In J. Byrne and D. Rich, eds. Technology and Energy Choice (1983) Pp. 124-160.
Newark, DE: CEEP, University of Delaware

Energy Markets and Energy Myths: The Political Economy of Energy Transitions

By John Byrne and Daniel Rich

Introduction

The dominant assumption in current U.S. energy policy is that our best hope for a viable energy future lies in the unfettered operation of market forces. Markets are believed to provide for an intrinsically rational and just allocation of resources unequalled by any other social institution. Thus, Walter Mead concludes, "[p]rivate enterprise and the free market is the worst system of allocating resources, except for the next best system, which is much worse" (Mead, 1982:123).

For advocates, evidence of the superiority of market allocations of energy abounds. The performance of energy markets since the embargo, despite regulatory interference, is widely regarded as one of the few positive developments of the past decade. The substantial energy conservation achieved since 1973 is seen as demonstrating the market's adaptability to higher and more realistic prices. The apparent oil glut of 1982-83 has been portrayed as proof that the previous decade's shortfall was an artificially induced aberration and that the return to competitive pricing is fomenting OPEC's collapse. The Reagan administration and oil companies point with pride to the dramatic growth in investments in oil and gas exploration as a sign of the market's capacity for self-renewal. At the same time, the introduction of a plethora of energy-saving contraptions into the marketplace is greeted by do-it-yourself mass media, such as Solar Age and Popular Electronics, as confirmation of the inventiveness of the market system. The Wall Street Journal and other business publications herald the entry of venture firms and capital into the energy business, enticed there, we are told, by precise "scientific" price signals directing economic efforts (and substantial profits) toward the satisfaction of the national need for new energy. Market forces, even diluted ones, seem able to focus the necessary attention and resources on all aspects of energy provision and on a whole array of opportunities for solving our energy problems.

Policies based on market logic have sought to deregulate the energy system with the expectation that this will usher in an era of free competition and inevitably lead to the most economically efficient and socially beneficial arrangement of energy production and use. If the current energy system meets the market test, we will have indisputable evidence of its superiority for the future. If a transition to a different energy system is required, we can expect it to implement itself as new options are introduced, tested, certified and diffused by market forces. In either case the removal of market restraints is expected to make available the best of all possible energy futures.

But before we constrain our energy future, and indeed our social future, to the limits of what the marketplace prescribes, we should look more closely at the evidence at hand and ask if it justifies our confidence in the omniscience of market forces. What is the evidence that deregulation will unleash forces which, if left unimpeded, will naturally generate the most efficient and thereby most socially desirable energy future? Is there evidence that the result of reliance on the market will be a least-cost energy future manifested in efforts to conserve energy? Most important, what is the evidence that the portrayal of energy problems and processes under the logic of markets accurately reflects the political and economic circumstances that have historically shaped and sustained arrangements for the production and use of energy?

The Romance of Private Energy

The marketplace is guided by an efficiency principle: we should invest in energy options to the point where the marginal cost of their supply are equal to the marginal cost of equally preferred alternatives. With marginal cost pricing, society invests in any energy option precisely and only up to the point where a Btu via one option equals the added

The authors wish to thank Cecilia Martinez and Rebecca Wykoff for their assistance in collecting and analyzing certain data reported in this paper.

cost of a Btu from any other source, given the prices of all other goods. This is the precision which the market delivers and which is unequalled by any other system of decision making. Moreover, it is this precision which supposedly makes the market uniquely suited to deal with the problems created as a result of changing energy conditions. As David Stockman has proposed:

> The world economy ... was confronted with a wrenching price shock and then with a massive task of reconfiguring its entire capital stock, from automobiles to oil-field technology, to compensate for this sudden leap upward along the supply-and-demand schedules.
>
> This task of reordering of the worldwide capital stock was so far-reaching-- bearing implications for the insulation thickness of attics, the design of transmissions, the mix of industrial boiler fuels, and competitive position of natural rubber and cotton versus synthetics, residential development and commuter patterns, oil-patch discovery and recovery technologies, transportation versus extraction tradeoffs on the world's energy frontiers, among other things-- that no computer model, think-tank seminar, international energy secretariat, Department of Energy or congressional subcommittee could hope to figure it out. It was a problem whose solution was tailor made almost exclusively for markets (Stockman, 1982:10-11).

Perhaps the most cogent argument for reliance on the market in dealing with our energy problems has been offered by Roger W. Sant in "The Least-Cost Energy Strategy" (1979). In Sant's view, our problem has not been OPEC or even energy per se, but rather an array of government-induced practices and policies which have systematically distorted energy prices and stifled competition. From this point of view, OPEC and the energy crisis have played constructive roles in forcing us to realize that tampering with the marketplace cannot go on without experiencing the burden of increasing costs for diminishing benefits. The Committee on Economic Development summarized the lesson to be drawn from past policies:

> In fact, controls on the price of energy have fueled excessive consumption, inhibited exploration and investment, and undervalued technologies that would help ease the energy supply problem and promote conservation. In addition, artificially low energy prices have not allowed industry and consumers to make decisions based on the actual cost of energy and have locked this country into an even-higher-cost energy future (CED, 1982:xii).

Had we recognized this earlier, Sant suggests, we would now be far better off--wealthier and more energy secure: reliance on the free market system "during the 10 or 12 years prior to 1978 could have reduced the cost of energy services by roughly 17 percent in 1978 with no curtailment of services" (Sant,1979:5).

Sant believes that the lack of good judgement evident in the past need only represent a temporary setback on our way to a viable least-cost energy future. What is required is a "strategy to maximize competition for energy services"; one that "would utilize much of the traditional free market system" (Sant, 1979:4-5).

> Our conclusion about the value of market forces in the operation of the least-cost strategy arises from the evidence of our analysis that, in regard to most of our 'energy' problems, a freely competitive environment would work, primarily because of the numerous, diverse and actually or potentially competitive technologies that can be brought into play in the energy economy (Sant, 1979:5).

From the standpoint of government, the emphasis must now be on undoing the damages done in the past. Deregulation of energy prices is the one indispensible action. With deregulation, energy prices will come to reflect the true costs of additional production and thereby provide producers and consumers with the incentives to discover and implement the most efficient arrangement of energy services. For the public at large, the evidence of this efficiency in the short-term will be in the conservation actions undertaken in response to higher real energy prices. For the advocates of a market-based strategy, however, conservation will signify the effort to maximize present value which is the real meaning of efficiency. As Mead has proposed:

> A naive view of conservation is...: conservation means use less. That is about what conservation means in Washington these days, and it is no theory at all.
>
> Economists have a definition of conservation. It is only three words: maximize present value. The trouble is nobody knows what it means except

businessmen, when they think about it. Maximize present value dènotes use scarce resources over time in such a way so as to render the present value of those resources the greatest at some discount rate. That may or may not help you, but that is what conservation means economically: to rationally spread the use of resources over time.

> But conservation also has a meaning at a given point in time, and it is simple: minimize your input of resources per unit of output...It should sound familiar to businessmen because it is exactly the same as maximizing profit. The only difference is that in some circles the latter is bad and the former is good. Conservation is a good word; profit maximization is bad. Yet they are synonymous (1982:121).

Deregulation is expected to introduce the incentive for profit maximization necessary to discover a natural solution to our energy problems; one that will liberate us from the ill-conceived and ineffective government interventions of the past and usher forth "the inventive capacity of free men and free markets to cope with changes in the global balance of available resources" (Stockman, 1982:16). Indeed, what is remarkable is the ease with which such a solution is expected to come about.

> The optimism of the 1980's, I suspect, is that by 1990 consumers will have what they are crying for now: choice... What is needed for that happy result? Nothing. What is needed if we want it to happen by 1985 instead of 1990? It certainly is not government. Legislators ought to do everything they can to remove themselves from the scene, rather than try to provide more tax incentives and subsidies, and put the highest priority on filling the strategic reserves in case of disruption between now and then.
>
> ...I cannot come up with anything that I would like to urge except let the forces start turning; we're not going to be able to stop them (Sant, 1982: 114,117).

The Deregulation Dream

While portrayed by advocates as a practical necessity, deregulation is, in fact, a concept fraught with many flaws. First, it is unclear what actions would fully embody the concept. This is not because of an absence of specific proposals from advocates. Listed under the rubric of deregulation are proposals for all of the following: ending federal policy procedures for allocating energy in the event of a supply interruption; reforming federal tax laws which subsidize any one source, technology, or use over another; withdrawing government investment from efforts to commercialize energy alternatives; reducing bureaucratic restrictions which contain private investments or alter private decision making; easing restrictions on plant siting and the use of licensing and review for nuclear facilities; revising laws that mandate particular pollution control devices; phasing out restraints on entry in energy markets, particularly in electric generation; and finally, decontrolling fuel prices and fuel supply allocations. This list is incomplete, but it is important to recognize that any such list must always be incomplete. The concept of deregulation is so inclusive as to be boundless; it incorporates any action or inaction which can be interpreted as being consistent with decision making under a hypothetical condition of perfect markets. Like perfect markets, deregulation is always an aspiration, never a reality. In seeking a hypothetical world, we can never be certain what actions are required or whether any actions are truly effective. As advocates claim, such wisdom and foresight is reserved only to the market.

Given the elusiveness of the concept of deregulation, it is difficult, to say the least, to derive consistent practical guidance from it. For example, advocates generally call for an end to energy price controls so that prices will reflect the true marginal costs of production. Yet, upon examination it appears that what is anticipated is selective application of this principle. There are few willing to argue for a free market in nuclear waste disposal or in insurance for catastrophic nuclear plant accidents. In such areas, one can readily understand the fears among advocates of letting the chips fall where they may.

Once we accept that practical constraints exist in the application of the concept, we must also accept that the market will never be the exclusive mechanism for allocation decisions. It may be reasonably argued that some deregulation is better than none. Questions remain, however: What will be deregulated and what will not? On what basis will this decision be made? How are we to decide what is the practical limit of reliance on the market? Even advocates of deregulation ultimately must turn to government to resolve these questions. They hope for a new government: one that fundamentally is the agent of its own self-control; one that disdains the urge to regulate economic affairs, since it is conscious of the costs of tampering with the market's inherent efficiency; and one that is willing to intercede only when it is undeniable that the market cannot solve the problem. It is believed that this mode of government is tolerable because it would avoid political judgment wherever market judgments are available.

Some, including Roger Sant, claim "an awaiting consensus" for this mode of government, at least insofar as energy affairs are concerned. Yet, advocates fail to demonstrate how this consensus is to be mobilized. Indeed, it is assumed that the intrinsic economic superiority of this mode of government will be all that is necessary to bring it about; in essence, the new government will implement itself. This proposal completely ignores the possibility of conflict among alternative goals and values and presumes a happy coincidence of economic and energy efficiencies that will benefit all. But what is the evidence for such a presumption? The recent history of energy affairs would suggest the opposite, a growing conflict between social, environmental, economic and energy interests, with real trade-offs between cleaner air and water, greater social equity and energy abundance.

Insofar as economic efficiency employs market prices to value alternatives or, where markets do not exist, shadow prices, the claim of neutrality is false. Particularly with regard to the environment, the evidence is that market prices and their surrogates have repeatedly undervalued social objectives. At least, political evaluations have been greater than the economic ones. It could be argued, of course, that the problem is really that politics overvalues the environment and other social goods. But in either case, the conflict is real. Democratic participation, the source of political values, systematically conflicts with market participation, the source of economic values. It is this conflict that raises questions as to whether efficiency is or can be a neutral goal.

Minimally, it must be conceded that privatizing energy policy will challenge other goals of society. Since these other goals involve such fundamental matters as environmental preservation and democratic participation, it is not at all clear that a market-like government is socially preferable. What is clear is that the proposal for such a government expresses a political judgement. Yet, it is the intrusion of political judgement that deregulation advocates claim is responsible for the energy crisis and is incapable of extricating us from our current plight. Why place our confidence in a political judgement that government can and should do little when its advocates portray the very exercise of political judgement as the source of our problem? This is not just an inconsistency in the deregulation argument, nor can it be redressed by insisting that the type of government envisaged will be apolitical. Above all else, deregulation is a political ideal and it is so because it seeks to answer the most basic political questions: What kind of government shall we have and what shall that government do?

The Robin Hood Principle in Reverse

The least compelling claim by market advocates is that reliance on energy markets is preferred to "socially conscious" energy policies in addressing the interests and needs of low-income individuals. There is no evidence that markets have or will ameliorate the inequitable distributive impacts of higher energy prices. Even if markets did work in the narrow sense of stabilizing prices and supply conditions, they would continue to fail as neutral arbiters in the allocation of social burdens.

Estimates of the shares of income required for various groups to pay their energy bills underscore the unequal impact of higher energy prices. A U.S. Department of Labor survey conducted in 1973-74, before the effects of OPEC control of oil had been felt, and before oil and gas prices were decontrolled, showed an energy market already characterized by substantial inequities. The poorest decile in the American population paid 34.1 percent of their income for direct and indirect energy consumption in that period, while the highest decile paid 5.2 percent (U.S. Department of Labor, 1977). A subsequent estimate by Landsberg and Dukert indicates that "as a national average--the poorest U.S. families in 1979 were required to spend nearly half of their reported income to pay for the direct and indirect costs of energy" (1981: 34). Beebout, Peabody and Doyle report that electricity and natural gas expenditures by the poor doubled between 1973 and 1978, while their incomes increased by only one-third in the same period (cited in Landsberg and Dukert,1981:31). Before the price spiral of the 1970s, energy markets were highly regressive. They continue to be so today, taxing the poor heavily in the pursuit of what we are promised will be an eventual solution to the energy problem.

Many deregulation advocates argue that constraining the market in order to help the poor is an inappropriate strategy for government. Thus, David Sternlight, chief economist for Atlantic Richfield Company, claims that:

...the argument, "What about the poor people?" is one of the things that hung us up in energy policy for many years.

In answer to the question, 'What about the poor people?" this country has a variety of well-established, very powerful policy techniques for income maintenance and other transfers. In fact, Congress has already acted to ameliorate for the poor many of the difficulties of higher energy prices. To make energy policy a hostage to incomes instead of dealing with incomes in the area where we have powerful policy tools seems to me to be one of the things that has caused delays and confusion in this country's energy policy (1982:76-77).

Notwithstanding Sternlight's optimism about Congressional actions, there is little evidence that they come close to compensating the poor for the full cost of a market solution. The Committee for Economic Development, a supporter of energy deregulation, has estimated the annual cost for compensating the poor back to 1973-74 levels at $3.5 to $7 billion (CED, 1982:20). Even this level of compensation would leave a roughly seven-fold difference in the share of income required between poor and rich to pay for their energy needs. But as the CED has observed, "...Congress appropriated only 1.6 billion for the winter of 1979-1980. In fact, the appropriation for energy assistance has never reached even $2 billion in any given year...Other welfare benefits have not taken up the slack" (1982:21).

It is not clear whether the awaiting consensus claimed by deregulation advocates for a least-cost energy strategy includes a serious commitment to compensating the poor. It is clear that many advocates find such compensating, through any means, ineffective, unproductive and, and in any case, inappropriate. Thus Arthur Laffer has castigated American energy policy for its supposed reliance upon a "Robin Hood" principle: "You make the poor a little better off; you make the rich a little bit worse off" (1982:145).

By taxing the rich and giving to the poor, all Robin Hood has really done is to make the poor literally worse off...There is virtually no association whatsoever between the incidence of the tax structure and the burden of that tax structure; the person on whom you place a tax does not necessarily bear the burden of that tax. As often as not, the tax burden ends up somewhere else, as you can see by the results that New York City or Great Britain

have had in eliminating poverty by redistributionist economic policies (1982: 146).

Further, redistributionist policies are seen as fundamentally undermining the productivity of a society. Thus, Mead regards the windfall profits tax levied on domestic oil as "a disaster" because:

What you are doing is taking $227 billion over eleven years out of one decision making structure, which is profit making --profiteering, if you want to use a bad word. It is based on costs and revenues and internal rates of return: it's conservation. You are turning the money over to government where those are not the relevant decision-making factors.

Government is going to distribute some to the poor: we are also going to stimulate alternative energy sources where rate of return to the public is a secondary factor. We all lose because government's claim on resources of $227 billion is going to be transferred and resources are going to be allocated in a way which will reduce our standard of living. Output per unit of input--that determines our standard of living (Christ and Laffer, 1982:136).

Finally, even if redistribution were not ineffective or unproductive, it would be regarded by at least some advocates of deregulation as inappropriate. Such efforts are portrayed by these advocates as a sign of society's failure to recognize that government ought not to be expected to "solve our social problems for us" (Christ and Laffer, 1982:138). One must wonder as to the logic used to justify the redistribution of income toward the rich in the name of market allocative efficiency, while at the same time eschewing redistribution as a principle of social policy. Inequities in the burdens imposed by energy prices will worsen in a world where government truly defers to the marketplace, notwithstanding protestations by the market's advocates that it is unfair to evaluate the private allocation of energy in terms of its fairness.

The Ideal of Efficient Power

If the market cannot deliver greater social equity, can we be confident that either with current imperfections or through deregulation, it will provide greater long-term economic efficiency? Will we experience greater output per unit of energy input? A central claim of the market forces thesis is that, by aligning society with the requirements of effective markets, a pattern of decision making will be promoted which assures maximum social wealth at least cost. It is this assumption that is used to justify the inequities in the market strategy.

The promise of markets is not maximum social wealth in any independently definable sense however. Maximum social wealth has no actual measure, amount, or even approximation; it is the market advocate's characterization of the necessary result of efficiency-based decision making. The internal logic of this reasoning, while perhaps peculiar, is at least consistent: after all, if every decision is concluded with the discovery of the least-cost action (including decision costs), and social wealth is defined as the residual after all costs are deducted, how could the product obtained be less than the maximum? Thus, what is actually promised by markets is efficiency-based decision making, from which it is assumed (but cannot be proved) that the greatest, if unequal, benefit for the greatest number will be secured. Efficiency, rather than wealth maximization per se, is the sine qua non of market grandeur.

If it is not possible to prove that the pursuit of efficiency through market forces will yield the maximum attainable social wealth, it is possible to provide evidence that this pursuit results in a system which rewards economic power. Market advocates attribute to markets the distinctive capacity to reward decisions based upon efficiency rather than economic power. They believe that, by contrast, the political system rewards power rather than efficiency and thereby threatens to diminish aggregate wealth. Our experience in energy affairs should lead us to challenge these depictions.

In order to discriminate between efficiency and power, markets must be capable of recognizing and adjusting to price distortions brought about by the exercise of power. For this to happen, however, advocates point out that markets must be deregulated prior to the exercise of market choice. Yet, there is reason to doubt that markets can be so empowered. An interesting example of this problem is provided by Roger Sant in his projection of what a least-cost energy strategy would have meant had we not pursued a policy of widespread regulation. With energy prices under the control of markets rather than governments since 1968, Sant argues that we would have seen a significant shift in the U.S. fuel mix, away from the use of oil (forecasted at 26 percent instead of the 36

percent actually experienced) and toward the use of natural gas (forecasted to grow from the actual 19 percent to 21 percent) (1979: 27). Sant may be right that unregulated oil prices during that period would have led to a significant decline in oil consumption and that unregulated natural gas prices, although increasing during the period as well, would have risen less and therefore would have stimulated some substitution. Whether the pattern of decisions behind these changes would be evidence of market choices based upon efficiency rather than power is another matter.

In the case of natural gas, for example, it was through the efforts of industry members, with the assistance of government regulations sought by these same members, that low natural gas prices were established. Without low prices, natural gas could not have captured the market share it currently possesses, much less the greater share projected by Sant. Moreover, without the high demand created by artificially depressed prices, investment in the transmission structure necessary to support further increases in demand would have been postponed. In both respects, government interventions sought by the industry played a vital role in the market fortunes of natural gas. Sant's projection, however, assumes that with price decontrol the past history of price manipulation can reasonably be erased from the market's memory. What once upon a time was evidence of the corruption by politics of market allocation--namely, overuse of a resource which had been underpriced--is now to be endorsed as evidence of the market's capacity to seek out least-cost energy solutions. It is only through such revised history that the least-cost energy strategy can be presented as evidence of the efficiency of market decisions, rather than as evidence of the institutionalization of economic power through the helping hand of the market.

The reliance on markets has not and will not banish power from resource decisions; rather, it will merely relabel power as efficiency. Deregulated markets will not remove the impact of generations of subsidies enjoyed by the oil, natural gas, coal and electricity industries; they will not reduce the market influence that utilities have gained through regulatory shelter; they will not compensate for the decades of favored status granted to nuclear power because of its military priority--indeed, the notion that compensation could be made is absurd; and most important, because they cannot affect these things, markets cannot remove institutional resistance to change in the energy system. Markets can be counted upon, instead, to certify the inherent costliness of alternative energy futures while sustaining the belief that current arrangements for the production and distribution of energy constitute the only practical and "efficient" option.

Saving Energy or Saving Money

If we cannot be sure what it means to deregulate markets, if reliance on market forces will expand social inequities, and if the operation of markets serves to entrench economic power in the name of efficiency, what basis remains for continued confidence in markets? To advocates and critics alike, the one overriding benefit to be derived from market forces is energy conservation. Thus, Amory Lovins, the Harvard Business School Energy Project, the Ford Foundation and the National Academy of Sciences, not to mention the past four national administrations, have all recognized conservation as the one tangible benefit of market-established prices for energy. Indeed, it is widely accepted that market prices, even though hindered recently by regulation, have been responsible for the only good news about energy--conservation.

But advocates of conservation as an energy option should be suspicious of what advocates of market forces mean by the good news in the record of conservation over the last decade. They should have been alerted by pronouncements such as Mead's that conservation is merely a good word for profit. The conceptual framework that exalts the marketplace finds the value in conservation, like anything else, to be its possible economic efficiency, not in its contributions to decentralization, environmental preservation, self-reliance and so on. The latter are irrelevant; only the possibility of increased economic wealth matters. Conservation pursued as a path to profit will in all likelihood ignore or exacerbate the highly centralized character of the American energy system, the environmental damage it causes, and the absence of local control it sustains. It is the kind of conservation that can most easily accommodate the current requirements of the dominant energy institutions in the American system because it is the kind pursued exclusively within the boundaries of price differentials produced by that system.

The market-based understanding of conservation is built upon a deceptively simple logic: as the price of a good rises, the demand for it will fall. Applying this logic, market proponents interpret conservation to be foregone energy consumption. Such an interpretation appears to have self-evident plausibility within a market economy. Upon

examination, however, this interpretation turns out to be anything but self-evident. Indeed, the assumption that conservation since the embargo has been primarily the result of increasing fuel prices is not easy to demonstrate. Efforts to estimate conservation have proved to be extremely difficult. While a variety of statistical techniques have been employed, they all are predicated upon a common specification of an economic demand function in which changes in energy consumption are linked to changes in fuel prices (and many other variables). A number of troubling anomalies have surfaced. Thus, projections of energy demand consistently underestimate the size and extent of conservation, despite ever more elaborate modeling techniques; values of elasticities (estimates of the economic response of demanders to increases in prices) change significantly, especially short- vs. long-run elasticities, although demand theory suggests that they should not without extensive changes in the economy overall; and the type of model used to estimate conservation appears to be a primary source of the variation observed, raising the possibility that the conclusions reached are artifact of the method employed (Kouris, 1981). If nothing else, such persistent irregularities seem at odds with what is purported to be a self-evident relationship; all the more so since the precision of the market is portrayed as its singular benefit.

The difficulties in estimating conservation are not merely manifestations of the everyday methodological problems encountered in social science research. We believe they indicate a conceptual inadequacy in viewing conservation as equivalent to curtailment caused by escalating fuel prices. While fuel prices are undeniably an important factor in the chain of events and decisions that contribute to conservation, they are not the exclusive or even necessarily the decisive one. Other factors may be equally or more important: the availability and cost of alternative forms of conservation, the extent of consumer information about energy-saving methods, the size of subsidies to other fuels, and the policy incentives and disincentives for conservation (e.g., building codes and tax regulations). Variables such as these are seldom incorporated into demand models. Even if they were, however, a major flaw would remain in the reasoning of the models. That is, energy conservation is seen exclusively as an attribute of demand, when analysis suggests that its greatest contribution could be as a supply option. An illustration of this point is provided by research trends on residential electricity consumption in Delaware during 1967-1980 (Byrne and Wang, 1981). A strong upward trend in consumption per household between 1968 and 1973 was unmistakably interrupted by 1974 and began leveling off between 1974 and 1976. By 1977, consumption actually began to decline. While the initial drop in consumption between 1973 and 1974 was clearly in response to a 22.5 percent increase in real prices, the continuing decline after 1974 is not easily explained as an adjustment to higher prices. In four of the five post-embargo years, real prices actually decreased, and the largest single-year drop in prices during the eleven-year period examined was recorded in the post-embargo period (1975-76). Nevertheless, annual electricity consumption per household declined to the equivalent of eleven months of pre-embargo consumption. Perhaps most interesting, while seasonally adjusted real prices continuously declined over all eight quarters of the 1977-79 period, consumption also steadily decreased.

If, as market advocates assume, conservation is largely an artifact of consumer response to higher energy prices, how is the continued reduction in household electricity consumption to be explained during a period of declining prices? If we accept the elasticity concept of conservation, we must conclude that the pattern of conservation evident in recent years is a temporary aberration and that little real optimism should exist for sustained conservation in the future. Thus, Delaware estimates of elasticity support national research which predict that an average 10 percent increase in the price of a Btu of delivered electrical energy is accompanied by an average reduction of only 2-5 percent in Btu's consumed (Taylor, 1975). But this explanation implies that conservation is not a "real" good with a price of its own. Projections of the opportunities for conservation imply just the opposite, that conservation is most importantly our least-cost supply alternative to the end of this century, with a highly competitive price of $7-8 per barrel of oil equivalent saved (California Energy Commission, 1981). Despite the failure of market advocates to recognize conservation as a source of supply, this energy alternative has been responsible for meeting 70 percent of the new energy needs of the U.S. since the embargo (Lovins, this issue).

The importance of conservation, however, is being systematically undervalued as markets and policies focus attention on the swings in conventional fuel prices. As matters now stand, consumers can choose oil, natural gas and electricity as systematic alternatives, but they cannot make the same kind of choice for conservation. As a market option, conservation appears and disappears depending upon existing differentials among the prices of conventional fuels. In this sense, conservation is reduced to a speculation about

future prices of oil, gas and so on, with profits awaiting those who correctly anticipate market supply and demand conditions. Even with a comtinued general increase in the cost of conventional energy, conservation would remain undervalued. While very high energy prices would, as they have, contribute to a significant decrease in the amount of energy consumed, they would not and have not altered the infrastructure of energy production and distribution or the economic interests that dominate the system. After all, higher prices mean higher value for the output of that system and, at least for a period of time, higher profits. It is simply not in the interest of the dominant energy institutions which organize markets and determine prices to make conservation easier, except as it serves their interests. Thus, fuel efficiency became appealing when smaller automobiles could be sold at a profitable level comparable to or greater than that for larger automobiles; similarly, utilities joined the conservation bandwagon when the rate of return on load management and load shedding bettered that for new capacity as a result of spiraling bond interest rates.

What these cases illustrate is merely the substitution of one source of profit for another. In this respect, conservation is maintained as a form of speculative investment in the current energy system. The value of these investments in conservation, as in conventional energy, is the profit to be derived by the institutions which currently dominate energy markets. What is not considered in such investments is the value to society of energy conservation. This difference will remain no matter how high conventional fuel prices become because the social value of conservation would support the pursuit of alternatives which are not justified by existing prices. Ultimately, the value of energy conservation as a systematic alternative lies in the benefits derived from its displacement of existing energy markets. Obviously, that value can never be accurately assessed from the vantage point of existing markets. Limited to a speculative investment, conservation at most will serve as a short-term palliative.

The Myth of the Least-Cost Energy Future

It may be said in defense of the market that the criticisms lodged so far are inconclusive. They challenge either the logic used by advocates or the short-term performance of markets during a volatile period. They do not demonstrate that market forces are failing to guide us to a viable, least-cost energy future. Perhaps what we should learn from the above criticism is to distrust market advocates, but not the market, and to decide, after all, that the best course is to "let the forces start turning." What could we expect from such a course?

While the further future is beyond our crystal ball, it would be prudent to at least consider where the market is leading us currently. In the short run, some of the signals provided by the market are clear. One of these signals is a well-documented migration south of population, industry, employment and income. Data presented in Table 1 illustrate these shifts for selected states from Frostbelt and Sunbelt regions. As indicated, the highest population growth rates in the Frostbelt are modest in comparison with those experienced between 1965 and 1980 by the Sunbelt states. Similar results obtain for growth in real per capita income, service employment and value added by manufacture. A recent Presidential Commission report cited this pattern as a key element in the transformation of the U.S. to a post-industrial society and a sign of the market's ability to stimulate economic renewal (The President's Commission on a National Agenda for the Eighties, 1981)

Some energy analysts perceive these shifts as beneficial since they see the movement toward a warmer climate as a force toward a more energy-efficient economy (Davis, 1979). If this is to be the ultimate result, there is no sign of it yet. Indeed the evidence to date indicates that the movement south has been accompanied by what can only be described as spectacular growth in energy demand. In total, energy consumption grew 5.5 times faster in the Sunbelt states than in the Frostbelt (Table 2). The residential sectors of the Sunbelt experienced slightly slower growth, outpacing the Frostbelt by a factor of 4.5. The slowest relative growth occurred in the transportation sector, where Sunbelt use increased "only" 2.3 times faster. Most instructive, though, are the shifts in commercial and industrial sector energy demand. The market's intentions are most apparent here; a post-industrial future will mean a concentration of business demand for energy in the commercial sector and falling demand in the industrial sector. Thus, the Sunbelt commercial sectors experienced the highest growth rate of any sector in either region since 1965, 134 percent on average. In contrast, industrial energy use grew the least in both regions, up 56.4 percent on average in the Sunbelt states and actually falling by 9 percent in the Frostbelt.

These differences in energy growth rates are greater than what could be expected as a result of shifts in population and economic activity. Computed on a per capita average

Table 1

Selected Statistics, 1965-1980

	Population (in thousands)			Per Capita Personal Income (constant 1972 dollars)			Service Employment (in thousands)			Value Added by Manufacture (in million dollars)		
	1965	1980	% Changes	1965	1980	% Change	1965	1980	% Change	1965	1980	% Change
Frostbelt												
Illinois	10,693	11,433	6.9	4,378	5,857	33.8	766	1,257	64.1	17,744	50,543	184.8
Massachusetts	5,502	5,743	4.4	4,067	5,656	39.1	474	798	68.4	7,450	23,221	211.7
Michigan	8,357	9,255	10.7	4,057	5,571	37.3	416	801	92.5	16,886	36,723	117.5
New Jersey	6,767	7,377	9.0	4,320	6,112	41.5	418	764	82.8	11,268	30,137	167.5
New York	17,734	17,575	-0.9	4,357	5,731	31.5	1,633	2,326	42.4	22,694	58,140	156.2
Ohio	10,201	10,800	5.9	3,646	5,288	45.0	560	1,036	85.0	18,359	50,176	173.3
Pennsylvania	11,620	11,880	2.2	3,772	5,269	39.7	729	1,206	65.4	17,116	47,046	174.9
Weighted Average[1]	--	--	4.6	4,099	5,624	37.5	834	1,328	68.0	17,358	45,855	166.7
Sunbelt												
California	18,585	23,771	27.9	4,324	6,109	41.3	1,251	2,786	122.7	18,950	80,450	324.5
Florida	5,954	9,874	65.8	3,233	5,027	55.5	382	1,069	179.8	2,689	15,013	458.4
Louisiana	3,496	4,222	20.8	2,765	4,727	71.0	164	345	110.4	2,251	12,893	472.8
New Mexico	1,012	1,305	29.0	2,963	4,404	48.6	59	112	89.8	135	6,653	4,828.1
Oklahoma	2,440	3,038	24.5	3,063	5,068	65.5	120	255	112.5	1,101	7,297	562.7
South Carolina	2,494	3,127	25.4	2,460	4,061	65.1	93	206	121.5	2,778	11,133	300.8
Texas	10,378	14,321	38.0	3,116	5,326	70.9	577	1,355	134.8	8,700	47,145	441.9
Weighted Average[1]	--	--	35.8	3,551	5,446	55.5	724	1,662	132.9	10,440	47,839	495.4

[1]Based on 1980 state population shares.

Sources: U.S. Bureau of the Census, Statistical Abstract of the United States, Washington, DC, 1966, 1968, 1980, 1981 and 1982-83. U.S. Bureau of the Census, 1977 Census of Manufactures, Washington, DC, 1977.

Table 2

Growth in Energy Consumption by Sector, 1965-1980
(Percent Change)

	Total	Residential	Commercial	Industrial	Transportation
Frostbelt					
Illinois	25.0	33.9	41.8	8.5	38.8
Massachusetts	- 2.6	- 0.3	20.0	-45.3	36.7
Michigan	20.9	35.7	65.2	- 4.2	35.1
New Jersey	32.5	21.2	72.7	17.2	42.4
New York	3.8	6.9	21.8	-19.2	17.8
Ohio	15.3	25.3	52.4	- 4.1	45.0
Pennsylvania	4.5	26.3	35.9	-17.7	45.5
Weighted Average[1]	13.4	21.3	42.0	- 9.0	35.5
Sunbelt					
California	53.7	45.1	90.3	37.8	58.5
Florida	126.2	200.6	140.7	96.2	110.9
Louisiana	102.0	111.5	195.3	90.6	109.6
New Mexico	40.1	48.1	123.0	12.2	51.9
Oklahoma	65.4	83.1	128.6	45.1	67.8
South Carolina	84.9	106.7	170.6	74.1	61.5
Texas	73.3	106.1	178.2	52.4	99.3
Weighted Average[1]	75.8	95.5	134.1	56.4	81.1

[1]Based on 1980 state population shares.

Source: U.S. Energy Information Administration, State Energy Data Report: 1960-1980, Washington, DC, 1982.

(Table 3), the growth rates in total energy consumption increased for both regions. However, Sunbelt per capita demand increased at a higher rate--over 3.5 times the Frostbelt states' average rate (29.5 percent vs. 8.2 percent). It is important to note that average Sunbelt per capita demand was higher at the outset (301 x 10^6 Btu's per capita vs. 268 x 10^6 Btu's per capita). Most disturbing are the differences in regional trends in commercial sector energy use. Whereas in 1965, the Frostbelt states averaged roughly 10 percent more energy use per service employee, by 1980 the situation had reversed as Sunbelt states averaged 9.7 percent more per employee than the Frostbelt. Moreover, commercial sector energy efficiency improved in every Frostbelt state during 1965-1980 and the region decreased its demand per employee by 15.6 percent; in contrast, five of the seven Sunbelt states posted decreases in commercial sector energy efficiency and the demand per employee rose 1.2 percent on average. Only in the industrial sector was there consistent evidence of conservation in the Sunbelt. Even there, however, the Sunbelt at the end of the period required more than twice the energy per dollar value added (58,000 Btu per dollar value added vs. 26,000 Btu per dollar value added); and both areas reduced their industrial energy demand per dollar value added by nearly the same proportion (-68.9 percent vs. -65.7 percent).

Whatever short-term gains have been realized in energy efficiency since the oil embargo, they almost certainly will be overwhelmed by the long-term structural pattern of increased energy consumption suggested by Table 3. Surely, these trends are disconcerting in light of the expectation that market transformations would lead to a least-cost energy future.

As alarming as the growing trend toward energy inefficiency is, it does not convey the full magnitude of the dilemma. The American energy system is failing to adapt structurally to new environmental, economic and resource conditions. Evidence of its non-adaptability can be found in the declining system efficiency that has accompanied spiraling rates of energy consumption and prices. Table 4 illustrates this system decline. During the 1965-1980 period, the percentage of energy lost through electricity conversions (including transmission losses) dramatically increased. The losses were experienced nationwide, but were most acute in the Sunbelt. By 1980, over half of the energy initially flowing into the residential sectors of four of the seven Sunbelt states was lost through electricity conversions. The pattern

Table 3

Selected Sector Energy Efficiencies,[1] 1965-1980

	Total			Commercial			Industrial		
	1965	1980	% Change	1965	1980	% Change	1965	1980	% Change
Frostbelt									
Illinois	283	331	17.0	594	514	-13.5	74	28	-62.2
Massachusetts	228	213	- 6.6	502	358	-28.7	52	10	-80.8
Michigan	274	299	9.1	615	527	-14.3	61	26	-57.4
New Jersey	231	281	21.6	532	503	- 5.5	49	21	-57.1
New York	209	219	4.8	460	393	-14.6	54	17	-68.5
Ohio	329	358	8.8	566	466	-17.7	98	34	-65.3
Pennsylvania	323	330	2.2	446	366	-17.9	127	38	-70.1
Weighted Average[2]	268	290	8.2	524	443	-15.6	75	26	-65.7
Sunbelt									
California	225	271	20.4	454	388	-14.5	69	22	-68.1
Florida	187	256	36.9	415	357	-14.0	115	42	-64.7
Louisiana	468	783	67.3	580	815	40.5	490	163	-66.7
New Mexico	341	371	8.8	539	631	17.1	1,115	26	-97.7
Oklahoma	304	404	32.9	585	629	7.5	323	71	-78.0
South Carolina	217	320	47.5	531	650	22.4	88	38	-56.8
Texas	469	589	25.6	474	562	18.6	371	104	-72.0
Weighted Average[2]	301	393	29.5	470	486	1.2	217	58	-68.9

[1]Efficiencies were calculated as follows: Total--million Btu per capita; Commercial--million Btu per service employee; Industrial--thousand Btu per dollar value added by manufacture.

[2]Based on 1980 state population shares.

Sources: U.S. Energy Information Administration, State Energy Data Report: 1960-1980, Washington, DC, 1982. U.S. Bureau of the Census, Statistical Abstract of the United States, Washington, DC, 1966 and 1981. U.S. Bureau of the Census, 1977 Census of Manufactures, Washington, DC, 1977.

Table 4

Electricity Losses By Sector, 1965-1980
(Percent)

	Residential		Commercial		Industrial	
	1965	1980	1965	1980	1965	1980
Frostbelt						
Illinois	17.3	27.6	27.2	40.4	11.6	20.4
Massachusetts	12.7	25.8	15.0	38.1	13.9	33.3
Michigan	17.1	25.1	28.7	32.7	15.4	25.6
New Jersey	15.4	28.4	25.4	36.3	17.2	21.0
New York	15.8	26.8	27.4	38.1	15.4	26.8
Ohio	17.2	31.9	26.5	39.7	19.0	26.5
Pennsylvania	17.6	30.2	23.9	40.9	10.9	21.2
Weighted Average[1]	16.4	28.1	25.7	38.3	14.7	24.6
Sunbelt						
California	24.2	36.9	43.1	48.5	18.0	23.7
Florida	52.9	64.8	47.7	59.2	16.5	24.5
Louisiana	32.1	50.0	41.2	37.2	4.4	9.1
New Mexico	18.9	32.0	37.4	39.2	6.8	14.0
Oklahoma	25.0	41.7	33.8	46.0	8.2	15.7
South Carolina	38.7	54.4	41.3	53.6	24.8	30.9
Texas	33.4	50.0	43.8	47.6	6.0	13.1
Weighted Average[1]	32.4	46.7	43.2	49.2	13.5	20.0

[1]Based on 1980 state population shares.

Source: U.S. Energy Information Administration, State Energy Data Report: 1960-1980, Washington DC, 1982.

is similar in the commercial sectors where the highest percent of energy consumption lost through electricity conversions was experienced. The Sunbelt commercial sector, supposedly the catalyst of an American economic revival, led all sectors with an average of 49.2 percent in electricity losses. Only the industrial sectors of both regions stayed well below the level of 50 percent losses. Nonetheless, the trend was toward inefficiency as electrical losses increased by one-half in the Sunbelt and by two-thirds in the Frostbelt. What these data indicate is not the wastefulness of energy choices by individuals who need high prices to conserve, especially since electricity is our most expensive fuel source. Rather, they are evidence of the failure of an energy system which cannot accommodate the need for change. This failure is not accidental, nor an unfortunate but temporary side effect of transition. It is precisely the result of the operation of market forces. The post-industrial economy urged by the market has its optimal location in the south, as determined by the market. With the selection of this location came also the selection of energy options. The electrical base of the Sunbelt energy system is not a recent occurrence, nor is the high rate of energy losses. Thus, these conditions must have been anticipated in the market calendar which determined that the Sunbelt was ideal for beginning the post-industrial transformation. If we are to place faith in market forces, then we must accept a growing reliance on energy systems with 50 percent losses. That such acceptance is to be understood, not as a reflection of our energy problem, but as a necessary part of our best economic solution is beyond credulity.

The Political Economy of Energy Transitions

An energy transition hinges upon whether our energy choices include alternatives to conventional sources as systematic options. The obstacles to a new energy future lie principally in the political and economic constraints which currently make change inherently costly and serve to disadvantage if not exclude alternatives to conventional sources of energy supply. These constraints reflect structural conditions that have been reinforced over decades to sustain and enhance the existing energy system. They are manifest in the seemingly natural roles and responsibilities fulfilled by energy producers and consumers, in the distribution and alignment of political resources in a manner favorable to the economics of conventional energy sources, in the operations of a financial and capital infrastructure that is geared primarily to serve a centralized system, and in the extensive

body of law and public policy that has become both a source of legitimation and of incentives for current patterns of production and use. In the past, these conditions secured for western societies the benefits of a political economy based on cheap and available energy. They have now become primary sources of inertia in choosing an alternative energy future.

Overcoming the inertia of the current energy system will require more than simply deregulating energy prices, correcting market imperfections, initiating government assistance to infant energy industries, or allocating public resources to stimulate technological development and diffusion of new options. An energy transition will require fundamental changes that will destabilize current energy politics and economics. Such fundamental changes typified the historic transitions to coal, oil, and electricity. In each case the energy transition involved more than a substitution in fuel types or the introduction of a supplement to existing fuels. Each transition was challenged by the institutional characteristics and expressions of the previous energy system, causing the political organization of allied economic interests. Each was confronted by legal and policy structures that secured the economic position and power of already prevailing energy sources and acted as barriers to new entrants. All of these transitions initially were evaluated on the basis of the costs and advantages for the existing energy system, and none of these transitions would have been achieved merely through the operations of the market.

For example, the transition to coal in the mid-nineteenth century involved more than a substitution for wood and other biomass products. It challenged an energy system primarily based on local public resources (forests) and replaced it with one based on regional commercial enterprises. The coal transition took place in the context of clear cost advantages for biomass products in certain energy uses (such as home heating) which emanated from government policy and law toward public lands, rather than intrinsic properties of woodburning. Similarly, the transition to oil beginning in the late 1800's in the U.S. displaced a regionally-based coal system heavily dependent upon public rail transport and introduced a system built on international production and consumption markets. While oil eventually surpassed not only coal but every American industry in both economic and political power, it originally confronted a competitor which received substantial public subsidy through the rail system, had successfully enlisted state and national governments to enforce low wages through anti-union and other labor policies, and could rely on a government laissez-faire philosophy to maintain the worst working conditions in American industry. To overcome such advantages, the oil industry required and received substantial government assistance in the organization of domestic and international markets and in the development of a transport structure to deliver its product cheaply. Finally, the electricity transition of the early twentieth century represents perhaps one of the most spectacular instances of institutional change in American political and economic history. Joint government-industry actions necessary to create and sustain the electricity market included these radical departures from past norms and practices: monopolization of the market by region; creation of new and substantial electricity markets through rural electrification programs and hydroelectric projects, paid for with public funds; reorganization of responsibilities for capital risk so that private ventures in the electricity market are publicly subsidized; and, with the advent of nuclear generation after World War II, the emergence of the American military as a major force in energy policy making.

The next energy transition will fail to materialize without changes in political economy comparable to those which accompanied each of the previous transitions. Without such changes some new options may be exploited, but the principal opportunities offered by a new energy future will be foregone. For the most part, options would be limited to those which can be easily absorbed within a primary system of centralized energy production and distribution.

Distortion of the potential and implications of new energy options is virtually inescapable so long as the criterion for judging energy futures remains the stability of existing energy markets and institutions. On this basis there is little reason to expect materially different answers from those already given to the questions of energy choice. As Amory Lovins has pointed out, we inevitably face a problem of exclusivity in choosing among energy futures that is not a result of "technical incompatibility of hardware but rather institutional and cultural incompatibility and logistical competitiveness of evolutionary paths..."; "the key distinction ... is in their architecture, the structure of the energy system" (Lovins,1977:42,29). Within the existing system one can envision a selected growth in end-use applications of new options as a supplement to conventional sources of supply. But this would hardly constitute an energy transition. Indeed, limited applications of new alternatives and sporadic efforts at conservation have been cited as justifying confidence in the regenerative powers of the existing

political economy of energy and thereby postponing the need for any alternative energy future.

Recognizing that structural changes in political economy are essential for an energy transition does not imply that technical problems are unimportant or that technological breakthroughs would have little impact on our energy prospects. However, even the technical dimensions of energy use need to be evaluated by the criteria of economic and institutional impact. Similarly, it is certainly possible that marketing techniques, better organization of new energy industries, wider industry-supported educational efforts, and other traditional and often successful strategies for improving market share of new products and services could have an important influence on our energy future. Yet the effectiveness of these strategies is largely moot without basic changes in the organization of energy markets and in the orientation of public policies.

What changes in the political economy of energy are necessary to bring about an energy transition? While it is nearly impossible to predict social change of any kind, much less the specific social changes required for a so far nonexistent transition, nevertheless it is possible to identify the types of changes that are likely to accompany a new energy future. One set represents necessary instrumentalities for expanded energy choice. These include changes in federal energy pricing policies, the removal of conventional fuel subsidies (or at least of the imbalance between conventional and alternative fuel subsidies), and the development of policies to offset entry barriers created by market imperfections. Such changes would address problems that currently disadvantage virtually all competitors to conventional sources of supply. By themselves, however, these changes would do little more than equalize opportunities to substitute alternatives for conventional fuels. The possibility of a transition that would take full advantage of the potential of alternatives like conservation and renewable energy would remain slim, while the possibility that these options would be incorporated as a supplement to the existing energy system would be increased.

For an energy transition to take place, other changes would be needed that bear directly on deriving the benefits of each alternative's distinctive resource characteristics. These relate to changes in the expectations, behavior, and responsibilities of producers and consumers and changes in the institutional infrastructure available to stimulate and support the choice of new options.

For example, because solar energy is renewable and deliverable by decentralized technologies, the direct cost of its consumption rests not with the amount consumed, but with the size and sophistication of the system employed for its collection, transfer, and storage. Thus capital rather than operating costs will determine its suitability at the retail/consumer level. This means a reversal of roles for most energy users: in the nonrenewable context most consumers purchase fuel, but in a solar-based energy system they would purchase the plant for delivery of the fuel. The behavioral changes required to accommodate this shift in responsibilities for capital costs constitutes an important challenge to the implementation of a solar transition. Households and other small energy consumers, for example, will have to reorient from a purchase-price to a life-cycle cost perspective in energy purchase decisions.

Without an accompanying change in the institutional setting within which consumers exercise economic choices, however, the redistribution of capital risks actually may leave consumers worse off. Thus it will be necessary for financial institutions to advance capital funds for this new energy market and to alter radically their mix of loans both in size and maturity to meet an influx of comparatively small loan demanders. Similarly, since household energy choice is significantly linked to the characteristics of residential housing stock, the construction and building industries will have to incorporate the architecture and engineering of solar energy into their practices, and substantial changes will undoubtedly be required to capture the potential profits of energy-efficient building and subdivision design.[1] State and local governments will need to revise building codes and zoning laws to accommodate solar construction and retrofitting, and the needed changes are likely to be substantial and controversial. Moreover, without a concurrent strengthening of the resources of these governmental units, the additional burdens created by the growing importance of their discretionary powers might simply overwhelm already beleaguered decision-making and service capabilities.

As with earlier energy transitions, a new future is likely to be accompanied by major shifts in political power that extend beyond the boundaries of energy production and use. For example, the prospect most frequently anticipated by advocates of renewables and small-scale delivery systems is that decentralization in energy production and use would result in a general deconcentration of power and create a more participative, community-based mode of decision making. But decentralization will have this effect only if there is a

concurrent enhancement of the opportunities for local citizen participation and a redistribution of authority and resources in the federal system to match the shift in risks and responsibilities to the local level. Similarly, a redesign in the prevailing structures of local governance may be necessary, since decision making at the local level has historically been no more responsive to broad-based citizen participation than at the federal level. Obviously such changes are not confined to issues of energy choice and are neither benign or neutral with respect to the current organization of political and economic power. Indeed, trends over the past forty years have diminished local authority to the point that cities have been reduced to "service delivery systems" and rarely possess the aspiration, much less the resources, for local self-reliance (Morris, 1983; Frug, 1980).

A significant deconcentration and redistribution of power and risk would have a profound and destabilizing impact on the political economy of energy. Yet, even changes of this magnitude create only the <u>possibility</u> of an energy future preferable to current arrangements. How, by whom, and in whose interest this new political economy of energy will be governed are influenced but unresolved by changes in infrastructure alone.

Fundamentally, political and economic structures represent systems of social valuation in which the worth of social actions and goals are determined. In the contemporary case, energy alternatives are unfailingly compared in both economic and political terms with the performance of the existing system of energy. Such a comparison makes sense only if, and so long as, the present political economy of energy is afforded the role of social measure. If, however, the current political economy is unstable and no longer viable, then it makes little sense to depend upon it as a system of energy valuation. This is of course precisely the issue raised by an energy transition. Are we to rely on existing political and economic structures to determine our energy future, or must the basis of social valuation itself change before our energy future can be decided?

Understood as a problem in political economy, it becomes clear that an energy transition will not take place simply by the force of recognition of the social, environmental, or economic benefits of options like solar or conservation. This is not because these benefits cannot be shown to be real or ample. Rather, the underlying dilemma is that realizing such benefits will require substantial changes that can only be seen as immense costs from the vantage point of the current energy system. These changes will alter not simply the form and appearance of the political economy of energy but the structure of social valuation that drives it.

Dynamic Conservatism: The Challenge to an Energy Transition

Recognizing the inertia of the existing energy system should direct our attention to the problem of "dynamic conservatism": the predisposition of political and economic institutions to regard change as a threat to the stable state rather than a product of its failures (Schon, 1971). Dynamic conservatism is manifested in efforts of the existing political economy of energy to resist changes that unquestionably threaten not only the technology and structure of established institutions but, perhaps more importantly, the theory and ideology which supports and justifies them. The prospect of an energy transition is constantly at risk of being dismissed as an abstraction so long as the energy status quo, however unstable it may be, is accorded the aura of stability. As Donald Schon has pointed out:

> The most prevalent responses to the loss of the stable state are anti-responses. They do not confront the challenge directly. They seek instead to deny it, to escape it or to become oblivious to it....(1971:29)

We can expect the energy system to respond with the least change necessary; least "in terms of how little or how much must be given up in order to accommodate them" (Schon,1971:49-50). There are at least three forms of dynamic conservatism that challenge the possibility of an energy transition: denial, containment, and crisis control. These forms differ in regard to whether the problems facing the energy system are seen as internal or external to that system, and whether these problems require structural responses. These differences determine the extent to which change is seen by energy producers, consumers and policy makers as necessary on the one hand and threatening on the other. In all three cases, the limits of an energy transition are established from the vantage point of the existing system. Thus, the advantages of any energy future different from the present are regarded as ephemeral, while the costs appear substantial. Each of these forms of dynamic conservatism operates through a valuation process which charges the costs of change to alternatives, while avoiding any systematic assessment of the costs of remaining the same.

The Denial Scenario

Under the first scenario the requirement for change in the current system is denied, since the energy problem is portrayed as external: it is created by the machinations of the OPEC cartel or by the misguided exercise of public authority that controls prices, regulates investment and profits, and generally sustains disincentives for development and production. Responsible action is understood as requiring the defense of the system against challenges to its stability while the search goes on to discover and implement the conditions of system renewal that can restore an era of cheap energy.

In this context, any energy transition engenders massive costs of solving the wrong problem, since the existing energy system is not in need of replacement. Moreover, the pursuit of a new energy future would carry additional costs, since it would not likely alleviate and perhaps would worsen many energy-related problems. Thus, an energy transition will not assure a return to an era of cheap energy, nor will it provide an antidote to declining economic productivity and growth. It also will not remove the pain of reorganizing society around more energy-efficient spatial patterns while the implementation of alternatives proceeds. While reliance on alternatives such as solar and conservation may not add to environmental deterioration, it will not by itself remove the danger and a new energy future certainly need not represent a cure for America's resource wastefulness. In addition, a transition may actually contribute to chronic economic and social problems. Thus, for example, the current difficulties of the electric utility industry are blamed by some upon efforts to address environmental, safety, and equity concerns which really lie outside the utilities' responsibilities (Navarro,1982). Responding to these externalities within the electricity system has led to underinvestment in generating capacity which will result in high costs in the near future to overcome the pending capacity shortfall.

Clearly, these costs are due to chronic weaknesses in the existing energy system and have little to do with progress toward a new energy future. The burden of such costs, however, is likely to be attributed to any transition so long as the existing energy system can succeed in denying its past and present failures and its growing instability. If this is successful, attention will be deflected from the high risks of continuing with the status quo, while at the same time a prohibitive premium will be placed on change towards any alternative energy future. Accommodating this form of dynamic conservatism effectively would limit alternatives to providing quick fixes for current energy problems and shoring up the existing system. The possibility of choosing an alternative energy future would be foregone in favor of an expected return to the stable state.

The Containment Scenario

Under the second scenario, the need for change is conceded because the existing system is seen to reflect a number of weaknesses that are not self-correcting. The problem is to stimulate the system's change through a process of technological evolution and innovation. Removing the obstacles to such technological change, however, will create transition costs.

In this case, the pace and extent of a transition would be contained by charging these costs against new options, rather than expecting them to be absorbed by the existing system as a price for its failures. Thus, for example, research and development on new technologies displaces capital that might otherwise be used to preserve existing markets or enhance current technologies. To avoid the deleterious effects of such displacement to established energy industries, public expenditures will be expected. Similarly, the cost of removing market imperfections that impede the introduction of new alternatives will be portrayed as the natural costs of market entry and considered the responsibility of the new industries. For example, uncertainty about the success of new technologies is likely to be greater than that for alternatives already available. Established energy interests will portray this uncertainty as a source of risk and will therefore apply the purportedly natural requirement of above-normal returns before investing in such ventures unless additional government incentives are provided. Further, the fact that little or no information may be available either to prospective purchasers or suppliers about new options and that a new energy industry would have to commit a high proportion of its resources to altering conditions of widespread ignorance and misinformation would be represented as the justifiable expense of a new enterprise. Since virtually any action in a complex society will have unintended side effects, the costs of transition will also extend to coping with currently unforeseen consequences of change. To the extent that such side effects might be negative, producers and buyers could defer decisions about new options while they await a clearer picture of the real costs of these technologies. On the other hand, advantageous side effects might also trigger underinvestment by consumers and suppliers until

ways are found for them to capture such benefits and thereby reduce what are termed "transactions" costs. In either case, the ability of new options to compete with existing technologies will be hampered unless certain public expenditures are made to offset the unavoidable natural problems of introducing and diffusing technological innovations. Finally, to the extent that the costs of transition are met by government expenditures, established industries may expect to be compensated for losses induced by such spending.

Considered as "realistic" reflections of problems of change in an imperfect world, these costs may appear to be the necessary and reasonable burdens of any energy transition. In fact, recognizing such burdens might be portrayed as serving a useful social purpose, since it discourages frivolous and destructive changes, insures that only those technologies which represent the best uses of society's resources and labor will be developed, and limits the extent of such development to the constraint of economic optimality. There are interesting questions, of course, as to how such precision can be adduced from patently imprecise conditions of ignorance and why market-like solutions should be sought in areas where market failure is inherent. The more central question, however, is why such costs should be assigned to an energy transition when they were created by the instability of the existing political economy of energy and its inability to assure future affordable energy supplies. Far from burdens brought on by competition with conventional sources of energy supply, these factors of uncertainty and market unreliability actually reflect the structural inflexibility of the existing system when confronted with the need for change.

Insofar as these transition costs will be attributed to and charged against alternatives, progress toward a new energy system will be highly contained. Those technological applications most compatible with present methods of generation or delivery will be favored, since they will involve fewer and lower potential risks and will minimize the problems of commercialization and diffusion. Clearly, an energy transition circumvented by such costs of change will not displace the existing institutional structure as the primary influence on our energy future. Energy choices would continue to be so dominated by the limits of the current political economy that differences between a pre- and post-transition society would be less striking than their considerable similarities.

The Crisis Control Scenario

Crisis control represents an extension of the scenario of containment, but in this case it is recognized that structural weaknesses of the existing system are too severe to await rectification through an orderly process of technological renewal. Change is seen as being accompanied by a breakdown in various sectors of the energy system that may result in massive disruptions of crisis proportions unless they are planned for and controlled. While it is acknowledged that the existing system may be or will become obsolete, its behavioral and institutional structure purportedly cannot be abandoned without unacceptable social costs. Therefore, an energy transition will be expected to internalize responsibility for these social costs and, thus, proceed in a manner which minimizes disruptive consequences.

As an example of a source of disruptive change, some energy analysts have argued that we face a neo-Malthusian dilemma with fossil fuels. Even their moderate or reduced use triggers explosive rates of environmental degradation that far outstrip any technological capacity to contain, much less correct, the damage. Because of this, the rate of reduction and eventual prohibition of their use may have to be determined by biological and ecological, rather than economic, criteria and therefore could result in major discontinuities in energy supply (Hayes, 1983; Mackenzie,1983). Another source of disruptive change is seen in the vulnerability of power utilities. Here the concern is that, while utilities represent an important bridge between nonrenewable and renewable energy futures, they could be made largely obsolete by this passage. Because utilities control a substantial share of the capital available to the energy system and maintain an essential part of the energy distribution subsystem, early obsolescence could seriously undermine the prospects for an energy transition, especially one based upon renewable resources. An energy future based on conservation and renewables, however, is likely to speed the collapse of these utilities, which are already experiencing serious fiscal decline. The social costs of this collapse will be enormous, and while certainly not caused by the transition to a new energy future, it purportedly would be irresponsible to neglect planning for them as part of a transition.

It is significant that this form of dynamic conservatism does not rely upon a logic of cause but one of consequence. Cost assignment focuses on the realities of change as they unfold, and thus no claims are made that the source of these costs lies in an energy transition. An important

issue remains as to whether such costs should--or will--constitute limits on the progress and shape of our energy future. Does the precarious future of power companies and the disruptive potential of their collapse justify actions to encumber certain options simply in the interest of forestalling such disruption? Similarly, the environmental danger of continued fossil fuel use cannot be ignored, but does that mean that energy development should be oriented to accommodate those energy uses that could be interrupted because of a ban on fossil fuels? Redirecting the focus of energy development solely to address these problems may result in a serious compromise of new alternatives. To the extent that the potential of an energy transition is mortgaged to prevent, reduce, pay for, or control the costs of disruption, the likelihood increases that much of the institutional architecture of the current energy system will be retained and that real choice about energy futures will remain illusory.

Conclusion

The logic and expectations underlying these three scenarios and the costs they project derive from the dynamic conservatism of the current political economy of energy. If such dynamic conservatism is accommodated, there will be at most a very modest energy transition. The challenge to advocates of any energy transition is to establish a basis for evaluating energy futures that subjects the energy status quo to the same order of accountability as is required of its alternatives.

The emerging national policy environment of the 1980s provides ample evidence of the challenge to an energy transition. The 1983 budget proposals of the Reagan administration call for eliminating virtually all federal support for solar research and conservation programs, while doubling funding for breeder reactor research (Shapley et al., 1983). These proposals reflect the related beliefs that current arrangements for the production and distribution of energy remain the only practical ones and that alternative energy options should be consigned to the status of futuristic technologies. The social cost of maintaining these beliefs is the double bind of being committed to a system that does not perform effectively even on its own criteria and has not generated any alternatives.

In our view the failures of the existing system are fundamentally failures of governance. They cannot be repaired by technological or economic renewal, by decontrol of energy prices, or by diffusing an external cartel's control of oil supplies. The energy crisis represents a breakdown in a political and economic system of energy production and use that could sustain itself only so long as it provided cheap and readily available energy. The system is currently preserved by the belief in a possible return to such an era. The prospect of a self-renewing market sustains that belief and has served to perpetuate an expectation that the existing system can survive in a modified but not radically different form.

What ought to have been learned from recent experience is the futility of trying to rescue the existing political economy of energy. If we learned from experience, we should conclude that the major opportunities for improving the governance of our energy future lie in an increasing reliance on decentralized systems of supply and choice. The importance of decentralized efforts that rely on behavioral and institutional as well as technological adaptations lies in their potential for stimulating a transition toward a new system of expanded energy choice. The existing system, however, defines these decentralized adaptations as only temporary adjustments along the path of system renewal. That is all they can be unless the current constraints on energy choice are removed.

We believe that the creation and maintenance of conditions for collective choice are essential for the governance of our energy future. Current policy denies the need for collective choice of energy futures, and current market arrangements are seen as providing the only normatively acceptable criteria for assessing our energy condition and prospects. In place of new opportunities we are still being asked to place confidence in the regenerative powers of technology and the "free" market and to feel assured, as former Secretary of Energy Edwards has put it, that the way to solve the nation's energy problem is to "produce, produce, produce" (Business Week, 1981:69). But something is amiss when we are to place our faith in the unfettered operation of the marketplace while expecting that the marketplace will never be unfettered. And clearly, there is something disconcerting about a strategy which pronounces all active efforts to improve our condition as failures, but can offer no other practical guidance than do nothing, or at least less. In light of the energy history of the last decade, the utopian faith in production, technology, and markets can only be regarded as mystical.

NOTES

[1]The importance of the construction industry in current energy decision making is substantial. As Colin Norman in a recent Science article observed, "More than half of the household appliances sold in the United States are bought by developers and landlords rather than by those who will use them and pay the fuel bills." (Norman, 1981: 1401).

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