energy waste is far less, satisfying basic energy needs will require heavy investments in energy production. In late 1980, Ernest Stern, Senior Vice President for Operations at the World Bank, reported that the Bank would try to double its existing $13 billion authorization for energy lending for the period 1980 to 1985 to $25 billion. This latter figure would represent the Bank’s share of funding for energy projects that total more than $90 billion. Behind this proposal is the desire to help developing countries reduce their oil import bill, which collectively climbed from $7 billion in 1973 to roughly $50 billion in 1980. To facilitate the sharp increase in energy lending, the Bank proposed to establish a new energy affiliate, the International Energy Corporation. Evidence of the unfolding difficulties in financing the transition to a sustainable society came in early 1981, when the newly inaugurated Reagan administration announced that it would not support creation of the proposed energy affiliate.

Today, more scientists work on new weapons systems than on new energy sources and increased food production combined.

In 1980, homeowners took advantage of tax incentives by claiming tax credits for $4 billion worth of expenditures on conservation and solar retrofitting.

Some of the technologies are long-standing, others are new. Cogeneration, a process that reuses steam produced for electrical generation as industrial-process heat or for space heating, has long been used in Europe, where energy has never been as cheap as in the United States. Newer to the scene is the use of computers linked to sensors to adjust heating, cooling, and lighting in buildings. This technology has become practical only with recent advances in micro-computers.

A pivot point in any effort to increase energy efficiency is the operation of utilities, which are increasingly hard-pressed to raise the capital needed to construct additional electrical generating capacity. Indeed, many utilities have begun to look carefully at the alternative ways of balancing supply and demand. What they are discovering is that it is far cheaper, less risky, and more profitable to invest in programs to conserve—and particularly to reduce peak requirements—that it is to build new capacity. For example, Pacific Gas and Electric, a large utility based in San Francisco, is planning to invest $164 million in the next decade in dozens of programs designed to cut peak demand by 25 percent by the year 2000. The object is to avoid having to invest several times this amount in additional generating capacity.

In Third-World countries, where energy waste is far less, satisfying basic energy needs will require heavy investments in energy production. In late 1980, Ernest Stern, Senior Vice President for Operations at the World Bank, reported that the Bank would try to double its existing $13 billion authorization for energy lending for the period 1980 to 1985 to $25 billion. This latter figure would represent the Bank’s share of funding for energy projects that total more than $90 billion. Behind this proposal is the desire to help developing countries reduce their oil import bill, which collectively climbed from $7 billion in 1973 to roughly $50 billion in 1980. To facilitate the sharp increase in energy lending, the Bank proposed to establish a new energy affiliate, the International Energy Corporation. Evidence of the unfolding difficulties in financing the transition to a sustainable society came in early 1981, when the newly inaugurated Reagan administration announced that it would not support creation of the proposed energy affiliate.

Whether the Bank will be able to expand its energy lending along the lines envisaged by Stern remains to be seen, but at current lending levels it provides invaluable assistance in the energy transition. When the Bank committed $11 million in early 1980 to a mangrove plantation in Bangladesh, it helped assure a long-term supply of indigenous fuel there. Similarly, its commitment of $125 million to a new hydroelectric project in Colombia will help put Colombia’s electrical supply on a sustainable basis. A $40 million loan to Kenya following earlier technical assistance from the United Nations Development Program will permit Kenya to obtain much of its additional electrical generating capacity for the eighties from geothermal sources.

In countries that import oil, the option of importing energy-producing equipment will become increasingly attractive as oil becomes ever more costly. If a government can import wind generators or geothermal plants to replace oil-fired electrical power plants, for example, it can sharply reduce foreign exchange outlays. Moreover, unlike expenditures for imported oil, investment in indigenous energy resources can be made partly, and sometimes entirely, with local capital.

The issue of local investment deserves a closer look, given the goals of the transition. In contrast to investments in fossil fuels, which are largely reserved to cor-
porations and governments, those in renewable energy resources can be made by individuals and communities. Whether by buying solar panels for water- or space-heating or planting trees for firewood or constructing a small-scale community hydroelectric facility, individuals, small firms, and local communities can participate meaningfully in the development of the renewable energy potential and thus broaden the capital base.

One of the attractions of investing in both energy efficiency and renewable energy resources is that such investments are inflation-proof. Once a homeowner invests in insulation to reduce fuel needs, his vulnerability to fuel-price increases is permanently diminished. Similarly, once a solar water heater is installed, the cost of the heat it supplies throughout its lifetime is fixed. Yet, the cost of electricity, oil, and natural gas used to heat water will undoubtedly continue rising.

As investments in energy are climbing, so too are those in food production. As world population increases, the capital investment required to feed each person increases apace. With little new land to plow, virtually all future gains in food production must come from boosting output on the existing resource base. Such boosts, in turn, are posited on highly capital-intensive techniques. (Even if world population were to stabilize at six billion, a goal far below present projections of world population growth, vast increases in food output would still be required to satisfy minimal needs.) In Asia, where half of humanity lives, future gains in food production will depend largely on heavy investments in water control and irrigation. Saburo Okita and Kimo Tahare of the Overseas Cooperative Development Fund of Japan estimate that doubling rice production in Asia over the next 15 years will require $67 billion, largely for investment in irrigation facilities.

One of the most troubling investment deficits is that in efforts to control excessive soil erosion and to halt the conversion of prime cropland to nonfarm uses. Few governments have recognized this dual threat to future food supplies, much less translated such awareness into budgetary commitments. As governments become more aware of this dilemma, soil conservation programs are likely to become a major budget item. Official estimates indicate the United States needs at least to double the public contribution to cost-sharing. Many Third-World countries need a several-fold increase in expenditures on soil-saving measures. Farmers will, of course, have to make heavy investments of their own resources in soil protection practices. But without governmental cost sharing, the world's soils will continue to deteriorate.

Public funding aimed at keeping cropland from being diverted to nonfarm uses in most of the world is at best negligible. Indeed, in late 1979 when Connecticut purchased the development rights for a farm threatened by urban sprawl it earned a news story in The New York Times. Neighboring Massachusetts has set aside some $10 million for the purchase of agricultural preservation restrictions for farmland. Of all Western industrial countries, only France has come anywhere near investing enough to make a major difference at the national level. As the eighties begin, this sound approach to farmland protection remains the exception rather than the rule that it must become if future supplies are to be assured.

With reforestation, the commitment of resources is grossly inadequate. Only a handful of Third-World countries have made a solid commitment to reforestation despite the obvious imperatives to do so. In contrast, the

---

No easy technological fixes, no simple breakthroughs will solve the food problem or the energy problem.

---

United States, which by international standards is generously endowed with forests, committed funds to reforesting 460,000 acres in its 1981 budget. The funds earmarked for this effort covered direct Forest Service commitments plus the employment in reforestation of thousands of young people in the Young Adult Conservation Corps, a youth employment and training program. Fortunately, international aid agencies are increasing sharply their investment in reforestation during the eighties. Since 1978, the U.S. Agency for International Development has quintupled its financial support for firewood projects. World Bank support of reforestation projects for the eighties has increased some tenfold over the preceding decade.

Investments aimed at stabilizing population are probably slighted most in government budgets. While most national political leaders at least acknowledge the threat of continued population growth, few governments have adequately funded either population education or family planning programs. The International Conference on Family Planning in the Eighties, meeting in Jakarta in early 1981, estimated that $3 billion will be needed annually to meet population and family-planning program needs, compared with roughly $1 billion currently being spent. Nationally, few governments have yet launched effective population-education programs—programs that explain the urgency of halting population growth.

By any reckoning, the transition to a sustainable society will require all the investment capital that can be mustered. Without a reduction in the $500 billion global military budget, the capital for a smooth and timely transition may not be available. Governments will be forced to weigh carefully the trade-off between reductions in military expenditures or possible declines in living standards. However unlikely a reversal of the recent trends in military expenditures may appear to be, new realities may make such a reversal mandatory. Indeed, straightening out our investment priorities so that they are
aligned with new economic and social realities is one of the most basic and urgent challenges of the transition.

Reorienting Research and Development

The systematic investment of public resources in scientific research is a relatively recent phenomenon. As recently as 1940, the U.S. was spending only $74 million annually on research. But World War II brought an outpouring of public funds for scientific research, a flow that has expanded substantially since. As of 1979, global research and development was a $150 billion undertaking, employing an estimated three million scientists and engineers.

The global R&D budget is dominated today by military expenditures, much as it has been since World War II. Far above any other category of expenditures, the global military establishment claimed some $35 billion for the development of new weapons systems, an activity that employed close to a half million of the world's finest scientists and engineers.

Ranking a distant second after military R&D was space research, roughly a third of that for the military. Although still large, its share has declined since the late sixties, when the American program culminated in the moon landings. Other major areas of research and development expenditures are energy, health, transportation, pollution control, and agriculture. All told, the wartime imprint on government R&D expenditures remains bold. Today, more scientists work on new weapons systems than on new energy sources and increased food production combined.

But the role of technology in the transition to a sustainable society is a central one. A pressing and in some cases a near-desperate need is that for technologies to harness locally available, renewable energy sources. Development of more energy-efficient technologies is lagging far behind the need in every major sector in the world economy. Research on farming practices that will stabilize soils is nonexistent in the countries that need it most. Investment in the breeding of plants that can capture sunlight more efficiently is trivial compared with the need for such plants, as is investment in more efficient long-distance electrical transmission techniques than the development of high-yield sweet sorghums than can be grown as temperate-zone energy crops, much as sugarcane is grown in the tropics and subtropics. So long is the list of such gaps, in fact, that the global R&D budget as it is now constructed scarcely corresponds to humanity's most pressing needs.

Yet while progress in shifting budgetary priorities is slow, changes in the energy research budget are heartening. Data compiled by the International Energy Agency (IEA) for the major Western industrial countries (except France) and Japan, show that public expenditures on energy research, development, and demonstration (RD&D) increased from $1.9 billion in 1974 (the first year after the Arab oil export embargo) to $7.1 billion in 1979. Even adjusted for inflation, this represented a healthy increase.

During this five-year period, expenditures for conservation increased from just over 2 percent of the energy research budget in 1974 to over 6 percent in 1979, while those for renewable and geothermal energy climbed from 1 percent to 12 percent. While energy conservation and the development of renewable resources should be at the center of a long-term global energy strategy, energy research expenditures do not yet reflect this recognition. Nuclear power, principally nuclear fission, still claims the lion's share of energy research and development funds in rich and poor nations alike. Although expenditures on nuclear fission declined from 69 percent to 45 percent, this commitment is still extraordinarily large given the declining prospect of nuclear power in the United States, Germany, and other key IEA countries.

Of the 19 member countries of the International Energy Agency, only Sweden has been fully able to realign its energy research budget in accord with the new energy realities. While IEA members as a group are allocating only 6 percent of their budget to energy conservation, Sweden is allotting 34 percent. Similarly, the community as a whole is devoting only 9 percent of its energy budget to renewable energy resources, but Sweden has increased its expenditures to 32 percent. Meanwhile, Swedish expenditures on nuclear fusion and fission combined have fallen to 19 percent.

While government expenditures on energy RD&D totaled just over $7 billion in 1979, industry's annual expenditures on energy RD&D in the larger IEA countries have reached $2.9 billion. Industry RD&D expenditures on energy are roughly proportional to the industrial capacity of the member countries: the United States leads with $1.3 billion, followed by Japan with $513 million and Germany with $329 million. In some cases, the industry expenditures are part of joint government-industry projects—the construction of coal liquefaction pilot plants, for instance. In others, notably those that manufacture automobiles and household appliances, government regulations (in the form of higher energy-efficiency standards) have spurred industrial product research.

With sustainability rather than endless growth as a goal, local research acquires new importance. In the case of the development of renewable energy resources, for
As the world faces the need for a rapid economic and social transition, there is a dearth of leadership, particularly at the national level. 

begun to survey the complex ecosystems of fast-disappearing tropical rainforests or the malignant spread of the world’s deserts.” Further, says Norman, “The nuclear arsenals of the superpowers contain enough explosive power to reduce to rubble most of the cities of the globe, yet the more challenging test of providing clean, safe power for those cities has received far less scientific attention.”

The global R&D budget was shaped largely by the needs of the fifties and no longer serves us well. Needed now is a wholesale restructuring, country by country, that will make the efforts of scientists responsive to the needs of the eighties and to the development of technologies that will lead us to a sustainable society. Overcoming the bureaucratic inertia and vested interests in the current configuration of expenditures is essential if the technologies needed to sustain society are to evolve.

Role of Leadership

The greater the need for economic and social change, the greater the need for leadership to guide the process. Throughout most of history, social change was so slow as to be scarcely perceptible within a given generation. Then, an occasional lack of leadership was tolerable since the consequences unfolded so slowly. But in recent centuries and decades the pace has picked up, and during the decades of transition the pace of change promises to accelerate sharply. Leadership was never needed more than it will be in the years immediately ahead.

Leadership can be defined in many ways—political, intellectual, or spiritual, to cite a few. Most commonly, it is thought of as political, in terms of elected or appointed officials. It also consists of organizers and facilitators, those who make things happen. Barbara Ward defined leadership as “the ability to get the best out of those around you.”

As the world enters the eighties, facing the need for a rapid economic and social transition, there is a dearth of leadership, particularly at the national level. Among contemporary political leaders of major countries, few stand out as historic figures. It is not clear whether the facelessness of national political leaders is absolute or relative to the unprecedented demands of the transition. Canadian Prime Minister Pierre Trudeau favors the latter explanation, observing that all national political leaders appear incompetent in the face of the problems societies now face. Warren G. Bennis, psychologist and former president of the University of Cincinnati, takes the other view—that the world is suffering from a paucity of leadership.

Whether leaders make history or history makes leaders, the eighties and nineties will unquestionably be periods of rapid, perhaps even convulsive, economic and social change. Our success in making that change smooth, purposeful, and guided will depend largely upon the willingness and ability of leaders to educate their constituents. Their responsibility in times of rapid change is to help people understand why change is needed, why it is inevitable, and what it will look like. As Bennis notes, “Our great political leaders, such as Jefferson, Lincoln, and Wilson tried to educate the people about problems,” in effect “transforming murky
problems into understandable issues." He believes that "a leader must get at the truth and learn how to filter the unwieldy flow of information into coherent patterns." With no understanding of the underlying causes of change, governments fail to respond to emerging problems and problems become crises.

At a time when there is a dearth of leadership at the national level a few stand out. One such leader was the late President Ziaur Rahman of Bangladesh, assassinated in an attempted coup d'etat in May 1981. Few if any countries are in more desperate need of effective leadership than Bangladesh. With some 90 million people squeezed into an area about the size of Louisiana, the country has been frequently described by development economists as an international basket case. Planning Minister Fasihuddin Mahtab sums up the desperation: "Unless we make a major breakthrough in the next five years, we are finished. With 80 percent of the people below the poverty line, we are barely floating. It is survival. The alternative is yearly famine." A father of two, Zia lived quietly in the same small house he occupied when he was a military commander. He worked long, hard days, frequently going from 7:30 in the morning until past midnight. His two principal goals were bringing population growth to a halt and expanding food production. Determined to halt population growth at 100 million, he was beginning to push the one-child family, following the Chinese example.

Zia believed, quite rightly, that the key to solving Bangladesh's food problem is increased multiple cropping, which in turn depends on digging irrigation canals. In his tireless campaign to slow population growth and to expand food production, he made some twenty trips a month by helicopter to remote villages where he exhorted people to greater efforts—and scolded lazy bureaucrats for failing to get things done. His Minister of Agriculture described him as "the chief extension agent of the Ministry of Agriculture."

Progress on both the food and population fronts in Bangladesh has slowly gained momentum since Zia took over in 1976, when he transformed a military government to civilian rule. One observer noted that Zia "sometimes appears to be trying to raise his country up by sheer force of his persuasion." An exemplary leader, committed to improving the lot of his people, Zia provided not only leadership for Bangladesh but inspiration for other countries as well.

At a time when effective high-level political leadership such as Zia offered is scarce, intellectual leadership is also lacking. In an essay, "The Cupboard of Ideas is Bare," journalist Bernard Nossiter describes this perplexing dilemma in challenging terms, noting that American presidents no longer view academia as the source of answers to the problems they face. Few contemporary economists stand tall enough to command wide public respect, perhaps because traditional economic theory no longer explains the workings of the economy. Leading economists have difficulty explaining the mounting inflationary pressures or the declines in labor productivity.

In the face of complexity, academics all too often retreat into ideology or technique. Sociologist Daniel Bell reports that two vacancies in his department for faculty members under 45 at Harvard went unfilled in the late seventies because the screening committee could not find candidates with the needed breadth. Bell noted that many of the candidates were "brilliant hotshots," but that nearly all were technicians, nothing more than computer model specialists. Faced with real world complexity, academics too often bow to the temptation to retreat into the world of computer models and the academic jargon of their discipline.

Apart from a few national political leaders, those leaders most actively promoting the transition to a sustainable society are local. One such is Michel Crepeau, former mayor of La Rochelle, France. From 1971 until his 1981 appointment as Minister of Environment in the Mitterrand cabinet, he organized and led a broad-based effort to create a model city for a sustainable society. Launching a recycling program, he called meetings in local neighborhoods on the proposed program for separating and recycling trash, gaining support before the project started. Street theater was used to teach how to separate the key components of garbage—metal, paper, and plastic. Solar water heaters were installed on over 1,000 public housing apartment buildings alone, reducing the vulnerability of La Rochelle's 100,000 inhabitants to oil embargoes. The center city, which dates from the Middle Ages, was converted into a network of streets for pedestrians only. Because the people of La Rochelle helped design and implement these programs, voter support for Mayor Crepeau has expanded steadily. Emphasizing broad public participation, the mayor has rejected dogma and ideological approaches in favor of practical proposals that work.

In energy, too, the outstanding models are local. Within the United States, California has consistently led the country in developing renewable energy resources. Under Governor Jerry Brown's leadership, the state has moved imaginatively, using tax incentives and the authority of the Public Utility Commission to encourage the
shift to solar and geothermal energy. In many cases, the goals set in California are higher than those set in Washington for the country as a whole.

In local energy development, Franklin County in rural western Massachusetts stands out. A detailed inventory of the potential both for conserving energy and for developing local renewable energy resources yielded astounding results. It showed that the county could rely heavily on available local energy resources—including existing, abandoned, and potential hydroelectric sites—and reduce its overall energy consumption by 60 percent through conservation. It further determined that the county had enough potential hydroelectric generating capacity to more than satisfy any projected needs for electricity and could even market surplus power.

Above all, the Franklin County study emphasized the need for community energy planning. Mark Cherniak, codirector of the energy-management project, notes that “energy statistics must be gathered as locally as possible if they are to be of value in policy making. . . . A particular building, stream, windy hillside, or acre of woods exists in town or city and is owned by someone. The decision to develop an energy resource can only be properly made at this most local level.”

Once leaders such as Michel Crepeau or Mark Cherniak and his associates take the initiative and create the local models, then it becomes easier for other community leaders to innovate. The critical inputs are the initial vision and political leadership that get the process started.

Outstanding among those who are launching the transition to a sustainable society are the organizers and facilitators. In 1979, Thailand had 41 percent fewer pregnancies than it had five years earlier. Unplanned births had dropped to a negligible level largely because of the efforts of one young man. Trained as an economist at the University of Melbourne, Mechai Viravaikya has organized the world’s most innovative family planning program. He abandoned his government position in 1974 to form the community-based, non-profit Family Planning Services. As he pointed out, “When I was in the government planning office, with my degree hanging on the wall, I was director of the team that made marvelous plans for Thailand. I saw that we were advancing economically, but all our gains were being eaten up by overpopulation. I realized we would have to adopt a radical new approach to this most terrible problem.”

As Mechai saw it, it would be necessary “to change the Thai’s puritanical view of sex, make the whole business of how many children a family had a subject easily discussed and thus acted upon.” The techniques and innovations introduced by Mechai seem endless. School children’s games have been devised in which condoms are used as balloons. Math exercises have been organized around population growth and its effects. Sterilization of a husband or wife in a village after they have had the desired number of children entitles the couple to a free baby pig. (Mechai notes that this accomplishes “two things at once, improving the diet and popularizing birth control.”) Key to Mechai’s approach has been popularizing family planning and involving people at the grassroots levels in the program—a two-pronged effort that has led to wide discussion of population problems and the need for family planning in all segments of Thai society.

More than 1,000 miles to the west in India, another organizer has literally transformed large rural areas. In May of 1949, Verghese Kurien, a recent graduate of Michigan State University in mechanical engineering, arrived in Anand (a small town north of Bombay) to work with an Indian research creamery. Within a few years, he had organized a farmer’s dairy cooperative for village milk producers, few of whom owned more than four cows. Then he organized another, and another. As the number of local village cooperatives multiplied, they eventually formed unions of about 800 villages each. The typical union now operates a fleet of milk-collection trucks, a marketing system that extends into the big cities, and a feed-mixing mill. It provides veterinary and extension services, including artificial insemination to upgrade local stock. Close to 30 such unions modeled on the original Kaira Dairy Union now exist throughout India. They involve 5.5 million milk producers, 60 percent of whom are marginal farmers or landless laborers, and supply milk both locally and to India’s four largest cities—Bombay, New Delhi, Calcutta, and Madras. Much of the milk moves by insulated railway tankers on fast trains, some of it traveling several hundred kilometers.

The dairy cooperatives organized by Kurien provide a reliable market for small farmers who may have only a few acres of land and only one or two cows. It also provides them with cash income from the sale of their small marketable surplus and with technical services that would not otherwise be available to most farmers. These cooperatives have increased income in rural areas and have improved nutrition in a country where dairy products are the dominant source of animal protein in the diet. They key to developing this food resource was not massive investments or foreign aid but vision and commitment, in short—leadership.

Leadership takes many forms. It may be as simple as a personal example or as profound as the influence embodied in a head of state. Princeton’s Rufus Miles believes that leadership for the transition is at least as likely to be “bottom up” as “top down.” Everyone will have the opportunity not only to participate in the transition but to help lead it.

Lester R. Brown is president of and a senior researcher with the Worldwatch Institute and the author of numerous books, including Running on Empty: The Future of the Automobile in an Oil-Short World and The Twenty-Ninth Day.